# Title:

**Worlds of Long-term-care: A Typology of OECD countries**

## Author names and affiliations:

Mareike Ariaans1,2, \*, Philipp Linden3, Claus Wendt4

1 University of Mannheim, Mannheim Centre for European Social Research, A5, 6, 68159  Mannheim, Phone: +49-621-1812813, Mareike.Ariaans@mzes.uni.mannheim.de

2 University of Siegen, Department of Social Sciences, Adolf-Reichwein-Str. 2, 57068 Siegen, Germany; Phone: +49-271-740-5288, [ariaans@soziologie.uni-siegen.de](mailto:ariaans@soziologie.uni-siegen.de)

3 University of Siegen, Department of Social Sciences, Adolf-Reichwein-Str. 2, 57068 Siegen, Germany; Phone: +49-271-740-5288, [linden@soziologie.uni-siegen.de](mailto:linden@soziologie.uni-siegen.de)

4 University of Siegen, Department of Social Sciences, Adolf-Reichwein-Str. 2, 57068 Siegen, Germany; Phone: +49-271-740-3182, wendt@soziologie.uni-siegen.de

\* Corresponding author

## Short biography – 50-100 words

**Mareike Ariaans** …

**Philipp Linden** is a sociologist (M.Sc.) and works as research assistant and doctoral candidate in the junior research group MEPYSO at the University of Siegen. His research interests are in the field of medical sociology and demography of health, the consequences of medicalization and psychologization of unemployment and early childhood development as well as quantitative research methods.

**Claus Wendt, PhD.,** is Professor of Sociology of Health and Healthcare systems at the University of Siegen. He is a 2008-09 Harkness/Bosch Fellow of Health Policy & Practice at Harvard School of Public Health and J. F. Kennedy Fellow at Harvard’s Center for European Studies. His research interests include international comparisons of welfare states and healthcare systems, health policy and demographic change, and the sociology of health.

## Funding

This article is part of the project “Comparing the Coordination of Elderly are Services in European Welfare States: How Organizational Actors Respond to Marketization Policies” funded by the Deutsche Forschungsgemeinschaft (DFG) grant number: [INSERT PROJECT NUMBER]

**Wordcount**

|  |  |
| --- | --- |
|  | **Ist** |
| Abstract (zählt nicht) | 93 |
| Intro | 351 |
| Theoretical background | 1337 |
| Methods | 1239 |
| Results | 875 |
| Discussion | 366 |
| Conclusion | 403 |
| Notes | 0 |
| References (zählt nicht) | 1074 |
| Only Words | 4571 |
| Figures/Tables | 692 |
| TOTAL | 5263 |
| **Journal Max.** | **7000** |
|  |  |
|  |  |

|  |  |
| --- | --- |
| **Tabels/Figures** |  |
| T1 (Methods) | 164 |
| Total Methods | **164** |
|  |  |
| T2 (Results) | 148 |
| F1 (Results) | 24 |
| T3 (Results) | 181 |
| T4 (Results) | 175 |
|  |  |
|  |  |
| Total Results | **528** |
| Total | **692** |
|  |  |
|  |  |
|  |  |
|  |  |

# Highlights

* Compare and classify 25 OECD long-term care systems
* adopt most recent quantitative and institutional indicators on long-term care
* use a new, innovative clustering approach
* provide an updated and adjustable long-term care typology

# Abstract – 93 words

Providing long-term care (LTC) to the elderly is a major challenge for all welfare states. However, LTC systems differ widely across countries. Moreover, due to recent maturation, economization, and marketization of LTC an updated and extended typology is needed. In this paper we aim to typologize OECD LTC systems and to make results more comparable to other welfare and healthcare typologies. We use most recent OECD data and a unique set of institutional indicators, which are based on scientific literature and experts’ evaluations. Our results reveal at least four distinct LTC system types.

**Keywords:** OECD countries, comparative analysis, long-term care, elderly, typology, classification

# Introduction – 351 words

It is a major challenge of developed welfare states to provide long-term care (LTC) for the elderly. Increasing longevity and the ageing of the baby-boom generation have a huge impact on the provision of LTC (Colombo et al., 2011) The rising number of elderly people in need of LTC increases the financial pressure on LTC systems (Ranci and Pavolini, 2013). At the same time, claims of better access and higher quality services become louder (OECD and European Commission, 2013). To cope with these pressures, many countries have started to reform their LTC systems, often by adopting marketization, economization, and corporatization measures. These measures altered the scope and functioning of many established LTC systems (Farris and Marchetti, 2017; Ungerson, 1997). As a consequence, it has become increasingly difficult to describe and categorize existing long-term care systems which is essential to analyze their effects with respect to coverage, access, social security, quality, and other factors.

This paper aims to provide a new and updated LTC typology that takes into account recent LTC reforms. Besides the update, compared to earlier typologies, we make two methodological advancements. First, earlier typologies used either quantitative data (Damiani et al., 2011; Halásková et al., 2017) or standardized information on institutional and regulatory aspects of LTC systems (Colombo, 2012; Kraus et al., 2010). We integrate both approaches by analyzing quantitative data on supply, public-private mix, performance as well as institutional information on accessibility of systems. Second, most LTC typologies selected one cluster analysis to categorize countries (Damiani et al., 2011; Halásková et al., 2017; Kraus et al., 2010). For our LCT typology we have used cluster technique as well. However, we calculate numerous cluster analyses to incorporate the internal consistency of clusters. This method, that has been used to classify healthcare systems (Reibling et al. 2019), has so far not been applied in earlier LTC typologies.

We first describe dimensions and indicators of earlier LTC typologies and summarize their results. Second, we explain indicators and the sample composition of our study. In the results section, third, we provide a detailed method-driven cluster solution. On this basis, we develop a condensed content-based clustering solution with six distinct system types.

# Theory – 1337 words

## Long-term Care Classifications

Typologizing welfare states and welfare state systems is a common endeavor in welfare state research since Esping-Andersen's (1990) seminal study. His work and the following adaptions and discussions (Ferrera, 1996; Arts and Gelissen, 2002; Castles and Mitchell, 1993) still provide a basic template for case selection and evaluation in all areas of welfare state research (Rostgaard, 2002). Since then a vast amount of issue and area-specific typologies have been developed, not least in healthcare (Wendt, 2009, 2014; Wendt et al. 2009; Reibling et al., 2019; Böhm et al., 2013), a field that is particularly close to the field of long-term care (LTC).

LTC is defined as:

“Range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent for an extended period of time on help with basic activities of daily living (ADL). This “personal care” component is frequently provided in combination with help with basic medical services such as “nursing care” (help with wound dressing, pain management, medication, health monitoring), as well as prevention, rehabilitation or services of palliative care. Long-term care services can also be combined with lower-level care related to “domestic help” or help with instrumental activities of daily living (IADL).” (Colombo et al., 2011: 11–2).

This definition does not consider LTC recipients’ age. However, most recipients are older than 65 years.

Typologies that capture the institutional structure of LTC systems or facets of LTC systems can be divided into three major groups. A first group focuses on social services in general where LTC is just one part of a larger social service picture (Anttonen and Sipilä, 1996; Bettio and Plantenga, 2004; Kautto, 2002; Leitner, 2003; Saraceno and Keck, 2010). A second group concentrates on LTC for the elderly, although they often include disability as well due to data reasons (Alber, 1995; Colombo, 2012; Damiani et al., 2011; Kraus et al., 2010; Halásková et al., 2017; Pommer et al., 2009; van Hooren, 2012). A third group focuses on special aspects of LTC and zoom in on migration in the context of LTC (Anderson, 2012; Da Roit and Weicht, 2013; Simonazzi, 2008; van Hooren, 2012; Simonazzi, 2008), cash for care schemes in LTC (Da Roit and Le Bihan, 2010), and informal care by families (Di Rosa et al., 2011; Leitner, 2003; Pfau-Effinger, 2014; Simonazzi, 2008).

Our focus lies on building a typology of LTC system types, we therefore have identified the second group of typologies as most relevant for our analysis. These typologies include a huge variety in the (number of) included country cases, data, methods, and results. With regard to dimensions and indicators, most studies repeatedly analyze four central dimensions and thereby have created a certain standardization and comparability.

I. Supply: Most typologies under analysis, incorporate the dimension of supply. Indicators in this dimension include financial resources (Alber, 1995; Colombo, 2012; Damiani et al., 2011; Halásková et al., 2017; Kraus et al., 2010), staff and staffing levels (Alber, 1995), and bed density in institutional LTC (Alber, 1995; Damiani et al., 2011). Furthermore, the type of provision is often included in the supply dimension and operationalized via the percentage of people in ambulatory or residential care settings (Alber, 1995; Damiani et al., 2011; Halásková et al., 2017).

II. Public-Private Mix: The second dimension, the public-private-mix that is often part of healthcare typologies (Wendt et al. 2009; Reibling et al., 2019; Böhm et al., 2013), operationalizes the role of the state and private actors. Only LTC typologies that specialize on specific aspects or take a broader view on social services, have integrated this dimension (Anderson, 2012) by focusing on the intensity of informal care (Bettio and Plantenga, 2004), the reach of public funds (van Hooren, 2012), the proportion of for-profit-providers (Da Roit and Weicht, 2013; Simonazzi, 2008), and the expenditure on or use of uncontrolled cash benefit schemes (Da Roit and Weicht, 2013; Simonazzi, 2008).

III. Access regulation: Restrictions in LTC systems may pose barriers especially for lower social status groups to access care. Common barriers are means-testing of benefits and limitations of choice (Bakx et al., 2015; Colombo et al., 2011). The access dimension has been highly relevant in the development of healthcare typologies (Wendt, 2009; Reibling, 2010; Reibling et al., 2019) and is operationalized via means-testing for benefits, entitlement to residential care, home-care benefits, cash benefits, and choice restrictions (Kraus et al., 2010).

IV. Performance: The performance of LTC systems has so far hardly been studied in international comparisons. Indicators for measuring the quality of LTC service provision such as the share of institutional and home-based LTC patients with pressure ulcers or unintended weight loss are not available in many countries (Halfens et al., 2013). Hence, only few typologies include performance or quality indicators. Damiani et al. (2011) for example use the share of people over 80 reporting good or very good health and the perceived limitations in activities in daily living (ADLs) for people aged 65 or older. Kraus et al. (2010) take institutional indicators of mandatory quality assurance systems and the degree and functioning of integrated services.

When summarizing existing LTC typologies we see that most are solely based on quantitative (usually OECD and Eurostat) indictors (Alber, 1995; Colombo, 2012; Damiani et al., 2011; Kraus et al., 2010). Sometimes, also micro-data (Share data) are used (Pommer et al., 2009). Only Kraus et al. (2010) adopts both quantitative andqualitative data on institutional setting and rules for access to the system based on an own primary data collection. The results of these typologies are influenced by their focus and aim but also by the (number of) included countries. Some studies include only about ten European/OECD country cases (Alber, 1995; Halásková et al., 2017; Pommer et al., 2009) while others analyze about 20 and more European (Damiani et al., 2011; Kraus et al., 2010) or OECD cases (Colombo, 2012).

Despite the large variety in the number of clusters and the composition of those clusters in the different typologies some similarities and parallels can be depicted. The most robust system type is a Scandinavian or Northern European cluster that mostly includes Sweden, Norway, Denmark, Finland, and often also the Netherlands (Alber, 1995; Colombo, 2012; Damiani et al., 2011; Kraus et al., 2010; Pommer et al., 2009). Clusters which include only Eastern European countries can be found in the typologies by Damiani et al. (2011), Halásková et al. (2017) and Kraus et al. (2010). Often Bulgaria, Hungary, Czech Republic, Estonia, and Slovakia are included, while other Eastern European countries such as Slovenia, Romania, and Lithuania only sometimes join this cluster. In some studies, a cluster which incorporates Eastern and Southern European countries is identified (Damiani et al., 2011; Kraus et al., 2010; Colombo et al., 2011) including Poland, Italy, Spain, and Greece. These three latter countries are depicted in a genuine Southern European cluster by Pommer et al. (2009). Continental European countries such as Germany, France, Austria, Belgium, and Luxemburg can be found in many typologies together in one system type, however mostly together with some Eastern or Northern European countries (Alber, 1995; Damiani et al., 2011; Halásková et al., 2017; Kraus et al., 2010; Pommer et al., 2009). Non-European countries are rarely included in LTC typologies. The typology by Colombo (2012) categorizes countries based on financing indicators and include Japan and South Korea in a cluster with Germany, Luxemburg, and the Netherlands due to their common social insurance approach. New Zealand and Canada are clustered together with Greece, Spain, and Switzerland due to their universal but means-tested financing approach (Colombo, 2012). The study by Halásková et al. (2017) identifies a cluster with Australia and South Korea.

This overview demonstrates that LTC typologies need to be advanced. First, many typologies have a European focus or only use a small sample of countries. Thus, in this contribution we extend these typologies by using an OECD sample with a large number of countries. Second, most typologies only use quantitative indicators in particular with financing data. We also include institutional indicators focusing on access to long-term care and therefore combined both quantitative and qualitative approaches.

# Methodology – 1403 words

## Quantitative and institutional indicators

Indicators for our typology of LTC systems come from two data sources (Table 1). First, six quantitative measures are taken from OECD health data (OECD, 2018). Five institutional indicators are taken from the Missoc database (MISSOC, 2018), the Health in Transition reports (European Observatory on Health Systems and Policies, 2018), and the ESPN reports of the European Union (European Commission, 2018). All values of the institutional indicators refer to the national rules or the dominant rules in place since in some countries regional or municipal rules prevail. To double-check our values, we contacted national LTC policy experts with a questionnaire containing the description of indicators and values including our country-specific assessment. Based on the questionnaires we received answers and comments to our coding between May and July 2019 for all countries in the sample (see Table 5 in the Appendix).

As a measure of financial input into the system we use LTC (health) expenditure per capita in US$ of purchasing power parities (expenditure). It includes all expenditure on bodily related LTC, mainly on “(basic) Activities of daily living (ADLs)” like bathing, dressing or eating. We would also have included LTC (social) expenditure covering “instrumental activities of daily living (IADLs) to give LTC system expenditure a broader scope (Halásková et al., 2017), but data were extremely limited in this dimension. Institutional supply of services is measured by the number of LTC beds per 1,000 population aged 65 and older (beds) while the actual supply of spots in these facilities is reflected by the number of LTC recipients in institutions measured as the percentage of all people aged 65 years and older (recipients).

To capture the public-private-mix of LTC systems we use two indicators. First, private (voluntary and out-of-pocket) expenditure as a percentage of total expenditure (private expenditure) to measure public and private involvement in payments for care. Second, we include the availability of cash benefits (cash benefit) as an approximation of formal and informal care provision. Research has shown that the availability as well as the unrestricted usage of cash benefits fosters family and migrant care (Da Roit and Le Bihan, 2010; Da Roit and Weicht, 2013). In our setting, the cash benefit indicators may take the value 0, describing a system where only in-kind-benefits are available. If the use of cash benefits is bound to specific services and aids, the indicator is coded 1, while unbound benefits, where the use of the benefit is at the beneficiary’s own discretion, are coded 2.

To capture access to LTC systems we use three choice indicators and one means-testing indicator. Limitations in choice are defined as restrictions in the kind of benefit or provider that can be chosen and can relate to regional restriction or to insurance or benefit plans. The indicators are choice of homes-care provider (choice homecare), choice of institutional care provider (choice institutional care), and choice between cash and in-kind benefits (choice cash). We constructed a cumulative index from these three choice indicators since cluster analysis improves when a small number of variables is included while multicollinearity might weight individual variables too strong biasing the derivation of meaningful clusters (Milligan and Cooper, 1987). Moreover, this prevents findings from being biased by a strong overweighting of choice within the cluster analysis. This index (choice index) may take values between 0-4, with 0 representing absolute freedom of choice and 4 strong restrictions. Furthermore, we use means-testing for any benefit (means-testing) that includes cash benefits, in-kind benefits, and other care related benefits. If a country system applies no means-testing in LTC systems at all, it was coded 0 and 1 if means-testing takes place.

For the performance dimension, we use data that indicate the quality of LTC services. We include life expectancy of people aged 65 and older (life expectancy) and the percentage of the population who are 65 years and older and perceive their health as good or very good (self-rated health).

--- TABLE 1 ABOUT HERE ---

Table 1: Overview of LTC typology indicators

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Abbreviation | Mean | SD | Min. | Max. |
| *I: Supply* |  |  |  |  |  |
| Expenditure per capita in US$, PPP | Expenditure | 709.89 | 524.81 | 9.48 | 1745.09 |
| Number of beds per 1000 inhabitants | Beds | 47.73 | 18.27 | 12.2 | 85 |
| Number of recipients in institutions,  % of all people aged 65+ | Recipients | 3.88 | 1.66 | 0.43 | 7.17 |
| *II: Public-Private-Mix* |  |  |  |  |  |
| Share of private expenditure,  % of total expenditure | Private expenditure | 15.84 | 11.09 | 0.19 | 34.56 |
| Cash Availability of cash benefits  (only in kind, Bound, Unbound) | Cash benefit | 1.08 | 0.81 | 0 | 2 |
| *III: Access regulation* |  |  |  |  |  |
| Choice Index (Unlimited - Limited) | Choice Index | 1.64 | 0.5 | 0 | 4 |
| Choice of homecare provider | Choice homecare | 0.4 | 0.49 | 0 | 1 |
| Choice of institutional care provider | Choice institutional care | 0.36 | 0.83 | 0 | 1 |
| Choice between cash vs in kind-benefits | Choice cash | 0.88 | 1.25 | 0 | 2 |
| Means-testing for any benefit (No/Yes) | Means-testing | 0.56 | 0.51 | 0 | 1 |
| *IV: Performance* |  |  |  |  |  |
| Life expectancy 65+ | Life expectancy | 19.77 | 1.35 | 16.48 | 21.85 |
| Self-perceived health status (very) good,  % of the population 65+ | Self-perceived health | 46.11 | 21.83 | 8.6 | 86.9 |

## Data

After extraction, we exclude countries from the 36 OECD country sample, where data is missing on single indicators for the whole observation period (Austria, Canada, Chile, Greece, Hungary, Iceland, Italy, Lithuania, Mexico, Portugal, and Turkey) leading to an analysis sample of *N*=25 countries. To handle missing values within quantitative indicators we conduct a three-step process: First, we estimate a multiple imputed chained equation (MICE) regression model using predictive mean matching (PMM) for 20 cycles. Following the findings and recommendations of White et al. (2011) and Kleinke et al. (2011), we impute missing mean values of indicators by predictive mean matching of the next neighbor, here the next year. If for example the value is missing for 2105 for a specific country, we estimate the model with the full information from 2014 and aggregated the values of 20 cycles to yearly mean. Second, we aggregate imputed data to the yearly-mean of the specific indicator if the true value is missing. Finally, we calculate an overall mean of the observation period between 2014-2016 for our analysis (see Table 5 in the Appendix).

## Cluster analysis

Cluster analysis is the standard method in welfare state typologies (Bambra, 2007; Jensen, 2008; Kammer et al., 2012) and healthcare typologies (Reibling, 2010; Wendt, 2009; Wendt, 2014) and LTC typologies (Halásková et al., 2017; Kautto, 2002; Kraus et al., 2010; Saraceno and Keck, 2010) to classify and develop system types. The innovative approach with multiple cluster analyses within the same methodological framework (Reibling et al., 2019) has several advantages compared to classical approaches that often lack accepted standards and statistical rules (Fonseca, 2013). Since researchers must make technical decisions that potentially shift findings in different ways of interpretation, a single cluster analysis is not appropriate for classifying complex long-term care systems. The flexibility of the multi-cluster-analysis allows to combine results from different specifications “using the variability across those results as measure of confidence about the membership of two observations in one cluster” (Reibling et al., 2019: 615) increasing reliability of the method itself.

Following the proposed framework we specified cluster analysis in Stata 16 with either z- and range-standardized variables, used Gower and squared Euclidian distance as measures of dissimilarity in both, a k-means partitioning analysis as well as a agglomerative cluster analysis with average and Wards algorithms as linkage methods and selected the first and second-best result determined by stopping rules of Calinski-Harabasz and Duda/Hart and Dendrogramms for each of the 24 separate cluster analysis.

Findings from 8 k-means and 16 hierarchical cluster analysis results went equally in the calculation on how often each country was in the same cluster with every other country. To classify as full membership within this network of long-term-care systems, a connection between two countries must show up in ≥ 66% of all cluster analyses and a country needs to have such strong ties with at least half of all countries in the cluster. A partial membership is defined as a connection of two countries in ≥ 50% of cluster analyses. We present one cluster solution which is based on the full membership rule and one cluster solution which also integrates the partial memberships into the solution. We map the cluster solution by a network graph modelled by UNICNET6/Netdraw. The graph visualizes groups of countries and how likely it is that two countries belong to a similar LTC system type. Furthermore, it displays the internal consistency of LTC systems allowing for an in-depth analysis of the composition of clusters.

# Analysis

Based on 24 cluster analyses and by applying the full membership rule, nine clusters can be separated (see Table 2):

--- TABLE 2 ABOUT HERE ---

Table 2: Clustering based on benchmark percentages of same cluster solutions

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| ≥ 0.66 and ≥ 0.5 cluster ties | CZ, LV, PL | DE, FI | DK, IE, NO, SE | JP, KR | AU, BE, CH, LU, NL | SI, SK | FR, IL, ES, UK, US | EE | NZ |
| ≥ 0.5 cluster ties |  |  | JP, KR | DK, IE, NO, SE | FR, UK, IL, SI, SK |  | AU, BE  CH, EE, LU, NL, NZ, SK, SI |  | FR, UK, US |
| Strongest tie  in full cluster | LV\_PL  (1,0) | FI\_DE  (0.94) | DK\_IE (1,0)  DK\_NO (1,0)  DK\_SE (1,0)  IE\_NO (1,0)  IE\_SE (1,0)  NO\_SE (1,0) | JP\_KR  (0.94) | LU\_NL (1,0) | SI\_SK  (0.72) | ES\_US  (0.94) |  |  |
| ≥ 0.9 cluster ties | CZ\_LV  CZ\_PL LV\_PL | FI\_DE | DK\_IE  DK\_NO  DK\_SE  IE\_NO  IE\_SE  NO\_SE | JP\_KR | BE\_LU  BE\_NL  LU\_CH  LU\_NL  NL\_CH |  | ES\_US |  |  |
| # of ties in  full cluster | 3/3 | 1/1 | 6/6 | 1/1 | 10/10 | 1/1 | 9/10 |  |  |

The nine clusters consist of one to five countries:

1. The first cluster consist of Czech Republic, Latvia, and Poland who form a distinct and highly consistent cluster, with all ties between these countries ≥ 90%. No other country has a partial membership in this cluster.
2. Finland and Germany form another distinct cluster with a strong tie (94%). Both countries do not have any partial membership in other clusters.
3. Denmark, Ireland, Norway, and Sweden show a high internal consistency. All countries can be found in the same cluster in all performed cluster analysis.
4. Japan and Korea have a strong tie among them (94%) and join the previous cluster as partial members.
5. Australia, Belgium, Luxemburg, the Netherlands, and Switzerland form a dense cluster in which each country shares strong ties to all other included countries.
6. Slovenia and Slovakia have a strong tie, yet with 72% less strong than the other two-country clusters. The countries have strong and weak ties to clusters 5 and 7.
7. France, Israel, Spain, the United Kingdom, and the United States constitute a cluster in which the tie between the US and France is the only weak one.
8. Estonia and 9) New Zealand are one-country clusters. Estonia has weak ties to France and the US and is hence considered a partial member of cluster four. New Zealand has three weak ties to cluster four and is hence considered a partial member in this cluster, too.

Although from a methodological point of view, nine clusters can be clearly distinguished such a solution with clusters covering only one or two countries is not suitable for most purposes.

Our typology allows to go beyond this interpretation. Based on their partial memberships, the clusters can be condensed. As a result, we identify four distinct clusters . These clusters have no ties ≥ 50% to countries from other clusters and within the four clusters all countries have ties ≥ 50%. Figure 1 shows a graphical depiction of the ties between countries and the clusters with only ties ≥ 50% depicted.

--- FIGURE 1 ABOUT HERE ---

Figure 1: Network of OECD LTC systems.



Light grey: ≥ 50%; Full grey: ≥ 66%; Black: ≥ 90%.

The graphic representation shows that two clusters (bottom right and bottom left in Figure 1) could be each split up into two furtherclusters leading to six clusters. Based on their tie strength Cluster 1, 2, 3, and 4 remain as types. Cluster 5 and 6 are joined as well as cluster 7, 8, and 9.

# Results

We propose a LTC typology of six system types:

**The residual public system**

The residual public system is marked by low levels of supply (Table 3). It has by far the lowest overall expenditure, beds, and recipients in comparison to all other system-types. Although access barriers are low by applying no means-testing and a low level of choice restrictions, bound cash benefits hint at a high level of informal care provision. However, the share of public LTC expenditure is the highest of all system types. Performance of these systems measured by life expectancy and subjective health status are by far the lowest compared to all other systems.

**The private supply system**

The supply in this system is medium to high lowest public, Access restrictions are among the lowest for all systems with no-means-testing and limited choice restrictions. Performance levels are medium.







**The public supply system**

This system is defined by high supply and above average public expenditure. Benefits are mainly only available in-kind, which hints at a low level of informal care provision. Furthermore, choice is limited in these systems, yet no means-tests apply. The performance in this system is quite high.

**The evolving public supply system**

This system is marked by medium to low supply and public financing and provision. Expenditure and the number of recipients in institutions are on a medium level, the supply of residential beds below average. Public expenditure is medium and benefits only provided in-kind. Access to the system is provided without means-testing but medium to high choice restrictions apply. Performance is the highest concerning life expectancy but among the lowest concerning self-perceived health.

**The private need-basedsupply system**

This type can be depicted as oriented towards private provision and financing as public expenditure is below average and cash benefits available in almost all countries and often unbound. However, supply is high. Access is restricted by a high level of means-testing, yet choice restrictions are rarely applied. Performance is above average ,.

**The evolving private need-based system**

This type shares a lot of similarities to the prior system type. The public-private mix is oriented towards private financing. Performance is high. Access is restricted both by means-testing as well as high choice restrictions. The main difference to the prior system type is the low supply, especially the low expenditure, but also the provision of beds in residential care and the number of recipients of residential care is medium to low.

--- TABLE 3 ABOUT HERE ---

Table 3: Means of quantitative indicators in LTC typology over (N=4) clusters with (N=4) subclusters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Residual public system | Private supply system | Public supply system | Evolving Public Supply system | Private need-based supply system | Evolving private need-based system |
| Cluster comp. | CZ, LV, PL  (Cluster 1) | DE, FI  (Cluster 2) | DK, IE, NO, SE  (Cluster 3) | JP, KR  (Cluster 4) | AU, BE, CH, LU, NL, SK, SI | EE, ES, FR, IL, NZ, UK, US |
| Cluster size | 3 | 2 | 4 | 2 | 7 | 7 |
| expenditure | 161.82 | 811.33 | 1369.15 | 603.97 | 819.81 | 459.42 |
| Beds | 21.76 | 56.33 | 53.21 | 24.28 | 64.28 | 43.43 |
| Recipients | 1.18 | 4.4 | 4.16 | 2.63 | 5.51 | 3.46 |
| Private expenditure | 5.77 | 23.94 | 10.49 | 18.17 | 11.81 | 24.25 |
| Cash | 1.67 | 2 | 0.25 | 0 | 1.57 | 0.86 |
| Choice restrictions | 1 | 1 | 3 | 2 | 0.57 | 2.29 |
| Means-testing | 0 | 0 | 0 | 0 | 1 | 1 |
| Life expectancy | 17.49 | 19.84 | 19.93 | 21.06 | 19.90 | 20.15 |
| Self-perceived health | 16.08 | 42.73 | 63.43 | 22.68 | 49.99 | 52.88 |

--- TABLE 4 ABOUT HERE ---

Table 4: Overview of cluster labels and characteristics within the 4+2 cluster typology

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Residual Public system | Private Supply system | Public supply system | Evolving Public supply system | Private need-Based supply system | Evolving Private Need-Based system |
| Cluster comp. | CZ, LV, PL | DE, FI | DK, IE, NO, SE | JP, KR | AU, BE, CH, LU, NL, SK, SI | EE, ES, FR, IL, NZ, UK, US |
| Supply  Expenditure  Beds  Recipients | Low  Low  Low | Medium  High  High | High  High  High | Medium  Low  Medium | Medium  High  High | Low  Medium  Medium |
| Public-Private Mix  Private Expenditure  Cash | Low  Medium | High  Medium | Medium  Low | Medium  Low | Medium  High | High  Medium |
| Access Regulation  Choice Restrictions  Means-testing | Low  Low | Low  Low | High  Low | High  Low | Low  High | High  High |
| Performance  Life expectancy  Self-perceived health | Low  Low | Medium  Medium | Medium  High | High  Low | Medium  High | High  High |

# Discussion – 366 words

Focusing on the countries in the six systems, we find expected patterns based on earlier studies, but also unanticipated countries joining these types. The high-supply, public-oriented, system is led by the Nordic countries of Sweden, Norway, and Denmark. This group of countries is found in several studies (Alber, 1995; Colombo, 2012; Damiani et al., 2011), but mostly also includes Finland and the Netherlands (Colombo, 2012; Damiani et al., 2011; Kraus et al., 2010; Pommer et al., 2009). Furthermore, the low-supply, low-performance system is built by Poland, Latvia, and the Czech Republic – three Eastern European countries (Damiani et al., 2011). However, other Eastern European countries join the high supply, private oriented system as Slovenia, Slovakia, and the low supply, private oriented system as Estonia. As we could only incorporate Spain into the typology as a southern European country, the results cannot show or negate the existence of such a cluster of LTC systems. Continental European countries are mainly included in the high supply, private-oriented types , yet the cluster includes Slovenia and Slovakia as Eastern Europeanas well. As Japan and Korea have been attached to Germany and the Netherlands in earlier typologies due to their social insurance model in LTC (Colombo, 2012) our results show that these countries have a distinct type of LTC system, which is closer to those of Northern European LTC systems. Finding Finland and Germany in one cluster seems rare. Only one typology finds both countries in one cluster, yet together with other countries (Damiani et al., 2011). However, one could speculate if this cluster would also include countries such as Austria or Luxembourg which were not included due to data limitations.

Despite many reforms in OECD countries’ LTC systems in recent years, our results underline certain patterns of LTC system types. A low-performance and low-supply system marked by Eastern European countries, as well as a high-supply, public-oriented system mainly occupied by Northern European countries. However, the membership of Eastern European countries in several system types, the inclusion of Ireland in the Northern European system, and the fact that Finland – a Northern European country – and Germany – a continental European country – form a distinct system might show that privatization and marketization reforms in OECD LTC systems (Ranci and Pavolini, 2013; Farris and Marchetti, 2017) led to a convergence of these countries’ LTC systems.

# Conclusion – 403 words

We provided an updated, innovative, and flexible LTC typology. Updated, since we used the latest available data from the OECD database as well as a unique institutional dataset, which we developed ourselves and which has been checked by country policy experts. Innovative, because most typologies rely mainly on quantitative indicators, especially when a larger country sample is included (Colombo, 2012; Damiani et al., 2011; Halásková et al., 2017). Only in cases of smaller country samples, which use more often qualitative comparisons, institutional indicators are considered. A larger country sample as well as a mix of quantitative and institutional indicators has only been adopted by Kraus et al. (2010). Flexible, due to the fact that we defined nine clusters on methodological grounds but go further in interpretation condensed them to six clusters based on less strict methodological as well as content-related considerations. In the last century marketization, commodification, and corporatization of care changed LTC systems all over the world (Farris and Marchetti, 2017), which makes a new and updated LTC typology necessary.

Still, typologies always imply generalizations. For example, in many countries LTC service provision and access have a high regional fragmentation (Spasova et al., 2018), which cannot be displayed on a broad basis in an internationally comparative typology. Furthermore, LTC systems have not that clear boundaries as other welfare state systems such as healthcare, unemployment, or pensions systems do. LTC can be provided via a separate LTC system or it can be partially integrated in healthcare, social assistance, or pension systems, where different access and provision rules apply (Nies et al., 2013). Finally, LTC is in many countries still a new issue in the welfare state, because the provision was traditionally devolved to families and now increasingly to migrant care workers (Colombo et al., 2011; Da Roit and Le Bihan, 2010). Unfortunately, indicators on informal care are not available and by nature not reliable. The only approximation, we have included, are cash benefits (especially unbound) which are an institutional measure to increase informal family and migrant care (Da Roit and Le Bihan, 2010; Da Roit and Weicht, 2013).

Despite these limitations, this article provides an innovative and updated LTC typology, which can extend our understanding of the composition and design of different LTC systems. Lastly, this flexible typology can be of use by welfare state and LTC scholars and is of relevance for LTC policy officials who face the challenges of aging societies.

# References – 1074 words

References

Alber, J. (1995) ‘A Framework for the Comparative Study of Social Services’, Journal of European Social Policy 5(2): 131–49.

Anderson, A. (2012) ‘Europe's Care Regimes and the Role of Migrant Care Workers Within Them’, Journal of Population Ageing 5(2): 135–46.

Anttonen, A. and Sipilä, J. (1996) ‘European Social Care Services: Is it possible to identify models?’, Journal of European Social Policy 6(2): 87–100.

Arts, W. and Gelissen, J. (2002) ‘Three worlds of welfare capitalism or more?: A state-of-the-art report’, Journal of European Social Policy 12(2): 137–58.

Bakx, P., Chernichovsky, D., Paolucci, F., Schokkaert, E., Trottmann, M., Wasem, J. and Schut, F. (2015) ‘Demand-side strategies to deal with moral hazard in public insurance for long-term care’, Journal of health services research & policy 20(3): 170–6.

Bambra, C. (2007) ‘Defamilisation and welfare state regimes: a cluster analysis’, International Journal of Social Welfare 16(4): 326–38.

Bettio, F. and Plantenga, J. (2004) ‘Comparing Care Regimes in Europe’, Feminist Economics 10(1): 85–113.

Böhm, K., Schmid, A., Götze, R., Landwehr, C. and Rothgang, H. (2013) ‘Five types of OECD healthcare systems: empirical results of a deductive classification’, Health policy (Amsterdam, Netherlands) 113(3): 258–69.

Castles, F. G. and Mitchell, D. (1993) ‘Worlds of Welfare and Families of Nations’, in F. G. Castles (ed.) *Families of nations: Patterns of public policy in Western democracies.* Aldershot: Ashgate.

Colombo, F. (2012) ‘Typology of Public Coverage for Long-Term Care in OECD Countries’, in J. Costa-Font and C. Courbage (eds) *Financing Long-Term Care in Europe: Institutions, Markets and Models*, pp. 17–40. London, s.l.: Palgrave Macmillan UK.

Colombo, F., Llena-Nozal, A., Mercier, J. and Tjadens, F. (2011) *Help wanted?: Providing and paying for long-term care.* Paris: OECD.

Da Roit, B. and Le Bihan, B. (2010) ‘Similar and Yet So Different: Cash-for-Care in Six European Countries’ Long-Term Care Policies’, The Milbank Quarterly 88(3): 286–309.

Da Roit, B. and Weicht, B. (2013) ‘Migrant care work and care, migration and employment regimes: A fuzzy-set analysis’, Journal of European Social Policy 23(5): 469–86.

Damiani, G., Farelli, V., Anselmi, A., Sicuro, L., Solipaca, A., Burgio, A., Iezzi, D. F. and Ricciardi, W. (2011) ‘Patterns of Long Term Care in 29 European countries: evidence from an exploratory study’, BMC health services research 11: 316.

Di Rosa, M., Kofahl, C., McKee, K., Bień, B., Lamura, G., Prouskas, C., Döhner, H. and Mnich, E. (2011) ‘A Typology of Caregiving Situations and Service Use in Family Carers of Older People in Six European Countries’, GeroPsych 24(1): 5–18.

Esping-Andersen, G. (1990) *The three worlds of welfare capitalism.* Princeton, N.J.: Princeton University Press.

European Commission (2018) ‘ESPN thematic report on Challenges in long-term care’. https://ec.europa.eu/social/main.jsp?advSearchKey=espnltc\_2018&mode=advancedSubmit&catId=22&policyArea=0&policyAreaSub=0&country=0&year=0.

Farris, S. R. and Marchetti, S. (2017) ‘From the Commodification to the Corporatization of Care: European Perspectives and Debates’, Social Politics: International Studies in Gender, State & Society 24(2): 109–31.

Ferrera, M. (1996) ‘The 'Southern Model' of Welfare in Social Europe’, Journal of European Social Policy 6(1): 17–37.

Fonseca, J. R.S. (2013) ‘Clustering in the field of social sciences: that is your choice’, International Journal of Social Research Methodology 16(5): 403–28.

Halásková, R., Bednář, P. and Halásková, M. (2017) ‘Forms of Providing and Financing Long-Term Care in OECD Countries’, Review of Economic Perspectives 17(2): 159–78.

Halfens, R. J. G., Meesterberends, E., van Nie-Visser, N. C., Lohrmann, C., Schönherr, S., Meijers, J. M. M., Hahn, S., Vangelooven, C. and Schols, J. M. G. A. (2013) ‘International prevalence measurement of care problems: results’, Journal of advanced nursing 69(9): e5-17.

Jensen, C. (2008) ‘Worlds of welfare services and transfers’, Journal of European Social Policy 18(2): 151–62.

Kammer, A., Niehues, J. and Peichl, A. (2012) ‘Welfare regimes and welfare state outcomes in Europe’, Journal of European Social Policy 22(5): 455–71.

Kautto, M. (2002) ‘Investing in Services in West European welfare states’, Journal of European Social Policy 12(1): 53–65.

Kleinke, K., Stemmler, M., Reinecke, J. and Lösel, F. (2011) ‘Efficient ways to impute incomplete panel data’, AStA Adv Stat Anal 95(4): 351–73.

Kraus, M., Riedel, M., Mot, E. S., Willemé, P. and Röhrling, G. (2010) *A typology of long-term care systems in Europe.* Brussels: ENEPRI.

Leitner, S. (2003) ‘Varieties of familialism: The caring function of the family in comparative perspective’, European Societies 5(4): 353–75.

Milligan, G. W. and Cooper, M. C. (1987) ‘Methodology Review: Clustering Methods’, Applied Psychological Measurement 11(4): 329–54.

Nies, H., Leichsenring, K. and Mak, S. (2013) ‘The Emerging Identity of Long- Term Care Systems in Europe’, in Leichsenring, Kai, Billings, Jenny and H. Nies (eds) *Long term care in Europe: Improving policy and practice*, pp. 19–41. Basingstoke: Palgrave Macmillan.

OECD (2018) ‘OECD Health Statistics 2018’. http://www.oecd.org/els/health-systems/health-data.htm.

OECD and European Commission (2013) *A Good Life in Old Age?:* OECD Publishing.

Pfau-Effinger, B. (2014) ‘New policies for caring family members in European welfare states’, Cuad. Relac. Lab. 32(1).

Pommer, E., Woittiez, I. and Stevens, J. (2009) *Comparing care: The care for elderly in ten EU-countries.* Amsterdam: Aksant Acad. Publ.

Ranci, C. and Pavolini, E. (eds.) (2013) *Reforms in Long-Term Care Policies in Europe: Investigating Institutional Change and Social Impacts.* New York, NY: Springer.

Reibling, N. (2010) ‘Healthcare systems in Europe: towards an incorporation of patient access’, Journal of European Social Policy 20(1): 5–18.

Reibling, N., Ariaans, M. and Wendt, C. (2019) ‘Worlds of Healthcare: A Healthcare System Typology of OECD Countries’, Health policy (Amsterdam, Netherlands) 123(7): 611–20.

Rostgaard, T. (2002) ‘Caring for Children and Older People in Europe - A Comparison of European Policies and Practice’, Policy Studies 23(1): 51–68.

Saraceno, C. and Keck, W. (2010) ‘Can we identify intergenerational policy regimes in Europe?’, European Societies 12(5): 675–96.

Schieber, G. J. (1987) *Financing and delivering health care: A comparative analysis of OECD countries.* Paris: OECD.

Simonazzi, A. (2008) ‘Care regimes and national employment models’, Cambridge Journal of Economics 33(2): 211–32.

Spasova, S., Baeten, R., Coster, S., Ghailani, D., Peña-Casas, R. and Vanhercke, B. (2018) *Challenges in long-term care in Europe: A study of national policies.* Brussels.

Ungerson, C. (1997) ‘Social Politics and the Commodification of Care’, Social Politics: International Studies in Gender, State & Society 4(3): 362–81.

van Hooren, F. J. (2012) ‘Varieties of migrant care work: Comparing patterns of migrant labour in social care’, Journal of European Social Policy 22(2): 133–47.

Wendt, C. (2009) ‘Mapping European healthcare systems: a comparative analysis of financing, service provision and access to healthcare’, Journal of European Social Policy 19(5): 432–45.

Wendt, C. (2014) ‘Changing Healthcare System Types’, Social Policy & Administration 48(7): 864–82.

White, I. R., Royston, P. and Wood, A. M. (2011) ‘Multiple imputation using chained equations: Issues and guidance for practice’, Statistics in medicine 30(4): 377–99.

Online Appendix

Table 5: Means LTC typology indicators over countries (N=25) and years (2014-2016)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Quantitative indicators | | | | | | Institutional indicators | | |
| ID | EXPND | BEDS | RCPTIN | PEXPND | LEX | SPH | CASH | CIDX | MTAB |
| AU | 99.86 | 52.53 | 6.40 | 5.87 | 20.88 | 76.40 | Unbound | 0 | Yes |
| BE | 1037.03 | 68.10 | 7.16 | 9.43 | 20.05 | 52.30 | Unbound | 2 | Yes |
| CZ | 314.19 | 38.87 | 2.24 | 0.19 | 17.90 | 23.57 | Unbound | 0 | No |
| DK | 1223.61 | 45.95 | 3.97 | 8.25 | 19.43 | 58.57 | In-kind | 3 | No |
| EE | 106.22 | 45.60 | 5.00 | 34.56 | 18.05 | 15.87 | In-kind | 4 | Yes |
| FI | 763.24 | 59.30 | 4.70 | 17.21 | 20.03 | 44.87 | Unbound | 2 | No |
| FR | 696.76 | 53.07 | 4.20 | 22.47 | 21.77 | 41.03 | Bound | 1 | Yes |
| DE | 859.42 | 53.35 | 4.10 | 30.67 | 19.65 | 40.60 | Unbound | 0 | No |
| IE | 1126.68 | 49.20 | 3.53 | 17.79 | 19.76 | 65.43 | In-kind | 2 | No |
| IL | 244.61 | 21.00 | 1.90 | 28.29 | 20.37 | 55.47 | Unbound | 1 | Yes |
| JP | 796.31 | 24.10 | 2.70 | 8.39 | 21.85 | 24.00 | In-kind | 2 | No |
| KR | 411.63 | 24.47 | 2.57 | 27.95 | 20.30 | 21.37 | In-kind | 2 | No |
| LV | 73.42 | 14.20 | 0.43 | 13.10 | 16.48 | 8.60 | Bound | 2 | No |
| LU | 1503.52 | 85.00 | 5.47 | 20.19 | 20.57 | 47.10 | Bound | 0 | Yes |
| NL | 1360.82 | 75.70 | 4.80 | 8.39 | 19.85 | 60.47 | Bound | 0 | Yes |
| NZ | 635.47 | 56.43 | 4.60 | 6.13 | 20.37 | 86.90 | In-kind | 2 | Yes |
| NO | 1745.09 | 52.17 | 4.63 | 8.63 | 20.27 | 66.37 | Bound | 3 | No |
| PL | 97.86 | 12.20 | 0.87 | 4.03 | 18.10 | 16.07 | Unbound | 1 | No |
| SK | 9.48 | 52.07 | 3.93 | 1.17 | 17.08 | 18.77 | Bound | 0 | Yes |
| SI | 266.88 | 50.67 | 4.93 | 4.11 | 19.67 | 31.03 | Unbound | 1 | Yes |
| ES | 294.38 | 44.47 | 1.83 | 18.54 | 21.30 | 40.03 | Bound | 3 | Yes |
| SE | 1381.24 | 65.53 | 4.50 | 7.29 | 20.25 | 63.33 | In-kind | 4 | No |
| CH | 1461.08 | 65.90 | 5.90 | 33.53 | 21.17 | 63.83 | Unbound | 1 | Yes |
| UK | 747.22 | 47.60 | 4.22 | 33.42 | 19.90 | 52.70 | Bound | 2 | Yes |
| US | 491.26 | 35.83 | 2.50 | 26.36 | 19.28 | 78.16 | Bound | 3 | Yes |
| *TM* | 709.89 | 47.73 | 3.88 | 15.84 | 19.77 | 46.11 | - | 1.64 | - |

Sources: OECD health data (extracted on 10.12.2018) &MISSOC 2018 (European observatory on health systems and policies 2018), European commission 2018; Own Coding Scheme; TM = Total mean

Table 6: Means of quantitative indicators in LTC typology over (N=9) methodological clusters

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Cluster composition | AU, BE, CH, LU, NL | CZ, LV, PL | DK, IE, NO, SE | EE | DE, FI | ES, FR, IL, UK, US | JP, KR | NZ | SI, IK |
| Cluster Size | 5 | 3 | 4 | 1 | 2 | 5 | 2 | 1 | 2 |
| EXPND | 1092.46 | 161.82 | 1369.15 | 106.22 | 811.33 | 494.85 | 603.97 | 635.46 | 138.18 |
| BEDS | 69.45 | 21.76 | 53.21 | 45.6 | 56.33 | 40.39 | 24.28 | 56.43 | 51.37 |
| RCPTIN | 5.95 | 1.18 | 4.16 | 5 | 4.4 | 2.93 | 2.63 | 4.6 | 4.43 |
| PEXPND | 15.48 | 5.77 | 10.49 | 34.56 | 23.94 | 25.82 | 18.17 | 6.13 | 2.64 |
| CASH | 1.6 | 1.67 | 0.25 | 0 | 2 | 1.2 | 0 | 0 | 1.5 |
| LEX 65+ | 20.50 | 17.49 | 19.93 | 18.05 | 19.84 | 20.52 | 21.08 | 20.37 | 18.38 |
| SPH | 60.02 | 16.08 | 63.43 | 15.87 | 42.73 | 53.48 | 22.68 | 86.9 | 24.9 |
| CIDX | 0.6 | 1 | 3 | 4 | 1 | 2 | 2 | 2 | 0.5 |
| MTAB | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |

Sources: OECD health data (extracted on 10.12.2018) & MISSOC 2018 (European observatory on health systems and policies 2018), European commission 2018; Own Coding Scheme

CUT CONTENT

## Table X: Means of quantitative indicators in LTC typology over (N=5) theory-based clusters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |
| Cluster composition | AU, BE, FR, IL, LU, NL, NZ, ES, CH, UK, US | CZ, LV, PL | DK, IE, JP, KR, NO, SE | EE | FI, DE |
| Cluster Size | 11 | 3 | 6 | 1 | 2 |
| EXPND | 779.27 | 161.82 | 1114.09 | 106.22 | 811.33 |
| BEDS | 55.06 | 21.76 | 45.57 | 45.6 | 56.33 |
| RCPTIN | 4.45 | 1.18 | 3.65 | 5 | 4.4 |
| PEXPND | 19.33 | 5.77 | 13.05 | 34.56 | 23.94 |
| CASH | 1.27 | 1.67 | 0.17 | 0 | 2 |
| LEX 65+ | 20.5 | 17.49 | 20.31 | 18.05 | 19.84 |
| SPH | 59.49 | 16.08 | 49.84 | 15.87 | 42.73 |
| CIDX | 1.36 | 1 | 2.67 | 4 | 1 |
| MTAB | 1 | 0 | 0 | 1 | 0 |

Sources: OECD health data (extracted on 10.12.2018) & MISSOC 2018 (European observatory on health systems and policies 2018), European commission 2018; Own Coding Scheme

## Table X: Overview of Cluster Labels and Characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |
| Cluster composition | AU, BE, FR, IL, LU, NL, NZ, ES, CH, UK, US | CZ, LV, PL | DK, IE, JP, KR, NO, SE | EE | FI, DE |
| Supply  EXPD  BEDS  RCPTIN | Medium  Med.-High  Med.-High | Low  Low  Low | High  Medium Medium | Low  Medium  High | Medium Med.-High  Med.-High |
| Public-Private Mix | Med.-High  Medium | Low  Med.-High | Medium  Low | High  Low | Med.-High  High |
| Pefrormance | Med.-High  Med.-High | Low  Low | Med.-High  Medium | Low  Low | Medium  Medium |
| Access Regulation |  | Low  Low |  | High  High | Low  Low |

## Why do lines between Estonia/France and US appear light grey, not full grey?

The ties of Estonia to France and the US are rounded values of 0,66. As we us unreounded values for Figure 1, the lines appear light grey, not full grey. As Estonia only has ties to these two countires of the five countries of cluster 7, according to the rules set out in the Data and Methods section it is condiered a partial member of this cluster.