IMPACT OF AGEING ON CURATIVE HEALTH CARE WORKFORCE IN SELECTED EU COUNTRIES

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This paper shows the impact of demographic change on the demand for and supply of health care workforce in five countries until 2025: Denmark, Germany, Italy, Poland and Slovakia. The demographic change in all these countries is characterized by two developments (a) an ageing of the population forced by the shift of the baby-boomer to higher ages and the further increase in life expectancy, (b) the changes in the size of the population forced mainly by emigration and immigration flows. On the one hand, the ageing of the population leads to an increase in the demand for health care services as elderly need more medical and therapeutically treatments than younger people. On the other hand, the ageing of the health workforce leads to a significant proportion of health professionals retiring. In addition, an population growth due to immigration further strengthens demand for health care services, and increases the number of persons active at the labour market immediately. A decline in population size due to emigration has the opposite effect.

We employed an utilization approach to quantify the changes in the demand for health care services and its workforce. In order to calculate changes in labour supply we used a top-down approach. The changes in employment are calculated based on the results of the macro-economic model NEMESIS. Depending on the demographic development a marked increase in demand for health workforce is expected in Denmark, Italy and Slovakia, and a moderate increase or decline in Germany and Poland. The results indicate particularly for Italy a significant pressure on the health care market in the coming years.

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Impact of Ageing on Curative Health Care Workforce in Selected EU Countries

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1   Introduction

All European countries are facing the same phenomenon: population ageing and changes in household and family structures. The impact of demographic change on the society in general and in particular on the social security systems has been broadly discussed in the past two decades. Several studies and EU projects have focused on the influence of increasing numbers and shares of the elderly on the sustainability of pension systems and health care systems (for example the EU financed projects AGIR and AHEAD). Almost all studies analysing the impact of ageing on the health care sector are focussing on the financial aspects, that is to say on the development of health care expenditures (for example the Ageing report 2012 (EC DG ECFIN and EPC 2012). Studies showing the impact of demographic change on the labour force and in particular the health workforce are rare.

The project NEUJOBS has the aim to analyse the likely future developments in the European labour market, taking into account - among other things - the expected societal transition. This report focuses on the health care sector representing 10.4 % of total employment in EU27 in 2011. This important sector showed a high dynamic in the last decade. 5 million new jobs were created, accounting for more than a third of all new jobs created in the EU27 between 2000 and 2011. The high dynamic can be explained not at least by demographic changes. It is expected that the societal transition with a combination of population ageing, changing household and family structures as well as increasing female employment will directly influence the health care market and its workforce. This report has the objective to show the impact of societal changes, in particular the population ageing, on the health workforce.

The ageing of the population has an influence on the demand for health care services as well as on the supply of health professionals. In general, the demand for health care services increases with age. Elderly people have a higher number of consultations of different types of doctors, they suffer to a higher degree from multi-morbidity, and their hospital visits are both more frequent and longer. Thus, an ageing population is expected to lead to a higher demand for services and personnel needed. In order to

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meet the demand for ambulatory care, hospital and nursing services a sufficient supply of medical and non-medical personnel is required.

The supply side is characterized by a high share of elderly health professionals. Currently one third of workers in health and social care are 50 or older (Schulz 2013a). Their majority will retire over the next 15 years. The retiring workforce ultimately must be replaced by younger individuals who enter the health care labour market. As the replacement rate of the population is on average only 66%, it becomes increasingly challenging to replace retiring workers. Additionally, the labour supply in health care is influenced by overall economic growth which determines the labour demand in other sectors of the economy. As people can choose between different occupations and industries to work, the health care sector competes with other sectors of the economy. Thus, the analyses in this report takes into account NEUJOBS demographic projections (Huisman et al 2013) as well as the NEUJOBS estimation of the labour force and employment in total economy and in industrial sectors (Boitier, Lancesseur, Zagamè 2013).

The demographic projections as well as the economic and employment forecasts were carried out using the two NEUJOBS scenarios named friendly and tough (Fischer-Kowalski et al. 2012). The friendly scenario combines a higher economic growth, higher employment, higher shares of high educated people and higher population growth compared to the tough scenario. The expected development under the two scenarios friendly and tough may have a different impact on employment in health and social care in European countries depending on the expected change in population size and age-structure as well as on the expected economic development and employment.

Furthermore, the demographic development, in particular changes in household compositions and increasing female employment, is expected to have different effects on the two main activities of human health and social work, namely curative health care and long-term care. The employment in long-term care depends strongly on the division of care tasks between members of the family and professional care givers that is on the long-term care system and the realized care settings. Changes in household compositions and family structures as well as increasing female employment all will have a higher impact on long-term care than on curative health care. Thus, we distinguish between long-term care and acute health care activities. This paper focuses on the curative health care sector. A similar analysis will be done for long-term care and published separately as working paper D12.2.

For our analysis we selected five countries: Denmark, Germany, Italy, Poland and Slovakia. These represent European countries from the north (Denmark), the centre (Germany), the south (Italy), and new member states (Poland and Slovakia). The countries differ with respect to the share of health workforce in total employment, the expected change in population size and age-structure, the health care systems and the economic situation. The latter, due to differences in earnings potentials of health professionals, also influences the migration of health workers between European countries. In particular, both Poland and Slovakia reported significant migration outflows of health professions, while Germany is a net recipient.

Country specific analyses were carried out by experts of each country (with the exception of Denmark) using a common template for the research topics included in

the report and the same approach for health workforce estimation. This report is based on the country reports and on the analysis of the health care workforce in the EU27.

In this report we want 1) to show the current situation of health care workforce in selected European countries and the EU27 average, 2) to analyse the impact of population ageing on the demand for health care services and the corresponding workforce, 3) to analyse the development of the health care workforce supply, and 4) the future employment in health care services. Thus, this paper is structured as follows: Section 2 provides an overview of the size and characteristics of the personnel employed in curative health care. Section 3 describes the methods to estimate the future health workforce demand and supply. Section 4 focusses on the impact of the demographic development on the changes in health care demand. Section 5 concentrates on the impact of demographic development and changing labour force participation on the total labour force. Section 6 provides a calculation of health care workforce supply and shows the result of demand and supply of health workforce. Section 7 discusses the future situation on the health labour market and the challenges.

2 Current situation

All European countries have a highly regulated health care market. The demand for health care services as well as the supply of health professionals is influenced by the health care system, including the regulations concerning the required educational and vocational training and the amount of public spending on health care. Budget constraints frequently lead to restrictions in health care supply. In the following subsections we discuss some relevant indicators of the health care systems of the included countries (2.1); the changes in health care expenditures indicating the amount of money spent for health care provision (2.2), and the employment situation (2.3). We also include figures for the EU27 average where possible.

2.1 Health care system

In health care systems it is broadly accepted that health care services should be financed according to the ability to pay but delivered according to need, independently of income, assets, age, or individual characteristics (Van Doorlaer and Wagstaff 1992). The health care systems in European countries follow the Beveridge or Bismarck type. The health care services are financed either through taxes (Beveridge) or mandatory health care insurance (Bismarck). In some countries a combination of public and private insurance exists. While no one financing system, *per se*, performs better, the organisational design and governance as well as the range of services covered and the degree of cost-sharing applied for some services and goods make a difference (Or et al 2009; Paris et al 2010).

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In general, European health care systems provide financial security against unexpected or serious illnesses through universal coverage of health care costs for a minimum of a core set of services (Devaux and de Looper 2012). Whilst all health care systems in Europe follow the same principles, the pathways through the health care system, the amount of co-payments and the publicly financed health care basket (ambulatory care) as well as the regulations concerning capacity planning, provider status, and payment systems of providers are different. The design of the health care system influences the demand for health care services and directly impacts on the supply of health care services and the corresponding health workforce. In particular, from the viewpoint of patients co-payments, the number of non-covered services, and the waiting times for visits to a specialists and non-elective surgeries limit demand for health care services (Devaux and de Looper 2012; Paris et al 2010; Sirven and Or 2010; Or et al 2008). On the supply side, the division of responsibilities of capacity planning and financing between government, regions and local authorities as well as the payment system of providers and the provider status (employees of the state or self-employed) are relevant factors. In particular budget constraints increase the pressure for cost containment measures and may negatively affect publically financed services in both health and social areas (Scherer and Devaux. 2010). Table 37 in appendix gives a brief overview and description of some relevant indicators for the five included countries.

Financing and access:

In all five countries nearly the total population is covered by the public health care system. In Denmark and Italy it is financed by taxes while Germany, Poland and Slovakia have mandatory health care insurances financed by contributions. All countries provide free choice and access to primary care provided by general practitioners (GPs) and some kind of specialists (dentists, gynaecologists, paediatricians), while referrals are needed for secondary and tertiary care provided by specialists (except Germany) and hospitals.

Organisation and capacity planning

Primary care is organized similarly in all studied countries: General practitioners act independently in private (shared) practices with contract to the national health system. They are the first contact person for people with health issues. General practitioners act as gatekeeper to other health services, except for Germany. The capacity planning of primary care is the responsibility of the regions (Denmark, Germany, Italy), the local territorial self-government in Poland, and is centralized in Slovakia. The capacity planning is based on quotas of practising physicians to population in geographical areas with the aim to provide adequate primary care in all regions (communities).

Secondary care by specialists is organized differently. In Denmark, specialists are either employed in outpatient departments of hospitals or they are working in private practices. In Germany, specialists are working independently in private (shared) practices with contract to the national health system. Contrary to most European countries, outpatient care activities in hospital departments are not common in Germany. In Italy, specialists are employees of Local Health Units or hospitals, and

some work (additionally) in private practices. In Poland, specialists act independently in private practices or health centres with contract to national health funds. Often, specialists are employed at hospitals and work additionally in private practices. In Slovakia, specialists work in private practices or in publicly run care facilities (usually health centres) with contract to the national health system. The organisation of capacity planning for secondary care is in general the same as for primary care. In Denmark the capacity planning of outpatient departments of hospitals is the responsibility of the regions (as owners of hospitals).

Hospital inpatient care is provided by (in the majority) publicly owned hospitals in the studied countries (except in Germany). The capacity planning and the health workforce planning is the responsibility of the regional authorities, with the exception of Slovakia. In Slovakia the hospital planning is centralized.

Indicators for limited supply and demand:

In general, no long waiting times for primary care services occur in the studied countries. But for examinations by specialists and hospital care (in particular for some kind of surgeries) long waiting time are reported in Italy, Poland, and Slovakia. In Denmark, patients have prelaw the right to choose a hospital or specialist in another region or abroad if the needed treatment cannot be realized in a fixed time span (2 months). Long waiting times are an indicator for imbalances on the health care market. The demand for services and the needed workforce exceeds the supply. The supply could be limited due to budget constraints or due to a shortage of health professions (due to emigration, available jobs in hospitals or private practices which cannot be reoccupied). These current imbalances have to be kept in mind when analysing the current employment situation and the future development.

In general, high co-payments have a limiting effect on the demand for health services and goods. In particular for pharmaceuticals, dental care, physiotherapy, and eyeglasses high co-payments are required in all studied countries. In Italy co-payments are required for all kind of services; exemptions are provided to the indigents, the elderly and some other special groups. The share of out-of pocket payments in total health expenditure is highest in Slovakia (27 %), followed by Poland (24 %) and Italy (18 %). In Denmark and Germany the share of out-of-pocket payments is about 13 %. The differences in the share of co-payments (out-of-pocket payments) among the studied countries have to be kept in mind when analysing the demand for health services and pharmaceutical goods.

2.2 Health care expenditure

The amount of health care expenditures can be used as an indicator for the generosity of the health care system. In general, Germany and Denmark spend a significant higher share of their national income on health care than Slovakia, Poland or Italy. Since 2003, health care expenditures (HCE), as a share of gross domestic product (GDP) have increased in all selected countries, although the rise was especially noticeable during

the economic crisis (Figure 1). An increase in the share of HCE can be seen whenever the GDP growth is lower than the growth in HCE, in particular when a decline in GDP is realized (Scherer and Devaux 2010). The gross value added (GVA) declined in Denmark, Germany and Italy in 2009, in Poland in 2010, and only in Slovakia can economic growth during the crisis be seen (Eurostat 2013). The gross value added in the 'human health and social work' sector increased in 2008 and 2010 in all selected countries, except for Poland in 2010. Thus, the observed increase in the share of HCE in GDP was also influenced by the economic decline in particular in 2009 (see Table 38 in appendix).

Figure 1   Health care expenditure as % of GDP 2003 to 2010
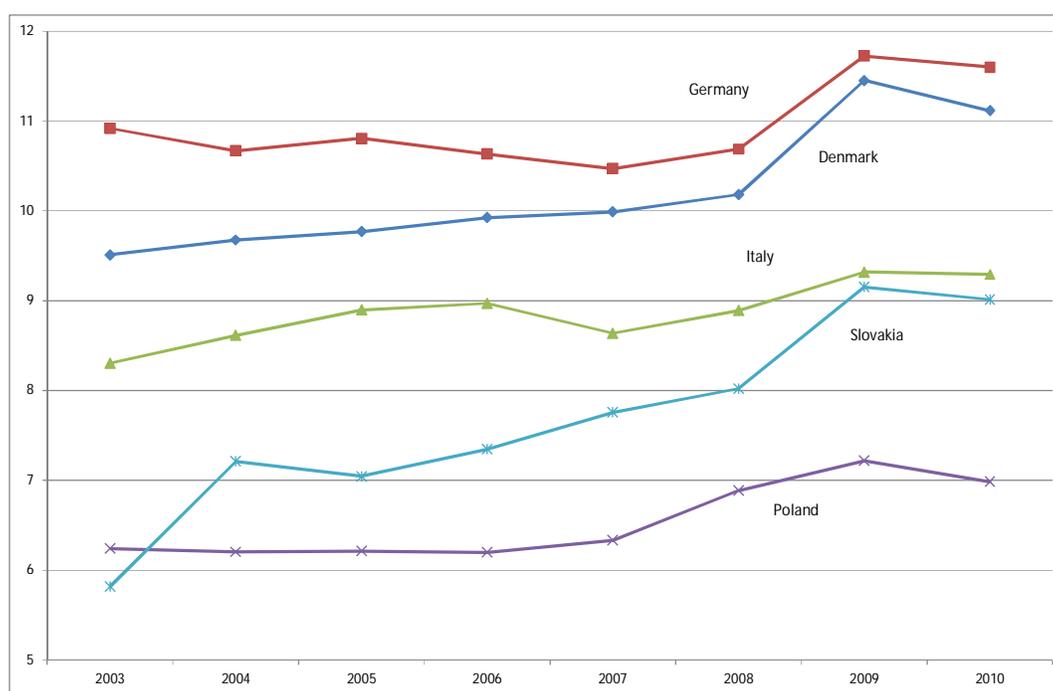
Source: OECD Health Data.

In all European countries health care expenditures are under strong pressure to provide high quality health care services that meet the needs of the population. Frequently cost cutting strategies are undertaken in an attempt to stem the growth of health expenditures. However, there is evidence that the cost containment measures designed to reduce public expenditures is profoundly affecting the recruitment and retention of healthcare staff and in particular nurses. The latter is the largest health profession, in almost half of EU27. Maintaining an adequate supply and quality of health care services under severe budget constraints is a key issue to be addressed by policy makers (EC 2012a). As health care is labour intensive, a large share of health care expenditures is labour cost. In Germany, for example, two thirds of hospital costs are labour costs (GBE 2013). However a correlation between the real health care costs and employment is not as strong in all partner countries as expected. A strong

correlation can be seen in Germany, Denmark, and Poland, but not in Slovakia and Italy (see Figure 11 in appendix).

Another strategy to reduce the public spending on health care is increasing co-payments as well as reducing the services and products covered under the public financed system. Nevertheless, between 2003 and 2010, the share of co-payments out of total current health care expenditures shows a slightly decline in Denmark, Poland, and Italy, but an increasing, even not strictly linear, trend in Germany and Slovakia (Table 39 in appendix 2). The share of private insurance increased, but still plays a marginal role in Slovakia, Poland and Italy.

2.3 Employment

2.3.1 Overview

Employment in the total sector "human health and social work"

A common and broadly used data base providing information on the employment situation in European countries differentiated by age, gender, working time, occupations and economic sectors is the EU labour force survey (LFS). According to the LFS, in 2011 total employment amounted to some 217 million people in the EU27. The number of employees engaged in the 'human health and social work' sector was around 23 million people in 2011, which is to say 10.4 % of total employment. This sector showed a high dynamic in the past. Between 2000 and 2011 more than 5 million new jobs were created in 'human health and social work', accounting for more than a third of all new jobs created in the EU economy (EC 2012 b). The health care workforce increased despite the overall trend of declining employment also during the economic crises. Between 2008 and 2011 more than 1.5 million new jobs were created in 'human health and social work' whilst total employment declined by 4.1 million in EU27 (Table 40 in appendix). Thus, the importance of employment in the health and social work sector increased in the last decade, in particular during the economic crises. In the EU27 the share of the health workforce in total employment increased from 8.6 % in 2000 to 10.4 % in 2011.

The proportion of people employed in health and social services varies widely across European Countries, and also the development in the last decade was different (Schulz 2013a). Denmark realized the highest share of health workforce in total employment. In 2011, the share of health workforce was with 19 % nearly twice the EU average. Germany realized also a share of health employment above the EU average (12.2 % in 2011), whereas Italy (7.4 %), Slovakia (6.8 %), and in particular Poland (5.7 %) realized a proportion of health workforce well below the EU27 average.

Since 2000, the share of health workforce in total employment increased in Denmark, Germany, and Italy. In Slovakia the proportion was essentially constant, while it was declining in Poland (Figure 2). The ranking of the five mentioned countries among all European Member States and further information are included in the report on employment in health and long-term care in European countries (see Schulz 2013a).

Figure 2   Share of health workforce in total employment between 2000 and 2011
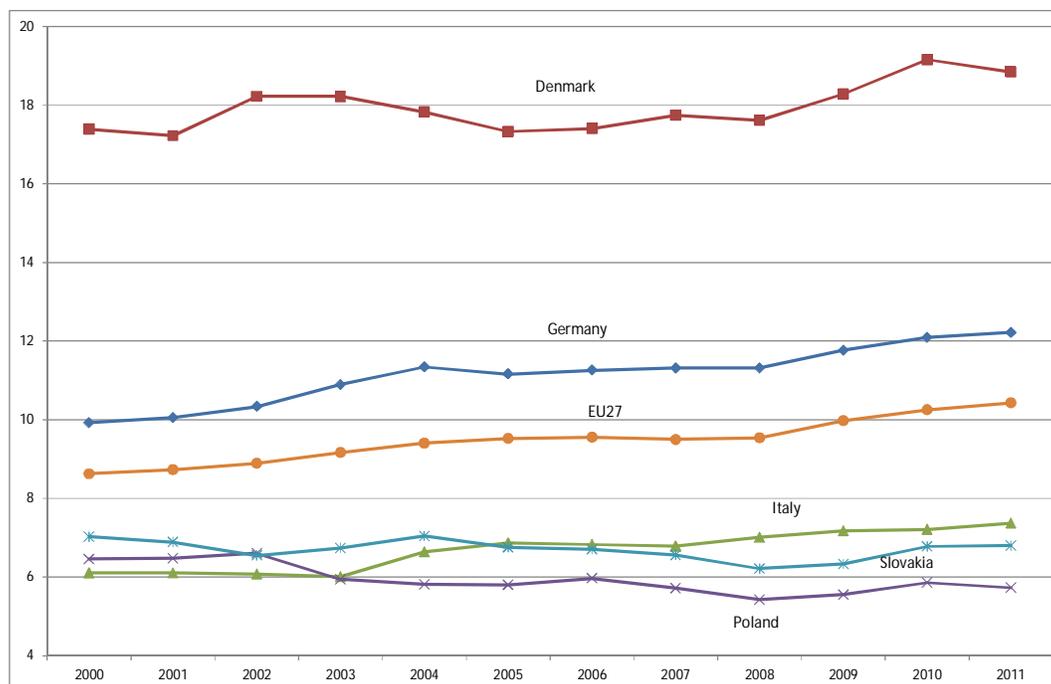
Source: Eurostat, LFS; calculation of DIW Berlin.

Employment in subsectors

According to the main activities of health and social work, the sector can be subdivided into the subsectors of human health activities, residential care activities, and social work without accommodation. Human health includes hospital activities, medical and dental practice activities as well as other human health activities. Residential care includes nursing homes and homes for the elderly or persons suffering from mental illnesses. Social work activities include care giving to the elderly at home. The EU27 average share of human health activities in health and social work sector was 58.5 %, the share of residential care was 20 % and the share of social work was 21.5 % in 2011 (Figure 3). The health and long-term care system has a significant influence on the share of the subsectors in the single European countries. Denmark with a generous social service system has the highest share of social work activities with some 40 %, and also a disproportional high residential care sector. On the other side, Poland and Italy have a high share of human health and only a small part of residential care as well as social work without accommodation. Also in Slovakia the share of human health activities is above the EU average, while in Germany the share of residential care activities is higher than the EU average.

Figure 3   Share of subsectors in human health and social work (sector Q) in 2011
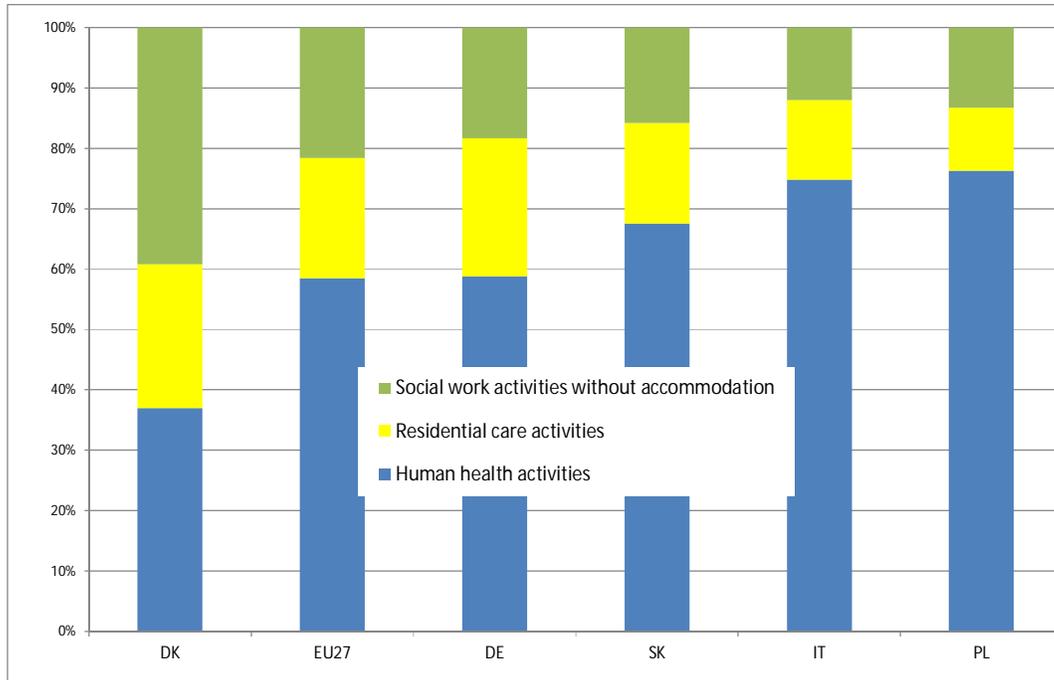
Source: Eurostat, LFS; calculation of DIW Berlin.

In 2011, 13.2 million were employed in 'human health activities' in the EU27. The share of human health in total employment was 6 % (Table 1). As Denmark has in general a disproportionally high share of health workforce, also the share of human health in total employment was at 7 % above the EU average. Germany also realized a share of human health employment above the EU average (7.2 %), while in Italy, Poland and Slovakia the share of human health in total employment was below the EU average. In the five analysed countries 5.1 million people were employed in human health accounting for 39 % of the total EU employment in human health.

In 2011, 4.5 million were employed in 'residential care activities' in the EU27. The share of residential care in total EU employment was 2.1 %. Again, Denmark realized the highest share of residential employment in total employment of 4.5 %, followed by Germany at 2.8 %. Italy, Poland and Slovakia realized a share of residential employment below the EU average. In the five countries 1.6 million were employed in residential care accounting for 35 % of the total EU employment in this subsector.

Table 1   Employment in total economy and in human health and social work in 2011

Country	Human health	Residential care	Social work without accommodation	Total health and social work	Total economy
	Employment in 1000 persons				
EU27	13 243	4 521	4 876	22 640	217 182
Denmark	188	122	200	509	2 703
Germany	2 855	1 110	891	4 855	39 737
Italy	1 268	223	203	1 694	22 967
Poland	705	96	123	924	16 131
Slovakia	108	27	25	160	2 351
	Share of sectoral employment in total economy in %				
EU27	6.1	2.1	2.2	10.4	100
Denmark	7.0	4.5	7.4	18.8	100
Germany	7.2	2.8	2.2	12.2	100
Italy	5.5	1.0	0.9	7.4	100
Poland	4.4	0.6	0.8	5.7	100
Slovakia	4.6	1.1	1.1	6.8	100
	Share of females in %				
EU27	75.3	81.1	82.8	78.0	45.5
Denmark	80.4	83.1	80.1	80.9	47.4
Germany	77.9	76.4	73.8	76.8	46.1
Italy	63.0	84.4	85.8	68.6	40.7
Poland	80.8	77.4	90.5	81.8	44.9
Slovakia	80.4	87.2	90.9	83.2	44.3
	Share of elderly (50+) in %				
EU27	31.9	30.7	30.2	31.2	27.6
Denmark	36.6	37.5	29.0	33.8	28.9
Germany	29.1	30.9	32.3	30.1	30.4
Italy	37.3	25.3	19.2	33.5	26.8
Poland	32.6	29.0	29.0	31.8	25.7
Slovakia	32.8	37.6	32.4	33.6	25.6
Source: Eurostat; LFS; calculation of DIW Berlin.					

In 'social work without accommodation' 4.9 million were employed in the EU27. The share of this subsector in total employment accounts for 2.2 % in the EU27. In Denmark, the number of employees engaged in social work was higher than the number of employees in human health activities (200,000 compared to 188,000). The share of social work workforce in total employment amounted to 7.4 % well above the EU average. Germany realized a share of employment in social work similar to the EU average, while Italy, Poland and Slovakia showed a lower share of workforce engaged in social work (less than half of the EU average).

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In general the health workforce is characterized by

- a disproportionally high share of female employment
- a high share of elderly employment
- a high proportion of part-time employment.

Female employment

In the EU27, the share of female employment amounts 46 % in total economy, but in the health and social work sector it is, at 78 %, considerably larger (Table 1). The share of female employment is highest in social work without accommodation (82.8 %). It amounts 81 % in residential care and 75 % in human health activities (EU27). In 2011, around 99 million females were employed in the EU economy; thereof 18 million in health and social work activities. Thus, 18 % of total female employment is engaged in health and social work in the EU27.

In general, the employment in health and social work is dominated by women in all studied countries. However, the share of female employment in the health and social work sector ranges from 69 % in Italy to 83 % in Slovakia, and differs across activities within the sector. The share of female employment in the subsector human health activities is approximately 80 % in Denmark, Poland and Slovakia and 78 % in Germany (above the EU average). Only Italy realizes a share of female employment in human health activities below the EU average (63 %). The share of female employment in residential care in Denmark, Italy and Slovakia is above the EU average, while it is below the EU average in Germany and Poland. In Poland and Slovakia 90 % of social work activities are carried out by females. Also Italy realizes a share of female employment in this subsector above the EU average, while Denmark and in particular Germany show a lower share than the EU average.

In view of the high share of female employment in health and social care, this sector plays an important role for total female employment. In Denmark, around one third of all working women are employed in this sector. In Germany, the female employment in health and social work amounts to 20 % of total female employment. Their share is about 12 % in Italy and Slovakia and around 10 % in Poland.

Elderly employment

In the EU27 around 31 % of health and social work workforce is at least 50 years old, compared to 28 % in the overall economy (2011). In particular the subsector human health shows a high share of elderly employment (32 %). Thus, it can be expected that some 7.1 million people will exit the health care labour market in the next 15 years across the EU27, thereof 4.2 million in human health activities, 1.4 million in residential care and 1.5 million in social work.

All studied countries show a higher share of elderly employment in <u>health and social work</u> than in the total economy, except for Germany. In Germany the share of elderly employment in health and social work is similar to the average of the economy. In Denmark, Italy, Poland and Slovakia about one third of health workforce was 50 or older.

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In the subsector human health the share of elderly employment ranges from 29 % in Germany to approximately 37 % in Italy and Denmark. Both latter countries show a proportion of elderly employment well above the EU average and will face a strong challenge to replace the human health workforce retiring during the next 15 years. In the subsector residential care the share of elderly employment ranges from 25 % in Italy to 38 % in Slovakia and Denmark. Again Denmark but also Slovakia face a difficult situation. In the subsector social work Italy has a relatively young workforce. The share of elderly employment amounts to 19 % well below the EU average. On the other side Germany and Slovakia show a proportion of elderly employment above the EU average.

In total, it can be expected that in Denmark 170,000, in Germany 1.5 million, in Italy 570,000, in Poland 300,000 and in Slovakia 53,000 persons will exit the health workforce in the next 15 years. The ageing of the health workforce is a challenge for all studied countries and also for the EU on average.

Part-time employment

In 2011, the share of part-time employment amounted to 20 % of total employment in the EU27, its share in health and social work was about 32 %. Part-time employment is more common among females than males. Around 32 % of all working women in the EU were part-time employed while only 9 % of all working men. In 'human health and social work' the shares are higher, with 15 % for males and 37 % for females.

The share of part-time employment varies widely across the European countries. In some countries part-time employment is not common. Among our studied countries Poland and Slovakia show only low shares of part-time employment. In Slovakia, only 4 % of all employees work part-time (in total economy as well as in 'human health and social work'); among males the share of part-time employment amounts to 3 %, among females to 6 %. In contrast to the EU average the share of part-time employment in Slovakia is lower in 'human health and social work' than in total economy for both males and females.

In Poland some 8 % are working part-time, 5 % of all working men and 11 % of employed women (total economy). The share of part-time employment is only slightly higher in 'health and social work'. Also Italy realized a share of part-time employment below the EU average in both the total economy and 'health and social work'.

Contrary to these countries Denmark and in particular Germany show high shares of part-time employments which are above the EU average. In both countries the proportion of part-time employment is around 26 % in total economy and around 40 % in 'health and social work'. That is 10 times higher than in Slovakia and 5 times higher as in Poland. The highest difference in part-time employment can be observed between women employed in 'health and social work' in Slovakia compared to Germany: in Slovakia only 4 % of females work part-time, in Germany 46 %. We have to keep these differences in mind when analysing the development of employment measured in head counts. To avoid problems of comparing different working time arrangements across countries, we are focusing on full-time equivalents (FTE) were possible.

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2.3.2 Employment in human health activities

As the aim of this working paper is to show the development (past and future) of employment in the subsector ' human health care activities' we tried to collect detailed data, such as employment by facilities and occupations. The EU LFS provides an overview. Detailed employment data by industries (NACE2 3-digit level) are available for Germany, Italy, Poland and Slovakia. Additionally, Statistics Denmark provides similar data for the human health activities in Denmark. It is important to note, that the figures for EU27 include only countries that provide information on the 3-digit level. In 2011 a total of 22.64 million people were employed in 'health and social work' in the EU27 but detailed data are only available for about 20.98 million employed persons.

In the EU27 12.7 million are employed in human health care (Table 2). The employment in hospital care plays a dominant role. Around 7 million people work in hospitals, about 57 % of the employment in human health care. 23 % are working in medical and dental practices and 20 % in other human health activities like therapist's offices, pharmacies or laboratories. Across the five studied countries, 5.1 million people are employed in human health care, thereof 2.8 million in hospital care, 1.5 million in medical and dental practices, and 0.8 million in other human health activities. Thus, also in the studied countries the majority of employed people is engaged in hospital care, but the share is on average slightly lower (55 %) than in the EU27. This can be traced back to the relatively low proportion of hospital employment in Germany. In Germany half of the human health care workforce is engaged in hospital care. In Slovakia more than two thirds of human health employment is related to hospital care; in Italy about 63 %, while in Poland and Denmark it is around 60 %.

The share of employment in medical and dental practices ranges from 20 % in Slovakia to 31 %in Denmark and Germany. The proportion of employment in other human health activities like therapeutic measures amounted to an average of 15 % in the five countries. In particular Denmark (9 %) showed a share of employment in other human health activities well below the EU average. Rehabilitation measures and other therapeutic treatments are often carried out in outpatient departments of hospitals, which are specialized in pre- and post-hospital care. But also Italy (11 %), Poland (11 %) and Slovakia (12 %) realized a share of employment in other human health activities below the EU average. In these countries co-payments may influence the demand for this kind of health services.

For single health care activities information on gender and age-groups is also available. The share of female employment in hospital care as well as in medical and dental practices is lowest in Italy (65 %, 60 %, respectively). In the other countries more than 80 % of employed persons in these subsectors are females, with the exception of hospital care in Germany (76 % females).

Remarkable is the high share of elderly employment in medical and dental practices. On average across the analysed five countries, 22 % are at least 55 years of age, but the proportion is significantly higher in Italy (28.3 %), Denmark (27.4 %) and Slovakia (26.6 %). The high share of elderly employment is an indicator for the high number of employees expected to exit the labour market during the next decade.

Table 2 Employment in health and social work by subsectors in 2011

	NACE Rev2 classification	Denmark	Germany	Italy	Poland	Slovakia	5 countries	EU27*
		Employment in 1000 persons						
Q	Human health and social work	509	4854	1694	923	158	8138	20983
86	Human health actvities	188	2855	1269	705	107	5123	12400
861	Hospital activities	112	1432	794	427	72	2838	7090
862	Medical and dental practice activities	59	879	341	200	21	1500	2875
869	Other human health activities	17	543	134	79	13	786	2435
87	Residential care activities	122	1109	223	96	26	1575	4175
871	... nursing care activities	-	491	86	20	6	603	1381
872	... for mental health and substance abuse	-	19	29	7	5	60	425
873	... for elderly and disabled	-	520	90	28	10	647	1601
879	Other ...	-	80	18	41	5	143	768
88	Social work activities without accommodation	200	891	202	122	25	1440	4408
881	... for the elderly and disabled	-	311	74	43	20	449	1465
889	Other ...	-	580	128	79	5	792	2943
		Share of female employment (%)						
Q	Human health and social work	80.9	76.8	68.6	81.8	83.6	76.0	77.9
86	Human health actvities	80.4	77.9	63.0	80.8	80.8	74.8	75.1
861	Hospital activities	82.0	75.9	64.8	83.3	81.6	74.3	75.6
862	Medical and dental practice activities	80.7	83.2	59.5	83.1	79.1	77.7	76.0
869	Other human health activities	68.7	74.5	61.5	61.6	79.1	70.9	72.7
87	Residential care activities	83.1	76.4	84.6	77.4	88.2	78.3	81.0
871	... nursing care activities	-	70.0	87.7	83.2	95.5	73.3	79.0
872	... for mental health and substance abuse	-	67.4	78.2	75.2	91.0	75.4	73.2
873	... for elderly and disabled	-	83.2	84.5	79.6	87.7	83.3	85.4
879	Other ...	-	73.1	81.2	73.3	77.9	74.3	79.6
88	Social work activities without accommodation	80.1	73.8	85.8	90.8	91.0	78.1	82.8
881	... for the elderly and disabled	-	81.9	85.3	90.1	90.7	83.6	83.6
889	Other ...	-	69.4	86.1	91.2	92.4	74.4	82.4
		Share of elderly (55+) employment (%)						
Q	Human health and social work	19.6	16.5	17.8	15.1	16.2	16.8	17.1
86	Human health actvities	22.8	16.2	20.4	15.8	16.2	17.5	17.5
861	Hospital activities	20.9	14.9	17.8	12.2	14.2	15.5	15.4
862	Medical and dental practice activities	27.4	17.9	28.3	23.9	26.6	21.6	23.0
869	Other human health activities	19.1	17.0	16.2	14.9	9.7	16.6	17.1
87	Residential care activities	20.2	16.3	9.9	10.9	19.8	15.4	16.4
871	... nursing care activities	-	15.4	10.8	8.7	27.4	14.6	15.7
872	... for mental health and substance abuse	-	13.8	4.9	16.3	12.5	9.7	16.5
873	... for elderly and disabled	-	17.7	10.7	12.3	16.7	16.5	17.7
879	Other ...	-	13.5	9.1	10.2	23.0	12.4	15.2
88	Social work activities without accommodation	16.2	17.6	9.9	14.2	12.9	16.0	16.7
881	... for the elderly and disabled	-	15.5	12.1	17.8	14.1	15.1	17.3
889	Other ...	-	18.8	8.6	12.2	8.2	16.4	16.4
*) Only countries with detailed 3digits data.								
Source: Eurostat, EU LFS; Statistics Denmark; calculation of DIW Berlin.								

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2.3.3 Employment by occupation and age-groups

Since 2010, Eurostat, OECD and WHO have jointly collected data on health employment. They provide statistics on physicians, general practitioner, specialists, dentists, pharmacists, physiotherapists (numbers and per 100,000 population) as well as on nursing and caring professionals. The health workforce is not differentiated by type of service (facilities) or sub-sectors. An exception is the personnel in hospitals. Unfortunately the definition of "health personnel" is inconsistent across all countries, some countries are reporting practising physicians, and some are reporting active physicians. Physicians are classified as practising if they are engaged in health care provision to the population. Active physicians comprise also physicians working in administration and other jobs requiring this kind of professional training.

In 2010 almost 1.7 million physicians were practising or active in Europe. The supply of medical care by physicians varies widely across Member States. Poland had the lowest density of physicians with 2.2 physicians per 1,000 populations. The medical care by physicians is above the EU27 average in Italy (3.9), Germany (3.7) and Denmark (3.3), while Slovakia was at the EU27 average, with 3.3 physicians per 1,000 populations. As the number of physicians is measured as head counts, we have to keep in mind the high differences in part-time employment across the European countries.

In the EU27, no general standard of a sufficient health care provision exist. However, the ratio of inhabitants per health professional is used as an indicator showing the situation of health care provision across EU States. Eurostat provides the ratio of inhabitants per physician providing primary care services (mostly general practitioners), the ratio of inhabitants per specialist, and the ratio of inhabitants per dentist. As general practitioners act as gatekeepers, the primary care provision by GPs is essential for the access to secondary care. A high ratio of inhabitants per GP is an indicator for high workloads of GPs, resulting in time pressures of GPs and may lead to long waiting times in practices.

In the EU27, on average 295 inhabitants are cared for by one physician, but 834 inhabitants by one generalist (including not further defined) and 476 by one specialist. There are huge differences in the supply of generalists across the Member States. In Slovakia, 2,480 persons are cared for by one generalist, but in Denmark only 488. On the other hand, Slovakia has a high share of specialist medical practitioners, thus the number of persons cared for by a specialist (391) is lower than the EU27 average. Poland shows a similar situation with 2,183 persons cared for by one generalist and 581 per specialist. Poland has the lowest density of physicians: on average 459 persons per physician. Italy, Denmark and Germany have in general a higher medical care supply. On average, the number of people who have to be cared for by a generalist amounts to 639 in Germany and 1,063 in Italy, for specialists they become 701 in Denmark, 462 in Germany and 367 in Italy (Figure 4).

Eurostat provides additional statistics of physicians by speciality per 100,000 populations. The density of medical groups of specialists is highest in Slovakia followed by Italy; the density of surgical groups of specialists is highest in Italy followed by Germany (Table 41 in appendix).

Figure 4   Population per physician, generalist and specialist in 2010
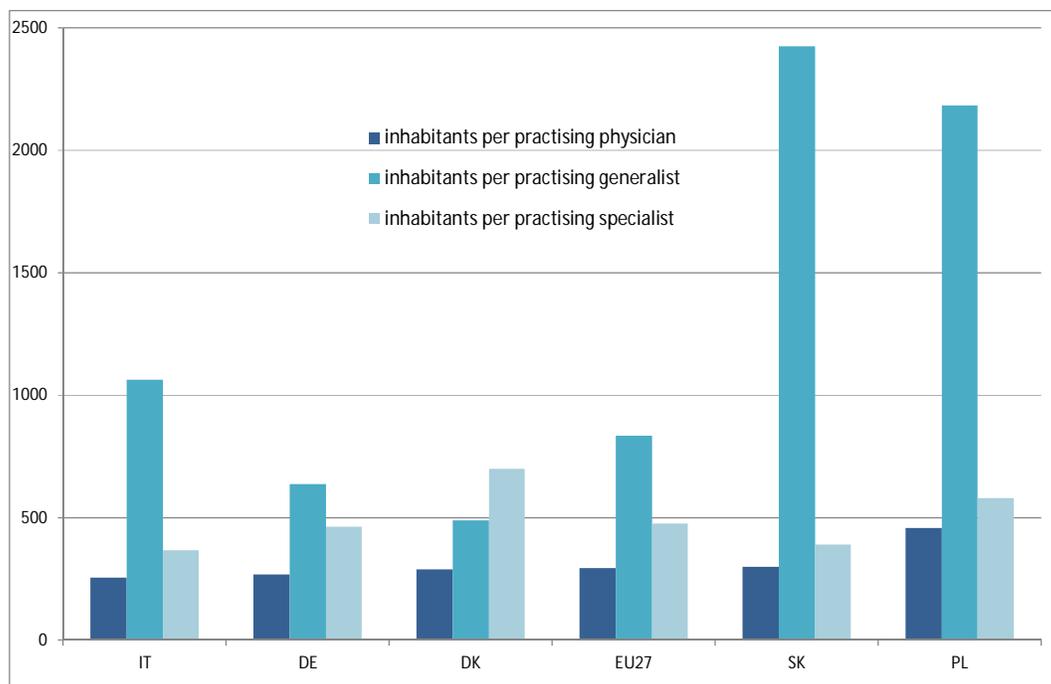
Source: Eurostat, health personnel statistics, calculation by DIW Berlin.

Information on non-medical staff in health and social work is only available for the number of nurses per 1,000 populations. In the EU27 on average 8.3 nurses per 100,000 persons were available in 2010. In particular Denmark has a high ratio of nurses with 15.8, followed by Germany with 11.5. In Italy, Slovakia and Poland the ratio was about 6 nurses per 1000 population; significantly smaller. Nurses are active in acute health care, in particular in hospitals, as well as in long-term care. Denmark has a generous provision of personal care and help with household chores by community nurses. Since the introduction of the long-term care insurance law in 1995 Germany has a relatively high and increasing provision of long-term care by ambulatory care services and in institutions. In Germany, a significant percentage of nurses, in particular geriatric nurses are employed in long-term care. In Italy, Slovakia and Poland long-term care provision does not have such a prominent role. This partly explains the difference to countries like Germany and Denmark.

Eurostat provides also information on physicians by age-groups, but not for Poland. The LFS showed a high share of elderly health care workers. This is also the case for physicians. The share of physicians at least 55 years old is highest in Italy with 42 %, followed by Germany with 40 %. Slovakia (34 %) and Denmark (32 %) also have high proportions of elderly physicians (Table 42 in appendix)

Additionally, Eurostat provides information on hospital staff by professions (Table 3). For Denmark, Germany, Italy and Poland headcounts are provided, while the data for Slovakia comprise numbers of FTEs. As mentioned above part-time work is not common in Slovakia. The largest group of hospital personnel consists of professional

nurses and midwives. Also other health service providers play a significant role, but detailed information on that health professions are not available for all countries. In particular for Poland information is only available for physicians and nurses.

Table 3   Employment in hospitals by occupations 2009 (in persons)

	Total hospital employment	Physicians or doctors	Professional nurses and midwives (total)	Associate professional nurses	Caring personnel	Other health service providers employed by hospital	Other staff employed by hospital
Denmark	113 139	13 748	39 383	10 015	3 813	17 121	29 059
Germany	1 223 000	153 000	488 000	57 000	:	278 000	247 000
Italy	654 478	129 074	274 948	:	:	69 658	180 798
Poland	:	42 963	139 929	:	:	:	:
Slovakia*	40 322	8 219	22 058	:	6 252	3 794	:
*) full-time Equivalents.							
Source: Eurostat, Employment in hospitals.							

2.3.4   Detailed employment data based on national statistics

Detailed data on employment by facilities and occupations as well as age-groups and gender are not available on a common and comparable basis. National statistics provide some information, but not for all facilities and often not for the total employment across all mentioned facilities. The following information is derived from the national reports for Denmark (Schulz 2013 b), Germany (Schulz 2013c), Italy (Coda Moscarola 2013), Poland (Golinowska et al 2013) and Slovakia (Radvanský and Dováľová 2013). The national reports provide a lot of additional information and detailed descriptions. They are available as supplements to this report.

Germany

The most comprehensive statistics is available for Germany. The Federal Statistical Office of Germany provides the health labour accounts (HLA) statistics that comprises data on employment by facilities, age-groups, gender and occupations. The HLA includes all employed people needed for health care provision, as well as the employment in intermediate consumption industries of the health care sector plus health insurance companies' administration. While the EU LFS focusses on the employment in sector Q 'Human health and social work', the HLA accounts in addition for employment in manufactures of pharmaceuticals, and whole sale and retail sale of medical products, pharmaceutical products, as well as products required for therapeutically treatments and appliances. Thus, the HLA comprises also employment from other industrial sectors of the economy.

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Table 4 provides an overview of the employment in human health activities; residential care activities and long-term care provided by ambulatory services are excluded. Information is available as head counts and as FTEs. According to the HLA, the ambulatory health care sector is the largest employer in acute health care. Around 47 % of personnel in acute health care (1.9 million) are employed in ambulatory care, most in the offices of physicians, dentists and health practitioners. One third are employed in hospitals and rehabilitation institutions (1.3 million), 8 % in intermediate consumption industries of health care sector (0.3 million), 5 % each in administration and other providers (together 0.39 million), as well as 1 % each in public health and ambulance services (together 0.1 million).

Table 4   Personnel in human health care by facilities in Germany in 2011

Type of facility	Head counts				FTE
	Persons in 1000	Share females	Share part-time	Share 50+	FTE in 1000
Facilities total	3 968	71.2	27.9	29.0	3 036
Public health	41	65.9	26.8	32.5	34
Ambulatory care	1 867	77.5	28.6	29.3	1 440
Offices of physicians	692	82.8	29.0	31.5	531
Offices of dentists	355	84.5	28.7	27.2	275
Offices of health practitioners	397	76.6	31.7	28.2	295
Dispensing chemists	180	77.8	29.4	26.8	138
Retail sale and suppliers of medical appliances	167	43.1	16.8	28.3	142
Institutions providing other ambulatory care	76	75.0	31.6	32.9	59
Stationary/semi-stationary health care	1 307	75.9	30.5	26.9	956
Hospitals	1 137	76.0	30.3	26.8	826
Preventive care/rehabilitation facilities	170	75.3	31.2	27.2	130
Ambulance services	55	30.9	21.8	27.3	45
Administration	196	39.8	20.4	33.7	159
Other providers	185	63.8	27.0	31.4	143
intermediate consumption industries of the health care sector	317	46.1	19.6	31.9	259
pharmaceutical industry	106	50.9	20.8	32.7	85
medicotechnical and ophthalmic industry	126	43.7	18.3	31.0	105
medical laboratories and wholesale trade	84	44.0	20.2	32.1	69

Source: Federal Statistical Office of Germany; Health personnel accounts; calculations of DIW Berlin.

Medical and nursing professions as well as assisting personnel are employed in curative health care facilities. As mentioned before, also personnel in intermediate industries, in administrations and housekeeping are accounted for. Most occupations can be seen in all facilities, except, for example, dentists which work almost completely in their own offices.

Table 5 shows the occupational structure distinguished by facilities. Physician work in their own offices or in hospitals, but the division depends on the type of speciality.

Table 5   Personnel in acute health care facilities by occupations in Germany in 2011

	Facilities total	Public health	Ambulatory care					Stationary care				intermediate consumption industries
			Ambulatory care total	Offices of physicians	Offices of dentists	Offices of health practitioners	Other ambulatory Services	Stationary health care total	Hospitals	Preventive and rehabilitation facilities	Ambulance, administration, other providers	
	1000	share of %										
Total of health care personnel	3 968	1.0	47.1	17.4	8.9	10.0	10.7	32.9	28.7	4.3	11.0	8.0
health service professions	2 572	1.0	49.7	21.3	10.9	11.5	6.0	38.9	35.1	3.8	8.5	1.9
physicians, pharmacists, psych. psychotherapists	507	1.2	56.8	28.2	13.0	4.1	11.4	35.7	32.3	3.4	4.7	1.6
physicians	342	1.5	42.1	41.8	0.0	0.0	0.3	49.7	45.0	4.7	5.3	1.5
physicians specialised in general medicine, pa	100	1.0	67.0	67.0	0.0	0.0	0.0	27.0	23.0	4.0	4.0	1.0
surgeons, orthopedists	35	0.0	37.1	37.1	0.0	0.0	0.0	60.0	57.1	2.9	2.9	0.0
gynecologists/obstetricians	16	0.0	68.8	68.8	0.0	0.0	0.0	31.3	31.3	0.0	0.0	0.0
neurologists, psychiatrists	23	0.0	47.8	47.8	0.0	0.0	0.0	47.8	39.1	8.7	4.3	0.0
general practitioners	102	2.0	13.7	13.7	0.0	0.0	0.0	75.5	69.6	5.9	6.9	2.0
other medical specialists	62	1.6	45.2	45.2	0.0	0.0	0.0	45.2	41.9	3.2	6.5	1.6
pharmacists	61	0.0	85.2	0.0	0.0	0.0	85.2	3.3	3.3	0.0	6.6	4.9
psychological psychotherapists	36	0.0	72.2	0.0	0.0	58.3	13.9	22.2	16.7	5.6	5.6	0.0
dentists	68	1.5	97.1	0.0	97.1	0.0	0.0	1.5	1.5	0.0	0.0	0.0
remaining health service professions	2 061	0.9	48.0	19.6	10.4	13.3	4.6	39.8	35.8	4.0	9.4	1.9
medical assistant/dental assistant	644	0.5	90.1	55.7	32.8	1.4	0.2	8.1	7.5	0.6	0.9	0.5
incl: dental assistants	247	0.0	98.4	12.6	85.4	0.4	0.0	1.6	1.6	0.0	0.0	0.0
assistant dieticians	12	8.3	41.7	0.0	0.0	41.7	0.0	41.7	25.0	16.7	0.0	8.3
non-medical practitioners	32	0.0	87.5	0.0	0.0	81.3	6.3	6.3	3.1	3.1	6.3	0.0
nurses	658	0.5	7.8	2.4	0.2	4.3	0.9	87.1	83.1	4.0	4.0	0.8
incl: midwives	21	0.0	52.4	0.0	0.0	52.4	0.0	47.6	47.6	0.0	0.0	0.0
health care and nursing aid	245	2.9	24.1	1.2	0.4	17.1	5.3	27.3	22.4	4.9	41.2	4.5
physiotherapists, masseurs, medical bath atten	204	1.0	59.3	3.4	0.0	52.0	3.9	24.0	11.3	12.7	15.2	0.5
incl: physiotherapists	132	0.8	54.5	3.0	0.0	47.7	3.8	28.8	15.2	13.6	15.2	0.8
medical laboratory assistants	98	1.0	20.4	16.3	2.0	1.0	1.0	52.0	49.0	3.1	13.3	13.3
pharmaceutic-technical assistants	66	0.0	87.9	0.0	0.0	0.0	87.9	3.0	3.0	0.0	1.5	7.6
therapeutic professions not named elsewhere	98	1.0	64.3	1.0	0.0	59.2	4.1	19.4	10.2	9.2	13.3	2.0
social professions	118	4.2	40.7	13.6	0.0	11.9	15.3	44.1	28.8	15.3	11.0	0.0
geriatric nurses	97	2.1	45.4	16.5	0.0	12.4	16.5	42.3	33.0	9.3	10.3	0.0
remedial therapists	9	11.1	33.3	0.0	0.0	11.1	22.2	33.3	11.1	22.2	22.2	0.0
orthopaedagogues	12	8.3	8.3	0.0	0.0	8.3	0.0	66.7	8.3	58.3	16.7	0.0
health craftsmen	149	0.0	71.1	0.0	8.1	0.0	63.1	1.3	0.7	0.7	2.7	24.8
opticians	50	0.0	70.0	0.0	0.0	0.0	70.0	0.0	0.0	0.0	4.0	26.0
orthopaedic mechanics	12	0.0	41.7	0.0	0.0	0.0	41.7	0.0	0.0	0.0	8.3	50.0
dental technicians	67	0.0	76.1	0.0	17.9	0.0	58.2	0.0	0.0	0.0	1.5	22.4
other health craftsmen	21	0.0	71.4	0.0	0.0	0.0	71.4	0.0	0.0	0.0	9.5	19.0
other special professions in health care	95	5.3	46.3	0.0	0.0	0.0	46.3	4.2	4.2	0.0	22.1	22.1
health engineers	12	0.0	66.7	0.0	0.0	0.0	66.7	0.0	0.0	0.0	16.7	16.7
health-protecting professions	24	20.8	8.3	0.0	0.0	0.0	8.3	0.0	0.0	0.0	66.7	4.2
health technicians	8	0.0	12.5	0.0	0.0	0.0	12.5	0.0	0.0	0.0	0.0	87.5
pharmaceutical technicians	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
pharmaceutic-commercial employees	42	0.0	83.3	0.0	0.0	0.0	83.3	4.8	4.8	0.0	2.4	9.5
other professions in health care	1 032	0.5	37.9	12.6	6.1	8.4	10.8	24.0	19.1	4.9	17.2	20.3

Source: Federal Statistical Office; Health personnel accounts; calculation by DIW Berlin.

Two thirds of 'specialists in general medicine', gynaecologists, and obstetricians provide ambulatory care, while surgeons are mostly employed by hospitals. Different to the common definition of GP, employees classified in this statistics as 'general practitioners' are graduates who are in further training courses to become a medical specialist (also specialist in general medicine). They are required to complete a further training in hospitals as well as in offices of physicians. In 2011, 102,000 general

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practitioner (in further training measures) were employed, thereof 14 % in offices of physicians, 14 % in ambulatory care facilities, and 70 % in hospitals.

Denmark

In Denmark similar HLA statistics do not exist. In addition to the afore mentioned information from the EU LFS concerning the employment in hospital care as well as medical and dental practices, Statistics Denmark provides data on hospital employment by occupation and data on the staff employed in municipal health care. In public hospitals 103,000 full-time equivalents (FTE) were employed in 2011 (Table 6). Nurses were the largest occupational group accounting for one third of hospital staff. Physicians are the second largest group with about 15,000 FTE, followed by assistants (11,000 FTE). As hospitals in Denmark provide also rehabilitation services; chiropractors, physiotherapists, and occupational therapists are also employed (together 2,900 FTE).

Table 6   Employees (FTE) in hospitals by occupations in Denmark 2001 to 2011

Occupation	2001	2005	2010	2011
Physicians	10 824	12 192	14 335	14 490
Nurses	29 660	30 985	34 330	34 214
Pharmacists	129	209	323	354
Chiropractors	0	7	22	24
Dentists	48	60	71	73
Occupational therapist	1 046	1 083	1 094	1 081
Physiotherapist	1 757	1 925	1 817	1 801
Midwives	1 017	1 149	1 323	1 309
Bioanalysts	4 777	4 677	5 213	5 154
Radiographer	918	966	1 374	1 409
Other health professions	174	192	234	234
Assistants	623	789	884	888
Social and health care assistants	12 949	12 187	11 994	11 010
Other patient oriented functions	11 099	11 229	13 455	13 341
Administrative and other staff	15 191	15 310	17 337	17 195
Total	90 212	92 961	103 805	102 578
Source: StatBank Denmark; employees in public hospitals; 2001-2003 employment statistics Ministry of Health, 2004 onwards statistics of regions.				

Statistics Denmark provides no statistics showing total employment in ambulatory care. Only some information on the personnel employed by municipalities for dental care (mostly children's free dental care) and municipal health care exists. Nearly all municipal health care staff consists of employed health visitors, who, for example, visit

families with new-born babies' between 4 and 7 times during the baby's first year. In 2011, approximately 900 dentists and 2,250 dental assistants, plus some 1,700 health visitors were employed. Statistics Denmark provides also information of physicians by specialities.

Italy

In addition to the EU LFS data, information on the Italian health-care personnel can be derived from the administrative archives of the Ministry of Health and from the data bases of the National Statistical Office (ISTAT). In particular, the country report focusses on the personnel working in public facilities and accredited private facilities and on dentists (that work mainly in private practice).

Table 7   Health care personnel by categories and structures in Italy in 2010

		Physicians	Nurses	Rehabili-tation personnel	Health technicians	Surveil-lance and Inspection	Total
National Health System							
	General paediatrician	7,631					7,631
	General practitioner	45,536					45,536
	Public rehabilitation institute	4,432		19,456			23,888
	Emergency general practitioner (medical guard)	11,564					11,564
	Specialist physicians in ambulatory care	10,045					10,045
RGS-surveyed institutions	*On permanent contracts by ASL, A.O., A.O.U.,I.R.R.C.S. publ., ARES*	*110,732*	*274,600*	*20,337*	*35,264*	*10,269*	*451,202*
	On temporary contracts by ASL, A.O., A.O.U.,I.R.R.C.S. publ., ARES	*7,192*	*11,263*	*1,162*	*1,324*	*496*	*21,437*
	University students	6,467	2,413	66	1,129	14	10,089
	Facilities considered as public	10,287	20,144	2,421	3,665	180	36,697
	Private nursing home in NHS	21,157	24,955	5,267	3,726	136	55,241
Private nursing home outside NHS		2,345	1,543	115	234	8	4,245
	TOTAL	**237,388**	**334,918**	**48,824**	**45,342**	**11,103**	**677,575**
Source: Health Ministry, Il personale del sistema sanitario nazionale; Coda Moscarola 2013.							

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Table 7 reports the number of medical doctors, nurses, technical personnel, rehabilitation personnel and surveillance and inspection workers in public and private facilities - both hospitals (secondary/tertiary care) and Local Health Units (primary care). They represent the majority of workers hired by NHS institutes[1] and the 43 per cent of the total health-care workforce (678,000 out of 1.6 million). In Italy, primary care is provided by general practitioners and general paediatricians. The majority of ambulatory care by specialists as well as rehabilitation measures is provided by inpatient and outpatient departments of hospitals.

Nurses are the most numerous group – 335,000 - followed by doctors – 237,000. Technical roles employ about 45,000 workers, rehabilitation about 49,000 workers, while surveillance and inspection personnel are about 11,000. Among physicians, general practitioners and paediatricians are respectively 45,500 and 7,600. Dentists - not reported in table 7 - are about 59,000.

The country report for Italy also provides information on the share of part-time and full-time employment, on flexible contracts, and age-structures, but only for public workers surveyed by the RGS (about 470,000). For further details please refer to Coda Moscarola (2013).

A special issue concerning Italy is the noticeable dimension of irregular employment in total economy. ISTAT estimates a share in service sectors of about 23%. However, the share in the health care and social work sector would amount only to 1%.

Poland

The country report of Poland provides information on health care personnel by type of provider and occupational groups (see Golinowska et al 2013). In 2011, approximately 23,000 physicians, 31,000 nurses and 5,000 midwives were employed in primary care. Family doctors and paediatricians accounted for the majority of primary health care physicians, representing 28.1 % and 23.4%, respectively. Primary health care physicians constitute approximately 30 % of all practicing physicians. The number of nurses employed in primary care was 31,000 in 2011, accounting for 16 % of all practicing nurses. Some 39 % of primary care nurses are family community nurses who are responsible for the provision of home care.

Data on the total employment in secondary care are not available, except for the number of physicians active in specialist care facilities. In particular, specialists often work in more than one medical facility (hospitals and public/private secondary care facilities or in more than one secondary facility) and may be counted twice. This must be kept in mind when interpreting the number of physicians across all types of facilities. In 2011, approximately 72,000 physicians, 129,000 nurses, and 17,000 midwives work in hospitals. In medical intervention units (on hospitals) 24,000 physicians were employed. 17,000 dentists and 15,000 physicians work in internal care units. 9,000 physicians provide services in mother and child care units.

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[1] Remaining workers are: veterinarians, dentists, pharmacists, biologists, chemists, physicists, psychologists, managers, administrative personnel and other technical personnel.

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Slovakia

In addition to the EU LFS, the country report for Slovakia provides information on (1) the employment by occupations per 100,000 inhabitants, (2) the age structure of employed nurses, (3) employment by type of facilities, and (4) personnel working in outpatient care by kind of speciality (Radvanský and Dováľová 2013).

In 2011, in total 11,700 physicians and dentists and 12,300 nurses and midwifes were employed in outpatient facilities in Slovakia (Table 8). Primary care by general practitioners for adults and for children is provided by approximately 3,000 physicians as well as 3,000 nurses and midwives. In specialist care some 24,000 persons are employed, thereof 9,000 physicians (including dentists) and 9,000 nurses (including midwives).

Table 8   Personnel in outpatient health care facilities by occupations, 2009 and 2011

Selected specialization	Out-patient unit		working posts					
			total		physicians and dentists		nurses and midwises	
	2011	2009	2011	2009	2011	2009	2011	2009
Total	15 251	15 621	27 070	27 461	11 732	12 225	12 276	12 845
internal medicine	768	781	1 060	1 102	449	460	575	594
neurology	420	393	591	578	271	266	310	311
psychiatry	341	326	506	536	262	276	236	255
paediatrics	124	143	114	147	51	64	60	80
general care for children and adolescents	1 141	1 149	2 065	2 098	1 035	1 065	1 027	1 033
gynaecology and obstetrics	883	866	1 306	1 349	638	694	661	651
surgery	413	417	700	706	268	271	400	411
orthopaedics	309	300	488	466	231	214	242	242
stomatology	2 346	2 516	4 758	4 822	2 358	2 392	2 132	2 267
general care	2 129	2 219	4 091	4 265	2 035	2 145	2 042	2 104
physiotherapy, balneology and medical rehabilitation	366	360	393	453	223	238	118	163
clinical immunology and allergology	225	226	408	380	187	185	199	188
cardiology	233	231	377	352	171	158	203	192
diabetology, metabolic disorders	233	230	294	304	138	141	153	161
clinical psychology	266	248	269	246	2	12	18	21
haematology and transfusiology	111	112	572	298	157	93	246	172
clinical immunology and allergology	225	226	408	380	187	185	199	188
rheumatology	123	123	208	166	87	78	120	86
gastroenterology	176	175	332	322	139	126	184	190
jaw orthopaedics	158	175	236	257	113	125	104	123
nephrology	131	132	173	131	69	60	104	72
endocrinology	129	120	164	142	78	69	84	73

Source: Radvanský and Dováľová (2013); Health statistics yearbook of Slovak Republic, 2009, 2011.

The employment in institutions and in outpatient care facilities of physiotherapy, balneology, and medical rehabilitation is used as an indicator for health care personnel in rehabilitation care. In institutional care facilities some 90 physicians (FTE) were employed in 2011, in outpatient care facilities some 223 physicians and 118 nurses.

2.4   Shortage of health workforce

The data on employment show the current situation on the health care labour market, but they do not indicate that the realized employment meets the needs of the population. All five studied countries reported some kind of the health care workforce shortage, leading to unmet needs and long waiting times.

Denmark: Pedersen (2011) reported an expected shortage of 5,700 nursing assistants, of 5,600 nurses, and of 2,600 physicians in Denmark in 2015.

Germany: In Germany a shortage of nurses as well as of physicians in particular GPs is reported in some regions. The Labour Union of Physicians (Marburger Bund) reported a shortage of 12,000 physicians in hospitals in 2013 (Focus online, 2013).

Italy: In Italy very long waiting lists are observed. On average patients wait 50 days for diagnostic tests. The waiting time in public hospitals and ambulatories is about 57 days, in private facilities and in accredited facilities is lower, at 27 days (Coda Moscarola 2013). The results of the Census Survey 2010 highlight in particular the undersupply of hospitals and first aid (15 %) and of public ambulatories (14.9 %). Unmet needs for dental care services are also reported due to the fact that they are not covered by the national health system.

Poland: Golinowska et al (2013) reported that the shortage of medical professionals started to limit the access to health care services in Poland, but no exact data are reported. Also Kolodziejska et al (2012) report shortages of health professionals, which relate mainly to particular specializations, such as anaesthesiologists, paediatricians, psychiatrists for children, and qualified specialist nurses.

Slovakia: A study which evaluated the primary care provision in Slovakia provides information on the estimation of health care personnel shortage (WHO 2012b). They surveyed practicing physicians as well as patients. The practising physicians stated only for some regions a shortage of GPs and paediatricians. Only a few patients reported that the have to wait more than 3 days to visit of GP (2.1 % in rural and 1.3 % in urban areas – WHO 2012b). This stands in contrast to the experience of the health insurance funds. On the waiting lists of health insurance companies in total 8,300 patients are listed (Radvanský and Dováľová 2013).

Moreover, high emigration of health professions is reported, which strengthens the shortage of health professionals. It is estimated that 2,800 doctors have emigrated between 2004 and 2009 (Radvanský and Dováľová 2013). A significant share of medical graduates leaves the country immediately after studies.

Other facts indicating a health personnel shortage are the increase in the numbers of work contracts per practicing physicians as well as unusual long working hours. According to data from the National Registry of healthcare workers (NR HW), at the end of 2010, 3,700 doctors out of 18,000 doctors reported working hours which exceeded the normal working time of a full-time employee in medical care occupations.

The European Commission estimates a potential shortfall of around 1 million healthcare workers by 2020 rising up to 2 million if long term care and ancillary professions are taken into account in the EU27 (Matrix Insight 2012). This means that about 15 % of total care will not be covered compared to 2010. Potential shortfalls might worsen the working conditions and increase pressures on the healthcare workforce raising concerns over the impacts on patient safety and quality of care (EC 2012b).

An indicator for health workforce shortage is the amount of unmet needs due to long waiting-times or high costs (co-payments and private financed services). The EU SILC survey provides information on the unmet needs for medical and dental examination. In 2011 in the EU27, on average, 6.6 % of the survey population report having experienced unmet medical needs and 7.2 % unmet dental needs (Table 9). Among the five countries studied here, the share of people with unmet medical needs is highest in Poland (14 %) followed by Italy (7 %), and Germany (6 %). In Slovakia and Denmark the share of people reporting unmet medical need was lower (5.4 % and 3.7 %). The share reporting unmet dental needs is highest in Italy (10.3 %), followed by Poland (9.9 %). There are two main reasons for unmet needs: waiting times and expensive co-payments or private payments. The answer 'too expensive' is particularly prevalent with respect to dental care. The share of people reporting unmet needs is a little bit higher for females than for males. There is no clear trend of increasing unmet needs with age.

Table 9   Share of people reporting unmet needs by reasons in 2010 (%)

	Total	Too expensive	Too far to travel	No time	Didn't know any good doctor or specialist	Waiting list	Fear of doctor, hospital, examination or treatment	Wanted to wait and see if problem got better on its own	Other reasons
Medical examination									
EU27	6.6	2.0	0.2	1.0	0.1	1.0	0.4	1.3	0.8
Denmark	3.7	0.3	0.0	0.5	0.1	0.8	0.2	1.1	0.8
Germany	6.3	1.1	0.2	1.3	0.1	0.6	0.3	1.5	1.2
Italy	7.2	3.6	0.1	0.7	0.1	1.4	0.2	0.6	0.6
Poland	14.3	3.2	0.6	2.3	0.2	4.5	0.9	2.0	0.6
Slovakia	5.4	0.7	0.3	0.8	0.2	0.7	0.6	1.5	0.6
Dental examination									
EU27	7.2	4.1	0.1	0.6	0.1	0.4	0.9	0.4	0.6
Denmark	3.8	2.4	0	0.4	0.1	0.1	0.3	0	0.5
Germany	4.1	2.1	0.0	0.3	0	0.1	0.6	0.3	0.6
Italy	10.3	6.7	0.1	0.9	0	0.6	0.6	0.8	0.6
Poland	9.9	4.0	0.1	1.4	0.1	1	2.2	0.7	0.4
Slovakia	4.3	1.5	0.0	0.4	0	0.4	0.8	0.7	0.3
Source: Eurostat; results of EU SILC; calculation by DIW Berlin.									

The share of people reporting long waiting times for medical examinations as well as for dental examinations are well above the EU average in Poland and Italy. This

situation was reported also in other sources (see section 2.1). The demand for health services is also restricted by high costs for medical and dental examinations. Again, the share of people reporting unmet needs due to high costs is in Poland and Italy above the EU average. As mentioned in section 2.2 in Italy, Poland, but also Slovakia high out-of pocket payments are required. In 2010, the share of out-of-pocket payments in current health expenditure was 27 % in Slovakia, 24 % in Poland and 18 % in Italy. In Slovakia the share of people reporting high costs is below the EU average. That is an indicator for high privately financed services other than medical and dental examinations, for example rehabilitation measures.

3 Methods to estimate the future health workforce

3.1 Introduction

The current situation is the starting point for the estimation of the effect of societal change, in particular demographic change, on the demand of health care services and the workforce needed to meet this demand as well as for the expected changes in the health workforce supply. In view of the challenges due to the ageing of the population as well as due to the high share of health workforce that is expected to retire over the next decade the need for health workforce planning has become a central issue for politicians and health care providers. In Australia (HWA 2012) and in Canada (Birch et al 2009) health workforce planning is carried out for special occupations or medical specialities, in the EU a feasibility study for health workforce planning is conducted (Matrix Insight 2012). A project financed by the EU concerning health workforce planning has started in 2013. The general objective of the 'EU joint action on health workforce planning' project is a platform for collaboration and exchange between Member States to prepare the future for health workforce (EU HWF 2013). One work package of this project deals with the data and methods of health workforce planning (WP4).

Generally, health workforce planning is based on the estimation of effects of demographic change on the supply of and requirements for healthcare services (Birch et al 2009). But the studies take also into account changes in productivity (HWA 2012b) and changes in the need for health care services (Birch et.al. 2009). Forecasting health workforce need approaches to estimate the changes in demand and estimation of changes in supply of health workforce. The Health Workforce Australia (HWA 2012c) discusses different approaches on the demand as well as on the supply side. Roberfroid et al. (2009) discuss different approaches to forecast physicians supply.

3.2 Methods to estimate the demand driven need for health workforce

The demand for health workforce is influenced by a variety of factors like the changes in the demand for health care services, changes in regulations, economic growths (in particular in tax financed public health systems), new technologies and new available treatment methods. We are focusing on the impact of changes in the demand for services on the health workforce only. The question is how to measure the demand for health services. As mentioned above, the health care market is a highly regulated market. EU health care systems provide universal and - in the point of use - free access to at least a core set of health care services, and the prices of these health services are fixed by the state or result from agreements between health care providers and funding institutions (health insurance funds or public authorities). The demand for services is also influenced by the providers of health care due to asymmetric information (physicians are in general better informed about the appropriate level and kind of treatments). The Health Workforce Australia (HWA 2012c) mentioned as main methods to measure demand:

Need based approach:

This approach measures the need for health services based on the health status of all persons living in the community, not just of those people seeking medical services. It requires significant information on the incidence, prevalence and disability states (level of impairments) for virtually all diseases and conditions by age and gender.

Pros: This approach is comprehensive; measuring needs is more appropriate than measuring the – by manifold factors influenced – realized demand.

Cons: This approach requires significant amounts of detailed data that are not often available.

Utilization method:

This approach measures expressed demand, and is based on service utilization patterns as currently observed. It uses medical service and hospital inpatient data by age and gender.

Pros: This approach has the advantage that the realized demand is measured.

Cons: A problem is data limitations for outpatient services. However this approach is relevant for modelling demand for health services and the medical workforce.

Economic estimation method:

This method links demand for the health workforce to variables presumed to contribute to demand for health. For example the assumed relationship between national income and demand for health services can be built into the forecasting equation.

Pros: Easy to use.

Cons: This approach has the disadvantage that it provides no information of the composition of workforce, no direct relationship between demand for services and changes in the needed health workforce.

Benchmarking method:

This method compares a workforce-to-population ratio (benchmark) in best performing health care systems with the ratios in the country of interest. It assumes that the used benchmark is optimal for providing effective health care.

Pros: This approach has the advantage that is requires only a minimal set of data and can be easily used.

Cons: This approach may lead to insufficient results is the case that the benchmark is influenced by regulations, historical development, maybe an oversized workforce.

3.3 Methods to calculate the development of the health workforce supply

The HWA (2012c) identifies two methods for measuring health workforce supply:

Time series approach:

This approach uses past trends for the projection of workforce supply. Time series analysis assumes that the influencing factors underlying past trends remain constant in the future.

Pros: The advantage of this approach is that it requires only a minimal set of data.

Cons: The disadvantage is that the quality of the projection depends on the quality of the data included in the estimation equation (interlinks with other subsectors in health care, but also other sectors).

Stock and flow method:

This method identifies the size of the current workforce, and the sources of inflows and outflows from the stock. The future supply health workforce supply is calculated by moving forward the initial stock using the expected in- and outflows. The stock data on

the current workforce by age and gender have to be differentiated by occupations, facilities, and working-time. The inflows comprise data on students and graduates, students in vocational training, migrants, and persons moving from other sectors or other occupations in the health care market. The outflows comprise data on retirement, emigration, movement to other sectors.

Pros: This approach can be applied also for single occupations, in particular if detailed data are available from the Associations of the health professions.

Cons: While data on the workforce stock are available in most EU countries, data on in- and outflows are not easily to collect. In particular the estimation of migration flows (from/into another country, but also from/into another sector) is a challenge due to the manifold influencing factors and missing data on current migration flows by occupations, age and gender. Another fact is that the current workforce may not represent the balance on the health care market. May be the health workforce is oversized or there may be a shortage of health professionals. Additional data showing the imbalances are needed differentiated by occupations and kind of services.

Another approach to estimate the changes in health workforce by main occupational fields was used for the case of Germany (Helmrich and Zika 2010).

Top down method:

This method identifies the share of health workforce in total employment and the trend in the past as well as the underlying factors. The estimation of the health workforce is based on the overall development of the total workforce and assumptions about changes in sectorial employment.

Pros: The advantage of this approach is that the health workforce is estimated in relation to the overall changes in labour supply, the economic growth, and the development in total employment. It takes into account future changes in industrial structure.

Cons: The disadvantage is that no detailed information by types of service or occupation is provided.

3.4   Conclusion: preferred methods and data bases

To estimate the future supply of health workforce the flow model is typically used. The Health Workforce Australia, for example, used a dynamic version of the stock and flow approach (HWA 2012c). However, in WP12 a variant of a top down model is used due to the fact that in the NEUJOBS project the growth and employment by countries and sectors is estimated (Boitier, Lancesseur, Zagamé 2013). One sector is the pooled sector 'non-market services' which consists of sectors Q 'Human health and social work activities', O 'Public administration and defence; compulsory social security', P 'Education', subsectors R90-92 'Creative, arts and entertainment activities', R93 'Sports

activities' and S 94 'Activities of membership organisations'. Thus, we must take into account the development of the pooled sector by estimating the supply of health workforce (see chapter 6.1).

For the estimation of the demand we use the utilization approach. We collect utilization data for institutional care and ambulatory care and carry out scenarios showing the pure demographic effect (demography), and taking into account changes in utilisation (need) as well as changes in productivity (for example changes in the average length of stay in hospitals).

4 Demand for curative health care workforce 2025

The calculation of the future demand for health care workforce follows a stepwise procedure. At first the changes in the demand for health care services have to be calculated and, in a second step, the impact of changing demand on the required health care staff has to be estimated. To show the effect of an ageing population on the demand for health care services, utilization data by age-groups are needed. The utilization data are combined with the population data to show the development of the demand for health care services. Based on the changing demand an estimation of the health care workforce is carried out using quotas of the needed personnel.

The utilization approach requires detailed data that are not easy to collect. Ideally we need utilization data for each type of health care service by age-groups and gender, but also – for the calculation of the effect of changing demand for health care services on the health workforce – employment data by the same types of health care services. Data on utilization or the number of patients by kind of services and age-groups are not gathered on a regular basis. For some countries as well as some types of services data are still missing. An exception is the statistics on hospital inpatients which provides data on hospital discharges or admissions by age-groups and gender for all studied countries. Additional, some information on hospital staff is available. Utilization data for ambulatory health care services are rare. To get an idea of the impact of changing demand for ambulatory health care workforce partners used different approaches based on the available data for their country.

The following parts show the population development, the collected utilization data and the approaches used to calculate the demand for health care services and health workforce.

4.1 Population development

NEUJOBS carried out two population projections – tough and friendly - which take the EUROPO2010 projection of Eurostat as a reference scenario into account (Huisman et al 2013). Demographic projections are based on three components: fertility rates, life

expectancy (LE) and migrations. The future development of these demographic components is influenced by the different framework conditions of the NEUJOBS global scenarios (Fischer-Kowalski et al. 2012). In general, the friendly scenario presents a more comfortable situation with higher fertility rates, higher life expectancies for males and females and higher net migrations than the tough scenario. The assumptions are summarized in Table 43 and described in detail in Huisman et al (2013).

In 2010 Denmark had the highest total fertility rate (TFR) of 1.87, whilst the other four countries showed more or less the same fertility rate of around 1.4 (Table 10).

Table 10   Assumption of population forecasts

	2010	2030		
		Friendly	Tough	Europop
Fertility rates				
Denmark	1.87	1.94	1.87	1.84
Germany	1.39	1.70	1.39	1.43
Italy	1.41	1.71	1.41	1.48
Poland	1.38	1.69	1.38	1.46
Slovakia	1.40	1.70	1.40	1.48
Life expectancy at birth males				
Denmark	77.2	83.1	79.4	80.2
Germany	78.0	83.9	80.1	80.8
Italy	79.4	85.3	81.5	81.8
Poland	72.1	79.2	74.9	76.4
Slovakia	71.7	80.7	76.5	76.2
Life expectancy at birth females				
Denmark	81.4	86.3	83.2	84.3
Germany	83.0	87.6	84.6	85.4
Italy	84.6	89.2	86.1	86.6
Poland	80.7	85.7	82.6	83.5
Slovakia	79.3	86.4	83.4	82.7
Net migration per year (1000)				
Denmark	15.3	18.0	5.9	12.0
Germany	-10.7	366.2	-100.3	133.0
Italy	311.6	549.1	128.2	338.7
Poland	-1.2	91.7	-85.3	3.2
Slovakia	4.4	18.9	-2.6	8.2
Source: Eurostat, Europop; NEUJOBS D10.1 (version March 2013).				

In the tough scenario the realized fertility rates will be constant and thus also the differences in TFR between the four countries (DE, IT, PI and SK) and Denmark will not change. In the friendly scenario a further increase in fertility is assumed with shrinking differences to the increasing TFR of Denmark. The increase in fertility rates

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has an impact on the number of new-borns, but there will be no significant effect on the total population over the projection period of 15 years.

In 2010 Italy realized the highest LE for men (79.4 years) and women (84.6 years), while Slovakia experienced the lowest LE (71.7 years for men and 79.3 years for women). The other studied countries realized a LE in between. The LE is expected to increase for men and women in all countries and scenarios. A catching up process is assumed for countries showing a currently low LE, like Slovakia. In Slovakia the LE of men, for example, is expected to increase by 9 years in the friendly and by 4.8 years in the tough scenario. Also Poland will realize a relatively high increase in LE of men by 7.1 years in the friendly and 2.8 years in the tough scenario. In Denmark, Germany and Italy the growth in LE of men is lower: Until 2030 the LE will increase by 5.9 years in the friendly scenario and by approximately 2 years in the tough scenario.

The increase in LE results from a reduction in mortality in particular in the older age-groups. The decline in the number of deaths has a direct and immediate impact on the total population and, in particular, the number of the elderly and oldest old.

The assumptions of migration inflows and outflows are fraught with uncertainty. The impact on the size and age-structure of the inhabitants depends on the age-structure of the migrants and the duration of stay in the foreign country. The authors assume that the majority of migrants will be of working age and, therefore, an effect on the labour force can be expected (Huisman et al 2013).

The results of the demographic scenarios are shown in Table 11. Under the friendly scenario assumptions, all countries but Germany show an increase in total population. The highest increase is expected for Italy (8 %) followed by Denmark with 5.3 %. Both countries are expected to grow faster than the EU27 average. In the tough scenario Germany, Poland and Slovakia show a decline in population.

A markedly greater dynamic can be seen for the elderly (65+) and oldest old (80+). In the EU27 the number of elderly will increase by 29 % in the friendly and by 20 % in the tough scenario. In Slovakia, Poland and Denmark the growth in elderly will be considerably higher. In the friendly scenario in Slovakia an increase of 53 %, in Poland of 50 % and in Denmark of 31 % is expected, whilst Germany is expected to have a growth in elderly of 15 % and Italy of 25 % (well below the EU27 average). Also in the tough scenario the growth of the elderly population is higher than the EU average in Slovakia, Poland and Denmark, and lower than the EU average in Germany and Italy.

Table 11   Population in 2010 and 2025 - results of population forecasts

	2010	2025			Changes 2025/2010			Changes 2025/2010		
		Friendly	Tough	Europop	Friendly	Tough	Europop	Friendly	Tough	Europop
	in 1000	in 1000			in 1000			in %		
All age-groups										
Denmark	5535	5829	5657	5811	294	122	276	5.3	2.2	5.0
Germany	81802	80082	75250	79078	-1721	-6552	-2725	-2.1	-8.0	-3.3
Italy	60340	65159	61212	63737	4819	872	3397	8.0	1.4	5.6
Poland	38167	38174	36194	38121	7	-1973	-46	0.0	-5.2	-0.1
Slovakia	5425	5618	5361	5600	193	-64	175	3.6	-1.2	3.2
Total	191270	194862	183674	192347	3592	-7596	1077	1.9	-4.0	0.6
EU27	499200	522197	495159	519109	22997	-4041	19910	4.6	-0.8	4.0
Elderly (65 years old and older)										
Denmark	903	1187	1107	1224	284	204	321	31.4	22.6	35.5
Germany	16902	19489	18005	19834	2587	1103	2932	15.3	6.5	17.4
Italy	12206	15227	14163	14984	3020	1956	2778	24.7	16.0	22.8
Poland	5161	7718	7154	7928	2557	1993	2767	49.5	38.6	53.6
Slovakia	665	1015	943	1039	350	278	374	52.6	41.8	56.2
Total	35838	44636	41372	45009	8798	5535	9171	24.5	15.4	25.6
EU27	86886	112211	104328	113130	25325	17442	26244	29.1	20.1	30.2
Oldest old (80 years old and older)										
Denmark	228	312	261	327	85	34	99	37.2	14.9	43.7
Germany	4181	6197	5169	6371	2016	988	2190	48.2	23.6	52.4
Italy	3478	5091	4356	4761	1613	878	1283	46.4	25.3	36.9
Poland	1257	1627	1333	1653	370	75	396	29.4	6.0	31.5
Slovakia	147	207	171	205	60	24	58	40.6	16.0	39.0
Total	9291	13435	11290	13316	4144	1999	4025	44.6	21.5	43.3
EU27	23284	32587	27489	32093	9303	4205	8809	40.0	18.1	37.8
Source: Eurostat, Europop2010; NEUJOBS D10.1 and 10.2 (version March 2013); calculation by DIW Berlin.										

The difference in current LE and the differences in the expected changes in mortality determine the development of the number of elderly and oldest old, but the changes are also influenced by the shift of the baby-boomer to higher ages (effect of the population size and age-structure in the base year). One example is Poland. The current low LE leads only to a moderate increase in the number of the oldest old, but the expected high decline in mortality has an impact on the number of 65+ in total.

The share of the elderly will increase by some 4 %-points (friendly) on average in the EU27 and the five studied countries on average with the highest increase in Poland and Slovakia (Table 12). However, both countries are also expected to have a lower proportion of elderly in 2025 than Denmark, Germany and Italy.

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Table 12   Share of elderly and oldest old in 2010 and 2025 – results of population forecasts

	2010	2025			Changes 2025/2010		
		Friendly	Tough	Europop	Friendly	Tough	Europop
	in %	in %			in %-points		
Share of elderly (65 years old and older)							
Denmark	16.3	20.4	19.6	21.1	4.0	3.3	4.7
Germany	20.7	24.3	23.9	25.1	3.7	3.3	4.4
Italy	20.2	23.4	23.1	23.5	3.1	2.9	3.3
Poland	13.5	20.2	19.8	20.8	6.7	6.2	7.3
Slovakia	12.3	18.1	17.6	18.6	5.8	5.3	6.3
Total	18.7	22.9	22.5	23.4	4.2	3.8	4.7
EU27	17.4	21.5	21.1	21.8	4.1	3.7	4.4
Share of oldest old (80 years old and older)							
Denmark	4.1	5.4	4.6	5.6	1.2	0.5	1.5
Germany	5.1	7.7	6.9	8.1	2.6	1.8	2.9
Italy	5.8	7.8	7.1	7.5	2.0	1.4	1.7
Poland	3.3	4.3	3.7	4.3	1.0	0.4	1.0
Slovakia	2.7	3.7	3.2	3.7	1.0	0.5	0.9
Total	4.9	6.9	6.1	6.9	2.0	1.3	2.1
EU27	4.7	6.2	5.6	6.2	1.6	0.9	1.5
Old age dependency ratio (65+ to 15-64)							
Denmark	0.249	0.326	0.310	0.339	0.078	0.061	0.090
Germany	0.314	0.390	0.377	0.402	0.076	0.064	0.089
Italy	0.308	0.368	0.359	0.370	0.060	0.051	0.062
Poland	0.190	0.313	0.301	0.324	0.123	0.111	0.135
Slovakia	0.169	0.271	0.260	0.280	0.102	0.090	0.110
Total	0.279	0.362	0.350	0.370	0.082	0.071	0.091
EU27	0.260	0.340	0.330	0.346	0.080	0.070	0.086
Source: Eurostat, Europop2010; NEUJOBS D10.1 and 10.2 (version March 2013); calculation by DIW Berlin.							

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4.2   Utilization data by age-groups and sex

The utilization approach requires utilization data for institutional and ambulatory care by age-groups and gender. Detailed data may provide a better insight into the kind of health care needed in view of the expected ageing of the population in EU countries. They may provide information of which types of health professionals are needed in selected facilities.

In general health care expenditure data show an increase with age that is different for males and females (EC EPC AGEING2012). The project Ageing, Health and Retirement in Europe (AGIR), which was funded within the 6th EC Framework Programme, analysed the impact of an ageing population on retirement and health care in selected EU15 countries. The AGIR project used also the utilization approach to show the changing demand for health care and long-term care (Schulz 2004). The collected data on hospital care and contacts to a doctor showed an increase in utilization with age for the selected countries, but not for all kind of health care services data on utilization were available.

While in the meantime a great progress in data collection has been made, our experience is that, beside hospital care, detailed data on the employment by occupations as well as utilization data differentiated by age and gender are still rarly available for scientific research. Data on hospital care are available from the National Statistical Offices of the individual countries as well as from Eurostat. Eurostat provides data on hospital discharges as well as the length of hospital stay by age-groups and gender (Table 13).

Table 13   Data Sources on health care utilization

	Hospital care	Ambulatory care
Denmark	National Patient Register published by National Statistical Office	National Statistical Office based on data collected by regions
Germany	Hospital Diagnosis Statistics published by National Statistical Office	Data on health care utilization of insurants of one Social Health Insurance Funds (Barmer GEK)
	Rehabilitation Diagnosis Statistics published by National Statistical office	
Italy	Eurostat data based on statistics of the Ministry of Health in Italy	Survey data collected by National Statistical Office every 5 years
Poland	Eurostat data based on statistics of the Central Statistical Office	GUS: Health and Health care in 2010;
		EHIS European health Information Survey
Slovakia	Eurostat data based on statistics of the National Health Information Center	EHIS European health Information Survey
Source: Compilation by DIW Berlin.		

The total number of hospital days (number of inpatients multiplied with the length of stay) is used as hospital utilization. In Denmark the statistics of hospital discharges is available only for the years until 2007, but the National Statistics provide a statistics on

hospital admissions that is available also for the current years. Thus, hospital utilization in Denmark is based on admissions instead of discharges. As the discharges also include deaths, the difference between admissions and discharges is small.

Data on ambulatory care stem mostly from health care surveys or – in Germany - from one health care insurance fund. In Poland and Slovakia the results of the EHIS 2008 (European Health Interview Survey) published on the Eurostat website are used. In Italy information on health care services other than hospital care can be derived from the National Statistical Institute (ISTAT) survey on the "Health conditions and access to health services" that is conducted every 5 years. The most recent, published in 2008, provides information for 2005. Data for ambulatory health care services in Denmark are provided by the National Statistical Office based on information of the regions.

Concerning hospital inpatient care for all countries data on discharges (admissions in Denmark) as well as the length of hospital stay by age-groups and gender for several years in the past are available (Table 14). The data are not fully comparable between countries, but nevertheless they provide the most comparable overview of hospital utilization and can be used for the calculation of health care demand and required hospital workforce.

Table 14   Available data on health care utilization

	Hospital inpatient care	Hospital outpatient care	Ambulatory care
Denmark	Admissions and length of stay by age-groups, gender and diagnosis (2006 onwards), rehabilitation measures included	Number of patients by age-groups, gender and diagnosis (2006 onwards)	Number of outpatient care consultations by age-groups and gender (GPs, dentists, specialists, psychlogists, physiotherapists, chiropractors, other)
Germany	Discharges and length of stay by age-groups, gender and diagnosis (2003 onwards)	no	Number of docotors' consultations by age-groups and gender, dentists' consultations by age-groups and gender
	Rehabilitation instituions with 100 and more beds: Discharges and length of stay by age-groups, gender and diagnosis (2003 onwards)	no	Prescriptions on therapeutical measures by age (no gender), prescriptions of drugs (age, gender), prescriptions of medical aids (age, gender)
Italy	Discharges and length of stay by age-groups, gender and diagnosis (2001 onwards); rehabilitation included?	no	Consultations to GPs and paediatricians (age, gender), dentists' consultations (age, gender), rehabilitation services (age, gender), diagnostic examinations and first aid (age, gender) all information for 2005
Poland	Discharges and length of stay by age-groups, gender and diagnosis (2003 onwards); rehabilitation included?	no	Number of visits to a primary care physician (age-groups,gender), specialists (age-groups,gender), dentists (age-groups, gender) 2010
Slovakia	Discharges and length of stay by age-groups, gender and diagnosis (2003 onwards); rehabilitation included?	no	Number of visits to a primary care physician (age-groups,gender), specialists (age-groups,gender), dentists (age-groups, gender) 2010
Source: Compilation by DIW Berlin.			

Concerning ambulatory care the data availability differs markedly. In Denmark, Italy, Poland and Slovakia statistics about contacts to a GP (in Italy including paediatricians) are provided separately from contacts to specialists. Data allow separating for age-groups but not for gender in Poland and Slovakia. In Germany data on doctor's consultations do not distinguish between general practitioners and specialists. All

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countries provide data on dentist's consultations, but EHIS data used in Poland and Slovakia do not include information on gender. Beside this common data, countries provide additional information. For Denmark data on physiotherapists and chiropractor exist. In Germany data on prescriptions of therapeutically measures, prescriptions of medical aids and appliances as well as pharmaceuticals are available. In Italy data on diagnostic examinations, first aid, and rehabilitation services exist. In Slovakia information on ambulances and home visits of doctors and dentists are available.

4.3   Estimation of demand for hospital care

In general, the prevalence of hospitalization is high in the youngest age-group (persons under the age of 5) due to the new-borns in hospitals and is lowest in the young ages (5 to 19 years). Thereafter, hospitalizations increase with a small peak for women during the birth giving ages (Figure 5). The prevalence of hospitalizations increases significantly with age from the age-group 40-44 years onwards. An exception is the highest age-group.

Figure 5   Hospital cases per 100 populations by age-groups in 2011
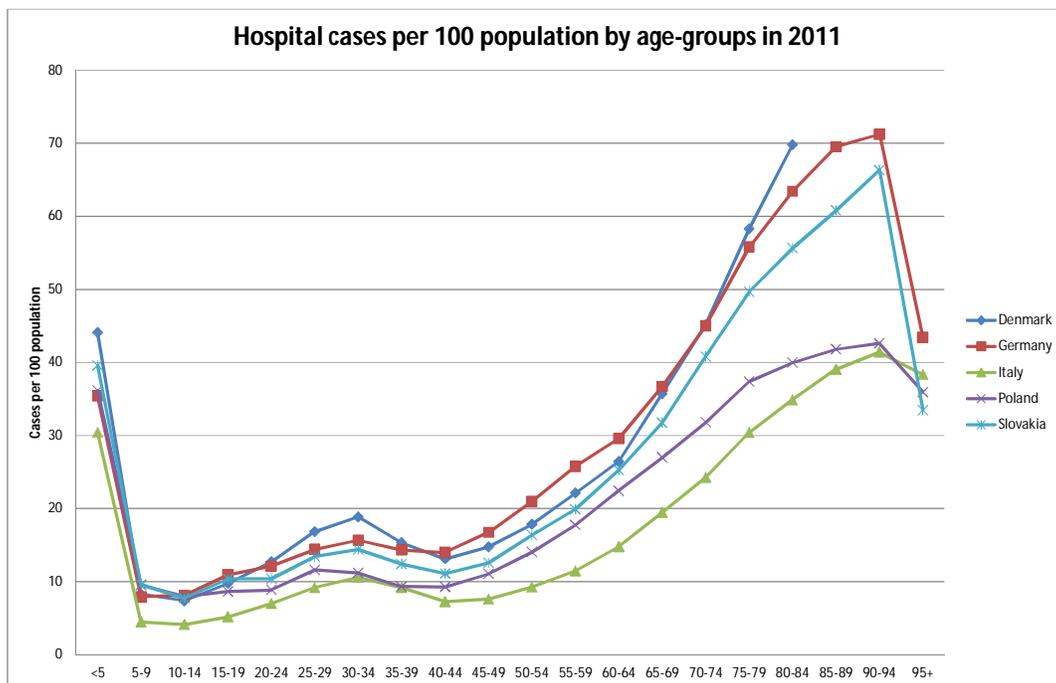
Source: Eurostat, hospital statistics; Statistics Denmark, calculation of DIW Berlin.

The prevalence of hospitalization of the people aged 95+ is lower than for people aged 90 to 94. Despite this general trend, great differences between the five studied countries

exist, with Italy showing the lowest prevalence of hospitalizations followed by Poland. Denmark and Germany have similar prevalence rates until the age-group 75-79 years; thereafter the prevalence rate in Germany is slightly lower. Slovakia has, in all age-groups, a slightly smaller prevalence than Germany.

The length of hospital stay also shows an increasing trend with age, but this trend is not so strong (Figure 6). Among the five studied countries markedly differences in the length of stay at all age-groups exist. Denmark realized a noticeable short average length of stay in all age-groups, between some 2 days in the youngest and fewer than 6 days in the oldest age-group. In the other countries the average length of stay ranges from 4 to 6 days in the youngest age-group, up to 8-12 days in the age-group 85-89 years. In Denmark as well as in the other countries day cases are excluded, so that all hospital length of stay data refers to inpatients with at least one overnight stay. The high difference in length of stay between Denmark and the other countries can possibly be traced back to the different health care pathways. In Denmark patients can be discharged earlier because they can be treated afterwards in outpatient departments of the hospital.

**Figure 6   Average length of hospital stay by age-groups in 2010**
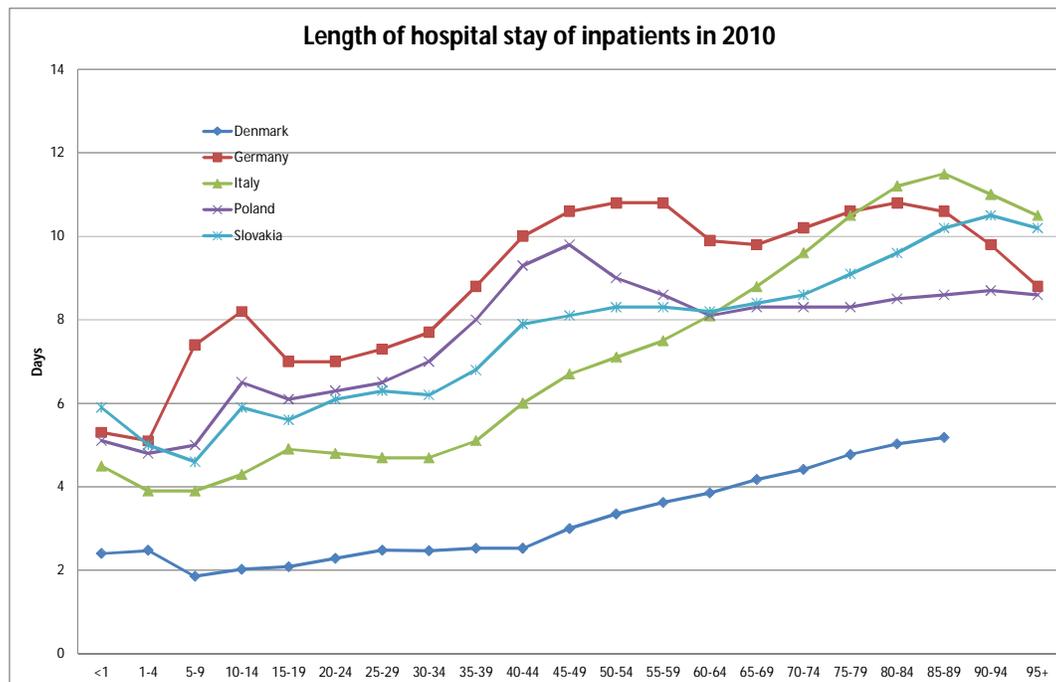
Source: Eurostat, hospital statistics; Statistics Denmark, calculation of DIW Berlin.

The changes in demand for hospital care activities can be shown by combining constant age- and sex-specific utilisation rates with the changes in population of the population scenarios. All partners carried out this calculation. The results show the

pure demographic effect on the demand for hospital care services. Table 15 shows the results.

Table 15 Changes in hospital utilization – pure demographic effect (constant utilization rates)

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
				Hospital cases in million						
Denmark	1.29	1.40	1.48	1.49	0.11	0.19	0.20	8.53	14.55	15.35
Germany	18.49	18.42	19.92	19.88	-0.07	1.43	1.39	-0.40	7.72	7.51
Italy	7.51	8.11	8.72		0.60	1.21		7.96	16.11	
Poland	6.11	6.12	6.57	6.60	0.01	0.46	0.49	0.16	7.53	8.02
Slovakia	1.14	1.21	1.29		0.07	0.15		6.20	13.22	
				Total hospital days in million						
Denmark	4.54	5.07	5.41	5.49	0.53	0.87	0.95	11.67	19.21	20.92
Germany	145.55	147.84	160.06	160.64	2.29	14.51	15.10	1.57	9.97	10.37
Italy	59.25	66.46	71.80		7.21	12.55		12.18	21.18	
Poland	46.60	47.90	51.20	51.60	1.30	4.60	5.00	2.79	9.87	10.73
Slovakia	8.27	9.08	9.70		0.82	1.43		9.88	17.31	
Source: Results of country reports Schulz 2013b; Schulz 2013c; Coda Moscarola 2013; Golinowska et al 2013; Radvansky 2013.										

The number of hospital cases will increase in all five countries under both demographic scenarios, except for Germany in the tough scenario. The increase will be highest in Denmark with approximately 9 % in the tough and 15 % in the friendly scenario. Italy will realize a slightly lower increase in the tough, but a higher increase in the friendly scenario compared to Denmark. The lowest increase is expected in Poland in the tough scenario.

The changes in total hospital days are an indicator for the changes in hospital service demand and will therefore be used for the calculation of needed hospital staff. The total number of hospital days is calculated using constant age- and gender-specific hospitalization rates as well as constant age- and gender-specific length of hospital stay. The hospital days are the hospital cases multiplied with the average length of hospital stay. The changes in hospital days are in all studied countries higher than the changes in hospital cases due to increasing length of stay with age. The expected changes in total hospital days range in the tough scenario from 2 % in Germany to 12 % in Italy, and in the friendly scenario from 10 % in Germany to 21 % in Italy.

To take the changes in morbidity and productivity into account, time trend analyses were carried out. For hospitals the age- and gender-specific changes in utilization are used as proxy for changes in morbidity, and the changes in the age- and gender specific length of stay as proxy for the changes in productivity. The underlying assumption is that an equal health outcome supposed a treatment which needs a shorter stay is more effective and efficient.

Estimations taking changes in prevalence rates and length of stay into account were carried out for Denmark, Germany, Poland and Slovakia. In Italy the observed historical changes in discharges seem not repeatable in the future, thus no trend scenario was carried out. Slovakia used the unchanged trend in discharges and length

of stay in the past for the extrapolation. Poland and Germany used the unchanged trend in length of stay for the calculation, but the trend in prevalence rates was halved. The underlying hypothesis is that the morbidity driven increase in hospital utilization will be extenuated by the medical-technological progress, which also allows more patients to be treated in ambulatory facilities. Another fact is that with the introduction of the Diagnosis Related Group (DRG) system for reimbursement in German hospitals, an incentive was set to increase the number of patients in particular in DRGs with high profit margins (Felder, Mennicken, Meyer 2013). It is assumed that measures will be taken to reduce these incentives. In Denmark the average length of stay is compared to the other countries very low. Thus it is expected, that the past trend will not continue in the future, but that the annual rate of decline will be halved. Also the trend of changes in prevalence was halved.

Taking changes in hospitalization rates and length of hospital stay into account changes the overall picture. Whereas hospital cases will increase to a higher degree than under the pure demographic scenario, the total number of hospital days will decline (Table 16). In particular in Germany a marked decline in total hospital days in the tough scenario is expected. This demonstrates the impact of changing productivity on hospital utilization.

Table 16   Changes in hospital utilization taking past trends in prevalence and length of stay into account

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
				Hospital cases in million						
Denmark*	1.29	1.51	1.59	1.60	0.22	0.30	0.32	16.91	23.56	24.49
Germany**	18.49	18.70	20.27	20.25	0.21	1.78	1.76	1.14	9.61	9.50
Poland**	6.11	6.90	7.50	7.50	0.79	1.39	1.39	12.93	22.75	22.75
Slovakia***	1.14	1.34	1.43		0.20	0.29		17.74	25.53	
				Total hospital days in million						
Denmark*	4.54	3.73	3.97	4.03	-0.81	-0.56	-0.51	-17.75	-12.39	-11.24
Germany**	145.55	107.68	116.89	117.24	-37.87	-28.66	-28.31	-26.02	-19.69	-19.45
Poland**	46.60	42.80	45.60	45.80	-3.80	-1.00	-0.80	-8.15	-2.15	-1.72
Slovakia***	8.27	7.83	8.36		-0.43	0.10		-5.23	1.18	
*) Half of past annual average growth rate in length of stay; half of past annual growth rate in prevalence rates.										
**) Trend of annual average growth rate in length of stay; half of past annual growth rate in prevalence rates.										
***) Trend of annual average growth rate in length of stay; trend of past annual growth rate in prevalence rates.										
Source: Results of country reports Schulz 2013b; Schulz 2013c; Golinowska et al 2013; Radvansky 2013.										

4.4   Estimation of demand for ambulatory care

The calculation of the future demand for ambulatory care is more difficult due to data restrictions. The country experts collected as much data as were available, but the data are not fully comparable between countries. Therefore, the calculation of the demand for ambulatory care services will be described for each country separately.

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Denmark

In Denmark specialist care will be also provided in outpatient departments of hospitals. Data on outpatient care in hospitals are available from 2006 onwards. In 2011 some 6.9 million outpatient treatments were carried out in hospitals. As outpatient departments in hospitals provide pre- and post-hospitalization treatments the prevalence rates follow a similar age-specific trend as hospital inpatient treatments. The pure demographic effect will lead to an increase in outpatient cases by 8 % in the tough and 12 % in the friendly scenario (Table 17).

Table 17 Changes in hospital outpatient treatment cases in Denmark between 2010 and 2025 – constant utilization rates

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Hospital outpatient treatment cases in million	6.7	7.2	7.5	7.6	0.5	0.8	0.9	7.9	12.3	13.5
Cases per inhabitant	1.2	1.3	1.3	1.3	0.1	0.1	0.1	5.6	6.7	8.1
Share women	0.57	0.56	0.56	0.55	0.0	0.0	0.0	-1.1	-1.8	-2.7
Share of elderly	0.35	0.40	0.41	0.42	0.1	0.1	0.1	15.4	19.0	22.0
Mean Age of patients	52.3	54.2	54.8	55.3	1.9	2.5	3.0	3.7	4.7	5.8
Source: StatBank Denmark; NEUJOBS demographic scenarios D10.1; calculations of DIW Berlin.										

In addition to outpatient departments in hospitals, practising GPs, practising medical specialists, psychologists, dentists and other health professions provide ambulatory care to the population. As GPs act as gatekeepers all patients (except in emergency cases) have to consult at first a GP. Approximately 70 % of all ambulatory contacts to health professionals are contacts to GPs (Table 18).

Table 18 Changes in the number of consultations to health professionals in Denmark – pure demographic effect

	2010	2025			changes 2025/2010			changes 2025/2010		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
		in millions						in %		
Number of outpatient consultations total	58,57	61,81	64,29	64,63	3,24	5,72	6,06	5,5	9,8	10,3
GP consultations	40,79	43,22	45,11	45,32	2,42	4,31	4,53	5,9	10,6	11,1
Dentist consultations of adult persons	3,90	4,05	4,17	4,20	0,16	0,27	0,30	4,0	7,0	7,8
Number of contacts to a specialist	5,27	5,53	5,73	5,75	0,26	0,46	0,48	5,0	8,8	9,2
Chiropractor consultations	1,97	1,98	2,03	2,03	0,01	0,05	0,06	0,4	2,7	2,9
Physiotherapists conculations	6,20	6,59	6,81	6,88	0,39	0,61	0,68	6,3	9,8	11,0
Psychologists consultations	0,41	0,41	0,42	0,42	0,00	0,01	0,01	0,4	2,6	1,6
Other health professions	0,03	0,03	0,03	0,03	0,00	0,00	0,00	3,9	6,6	7,7
Source: StatBank Denmark; NEUJOBS demographic scenarios D10.1; calculations of DIW Berlin.										

In 2010, in total some 59 million consultations of ambulatory health care professionals are reported, thereof 40.6 million contacts to GPs, 5.3 million contacts to practising specialists, and 6.2 million contacts to physiotherapists. Due to the ageing of the population the number of consultations will increase for all health professionals. In total an increase of 6 % in the tough and of 10 % in the friendly scenario is expected.

Germany

In Germany, in addition to data on inpatient hospital care, data on treatments in rehabilitation institutions by age-groups, gender and diagnosis are available for institutions with more than 100 beds. Medical rehabilitation is carried out in institutions and in ambulatory care facilities by - for example - physiotherapists or other therapeutically professions. In the past a shift from institutional rehabilitation care to ambulatory rehabilitation care could be observed. In the pure demographic scenario the share of institutional and ambulatory rehabilitation care will be held constant.

Data on consultations of health professionals by gender and age-groups are available for the insurants of one large social health insurance fund. Data on consultations of doctors – not subdivided by speciality - are available for 2008 to 2011, data on consultations of dentists only for the year 2010 (Schulz 2013c). The development in the demand for treatments of physicians and dentists can be shown using these utilization data. For the other areas of ambulatory care provision no data on consultations, for example of physiotherapists exist. Data on prescriptions of cure measures are used as proxy for ambulatory care provisions by therapists.

As shown in section 2.3, the German health workforce comprises also employees in the intermediate consumption industries of the health care sector. Thus, to calculate the future changes in health workforce also the employment in these industries have been taken into account. The changes in the demand for goods and services of the intermediate consumption industries of the health sector are calculated using the prescriptions of medical aids and appliances as proxy. The changes in the demand for goods and services of pharmacies as well as related intermediate industries are calculated using the prescriptions of drugs as proxy.

The demand for rehabilitation activities is expected to decline in the tough scenario and to increase in the friendly scenario. A similar development is expected for consultations of doctors, while visits to dentists will decline in both scenarios (Table 19). The decline in the number of visits to a doctor in the tough scenario is a little bit surprising. The decline in the number of population (size effect) has in this case a higher impact on the demand as the changing age-structure of the population (ageing effect).

The demand for therapeutically treatments as well as for medical aids and appliances will decline in the tough scenario and will increase in the friendly scenario. A high increase is expected for the demand for pharmaceuticals in both scenarios. Prescribed pharmaceuticals are only a part of the demand for goods and services of pharmacies.

Private financed over the counter consumption plays a significant role. It can be expected, that the demand for private financed drugs will increase in line with the prescribed drugs.

Table 19   Changes in the demand for acute health care activities between 2010 and 2025 - pure demographic effect (constant utilization rates)

	2010	2025			changes 2025/2010			changes 2025/2010		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
		in million						in %		
Rehabilitation days	41.8	40.9	43.0	43.0	-0.8	1.2	1.3	-2.0	2.9	3.0
Ambulatory care										
Doctors' consultations	1198.5	1164.3	1241.8	1238.4	-34.2	43.2	39.9	-2.9	3.6	3.3
Dentists' consultations	177.8	165.5	174.6	173.3	-12.3	-3.2	-4.5	-6.9	-1.8	-2.5
Prescriptions										
Person with prescriptions of medical aids and appliances	16.4	16.1	17.3	17.3	-0.3	0.9	0.9	-1.7	5.5	5.3
Cure prescriptions	38.4	37.9	40.4	40.3	-0.5	2.0	1.9	-1.3	5.1	5.0
Pharmaceuticals in DDD	40600.8	42286.1	45139.2	45460.3	1685.4	4538.5	4859.5	4.2	11.2	12.0
Source: Schulz 2013c.										

Italy

In Italy information on ambulatory care consultations are available for GPs, paediatricians, specialists, dentists, diagnostic examinations and rehabilitation services. Between 2010 and 2025, the demand for GP activities is expected to increase by 5 % in the tough and 11 % in the friendly scenario, while the consultations of paediatricians is expected to decline by 14 % due to the decrease in the number of children (Table 20). Dental services are expected to stay nearly constant in the tough scenario and to increase by around 6 % in the friendly scenario. The ageing of the population will lead to an increase in the demand for rehabilitation measures by 8 % in the tough and 15 % in the friendly scenario.

Table 20   Changes in the number of examinations by type of ambulatory health care activities – pure demographic effect

		2025		Changes 2025/2010		Changes 2025/2010	
	2010	tough	friendly	tough	friendly	tough	friendly
		in millions				in %	
Generic medical examinations	15.18	15.90	16.84	0.72	1.65	4.73	10.87
Paediatric examinations	2.30	1.98	2.31	-0.33	0.01	-14.14	0.26
Diagnostic exams	16.17	17.29	18.30	1.13	2.13	6.96	13.17
Specialist medical examinations	11.16	11.84	12.56	0.68	1.39	6.08	12.48
Orthodontist services	4.02	4.06	4.28	0.04	0.26	0.99	6.41
Rehabilitation services	24.69	26.69	28.34	2.00	3.65	8.11	14.81
Source: Coda Moscarola 2013.							

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Poland

In Poland data on ambulatory care are available for primary care doctors, specialists and dentists. Overall, the annual number of primary care consultations over the year was slightly higher than 152,000 in 2010.The number of secondary care consultation was almost 50 % lower, and the number of dentist's consultations constituted only one fifth of the number of primary care consultations. Elderly account for almost one third of the primary care patients and one fourth of the secondary care patients.

In ambulatory care a different situation in the case of friendly and tough variants can be seen. For primary and secondary (specialist) care there are differences even in the direction of change – in the friendly variant the forecasted utilization increases, and decreases in tough scenario (Table 21). For dentistry all variants show declining trends. As above, the highest changes in demand for ambulatory specialty visits are expected in the case of older patients (70+).

Table 21   Changes in ambulatory visits in Poland between 2010 and 2025 –constant utilization scenario

Indicators	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		friendly	tough	Europop	friendly	tough	Europop	friendly	tough	Europop
Primary care										
Number of visits (million)	152.23	161.46	151.98	162.01	9.23	-0.25	9.78	6.06	-0.16	6.43
Share of females	55%	56%	56%	55%	0.43	0.86	-0.06	0.77	1.56	-0.1
Share of elderly (70+)	17%	22%	21%	23%	5.13	4.36	5.82	30.22	25.65	34.23
Ambulatory										
Number of visits (million)	95.59	100.39	95.27	95.59	4.8	-0.33	0	5.02	-0.34	0
Share of females	61%	60%	61%	60%	-0.29	0.11	-0.8	-0.49	0.19	-1.32
Share of elderly (70+)	16%	21%	20%	22%	5.07	4.22	5.72	31.72	26.4	35.77
Dentistry										
Number of visits (million)	31.23	29.97	28.58	29.87	-1.26	-2.65	-1.36	-4.04	-8.49	-4.36
Share of females	55%	55%	55%	54%	-0.07	0.15	-0.33	-0.13	0.28	-0.6
Share of elderly (70+)	5%	8%	7%	8%	2.38	2.05	2.7	45.08	38.77	51.07
Source: Golinowska et al 2013.										

Slovakia

Utilization of ambulatory care is based on data on annual contacts from the European Health Interview Survey (EHIS) from 2008. Radvanský and Dováľová used the population structure by age and gender to estimate the total number of contacts to doctors. The significantly higher population level in the friendly scenario combined with a slower aging process results in higher demand for care than in the tough scenario (Table 22). The highest increase can be observed in demand for specialists, at 10.2 %. The increases in demand for GPs is slightly lower (9.6 %). Only a low increase in demand is observed for dental care (2.6 % in the friendly scenario).

In the tough scenario, the increase of demand is significantly lower. The number of specialists' consultations increases by around 5 %, and the number of contacts to a GP by 4.3 % between 2010 and 2025. The demand for dental care is expected to decline by 2.1 % during the next 15 years. This is caused by a stronger ageing effect and the decline in total population. In contrast to general health care, the demand for dental care decreases with age.

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Table 22 Changes in the number of consultations to a doctor or dentists in Slovakia – constant utilization rates

	2010	2025		changes 2025/2010		changes 2025/2010	
		tough	friendly	tough	friendly	tough	friendly
		in million				in %	
GP consultations	39.5	41.2	43.3	1.7	3.8	4.31	9.63
Specialist consultations	29.2	30.7	32.2	1.4	3.0	4.89	10.21
Dentist consultations	22.6	22.1	23.2	-0.5	0.6	-2.09	2.62
Source: Radvanský and Dováľová 2013.							

4.5   Impact of changing demand on the needed health workforce

The approach employed to calculate the changes in employment is different between the countries and depends on the data availability. The following section presents the results for each country separately.

Denmark

In Denmark information on employees by facilities and occupations is rare. In addition to the EU LFS Statistics Denmark provides data on hospital employment by occupations. These data are used to calculate the number of total hospital days per employee in 2010. This ratio was held constant to calculate the needed hospital staff based on changes of hospital utilization measured in total hospital days. According to the hospital statistics, in 2010 some 115,000 persons were employed in hospitals thereof 15,000 physicians and 38,000 nurses (Table 23). As there is no detailed information on personnel needed or specific treatments, it is expected that the current occupational structure will be constant over time. Thus, the employment in all occupations will increase like the total employment in hospitals. This is also assumed for midwives, because in Denmark the number of children aged under 5 years will increase in all demographic scenarios (contrary to the situation in Germany). The needed hospital personnel will increase by 11,000 in the tough scenario and 17,000 in the friendly scenario. The increase in hospital demand requires additional nursing staff of 3,600 in the tough and 5,800 in the friendly scenario. To meet the demand the number of physicians employed in hospitals has to increase by 1,400 in the tough and 2,200 in the friendly scenario.

Information on practising physicians and dentists and employment in other ambulatory health care activities is rare. Only the Health Systems in Transition report for Denmark (HiT Denmark 2012) mentioned the number of general practitioners (3,600) and the number of practising dentists (3,300). Thus, only the development of the total employment needed for "medical and dental care activities" can be calculated. In the tough scenario additional 3,200 employees are needed, and in the friendly scenario

5,600. The demand for primary care activities by general practitioners will be higher than for dentists' activities.

Table 23   Changes in demand for human health care personnel in Denmark

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
				Employment in hospital activities (persons)						
Physicians	14 592	15 971	16 800	17 005	1 379	2 207	2 413	9.5	15.1	16.5
Nurses	38 126	41 730	43 893	44 430	3 604	5 767	6 304	9.5	15.1	16.5
Pharmacists	335	366	385	390	32	51	55	9.5	15.1	16.5
Chiropractors	24	27	28	28	2	4	4	9.5	15.1	16.5
Dentists	93	102	108	109	9	14	15	9.5	15.1	16.5
Occupational therapist	1 189	1 301	1 369	1 386	112	180	197	9.5	15.1	16.5
Physiotherapist	1 969	2 155	2 267	2 295	186	298	326	9.5	15.1	16.5
Midwives	1 532	1 677	1 764	1 785	145	232	253	9.5	15.1	16.5
Bioanalysts	5 714	6 254	6 578	6 658	540	864	945	9.5	15.1	16.5
Radiographer	1 428	1 563	1 645	1 665	135	216	236	9.5	15.1	16.5
Other health professions	276	302	317	321	26	42	46	9.5	15.1	16.5
Assistants	958	1 049	1 103	1 117	91	145	158	9.5	15.1	16.5
Social and health care assistants	14 518	15 890	16 714	16 918	1 372	2 196	2 400	9.5	15.1	16.5
Other patient oriented functions	14 547	15 922	16 747	16 952	1 375	2 200	2 405	9.5	15.1	16.5
Administrative and other staff	19 956	21 842	22 974	23 255	1 886	3 019	3 299	9.5	15.1	16.5
Total personnel (needed)	115 257	126 151	132 692	134 313	10 894	17 435	19 056	9.5	15.1	16.5
				Employment in ambulatory care activities (persons)						
Medical and dental care activities total	57 122	60 282	62 702	63 030	3 160	5 580	5 908	5.5	9.8	10.3
thereof										
GP (HiT 2012)	3 600	3 814	3 981	4 000	214	381	400	5.9	10.6	11.1
Dentist (private practice) (HiT 201	3 300	3 433	3 530	3 556	133	230	256	4.0	7.0	7.8
				Employment in hospital and ambulatory care activities (persons)						
Total hospital and ambulatory care	172 379	186 433	195 394	197 344	14 054	23 015	24 965	8.15	13.35	14.48
Source: Schulz 2013 b.										

Germany

In Germany data on employment by health care facilities and occupations are available from the Health Labour Account (HLA), but data on utilization are not available in the same demarcation. The demand for hospital personnel can be calculated using the changes in total hospital days, and constant ratio of total hospital days to staff needed. The same approach can be established for rehabilitation care in institutions. Thus, the development of staff needed for institutional care can be estimated directly using changes in utilization. The same approach can be employed for personnel in offices of physicians and offices of dentists using changes in the number of consultations and a constant ratio of consultation per doctor or dentists in 2010.

For the demand for workforce in the other areas of human health care activities, proxies have to be used. For offices of practitioners and intermediate consumption industries prescription of drugs, medical appliances and therapeutically treatments are used to calculated changes in utilization and personnel needed. In total, information on needed personnel based on changing utilization is available for 76 % of the human health care employment. The demographic based change in personnel needed in the other not covered health care facilities is estimated by transferring the average change (in %) in personnel needed calculated out of the covered activities in facilities to the not covered once.

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The expected demographic decline in the tough scenario will lead to a decline in human health care workforce needed. The pure demographic effect results in a reduction of personnel needed by 48,000 persons (Table 24). More than half of the decline is concentrated on assistant occupations like medical assistant, laboratory assistant or pharmaceutical assistant (-27,000), while for nurses an increase is expected (+8,000).

The demographic growth in the friendly scenario leads to an increase in the demand for human health care personnel by 229,000 during the next 15 years. All kind of health professions will experience a growth in demand, in particular nurses and other nursing occupations (+85,000).

Table 24   Changes in health care personnel needed in Germany – constant utilization scenario

	Headcounts in 1000 persons				FTE in 1000			
	2010	Changes 2025/2010			2010	Changes 2025/2010		
		tough	friendly	Europop		tough	friendly	Europop
Total of health care personnel	3910	-48	229	223	2996	-34	176	172
physicians, pharmacists	496	-9	19	25	437	-7	23	22
assistants (medical,laboratory,pharmaceutical)	810	-27	28	21	590	-20	18	15
nurses, geriatirc nurses, health care and nursing aid	985	8	85	88	725	5	62	64
physiotherapist, therapeutic prof., therapists	349	-4	19	19	251	-3	13	13
health craftsmen, other professions in health care	1270	-18	69	68	993	-15	54	52
Source: Federal Statistical Office, Health personnel accounts; calculation of DIW Berlin.								

The development of demand for human health care will be different in institutional care and ambulatory care facilities. A relatively high demand is expected for hospital personnel and rehabilitation personnel. Also in the tough scenario an increase in employment needed in these institutions of about 13,000 persons is expected (Table 25). In the friendly scenario the demand is expected to be higher at 116,000 additional personnel. Again, in both scenarios the demand for nurses is higher (absolute and in %) than for physicians or assistants.

The demand for personal in offices of physicians and dentists will decline in all occupational groups in the tough scenario. The decline amounts to 44,000 persons by 2025. In the friendly scenario still an increase is expected, in total 18,000 additional personnel is needed.

Table 25 Changes in the demand for health personnel in selected facilities in Germany

	2010	2025			changes 2025/2010			changes 2025/2010		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
		in thousand						in %		
Employment in institutional care (hospitals and rehabilitation institutions)										
Total of health care personnel	1 291	1 304	1 407	1 411	13	116	120	1.01	9.01	9.30
physicians, pharmacists	175	177	191	192	2	16	17	1.22	9.34	9.65
assistants (medical,laboratory,pharmaceutical)	107	108	117	117	1	10	10	1.27	9.43	9.75
nurses, geriatric nurses, health care and nursing aid	669	678	733	735	9	64	66	1.32	9.54	9.86
physiotherapist, therapeutic prof., therapists	80	80	85	85	0	5	5	-0.52	6.00	6.16
health craftsmen, other professions in health care	259	261	281	282	2	22	23	0.82	8.57	8.84
Employment in offices of physicians and dentists										
Total of health care personnel	1 040	996	1 058	1 052	-44	18	12	-4.27	1.74	1.14
physicians, pharmacists	206	198	210	209	-8	4	3	-4.09	1.96	1.37
assistants (medical,laboratory,pharmaceutical)	585	560	595	592	-25	10	7	-4.26	1.73	1.11
nurses, geriatric nurses, health care and nursing aid	37	36	38	38	-1	1	1	-3.12	3.31	2.93
physiotherapist, therapeutic prof., therapists	8	8	8	8	0	0	0	-2.92	3.59	3.25
health craftsmen, other professions in health care	203	194	206	205	-9	3	2	-4.29	1.68	1.05
Employment in offices of practitioners										
Total of health care personnel	381	376	401	400	-5	20	19	-1.24	5.13	5.06
physicians, pharmacists	20	20	21	21	0	1	1	-	-	-
assistants (medical,laboratory,pharmaceutical)	15	15	16	16	0	1	1	-1.24	5.13	5.06
nurses, geriatric nurses, health care and nursing aid	79	78	83	83	-1	4	4	-1.24	5.13	5.06
physiotherapist, therapeutic prof., therapists	187	185	197	196	-2	10	9	-1.24	5.13	5.06
health craftsmen, other professions in health care	80	79	84	84	-1	4	4	-1.24	5.13	5.06
Source: Schulz 2013c.										

Due to the ageing of the population in general an increase in therapeutically measures is expected, but in the tough scenario the reduction in population size has a compensating effect. The personnel needed in practices of practitioners is expected to decline by 5,000. In the friendly scenario the population ageing is combined with an increase in population size and additional personnel is needed in offices of practitioners, in total 20,000 by 2025.

Italy

In Italy the expected change in utilization is calculated for selected areas of the health sector, namely GPs, paediatricians, dentists, specialists, hospital care activities, rehabilitation services and diagnostic examinations. But the available data on employment do not allow to disentangle properly personnel involved in ambulatory care from personnel in hospital care and first aid, as personnel is partitioned by structure of pertinence and many institutions often provides all kind of services. In the projections Coda Moscarola (2013) assumes that the demand for:

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- ✓ GP physicians evolves according to the demand for GP's examinations
- ✓ Paediatricians evolves according to the demand for paediatric examinations
- ✓ Physicians, nurses, as well as personnel of inspection and surveillance in ambulatory and hospital care vary according to the demand for hospital admittances for 50 per cent and for specialist examinations for the other 50 per cent.
- ✓ Technical personnel in ambulatory and hospital care vary according to the demand for hospital admittances for 50 per cent and for diagnostic examinations for the other 50 per cent.
- ✓ Personnel in rehabilitation services varies according to the demand for rehabilitation services
- ✓ Physicians in dental studios changes according to the demand for dental examinations.

Under the tough scenario, in 2025 we expect to need 47,700 GPs, 6,600 paediatricians, 188,400 medical doctors in hospitals and ambulatory care and 59,100 dentists. In the friendly scenario, the increase would be even higher. In 2025 we expect to need 50,500 general practitioners, 7,700 paediatricians, 201,600 medical doctors in hospitals and ambulatory care and 62,300 dentists. The expected need for nurses in 2025 will reach 365,400-391,100 followed by the demand for rehabilitation personnel that will be for 52,800-56,000, for health technicians about 49,700-53,100, and services and inspection workers about 12,100-13,000 (Coda Moscarola 2013) (Table 26).

Table 26 Changes in the demand for health care personnel in Italy – constant utilization rates

	2010	2025		changes 2025/2010		changes 2025/2010 in %	
		tough	friendly	tough	friendly	tough	friendly
Physicians	284 360	301 728	322 050	17 368	37 690	6.11	13.25
GPs	45 536	47 692	50 488	2 156	4 952	4.73	10.87
Paediatricians	7 631	6 552	7 651	-1 079	20	-14.14	0.26
Specialists in hospital and ambulatory care	172 657	188 371	201 622	15 714	28 965	9.10	16.78
dental studios	58 536	59 113	62 289	577	3 753	0.99	6.41
Non-medical health professions	440 187	479 968	513 232	39 781	73 045	9.04	16.59
Nurses	334 918	365 401	391 104	30 483	56 186	9.10	16.78
Health technicians	45 342	49 671	53 109	4 329	7 767	9.55	17.13
Rehabilitation personnel	48 824	52 782	56 053	3 958	7 229	8.11	14.81
Surveillance and inspection	11 103	12 114	12 966	1 011	1 863	9.11	16.78
Total	724 547	781 696	835 282	57 149	110 735	7.89	15.28
Source: Coda Moscarola 2013.							

Poland

In Poland the future health care personnel is calculated focussing on health professionals by selected occupations active in hospitals and in ambulatory health care services. In total data on 308,000 health care staff were collected and used for the calculation. According to the EU LFS some 714,000 persons were engaged in human health care in 2010. Thus, in the estimation 43 % of the human health care staff was included.

In Poland the demand for hospital personnel is expected to be higher than the demand for personnel in ambulatory health care facilities (Table 27). The demand for hospital personnel is based on changes in total hospital days, but the demand for midwives is calculated using the changes in utilization in hospital care related to birth giving. Due to the expected decline in new-borns the demand for midwives is expected to decline markedly in the tough (-26 %) as well as in the friendly (-19 %) scenario. The demand for physicians, nurses and dentists employed in hospitals will grow by 2.9 % in the tough scenario and about 10 % in the friendly scenario.

**Table 27   Changes in hospital and ambulatory health personnel in Poland –
constant utilization rates**

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		friendly	tough	Europop	friendly	tough	Europop	friendly	tough	Europop
				Hospital care personnel						
Physicians	69 032	75 909	71 045	76 528	6 877	2 013	7 496	9.96	2.92	10.86
Nurses	124 840	137 276	128 480	138 396	12 436	3 640	13 556	9.96	2.92	10.86
Midwives	16 585	13 420	12 320	13 024	- 3 165	- 4 265	- 3 561	-19.08	-25.72	-21.47
Dentists	615	676	633	682	61	18	67	9.92	2.93	10.89
Total	211 072	227 281	212 478	228 630	16 209	1 406	17 558	7.68	0.67	8.32
				Ambulatory care personnel						
Primary care doctors	21 169	22 453	21 135	22 529	1 284	- 0 34	1 360	6.07	-0.16	6.42
Specialists	59 545	62 533	59 342	62 787	2 988	- 203	3 242	5.02	-0.34	5.44
Dentists	16 546	15 878	15 142	15 824	- 668	-1 404	- 722	-4.04	-8.49	-4.36
Total	97 260	100 864	95 619	101 140	3 604	- 1 641	3 880	3.71	-1.69	3.99
				Hospital and ambulatory care						
Physicians	149 746	160 895	151 522	161 844	11 149	1 776	12 098	7.45	1.19	8.08
Dentists	17 161	16 554	15 775	16 506	- 607	-1 386	- 655	-3.54	-8.08	-3.82
Nurses, Midwives	141 425	150 696	140 800	151 420	9 271	- 625	9 995	6.56	-0.44	7.07
Total	308 332	328 145	308 097	329 770	19 813	- 235	21 438	6.43	-0.08	6.95
Source: Golinowska et al 2013.										

In ambulatory care the changes in the demand for personnel differs between the tough and friendly scenario. In the tough scenario a decline in personnel needed is expected, in particular for dental care activities (-8 %). In the friendly scenario in general an increase in demand for health care personnel is expected, but the demand for dentists is still expected to decline (-4 %).

Golinowska et al. (2013) calculated the demand for hospital personnel additional under the assumption (a) of changes in the length of hospital stay and also under the assumption (b) of changes in both, length of stay and prevalence. Taking the trend of reduction of length of hospital stay into accounts leads to a significant decline in the number of needed hospital personnel. This will be nearly compensated if additionally

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the trend of increasing hospitalisation rates is taken into account. Then the result is nearly the same as under constant utilization rates (see Golinowska et al 2013).

Slovakia

In Slovakia the demand for hospital personnel is calculated using the changes in total hospital days under to assumptions (a) constant utilization rates and (b) the so called dynamic approach taking past trends in hospitalization and length of stay into account. In both scenarios the ratio of personnel to total hospital days is held constant. The demand for personnel employed in ambulatory care facilities is expected to increase in line with the development of contacts to GPs, specialists and dentists. As data on physicians and dentists working in ambulatory care is rare, the average changes in the number of consultations are transferred to the employment in medical and dental care activities. Also for ambulatory care a dynamic approach is applied assuming simply a decline in utilization of 5 % until 2030 (see Radvanský and Dováľová 2013).

As in other countries the demand for hospital personnel is expected to increase to a higher degree than the demand for ambulatory health care personnel (Table 28). Using constant utilization rates the hospital personnel needed is expected to increase by 20 % in the tough scenario and 23 % in the friendly scenario, while the demand for personnel in ambulatory care is expected to increase by 5 % (tough) and 12 % (friendly). The high increase in hospital workforce can be partly traced back to the high dynamic between 2010 and 2011. According to the LFS the hospital staffs has increased by around 5,000 persons. Taking past trends in length of hospital stay and hospitalization rates into account leads to a significant lower increase in hospital personnel needed, while in ambulatory care and other health care activities a slightly higher dynamic is calculated.

Table 28   Changes in the demand for human health care personnel in Slovakia

	2010	2025		changes 2025/2010		changes 2025/2010	
		tough	friendly	tough	friendly	tough	friendly
		in persons				in %	
		constant utilization rates					
Hospital activities	65.1	78.1	80.2	13.0	15.1	19.97	23.20
Medical and dental practice activities	21.0	22.1	23.5	1.1	2.5	5.24	11.90
Other human health activities	14.3	14.9	16.0	0.6	1.7	4.20	11.89
Total	100.4	115.1	119.7	14.7	19.3	14.64	19.22
		dynamic approach					
Hospital activities	65.1	67.5	71.3	2.4	6.2	3.69	9.52
Medical and dental practice activities	21.0	22.4	23.5	1.4	2.5	6.67	11.90
Other human health activities	14.3	15.4	16.0	1.1	1.7	7.69	11.89
Total	100.4	105.3	110.8	4.9	10.4	4.88	10.36
Source: Radvanský and Dováľová 2013.							

5 Estimation of labour supply in curative health care

In the next two sections 5 and 6 the expected changes in the health workforce supply is discussed. As mentioned above (in section 3) we are using a top down approach to calculate the labour supply in health care. This approach requires a stepwise procedure:

At first the changes in total labour force have to be calculated. The two demographic scenarios, friendly and tough, provide data on the changes of the population in working age differentiated by education level. The EU LFS provides information on the labour force participation of men and women differentiated by age-groups and education level. Based on this information the future labour force is calculated in two variants a) using constant labour force participation rates, and b) taken changes in labour force participation in particular of females and elderly into account. In section 5 this calculation of the total labour force is carried out.

The total labour force provides information on the size of the workforce available. The labour force comprises employed and unemployed people. To calculate the total employment and the employment in health care sector, the labour force has to be split into employment and unemployment. This requires a model that takes into account the overall economic development and that allows for the simultaneous modelling of the supply and demand side of the labour market. In the NEUJOBS project the so called New Economic Model of Evaluation by Sectorial Interdependency and Supply (NEMESIS) model is used (Boitier et al 2013). The NEMESIS model provides information on the total employment and the employment broken down by broad groups of industries for all EU countries. Based on this information the changes in employment in the health care sector are calculated in section 6.

5.1 Working age population

In statistics comparing the situation across the EU Member States, the potential workforce is defined as people between 15 and 64 years old. In the past decades labour force participation of people over 64 was low and in some countries nearly zero. This is expected to change significantly in the future due to modifications in the pensions systems. Several countries have implemented regulations that increase – often stepwise - the age required to receive old age pensions. The activity rates have already increased in the older working age groups. Therefore we also provide figures for an extended potential workforce, people aged 15 to 69 (Table 29).

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Table 29   Potential workforce and mean age in 2010 and 2025

	2010	2025		
		Friendly	Tough	Europop
Potential workforce I (persons 15 - 64 in millions)				
Denmark	3.63	3.64	3.57	3.61
Germany	53.88	50.00	47.73	49.31
Italy	39.66	41.39	39.48	40.48
Poland	27.22	24.66	23.79	24.45
Slovakia	3.93	3.75	3.63	3.71
Total	128.32	123.43	118.20	121.57
EU27	334.50	330.02	316.58	327.25
Mean age (15-64)				
Denmark	40.5	40.3	40.4	40.5
Germany	40.8	42.3	42.5	42.5
Italy	40.9	41.9	42.2	42.2
Poland	39.3	40.8	40.9	40.9
Slovakia	38.9	41.1	41.2	41.3
Total	40.5	41.8	42.0	42.0
EU27	40.1	41.1	41.3	41.3
Potential workforce II (persons 15 - 69 in millions)				
Denmark	3.9	4.0	3.9	3.9
Germany	58.8	55.4	53.0	54.8
Italy	42.8	45.2	43.2	44.3
Poland	28.6	27.2	26.2	27.0
Slovakia	4.1	4.1	4.0	4.1
Total	138.3	135.9	130.3	134.1
EU27	358.4	360.9	346.7	358.4
Mean age (15-69)				
Denmark	42.6	42.5	42.6	42.7
Germany	43.0	44.8	45.0	45.0
Italy	42.9	44.1	44.4	44.4
Poland	40.6	43.2	43.3	43.4
Slovakia	40.4	43.3	43.4	43.5
Total	42.4	44.1	44.4	44.4
EU27	41.9	43.4	43.6	43.6
Source: Eurostat, Europop; NEUJOBS D10.1 (version March 2013); calculation of DIW Berlin.				

In the EU27 the potential workforce amounts to 335 million (15-64) and 358 million (15-69) in 2010. This is expected to decline slightly through 2025 in all demographic scenarios. Generally, the same is true for the five studied countries, although an increase in the potential workforce is expected for Italy in the friendly scenario. The potential workforce is also influenced by the ageing of the population. The mean age increases in all countries but Denmark.

The differentiation of the potential workforce into population in young working age (15-24 years), prime working age (25-54 years) and old working age (55-64 or 55-69 years) gives an impression of the shift in age-structure of the potential workforce (Table 30).

Table 30   Population in young, prime and old working age in 2010 and 2025 (in 1000)

	2010	2025			Changes 2025/2010			Changes 2025/2010		
		Friendly	Tough	Europop	Friendly	Tough	Europop	Friendly	Tough	Europop
	in 1000	in 1000			in 1000			in %		
Population in young working age (15-24)										
Denmark	677	694	681	683	16	3	5	2.4	0.5	0.8
Germany	9 252	7 739	7 354	7 441	-1 513	-1 898	-1 811	-16.4	-20.5	-19.6
Italy	6 086	6 669	6 357	6 342	583	271	257	9.6	4.5	4.2
Poland	5 486	3 797	3 673	3 727	-1 689	-1 813	-1 759	-30.8	-33.1	-32.1
Slovakia	788	563	548	552	- 225	- 240	- 236	-28.6	-30.5	-29.9
Total	22 289	19 462	18 612	18 745	-2 827	-3 677	-3 544	-12.7	-16.5	-15.9
EU27	60 357	56 539	54 307	55 058	-3 817	-6 049	-5 298	-6.3	-10.0	-8.8
Population in prime working age (25-54)										
Denmark	2 230	2 176	2 133	2 161	- 54	- 97	- 69	-2.4	-4.3	-3.1
Germany	34 895	29 167	27 559	28 782	-5 727	-7 336	-6 112	-16.4	-21.0	-17.5
Italy	26 176	25 136	23 731	24 553	-1 040	-2 444	-1 622	-4.0	-9.3	-6.2
Poland	16 808	16 475	15 845	16 311	- 332	- 963	- 497	-2.0	-5.7	-3.0
Slovakia	2 479	2 495	2 412	2 469	15	- 67	- 10	0.6	-2.7	-0.4
Total	82 588	75 449	71 680	74 276	-7 139	-10 908	-8 311	-8.6	-13.2	-10.1
EU27	213 365	202 526	192 821	200 957	-10 839	-20 544	-12 408	-5.1	-9.6	-5.8
Population in old working age I (55-64)										
Denmark	723	766	757	771	43	34	48	6.0	4.7	6.6
Germany	9 732	13 093	12 818	13 087	3 361	3 086	3 355	34.5	31.7	34.5
Italy	7 395	9 587	9 394	9 580	2 193	2 000	2 186	29.7	27.0	29.6
Poland	4 929	4 387	4 269	4 415	- 542	- 660	- 514	-11.0	-13.4	-10.4
Slovakia	661	688	672	693	27	11	31	4.1	1.7	4.7
Total	23 439	28 522	27 910	28 545	5 082	4 471	5 106	21.7	19.1	21.8
EU27	60 777	70 955	69 456	71 237	10 178	8 679	10 460	16.7	14.3	17.2
Population in old working age II (55-69)										
Denmark	1 022	1 087	1 072	1 095	66	50	74	6.4	4.9	7.2
Germany	14 612	18 524	18 113	18 535	3 912	3 501	3 923	26.8	24.0	26.8
Italy	10 558	13 430	13 146	13 429	2 872	2 589	2 871	27.2	24.5	27.2
Poland	6 308	6 889	6 690	6 953	581	382	645	9.2	6.0	10.2
Slovakia	877	1 023	997	1 032	146	120	155	16.7	13.7	17.7
Total	33 377	40 953	40 018	41 044	7 576	6 641	7 667	22.7	19.9	23.0
EU27	84 726	101 872	99 590	102 393	17 146	14 864	17 667	20.2	17.5	20.9
Source: Eurostat, Europop2010; NEUJOBS D10.1 and 10.2 (version March 2013); calculation by DIW Berlin.										

Poland and Slovakia will experience a dramatic decline in the number of people between 15 and 24 years old. In Poland the reduction is expected to be 31 % in the friendly and 33 % in the tough scenario. In Slovakia the reduction is at 29 % (friendly) and 31 % (tough) only slightly lower. Also Germany shows a marked decline in the young population at 16 % in the friendly and 21 % in the tough scenario. In contrast, Italy and Denmark will realize an increase in the number of young people. The potential of people who are able to enter the labour market in the future will decline in the five countries in total by 2.8 million (friendly) and 3.7 million (tough).

Germany will experience a marked decline in prime age potential workforce. It is expected that the German population in prime working age will decline by 5.7 million in the friendly scenario and 7.3 million in the tough scenario. The population in prime working age will decline also in the other studied countries in both scenarios, except for Slovakia in the friendly scenario. In total, in the five countries the population in working age is expected to decline by 7.1 million in the friendly and by 10.9 million in the tough scenario.

The population in old working age is expected to increase in all five countries and all scenarios due to the ageing of the population, except Poland in the age-group 55-64 years. In total, in the five countries together the population in old working age (55-69 years) will increase by 7.6 million in the friendly and 6.6 million in the tough scenario.

The demographic projection (Huisman et al 2013; D10.2) provides also information on the population by education level. Higher educated people show different labour force participation behaviour than low educated people. In particular high educated women are, to a markedly greater share, active at the labour market. Therefore the calculation of the future labour force has to take into account the changes in education level of the population.

In 2010 the share of higher education in population aged 15-74 years ranges from 12% in Italy to 27% in Denmark. Females realized a higher share than males, except Germany. For all studied countries an increase in the share of higher educated people is assumed. In particular the framework conditions of the friendly scenario support the shift to higher education. In 2025 the share of higher educated people in population aged 15-74 will range from 18% in Italy to 36% in Denmark (Table 31).

Table 31   Share of higher educated people (ISCED 5+6) in 15-74 years old population

	2010			2025 Tough scenario			2025 Friendly scenario		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Denmark	25.15	29.22	27.18	29.99	37.36	33.67	32.88	40.67	36.76
Germany	25.36	18.81	22.09	25.19	22.66	23.93	29.66	25.76	27.72
Italy	11.03	13.02	12.03	12.93	17.72	15.34	16.08	19.98	18.04
Poland	16.05	21.72	18.95	21.11	31.11	26.25	24.65	33.25	29.05
Slovakia	13.44	15.69	14.59	15.17	21.95	18.62	19.03	24.39	21.75
Source: NEUJOBS population projection D10.2 (Huisman et al 2013)									

5.2   Changes in activity rates

According to the definition of the International Labour Organisation people are classified as active at the labour market, if they are working at least one hour per week or if they are unemployed, but searching for a job. That means, also marginal employment is included. The activity rates (or labour force participation rates), show the share of the employed and unemployed people in the population in the age-

groups. Figure 7 shows the activity rates of males in the five studied countries in 2011. In general, in Denmark and Germany men realized the highest activity rates during the working life compared to the other three studied countries. In Italy, the activity rates are lower than in the other countries, in particular in the age-group 20-34. In Poland the male activity rates are relatively low in the age-groups 45-65. The high differences in activity rates in the youngest age-group, 15-19 years, can be explained by different accounting methods used in the studied countries. The countries use different approaches in the accounting of people who are partly in education and partly or temporarily employed, some countries classify such people as people in education and therefore not active at the labour market and some countries classify them as "employed". Thus, the activity rates of the young have to be interpreted cautiously. The activity rates of men differ only slightly between the education levels.

Figure 7   Male activity rates 2011
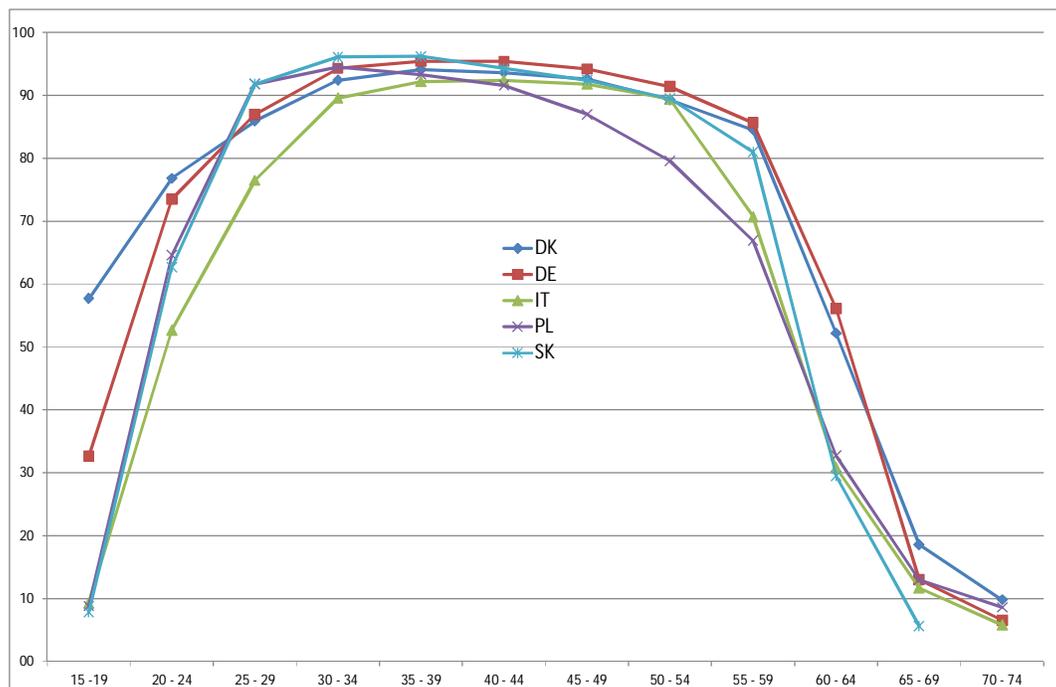
Source: Eurostat; LFS, calculation of DIW Berlin.

Unlike the activity rates of men the activity rates of women vary significantly across the studied countries (Figure 8). In 2011, Italy showed the lowest activity rates in all age-groups. Slovakia showed low activity rates in the birth giving age-groups, but thereafter a marked increase in labour force participation. Poland realized activity rates like Germany in the middle age-groups, but showed a noticeable decline in activity from the age-group 50-54 years onwards. Denmark realized the highest share of active women in population in all age-groups. The labour force participation rates of women depend on the education levels. Highly educated women realized activity rates that were close to male activity rates.

Figure 8   Female activity rates 2011
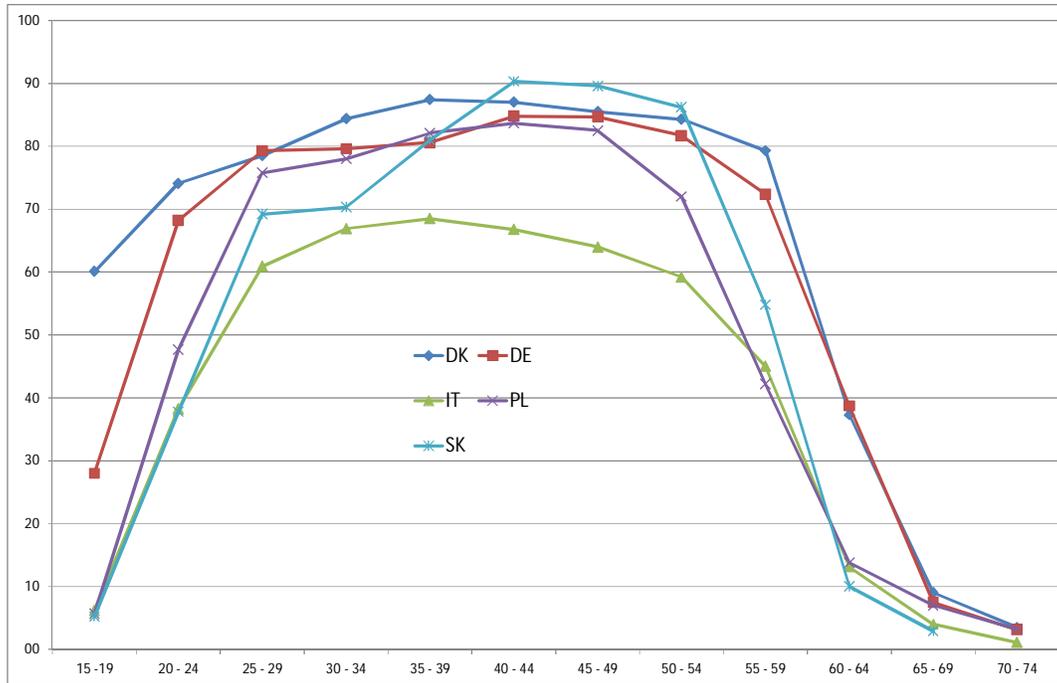
Source: Eurostat; LFS, calculation of DIW Berlin.

Figure 9   Changes in male activity rates between 2000 and 2011
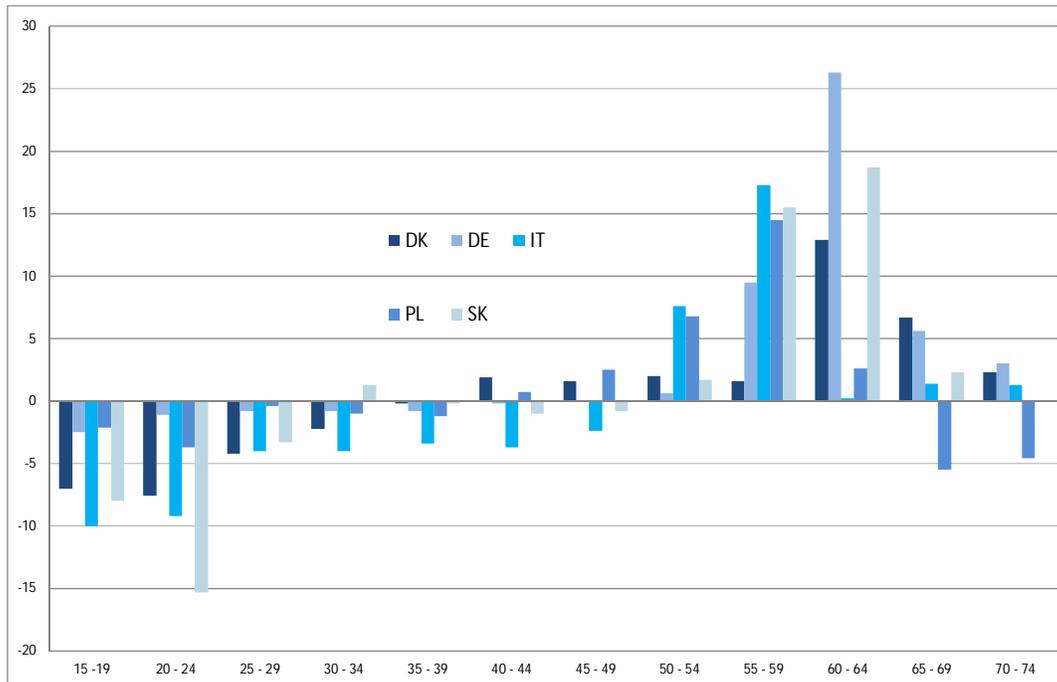
Source: Eurostat; LFS; calculation of DIW Berlin.

The labour force participation behaviour has changed during the last decade. In particular, the activity rates of people in older working ages increased for both men and women. The main reason is that in most European countries the pension system was changed and the regular age for retirement was increased. Due to the changes in the pension systems elderly stay longer in the labour market. The activity rates increased in particular in the 55-59 and 60-64 age-groups in all countries but Poland. In the young working ages the activities rates declined for both men and women in all countries, except females in Germany. In the prime working ages only marginal changes in male activity rates were observed between 2000 and 2011, while the female activity rates increased in all countries but Slovakia. The changes in female activity rates can be traced back to changes in the participation behaviour of mothers (with young children), and the increase in the share of higher educated women.

Figure 10 Changes in female activity rates between 2000 and 2011
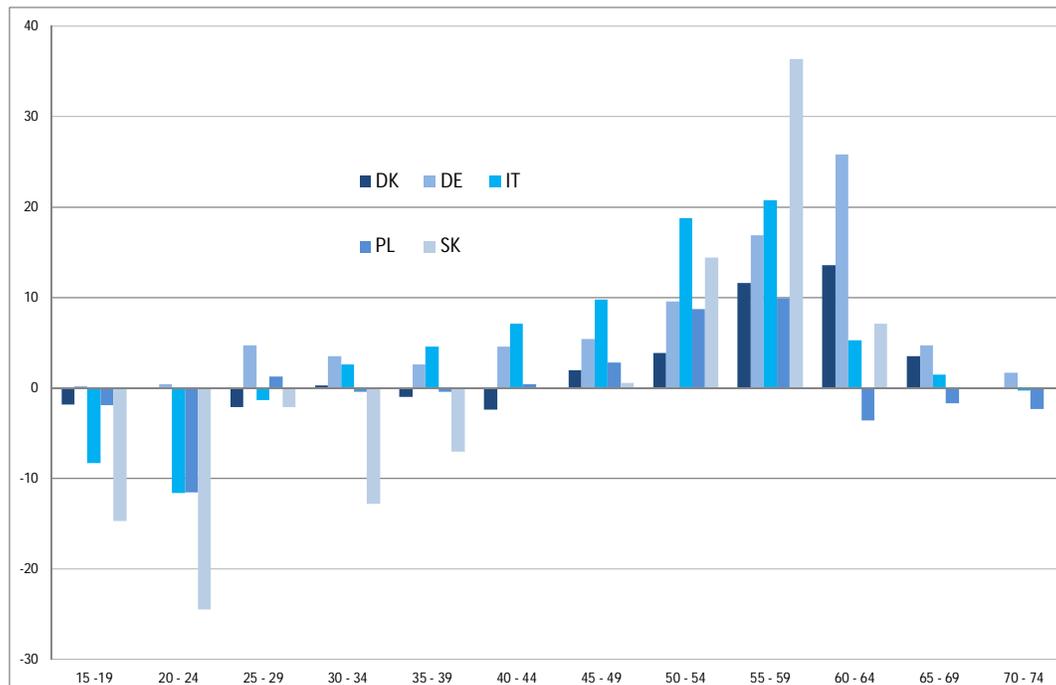
Source: Eurostat; LFS; calculation of DIW Berlin.

5.3   Development of total workforce

The future labour force is calculated using the demographic scenarios friendly and tough differentiated by gender, age-groups and education level as well as the activity rates in the same demarcation. We calculated the labour force in two ways: firstly using constant activity rates of 2010 (because the population base year is 2010), and secondly taking the changes in labour force participation in the last decade into account. We

calculated the average yearly growth rates and we assumed half of these growths for the next 15 years.

The variant with constant activity rates shows the impact of population change and changing education levels on the labour force. In this variant Germany, Poland and Slovakia will realize a decline in labour force in both demographic scenarios, friendly and tough, while Denmark and Italy show a decline only in the tough scenario (Table 32). The reduction in labour force is expected to be highest in Germany by 13 % in the tough and 8 % in the friendly scenario. Poland will also realize a high decline with 7 % in the tough and 3 % in the friendly scenario. Slovakia will experience a decline in labour force by 4 % in the tough scenario and only 0.5 % in the friendly scenario. In Denmark and Italy the labour force is expected to decline only slightly in the tough scenario and will increase in the friendly scenario by 1.9 % in Denmark and 4.3 % in Italy. The labour force in the five studied countries together is expected to decline by 7 million in the tough and by some 3 million in the friendly scenario.

A further increase in activity rates (second variant) in particular in the older age-groups will lead to a smaller decline respectively increase in labour force, except Poland. In Poland the expected change in participation behaviour will have no significant effect on the decline in labour force. A shrinking labour force is expected – beside Poland - in Germany (-4.4 %) and Slovakia (-1.2 %) in the tough scenario. In Denmark and Italy the labour force will grow in both scenarios. In total of the studied countries, increasing activity rates will lead to a moderate decline of the labour force by 2.5 million in the tough and an increase of the labour force by 1.8 million in the friendly scenario.

Table 32   Development of labour force in selected EU countries

	2010	2025			Changes 2025/2010			Changes 2025/2010		
	Base year	tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
	in millions	in millions						in %		
				constant activity rates						
Denmark	2.95	2.94	3.00	2.98	-0.01	0.06	0.03	-0.32	1.90	0.97
Germany	41.83	36.22	38.34	37.66	-5.60	-3.49	-4.16	-13.40	-8.35	-9.96
Italy	25.00	24.97	26.07	25.73	-0.03	1.07	0.73	-0.11	4.30	2.92
Poland	18.09	16.82	17.63	16.92	-1.27	-0.46	-1.17	-7.01	-2.54	-6.48
Slovakia	2.70	2.59	2.69	2.65	-0.12	-0.01	-0.06	-4.34	-0.48	-2.07
Total	90.56	83.53	87.73	85.93	-7.03	-2.83	-4.64	-7.76	-3.13	-5.12
				increasing activity rates						
Denmark	2.95	2.99	3.06	3.03	0.05	0.12	0.09	1.55	4.00	2.91
Germany	41.98	40.14	42.32	42.62	-1.84	0.34	0.65	-4.38	0.81	1.54
Italy	25.00	25.57	26.65	26.34	0.57	1.65	1.34	2.30	6.59	5.38
Poland	18.09	16.84	17.66	17.34	-1.25	-0.43	-0.75	-6.92	-2.38	-4.13
Slovakia	2.70	2.67	2.77	2.73	-0.03	0.07	0.03	-1.22	2.57	1.14
Total	90.71	88.21	92.46	92.07	-2.50	1.75	1.36	-2.76	1.93	1.50
Source: D10.2 population projection; Eurostat, activity rates by education level; calculation of DIW Berlin.										

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6   Estimation of employment in curative health care

As mentioned above, we will build on the results of the NEMESIS model (**N**ew **E**conometric **M**odel of **E**valuation by **S**ectorial **I**nterdependency and **S**upply) that has been constructed by the ERASME team (Boitier et al 2013). In the NEUJOBS project the NEMESIS model is used to show some quantitative socio-economic and environmental results to reveal the main challenges for EU in the framework of the "socio-ecological transition" without policy intervention and according to the global context. The NEMESIS model is based on detailed sectorial models for each of the EU27. It provides results for the economic development, changes in industrial structures, labour supply and sectorial employment. The NEMESIS model also provides an estimation of the labour force in the five studied countries (Table 33). As the model is based on data from National Accounts, also the labour force calculation uses the employment and unemployment figures from the National Accounts. In 2010 the labour force based on National Accounts showed a significant difference to the figures provided by the LFS in particular for Germany (1.7 million) and Italy (2 million). In Germany the difference can be traced back to the incomplete coverage of marginal employment in the LFS, in Italy it is reported that the National Accounts also include an estimation of illegal employment (Eurostat 2013). The labour force in the National Accounts is lower than the figures from the LFS in Poland and Slovakia

Table 33   NEMESIS results – labour force in 1000

	2010	2025		Changes 2025/2010		Changes 2025/2010	
	Base year	tough	friendly	tough	friendly	tough	friendly
	in 1000					in %	
	based on employment and unemployment in the National Account systems						
Denmark	2 982	2 965	3 043	- 17	61	-0.57	2.05
Germany	43 609	41 173	43 456	-2 436	- 153	-5.59	-0.35
Italy	26 824	27 805	29 426	981	2 602	3.66	9.70
Poland	17 580	17 493	18 349	- 87	769	-0.49	4.37
Slovakia	2 518	2 521	2 636	3	118	0.12	4.69
Total	93 513	91 957	96 910	-1 556	3 397	-1.66	3.63
Source: D10.2 population projection (Version Oct 12); NEMESIS results March 13; calculation of DIW Berlin.							

Not only the total amount of labour force also the expected changes differ significantly between the LFS and the NEMESIS model. This can be traced back to the different methods used for the calculation of the future development. The estimation based on the LFS uses a bottom-up approach calculating the changes in population by gender and age-groups as well as changes in labour force participation behaviour. The NEMESIS model uses a macro-model calculating the changes in sectorial employment and the changes in unemployment. The labour force development is the result of employment and unemployment in the year 2025.

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An advantage of the NEMESIS model is that the model provides an estimation of the total employment as well as the employment broken down by broad industries. For countries that provide input-output-tables also a downscaling by industries according the NACE2 classification was carried out. For all studied countries estimations of the total employment and the employment in the grouped sector "non-market services" are available. The non-market sector comprises of the NACE2 industries O "Public administration and defence, compulsory social security", P "Education", Q86 "Human health services", Q87+88 "residential care activities and social work activities without accommodation", R90-92 "Creative, arts and entertainment activities, libraries, museums, cultural activities etc.", R93 "Sports activities, amusement + recreation activities" and S94 "Activities of membership organisations".

For Germany a downscaling of NEMESIS sectors into NACE2 industries was carried out by the ERASME team using the National Accounts and the input-output-tables. Thus, information for Q86 "Human health activities" and Q87+88 "Residential care and social work" is available. For the other countries we carry out a kind of downscaling ourselves. We used the information from the National Accounts and from the LFS both based on the NACE2 classification and calculated the historic shares of Q86 and Q87+88 sectors in total employment as well as in the combined sector 'non-market services'. We used constant shares to calculate the employment in 2025.

In 2010, the total employment amounted to 86 million in the five countries in total, thereof 22 million in the non-market sector and 4.6 million in human health activities (Table 34). According to the NEMESIS model, in the tough scenario the total employment is expected to decline in all countries, except Slovakia (Table 35). In total, in the five studied countries together a reduction of 4.2 million employees is calculated.

In Denmark and Poland a contrary trend is expected for the "non-market services". Germany, and Italy will have a decline also in that sector, Slovakia will realize an increase in employment. The employment in 'human health care' is expected to decline in Germany and Italy, while Denmark and Poland show an increase and Slovakia shows nearly no change. In Denmark and Poland it is expected that the importance of 'human health care' employment in total employment will increase. In Slovakia the increase in total employment is higher than in 'non-market services'. In Italy the decline 'non-market services' employment will be significant higher than in total economy. In Germany the decline in health workforce is significant higher than the decline in total employment.

The employment in the friendly scenario shows a positive trend in total economy as well as in 'non-market services', except Italy (decline in non-market service employment). In human health activities 0.4 million new jobs are expected under the friendly scenario in the five studied countries. The employment in 'human health activities' will be nearly constant in Italy. In Denmark an increase of 13 %, in Germany of 5.4 %, in Slovakia of 19 % and in Poland of 28 % is estimated.

Table 34 Employment by sectors – results of the NEMESIS model (in 1000)

Country	total	Non market services	Health care and social work (Q)*	Human health (Q86)*	Residential care and social work (Q87+88)*
	Employment (in 1000)				
2010					
Denmark	2 758	973	496	169	327
Germany	40 513	11 611	4 144	2 427	1 717
Italy	24 571	5 632	1 648	1 205	443
Poland	15 875	3 617	918	701	217
Slovakia	2 153	508	132	103	28
total	85 870	22 340	7 336	4 605	2 732
2025 tough scenario					
Denmark	2 757	1 037	529	180	348
Germany	37 054	11 366	3 788	2 118	1 670
Italy	24 248	4 633	1 355	991	364
Poland	15 344	3 975	1 008	770	238
Slovakia	2 236	512	133	104	28
total	81 639	21 523	6 813	4 164	2 650
2025 friendly scenario					
Denmark	2 865	1 099	560	191	369
Germany	40 674	13 631	4 635	2 558	2 077
Italy	26 720	5 614	1 642	1 201	441
Poland	16 685	4 633	1 175	897	278
Slovakia	2 404	603	156	123	33
total	89 348	25 580	8 168	4 971	3 198
*) Estimation of DIW Berlin with the exception of Germany.					
Source: Boitier, B., Lancesseur, N. and Zagamé, P. "Global scenarios for European socio-ecological transition", NEUJOBS Deliverable D9.2, 2013, for scenarios results; calculations of DIW Berlin.					

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Table 35   Changes in employment between 2010 and 2025 – results of the NEMESIS model

Country	Employment (in 1000)				
	total	Non market services	Health care and social work (Q)*	Human health (Q86)*	Residential care and social work (Q87+88)*
Changes between 2010 and 2025 tough scenario					
Denmark	-1	64	33	11	22
Germany	-3 459	-246	-355	-309	-47
Italy	-323	-999	-292	-214	-79
Poland	-531	358	91	69	21
Slovakia	83	4	1	1	0
total	-4 231	-818	-523	-441	-82
Changes between 2010 and 2025 friendly scenario					
Denmark	107	126	64	22	42
Germany	161	2020	491	132	359
Italy	2 149	- 18	-5	-4	-1
Poland	810	1 016	258	197	61
Slovakia	251	96	25	19	5
total	3 478	3 239	832	366	466
*) Estimation of DIW Berlin with the exception of Germany.					
Source: Boitier, B., Lancesseur, N. and Zagamé, P. "Global scenarios for European socio-ecological transition", NEUJOBS Deliverable D9.2, 2013, for scenarios results; calculations of DIW Berlin.					

Coda Moscarola (2013) employed another approach to calculate the future supply of health care personnel in Italy based on the NEMESIS results. She focusses on the changes in employment in total economy and in non-market services differentiated by education level for Italy. She used the occupations to cluster the health personnel by education levels. Physicians, nursing staff and other non-medical staff are classified as high skilled. Based on the NEMESIS results for the growth rates of employment in 'non-market services' by education level and the employment data by occupations in the base year she calculated the employment by occupation in 2025. According to this approach the supply of physicians, nurses and other non-medical staffed is expected to decline markedly in the tough scenario. In total Coda Moscarola estimated a decline in human health care personnel that is slightly higher than under the approach not taken the different changes by education level into account.

7   Results and Discussion

7.1   Comparing expected changes in demand for health workforce with the projected change in employment in health care sector

The paper had the aim to show the impact of demographic change on the demand for health care workforce in acute health care facilities. We use the utilization approach to calculate the demand for human health care workforce and we used the NEMESIS results for the supply side. The NEMESIS model provides results of the projected employment in total economy and in industrial sectors.

The utilization approach requires data on employment by kind of health care service and ideally by occupations as well as data on the use of health care services differentiated by age and gender of the patient also for all types of health services. While in the past years the information on health care activities and employment expanded, our experience was that the collection of the required data is still hard work and a challenge for all countries. Nonetheless, at the end an estimation of the future demand for human health workforce could be carried out using a pure demographic scenario in all studied countries. Due to data limitations, for Italy and Poland we could only calculate the demand for a part of the human health workforce. For the comparison of the countries as well as for the comparison with the results of the supply, we calculated the changes in total demand using the average changes in covered health personnel also for the not covered once.

Due to the higher dynamic in population change the demand for health workforce is expected to increase to a higher degree in the friendly scenario compared to the tough scenario. The highest increase in demand for health workforce is estimated for Italy with 16 % in the friendly and 8.5 % in the tough scenario (Table 36). The lowest increase is expected in Germany with 5.7 % in the friendly scenario, and a decline by -1.3 % in the tough scenario. In general, the changes in demand for health personnel lie close together in Denmark, Italy and Slovakia with expected relatively high increases in demand. Germany and Poland show instead a lower increase or even a decline in the demand for health personnel.

The expected demand for health care workforce can be compared with the projected supply of human health care workforce derived from the NEMESIS model. However, we have to interpret the results based on the NEMESIS model with caution, because results by industries according to the NACE classification are only available for Germany. For the other four studied countries only a raw estimation of the development in human health care could be done. In the friendly scenario the expected changes in employment are higher than the changes in the demand for health personnel in Poland. In Denmark and Slovakia an increase in health workforce is estimated that is lower than the increase in demand. In Germany both the demand and supply of health workforce will decline, but the reduction of supply is significant higher. In Italy an increase in demand is combined with a markedly decline in health workforce supply. In particular in Italy the situation on the health care market is expected to worsen.

Table 36 Expected changes in demand for and supply of human health care personnel between 2010 and 2025 in %

	Tough scenario		Friendly scenario	
	Demand	Supply	Demand	Supply
Denmark	8.2	6.6	13.4	12.9
Germany	-1.3	-12.7	5.7	5.4
Italy	8.5	-17.7	15.8	-0.3
Poland	-0.1	9.9	6.4	28.1
Slovakia*	14.6	0.9	19.2	18.8
*) The high change in demand can be partly traced back to the significant increase in hospital staff between 2010 and 2011.				
Source: Calculation of DIW Berlin based on the supply side projections of the NEMESIS model and on the country specific variations in the demand for health personnel.				

In the tough scenario the projected increase in supply is only slightly lower than the increase in demand in Denmark, Germany and Slovakia. Poland shows a high increase in health workforce supply (28 %) while the demand is expected to increase by 6 %. In Italy a significant increase in the demand for health workforce is combined with a slightly decline in health workforce supply. Thus also under the tough scenario Italy will experience difficulties in providing the needed health care services without compromising their quality.

7.2   Discussion of the results

Factors influencing the demand for health workforce beside demography

The changes in demand for health care workforce show only the pure demographic impact under a steady state approach. The current situation is the starting point with the current employment situation, the current shortage of health workforce and the current health systems and health policies. Despite the demographic change no changes in health care policies and no adjustments of regulations is taken into account.

Beside demographic change, the demand for health care and the required workforce is influenced by the medical and technological progress which has an impact on the availability of medical and pharmaceutical treatments and may pose the request on new, additional treatments or treatments for persons who could not be treated before (additional demand on health care services). This kind of changing demand cannot be taken into account because it could not be quantified.

Also changes in the health status of the population could not be taken into account. A socio-ecological transition away from fossil fuels, towards solar and other low carbon energy sources is expected to have an impact on climate change with global warming and weather extremes. Heat waves, floods, droughts, storms, but also air pollutions have an influence on the health of the population (EEA 2012). For example, the heat wave in 2003 increased the number of deaths by 70,000 in Europe (D'Ippoliti et al.

2010). In particular under the tough scenario weather extremes may become more frequently with an impact on the health status and may increase the demand on health care. But no data on possible changes in health care demand exist.

Regional disparities

Currently regional differences in the shortage of health care professionals are reported in Germany, Italy and Denmark. As a shortage of health care professionals is stated if the ratio of population to – for example – practicing physicians or GPs falls under a fixed threshold, changes in regional distribution of the population due to the new territorial dynamics (as one of the four transition pathways of NEUJOBS) can reduce or expand the health care shortage. While the population projection provides information also for regions, no utilization data at regional level are available. Thus no calculation on the impact of changes in regional distribution of the population on the regional health care demand and the regional health workforce could be carried out.

How can the expected increase in health workforce supply be realized?

According to the NEMESIS results, the employment is expected to increase significantly under the framework conditions of the friendly scenario in Denmark, Poland and Slovakia. This poses the question: What has to be done to realize such an increase in employment which is significant higher than the increase in total labour force?

As mentioned above, in 2010, in the five studied countries together around 32 % of the human health workforce was at least 50 years old and 17.5 % at least 55 years old. That means 1.6 million employees and self- employed (50+) have to be replaced during the next 15 years. The number of graduates of physicians accounts for about 21,000 per year in the five studied countries. The past experience is that only a part of them will be active in the health care sector. It is foreseeable that it will be hard to replace the retiring workforce if the number of yearly graduates will not change. In particular in Italy the numerus clausus in universities is limiting the number of students (Coda Moscarola 2013), but also in other countries a more flexible regulation concerning the access to medicine degree courses is required. More universities, training schools and teachers are needed.

A possible opposing trend that could alleviate the demographic pressure on the health labour market is the (labour saving) technological progress. The impact and significance of future innovations in the health sector is difficult to predict, not only because it is partly endogenous with respect to the development of labour supply and demand. If wages rise due to labour shortages, labour saving technologies become more attractive as well as research in that direction.

The recruitment of health workforce from other countries is another strategy to increase the health workforce supply. Across the EU countries free movement of workers is guaranteed. The effect of health workforce working abroad is twofold. On the one side health professionals can get experience in another setting, on the other side in sending countries an existing shortage of health workforce can be exacerbated.

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In particular in Poland and Slovakia is the emigration of health professionals a problem. In these countries, but also in Italy physicians and nurses have an incentive to work abroad due to higher earnings (Wismar et al. 2011). The increase in earnings can help to reduce the emigration of doctors and nurses. In Italy an oversupply of medical doctors was also in the past a motivation to emigrate (Bertinato et al. 2011).

The recruitment of health workforce from third countries outside the EU is limited due to the specific ethical recruitment principles. Health professionals are not recruited in countries showing a shortage of health workforce (WHO 2010).

In all EU countries care activities are traditionally female professions. An expansion of the health workforce requires the encouragement of males to enter nursing and caring professions. In addition, under the working conditions in hospitals, but also in ambulatory health care centres and offices of physicians and dentists it is often hard (especially for women and in particular for mothers) to combine careers and family life. In Germany, doctors and nurses in hospitals complain a high workload, long working hours, and not flexible working times. Changes in working conditions, more flexibility in working times and working hours per week are required to encourage more health professionals to work in hospitals and ambulatory health care and not to change to other industries with higher earnings and normal working times. Changes in working conditions can also help to reduce the share of graduates not engaged in direct health care provision. It can also help that nurses and assistants stay longer (longer duration of working life in health care activities) in the health care sector.

APPENDIX 1

Selected indicators of the health care systems in the five studied countries:

Financing: Denmark and Italy have tax- based decentralized health care systems, whereas in Germany, Poland and Slovakia a public mandatory health care insurance system is in operation. In Germany, high income individuals, above a fixed threshold, can opt for private health care insurance. In Slovakia no private health insurance exists. In all countries, except Slovakia, there is an option to cover co-payments or services not covered by the public system by voluntary private insurance contracts. This extended private coverage is only taken up by about 2% of the Polish population.

Access to services: All countries provide free choice and access to GPs (primary care), as well as access without a referral to some specialists such as dentists, gynaecologists and paediatricians. In Denmark and Italy free choice is limited to GPs whose patient list cannot exceed the fixed threshold. GP selection in Slovakia is based on mutual agreement between the patient and GP, but each GP also has a geographical territory and is obliged to serve patients from this area. GPs act as gatekeepers for specialists (with the exception of some specialists like dentists, gynaecologists) and hospital care in all countries except Germany. In Germany patients are allowed to visit specialist without a referral, but need a referral from GPs or specialists for hospital inpatient treatments.

Waiting lists: Long waiting lists for examinations and for hospital treatments are an issue in Poland, Slovakia, and Italy. While waiting lists and long waiting times are also reported in Denmark, measures to ensure that waiting times do not exceed an upper limit have been institute: Patients can choose a hospital or specialist in another region or abroad if the needed treatment cannot be realized within a fixed time span; as of 2013, 2 months. In Germany there are cases where waiting lists for specialists are reported. It often appears that privately covered patients in Germany receive preferential services to those who are publically covered, a situation that is declared to be unfair by many.

Co-payments: In all five studied countries co-payments are required for pharmaceuticals, dental care, appliances and with the exception of Slovakia also therapeutically care. In Denmark dental care for children is free, but adults must pay. In Slovakia co-payments for dental care are high, although basic dental care is covered by insurance company if patients have regular preventive care (once a year). Out of total health care expenditures in 2008, the share of out-of-pocket expenditures amounted to 26% in Slovakia, 22% in Poland, 14% in Denmark.

Provider status: The hospital inpatient care is provided by public hospitals in most countries with the exception of Germany. In Denmark 97% of hospitals are run and owned by regional governments, in Italy nearly all hospitals are public or private but financed by the national health system, in Poland some 90%of hospitals are public, and in Slovakia most hospitals (77 %) are public with 66% are run by the state, 11% by regions. In Germany the share of public hospitals was 30 % in 2011, with the others run by charitable (37 %) and private (33 %) organisations under contract to the national health system (NHS).

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Most GPs act independently in private (group) practices with contract to the national health system. Specialists also act independently in private practices in Denmark, Germany and Slovakia. In Poland specialists act independently in private practices or health centres with contracts to the NHF, but there is a high share of private practices (without contract to NHF) which have to be paid out of pocket. In Italy they act as employees of public and accredited private structures (hospitals or outpatient ambulatories), and as doctors in private practice, eventually with contracts to the NHS. If a specialist works in public hospitals he needs a specific contract to work in private sector (so called „intra moenia or extra moenia"contract).

Capacity planning: As on average of the five countries the majority of hospitals is publicly owned the capacity planning (and also the health workforce planning) is the responsibility of regional authorities. In Germany the regions (Länder) are responsible for capacity planning and financing of hospital investments. Planning of primary care - in particular the regional distribution of practising physicians (in particular GPs) - is the responsibility of German regions based on quotas of practising physicians to population taking into account the age-structure and other influencing factors. In Slovakia, the capacity planning for hospital coverage (workforce and number of hospital beds) as well as ambulatory care and specialists (the minimal number of providers in a given specialization and geographical area) is based on the "Minimum required network of health care services" set by the Ministry of Health. This minimal network must be kept in all regions and insurance companies are responsible for ensuring that this network is achieved, but they are not penalised if the standards are not achieved.

Payment of provider: Hospitals are reimbursed by a Diagnosis Related Groups (DRG) system in Germany and Poland and a mix of per-diem and DRG system in Denmark. Slovakia uses a reimbursement based on lump sum payment from the insurance company made for terminated hospitalization irrespective of the number of treatment days. It depends on the type of hospital department and not directly from the diagnosis; while a DRG system is scheduled to be introduced in 2016 (it is currently in the preparation phase and is based on the German DRG system). The Italian system of hospital financing is very complex. Hospitals in NHS scheme are financed on a fee-for-service basis. Payment is in part on a historical basis and in part on DRG. Private hospitals, under contract to the regions, are reimbursed with per diem rate for inpatient care and fee-for-service for outpatient care.

GPs are reimbursed by capitation in Denmark, Italy, Poland and Slovakia (with limited fee-for service payments), and by a fee-for-service system in Germany.

Specialists are reimbursed by fee-for-service system in Germany, Slovakia and a mix of fee-for-service and capitation in Poland. In Italy hospital physicians delivering secondary care earn a monthly salary. They can treat patients privately on a fee-for-service basis, but they have to pay a proportion of their extra income to the hospital. Specialists exclusively in private practice are paid on a fee-for-service basis out-of-pocket from the patient. In Denmark specialists are employed in inpatient and outpatient departments in hospitals and earn a monthly salary.

Table 37 Health care system

Indicator	Denmark	Germany	Italy	Poland	Slovakia
FINANCING					
Public	tax based decentralized system	Compulsory insurance (Persons with high income can opt out)	tax based decentralized system	public mandatory health insurance	public mandatory health insurance
private	insurance to cover co-payments and services not public financed	Compulsory insurance for civil servants, self employed and persons with high income and voluntary additional insurance for out-of-pocket payments and services not covered by compulsory insurance	voluntary insurance to cover co-payments and services not public financed	only small part of voluntary insurance to cover co-payments and services not public financed	no voluntary private insurance exist
ACCESS					
Generell	all residents (100% covered)	all residents (99.9% covered)	all residents (100% covered in 2006)	all residents (97.8% covered)	all residents (95.4% covered)
GP	residents have to register with a GP	free access	free access	free access	free access
hospital	referral	referral by GP or specialist	referral	referral	referral
specialist	referral	free access	referral	referral	referral (some exceptions)
FREE CHOICE					
GP	yes (GPs not exceeding the maximum number of patients registered),may change GP every 6 months	yes	yes	yes	yes,my changed every 6 months
hospital	yes, after referral from GP	yes, after referral from GP	yes, after referral from GP	yes, after referral from GP	yes, after referral from GP
specialist	yes, after referral from GP	yes	yes, after referral from GP	yes, after referral from GP	yes, after referral from GP
GP as gatekeeper	yes	no (exceptions*)	yes	yes	yes

Source: HiT country reports and HiT online information; Coda Moscarola 2013; Golinowska et at 2013; Radvansky et al2013; DIW Berlin.

Table 37 continued

Indicator	Denmark	Germany	Italy	Poland	Slovakia
WAITING TIMES					
GP	no	no	no	no	no
surgeries at hospitals	yes, but patients can use services in other regions or abroad if waiting time exceeds a certain limit	in general no,but for some special surgeries up to some weeks	long	long	long
specialist	yes	only for some specialists up to some weeks	long	long	only for some specialists up to some weeks
examinations	yes	only in special cases	long	long (exception: easy access to basic ambulatory tests)	long
CO-PAYMENTS					
primary care	no	defined list of re-imbursed services,other out-of-pocket	Yes, except low income, elderly and special groups	no	no
hospital care	no	yes, small co-payments per day up to1 4 days	Yes, except low income, elderly and special groups	Generally no, but co-payments for extra services	no (only for extra service)
specialists	no	defined list of re-imbursed services,other out-of-pocket	Yes, except low income, elderly and special groups	partly out-of-pocket	no
pharmaceuticals	yes	yes, small co-payments per prescription, high share of over the counter pharmaceuticals	Yes, except low income, elderly and special groups	yes, high share	yes, high share
dental care	out of pocket (exceptions	defined list of re-imbursed services,other out-of-pocket	Yes high share, except low income, elderly and special groups	partly out-of-pocket	basic free, other high co-payments
physiotherapy and other measures	yes	yes	Yes high share, except low income, elderly and special groups	partly out-of-pocket	medical prescribed - free
eyeglasses, contact lenses,dental protheses	out-of-pocket	yes, high shares	out-of-pocket	out-of-pocket	out-of-pocket (some exceptions)
private expenditure	15.4% of THE (2010)	22% of THE (2010)	18.9% of THE (2010)	28.0% of THE (2008)	27.2% of THE (2010)
out-of-pocket	13.7% of THE (2010)	12.4% of THE (2010)	17.8% of THE (2010)	23.7% of THE (2010)	27.2% of THE (2010)
Source: HiT country reports and HiT online information; partner country reports; DIW Berlin.					

Table 37 continued

Indicator	Denmark	Germany	Italy	Poland	Slovakia
CAPACITY PLANNING					
Hospitals	Regional Authorities	Länder (regions)	Regions	Regions	Centralized
ambulatory care	Regional Authorities	Länder (regions)	Regions	Local territorial self - governments	Centralized
rehabilitation, prevention	Local Authorities	Länder (regions)	Regions	Local territorial self - governments	Centralized
school health service, dental care for children, health promotion	Local Authorities		Regions and Local Health Units	Local territorial self - governments	limited
PROVIDER STATUS					
GP	independent, private group practice with contract to NHS	independent, private practice with contract to NHS	independent, private practice with contract to NHS	public or private practice based on the contracts with the NHF	mix public-private provider with contract to NHS
Hospitals	97% owned and run by regions	mix of public, private and charitable hospitals with contract to NHS	public hospitals	public (majority) and private hospitals	most public
Specialist	independent, private practice with contract to NHS	independent, private practice with contract to NHS	Employees of Local Health units or hospitals, also private practices	independent, private practice or health centres with contract to NHS	mix public-private provider with contract to NHS
PAYMENT OF PROVIDER					
GP	capitation	fee-for-service	capitation	capitation	capitation
specialists	fee-for-service	fee-for-service	employees of hospitals can act also privately on a fee-for-service basis; private practising fee-for-service	fee-for-services	fee-for-service
hospitals (inpatient care)	mix of per diem+DRG	DRG	hospitals with contract to NHS partly DRGs, private hospitals per diem	DRG	fee-for-service, depending on department
hospitals outpatient care	fee-for-service	fee-for-service	fee-for-service	fee-for-service	fee-for-service
Source: HiT country reports and HiT online information; partner country reports; DIW Berlin.					

APPENDIX 2

Health care expenditures

Table 38 Gross value added of total economy and human health and social work (chain-linked changes)

GEO/TIME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Gross value added (total) without Human health and social work activities (at prices of previous year)									
EU27	-	103,3	103,7	102,9	104,1	105,5	105,6	102,9	95,6	100,9
Denmark	103,6	102,5	102,7	103,3	104,3	106,1	103,8	101,8	98,5	101,6
Germany	100,6	101,0	100,8	102,6	101,6	104,3	104,1	101,5	94,5	105,8
Italy	103,4	104,0	103,0	105,4	102,9	103,9	102,7	101,5	96,7	104,6
Poland	115,8	114,0	100,1	92,5	105,5	121,7	111,8	112,0	112,8	88,6
Slovakia	118,7	108,0	109,6	113,5	116,6	117,3	117,6	118,7	105,7	106,8
	Gross value added Human health and social work (at prices of previous year)									
EU27	-	106,9	105,8	103,7	107,2	104,9	105,4	105,5	102,8	101,2
Denmark	103,3	105,5	104,2	104,0	103,2	105,4	102,7	104,9	106,0	107,1
Germany	102,5	105,8	103,3	100,4	104,8	102,0	103,5	105,1	100,7	105,6
Italy	110,7	103,8	103,7	105,1	107,9	104,4	104,3	99,8	107,2	101,6
Poland	120,7	136,4	100,0	95,8	102,6	122,6	109,8	115,4	123,4	85,8
Slovakia	124,0	97,8	110,1	106,0	116,6	104,6	136,4	109,4	111,3	116,7
Source: Eurostat; National Accounts by 64 branches; extracted May 2013; calculation of DIW Berlin.										

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Figure 11 Correlation between health workforce and HCE 2003 to 2010
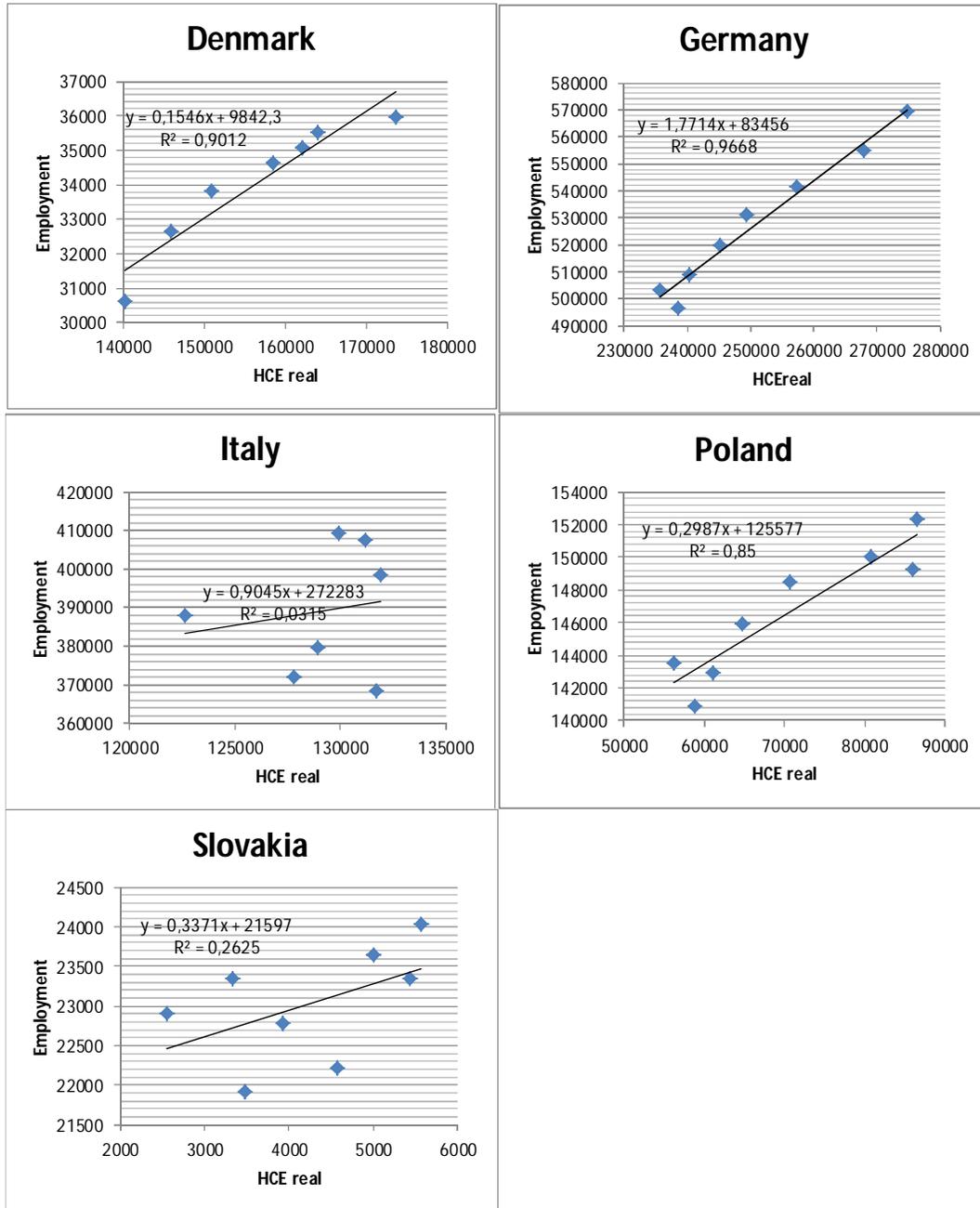
Table 39   Share of private sector payments in current health expenditure (in %)

	Denmark	Germany	Italy*	Poland	Slovakia**
	Out-ofpocket payments				
2003	14.6	11.4	22.3	27.6	11.6
2004	14.9	12.8	21.1	29.4	19.1
2005	14.7	12.7	20.4	27.7	23.6
2006	14.5	12.9	19.8	27.1	26.6
2007	14.6	12.8	20.1	26.3	27.4
2008	14.1	12.6	18.4	24.4	26.1
2009	13.7	12.3	17.9	24.4	26.9
2010	13.7	12.4	17.8	23.7	27.2
	Private insurance				
2003	1.5	9.0	0.9	0.6	0.0
2004	1.5	9.3	0.9	0.6	0.0
2005	1.5	9.4	0.8	0.6	0.0
2006	1.5	9.4	0.9	0.6	0.0
2007	1.7	9.5	0.9	0.6	0.0
2008	1.8	9.7	0.9	0.6	0.0
2009	1.8	9.6	1.0	0.6	0.0
2010	1.7	9.6	1.1	0.7	0.0
	Other institutions (not health care insurance)				
2003	0.1	0.8	2.1	2.7	0.0
2004	0.1	0.8	1.9	2.2	0.7
2005	0.1	0.8	2.4	3.0	0.8
2006	0.1	0.7	2.6	3.1	0.8
2007	0.1	0.7	2.3	3.0	0.8
2008	0.1	0.7	1.6	3.3	0.8
2009	0.1	0.7	1.5	3.4	0.8
2010	0.1	0.8	1.5	3.4	0.8
	Total private sector				
2003	16.1	21.1	25.3	30.8	11.6
2004	16.5	22.9	23.9	32.3	19.8
2005	16.3	22.9	23.6	31.3	24.4
2006	16.1	23.1	23.3	30.8	27.4
2007	16.3	23.1	23.3	29.9	28.2
2008	16.0	23.0	20.9	28.3	26.9
2009	15.5	22.6	20.4	28.3	27.7
2010	15.4	22.7	20.4	27.8	28.0

*) In % of total health expenditure; **) 2003 and 2004 in % of total health expenditure.

Source:OECD Health data (extracted May 2013 stats .oecd.org).

APPENDIX 3

Health care workforce

Table 40 Changes in employment in total economy as well as health and social work activities between 2008 and 2011

	Changes in employment (in 1000)			Changes in %		
	Total	Males	Females	Total	Males	Females
All sectors						
total	-4 122	-3 890	- 232	-1.9	-3.2	-0.2
full-time	-6 146	-4 968	-1 178	-3.4	-4.4	-1.7
part-time	2 010	1 070	940	5.0	11.2	3.1
Changes in the share of part-time (%-points)	1.3	1.2	1.0			
Health and social care						
total	1 528	388	1 141	7.2	8.5	6.9
full-time	889	279	610	6.1	7.1	5.8
part-time	639	109	530	9.6	17.0	8.9
Changes in the share of part-time (%-points)	0.7	1.1	0.7			
Source: Eurostat, Labour force survey, calculation of DIW Berlin.						

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Table 41 Physicians by specialty per 100,000 populations in 2009

MED_SPEC/GEO	Denmark	Germany	Italy	Poland	Slovakia*
Generalist medical practitioners	73.3	152.4	94.3	44.4	41.4
General practitioners	73.3	65.4	76.8	20.5	41.4
Other generalist medical practitioners	-	87.0	17.6	23.8	:
Specialist medical practitioners	143.0	211.2	273.2	172.7	256.7
General paediatricians	6.7	13.7	12.8	12.0	20.3
Gynaecologists and obstetricians	9.5	19.2	20.5	15.9	20.6
Psychiatrists	16.9	19.8	17.6	9.3	11.5
Medical group of specialists	57.8	80.0	121.0	75.3	133.1
Internal medicine	5.7	47.8	37.7	21.1	:
Cardiology	6.0	0.3	23.5	7.7	:
Endocrinology	3.1	0.0	2.5	1.8	:
Gastroenterology	2.8	0.2	5.7	1.4	:
Respiratory medicine	2.1	0.6	6.0	4.3	:
Oncology	2.2	:	7.9	2.3	:
Immunology	4.5	0.0	4.1	4.6	:
Neurology	5.1	5.3	10.8	9.1	:
Otorhinolaryngology	5.8	6.6	7.5	6.6	:
Radiology	10.0	10.2	2.3	9.2	:
Microbiology-bacteriology	1.3	0.6	1.2	0.4	:
Haematology	1.7	0.6	4.0	1.2	:
Dermatology	2.8	6.0	6.5	4.1	:
Pathology	3.3	1.8	1.3	1.5	:
Surgical group of specialists	52.2	74.2	83.2	54.9	71.3
General surgery	8.4	22.1	15.8	16.4	:
Neurological surgery	1.4	1.8	1.2	1.2	:
Plastic surgery	1.7	0.8	1.3	0.3	:
Ophthalmology	5.2	8.0	10.1	7.8	:
Orthopaedics	11.6	12.6	15.1	8.1	:
Thoracic surgery	1.5	1.0	1.1	0.8	:
Vascular surgery	1.2	0.2	1.4	0.7	:
Anaesthesiology and intensive care	16.6	21.6	17.1	13.1	:
Urology	4.7	6.1	12.8	4.8	:
Accident and emergency medicine	0.0	:	7.2	1.8	:
Other specialists not elsewhere classified	:	4.4	18.1	5.2	2
Occupational medicine	1.4	0.7	5.4	5.2	:
Other categories not elsewhere classified	:	3.7	0.1	29.0	:
Medical doctors not further defined	131.9	0.0	:	0.0	2
*) 2007.					
Source: Eurostat; health personnel statistics.					

Table 42   Physicians by age-groups in 2009

	Denmark* Total	Denmark* Males	Denmark* Females	Germany Total	Germany Males	Germany Females	Italy Total	Italy Males	Italy Females	Poland Total	Poland Males	Poland Females	Slovakia Total	Slovakia Males	Slovakia Females
							Persons								
Total	19.232	10.618	8.614	305.093	176.019	129.074	371.450	233.129	138.321	83.201	36.070	47.131	18.110	8.002	10.108
<35	3.733	1.472	2.261	55.104	23.369	31.735	45.708	16.576	29.132	:	:	:	3.577	1.399	2.178
35-44	4.458	1.911	2.547	35.438	19.072	16.366	54.760	24.571	30.189	:	:	:	4.501	1.946	2.555
45-54	4.923	2.682	2.241	94.048	53.340	40.708	114.308	69.089	45.219	:	:	:	3.970	1.740	2.230
55-64	4.907	3.553	1.354	109.509	72.004	37.505	113.069	84.699	28.370	:	:	:	4.797	2.299	2.498
65+	1.211	1.000	211	10.994	8.234	2.760	43.605	38.194	5.411	:	:	:	1.265	618	647
							Age-structure in %								
<35	19.4	13.9	26.2	18.1	13.3	24.6	12.3	7.1	21.1				19.8	17.5	21.5
35-44	23.2	18.0	29.6	11.6	10.8	12.7	14.7	10.5	21.8				24.9	24.3	25.3
45-54	25.6	25.3	26.0	30.8	30.3	31.5	30.8	29.6	32.7				21.9	21.7	22.1
55-64	25.5	33.5	15.7	35.9	40.9	29.1	30.4	36.3	20.5				26.5	28.7	24.7
65+	6.3	9.4	2.4	3.6	4.7	2.1	11.7	16.4	3.9				7.0	7.7	6.4
*) 2009.															
Source: Eurostat;health personnel statistics.															

Table 43 Assumptions of the demographic scenarios

Friendly scenario	Tough scenario
Fertility rates	
the fertility rate in Sweden will be used as a benchmark (2.0 in 2030); countries will converge so that the current difference will be halved by 2030	constant fertility rates over time
Life expectancy	
France and Italy as benchmark, the current difference will be reduced by 15% in western and 50% in eastern countries	lower not linear trend than in the friendly scenaio, but still an increase in all countries
Migration	
Europop assumptions as a referecne with bandwidths	
higher net migration as Europop	lower net migration as Europop
Source: Huisman et al 2013.	

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Table 44 Share of people in young, prime and old working age in total potential workforce (%)

	2010	2025			Changes 2025/2010		
		Friendly	Tough	Europop	Friendly	Tough	Europop
	in %	in %			in %-points		
Share of population in young working age (15-24) in 15-64 years sold							
Denmark	18.7	19.1	19.1	18.9	0.4	0.4	0.2
Germany	17.2	15.5	15.4	15.1	-1.7	-1.8	-2.1
Italy	15.3	16.1	16.1	15.7	0.8	0.8	0.3
Poland	20.2	15.4	15.4	15.2	-4.8	-4.7	-4.9
Slovakia	20.1	15.0	15.1	14.9	-5.0	-5.0	-5.2
Total	17.4	15.8	15.7	15.4	-1.6	-1.6	-2.0
EU27	18.0	17.1	17.2	16.8	-0.9	-0.9	-1.2
Share of population in prime working age(25-54) in 15-64 years old							
Denmark	61.4	59.9	59.7	59.8	-1.6	-1.7	-1.6
Germany	64.8	58.3	57.7	58.4	-6.4	-7.0	-6.4
Italy	66.0	60.7	60.1	60.7	-5.3	-5.9	-5.3
Poland	61.7	66.8	66.6	66.7	5.1	4.9	5.0
Slovakia	63.1	66.6	66.4	66.5	3.5	3.3	3.4
Total	64.4	61.1	60.6	61.1	-3.2	-3.7	-3.3
EU27	63.8	61.4	60.9	61.4	-2.4	-2.9	-2.4
Share of population in old working age I (55-64) in 15-64 years old							
Denmark	19.9	21.1	21.2	21.3	1.2	1.3	1.4
Germany	18.1	26.2	26.9	26.5	8.1	8.8	8.5
Italy	18.6	23.2	23.8	23.7	4.5	5.1	5.0
Poland	18.1	17.8	17.9	18.1	-0.3	-0.2	-0.1
Slovakia	16.8	18.4	18.5	18.6	1.5	1.7	1.8
Total	18.3	23.1	23.6	23.5	4.8	5.3	5.2
EU27	18.2	21.5	21.9	21.8	3.3	3.8	3.6
Share of population in old working age II (55-69) in 15-69 years old							
Denmark	26.0	27.5	27.6	27.8	1.5	1.6	1.8
Germany	24.9	33.4	34.2	33.8	8.6	9.3	9.0
Italy	24.7	29.7	30.4	30.3	5.0	5.8	5.6
Poland	22.1	25.4	25.5	25.8	3.3	3.5	3.7
Slovakia	21.2	25.1	25.2	25.5	3.9	4.0	4.3
Total	24.1	30.1	30.7	30.6	6.0	6.6	6.5
EU27	23.6	28.2	28.7	28.6	4.6	5.1	4.9
Source: Eurostat, Europop2010; NEUJOBS D10.1 and 10.2 (version March 2013); calculation by DIW Berlin.							

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Abbreviations

A.O.	Aziende ospedaliere, Hospitals
A.O.U.	Aziende Ospedaliere Universitarie, University Hospitals
AGIR	Ageing, Health and Retirement in Europe
ARES Lazio	Agencies for cost monitoring of Lazio
ASL	Local Health Unit
Barmer GEK	Name of a Social Health Insurance
DE	Germany
DIW	German Institute for Economic Research (DIW Berlin)
DK	Denmark
DRG	Diagnosis Related Groups
EC EPC	European Commission and European Health Policy Committee
EC	European Commission
EEA	European Economic Association
EHIS	European Health Interview Survey
EU SILC	European Union Statistics on Income and Living Conditions
EU	European Union
EU27	European Union 27 countries
Europop	Demographic forecast scenario of Eurostat
Eurostat	European Statistical Office
FTEs	Full-Time Equivalents
GBE	German Health Reporting System (Gesundheitsberichterstattung)
GDP	Gross Domestic Product
GPs	General Practitioners
HCE	Health Care Expenditures
HiT	Health care Systems in Transition
HLA	Health Labour Accounts
HWA	Health Workforce Australia
I.R.R.C.S.	National Institutes for scientific research
ISTAT	National Statistical Institute of Italy
IT	Italy
LE	Life Expectancy

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LFS	European Union Labour Force Survey
NACE2	National Account Classification of Economy, Version 2
NEMESIS	New Econometric Model of Evaluation by Sectorial Interdependency and Supply
NHS	National Health System
NR HW	National Registry of Healthcare Workers
OECD	Organisation for Economic Co-operation and Development
PL	Poland
PWC	Price Waterhouse Cooper
RGS	General Accounting Department
SK	Slovakia
StatBank	Database of the Statistical Office of Denmark
TFR	Total Fertility Rate
WHO	World Health Organization
WP	Work Package

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