An Italian business case for an eHealth platform to provide remote monitoring and coaching services for elderly with mild cognitive impairment and mild dementia

An Italian Business Case for an eHealth Platform to Provide Remote Monitoring and Coaching Services for Elderly with Mild Cognitive Impairment and Mild Dementia

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Abstract: The purpose of this study was to define a business case for an eHealth platform to provide remote monitoring and coaching services for elderly with mild cognitive impairment and mild dementia in the Italian context. 107 patients with mild cognitive impairment and mild dementia were divided into the intervention and control groups. The data was collected using standardized instruments Clinical Dementia Rating Scale (CDR) and EuroQoL-5D-5L, and tailor-made instruments, such as surveys to technology and healthcare providers, and semi-structured interviews to patients and healthcare professionals. The data that was not collected in the study, was obtained from the scientific literature. Benefit/cost ratio was calculated for three years. The study shows that a digital platform to provide remote monitoring and coaching services for elderly with mild cognitive impairment and mild dementia can be cost-effective from the first year, and can improve care without monetary loss for the healthcare provider. The key benefits show that the deterioration of the illness is postponed, and that the satisfaction of the patients and the healthcare professionals increases. Therefore, such an eHealth platform can be a worthy investment in Italy, and could be considered for wider nation-wide adoption.

1 INTRODUCTION

The number of people living with dementia increases. It is currently estimated to affect more than 40 million people globally, whose care generates more than 800 billion USD in cost (Prince et al., 2015). This growth will continue to strain healthcare systems worldwide. One solution to cope with this situation could be to widely use digital technologies (hereafter – eHealth) that aim to improve outcomes (both clinical and quality of life) and to save costs. While there is a growing body of literature that examines effects of eHealth to elderly patients with various levels of severity of cognitive impairment, adoption of eHealth into routine care is lagging (Swinkels et al., 2018). One barrier concern limited resources in healthcare. eHealth initiatives compete against one another and other options for investment, while the return-on-investment for this type of eHealth service remains unclear. Before allocating funds, decision-makers will create a thorough overview of which investments can maximize impact on health and efficiency. If the business case for eHealth in this context remains vague, its adoption will falter.

Different reviews (Goldzweig et al., 2009; Kim et al., 2017) reported a lack of published evaluations of costs and benefits of eHealth implementations. A similar gap of missing cost-benefit evaluations has been noted for technology implementations in the area of dementia (Westphal et al., 2010). Still in 2016, it was reported that majority of the evaluations of technology for people with dementia focus on usage, usability, and adoption (Knapp et al., 2016). The paucity of economic data is one of the biggest barriers to the creation of business cases that are essential for eHealth adoption.

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A business case, as defined by Gambles (2017, p. 1), is *"A recommendation to decision makers to take a particular course of action for the organization, supported by an analysis of its benefits, costs and risks compared to the realistic alternatives, with an explanation of how it can best be implemented"*. In this paper, we describe a business case for investment in an eHealth platform to provide remote monitoring and coaching services for elderly with mild cognitive impairment (MCI) and mild dementia (MD). We examine whether it could improve quality of care by enhancing care outcomes and saving costs in Italy. Hereby, we aim to add knowledge to the scarce body of literature on which eHealth interventions have a positive business case.

2 RELATED WORK

Cost-effectiveness or business case development studies of non-pharmacological eHealth interventions for treating MCI and MD are scarce. Most eHealth studies have focused on clinical and social outcomes (e.g. Van Mierlo et al., 2015; Ben-Sadoun et al., 2016) and have shown positive outcomes to caregivers, such as relatives, healthcare professionals, or a healthcare organization. Less evidence is available on clinical effectiveness of eHealth for the elderly patients themselves, with various levels of severity of cognitive impairment (Knapp et al., 2016). Similarly, there are cost-effectiveness studies that focus on non-pharmacological interventions without involvement of eHealth (e.g. Gitlin et al., 2010; Willis et al., 2018). The following paragraphs will summarize the cost-effectiveness outcomes of non-pharmacological eHealth interventions, obtained from a small number of published studies.

The ISISEMD (Intelligent System for Independent living and Self-care of seniors with cognitive problems or Mild Dementia) project introduced assistive technology for elderly people with mild dementia living in the community. The business case concluded that the system can only be sustainable if provided at a large scale, at the level of municipality or region (Mitseva et al., 2009).

On a general level, an economic modelling study for dementia conducted by Knapp et al. (2016) modelled three scenarios. The first scenario considered postponement of care home admission. It assumed that assistive and safety technologies can delay care home admissions by 8 months (based on Riikonen et al., 2010). Under this scenario, the technology intervention would be cost-effective if it postponed care home admissions by 8 months, and reduced hours spent on care by the informal caregiver by 20%. The second scenario considered reduction of career's stress. Impact in quality-adjusted life years (QALY) was examined. It was assumed that technology could reduce career's stress and improve career's quality of life by 0,05 EQ-5D tariff that lasts for 3 years (time of patient's living in a community). The technology intervention would be cost-effective if it cost less than 13.000 British pounds, delayed care home admissions by 8 months, reduced career's weekly hours by 15%, and increased career's quality of life by 0,05 QALY per year. The third scenario aimed to find out how much benefit that is relative to costs, the technology needs to generate in order to be deemed cost-effective (from societal and health perspectives). It was considered that the technology costs 5000 British pounds over 4.5 years (time of patient's living in a community). Under this scenario, the technology intervention would be cost-effective if it postponed care home admission by 3 months and reduced career's weekly hours by 8%, and increased career's quality of life by 0,06-0,08 QALYs per year.

As it can be seen from the overview of the related work, the cost-effectiveness studies on eHealth intervention in dementia care are fragmented and have not reached saturation of knowledge. It is challenging to draw conclusions from the published studies not only because the types of eHealth analyzed are different and applied in different contexts, but also the pace of technology development is fast and monetary values (e.g. prices, hourly tariffs) fluctuate over time. This leads to a need for more cost-effectiveness studies related to eHealth interventions in dementia care.

3 MATERIAL AND METHODS

3.1 Empirical Study

The business case was developed within a 3-year project "Digital Environment for Cognitive Inclusion" (DECI) funded by the European Union (EU). The study was carried out in four countries, and the study design was comparative, randomized, stratified and prospective. The case analyzed in this paper focuses on a business model to provide in-house remote assistance services in the Italian context, promoting independent living for elderly people diagnosed with mild cognitive impairment and mild dementia. The population was divided into an intervention group and a control group. In Italy, 53 persons were randomized into the intervention group (10 dropped-out), and 54 persons in the control group

that followed care as usual (5 dropped-out). The intervention lasted for 6 months. Measurements took place at a baseline and after 6 months.

The Intervention group received a technology-supported DECI care model, consisting of:

1. An integrated platform, installed on a tablet that enables professionals to share information about the patients, as well as patient-to-professional communication.
2. Web-based physical and cognitive exercise applications (an OTAGO-based falls prevention program by Roessingh Research and Development (The Netherlands) and SmartBrain (Spain).
3. An activity monitoring system, supported by a wearable device that records the number of steps and the duration of active hours throughout the day (Adamo watch by Consoft Sistemi s. p. a.).
4. A case manager, in Italian case a social worker, responsible for coordinating the care, introducing and supporting a patient in using the technology.

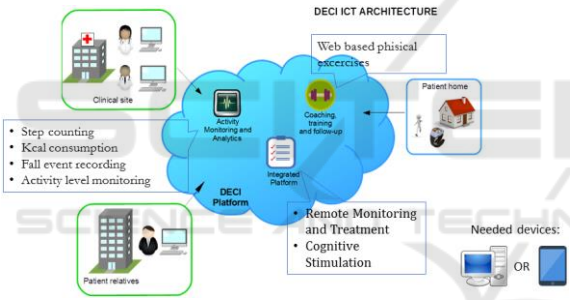

Figure 1: The DECI services.

The inclusion criteria for patients:

1. Age ≥ 60
2. Diagnosis of MCI or diagnosis of Dementia according to DSM V criteria
3. Clinical Dementia Rating (CDR) ≤ 1
4. Living at home
5. Ability to provide informed consent or availability of a proxy for informed consent

3.2 Business Case Creation

The approach towards creating the business case was based upon the TNO Business case model for innovation in long-term care, created by an organization TNO that aims to assess an innovation and to demonstrate its value to government and industry. The approach allows a multi-dimensional assessment of changes in variables before and after introduction of the innovation, and is intended to inform decision makers of the added value of the innovation.

The business case development starts with the description of the innovation (also called as boundaries of the innovation in the TNO approach). Then, risks are discussed. Afterwards, it is necessary to determine which of the variables are relevant to the investigation and how to obtain the data. Variables proposed by TNO to assess the before and after situations include:

- The cost of spent time by healthcare professionals.
- Consequences of using the innovation on the quality of care (e.g., patient satisfaction, quality of life, safety).
- The impact of the innovation on prevention or postponement of the health issue.
- Income generated by providing the service based on the innovation.
- Investment for starting the innovation.
- Operating expenses for using the innovation, after initial investment.
- Changes in quality of work by healthcare professionals (e.g., job satisfaction)

In this study, we approached the business case from the perspective of the healthcare organization (in this case, a Memory clinic).

3.3 Data Collection and Analysis

Spent time (operationalized as the cost of time spent by healthcare professionals for direct treatment) was collected via a survey to the healthcare provider. A total number was calculated by multiplying the number of spent hours by the applicable hourly tariff.

Quality of care consisted of the time spent on multi-disciplinary meetings for defining and refining treatment plans, patient satisfaction, safety, and quality of life. Data for time spent on multi-disciplinary meetings for defining and refining treatment plans was collected via a survey to the healthcare provider. A total number was created by multiplying the number of spent hours by hourly tariffs. Multi-disciplinary team meetings and refinement of care plans were not applicable to a control group. Patient satisfaction was assessed via semi-structured interviews with patients (purposeful sample of n=10 for the intervention group and n=10 for the control group). Data was thematically analyzed. Data regarding willingness to use the DECI services in the future was collected through a willingness-to-pay survey to the patients and their informal caregivers. Third, quality of life of the

patients was assessed using a questionnaire EuroQoL-5D-5L (EuroQoL Group, 1990; Wolfs et al., 2007; Janssen et al., 2013). Data was analyzed using SPSS software, Chi-square and one-way Anova statistical tests. The confidence level was set at 0.05. Safety data was collected using qualitative semi-structured interviews with the patients of the intervention group (n=10) supplemented by semi-structured interviews with healthcare professionals (n=4). Since safety aspects concerned the DECI solution, this element was not applicable to a control group. Data was thematically analyzed.

Prevent and postpone care consists of prevention of falls due to the DECI services and postponement of mild dementia. Since the falls data were not collected in the project, assumptions were extracted from relevant literature. People above 65 years fall, on average, 0.33 times per year (Gillespie et al., 2012). 9% of the falls require a GP visit, and 5% of the falls lead to an emergency visit (Berg et al., 1997). 3% of the falls end in a fracture (assumed by the project team). Completion of the OTAGO program leads to prevention of 68% of falls (Thomas et al., 2010). During analysis, a number of falls prevented is calculated (% of falls prevented (68%) multiplied by a targeted population size). Then, the total saved cost due to prevented falls is calculated by summing up: a) prevented GP consults (a number of falls prevented multiplied by 9% and by the cost of a single GP consult; b) prevented emergency room visits (a number of falls prevented multiplied by 5% and by the cost of a single emergency room visit; c) prevented fractures (a number of falls prevented multiplied by 3% and by the cost of a fracture treatment. Data for the cost of a GP consult (15 euros), an emergency room visit (241 euros), and a fracture treatment (2949 euros) were obtained through a survey to the healthcare provider.

Data for postponement of mild dementia was collected using Clinical Dementia Rating Scale (CDR) (Morris et al., 1997) on patients at the baseline and follow-up. Annual costs of treating MD were obtained through a survey to the healthcare provider and equals to 18.941 euros. During analysis, a proportion of people who converted from MCI to MD was calculated using changes in CDR from baseline to follow-up. The conversion rate was assumed to stay stable after 12 months. The saved costs due to the postponement of MD were calculated by multiplying the following elements: conversion rate from MCI to MD, annual target population, and annual MD treatment costs.

Income of a healthcare provider consists of annual insurance reimbursement for healthcare services provided. Data was obtained through a survey to the healthcare provider. Hypothetical income related to willingness to pay by a patient or an informal caregiver was collected through a survey to the patients and their informal caregivers. Data was analyzed by calculating the average amounts that would be paid by the patient or the informal caregiver.

Investment relates to the cost of personnel for server installation and configuration related to the DECI services. Data was obtained through a survey to the healthcare provider.

Operating expenses refer to the annual operating expenses for the technology in the DECI services, to be incurred by the healthcare provider (usage fees, hardware, servers, maintenance, helpdesk, etc.). Data was obtained through a survey to the technology providers and the healthcare provider. Usage fees for all the technologies are constant, except for the smartwatch fee, which increases with the size of patient population.

Quality of work refers to the satisfaction of healthcare professionals using the innovation. Data was obtained through semi-structured interviews with the healthcare professionals (n=4). Same professionals were involved in the care of the intervention and control groups. Data was thematically analyzed.

All benefits and costs that were possible to convert into monetary magnitudes were entered into the model which was set up in the MS Excel. Then, the ratio between the monetary benefits and costs of implementing DECI services were calculated for situations after year 1, year 2, and year 3.

$$\text{Ratio} = \text{Benefits} / \text{Costs} \quad (1)$$

Consideration of all outcome categories determine whether or not implementing the DECI service is a worthy investment. The business case for the usual care in the control group equals to zero, since several categories of evaluation that result in monetary values are not applicable, while other categories of costs and benefits compensate each other. First, the usual care does not involve technology innovation, which makes the categories of investment and operating expenses not applicable. Second, prevention of MD, GP consults, falls, emergency room visits, and fractures concern the innovation introduced, and are not applicable to the control group. The only applicable methodological categories that result in monetary values are spent time and income. However, the cost of time spent by the professionals are reimbursed (income). Therefore, the business case for the usual

care in the control group equals to zero. However, non-monetary qualitative results for the control group are discussed, where applicable.

4 RESULTS OF A BUSINESS CASE IN ITALY

In Italy, healthcare services are free-of-charge and funded from tax payments. DECI services were an extension of service offered by Centers for Cognitive Disorders and Dementia in the region of Lombardy (Milan) which have a primary responsibility to diagnose and assess the stage of illness and to determine the therapy. Every patient that met the inclusion criteria visited the healthcare professionals two times at the Memory Clinic of Istituto Palazzolo, Fondazione Don Carlo Gnocchi Onlus (FDG) in Milan: for inclusion and follow-up. Five professionals were involved in the DECI services: a geriatrician, two neuropsychologists, a social worker (also acting as a case manager), and an engineer. The case manager was engaged full-time in the study and had a role to coordinate patient's care with other professionals, to answer the incoming messages through the DECI platform, to check patient's adherence to prescribed physical and cognitive therapies, to send reminders, to monitor the status of the battery of the smartwatch, and to organize its replacement. The geriatrician worked with tailoring the physical activity program to fit the specific needs of the patients. The neuropsychologists designed therapies delivered via the cognitive stimulation program.

It is important to note that we evaluate the intervention as a whole, i.e. organizational and therapeutic inputs, and not just technology. Therefore, the outcomes reported cannot be attributed to the technology only.

Table 1 shows the demographics of the patients included in the study.

Projected Population Size

Based on the estimation of the project team, the population size in Italy can be targeted at 100 patients for year 1, 150 patients for year 2, and 175 patients for year 3.

Table 1: Patient characteristics at baseline.

Intervention group	N=53
Age	77.64±5.27
Gender (F/M)	27/26
Diagnosis (MCI/MD)	39/14
MCI type (Amn/N-Amn)	19/20
Education years	9.21±4.27
MMSE (range 0-30)*	26.56±2.87
CDT (range 0-5)*	3.30±1.38
ADL *	5.64±0.92
I-ADL*	6.13±2.19
Control group	N=54
Age	78.98±5.98
Gender (F/M)	31/23
Diagnosis (MCI/MD)	36/18
MCI type (Amn/N-Amn)	16/20
Education years	9.02±4.15
MMSE (range 0-30)	26.18±2.96
CDT (range 0-5)	3.13±1.33
ADL	5.59±0.81
I-ADL	6.09±2.09

*CDT = Clock drawing test (Shulman, 2000)
MMSE (Mini-Mental State Examination) (Folstein et al., 1975)
ADL (Activities of Daily Living) (Katz et al., 1970)
I-ADL (Instrumental Activities of Daily Living) (Lawton et al., 1969)

4.1 Benefits

Prevent and Postpone Care

16% of the control sample and 6% of the intervention sample converted to MD at a follow-up after 6 months. The rate of conversion is quite high since the samples are small and the mean age of the patients in the study was high, which affected the rate of conversion (Visser et al., 2006). Hence, the data shows that 10% fewer MCI patients converted to MD in the intervention group, compared to the control group. The costs that are prevented using the DECI services relate to 10% additional prevention from turning from MCI to MD. Hence, the preventable costs equal to 196.337,16 euros in year 1. Every consecutive year, the prevented costs rise due to a rising number of patients who would use the DECI services. The prevented cost in year 2 equals to 294.505,74 euros and 343.590,03 euros in year 3.

Income

Italian healthcare system does not reimburse the costs incurred by using eHealth. Therefore, insurance reimbursement would not differ between the DECI services and usual care. In this study, income in the

intervention group will be interpreted as the insurance reimbursement for the time spent by the healthcare professionals providing usual care, and equals to 26.458 euros in year 1, 39.687 euros in year 2, and 46.301,50 euros in year 3.

Willingness-to-pay analysis showed that 60% of the patients in the intervention group were willing to pay, on average, 47 euros monthly for the DECI services. It comprises, on average, 28,20 euros per patient. 70% of their informal caregivers were willing to pay, on average, 33 euros monthly. It comprises, on average, 23,10 euros per informal caregiver. However, the income that would come from the patients or informal caregivers is not included in the business case analysis in this study, since healthcare is supposed to be free-of-charge in Italy.

Patient Satisfaction

All the control group patients expressed trust in competence of the professionals and appreciated kind approach that made them feel good. However, one patient disliked to be charged for the visits, two patients thought that the waiting time between a contact and a visit was too long, and one patient found the process too bureaucratic.

Patients in the intervention group perceived that the key strengths of the DECI services were the simplicity of its features and the stimulating physical and cognitive exercises that helped them keep active. The main challenges concerned starting using the DECI technology and to learn navigating it. Therefore, an IT helpdesk was identified as a necessary addition to the service, that could reduce the need for clinical staff and family members to provide extra time for helping the patients learn the IT system (a helpdesk is estimated to cost 10.800 euros for a population of 100 patients in year 1). Also, the difficulty level of the physical and cognitive exercises needs to be customized, based on the state of the condition of the patient. The exercises were often perceived as too easy. Since the cognitive and physical training systems contain various levels of difficulty, it was deemed to be a learning point for clinical staff to select the right level for the patient. Design and size of the activity monitoring device (a wrist watch) needs to be improved to better suit the routines and aesthetic preferences of the elderly population (the watch was deemed to make people feel they look sick, and the design was too youthful).

A willingness-to-pay survey showed that 83% of the patients and 86% of the informal caregivers are willing to use the DECI services in the future. Also, 90% of the patients and 89% of their informal caregivers would recommend DECI to others.

Quality of Life

Analysis of proportions in each dimension, inside of each group, to locate changes between the baseline and the follow-up, did not yield statistically significant results. In the intervention group: mobility $\chi^2(1)$=0,051, p=0.822; self-care $\chi^2(1)$=0,212, p=0,645; usual activity $\chi^2(1)$=0,080, p=0,777; pain/discomfort $\chi^2(1)$=0,720, p=0,396; anxiety $\chi^2(1)$=0, p=1. In the control group: mobility $\chi^2(1)$=0,809, p=0.368; self-care $\chi^2(1)$=1,359, p=0,244; usual activity $\chi^2(1)$=0,970, p=0,325; pain/discomfort $\chi^2(1)$=2,256, p=0,133; anxiety $\chi^2(1)$=1,142, p=0,285.

Analysis of changes in the EQ visual analogue scale (VAS) between the baseline and follow-up did not yield statistically significant results too: intervention group p=0,450; control group p=0,910. In-between groups analysis using one-way Anova to locate a difference between the control and the intervention groups did not yield statistically significantly results, p=0,558.

Analysis of EQ index values used a Spanish value set. Analysis of changes in the index values between the baseline and the follow-up in each group did not yield statistically significant results: intervention group p=0,458; control group p=0,075. In-between groups analysis of the index values using one-way Anova to locate a difference between the control and intervention groups did not yield statistically significantly results, p=0,219. Intervention group, mean QALY=-0,0139± 0,0903; control group, mean QALY=-0,0448636±0,1404.

Quality of Work

In Italy, both groups were attended by the same healthcare professionals involved in the study. All the professionals indicated that introducing the case manager role was highly beneficial, since it is a dedicated contact person guiding the patients and answering their questions. The role was deemed useful for strengthening relationships between the patients, informal caregivers, and healthcare professionals. Professionals also appreciated the infrastructure and technological features of DECI, especially the ability to monitor the exercise and performance of the patients remotely.

The DECI study demanded healthcare professionals to spend, on average, 29,3 hours per week. All the professionals reported an increased workload, but it was deemed to be related to the administration of the study. However, the quality of work was perceived to have increased due to the higher empowerment of the professionals by being able to provide patients with useful tools. Healthcare

professionals also reported to have increased their knowledge about cognitive impairment and patients' statuses and needs. Moreover, the DECI services made it easier to work cross-functionally through facilitated data sharing in the DECI platform.

4.2 Costs

Spent Time and Quality of Care in Italy concerned the following professional categories engaging with the DECI services and multi-disciplinary meetings (please note that this time does not overlap): doctor, nurse practitioner, physiotherapist, technician, case manager, psychologist. In total, the cost of time spent by the professionals for the intervention group is projected to 66.325,27 euros in year 1, 99.487,90 euros in year 2, and 116.069,22 euros in year 3. The cost of time spent by professionals for the control group is projected to 26.458 euros in year 1, 39.687 euros in year 2, and 46.301,50 euros in year 3. Average costs per patient remain stable.

Investment (one-time) for the DECI services is relatively small on the side of the hospital. The investment includes the cost of staff of 140 euros for establishing the ICT infrastructure.

Operating Expenses consist of the annual usage fees for the DECI technology and the operating costs for hosting the technology in the hospital.

The annual usage fee for all DECI technologies is 52.100 euros (including tax). The highest fee is paid to the smartwatch provider due to the lease of hardware. The usage fee for year 2 equals to 70.400 euros, and 79.550 euros for year 3.

The annual operating costs for all DECI technologies equal to the total of 74.646 euros in year 1 and consists of the cost related to purchasing the hardware (depreciation in 12 months), server hosting, configuration of the tablets, personnel cost for maintenance and helpdesk, licenses, 4G connectivity. The annual operating costs for year 2 equals to 101.496 euros, and 114.921 euros for year 3.

Total annual operating expenses of the DECI technology equal to 126.746 euros for year 1, then 171.896 euros for year 2, and 194.471 euros for year 3.

4.3 Safety

The majority of the interviewed patients and healthcare professionals did not express any concerns or observations the DECI services might be not safe. However, two safety-related risks were reported. First, the physical activity program OTAGO might require supervision for an older population. One healthcare professional expressed concerns that some exercises put too high pressure on these patients. One patient has also mentioned that some interaction with a professional during the exercise session would have been helpful, in order to make sure the exercises are performed in a safe way. Second, one patient reported that Adamo activity monitoring sensor caused an allergic reaction to nickel and plastic.

4.4 Benefit/Cost Ratio

Table 2: Summary of the DECI scenario in monetary terms (euros).

	Total benefits	Total costs	Benefit/Cost ratio
Year 1	222.795,16	193.211,27	1,15
Year 2	334.192,74	271.383,9	1,23
Year 3	389.891,53	310.540,22	1,25

As it can be seen from the Table 2, the business case of the DECI services in Italy is positive from the first year. Benefits in year 1 comprise 222.795,16 euros and consist of preventable care costs 196.337,16 euros, and insurance reimbursement for the usual care (income) 26.458 euros. Other categories of the benefits were non-monetary, and therefore they were not included in the calculation of the benefits. Benefits for the year 2 and year 3 were calculated in the same way.

The costs in year 1 comprise 193.211,27 euros and consist of the cost of time spent by the professionals 66.325,27 euros, a one-time investment 140 euros, and annual operating expenses 126.746 euros. Costs for the year 2 and year 3 were calculated in the same way, except the investment cost of 140 euros was not included in the subsequent years, since it was a one-time expense.

The benefit/cost ratio was calculated by dividing the total cash benefits of the DECI services by the total cash costs of the DECI services.

5 DISCUSSION

Future predictions of an increase in dementia patients makes it important to assess new non-pharmacological forms of care. In this study, we assessed a business case of an eHealth platform to provide remote monitoring and coaching services for elderly with mild cognitive impairment and mild dementia (DECI). We compared two different

scenarios, DECI and the usual care. The comparison showed that the DECI services can be cost-effective from the first year, and it is a more beneficial alternative to usual care for elderly with mild cognitive impairment and mild dementia. In the DECI scenario, the cost increases compared to the usual care due to a different care model that includes multi-disciplinary work, usage of technology, and coordination activities performed by the case manager. However, the cost is partially reimbursed by insurers and outweighed by both monetary and non-monetary benefits.

From the patients' point of view, DECI helped to postpone a need for institutional care by reducing the rate of conversion from MCI to MD. Such postponement brings positive economic impact. The study adds knowledge on how such non-pharmacological intervention reduces the long-term costs of care (Lin and Neumann, 2013). The findings of this study were produced on a relatively small sample of patients. In the future, the effects of similar interventions to the costs for dementia management could be investigated on a larger scale. However, there was not enough evidence to suggest that there were statistically significant changes in quality of life of the patients. This result could be influenced by a sample size, or a rather short duration of the intervention that lasted for 6 months. In the future, it might be worthwhile to explore other aspects of quality of life than the ones covered by the instrument EuroQoL-5D-5L.

Healthcare professionals felt more empowered by a possibility to provide useful ICT tools of the DECI services to patients so that they feel more in control over their condition. Moreover, the DECI service has the ability to save time for home visits by monitoring patient's performance remotely. The case manager role, as part of DECI scenario, was perceived as a must-have in the care process, as it helps to build relationships with patients and facilitates coordination of care.

Hence, it can be concluded that such an eHealth platform, providing remote monitoring and coaching services, is a worthwhile investment in the Italian context, as care can be improved at no monetary loss for the healthcare provider. Furthermore, Italian authorities could consider assessing the possibility of a region-wide implementation of the DECI solution.

When comparing this study with other published cost-effectiveness studies on eHealth for elderly with mild cognitive impairment and mild dementia, it is challenging to draw conclusions. This is because the types of eHealth analyzed are different and applied in different contexts. Also, the pace of technology development is fast and monetary values (e.g. prices, hourly tariffs) are not stable over time. For example, the ISISEMD project (Mitseva et al., 2009) implementing assistive eHealth technologies concluded that cost-effectiveness can only be reached if it is provided at a large scale. The DECI services, applying a different technology, can be cost-effective on a scale of one organization and from year 1 itself. Our study added knowledge about cost-effective eHealth solutions that provide added value to elderly with mild cognitive impairment and mild dementia.

5.1 Future Plans in the Italian Site

From 2019, a new model of Lombardy region health system is going to be introduced. It will allow reimbursement and delivery of home healthcare services for elderly chronic patients suffering from cognitive decline. This will enable to deliver services also through ICT technologies (although the hardware and software technology will not be reimbursed). Based on this model, reimbursement for the delivery of home care services with ICT tools will exceed the usual care reimbursement. Such developments at regional level will create an opportunity to implement the DECI concept in the usual care system.

Being part of the DECI research, the Memory Clinic of Istituto Palazzolo, Fondazione Don Carlo Gnocchi Onlus (FDG) has appreciated the DECI concept and considers it beneficial compared to the usual care. The site aims to ensure that chronic elderly patients are followed in their clinical path, and more patients in need of assistance can be reached. Therefore, FDG has decided to adopt the DECI approach. However, even though the business case was positive, the site aims to reduce the cost of technology even more. At first, the site will re-use the hardware (tablets) that have already been used during the DECI study. Since ICT will not be reimbursed and will have to be covered at own expense by the site, the strategy is to consider other similar and cheaper software technologies that are already tested by the site in other research projects. To manage the costs, the site will create a strategy to balance the number of patients in need of the service and the duration of the service using technology. This way, the site expects to maximize the reach and benefits for the patients in need.

The principal risk for this future scenario is the under- or no-use of the technologies from care staff and patients, when they are implemented. This risk could emerge because the use of ICT tools requires changes in daily routines and activities for all the

stakeholders – healthcare providers, patients, and their informal caregivers.

6 RECOMMENDATIONS AND CONCLUSIONS

The aim of this study was to assess a business case for an eHealth platform to provide remote monitoring and coaching services for elderly with mild cognitive impairment and mild dementia. A lack of economic evidence leads to difficulties to decision-makers in investing in eHealth solutions for dementia. Findings from this study demonstrate that the eHealth platform containing remote monitoring and coaching functionalities is a worthwhile investment, with benefits for people with mild cognitive impairment and mild dementia, and also for the healthcare provider.

To further enhance the business case, several changes could be implemented to the DECI services:

(1) Patient or informal caregiver contribution. Willingness-to-pay analysis showed that the average monetary contribution by the patients could comprise 28,20 euros. The average contribution by the informal caregivers could comprise 23,10 euros per month.

(2) Healthcare insurance contribution. Financial burden could be shared with insurers. However, negotiations for eHealth reimbursement would need to be started. Since the positive monetary benefits of DECI affect insurers, achieving contribution from the insurers is deemed to be of good potential.

Delimit the technology of the DECI solution to software-only. Currently, the biggest part of the cost is caused by the smartwatch technology and its usage fees. And patients were not as satisfied with the smartwatch as with the software technologies (mainly due to the design issues). Eliminating the smartwatch would substantially reduce the cost, thus making the solution even more attractive for investment. For activity monitoring, one could also resort to using the accelerometers in patients' smartphones, which are equally capable of registering physical activity.

7 LIMITATIONS

The main limitation of the study was the follow-up period of 6 months, which affected the observed outcomes in terms of health and quality of life. A longer period could have possibly provided a more meaningful evaluation. Another limitation was related to the outcomes that could not be turned into monetary values (both for costs and benefits). In such cases, qualitative discussion is provided. Lastly, there was a lack of preventable falls data since this data was not collected in the study and had to be obtained from the literature. However, the literature used is based on the same OTAGO program in other studies.

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