Aging in the EU countries: How can information technologies improve healthcare quality?

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Abstract: Many post-war generations are getting older. However, fertility is not increasing. It is, therefore, necessary to think about how to deal with future population developments – mainly the reason for health care. One solution could be to improve information technologies (IT) that could help in the future. These would allow the government to save some money on healthcare. Of course, different EU countries have different strategies. Some countries, especially Northern European ones, have already been preparing for the future. On the other hand, in Central Europe politicians are not interested in these reforms. Thus, the aim of this paper is to offer EU countries recommendations on how to improve healthcare quality using IT, specifically mobile and wireless health.

Key words: aging, eHealth, health care, healthcare quality

1. Introduction

The main changes in the following years will be lower birth rates and higher life expectancy. Due to this reality, the age pyramid will be transforming. There will be a higher share of retired people in the population because the post-war baby-boom generation will enter retirement age. EU countries will have increase social expenditure (Eurostat, 2018). Figure 1 describes how the number of people aged 65 years or over increased between 2007 and 2017. We can see the biggest increase in Malta, Liechtenstein and Albania. On the other hand, we can find the lowest increase in Luxembourg, Germany, and Belgium.

Fig. 1: Increase in the number of people aged 65 years or over between 2007 and 2017
Source: Eurostat website (Eurostat, 2018)

Healthcare is intertwined with ageing in Europe. Our focus can be how long people remain healthy. It is important to identify strategies effective in promoting and sustaining activities. The problem has to be solved on both the local and national levels (Walker, 2002). This is the aim of the Active Ageing Index (AAI). This index compares countries’ capacity and enabling environments for active and healthy ageing. The first place is occupied by Sweden, followed by Denmark, the United Kingdom, Finland, the Netherlands, and Ireland. Central European countries have the worst results. The problem is that governments in these countries do not see ageing as a priority. It is important to say that women are in a worse situation than men across all countries (Zaidi et.al., 2017). According Kwan et. al (2006), it is important to teach people to understand IT technologies, the context of mobile technology, and the
Internet. Of course, increased ageing means increased spending. It is important to understand what health services and long-term care mean. Older people need more health care, because illnesses, chronic diseases, and hospital visits are more frequent for them (Bussolo, Koettl, Sinnott, 2015).

Thus, the aim of this paper is to offer EU countries recommendations on how to improve healthcare quality using IT, specifically mobile and wireless health.

2. Methodology

Cluster analysis is more important today than it was in the past. We need to summarize data sets, because we have a large volume of data. It is easier to create a small number of groups of objects and use them to find similarities and differences in the data. Using cluster analysis and other multivariate analyses is quite popular today. This is often called data mining (Everitt, Landau, Leese, Stahl, 2011).

When using the hierarchical cluster analysis method, we need to do the following:

- Create a data matrix, with objects in columns (they will be cluster-analysed) and attributes which describe the objects in rows.
- Optionally standardize the data matrix.
- Using the data matrix or a standardized data matrix, we can calculate the resemblance coefficient values. These coefficients describe the similarities between all pairs of objects.
- Document the results in a graph called a tree or dendrogram. This describes the hierarchy of similarities between all pairs of objects (Romesburg, 2004).

It is important to say, that we have two types of hierarchical clustering. The first one is called "agglomerative", meaning that groups are merged. Another type is the so called "divisive", with groups divided during each step. This approach is not common when the number of possible divisions is restricted (Fraley, Raftery, 1998). We will be using the former – the hierarchical agglomerative method. According to Fraley, Raftery (1998), splitting is formed by optimized criteria in each step. In our analysis, we can use the single link (nearest neighbour), complete link (farthest neighbour) or the sum of squares. In models, the criterion is a maximum-likelihood.

3. Results

In our analysis we use four variables:

- Current expenditure on healthcare (the percent of gross domestic product)
- Curative (acute) care beds (per 1000 people)
- Psychiatric care beds (per 1000 people)
- Hospital beds (per 1000 people)

All the data come from the OECD Health Statistics 2018 website. We have analysed data from 2000 to 2017. It is important to say that we have focused on selected European countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, and Switzerland. The selection criterion was data availability.

3.1. Descriptive statistics

At first, we have made descriptive statistics of all the above-mentioned variables. These results have helped us understand the development of healthcare in the selected European countries.

The first one is the current expenditure on healthcare. In OECD countries, the current level of healthcare expenditure is 8.8% of gross domestic product. Between 2000 and 2017 the biggest average growths per year were in:

- United Kingdom (0.216%) – they invested a great deal of money during the first half of the analysed period, specifically between 2008 and 2009 and 2012 and 2013.
- Sweden (0.206%)
- Norway (0.156%)

In Iceland the level of healthcare spending has been, on the average, decreasing in the long run. It is interesting that all the analysed states had a positive balance between 2008 and 2009. In these years the average growth of healthcare expenditure was 0.633% of the gross domestic product.

**The number of curative (acute) care beds** are the second selected variable. The important finding of this variable is that its development has been stagnant. We find the highest average number of curative beds between 2010 and 2017 in:

- Germany (6.3 per 1000 people)
- Austria (6.2 per 1000 people)
- Belgium (5.6 per 1000 people)
- Slovak Republic (5.5 per 1000 people)
- Hungary (5.1 per 1000 people)
- Czech Republic (5.0 per 1000 people)

**Total hospital beds per 1 000 people** were the third analysed variable. These values did not change significantly in the analysed period. The highest values of the average number of total hospital beds per 1000 people are in:

- Germany (8.435 per 1000 people)
- Austria (7.00 per 1000 people)
- Hungary (7.441 per 1000 people)
- Czech Republic (7.200 per 1000 people)
- Latvia (7.024 per 1000 people)

At the end of the descriptive analysis, we analysed the **number of psychiatric care beds per 1000 people**. We found the highest numbers in:

- Belgium (1.478 per 1000 people)
- Latvia (1.475 per 1000 people)
- Norway (1.246 per 1000 people)
- Germany (1.154 per 1000 people)
- Czech Republic (1.055 per 1000 people)

### 3.2. Cluster analysis

We calculated the averages of specific variables in the selected period. These averages are included in our cluster analysis. The analysis was conducted in the SPSS programme. As we mentioned in the methodology section, we used hierarchical agglomerative methods. Specifically, we used “Average (between groups) linkage method (sometimes referred to as UPGMA). The distance between two clusters is calculated as the average distance between all pairs of subjects in the two clusters. This is considered to be a fairly robust method. It is important to say that we used Squared Euclidean Distance as a criterion for finding the clusters.” (Cornish, 2017) In our calculation, we have drawn a dendrogram which described how states gradually move to one cluster.

Through cluster analysis, we have created three clusters for the analysed European states:

- **Cluster 1**: Denmark, Finland, Greece, Iceland, Ireland, Italy, Norway, Portugal, Slovenia, Spain, Sweden
- **Cluster 2**: Czech Republic, Estonia, Hungary, Latvia, Luxembourg, Poland, Slovakia
- **Cluster 3**: Austria, Belgium, France, Germany, Switzerland
4. Information technologies improving healthcare

As mobile and wireless health represent the implementation of information systems and information and communication technologies (IS/ICT), processes, and services on all levels of patient care, it is essential to include not only medical facilities but also the government and the patients themselves. The use of eHealth, such as telemedicine, mobile, and the wireless, supports the operation of each healthcare facility and remote collaboration of multiple facilities. The results of Kunstová, et al. (2013), OECD (2010), and Ilminen (2003) confirmed that correct implementation of eHealth or its elements can increase the quality of patient care to a significant extent, save work for medical personnel, bring financial savings, and eliminate risks in the course of preventative, diagnostic and therapeutic procedures.

Potančok (2017) designed a methodology for the implementation of eHealth and its elements on the outpatient healthcare facility level, where it can enable and support assisted living services for people aged 65 years or over. The designed methodology is a collection of the following factors, scenarios, and tasks (Potančok, 2017) using the MBI (Management of Business Informatics) model (MBI, 2015).

- Factors - F015/Healthcare; F901XHE/The national plan for eHealth; F902XHE/Outpatient healthcare facilities
- Scenario - S901XHE/An outpatient healthcare facility needs to implement eHealth
- Tasks - U551A/eHealth implementation feasibility study; U552A/eHealth implementation analysis and design; U553A/eHealth implementation; U554A/eHealth implementation into operation & migration

However, the above-mentioned study focuses mainly on the healthcare facilities level. Support on a national level is necessary (Stroetmann, et al., 2011), but there is no comprehensive concept. According to HIMSS (2017), “ehealth professionals describe the amount of central direction and support as rather moderate.” (HIMSS, 2017)
Professionals from most of the first cluster countries have described the amount of national level direction and support as more adequate than professionals from other countries and clusters (HIMSS, 2017). The United Kingdom invested a great deal of money (expenditure on healthcare) during the first half of the analysed period, specifically between 2008 and 2009, and 2012 and 2013. Professionals do not see signs of visible eHealth support. Germany, a representative of the last cluster, focused on the number of curative (acute) care beds and hospital beds. German professionals also do not see eHealth.

We recommend that countries from the second and third clusters generalize the above-mentioned methodology to the national level and thereby focus on eHealth support.

5. Conclusion
Aging will become a major problem in the future. Eurostat monitors how population in European countries evolves. This issue is very important because the share of post-productive population in the total population is increasing. According to Stroetmann et al. (2011), it is important to invest on the national level. Some European countries have started to prepare strategies for future developments. According to HIMSS (2017) and our results, there are similarities in the strategies employed in Denmark, Finland, Greece, Iceland, Ireland, Italy, Norway, Portugal, Slovenia, Spain, and Sweden. Many of these countries are the top European investors into healthcare. Of course, countries from the first cluster dominate in the AAI. One solution can be investing into eHealth. Potančok (2017) describes how eHealth can support assisted living services for people aged 65 years or over.

Unfortunately, Central Europe is not in a good situation. The main reason is that there are no politicians interested in addressing this situation. We recommend that countries from the second and third clusters focus on eHealth support. This can help in the future and save social expenditures and expenditures on healthcare. Strategies from North European countries can serve as a good example in this. Central European countries would benefit from implementing Factors of Healthcare and a national plan for eHealth and Tasks including the eHealth implementation feasibility study; eHealth implementation analysis and design; eHealth implementation; and eHealth implementation into operation & migration. For future research, we also need to monitor development and evaluate strategies regarding eHealth across all European countries.

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7. References


8. JEL Classification

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