

31 Multiple chronic conditions in older people in European countries: A network analysis approach

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- ▶ European countries differ in their distribution of comorbidities of older people
 - ▶ The differences largely follow Esping Andersen's welfare regime typology
 - ▶ Strong connections among diseases are found in eastern European countries in which this issue should receive additional attention from policymakers
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31.1 Introduction

The presence of multiple coexisting chronic diseases (i.e., comorbidities) in individuals and the expected rise in chronic diseases over the coming years are increasingly being recognized as major public health and health-care challenges of modern societies (Glynn et al., 2011). Individuals with multiple conditions are presumed to have greater health needs, higher risk of complications and more difficulty managing treatment regimens. Therefore, comorbidity is associated with worse health outcomes, more complex clinical management and increased healthcare costs. At present, the main healthcare model is disease-focused rather than person-focused; therefore, the involvement of several different healthcare providers in managing multiple disorders is inevitable and often results in competing treatments, sub-optimal coordination and communication between care providers and/or unnecessary replication of diagnostic tests or treatments. As a consequence, the common belief is that persons with multiple diseases have high rates of healthcare utilization, which is confirmed by international studies (Glynn et al., 2011; Barnett et al., 2012).

We use a dataset based on the SHARE Wave 6 survey, which includes data on 18 European countries: Austria, Germany, Sweden, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, the Czech Republic, Poland, Luxembourg, Portugal, Slovenia, Estonia and Croatia. We model the presence of comorbidities as a two-mode (affiliation) network analysis problem using cluster analysis techniques developed for network analysis (for more, see, e.g., Doreian, Ferligoj and Batagelj, 2005). This approach has special scientific

relevance because, to our knowledge, network analysis has been rarely used to date to study this problem and very seldom (if ever) before in analyses using SHARE data. In our case, the diseases form one mode of connections and the respondents having them form the second mode. By transforming such two-mode affiliation networks into one-mode networks with diseases as nodes and weights on the lines to measure the frequency of connections between any chosen pair of diseases, we can study the distribution of comorbidities in older age across the included European countries.

We study the following two main research questions: 1) which are the most frequent groupings of diseases that can be characterized from the data for older people in Europe; and 2) does the grouping of diseases differ across Europe (are comorbidities more frequent in some countries than in others and are some health systems more exposed to comorbidities). In the following section, we provide basic information on the data and methods used. In the third section, we discuss the results. In the final section, we provide conclusions and recommendations.

31.2 Data and method

This paper uses the dataset on the Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 6. The final included sample, which encompasses only individuals aged 50 years or older, includes 67,346 respondents.

In our analysis, we primarily use only one variable, ph006, and ask ‘Has a doctor ever told you that you had/Do you currently have any of the conditions on this card? With this we mean that a doctor has told you that you have this condition and that you are either currently being treated for or bothered by this condition. Please tell me the number or numbers of conditions’.

Given comparability with other waves, we use the following 17 diseases (we exclude chronic kidney disease as a special category, first asked in Wave 6) as answers to this question:

- A heart attack including myocardial infarction, coronary thrombosis or any other heart problem including congestive heart failure
- High blood pressure or hypertension
- High blood cholesterol
- A stroke or cerebral vascular disease
- Diabetes or high blood sugar
- Chronic lung disease, such as chronic bronchitis or emphysema

- Cancer or a malignant tumour, including leukaemia or lymphoma but excluding minor skin cancers
- Stomach or duodenal ulcer, peptic ulcer
- Parkinson’s disease
- Cataracts
- Hip fractures
- Other fractures
- Alzheimer’s disease, dementia, organic brain syndrome, senility or any other serious memory impairment
- Other affective or emotional disorders, including anxiety, nervous or psychiatric problems
- Rheumatoid arthritis
- Osteoarthritis or other rheumatism
- Other diseases (including children’s kidney disease)

We separate countries by welfare regimes into five clusters based on an updated Esping Andersen typology (1990), as follows:

- Continental countries: Austria, Germany, Switzerland, Belgium, France and Luxembourg
- Socio-democratic countries: Denmark and Sweden
- Mediterranean countries: Greece, Italy, Portugal and Spain
- Eastern European countries: Czech Republic, Estonia and Poland
- Mixed model countries: Israel

We use a cluster technique for network analysis called VOS (visualization of similarities), which was proposed by Van Eck and Waltman (see, e.g., 2009). In VOC clustering, the optimization is over the VOS quality function, where the following expression is maximized:

$$V = \frac{1}{2m} \sum_{i,j} [s_{ij} - \gamma] \delta(c_i, c_j) \quad (31.1)$$

where:

- m – the total number of edges in a network
- s_{ij} – association strength between vertices i and j
- γ – resolution parameter
- δ – a function that yields 1 if the vertices are in the same community and 0 otherwise
- C – respective community

The optimal number of clusters according to the VOS technique is found when the aforementioned function is maximized. To derive the optimal number of clusters, information provided by the Cramers' V statistic, Rajski's Index and the Adjusted Rand Index is also used and studied in a separate paper to be applied to the SHARE Working Paper Series.

31.3 Results

We present the results of the analysis by included countries and welfare regimes. In Figure 31.1, we present the results of the cluster analysis for six continental countries. In most countries, two clusters are visible, one with the diseases that strongly link each other (the 'connected' cluster) and encompass heart attacks, high blood pressure, high cholesterol, diabetes, cataracts and – in most cases – arthritis and osteoarthritis. In the other cluster are all remaining diseases that appear very weakly connected. Interestingly, judged by weights on the lines (shown as widths of the connections on the graph – the widths are normalized by the size of the sample), most of the connections in certain countries (e.g., Switzerland, Belgium) are rather weak; they seem stronger and have the greatest disparity between the two clusters in the Benelux countries and France.

In Figure 31.2, we present the results of the analysis for socio-democratic countries. Interestingly, the connections (and, consequently, the comorbidities) appear rather weak. Again, we find the presence of two large clusters – the 'connected' and the 'unconnected' ones – for which the diseases in both largely follow the distribution in the continental countries.

Figure 31.3 shows the comorbidities for Mediterranean countries. Interestingly, in most cases, three clusters come to the fore, with very unstable positions of arthritis and osteoarthritis relative to the previous sets of countries. Nevertheless, five main diseases appear as the most 'connected' and stable: heart attack, high blood pressure, high cholesterol, diabetes and cataracts. Furthermore, in most countries, the comorbidities appear not very strong, which holds in particular for Italy and Spain.

Relative to the previous sets of countries, in most eastern European countries (Figure 31.4), the comorbidities appear very strong – this finding holds for all countries except Poland (which also has one of the smallest samples of all included countries). In particular, in the Czech Republic, Croatia and Slovenia (and, to a certain extent, Estonia), the cluster of 'connected' diseases – again encompassing the same set of 'stable' diseases – that is, heart attack, high

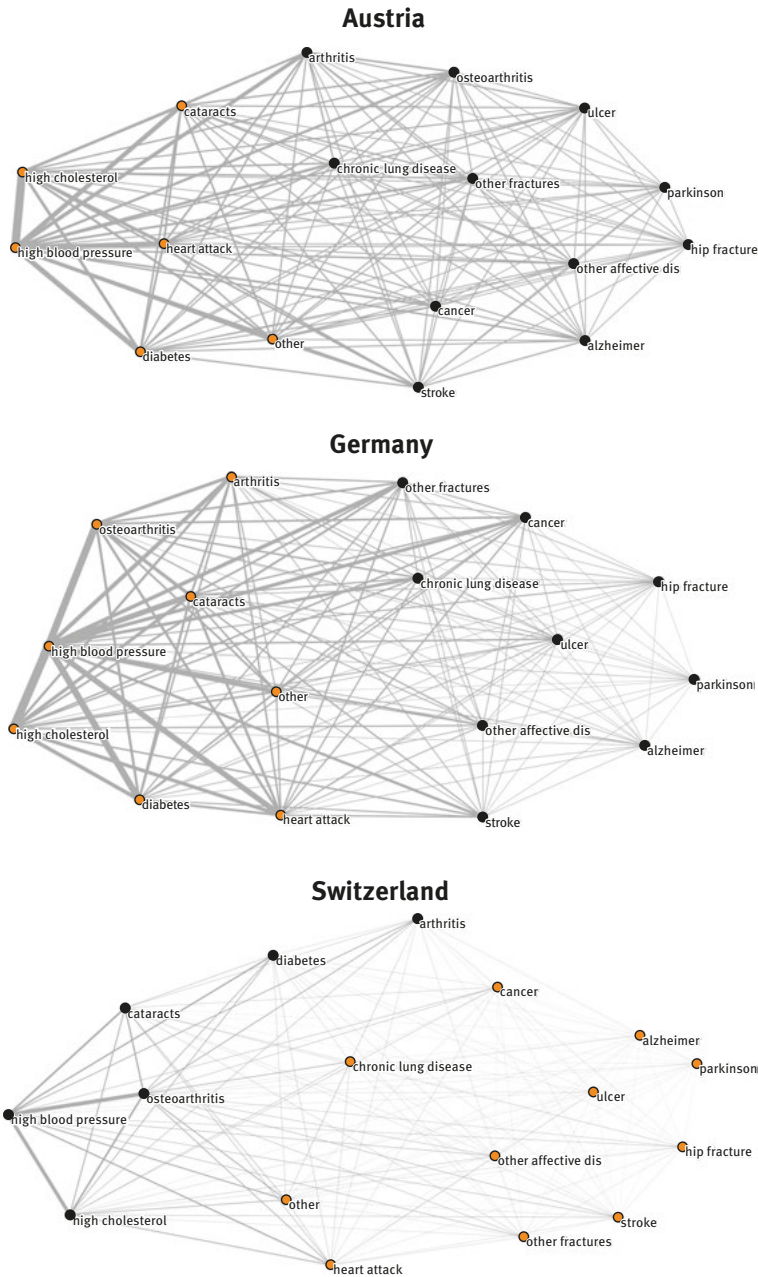


Figure 31.1: Clusters of comorbidities among continental countries.

Source: SHARE Wave 6 release 6.1.0

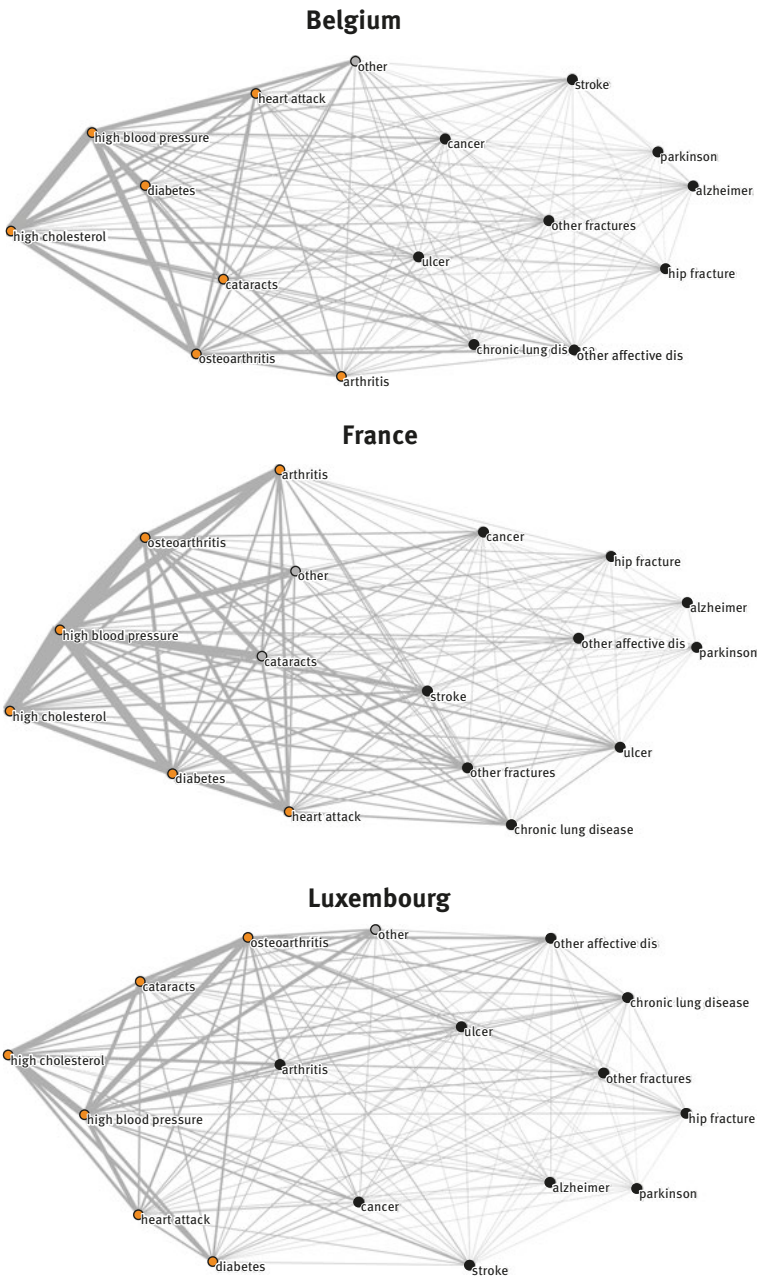


Figure 31.1 (continued)

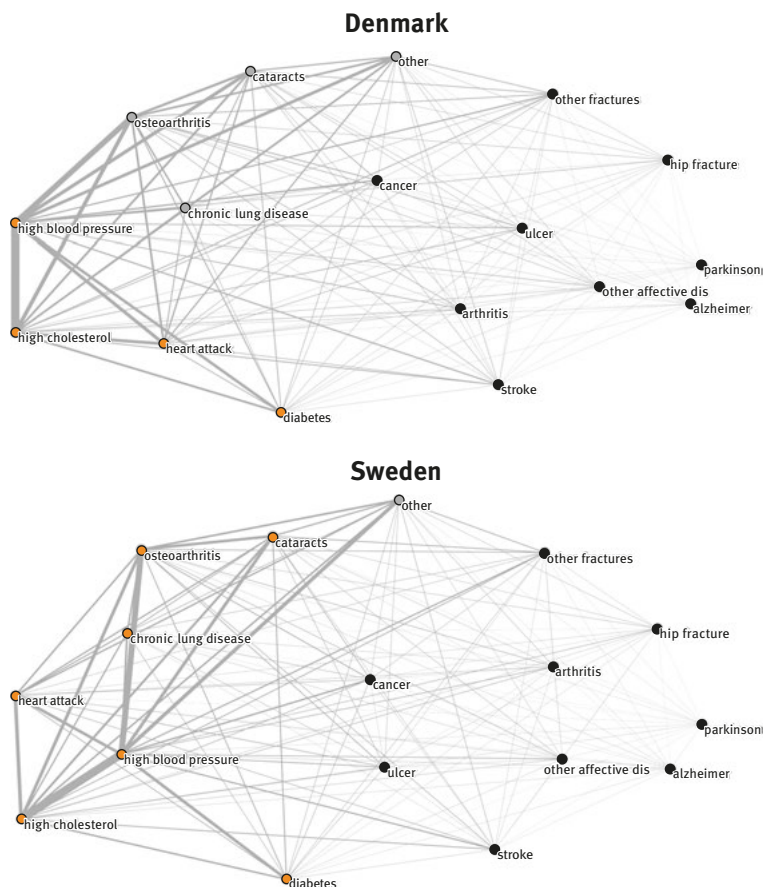


Figure 31.2: Clusters of comorbidities among socio-democratic countries.

Source: SHARE Wave 6 release 6.1.0.

blood pressure, high cholesterol, diabetes and cataracts, also arthritis and osteoarthritis (with the exception of Slovenia, where the distribution seems more complex and unclear), is very strongly connected.

Of the countries in the mixed model (Figure 31.5), only Israel is included in the study. For Israel, similar to most of the studied countries, three clusters are observed that have an unstable position of arthritis and osteoarthritis but a stable ‘connected’ cluster of four diseases – heart attack, high blood pressure, high cholesterol and diabetes.

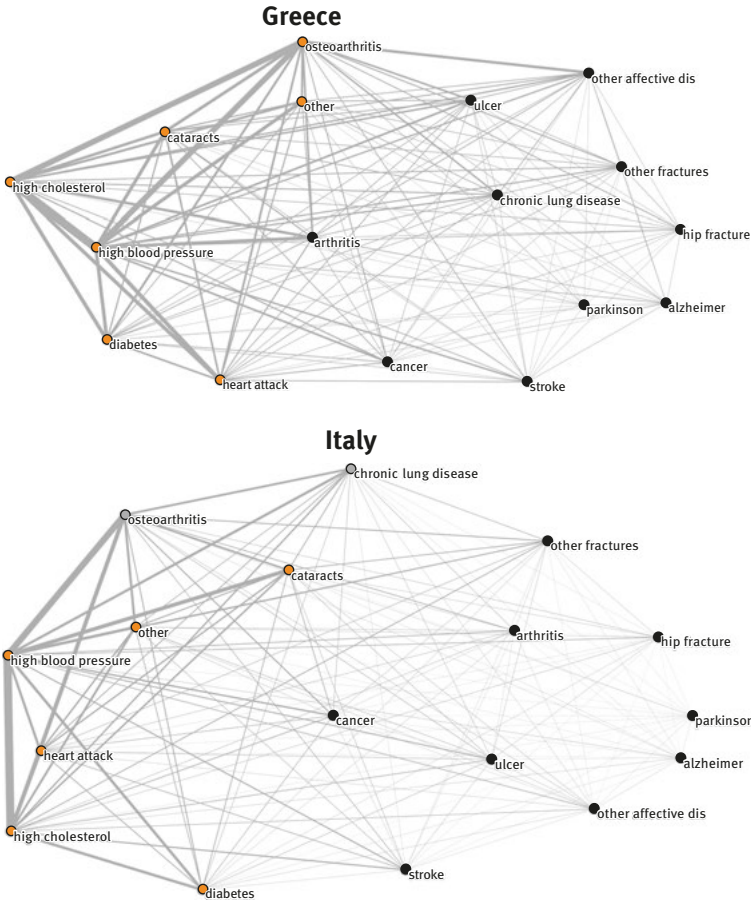


Figure 31.3: Clusters of comorbidities among Mediterranean countries.
Source: SHARE Wave 6 release 6.1.0.

31.4 Conclusion

Comorbidities are an extremely weakly studied problem, and not many empirical and statistical studies have been done to date to study this problem in comparative terms. We provide a new approach – network analysis – to study the problem that has to date not been used with SHARE data. We use the VOS cluster analysis technique to derive clusters of comorbidities across countries, which can be to a significant extent labelled ‘connected’ and ‘unconnected’ clusters. We find that the connected cluster with the most

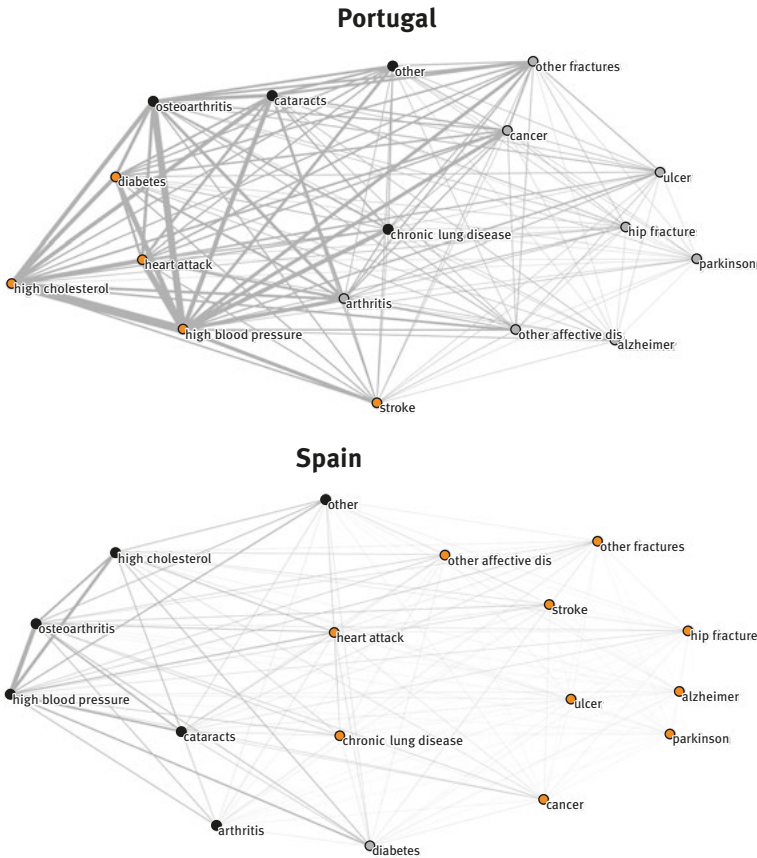


Figure 31.3 (continued)

comorbidities encompasses, in most cases, the following set of diseases, with variations across the countries: heart attack, high blood pressure, high cholesterol, diabetes, cataracts, arthritis and osteoarthritis. We also establish the extent to which the comorbidities seem the largest in eastern European countries relative to other welfare regime typologies. Furthermore, the distinctions between the connected and unconnected clusters seem clear and highly present in this regime.

The analysis also carries an important policy message. Systems that already suffer from healthcare problems, including eastern European countries, are likely to suffer even more in the future given the prevalence of comorbidities. Because the question of comorbidities brings worse health

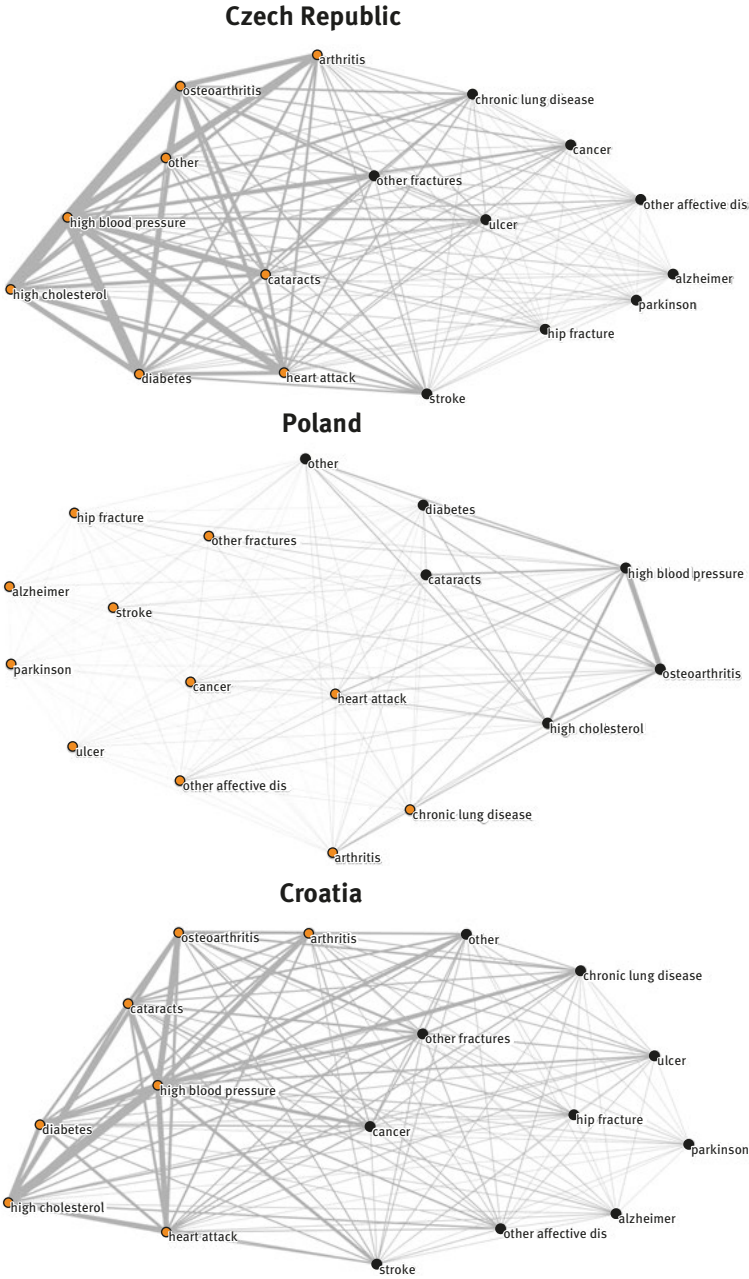


Figure 31.4: Clusters of comorbidities among eastern European countries.
Source: SHARE Wave 6 release 6.1.0.

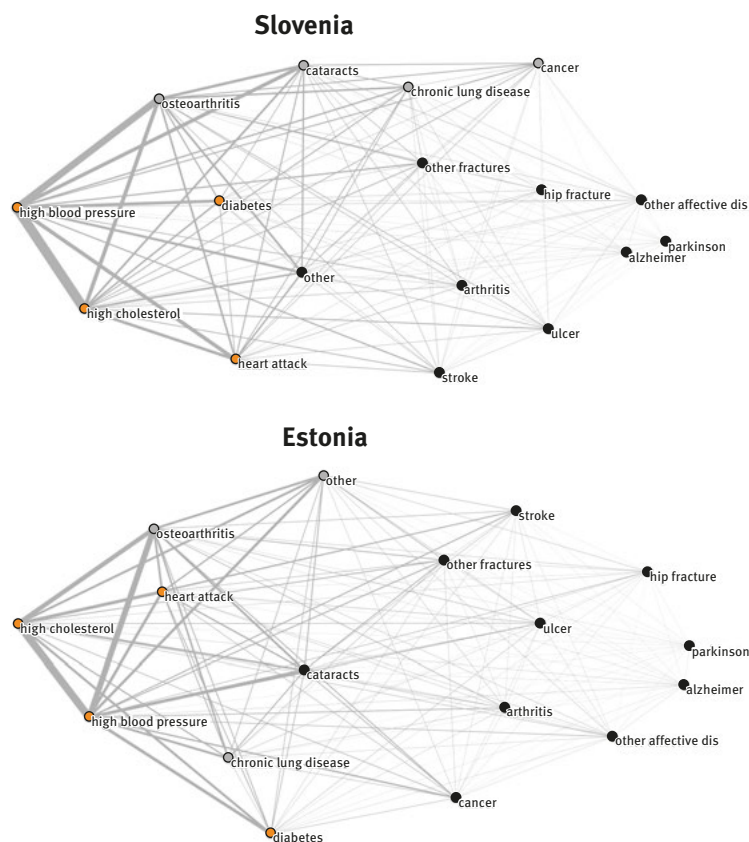


Figure 31.4 (continued)

outcomes, more complex clinical management and increased healthcare costs (as noted in the introduction to the article), the analysis points to the types of diseases of older people that should be most looked on in this respect when acting through policy means, as well as the countries in which the problem seems most pressing. We must also point to the research gap: this analysis represents an initial exploration, and significantly more work must be invested to research the issue in greater detail, such as estimating the costs of the presence of comorbidities in older people and their effects on healthcare utilization. We hope that this issue will receive more focus in future studies, also through the use of SHARE data (and different research approaches).

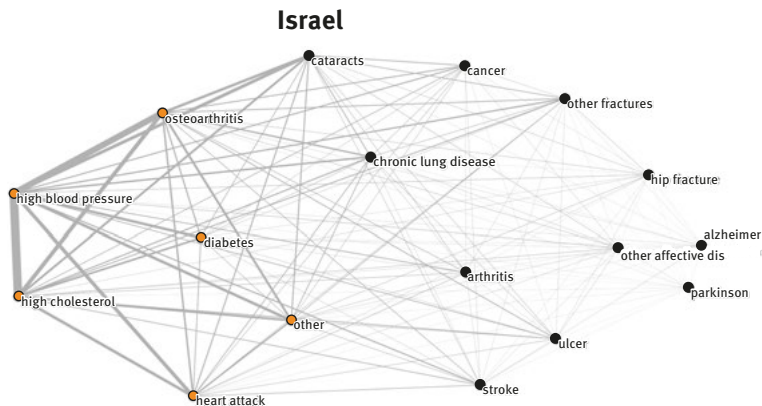


Figure 31.5: Clusters of comorbidities in Israel.

Source: SHARE Wave 6 release 6.1.0.

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