

Evaluation - Testing welfare technologies for people with dementia

**An initiative on welfare technology in cooperation between four Danish municipalities
- Rudersdal, Lyngby-Taarbæk, Gladsaxe, and Gentofte Municipalities.**

Testing technologies for the prevention and treatment of disruptive dementia behavior

Evaluation - December 2013

Table of contents

Summary	3
Preface	6
Introducing the initiative.....	7
The technologies.....	7
Criteria for success.....	9
Testing method	9
Test results	11
Premises of the analysis.....	11
Experiences with the specific technologies.....	12
Dementia mattress.....	12
Bed alarm	13
Rocking chair	13
Orb chair.....	14
General experiences	15
Resident perspective.....	15
Staff perspective.....	16
Conclusion	17
Recommendations for the use of technologies in the treatment of disruptive behavior ..	19
Key persons in the municipalities during the tests	20
Appendix	21
Appendix 1. Pre-assessment of working environment.....	21
Appendix 2. Observation schema.....	22
Appendix 3. Resident status	24
Appendix 4. Plan of action	25
Appendix 5. Post-assessment of work environment	26

Summary

The number of elderly individuals with dementia is growing rapidly, and the majority of those residents require municipal elderly care. With the rise in the number of elderly residents with dementia comes an increased need for prevention and treatment of the consequences of the disease. When the disruptive dementia behavior is not addressed properly it has a negative effect on the care staff involved and their work environment. In home care as well as in assisted living facilities an increased number of work situations are categorised as psychologically challenging. The consequences are higher levels of sickness absence and an increased need for psychological help.

To address this challenge, four Danish municipalities have decided to cooperate on the testing of simple welfare technologies. The four municipalities are Gladsaxe, Lyngby-Taarbæk, Rudersdal, and Gentofte.

The purpose of the initiative is to test and clarify to what extent different welfare technologies are capable of preventing and treating disruptive dementia behavior and improving the life quality of the residents. Furthermore, the purpose is to examine if the technology has the potential to improve the work environment and ease the emotional strain on relatives and care staff by reducing the number and intensity of the resource demanding situations caused by disruptive dementia behavior.

The test results are to form the foundation for future recommendations and guidelines concerning the use of the technologies as well as identifying the effect and potential of introducing welfare technologies in the treatment of dementia.

The project was initiated in 2012 with financial support from the four municipalities' welfare technology funds. The tests primarily took place in the first half of 2013 and involved 33 residents.

Based on a specialist assessment and selection process, the following technologies were tested:

- The dementia mattress ThevoVital which increases the body-consciousness of people with dementia and improves sleep quality. The mattress reduces the need for sleep during the day by reducing night-time wandering.
- The bed alarm Sleep-care with a sensor under the mattress that registers, if the individual with dementia gets up and subsequently, sends a text message to a pre-defined cell phone if the person does not return to the bed within a given timeframe. The purpose of the bed alarm is to reduce the need to watch over persons with dementia during the night.
- The rocking chair ThevoChair which with its rocking movements is supposed to stimulate the senses and calm persons with dementia.
- The orb chair Sensit that gently encloses the body, stimulates the senses and provides an increased feeling of the body which is supposed to have a calming effect.

Evaluation - Testing welfare technologies for people with dementia

- A GSM tracking system that can be placed in a shoe and helps trace the person with dementia if he or she leaves home or the assisted living facility.

A test and evaluation guide was developed in order to help the staff in the four municipalities systematically document the tests. This was done in order to ensure that the test results gave an accurate insight into the effects of the technologies on the residents and staff involved. The test and evaluation guide included a pre- and post-assessment of the work environment as well as an observation schema for describing the condition of the person with dementia.

Unfortunately, the material was not used to the desired extent during the tests because of interrupted test cycles. Furthermore, the questions regarding the work environment did not match the staff's experiences as expected. The evaluation is therefore based primarily on the qualitative feedback and supplemented with the data recorded.

After the tests, the ThevoVital dementia mattress and the ThevoChair rocking chair were given the best recommendations. The testing of the dementia mattress was the most successful and the employees were generally glad to use it. The feedback on the rocking chair has also been positive.

The feedback on the bed alarm is mainly positive. It is, however, not as highly recommended as the dementia mattress and the rocking chair primarily because of technical problems in connection with the tests, and because the technology is meant to correct a problem rather than preventing it from occurring.

The tests underlined certain reservations regarding the orb chair and the GSM tracking system. The orb chair provoked strong reactions from the users, and the design is problematic in terms of both comfort and safety.

The reservations regarding the GSM technology are based on the fact that it could not even be tested because of technical problems and problems with the battery. The GSM technology might be interesting to test, when the manufacturer has developed a more reliable solution.

The most important test experiences concern the actual introductory process, as these experiences apply universally when introducing any kind of technology. Based on these general experiences, a range of recommendations has been put forward:

- It is recommended that the individual with dementia tries out the technology in question temporarily at first to find out whether or not the technology has a positive effect. This is recommended as the technologies might have a calming effect on some people but the opposite effect on others.
- It is recommended to assemble a library of selected dementia technologies that allows the person with dementia to try a variety of different types of chairs before the final decision is made to invest in a specific type of technology for the person in question.
- Financing has to be provided in advance to avoid introducing technologies that subsequently cannot be offered permanently.

- When introducing a new technology, a two-week observation period is required based on a standard observation schema. In this way, the scale of the problem regarding inappropriate behavior can be identified, and it is easier to find out when the inappropriate behavior occurs, i.e. if it occurs at a specific time of the day (e.g. in connection with a change in staff, when specific persons are present or at mealtimes). This is important in order to determine which technology is best suited for the person in question.
- After introducing the new technology, it is advisable that the person with dementia is observed for the first two weeks preferably using the observation schema. This will ensure that the staff keeps focus on helping the resident become acquainted with the technology (to an adequate extent). Furthermore, the observations will show whether the technology seem to have an effect on the resident or whether it should be passed on to another resident with dementia.
- A person in charge of testing and allocating technologies for residents displaying disruptive dementia behavior has to be appointed. He or she preferably has practical experience in dementia (e.g. as a dementia coordinator), and his or her primary tasks are to introduce, test, and recommend technologies. In this way, he or she plays a very different role than the occupational therapist.

Preface

Dementia is an umbrella term that encompasses a diverse range of conditions involving deterioration of brain functions. Dementia mainly affects older people and can be caused by a wide range of brain diseases and other diseases that affect the brain. Deterioration of brain functions in connection with dementia often results in memory loss and loss of cognitive functions such as the ability to speak, sense of space, perspective, and judgement. Many people with dementia also develop disruptive behavior and psychological symptoms such as delusions, hallucinations, anxiety, a feeling of unease, aggression, and depression. The prevalence of behavioral symptoms increases as dementia worsens.

The number of elderly with dementia is growing rapidly, and they represent a large share of the residents who need help from municipal elderly care. An estimated 86,000 Danes are suffering from dementia. In 2040, the number is expected to rise to 160,000. In the four municipalities involved in this project this means:

Persons with dementia	Gentofte	Gladsaxe	Lyngby-Taarbæk	Rudersdal
2012	1,400	1,100	1,200	1,200
2040	2,100	1,700	1,400	1,800

With a rise in the number of elderly with dementia comes an increased need to prevent and treat the consequences of the disease. This will benefit not only the residents suffering from dementia but also their relatives and the nursing staff involved in their care.

Living with a family member with severe dementia is a devastating task both mentally and physically, and several studies show that spouses and cohabiting partners are at risk of developing stress. It is, however, equally difficult for relatives of people with dementia living in assisted living facilities to handle their family members' complex dementia behavior and symptoms.

The work environment of the care staff involved in the care of people with dementia deteriorates, when disruptive dementia behavior and psychological symptoms turn out to be difficult to treat. This problem afflicts both home care nursing staff as well as care assistants at assisted living facilities who experience an increased number of stressful work situations that might result in sickness absence and a need for psychological help.

The four municipalities already focus on staff competency development, have established dementia coordinator functions and have launched a range of other activities in order to be able to handle the increased caregiving demands related to elderly residents with dementia.

As the number of elderly suffering from dementia continues to rise, there is, however, an increased need for new solutions and methods that address the consequences of the disease affecting not only the person with dementia but also their surroundings.

To address this challenge and as part of a strategic focus on welfare technology, the four municipalities have launched an initiative that involves the testing of simple technologies to find out, if these technologies have the potential to reduce the mental stress and burden that people with dementia inflict on their surroundings.

Introducing the initiative

The purpose of the initiative is to test and clarify to what extent five selected welfare technologies have the capacity to:

- prevent and treat disruptive dementia behavior and thereby increase the quality of life of the person suffering from dementia.
- ease the emotional strain on family members and care staff by reducing the number and intensity of resource-demanding work situations caused by disruptive dementia behavior.

The test results are to

- form the foundation for future recommendations and guidelines concerning the use of the technologies.
- clarify the effect and potential of introducing welfare technologies in the treatment of dementia.

Residents and care staff of selected assisted living facilities in the Danish municipalities Gentofte, Gladsaxe, Lyngby-Taarbæk and Rudersdal have tested five welfare technologies (bed alarm, orb chair, rocking chair, dementia mattress, and a GSM tracking system). The purpose of the tests is to find ways to prevent and treat disruptive dementia behavior and thereby improve the quality of life of the person with dementia as well as the work environment of the care staff involved.

The initiative has been developed by the dementia coordinators in the municipalities. They have defined the project focus areas and have selected the technologies for testing. The dementia coordinators have been in charge of purchasing the technologies, the tests and the collection of data that forms the basis for this report.

The project was initiated in 2012 with financial support from the four municipalities' welfare technology funds. The systematic technology testings primarily took place in the first half of 2013.

The aim of this report is to evaluate and assess the potential of the technologies and to make recommendations on how to proceed.

The technologies

Five welfare technologies were selected for testing based on in-depth knowledge of the behavioral challenges caused by dementia. The selected technologies supposedly had the

potential to ease or prevent disruptive behavior, for example by creating a sense of security or by providing various types of stimulation. Furthermore, low-tech solutions that were recognisable and easy to use for the involved residents and nursing staff were preferred¹.

Based on the above-mentioned criteria, five technologies were selected for testing:

- The dementia mattress ThevoVital from Thomashilfen provides micro-stimulation in the shape of springs that automatically adjust to the body as well as a foam mattress that offers additional stability. The mattress is designed to increase the body-consciousness of persons with dementia and is expected to improve sleep quality. By reducing night-time wandering, the mattress relieves the pressure on relatives and care givers as well as reduces the need for sleep during the day for persons with dementia.
- The bed alarm Sleep-Care from Danish Care developed for people with dementia and elderly people at risk of falling. With a sensor under the mattress, Sleep-Care registers if the user is in bed or not. The bed alarm is able to send a text message to a pre-defined cell phone, when the person leaves the bed, or if he or she does not return to bed within a given timeframe. The alarm reduces the need to keep watch over people with dementia during the night and alerts a carer when help is required. When frequent check-ups are not required during the night, the person with dementia will sleep better and feel more independent.
- The rocking chair ThevoChair from Thomashilfen provides great stability and a gentle rocking motion. The movement of the chair stimulates the senses and is expected to reduce the symptoms of dementia and to have a calming effect. The chair is also supposed to improve balance and reduce the risk of falling. In addition, the chair strengthens the muscle pump function and thereby improves blood circulation and reduces the risk of blood clots. The rocking chair has a footstool that enhances the chair's functions.
- The orb chair SenSit from Protac is designed with plastic pellets in the seat and the back rest and with wings with poly pellets in the bottom and neck rest. The wings are long and can be tucked around the body. The chair provides a snug fit and offers an increased stimulation of the senses. The variety of sensory perceptions helps improve the user's body-consciousness, and this supposedly has a calming effect. The chair is expected to ease or prevent disruptive behavior and psychological symptoms such as restlessness, wandering, and aggression.
- GSM tracking system² from SafeCall. The tracking device can be placed in the user's shoe. GSM uses the mobile network to pinpoint the user's location instead of satellite technology

¹ Guideline prices for the technologies are: (As some of the technologies were borrowed from the manufacturers, we do not know the exact prices. Please contact the manufacturer for an exact price quote). Dementia mattress: Approx. DKK 11,000 exclusive of VAT. Bed alarm Sleep-Care: Price unknown. Rocking chair: Approx. DKK 15,000 exclusive of VAT. Orb chair: Approx. DKK 7,500 exclusive of VAT (prices vary according to model). GSM tracking system: Price unknown.

(GPS). With GSM it is possible to track users not only outside but also inside multi-storey buildings and in basements if necessary. The location of the tracking device can be seen on a web-based platform and subsequently, the exact position can be found with a handheld device.

Criteria for success

Initially, a range of criteria for success was defined for the tests. These criteria have formed the basis for the follow-up parameters.

A test is a success when:

1. The involved persons with dementia use the technology in question in their everyday lives.
2. The technology eases and prevents disruptive behavior, and the care staff experiences a positive effect on the involved persons.
3. The technologies are perceived as user-friendly by the care staff and are easily integrated in everyday life.
4. The care staff experiences fewer conflictual work situations involving the residents with dementia and thus, experiences an improved psychological work environment.
5. Implementing the technologies has the potential to reduce costs, for example by eliminating some of the expenses caused by a psychologically unhealthy work environment.
6. It can form the foundation for a business case for each of the selected technologies.

Furthermore, it is emphasised that the technologies are very different, are put to use in different situations and are expected to have varying effects. Consequently, all the technologies are not expected to meet the criteria for success to the same extent.

Testing method

A test and evaluation guide was developed in order to help the staff in the four municipalities to systematically document the test results and in order to evaluate to what extent the technologies have had an effect on the involved residents and care staff.

Before the technologies were introduced to the residents and the care staff, the care staff answered a questionnaire regarding their work environment. Furthermore, the individual

² It was originally decided to test a GPS-based tracking system from SafeCall - a less visible and less bothersome solution than previous generations of GPS tracking devices. Before trial start-up, it was, however, decided to replace the GPS solution with a GSM solution. This decision was made because GSM tracking systems - contrary to GPS systems - are able to locate users not only outside but also inside buildings.

Evaluation - Testing welfare technologies for people with dementia

resident's disruptive behavior was observed and registered in a observation schema by the care staff over a two-week period. This was done in order to provide a tangible and comparable overview of the disruptive dementia behavior experienced by the care staff.

The initial observation process was followed up by another observation period 2-4 weeks into the test period. This formed the basis for a new assessment of the disruptive behavior displayed by the individual resident. At the end of the test period, the care staff was asked once again to answer the questionnaire regarding their work environment.

Please refer to appendix 1-5 for further information on test and evaluation material.

Test results

The technology testings in the four municipalities have involved selected residents and care staff from dementia wards at assisted living facilities in each municipality. The tests have been conducted in close cooperation with the dementia coordinators in the municipalities. It must be noted that it is a small-scale test set-up involving a total of 33 residents.

The technologies have been tested by residents in the respective municipalities with the following distribution:

Number of test subjects	Gentofte	Gladsaxe	Lyngby-Taarbæk	Rudersdal	Test subjects per technology
Dementia mattress	0	4	2	2	8
Bed alarm	2	3	2	0	7
Rocking chair	2	1	3	3	9
Orb chair	4	3	0	2	9
GSM device	-	-	-	-	-
Number of test subjects per municipality	8	11	7	7	A total of 33 test subjects participated

As it appears from the chart above, it has not been possible to conduct an actual test of the GSM technology. Testing the GSM device was impossible because of technical problems, and the tracking system turned out to be not as well-functioning as promised. It is, therefore, impossible to evaluate the effect of the device.

It took the 33 test subjects a period of seven months to conduct the tests that led to very different results from technology to technology and from test subject to test subject. The duration and intensity of the tests have varied significantly depending on the test subject and care staff involved in the tests and their specific and individual experiences during the process.

The tests have resulted in valuable experiences and conclusions regarding the potential of the different solutions to treat and prevent disruptive dementia behavior. Furthermore, general conclusions have evolved concerning the actual process of introducing welfare technology, how to follow-up during the process, and how to ensure an effect when it comes to treating and preventing disruptive dementia behavior.

Premises of the analysis

It should be noted that the documentation material developed to assess the work environment as well as the test subjects' condition were not implemented as intended. Furthermore, several tests were interrupted during the process and have not been adequately documented.

In connection with the work environment assessment, it has been a methodical challenge to phrase the right questions to the care staff. It turned out that the survey questions did not

reflect the nursing staff's experiences, and it has therefore been difficult to draw any final conclusions concerning the technologies' effect on the work environment. Both the phrasing of the questions and the answer choices turned out to be unsuitable for the purpose.

With the answer choices "not at all", "a little", "moderately", "a lot", and "extremely" considerable variation in the answers cannot be expected, as the difference between some of the answer choices is relatively significant. For example, it seems fair to assume that it takes a significant change, before an employee is going to report an "extreme" improvement. This is consistent with the fact that the nursing staff has been found to provide relatively guarded answers to the survey questions regarding their work environment. Prior to the tests, the general assumption was that the care staff regularly experienced psychologically challenging work situations caused by residents displaying disruptive behavior and thus, the care staff was expected to provide a more negative assessment of their work environment than was actually the case. Another explanation for the unexpected guarded answers might be that the care staff involved in the welfare technology test project in general has a surplus of resources and thus, reports fewer psychologically challenging work situations than the average employee. A broader segment of the staff group could therefore - with advantage - have been asked to answer the survey.

The above-mentioned factors have complicated the assessment of the technologies, as the assessments are based on qualitative feedback and supplemented with the data recorded rather than the other way around.

Furthermore, the assessment of whether the criteria of success have been met has also been complicated by the factors above and consequently, the criteria of success will not be examined systematically in the following sections.

Experiences with the specific technologies

Dementia mattress

The dementia mattress was tested by a total of eight residents in three municipalities. For four out of eight residents a very big or extremely big effect of the dementia mattress has been recorded. Compared to the other technologies, the dementia mattress has thus obtained the best results in terms of improving disruptive behavior. In addition, the care staff involved in the tests also points to the mattress as a technology they would like to be able to introduce and use to a greater extent.

The positive feedback includes an example of a resident who used to be very unrestful in bed at night and suffered from interrupted sleep. After starting to use the mattress the resident has begun to sleep through the night and feels more safe. Another resident often got out of bed during the night but has now with the mattress developed a more tranquil sleep pattern. For two residents a neutral or no effect of the mattress has been reported. However, both residents were initially described as being less restless at night.

The less positive feedback does not concern the mattress' behavioral effect but emphasises attention points in relation to the referral process. One resident did not want the mattress, because it is red. The mattress was removed from another resident, because it is not suitable

for people who are overweight, and because using the mattress involved an increased risk of developing pressure sores.

The following points of attention have been emphasised regarding the dementia mattress:

- The mattress is easily introduced to the resident.
- The mattress comes in two different models for users of different sizes and weights. It is, however, not suitable for people with very low weight or for people weighing more than 140 kg, as it will increase the risk of pressure sores.
- Providing a resident with a mattress that later on might have to be taken away creates an ethical dilemma. Before introducing the mattress, it is therefore necessary with a plan on how to finance buying the mattress, in case the test period turns out to be a success.

Bed alarm

The bed alarm was tested in three municipalities involving a total of seven residents. The alarm appears to have an effect on some of the test persons. The effect is, however, limited or neutral when it comes to preventing and treating disruptive dementia behavior.

The bed alarm is considered to be an alternative for residents who do not respond positively to the dementia mattress. The advantage of the bed alarm is that it alerts a carer, if the user leaves the bed during the night allowing care staff to help the user return safely to bed. The bed alarm does not, like the mattress prevent restlessness, but it ensures that symptoms do not worsen.

Unfortunately, several of the tests were delayed or not completed because of technical difficulties. The bed alarm was expected to improve the work environment and reduce disruptive behavior, but the technical barriers turned out to stand in the way of good test results.

The following points of attention have been emphasised regarding the bed alarm:

- Even though the supplier had promised easy integration with existing alarm systems in the care homes, this turned out not to be the case.
- Setting the interval turned out to be a technical challenge for the care staff (the time interval between the resident leaves the bed and the alarm goes off). If the interval is not set correctly, there is a risk that the bed alarm will disturb the user rather than help.
- Test experiences with user adjustments and integration with existing alarm systems emphasised the fact that technical support is a prerequisite to ensure a successful implementation of the bed alarm.

Rocking chair

The rocking chair has been tested by a total of nine residents in the four municipalities. The responses from the test persons have been generally positive, but the feedback also includes a

few negative results. It seems that the test persons who did not respond positively to the rocking chair instead reacted very negatively. Two tests had to be cut short due to the reaction of the test person. The positive feedback comments from the care staff for example emphasise that the resident felt less stressed, approached the door less often, did not wander about as much, calmed down easily, and that the rocking chair reduced the resident's need for medicine.

In regard to usability and safety, it has, however, been a challenge that the chair moves when the resident sits down or stands up. The movement of the chair has made some residents feel insecure about using the chair alone, and some residents have had trouble getting up from the chair without help. To address these issues, the care staff suggests a locking mechanism and a height adjustable mechanism.

The following points of attention have been emphasised regarding the rocking chair:

- The rocking chair is easy to use for the care staff.
- The care staff suggests a locking mechanism to increase the safety of the chair. As it turns out, the chairs that were tested were apparently already equipped with a locking mechanism. However, this might not have been pointed out to the care staff.
- As mentioned previously, some of the test persons felt insecure when sitting down or standing up from the chair. It is a concern that some residents will lose their freedom of movement and will remain passive in the chair because they are unable to get up or are afraid of getting up. This is an ethical problem that has to be given careful consideration, if and when the rocking chair is put to use in the future.

Orb chair

The orb chair has been tested by nine residents in three municipalities. The nine residents responded very differently to the chair. Some residents showed very positive reactions, and the positive comments from the care staff included for example 'the orb chair creates a more peaceful environment', and 'the resident is well-balanced'. Furthermore, the care staff experienced fewer work-related conflicts.

However, neutral and downright negative reactions have also been observed. Several tests have been cut short because of the strong reactions from the test persons involved who found the chair very uncomfortable and even painful to sit in. One test was cut short, because the care staff was concerned that the chair might increase the risk of pressure sores.

It is a general observation that the chair is too low. The low chair design makes it difficult for some residents to stand up from the chair, and they feel insecure about using it alone because they fear falling.

The following points of attention have been emphasised regarding the orb chair:

- The orb chair is easy to use for the care staff.

- As the low design of the chair is considered a general problem, a height adjustable mechanism might be considered. Otherwise, buying the higher model of the orb chair is recommended.
- The chair is considered uncomfortable by some of the test persons. The chair can, however, be made more comfortable with for example a blanket.
- The care staff needs to consider the ethical issues that arise from using the chair. It is crucial that the residents keep their freedom of movement, that they are able to stand up from the chair, whenever they want to, and that they do not remain passive in the chair for longer periods of time. (Please refer to rocking chair for similar ethical considerations).

General experiences

The tests have revealed the potential of assistive technologies for people with dementia but have also brought into focus the problems and difficulties that might occur when introducing and implementing these specific technologies.

Resident perspective

In general, the tests show very individual responses to the technologies. The test persons' willingness to embrace new technologies differs widely and so does the effect of the technologies on the various test persons. The introductory period of observation has proven to be a valuable tool for outlining the individual resident's specific challenges and defining individual goals for the implementation of the new technology. Furthermore, it has helped the care staff keep their focus on guiding the residents in their use of the new technologies, and this turned out to be crucial especially in connection with the introduction of the orb chair and the rocking chair.

Based on the tests and the observed results, it can be concluded that assistive technologies for the treatment and prevention of disruptive dementia behavior have to be tried out by the resident in question before it is offered as a permanent solution. As people with dementia respond very differently, and as it is impossible to predict who are willing to embrace and use a specific technology, an observation period is of vital importance and a prerequisite for a successful implementation. During some of the tests, residents have rejected certain technologies based on e.g. comfort and colour. However, this does not enable us to exclude these technologies as some residents have experienced a positive effect of a certain technology regardless of the fact that others completely dismiss it.

To accommodate individual needs and preferences, establishing a depot or a library of dementia technologies is offered as a solution. At the library selected technologies for the prevention of disruptive dementia behavior can be borrowed enabling people with dementia to try out different technologies for a period of time. The results of the test periods will form the basis of informed technology purchase decisions. It is also emphasised that an introduction to the technology in question is of vital importance, if the resident is to embrace the technology and use it on a daily basis. If a proper introduction is not provided, the technology will end up as a passive piece of furniture. The tests have also clearly shown that

the implementation of new technologies is most successful, if the initiative is backed by the entire team around a resident's care including management and the charge nurse.

The effect of the technologies in terms of preventing and easing disruptive behavior varies significantly from resident to resident. The technologies seem to have had a positive effect on some residents and have improved their behavioral symptoms. However, some members of the staff found that especially the tests involving the two chairs raised ethical issues that have to be addressed. As the residents need assistance to get up from the chairs, it is of vital importance to ensure that they do not end up pacified in the chairs for longer periods of time.

For example, one resident became significantly more calm and had his medicine intake reduced after having used the rocking chair persistently for a period of time. Other residents appear to have become more calm and to experience quality of life improvements even though they still display behavioral symptoms. Furthermore, several residents have simply enjoyed using the technologies even though the care staff has not reported any beneficial effect of the use on the residents' behavioral problems.

A number of residents felt bad when using the technologies, especially when using the orb chair and in a few cases when using the rocking chair. One resident even said, "You have to promise me that I never have to sit in it again".

In their evaluation of the project, the dementia coordinators conclude that the technologies are most likely to have an effect on people with dementia who suffer from inner unrest as is commonly seen in people with Alzheimer's disease. However, due to the relatively low number of test persons, this cannot be concluded unequivocally.

Staff perspective

Only a few staff members report that the technologies have significantly improved their work environment. In connection with two of the tests, it is concluded that the technologies have a direct effect on the work environment. This result may be attributable to the scale which the staff used to evaluate the effect, or maybe the residents involved in these specific tests did not affect the work environment negatively to begin with. For further information, please refer to the premises of the analysis in the section Test Results.

In regard to usability, the care staff concludes that the technologies in general are easy to use. However, in connection with the tests involving the two chairs, the orb chair and the rocking chair, the care staff points out that several residents felt insecure about using the chairs on their own as they required assistance sitting down and standing up from the chairs.

On the whole, the tests show that there is potential in a systematic testing of selected technologies for the treatment and prevention of disruptive dementia behavior. There are several good examples of residents who have achieved a positive effect of the technologies in question even though some residents experienced no effect or even a negative effect. Based on the findings, it can also be concluded that if a resident experiences a positive effect of one of the technologies, this effect spills over to the work environment – i.e. if the technology improves the behavioral symptoms of a resident, a similar improvement in the work environment can also be detected.

Conclusion

The conclusion sums up the project's findings regarding systematic documentation and the specific technology tests, and outlines the general experiences concerning the introduction of the technologies and how these ought to be put to use to ensure the best results.

The dementia coordinators from all four municipalities emphasise the advantages of applying a systematic approach as it forms a basis for a better understanding of the challenges of each of the residents involved and improves the introductory as well as the follow-up processes. However, as mentioned earlier in the Test Results section, the extent of data collection differs significantly from test to test, as the care staff involved has chosen to apply the approved methodology and approach very differently. Some tests have for example been interrupted because the resident involved reacted very negatively to the technology in question. Some staff members found using the observation schemes very laborious, and general guidelines on how to use the methodology and the systematic approach have been requested. This means that the evaluation is based primarily on the qualitative feedback supplemented with the data recorded.

After the tests, the dementia mattress and the rocking chair got the best recommendations. The dementia mattress tests were the most successful, and the care staff was generally pleased to try it out. The feedback regarding the rocking chair has also been mainly positive. The most significant complaints address issues of usability and safety, but these problems can, however, probably be solved by using the locking mechanism, which the staff had not been introduced to.

The feedback regarding the bed alarm is also mainly positive, but it is not as highly recommended as the dementia mattress and the rocking chair. This can probably be attributed to the fact that technical difficulties complicated the testing process and to the fact that the technology primarily aims at solving a problem rather than preventing it.

The tests bring into focus certain reservations about the orb chair and the GSM technology. In the case of the orb chair, the reservations stem from very strong reactions from residents and from concerns regarding the design, comfort, and safety of the chair. In the case of the GSM technology, it was impossible to conduct the planned tests because of technical difficulties and problems with the battery. It might be interesting to test the GSM technology at a later point, when the manufacturer is able to provide a more reliable solution.

The most important test experiences concern the actual introductory process, as these experiences apply universally when implementing any type of assistive technology. Based on these general experiences that cover the entire spectrum of technologies, a list of attention points has been made:

- It is very difficult to determine in advance whether a resident might benefit from a specific type of technology. Because of the implications of the disease, it is impossible to predict how a person suffering from dementia will react to the implementation of welfare technology.

Evaluation - Testing welfare technologies for people with dementia

- Implementing technology solutions is a challenging process and in order to achieve the desired effect, it is essential to allocate the necessary resources.
- Staff needs to keep a constant focus on the purpose of the technology in order to avoid that it becomes a passive aid, a piece of furniture or even ends up pacifying the user.
- To ensure a successful implementation of a new technology, the initiative needs to be backed by the entire team around a resident's care including management, the charge nurse, the care staff, and the relatives.
- In some cases, it will be difficult to determine, whether it is actually the technology that has led to behavioral improvements, or if it is simply the increased focus on the disruptive behavior that has prompted the positive change. Using the documentation material, the actual cause of the change might be more easily determined.
- It is important to be aware of practical and economic conditions when purchasing the technologies; for example whether it is possible to achieve a quantity discount if several municipalities compile their orders.

Following up on the criterion of success, there is still potential for improvement of the work environment. Based on the tests, it is, however, not possible to determine to what extent the work environment can be improved. It is also difficult to estimate the economic benefits deriving from a more widespread use of the technologies. Based on the tests and the applied methodology, it is impossible to estimate how and to what extent a general implementation of technologies for treating behavioral issues will influence e.g. work hours or sickness absence. This would require testing on a larger scale and an improved methodology. One of the consequences is, that it is not possible to prepare a business case which deals with the potentials of implementing assistive technologies for people with dementia.

Finally, it has to be mentioned that the project has led to the formulation of a motto that sums up and reflects the most important experiences and points of attention. The motto is: "*The right technology for the right resident with the right introduction*".

The formulation "*the right technology for the right resident*" underlines the importance of determining the needs of the resident before choosing a technology solution as well as the importance of ensuring that the resident is open to the idea of trying out the technology in question. The formulation "*with the right introduction*" reflects the importance of providing residents as well as care staff with a thorough introduction to the technologies as this might significantly influence the effect and success rate of the implementation process. If these guidelines are followed, they will form a solid foundation for a more widespread use of technologies for the prevention and treatment of disruptive dementia behavior - creating a basis for positive change for both residents suffering from dementia and for the staff involved in their care.

Recommendations for the use of technologies in the treatment of disruptive behavior

- Allow the resident to try out the technology in question temporarily at first to find out whether or not the technology has a positive effect. This is important, as the technologies might have a calming effect on some people but the opposite effect on others.
- Assemble a library of selected dementia technologies that enables residents to try out for example different types of chairs before the final decision is made to invest in a specific type of technology for the person in question.
- In case of a successful test period, financing has to be in place in advance to avoid the ethical dilemma that will arise, if technologies are introduced to residents and then, subsequently, cannot be offered permanently.
- A code of practice needs to be established that addresses the issue of how care staff is to offer residents with dementia new technology with the purpose of treating and preventing disruptive behavior.
- The code of practice must include an obligatory two-week introductory observation period based on a standard observation schema. In this way, the scale of the problem regarding inappropriate behavior can be determined, and it is easier to find out when the inappropriate behavior occurs, i.e. if it occurs at a specific time of the day (e.g. in connection with a change of staff, when specific persons are present or at mealtimes). This is important in order to determine which technology is best suited for the person in question.
- After introducing a new technology, it is advisable to observe the user for the first two weeks preferably using the observation schema. This will ensure that the staff keeps focus on helping the resident become acquainted with the technology (to an adequate extent). Furthermore, the observation period will reveal whether the technology seem to have an effect on the user, or whether it should be passed on to another resident with dementia.
- The care staff needs to consider the ethical issues that arise when introducing new technology. It is crucial to ensure that residents are not kept passive for longer periods of time when using the selected technologies but maintain their freedom of movement and are able to move away from the technologies of their own accord.
- A contact person who is in charge of the entire process of testing and allocating technologies for residents displaying disruptive dementia behavior has to be appointed.
- The contact person preferably has practical experience in dementia (e.g. as a dementia coordinator) and is going to function as a specialist testing and allocating technologies for residents displaying disruptive dementia behavior. His or her primary tasks are to introduce, test, and recommend technologies. In this way, the contact person plays a very different role than the occupational therapist.

Key persons in the municipalities during the tests

Inge Sørensen

Dementia coordinator, Rudersdal Municipality
Contact information: sundhedsfremme@rudersdal.dk

Kirsten Ryssing

Dementia coordinator, Lyngby-Taarbæk Municipality
Contact information: traeningomsorg@ltk.dk

Birgit Clausen and Hanne Rügge

Dementia coordinators, Gladsaxe Municipality
Contact information: sofoms@gladsaxe.dk

Anne Knudsen

Dementia counsellor, Gentofte Municipality
Contact information: egebjerg@gentofte.dk

Stab & Udvikling (Staff & Development), Gentofte Municipality, is the author of the evaluation.

Appendix

Appendix 1. Pre-assessment of work environment

FORM 1

Welfare technology and dementia Assessment of the employees' work environment before technology tests

In connection with the project "Welfare technology and dementia" we are also going to examine how disruptive dementia behavior and the psychological symptoms of dementia affect the employees' work environment. We would therefore like to ask you a few questions regarding your work environment. When answering the questions, please cross out the number that you think describes your experience in the best way. If you have further comments, please write them in the space provided.

Name: _____

Technology: _____

Name of test subject: _____

Date: _____

Question	Answer	Comments
Do you feel that disruptive dementia behavior affects you at work?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Does disruptive dementia behavior affect you after work?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Does disruptive dementia behavior affect you before you go to work?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Do you feel that disruptive dementia behavior has an impact on your working relationship with your colleagues?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	

Other comments:

Appendix 2. Observation schema

Form 2

Observation schema

Name of resident: _____
Address: _____
Technology: _____
Date: _____

This observation schema is part of the assessment process in the project "Welfare technology and dementia". Please fill in the form in cooperation with the resident two weeks prior to testing the technology. Hereafter, the form has to be filled in during the entire testing period. The purpose of the observation schema is to assess the individual's disruptive behavior and psychological symptoms. The employee colours each space in the colour that reflects the individual's current behavior/situation. You can choose between four different colours. Each space are marked with date and time, and when all the spaces have been coloured, we have mapped the individual's psychological and behavioral condition during all hours of the day for two weeks.

Black: Is sleeping. The individual is in a more or less deep state of rest sitting down or lying down. The individual has his or her eyes closed and is not aware of the surroundings.

Green: Calm. The individual is sitting or moving around calmly.

Blue: Unrestful. The individual is unable to relax. The individual is wandering about, fiddling with things, moving things around, putting things in his or her mouth, is noisy, restless or in other ways fidgety in a way that is distracting to him/herself or the surroundings.

Red: Very restless/aggressive. The individual is aggressive or hostile either verbally or with his or her behavior. The individual is hitting, kicking, spitting, pinching, biting, throwing things around, yelling or using inappropriate language.

Appendix 3. Resident status

Form 3

Welfare technology and dementia

People with dementia also often suffer from psychological and behavioral disorders, BPSD (Behavioral and Psychiatric Symptoms of Dementia). With the project "Welfare technology and dementia" we strive to reduce or eliminate disruptive behavior and to suppress the psychological symptoms.

Form 3 has to be filled in before testing the technology.

In form 3 you are asked to describe the individual's type of dementia and disruptive behavior as well as the psychological symptoms that come with it. We also need to know what kind of medicine the individual is taking. If necessary, please attach medicine scheme.

Technology: _____
Testing period: _____
Name of resident: _____
Address: _____
Age: _____
Diagnosis: _____
Medicine: _____
Contact person: _____

Appendix 4. Plan of action

Form 4

Plan of action

Resident:	Technology:	Contact person:
Problem:		
Goal:		
Action:		
Evaluation:		

Appendix 5. Post assessment of work environment

Form 5

**Welfare technology and dementia
Assessment of the employee's work environment after technology testing**

In connection with the project "Welfare technology and dementia we would like to know what it has been like to work with the technology, and whether it has had the desired effect on the individual with dementia. We are therefore going to ask you a few questions about the technology and your work environment. When answering the questions, please cross out the number that you think describes your experience in the best way. If you have further comments, please write them in the space provided.

Name: _____

Technology: _____

Name of the test person with dementia who has tried out the technology:

Date: _____

Question	Answer	Comments
Is the technology easy to use?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Did the individual with dementia give the new technology a good reception?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Does the behavior of the individual with dementia affect you after work?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Does the behavior of the individual with dementia affect you before you go to work?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Does the behavior of the individual with dementia affect your working	0 = Not at all 1 = A little 2 = Moderately	

Evaluation - Testing welfare technologies for people with dementia

relationship with your colleagues?	3 = A lot 4 = Extremely	
Has the technology improved the life quality of the individual with dementia?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	
Has the technology reduced the number of conflicts?	0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely	

Other comments:
