	SEVENTH FRAMEWORK PROGRAMME Information and Communication Technologies
Grant agreement number	FP7-611650
Project acronym	DOREMI
Project Title:	Decrease of cOgnitive decline, malnutRition and sedEntariness by elderly empowerment in lifestyle Management and social Inclusion

Deliverable Number:	D7.4
Title of Deliverable:	Impact Assessment of DOREMI output on Health care system of EU27
WP related to the Deliverable:	WP7
Dissemination Level: (PU/PP/RE/CO)*:	PU
Nature of the Deliverable: (R/P/D/O):**	R
Contractual Date of Delivery to the CEC:	31/10/2016
Actual Date of Delivery to the CEC:	31/10/2016

WP responsible for the Deliverable:	UOC
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Reviewer(s):	-

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PU=Public
PP=Restricted to other program participants (including Commission Services)
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**Nature of Deliverables:
R=Report
P=Prototype
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Abstract

This deliverable performs an Impact Assessment of the potential impact of DOREMI on EU health systems, applying an extrapolation accounting framework model. It examines DOREMI expected benefits in the form of savings in hospitalisation costs and reduced mortality. It also constructs a break-even indicator to compare expected benefits from DOREMI with its costs.

Keywords

Extrapolation, DOREMI costs, hospital costs, mortality, break-even indicator, clusters

VERSION HISTORY

Version	Primary Author	Version Description	Date Completed
0.1	UOC	Final Version	31/10/2016

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EXECUTIVE SUMMARY

This deliverable performs an Impact Assessment of the potential impact of DOREMI on EU health systems. It applies an extrapolation accounting framework model developed by the JRC IPTS that uses statistics on diseases' prevalence, mortality, and hospital utilisation and costs to construct two output indicators: value of reduced hospitalisation, and value of reduced annual mortality. The model also presents a break—even indicator to compare expected benefits from DOREMI with its costs.

The results show how DOREMI can bring benefits to EU countries in the form of savings in hospitalisation costs and reduced mortality. The break-even indicator is often lower than the estimated DOREMI cost per user, which means that benefits would not cover the costs. However, a reduction of DOREMI cost will be feasible in large deployment scenarios. In fact, with a cost of 0.5€ per user, DOREMI would be profitable in most EU countries.

Finally, it seems that the cluster of Nordic countries, UK and the Netherlands is the most promising market for DOREMI, because they are usually characterised by high hospital costs (and thus wider scope for saving) and National Health Systems, which might be more predisposed to adopt the solution. In addition, countries with established health insurance schemes (continental model) also represent a market opportunity for DOREMI.

Abbreviations

BMI: Body Mass Index

CHF: Congestive heart failure

COPD: Chronic obstructive pulmonary disease

CVD: Cardiovascular diseases

HCUP: Healthcare Costs & Utilization Project

HF: Heart failure

HFA-DB: European Health for All database

HMDB: European Hospital Morbidity Database

IPHS: Personal Health and care Services

KPI: Key Performance Indicator

LTC: Long-term care

MCI: Mild Cognitive Impairment

MNA: Mini-Nutritional Assessment

NHS: National Health Service

PA: Physical Activity

PHS: Personal Health Systems

QALY: Quality-adjusted life year

QoL: Quality of Life

WHO: World Health Organisation

1. Introduction

The impact assessment has the aim to estimate the impact of DOREMI outputs on EU Health care system and on society at large. The impacts on the European health care systems are expected to be in the form of reduction of the prevalence of malnutrition, sedentariness and mild cognitive decline (the three conditions addressed by DOREMI) among the elderly and, thus, on the health expenditure related to these conditions. DOREMI is also expected to have impacts on society at large through improving the quality of life of the elderly.

DOREMI addresses these three conditions because they are related to the main causes of morbidity and premature mortality, such as obesity, hypertension, and mental disorders. More concretely, as explained in DoW, there are six leading causes of premature death among older people in Europe: ischaemic heart disease; stroke and other cerebrovascular diseases; lung cancer; colon and rectum cancer; chronic obstructive pulmonary and other respiratory diseases; prostate cancer (male), and breast cancer (female). The Impact Assessment uses an extrapolation accounting framework model that is related to three of these causes, since it includes CHF and CVD, as well as Diabetes which is closely associated with the conditions targeted by DOREMI as it will be exposed in the following section. This model gives an indication of DOREMI expected savings and expected reduction in mortality. It also presents a break—even indicator to compare expected benefits from DOREMI with its costs.

2. Ageing trends and expected impact of DOREMI

The projections of the European Commission Ageing report 2015 show that the percentage of population 65 years or over is expected to rise from 18% to 28%, by 2060. In consequence, age-related expenditure such as pensions, healthcare and long-term-care are also projected to increase (European Commission, 2015). This can put a heavy burden on the health systems and can threaten their sustainability. For example, Costa-font, Courbage, & Zweifel (2014) anticipate a rise in the need for formal long-term care including personal care, community care, institutional care in nursing homes, and assisted living facilities. In fact, government spending on LTC in OECD countries grew by an average of 4.8% annually from 2005 to 2011 (WHO, 2015).

In this context, ICT solutions such as DOREMI can be key to improve elderly's health condition, enhance their ability to live independently for longer, and ensure the sustainability of the public health systems. In this line, several projects have tried to estimate the potential impact of telehealth in general and specific ICT products and services for the elderly.

The project from the European Commission's JRC-IPTS Strategic Intelligence Monitor on Personal Health Systems phase 2 (SIMPHS 2) examined the market and innovation dynamics of the PHS. Its results showed that a 20% deployment of telehealth in chronic patients of CHF, CVD and Diabetes would bring benefits in the form of reduced hospitalisation days and costs and lower mortality (Zamora, 2012). A case study in South East Sussex for Doc@HOME®[1] (an integrated telehealth solution for the remote management of patients with long-term conditions and chronic diseases) showed a 75% reduction in A&E (accident & emergency) visits due to using the solution. This represented a public saving of £ 1,091 for 53 patients per month, and thus £ 13,092/year per for the group of study. Therefore, they highlighted that if it was deployed to 1,000 patients, yearly savings would be around £ 247.000. Furthermore, the same case study showed an 83% reduction in hospital admissions, which implied a monthly saving of £ 44,892 for this group of patients and 847.000 annually. In addition, the product reduced 999 calls by a 72% and GP visits by a 56% (EY & Danish Technological Institute, 2013).

[1] http://www.docobo.co.uk/telehealth-solutions/docobo-DOC@HOME.html

The results of a pilot with 200 elderly for the ESOPPE programme2 (which provides a pack of technology solutions for the elderly) showed a reduction in hospitalisations by a factor of 2.6 within those that used the product. Therefore they stated that the use of the pack would bring savings, taking into account that it costs € 700/year plus € 1,000 in the first year and that the average cost of a hospital stay is € 8,000 (EY & Danish Technological Institute, 2013). Home doctor is a solution for the remote monitoring of older patients' physiological parameters allowing them to remain at home. This reduces visits to the hospital and thus decreases total costs of healthcare. The estimated daily cost is € 180 per patient, much less than the average of € 700-1,000 at a hospital (EY & Danish Technological Institute, 2013).

On the other hand, the review conducted in D2.1 showed that the three conditions addressed by DOREMI are related to several diseases affecting elderly, such as Congestive Heart Failure (CHF), Diabetes and Chronic Obstructive Pulmonary Disease (COPD). First, malnutrition can affect elderly's wellbeing in several ways and diet is related to cardiovascular and cerebrovascular disease, diabetes, osteoporosis and cancer. For example, obesity among elderly can increase the risks of metabolic syndrome, type 2 diabetes, hypertension, coronary heart disease, stroke, respiratory diseases, cancer, osteoarthritis, or cognitive impairments.

Malnutrition is closely related with cardiovascular diseases (CVD) and heart problems. CVD cases and deaths are more prevalent among the elderly and they are partially caused by unhealthy dietary habits. For example, undernutrition can worsen existing cardiovascular problems and obesity is a risk factor for heart failure (HF). In fact, studies have shown higher HF risk with increasing BMI. Furthermore, inadequate intake of protein and energy causes loss of myocardial muscle; Vitamin D deficiency is associated with CVD; and a reduction in blood cholesterol concentration reduces the risk of coronary heart disease.

Malnutrition is also associated with diabetes. For example, an unbalanced diet, rich of saturated fats and simple sugars, can favour type 2 diabetes. Glucose uptake can also be affected by body fat accumulation. Moreover, making healthy food choices is essential in order to live healthy with diabetes. Finally, unhealthy dietary habits can also influence cognitive decline. In this line, several studies have demonstrated that higher adherence to the Mediterranean diet reduces risk of developing MCI and of MCI conversion to Alzheimer.

The WHO ranks lack of physical activity as the fourth leading cause of all deaths worldwide. In fact, the literature shows that sedentariness (lack of physical activity) is a risk factor for the development of several chronic diseases, including CVD, cardiovascular lung and renal diseases, diabetes mellitus, and cancer. Likewise, some studies show a link between walking and decreased chances of having a heart disease, suffering a heart attack or stroke, developing diabetes, or dying prematurely. Other studies have found a relationship between prolonged sitting time and CVD risk, regular physical activity and beneficial cardiovascular effects, and higher baseline cardiorespiratory fitness and lower heart failure and cancer mortality risk.

Moreover, Physical Activity (PA) is key to maintain a healthy weight, and thus, in lowering the risks related to obesity such as increased risk of heart failure. In addition, a reduction in weight combined with physical activity could prevent or delay the development of diabetes. Finally, sedentariness is a risk factor for different neurological and psychiatric diseases. Studies show that physical inactivity is connected to a progressive decline in cognitive function. On the other hand, PA has been shown to decrease depression, increase quality of life, and to improve cognitive performance in MCI, thus preventing or postponing cognitive decline into dementia.

The third condition targeted by DOREMI, Mild Cognitive Decline, is linked to a higher likelihood of developing dementia and Alzheimer, which affect people's autonomy and quality of life. Dementia prevalence worldwide is expected to rise and thus to increase healthcare costs associated with it. It is also important to underline that cognitive decline is linked with heart diseases and heart problems such as higher stroke risk.

[2] http://www.autonom-lab.com/wp-content/uploads/2012/04/ESOPPE.pdf

In sum, all this evidence emphasises the potential of a solution like DOREMI, and how it can help to improve the health condition of the elderly, to reduce health expenditure, and to increase older people's QoL. By addressing malnutrition, sedentariness and cognitive decline, DOREMI can reduce several risks for the elderly, such as those associated with the heart condition and diabetes.

3. Results from DOREMI pilots

In line with DOREMI goals of decreasing the prevalence of the targeted conditions: malnutrition, sedentariness and cognitive decline; it was expected that DOREMI pilots would reveal the improvement in participants' health conditions. In fact, as reported in d6.6, DOREMI pilots showed some positive results, which give an indication of the potential effect of DOREMI on increasing elderly wellbeing and at the same time in reducing costs for the health systems. Nonetheless, it must be stressed that the pilot had some limitations (mainly reduced sample and short-time intervention) and thus the recorded impacts were low. However, in larger and longer trials these impacts are expected to be much higher and more frequently significant.

Regarding nutrition, there were some positive results in glycated haemoglobin levels, the MNA test, and BMI, all of which might be related to dietary habits during the DOREMI trial. According to WHO, Glycated haemoglobin (HbA1c) tests can be used as a diagnostic test for diabetes[3], with a value of 48 mmol/mol (6.5%) recommended as the cut-off point. Higher haemoglobin levels, imply higher risks for diabetes complications. In the pilots, glycated haemoglobin showed a trend of reduction in the two populations (p=0.064), with the Hbglycate values for the treatment group decreasing on average 0.05 percentage points, this is a 0.90% decrease. The post-intervention MNA test (which was selected as a primary KPI) increased significantly in both groups (p=0.003). The value for DOREMI users increased on average 1 point, which indicates an improved nutrition. There was a significant decrease in BMI in general (p=0.026) and also among the overweight population (p=0.043). Concretely pilot results showed that, on average, participants' BMI was reduced by 0.40 points (a 1.64% reduction) after the short intervention period.

The pilots also reported significant results for physical activity in the entire population. The BERG Balance Scale score, had a significant increase in the two populations (p=0.006), although it was higher for the Control group. Higher values imply a lower risk to fall and thus better functional tasks. Similarly, within the SPPB (Short Performance Physical Battery) there was an increase in Balance and Walk subtests (p=0.083 and p=0.090). In addition, there was a significant reduction in the two groups, between the baseline and the follow-up period, in some haemodynamic parameters pre- and post-6MWT (6 Minute Walking Test). Concretely, there was a reduction in Systolic, Diastolic, and Mean blood pressure, and RPP (Rate pressure product)[4].

Concerning MCI, the values for the adjusted Token-test changed significantly. The values increased for the treatment, 0.25 points (0.76%), while they decreased for the controls 0.86 points (2.7%). Higher values indicate a better performance in the test. Regarding socialisation, elderly increased the time they spent with other people while engaging in indoor/outdoor activities from the first to the last period they played. Increased socialisation interactions can help elderly improve their Quality of Life.

In sum, these results seem to support the goal of DOREMI to successfully address malnutrition, sedentariness, and cognitive decline; and thus improve several health conditions in the elderly and help to reduce health expenditure.

[3] http://www.who.int/diabetes/publications/report-hba1c_2011.pdf

[4] P values for Systolic blood pressure: pre-, p=0.001; post-, p=0.021), for Diastolic blood pressure: pre-, p=0.025; post-, p=0.004, for Mean blood pressure: pre-, p=0.001; post-, p=0.001, and for RPP: pre-, p=0.017; post-, p=0.016.

4. Methodology and data

The Impact Assessment follows the extrapolation accounting framework model developed by the EC JRC in the Impact Assessment of SIMPHS2. This impact assessment aimed at investigating the economic impacts of deploying eHealth technologies in EU, and it specifically focused on Integrated Personal Health and care Services (IPHS) (Zamora, 2012).

This framework constructs some output indicators using Member States statistics on diseases' prevalence, mortality, and hospital utilisation and costs. The model includes three diseases: Congestive heart failure (CHF), Diabetes, and Chronic obstructive pulmonary disease (COPD). Similarly, the present assessment compares the costs of the deployment of DOREMI with the expected benefits obtained from the model. DOREMI costs depend on the production costs, the costs of installing and providing DOREMI per user, and the deployment level. On the other hand, benefits stem from the expected reduction in health care expenditure thanks to the deployment of DOREMI as well as to the expected increase in elderly's quality of life (decrease in mortality). In order to do this, the model links input data (diseases' prevalence, hospital costs, etc.) with two outputs: value of reduced hospitalisation, and value of reduced annual mortality, which are both measured in monetary terms.

DOREMI is expected to bring savings to the health systems by decreasing the prevalence of sedentariness, mild cognitive decline, and malnutrition in the EU society. As explained above, these conditions are associated with several diseases which imply heavy health expenditure. Therefore, a reduction in the prevalence of these conditions would decrease costs for the health systems. DOREMI savings can be calculated using the following formula:

(1) $\Phi(\Delta kBkhk)$

In which Φ is the impact parameter on reduced hospitalisation, Δ the deployment level (% of the elderly affected by the disease that use DOREMI), B the annual hospital beds used, and h the cost per bed. Savings will be compared to costs, which are represented by this formula:

(2) $Ck= Dk\Delta kPk$

D refers to annual DOREMI costs, Pk refers to the prevalence of each disease, and Δk the deployment level. These values might differ across countries (k), except DOREMI costs, which at the moment are the same (in the future they could vary if different organisations start commercialising the solution).

The model also constructs a break-even indicator that indicates the maximum cost per DOREMI user (D) in which the savings from reduced hospitalisation cover DOREMI costs. Therefore, this cost-effectiveness indicator is defined by the following formula in which DOREMI savings (1) equal DOREMI costs (2):

(3) CEk: $\Phi(\Delta kBkhk)= D\Delta kPk$

A small rearrangement allows to calculate DOREMI costs (D) in the break-even point:

(4) $D= \Phi(\Delta kBkhk) / \Delta kPk$

Since deployment appears in both sides, in can be deleted:

(4) $D= \Phi(Bkhk) / Pk$

Therefore, the break-even indicator equals the hospital costs of the disease (Bkhk) multiplied by the assumed reduction in bed days (savings), divided by the amount of people that suffer the disease. In the SIMPHS2 model this break-even indicators are presented by country and by disease. Here, we have built a sole indicator for the three, because DOREMI intervention targets three conditions, and it is expected to reduce at the same time the prevalence of the main diseases linked to the elderly morbidity and mortality, among which diabetes, COPD and CHF. Therefore, paying the costs for one intervention (DOREMI), would bring savings associated with all three diseases.

a. Parameters

The outcomes of the model depend on the definition of some parameters. First, the parameter on reduced hospitalisation (Φ) is computed as the reduction in bed days due to DOREMI and it is assumed to be 25%. This is the same parameter used in SIMPHS2 model, which is obtained from the results of the programme "Care Coordination/Home Telehealth" from the US Veterans Health Administration (Zamora, 2012). The parameter on reduced mortality is assumed to be 35% as in the SIMPHS2 model. The authors emphasise that part of the literature found lower values, at 20%, but others also found higher values. For example, the Whole System Demonstrator programme evaluation in the UK found a 45% reduction in mortality due to telehealth (Zamora, 2012).

Finally, DOREMI deployment will be assumed to be between 20% (lower bond) and 40% (upper bond) of the people suffering from the diseases. The deployment of 20% is the one usually applied for telehealth in the SIMPHS2 report (Zamora, 2012). The high deployment of 40% presents a more optimistic vision, which would be the consequence of a highly successful DOREMI commercialisation.

b. Costs of DOREMI

The costs of the DOREMI solution were estimated by the Consortium members. They estimated the costs of the different components of the system, both the one-off infrastructure costs and the recurrent usage costs for different deployment scenarios. For this assessment, since we are assuming at least a 20% deployment in the whole EU, DOREMI annual costs would be 1€ per day5.

c. Input data

The input data used in the model refers to diseases' prevalence, hospitalisation costs, and number of deaths by disease. Diabetes prevalence is obtained from Diabetes Atlas 4th Edition, COPD prevalence from Frost & Sullivan and WHO/Europe statistics6; and CHF prevalence is assumed equal to the percentage of hospital discharges in Heart Failure over total hospital discharges (Zamora, 2012).

The variables used to calculate hospitalisation costs are the annual number of hospital bed days per country and illness, obtained from HMDB and from Eurostat, and the costs of bed days. These costs come from different sources. The in-patient costs for CHF (average costs per hospital bed day CHF) are computed by dividing the data on CVD in-patient costs (from the British Heart Foundation Statistical Database and European Cardiovascular Disease Statistics) by data on CVD bed days from HMDB and Eurostat. For COPD, there are no available statistics on costs. The model assumes that COPD average costs per hospital bed day are equal to the average cost for all diseases in each country. Diabetes average costs per hospital bed day are calculated as the 92.8% of the average costs for all diseases, based on the evidence from the US HCUP (Healthcare Costs & Utilization Project) (Zamora, 2012).

The number of deaths for Diabetes come from Diabetes Atlas 2010. For CHF, deaths are calculated as the deaths caused by CVD (available in Eurostat) multiplied by the proportion of CHF discharges over the ones for CVD (both also from Eurostat). Deaths caused by COPD are obtained from WHO (Zamora, 2012).

[5] Further information is provided in D7.3.3.

[6] Data comes from F&S reports for all countries except for Bulgaria, Latvia, Lithuania, Malta, Romania and Slovakia (from WHO/Europe (HFA-DB)), and for Cyprus, Estonia and Slovenia (percentage of hospital discharges in COPD).

5. Simulation results

The following figures show the prevalence of the three conditions in each EU country. The EU-averages are 1.96 for CHF, 8.96 for Diabetes, and 3.32 for COPD. Bulgaria and Romania are those with higher CHF prevalence, followed by Spain and Poland. Diabetes, which is the most common disease among the three, is more prevalent in Portugal, Germany and Austria. Finally, Greece, Poland, and Germany are the ones with more people suffering from COPD.

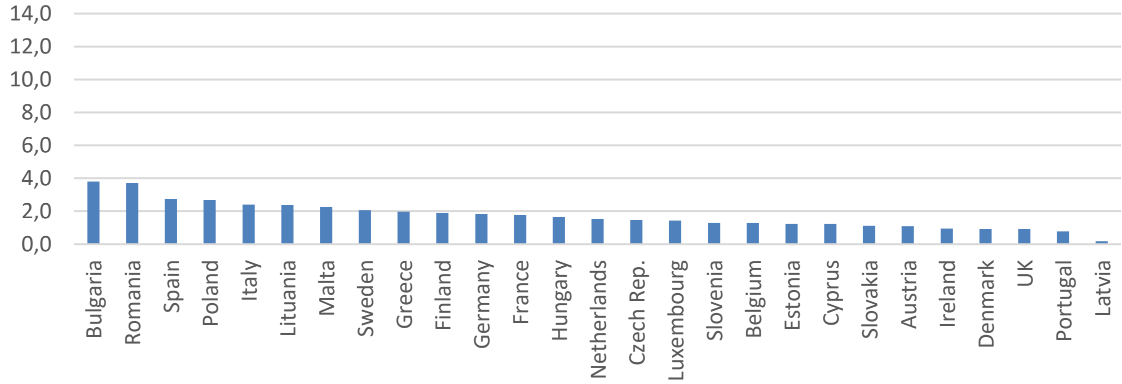

Figure 1. Prevalence of CHF (% population)

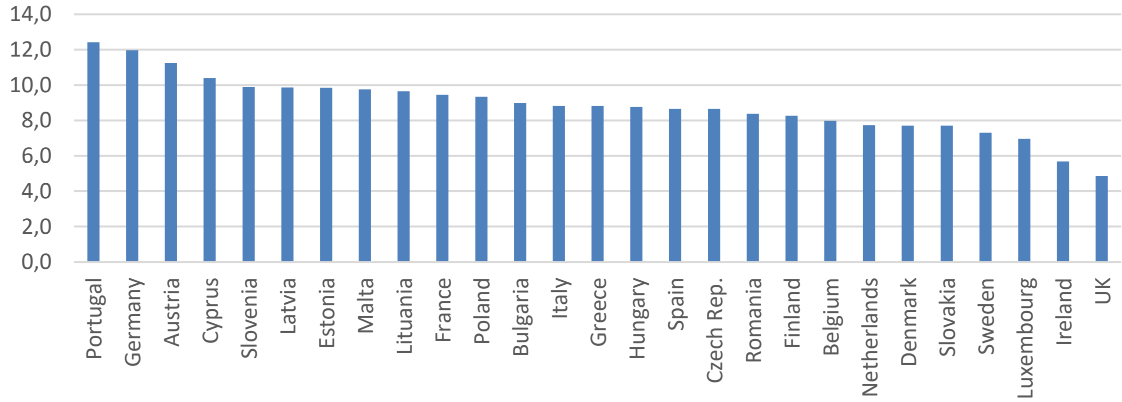

Figure 2. Prevalence of Diabetes (% population)

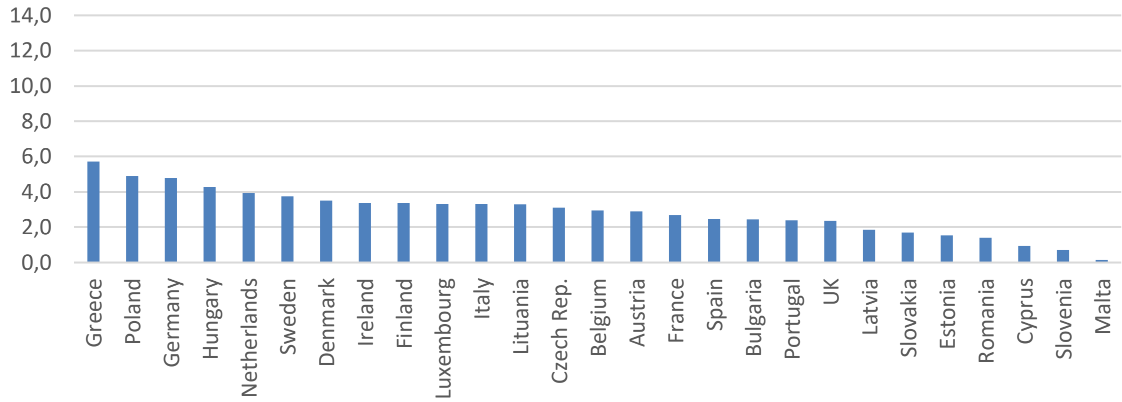

Figure 3. Prevalence of COPD (% population)

In order to calculate the impact of DOREMI, data on hospital costs related to these diseases was also collected. The figures below show the average costs per hospital day (€) for CHF, diabetes and for all diseases (which is assumed to be equal to COPD costs. The average values for the whole EU are 564.02€ for CHF, 602.12€ for Diabetes, and 648.84€ for all diseases. The Netherlands, Luxembourg and Denmark are the ones with higher hospital day costs for all diseases and diabetes. Also, the Netherlands ranks second in CHF, after the UK and preceding Sweden. In all three rankings the bottom is occupied by Eastern countries. Within Western Europe, the ones with lower costs are Finland (for the three diseases), Germany (except for CHF), and Austria (for CHF).

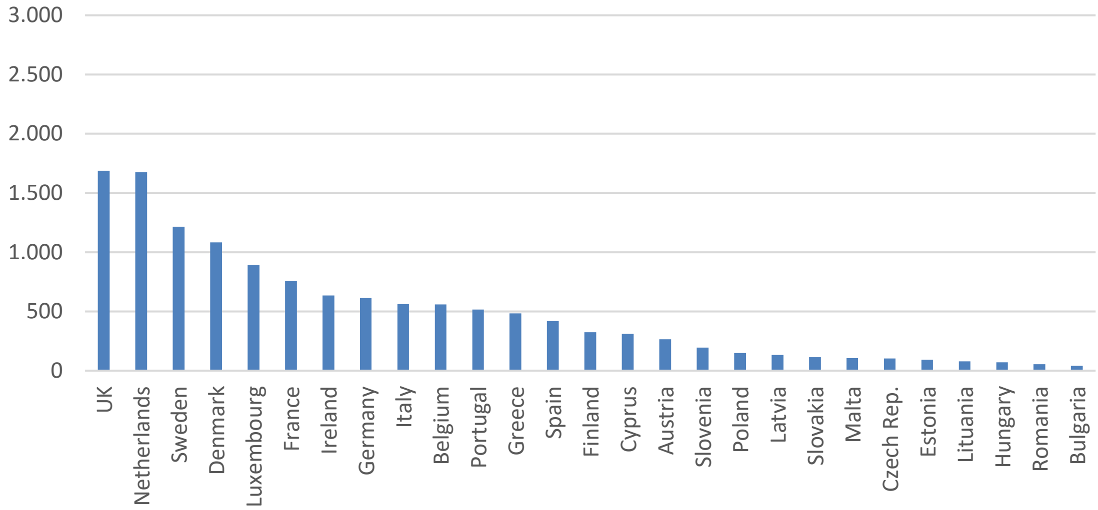

Figure 4. Average costs per hospital day (€). CHF.

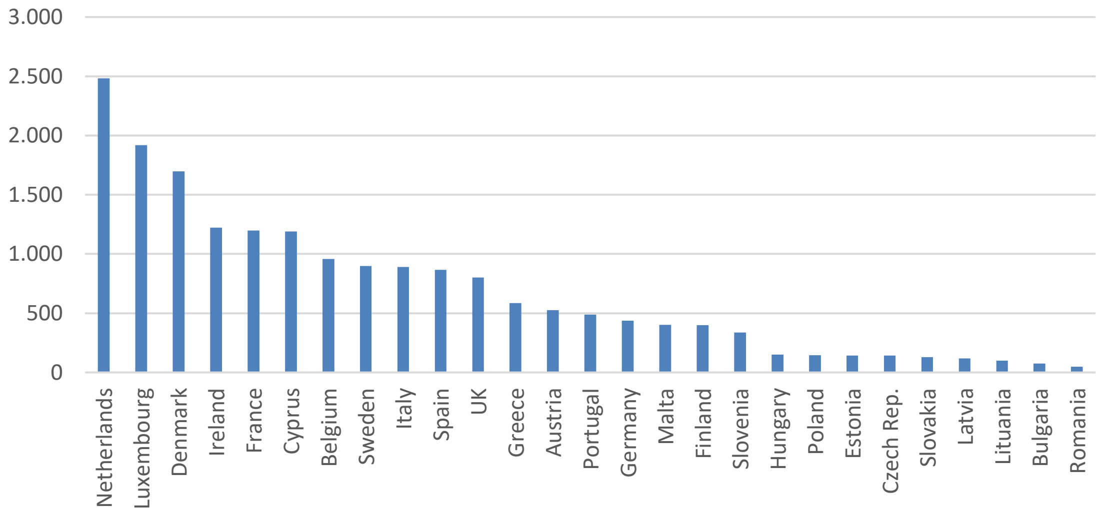

Figure 5. Average costs per hospital day (€). Diabetes.

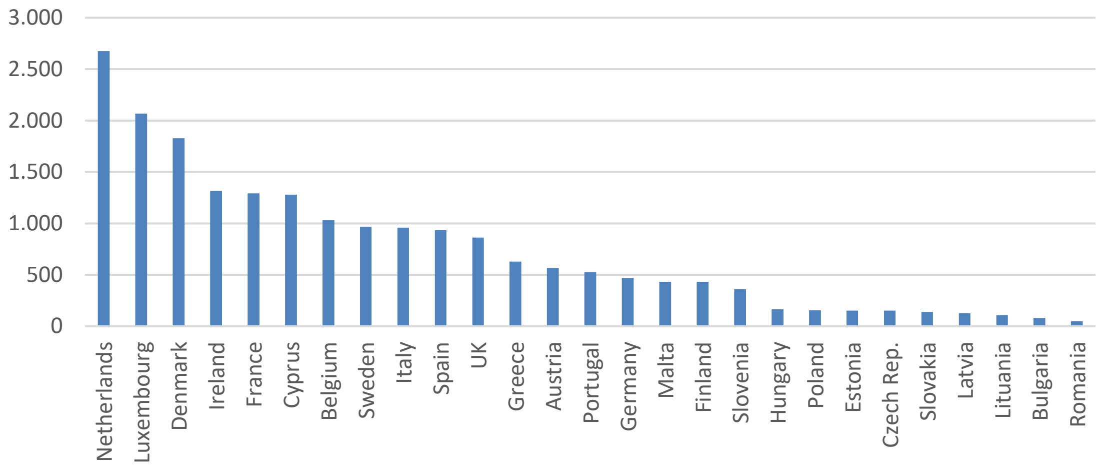

Figure 6. Average costs per hospital day (€). All diseases.

a. Impact on savings

In order to calculate the expected impact on savings, first the expected reduction in hospital beds is computed by multiplying the number of bed days of the treated patients (bed days associated with the disease multiplied by the deployment level) by the parameter in bed days reduction (25%). Afterwards, monetary value is obtained from multiplying the number of hospital beds saved by the average costs per hospital bed day for the corresponding disease.

After calculating the value for each disease, they were added up in order to obtain the impact on savings of deploying DOREMI. The following figures shows the expected savings, for each deployment scenario (20% and 40%). In the first scenario, savings range from around 0.3 Million € in Malta, Latvia and Cyprus to almost 250 Million € in Germany. Overall, the savings in the whole EU are estimated to be 1,049 Million €. In the more optimistic scenario of a 40% deployment, savings are almost 500 Million € in Germany, and they are around 300 Million € in Italy, France and the UK. EU savings total 2,099 Million €.

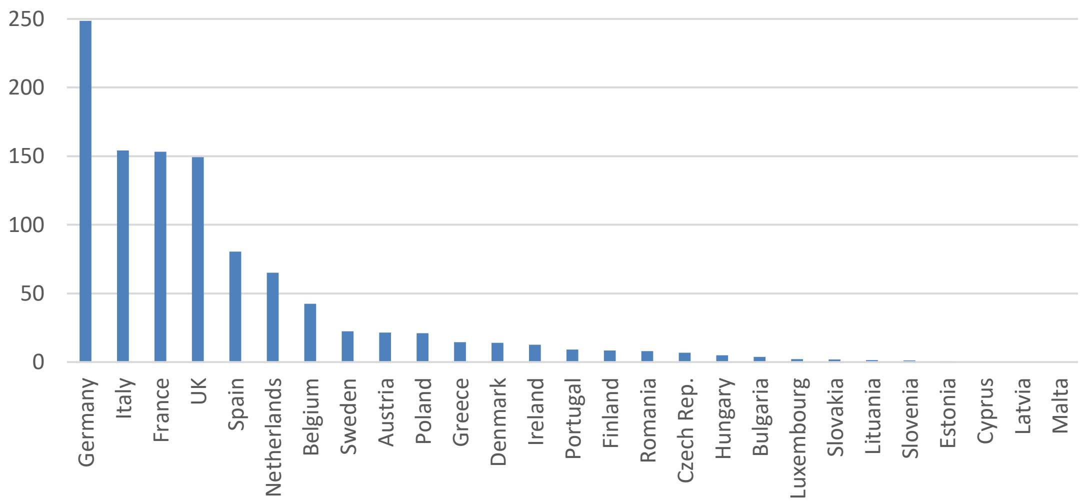

Figure 7. Total savings from reduced hospital bed days
(CHF, Diabetes and COPD) in the low deployment scenario (20%) (mill. EUR 2010)

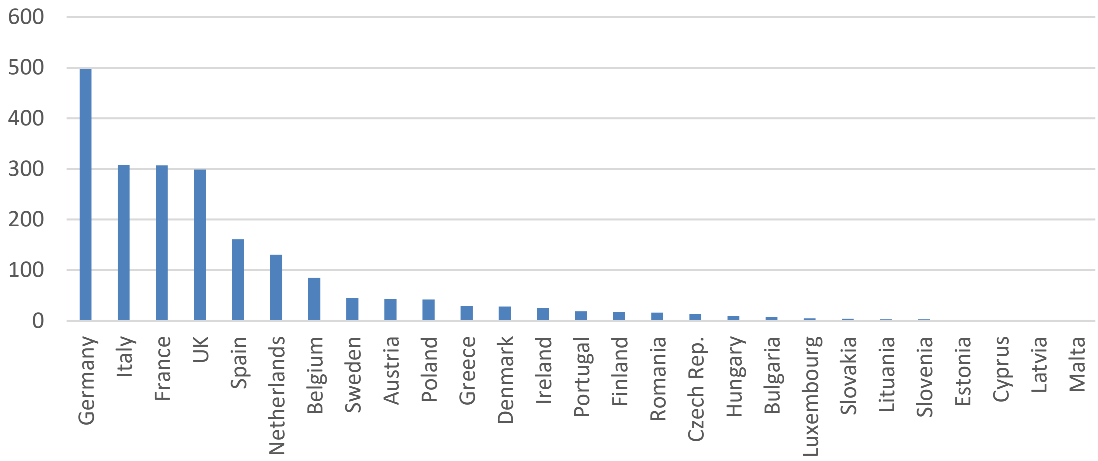

Figure 8. Total savings from reduced hospital bed days
(CHF, Diabetes and COPD) in the high deployment scenario (40%) (mill. EUR 2010)

b. Impact on mortality

Apart from benefiting the health system, DOREMI is expected to have a positive impact on society by encouraging active ageing and increasing the quality of life of the elderly. Therefore, the model calculates the value of the expected reduction in mortality (assumed to be 35%), as the value of one extra QALY year7, which is assumed to be €30,000 as in Zamora (2012). The expected annual reduced mortality is computed by multiplying the number of deaths due to each disease by the DOREMI deployment level and by the parameter on mortality reduction (35%). Since DOREMI can help reducing the prevalence of the three illnesses, the expected mortality reduction for the three of them is added up in order to obtain the expected total reduction due to DOREMI. Figure 9 and Figure 10 show the results by country in each deployment level. In the first scenario, the estimated reduction goes from 33 deaths less in Luxembourg to an 8,500 deaths reduction in Germany. In the second scenario, the reduction is above 15,000 deaths in Germany and above 8,000 in Italy, Poland, UK, Romania and France. In the EU as a whole, the expected reduced mortality would be 49,181 people in the low deployment scenario and 98,362 in the high.

[7] One QALY is equal to 1 year of life in perfect health. They are estimated as the years of life remaining for a patient and weighting each year with a quality-of-life score (on a 0 to 1 scale). https://www.nice.org.uk/glossary?letter=q

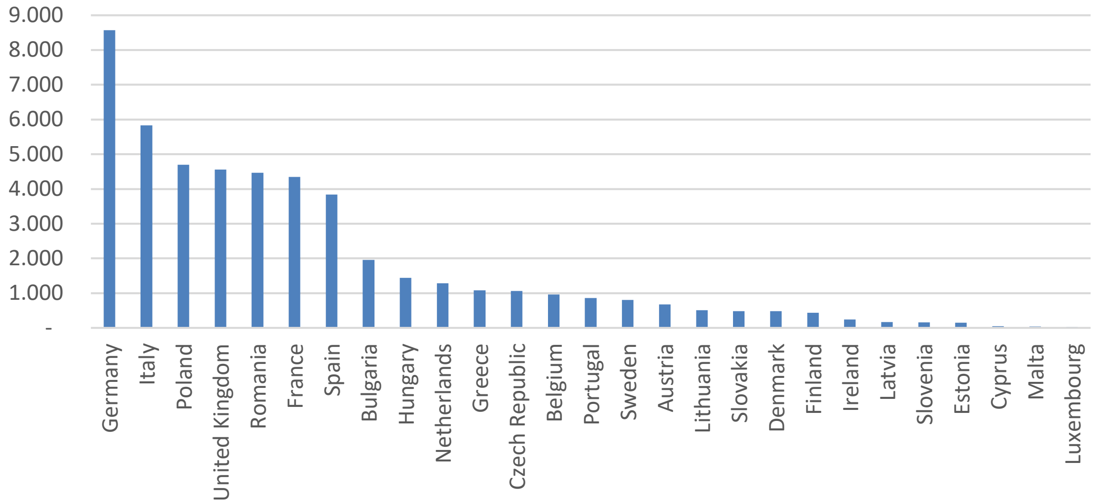

Figure 9. Expected reduction in deaths (20% deployment)

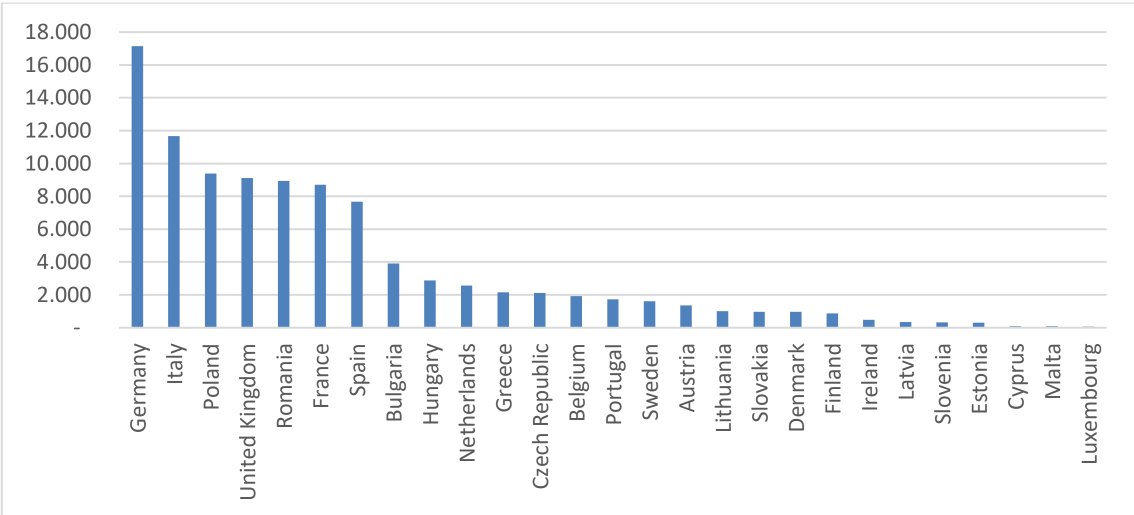

Figure 10. Expected reduction in deaths (40% deployment)

Afterwards, this reduced mortality is multiplied by the QALY value of one year extra life (€30,000). Figure 11 and Figure 12 display the economic value of this reduced mortality, which is almost 1 Million € in Luxembourg and 257 Million € in Germany in the low deployment scenario. For the 40% deployment scenario the estimated value rises to 514 Million € in Germany. The aggregate values at EU-level are 1,475 Million € with a 20% deployment and 2,951 Million € if the deployment is 40%.

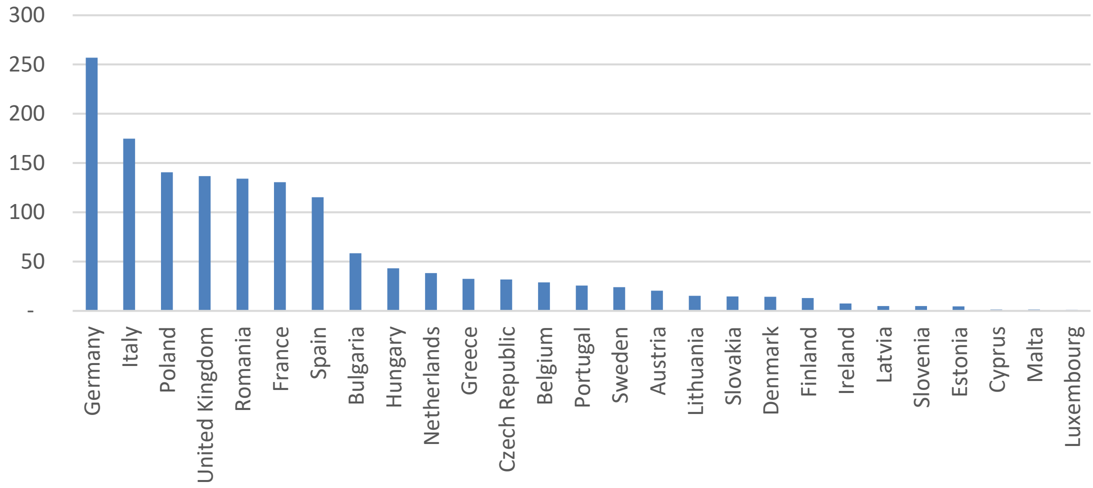

Figure 11. Value of one year extra life (mill. EUR, 20% deployment)

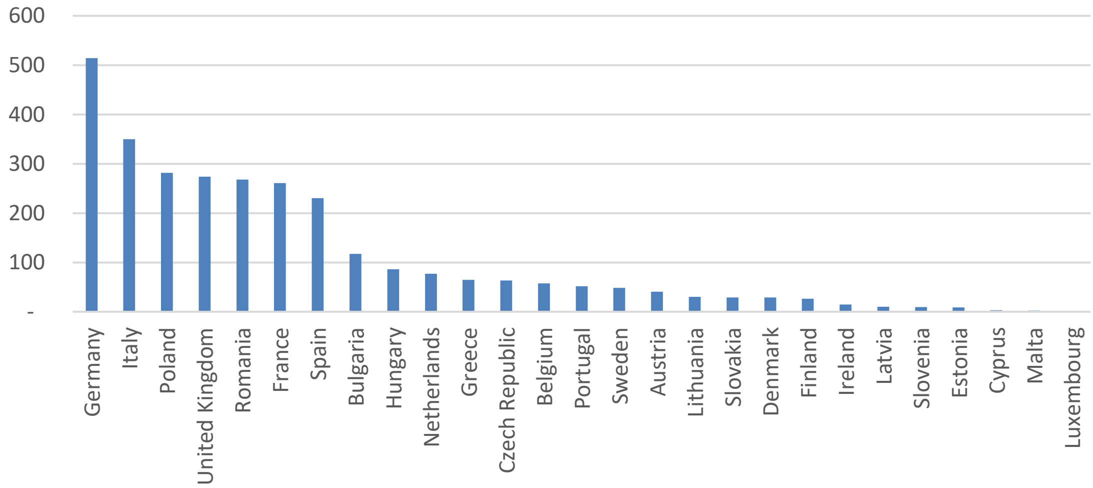

Figure 12. Value of one year extra life (mill. EUR, 40% deployment)

c. Break-even indicator

As explained above, the break-even indicator shows the price that should be charged so that the expenditure equals savings. This means that DOREMI price should not be higher than the indicator value in order to have a sustainable business model. This indicator should be compared with the minimum price that DOREMI producers should charge in order to cover, at least, their costs.

The indicator is computed as the savings from reduced bed days and the benefits from reduced mortality for all three diseases divided by the number of users. Then it is divided by 365 to indicate the daily cost. The number of users are the people suffering from either one of the three diseases multiplied by the deployment level. In fact, the indicator reports the benefits (hospital savings + reduced mortality) per treated person. Therefore, in order for costs to be compensated by savings, the cost per person should be at most the same than the break-even value. The countries with higher values are the ones where DOREMI could have higher changes of being profitable. The ranking is led by the UK, Belgium and Luxembourg. Based, on the estimations from partners, we have assumed that DOREMI annual costs would be 1€ per day. Therefore, the indicators are below costs for all countries, which implies that the DOREMI Business model could have difficulties in being profitable. However, it must be stressed that the assumption of 1€ per day is conservative, and that a deployment of at least 20% in the whole EU would most probably allow to reduce considerably the unit cost. This cost could decline to 0.5€. In this case, DOREMI would be profitable in most EU countries (eighteen).

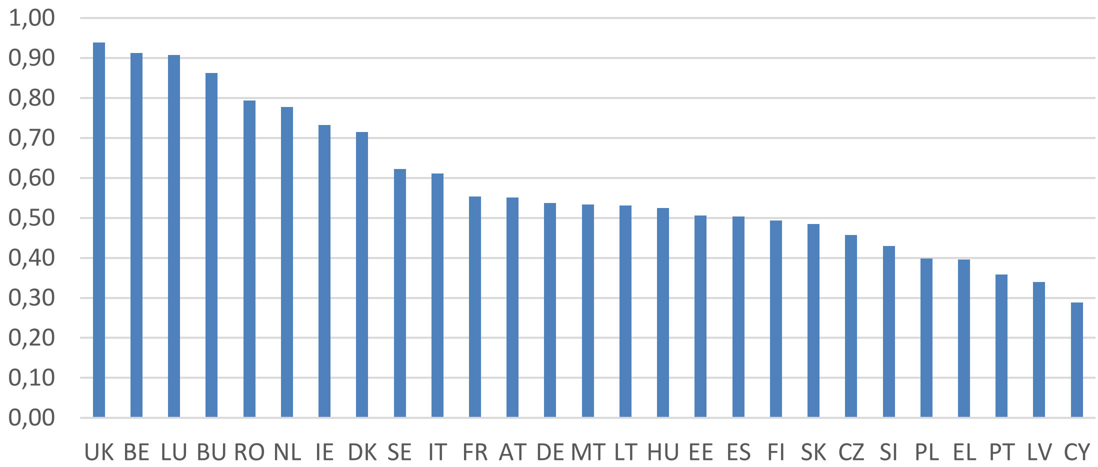

Figure 13. DOREMI break-even indicator by country including the benefits from reduced mortality (all three diseases)

These results can also be grouped by clusters of countries. Deliverable d7.2 identified four clusters: Nordic, UK and NL (Denmark, Finland, Ireland, The Netherlands, Sweden, UK), Continental (Austria, Belgium, France, Germany, Luxembourg), Mediterranean (Cyprus, Greece, Italy, Malta, Portugal, and Spain), and Central-Eastern European (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia). Mediterranean countries tend to have higher prevalence of diabetes, while the group of Nordic countries plus The Netherlands and the UK have on average more people suffering from COPD, followed by the continental countries. Finally, CHF prevalence is higher among Central-Eastern countries, while the Mediterranean cluster is in the second position. On the other hand, hospital costs are much higher for the cluster of Nordic countries, NL and UK. On the contrary, the hospital day costs in Central-Eastern Europe are very low. This implies that DOREMI could have a much higher impact in the first group, because it can help reduce these high costs. Costs are also important for the countries with a continental system, while Mediterranean countries are placed a bit behind, but clearly differentiated from the Central-Eastern cluster.

The following figure shows the average break-even indicator for each group. The indicator is higher for the Nordic and Continental clusters because they have higher costs, and thus a higher scope for saving. On the contrary, the break-even indicators for the Mediterranean and Central-Eastern European countries is lower. This implies that the first two groups of countries will be more suitable for deploying DOREMI. The group of Nordic countries, UK and NL is promising because DOREMI could be adopted by the National Health Systems in order to cut their high costs. On the other hand, the continental group is characterised by insurance schemes. In these countries, insurers are a clear potential target for DOREMI.

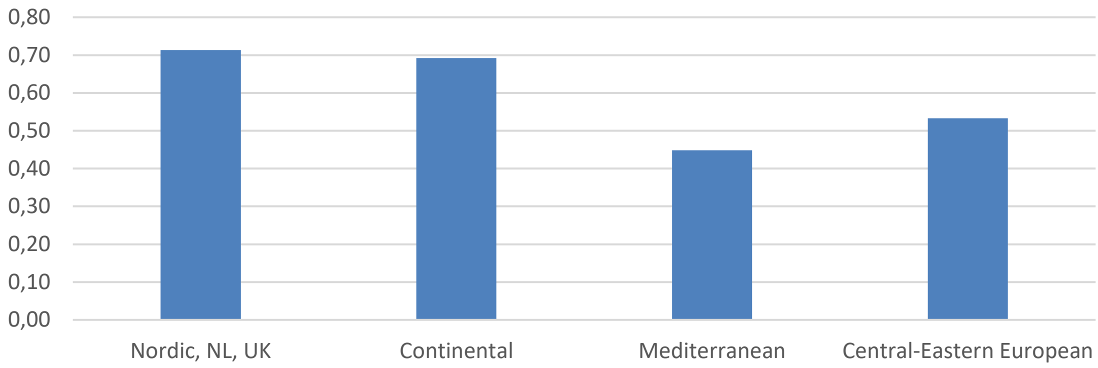

Figure 14. Break-even indicator by clusters of countries (average of cluster members)

6. Conclusions

The simulation exercise showed how DOREMI can bring savings from reduced hospitalisation and how it can also reduce mortality across EU countries. However, when comparing these benefits with the solution costs, we see that usually they are not compensated. The break-even indicator is lower than the minimum price that should be charged in order to cover DOREMI production. This implies that DOREMI should lower the costs in order to be profitable (for example by gaining higher reduction of costs from scalability), which is feasible in wide deployment scenarios. Another implication, is that the most suitable option seems that the health system deploys the system, because it would be more capable of covering the costs. Moreover, governments can decide to subsidise DOREMI through general taxation, if they consider that it has important benefits for the society. In fact, DOREMI can bring more benefits beyond those included in the model. For example, the elderly can increase their Quality of Life due to being able to live more independently, not only due to reduced mortality; relatives can be more satisfied and relieved because the older person can be better cared for; informal caregivers can gain extra time and reduce the caring burden; health professionals can feel that DOREMI facilitates their daily tasks, etc. In this line, countries with National Health Systems and also high hospital costs, such as the UK, seem the most promising markets for DOREMI. Countries with established health insurance schemes (continental model) also represent a market opportunity for DOREMI.

It must also be underlined that these results were based on some assumptions, and there exists the possibility that they do not hold. Parameters such as the ones on reduced hospitalisation and mortality, might have some deviations. In order to have a better insight of the correct parameters, it would be convenient to conduct further trials to assess better the effects of DOREMI on older people's health.

7. References

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