# Title:

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

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## Short biography – 50-100 words

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|  | **Ist** |
| Abstract (zählt nicht) | 52 |
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| T1 (Methods) | 165 |
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# Abstract – 52 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:** long-term care, elderly, typology, classification

# Introduction – 361 words

Providing LTC for the elderly is a current and future challenge of welfare states. Increasing longevity and the ageing of the baby-boom generation challenge the provision of LTC (Colombo et al., 2011). Due to this rising number of elderly people in need of LTC services, fiscal pressures on LTC systems increase (Ranci and Pavolini, 2013). At the same time, claims for better access to systems and higher quality of services become louder (OECD and European Commission, 2013). To cope with these pressures, many countries reformed their LTC systems, often by adopting marketization, economization, and corporatization measures, which often tremendously altered the scope and functioning of established LTC systems (Farris and Marchetti, 2017; Ungerson, 1997). Therefore, this paper aims to provide a new and updated LTC typology which includes these changes and shows in which way they lead to new or altered types of LTC systems. Compared to earlier typologies, we thereby make two advancements. First, earlier typologies used either quantitative OECD or Eurostat data (Damiani et al., 2011; Halásková et al., 2017) or standardized data on institutional and regulatory aspects of LTC systems (Colombo, 2012; Kraus et al., 2010). We integrate both approaches by analyzing OCED data on supply, public-private mix, performance *as well as* institutional data on accessibility of systems. Second, most LTC typologies use one cluster analysis to provide results (Damiani et al., 2011; Halásková et al., 2017; Kraus et al., 2010). We selected cluster analysis as method as well. However, we adopt the innovative approach by Reibling et al. (2019), who calculate numerous cluster analyses to incorporate the internal consistency of clusters. This has not been implemented so far in earlier typologies.

In the following we first describe the dimensions and indicators earlier LTC typologies used and summarize their results. We then explain our chosen indicators and the sample composition. The results section contains a detailed method-driven clustering solution. Based on this, we also discuss a condensed content-based clustering solution, which forms the basis for our typology proposal. We propose a solution of four distinct system types, two of which can be divided into two subtypes. In conclusion, we discuss these results in the light of previous studies.

# Theory – 1214 words

## Long-term Care Classifications

Typologizing welfare states or welfare state systems is a common endeavor in welfare state research, not at least 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, which includes social service research (Rostgaard, 2002). Since then a vast amount of issue and area-specific typologies have been developed, not least in the neighboring field of healthcare (Wendt, 2014; Reibling et al., 2019; Schieber, 1987; Böhm et al., 2013).

LTC is thereby 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).

Although this definition is independent of age most LTC recipients are above 65 years old. Typologies including 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 bigger social service picture (Anttonen and Sipilä, 1996; Bettio and Plantenga, 2004; Kautto, 2002; Leitner, 2003; Saraceno and Keck, 2010). The second group genuinely concentrates on LTC for the elderly, although they often include disability 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). Finally, the 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).

Because our focus lies on building a typology of LTC system types, we 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. However, with regard to dimensions and indicators, most studies repeatedly analyse four central dimensions, thus creating a certain standardisation and comparability that we can make use of.

### 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), but also staff and staffing levels (Alber, 1995) as well as 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

Often part of healthcare typologies (Reibling et al., 2019; Böhm et al., 2013), the second dimension of public-private-mix operationalizes the role of the state and of private actors. Only those LTC typologies specializing on specific aspects or taking a broader view on social services, integrate this dimension (Anderson, 2012) by 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), or 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). This access dimension has been proven of high relevance for healthcare typologies (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 in Kraus et al.'s (2010) typology.

### IV. Performance

Measuring the performance of LTC systems is especially on an internationally comparative level still in its infancy. Common indicators for measuring the quality of service provision in LTC 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 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.

### Same measure – different typologies

Most existing typologies are solely based on quantitative indictors, usually taking up OECD and Eurostat indicators(Alber, 1995; Colombo, 2012; Damiani et al., 2011; Kraus et al., 2010), but also Share-Data (micro-data) are used (Pommer et al., 2009). Only Kraus et al. (2010) adopts quantitative *as well as* qualitative data on institutional setting and rules for access to the system, which are based on own primary data collection. The results of these typologies are certainly influenced by their focus and aim but also by the (number of) included countries. Some studies included only about ten European/OECD country cases (Alber, 1995; Halásková et al., 2017; Pommer et al., 2009) while others analyzed about 20 and more European (Damiani et al., 2011; Kraus et al., 2010) and/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 sometimes join. In some studies a second cluster which incorporates Eastern-European as well as Southern European countries is built (Damiani et al., 2011; Kraus et al., 2010; Colombo et al., 2011) including Italy, Spain, and Greece. These countries are only 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 but mostly together with some Eastern European 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 the typologies. The typology by Colombo (2012), which categorizes countries based on financing indicators include Japan and South Korea in a cluster with Germany, Luxemburg, and the Netherlands due to their common social insurance approach, whereas New Zealand and Canada are in a cluster with Greece, Spain, and Switzerland due to their universal but means-tested financing approach. Halásková et al. (2017) find Australia and South Korea in one cluster.

This short overview on existing LTC typologies shows room for extension. First, many typologies have a European focus or only use a small sample of countries. Thus, we would like to extend these typologies by using an OECD sample with as many countries as possible. Second, most typologies only use quantitative indicators where a huge weight lies on financing indicators. In contrast, institutional indicators focusing on access to long-term care are rarely used. We therefore combined both approaches.

# Methodology – 1400 words

## Quantitative and institutional indicators

Indicators for the typology of LTC systems came from two data sources (Table 1). First, six quantitative measures were extracted at the 10th of December 2018 from OECD health data (OECD, 2018). Another five institutional indicators were distilled from information within 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 for 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 via e-mail, sent them a questionnaire containing the description of indicators and values including our country-specific assessment of values. We received XX questionnaires with comments to our coding between May and July 2019.

--- TABLE 1 ABOUT HERE ---

Table 1: Overview of LTC typology indicators

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Abbreviation | Mean | SD | Min. | Max. |
| *I: Supply* |  |  |  |  |  |
| Expenditure per capita in US$, PPP | EXPND | 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+ | RCPTIN | 3.88 | 1.66 | 0.43 | 7.17 |
| *II: Public-Private-Mix* |  |  |  |  |  |
| Share of private expenditure,  % of total expenditure | PEXPND | 15.84 | 11.09 | 0.19 | 34.56 |
| Cash Availability of cash ebenfits  (only inkind, Bound, Unbound) | CASH | 1.08 | 0.81 | 0 | 2 |
| *III: Access regulation* |  |  |  |  |  |
| Choice Index (Unlimited - Limited) | CIDX | 1.64 | 0.5 | 0 | 4 |
| Choice of homecare provider | HC | 0.4 | 0.49 | 0 | 1 |
| Choice of institutional care provider | IC | 0.36 | 0.83 | 0 | 1 |
| Choice between cash vs inkind-benefits | CVSI | 0.88 | 1.25 | 0 | 2 |
| Means-testing for any benefit (No/Yes) | MTAB | 0.56 | 0.51 | 0 | 1 |
| *IV: Performance* |  |  |  |  |  |
| Life expectancy 65+ | LEX | 19.77 | 1.35 | 16.48 | 21.85 |
| Self-perceived health status (very) good,  % of the population 65+ | SPH | 46.11 | 21.83 | 8.6 | 86.9 |

As a measure of financial input into the system we use the LTC expenditure (health) per capita in US$ of purchasing power parities (EXPND). It includes all expenditure on bodily related LTC, mainly on “(basic) Activities of daily living (ADL)” like bathing, dressing or eating). We would have liked to include LTC expenditure (social) as well, which includes “instrumental activities of daily living (IADL) giving the LTC system expenditure a broader scope (Halásková et al., 2017). Unfortunately, data availability was extremely limited in this dimension. Institutional supply of services was furthermore measured by the number of LTC beds per 1000 population aged 65 or older (BEDS) while the actual supply of spots in these facilities was reflected by the number of LTC recipients in institutions measured as the percentage of all people aged 65 years and older (RCPTIN).

To mirror the public-private-mix of LTC systems we use two indicators. First, the share of private (voluntary and out-of-pocket) expenditure in the total expenditure (PEXPND) as a measure of public and private involvement in payments for care. Second, we adopted the availability of cash benefits (CASH) as an approximation for 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, CASH may take values of 0, describing a system where only in-kind-benefits are available. If the use of cash benefits were bound to specific services and aids, the indicator was coded 1, while unbound benefits, where the use of the benefit was at the beneficiary’s own discretion, were coded with a 2.

Access to LTC systems is reflected by 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 (HC), choice of institutional care provider (IC) and choice between cash and in-kind benefits (CVSI). We constructed a cumulative index from these three choice indicators, since cluster analysis profits from a small number of variables, since 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 (CIDX) may take values between 0-4, where 0 means absolute freedom of choice, while 4 reflects strong restrictions. Furthermore, we used means-testing (MTAB) for any benefit, which 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.

Finally, within the performance dimension, we use indicators that are not exclusively but to a large part determined by the quality of LTC services. We integrate life expectancy of people aged 65 or older (LEX) and the percentage of the population who are 65 or older and perceive their health as good or very good (SPH).

## Data

After extraction, we excluded countries, where data was 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 conducted a three-step process: First, we estimated 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; Kleinke et al., 2011), we imputed missing mean values of indicators by predictive mean matching of the next neighbor, here the next year. If for example the value was missing in 2105 for a specific country, we estimated the model with the full information from 2014 and aggregated the values of 20 cycles to yearly mean. Second, we aggregated imputed data to the yearly-mean of the specific indicator if the true value was missing. Finally, we calculated an overall mean of the observation period between 2014-2016 for our analysis (Table 5, Online Appendix).

## Cluster analysis

Cluster analysis is the standard method in welfare state typologies (Jensen, 2008; Reibling, 2010; Wendt, 2014) as well as in LTC typologies (Halásková et al., 2017; Kautto, 2002; Kraus et al., 2010; Saraceno and Keck, 2010) for classifying and developing system types. The innovative approach by Reibling et al. (2019), where the authors utilize multiple cluster analyses within the same methodological framework 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 such complex long-term care systems. The flexibility of the multi-cluster-analysis proposed by (Reibling et al., 2019: 615), however 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” 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 analysis and a country needs to have these 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 analysis. 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 mapped the cluster solution by a network graph, which was modelled by UNICNET6/Netdraw. The graph thereby not only visualizes groups of countries and how likely it is that two countries belong to a similar LTC system type. Rather it displays the internal consistency of LTC systems allowing for an in-depth analysis of the composition of clusters.

# Results – 1273 words

Based on the full membership rule, nine clusters can be divided (Table 2):

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 as partial members of the previous cluster.
5. Australia, Belgium, Luxemburg, Netherlands, and Switzerland form a dense cluster, in which each country shares strong ties to all other countries in the cluster.
6. Slovenia and Slovakia have a strong tie, yet less strong than the other clusters of two by 72%. The countries have strong and weak ties to cluster 5 and cluster 7.
7. France, Israel, Spain, the United Kingdom, and the United States constitute another cluster, in which the tie between the US and France is the only weak one in the cluster.
8. Estonia and 9) New Zealand are sole clusters, including only one country. Estonia has two 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.

--- 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 |  |  |

Although nine clusters were clearly distinguished from a methodological point of view, such a solution with clusters covering only one or two countries may not be suitable for most purposes. However, our flexible typology is able to go beyond this interpretation. The clusters can be condensed based on their partial memberships. Four distinct clusters emerge, which have no tie ≥ 50% to each other. Figure 1 shows a graphical depiction of the ties between countries and the clusters. Only ties between countries ≥ 50% are depicted in the figure.

--- FIGURE 1 ABOUT HERE ---

Figure 1: Network of OECD LTC systems.



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

With the graphic representation it is also noticeable that two clusters (bottom right and bottom left in Figure 1) could be split up in two sub-clusters each, based on their tie strength Cluster 1 and 2 remain as types, cluster 3 and 4 are joined to one system type, with each representing a sub-type. All other countries built one system type with cluster 5 and 6 as one sub-type and cluster 7, 8, and 9 as one sub-type. Thus, we propose a LTC typology of four system types, with two systems having two sub-types each:

**The low-supply and low-performance system**

The first system is marked by low levels of supply (Table 3), which results in a low level of performance. It has by far the lowest overall expenditure, beds, and recipients in comparison to all other system-types. Although countries of this LTC system type have low access barriers 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, private LTC expenditure is the lowest 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 access-oriented private system**

Access restrictions are among the lowest for all systems with no-means-testing and limited choice restrictions. Supply can be evaluated as medium to high. Yet, this system shows one of the highest shares of private expenditure and the availability of unbound cash benefits which hint at a high level of informal care provision. Performance levels are medium.

--- TABLE 3 ABOUT HERE ---

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Low performance, low supply | Access-orientated private | High performance public orientated | High supply | Low supply | High performance private orientated | High supply | Low supply |
| Cluster comp. | CZ, LV, PL | DE, FI | DK, IE, NO, SE, KR, JP | DK, IE, NO, SE | JP, KR | AU, BE, CH, EE, ES, IL, LU, FR, NL, NZ, SK, SI, UK, US | AU, BE, CH, LU, NL, SK, SI | EE, ES, FR, IL, NZ, UK, US |
| Cluster size | 3 | 2 | 6 | 4 | 2 | 14 | 7 | 7 |
| EXPND | 161.82 | 811.33 | 1114.09 | 1369.15 | 603.97 | 639.61 | 819.81 | 459.42 |
| BEDS | 21.76 | 56.33 | 43.57 | 53.21 | 24.28 | 53.85 | 64.28 | 43.43 |
| RCPTIN | 1.18 | 4.4 | 3.65 | 4.16 | 2.63 | 4.49 | 5.51 | 3.46 |
| PEXPND | 5.77 | 23.94 | 13.05 | 10.49 | 18.17 | 18.03 | 11.81 | 24.25 |
| CASH | 1.67 | 2 | 0.17 | 0.25 | 0 | 1.21 | 1.57 | 0.86 |
| CIDX | 1 | 1 | 2.67 | 3 | 2 | 1.43 | 0.57 | 2.29 |
| MTAB | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| LEX | 17.49 | 19.84 | 20.31 | 19.93 | 21.06 | 20.02 | 19.90 | 20.15 |
| SPH | 16.08 | 42.73 | 49.84 | 63.43 | 22.68 | 51.43 | 49.99 | 52.88 |

--- TABLE 4 ABOUT HERE ---

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Low performance, low supply | Access-orientated private | High performance public orientated | High supply | Low supply | High performance private orientated | High supply | Low supply |
| Cluster comp. | CZ, LV, PL | DE, FI | DK, IE, NO, SE, KR, JP | DK, IE, NO, SE | JP, KR | AU, BE, CH, EE, ES, IL, LU, FR, NL, NZ, SK, SI, UK, US | AU, BE, CH, LU, NL, SK, SI | EE, ES, FR, IL, NZ, UK, US |
| Supply  EXPD  BEDS  RCPTIN | Low  Low  Low | Medium High  High | High  Medium  Medium | High  High  High | Medium  Low  Medium | Medium  Medium  Medium | Medium  High  High | Low  Medium  Medium |
| Public-Private Mix  PEXPND  CASH | Low  Medium | High  Medium | Medium  Low | Medium  Low | Medium  Low | Medium  Medium | Medium  High | High  Medium |
| Access Regulation  CIDX  MTAB | Low  Low | Low  Low | High  Low | High  Low | High  Low | Medium  High | Low  High | High  High |
| Performance  LEX  SPH | Low  Low | Medium  Medium | High  Medium | Medium  High | High  Low | Medium  High | Medium  High | High  High |

**The high-performance public-orientated system**

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

**The high performance private oriented system**

Performance in this LTC type is high with above average life expectancy and self-rated health. As private expenditure are above average and cash benefits available in almost all countries and often unbound, this type can be depicted as oriented towards private provision and financing. The sub-types differ by high and low supply. Both sub-types apply means-testing, yet only the low-supply type is marked by considerable choice restrictions.

# Discussion – 366 words

Focusing on the countries in the four systems, we find expected patterns based on earlier studies, but also unanticipated countries joining these types. The high-performance, public-oriented, high-supply sub-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 as Slovenia, Slovakia, and Estonia are loosely attached to the high performance private-oriented types. 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 performance private-oriented types – especially in the high-supply sub-cluster – yet the cluster includes Eastern European, Southern European, and Non-European OECD countries as 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 the high performance and the public-private mix of these LTC systems are 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-performance, public-oriented system mainly occupied by Northern European countries. However, the large group of countries in the high-performance, private-oriented system is a new finding. This 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 – 384 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 heavily 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 clusterson methodological grounds but go further in interpretation condensed them to four 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

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.

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.

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.

Rechel, B., Grundy, E., Robine, J.-M., Cylus, J., Mackenbach, J. P., Knai, C. and McKee, M. (2013) ‘Ageing in the European Union’, The Lancet 381(9874): 1312–22.

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. (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.