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IMPACT OF AGEING ON CURATIVE HEALTH CARE WORKFORCE COUNTRY REPORT GERMANY

ERIKA SCHULZ

SUPPLEMENT C TO NEUJOBS WORKING PAPER D12.1 SEPTEMBER 2013

Population ageing combined with a shrinking potential workforce are main factors influencing future socio-economic development and the labour market. This paper has the objective to show the impact of population change on one important sector of the economy, the health care market. As the need for health care services increases with age, the population ageing is expected to have a direct influence on the demand for services and the workforce needed. The shrinking labour force and the currently high share of elderly health professionals will have an impact of the future supply of health workforce.

Based on the NEUJOBS demographic scenarios tough and friendly and age- and gender specific utilization rates the changes in the health workforce needed are calculated. Changes in labour supply and employment are shown using the results of the econometric model NEMESIS. In both scenario a decline in population size and an ageing of the population is expected. In the friendly scenario the demand for health care services is expected to increase, although the population size declines. The population ageing has a higher effect on the demand as the shrinking population size. In the tough scenario the significant decline in population dominates the demand for health workforce. Due to the demographic change also a decline in labour supply is calculated, while the employment in health care is estimated to increase in both scenarios. In 2025, the estimated employment is higher than the demand for health workforce. But on the demand side the calculations show only the pure demographic effect. Due to data restrictions we could not take into account the technological medical progress, changes in health utilization behaviour or changes in health status of the population. All these factor have an influence on the future health workforce demand.



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IMPACT OF AGEING ON CURATIVE HEALTH CARE WORKFORCE –COUNTRY REPORT GERMANY

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SUPPLEMENT C TO NEUJOBS WORKING PAPER D12.1

1 Introduction

The health care sector is one of the most important sectors of the economy in Germany. The share of human health and social work activities (sector Q according to the NACE2 classification) in GDP was 11.6 % and the share of health care workforce in total employment 12.2 % in 2011. The health sector showed a high dynamic in the past. Between 2000 and 2011 about 1.3 million additional jobs were created in human health and social work, which is more than one third of all new jobs created in the economy (3.4 million jobs net). The high dynamic of the health care and social work sector can be explained by demographic changes, but also by other non-demographic drivers.

While the demand and spending for long-term care services is strongly related to age, the demand and spending for curative health care is related to the nearness to death (and death is related to age), and influenced by a variety of non-demographic factors, such as changes in the organisation, budget constraints to provide high quality health care cost effectively, political reforms and new technologies. In particular health care expenditures are influenced by non-demographic factors. Studies show that new technologies are an important driver of health care expenditures (Zweifel et al 1999; Breyer and Ulrich 2000, Henke and Reimers 2006). Nevertheless, the use of curative health care services is more strongly related to the characteristics of the patients than the health care expenditures. Elderly people have a higher number of contacts to different kind of doctors, they suffer to a higher degree from multi-morbidity, and their hospital visits are both more frequent and longer. The demand for ambulatory care and hospital activities requires a sufficient number of medical and non-medical personnel. Thus, the changes in the age-structure of the population have stronger impact on health workforce than on health expenditures.

Despite the markedly increase in health workforce in the past, a shortness of health workforce was reported in particular in some rural areas of Germany. This contradiction can be traced back to a feminisation of health workforce, a decline in working hours due to higher shares of part-time employees, and an increase in demand not least because of extended and better treatment methods due to the medical-technological progress, and inefficient and unequal distributions of physicians between regions (Kopetsch 2010). The share of females in health workforce increased in the past, and females are working to a higher proportion part-time. The medical-technological progress allows for treatments and measures which were not possible in

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the past, also new diagnostic measures allow for additional/new treatments of patients in ambulatory care but also in hospitals. New diagnostic and treatment methods are cost intensive and they increase the supply as well as the demand for new/additional treatments of patients. Additional treatments require additional working hours by health care staff, at the end an increase in employees. As a result, the ageing of the population combined with the demand driving medical progress have led to an increase in demand for health services which has been higher than the realized increase in health workforce. In view of the continuing trend of ageing and of the medical-technological progress on the one side and the expected high percentage of health workforce who will retire during the next 10 to 15 years, intensification (aggravation) of the health workforce shortage is expected in the future.

The demographic changes play also a significant role in the NEUJOBS project. NEUJOBS identified four main transition pathways for the future, (a) the socio-ecological transition with a shift to a green economy, (b) the skill transition with a shift to higher educated population, (c) a new territorial dynamic with a shift to agglomerations, and (d) the societal transition with a shift to a higher share of the elderly. In particular the expected societal transition with a combination of population ageing, changing household and family structure as well as increasing female employment will have a significant impact on the economic growth and employment in health care and social work. The impact of population ageing on the demand for services, the expenditures and the employment will be different between curative health care activities and long-term care activities. Thus, the development in the two parts of the health care and social work sector will be analysed separately.

This paper focuses on the curative health care sector. Section 2 provides an overview of the size and characteristics of the personnel employed in the curative health care. Section 3 describes the methods to estimate the future health workforce demand and supply. Section 4 focusses on the impact of 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 situation on the health labour market and the challenges.

2 Current situation and development of health care employment in the past

The situation on the health labour market is determined by the health care system. The health care market is not a normal market with the demands representing the preferences of the individuals and prices representing the value of a good or service. The supply and demand is determined by regulations concerning the financing system, the access to health care services, the defined health care basket public financed, as well as the organisation and reimbursement system for ambulatory care and hospitals. The health labour market is influenced by regulations concerning the needed

qualification, the regulations concerning the provision of ambulatory care by practising physicians and hospital services. To understand and interpret the current situation on the health labour market a description of the relevant health care system characteristics is essential.

2.1 Characteristics of the German health care system

In Germany the law on health insurance (Social Code Book V) regulates the eligibility criteria, access and provision of health care services (EC DG ECFIN 2010a and 2010b). The central government is responsible for the framework regulations, the Länder are responsible for the adequate supply of health care services. The health care providers act as independent agents under the overall framework of regulations. The German health care system is a self-governing system. The Federal Joint Committee comprises the four leading organisations of self-government: The National Associations of Statutory Health Insurance Physicians and Dentists, the German Hospital Federation, and the Central Federal Association of Health Insurance Funds.

Regulations and conditions influencing the demand on health care services and the needed employment

Germany has a universal mandatory health insurance system. All residents have the legal obligation to hold a health insurance policy. Employees with an income below a legally defined nominal threshold are mandatory members of a statutory health insurance funds. In 2011, 153 statutory health insurance funds exist. Also children and spouses with no or only marginal income are covered by dependents' co-insurance. Thus, the majority of people are members of the statutory health insurance. In 2011, 69.6 million persons (86 % of population) were insured in statutory health insurance.

People with an income above a fixed threshold can opt out, but they are obliged to conclude a contract with a private health insurance fund. Also self-employed people and civil servants are in the majority members of a private health insurance, but they can also be insured by a statutory health insurance fund on a voluntary basis as private insured persons. In 2011, some 8.9 million people (11 % of population) were members of one of the 46 private health insurance funds.

The statutory health insurance system is based on the solidarity principle, which guarantees identical benefits regardless of income respectively the income-related contributions paid, and morbidity risks. The legally defined basic benefit catalogue is the same for all statutory health insurance funds. The contributions are paid at a uniform rate set by the Federal Government. The National Health Fund (Gesundheitsfond) is responsible for pooling the income-related contributions. A risk adjustment mechanism takes account of diverging risk structures focusing on the actual morbidity costs (morbidity oriented risk adjustment mechanism) of the social health insurance funds. If costs of a SHI-fund exceed the risk adjusted allocations of the National Health Fund, that sickness fund has to charge its members an additional fee (EC DG ECFIN 2010b).

Patients have the free choice among general practitioner as well as of specialists under contract with their sickness fund. General practitioners have no gatekeeping function, but some sickness funds encourage their members to visit at first their GPs. The patients get a bonus if their GP functions as gatekeeper for specialists. An admission into a hospital requires a referral with the exception of emergency admissions.

Regulations and conditions influencing the supply of services and employees

Primary care is provided by private for-profit physicians in individual practices or shared practices (only 25% share a practice). The majority of doctors are accredited for statutory health insurance. They can also take private patients. Only a small minority of physicians resigns statutory health insurance accreditation and takes private patients only. The practice premises, equipment and personnel are financed by the physicians themselves (EC DG ECFIN 2010b).

Social health insurance in Germany operates with collective contracts covering provision by all doctors of a certain region. There is no affiliation to a single sickness funds.

Hospitals in Germany are run as public, private non-profit and private profit institutions. Hospital activities are focusing almost on inpatients care, but outpatient care activities are increasing due to the legal possibility to provide outpatient services in the treatment of certain diseases in hospitals. Hospital staff is paid salaries. The earnings of professionals working in ambulatory care are based on the fee-for-service base. All provided services are reimbursed based on the standard schedule of fees (Einheitlicher Bewertungsmaßstab - EBM). But there is a kind of an upper limit. The regional associations of statutory health insurance physicians receive budgets from the health insurance funds (OECD 2013). In general, this budget is fixed, and it is distributed among physicians in the region based on their activity in a base year. Thus, the earnings of an individual physician should not exceed the agreed budget.

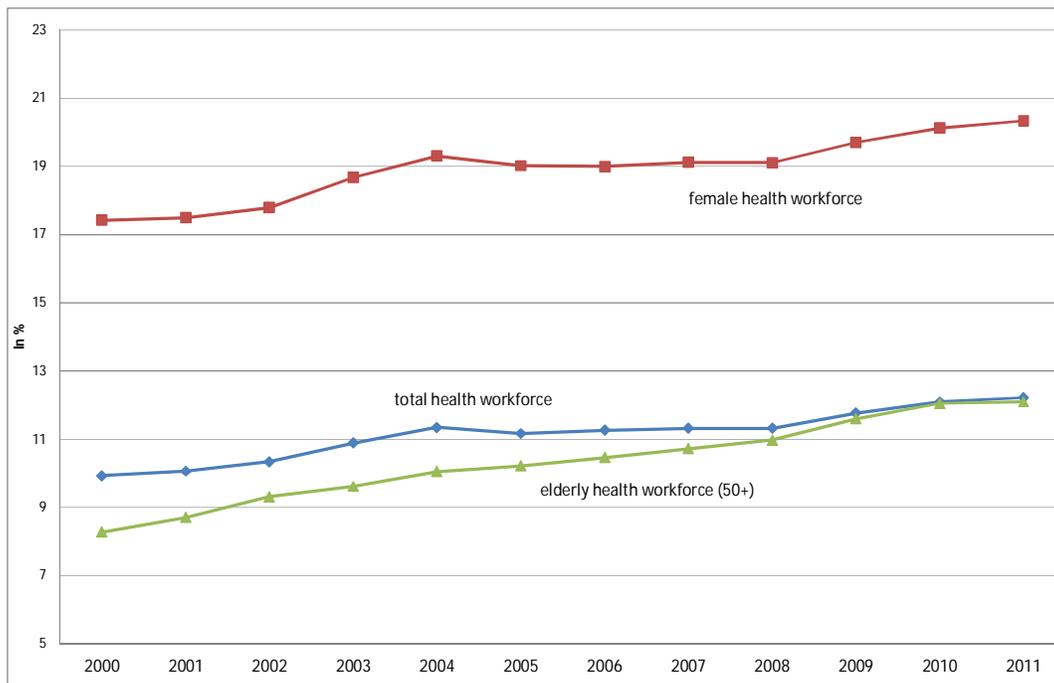
The need-related planning of hospitals is the responsibility of the Länder. The need-related planning of the social-health-insurance (SHI)-physicians is the tasks of the regional Associations of the SHI physicians and the regional Associations of the Health Insurance Funds. The planning is based on the ratios of the number of inhabitants to the number of physicians by specialty in each planning area. For general practitioner 883 planning regions exist (since 2013), for specialist the numbers of planning regions is smaller and depend of the type of specialty. If the overall supply within the planning area exceeds the specific local ratio by 10%, registration of new physician practicing in this local area is blocked. Areas with realized ratios below the fixed threshold are open for additional practicing physicians and for the replacement of physicians who want to exit the labor market. Special measures can be introduced for regions with a marked undersupply of practicing physicians.

2.2 Employment

An overview of the development in employment provide the data of the EU labour force survey (LFS), which are the most comparable data between the EU Member

States. The EU LFS provides information on the total employment by sex and age-groups as well as occupations. The LFS allows to distinguish between sectors of the economy classified by NACE1.1 (until 2008) respectively NACE2 (from 2008 onwards). Human health and social work activities are classified as sector Q, which can be distinguished in Q86 human health, Q87 residential care and Q88 social work without accommodation. According to the LFS some 4.9 million people were employed in human health and social work (sector Q) in Germany in 2011. The share in total employment was 12.2 % (Figure 1). In contrast to other EU countries which show a break in employment development due to the economic crisis in 2008, Germany has experienced an increase in employment in total economy as well as in health and social services during the whole period 2000 to 2011.

Figure 1 Share of health and social work employment in total employment in Germany (%)



Source: Eurostat, LFS, calculation of DIW Berlin.

The increase in total employment was with 2.4 million higher for females than for males (some 1 million). Thus, the feminisation of the health workforce continued and in particular nursing activities and assistant activities are predominant areas of female employment. One out of five female employees is engaged in the health care and social work sector in 2011. Some 1 million of the new jobs for females were created in this sector, that is to say 40 % of all new jobs for females. As a result the share of this sector in female employment has increased by nearly 3 %-points between 2000 and 2011 (from 17.4 % to 20.3 %).

The ageing of the workforce has been higher in health and social work than in economy in total. The share of elderly health workforce in total elderly employment increased from 8 % in 2000 to 12 % in 2011.

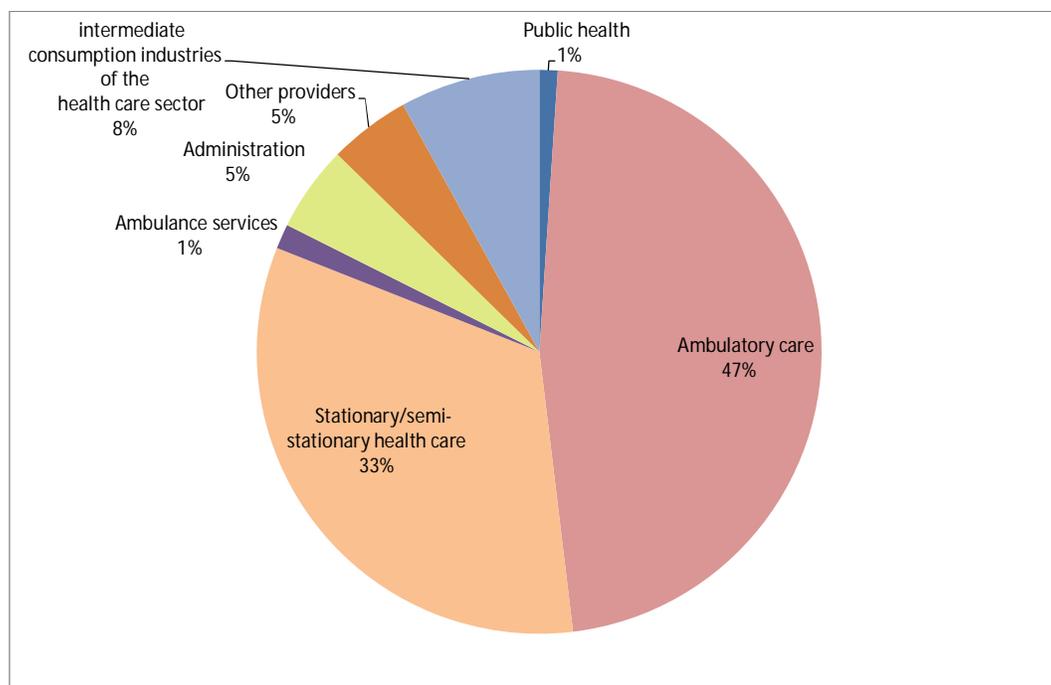
Compared to the EU27 average Germany has a relatively high standard of health care provision. In 2010 Germany had on average 3.7 practicing physician and 11.5 nurses per 1000 inhabitants. The number of specialist medical practitioner was with 2.2 per 1000 inhabitants higher than the EU27 average, but the number of generalist was with 1.6 per 1000 inhabitants lower.

2.2.1 Overview of personnel in curative health care

While the EU LFS provides an overview of the development in health care and social work, detailed analyses have to be based on national statistics. The Federal Statistical Office provides the health personnel statistics or health labour account (HLA). The statistics includes all persons required for health care and long-term care provision, and comprises also personnel required for services and goods of intermediate consumption in health care. Thus, the accounting is different from the National Accounts and the NACE classification. It includes also persons not accounted for in sector Q (see Table 45 in appendix). Nevertheless, the total employment differs not significantly from the figures of the LFS. The HLA delivers information on the number and structure of the persons employed in the health care sector by age-groups, gender, profession, facility and type of employment every year from 2000 onwards.

In 2011, in total 4.92 million persons are employed in health care (HLA), thereof some 4 million in acute health care (hospitals, rehabilitation institutions, ambulatory care, public health) and about 1 million in long-term care activities. As this report focusses only on acute health care, the employment in nursing homes and ambulatory long-term care services is excluded. The analysis of employment in long-term care will be carried out separately and is reported in the second country report.

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 (Figure 2). 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).

Figure 2 Distribution of personnel in acute health care (without LTC) 2011

Source: Federal Statistical Office; Health Personnel Account, calculation of DIW Berlin.

The curative health workforce is characterized through a high share of female employment, a high share of part-time employment and a disproportional high share of elderly employees (Table 1).

- In 2011 some 71 % of employees in curative health care were females. The share of females is highest in ambulatory care and lowest among the intermediate consumption industries. Health and in particular nursing care is still a field of female employment. Some 15 % of female employment in Germany is concentrated in curative health care. The share of females in curative health workforce increased by 1.7 %-points in the last decade due to the growing share of female students in human medicine and females among practising physicians (Table 46Table 50 in appendix).
- The health workforce is also characterized through a high share of employees working part-time. In 2011, 28 % of employees worked part-time. Part-time employment is more common among females and the high female employment in health care results in a relatively high share of part-time employment in this sector. In 2011, on average more than one third of female employees in health care worked part-time, but 10 % of males (see Table 47Table 56 in appendix). The number of full-time equivalents is therefore with some 3 million significantly lower than the workforce in head counts (Table 48Table 51 in appendix).

- Another fact is the high share of elderly employment in particular among practising physicians. In total curative health care some 29 % of employees are at least 50 years old, among practising physicians some 32 %. These employees will exit the labour market during the next 15 years and the high share indicates the challenge to replace the retirees (Table 49 in appendix).

Table 1 Employment in curative health care by facility in 2011

Type of facility	Head counts				FTE in 1000
	Persons in 1000	Share females	Share part-time	Share 50+	
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.

Between 2000 and 2011 the employment increased by 506,000, that is to say at 14.6 % (Table 2). The majority of the new jobs (72 %) were created in ambulatory care (364,000), whilst in institutional care only less than 10 % of the (net) new jobs were realized (46,000). Offices of physicians and dentists realized an increase in employment, but the highest increase show offices of health practitioners like physiotherapists, psychotherapists, occupational therapists, ergo therapists, speech therapists, orthopaedists and movement therapists. This is an indicator for the changing demand due to the ageing of the population, but also of an increase in the status of rehabilitation treatments. An increase in rehabilitation treatments can also be seen in institutional rehabilitation facilities (increase in employment by 11.8 %), while hospitals realized only a small increase in employment (2.5 %).

Two facilities realized a decline in employment, namely administration (-18,000) and pharmaceutical industry (-7,000). The reduction in administrative jobs can be partly traced back to measures increasing productivity. Administration comprises employees in social health insurance and other financial agents as well as employees of the Medical Services of Association of the Social Health Insurance Funds.

The changes in total health care employment were accompanied by an increase in part-time employment. Thus, the increase measured in FTE was significant lower; 227,000, thereof 200,000 females. It is notable, that - measured in FTE - also the hospital sector showed a decline in employment. The male hospital staffs have declined by 7,000 FTE, while the female employment was constant. The Association of Physician reported, that in 2011 some 7,000 vacancies for doctors could not re-staffed in hospitals.

Table 2 Personnel in acute health care (without LTC) by facilities 2000 and 2011

Type of facility	Head counts				Full-time equivalents		
	Changes in 1000 persons	Changes in %	Changes in share females	Changes in the share 50+	Changes in 1000 FTE	Changes in %	Changes in share females
Facilities total	506	14.6	1.7	10.1	227	8.1	1.7
Public health	-1	-2.4	-0.8	9.2	-2	-5.6	-1.8
Ambulatory care	364	24.2	1.7	10.5	198	15.9	1.6
Offices of physicians	84	13.8	1.2	10.9	33	6.6	0.9
Offices of dentists	50	16.4	2.5	10.5	22	8.7	2.4
Offices of health practitioners	171	75.7	1.8	10.9	112	61.2	1.6
Dispensing chemists	16	9.8	-5.1	8.5	8	6.2	-5.4
Retail sale and suppliers of medical appliances	-1	-0.6	5.0	9.3	-10	-6.6	4.6
Institutions providing other ambulatory care	44	137.5	3.1	14.1	33	126.9	2.0
Stationary/semi-stationary health care	46	3.6	0.9	10.1	-7	-0.7	0.5
Hospitals	28	2.5	0.9	10.1	-9	-1.1	0.4
Preventive care/rehabilitation facilities	18	11.8	1.0	9.5	2	1.6	1.2
Ambulance services	11	25.0	1.4	9.1	6	15.4	1.0
Administration	-18	-8.4	-0.4	8.8	-27	-14.5	0.4
Other providers	73	65.2	6.6	9.0	49	52.1	7.6
intermediate consumption industries of the health care sector	31	10.8	0.6	9.5	10	4.0	0.8
pharmaceutical industry	-7	-6.2	4.0	8.8	-12	-12.4	3.6
medicotechnical and ophthalmic industry	24	23.5	-0.5	11.2	15	16.7	-1.0
medical laboratories and wholesale trade	13	18.3	0.4	8.2	7	11.3	0.4

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

In curative health care facilities are medical and nursing professions engaged, as well as assisting personnel. As mentioned before, also personnel in intermediate industries, in administrations and housekeeping are accounted. Most occupations can be seen in all facilities, except, for example, dentist which work almost in offices of dentists. Table 3 shows the occupational structure of facilities.

Table 3 Personnel in acute health care by occupations and facilities in 2011

	Facilities total	Public health	Ambulatory care	Offices of physicians	Offices of dentists	Offices of health practitioners	Other ambulatory services	Stationary health care	Hospitals	Preventive care/rehabilitation facilities	Ambulance, administration, other providers	Intermediate consumption industries
	1000		share (%)									
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, paediatricians	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 attendants	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
pharmaceutic 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.

Physician work in their own offices or in hospitals, but the division depends on the type of speciality. 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. They are required to complete a further training in a hospital as well as in offices of physicians. In 2011, 102,000 general practitioner (in further training measures) were employed, thereof 14 % in offices of physicians, 14 % in ambulatory care facilities, and 70 % in hospitals.

2.2.2 Characteristic of employees in hospitals

In 2011, Germany had 2,045 hospitals with in total more than 500,000 beds (Table 4). Hospital activities are concentrated on inpatient acute care. Rehabilitation care in institutions is counted separately. In the last years outpatient care activities carried out by specialists employed by hospitals increased, but plays still a marginal role. Thus, the statistics on hospital patients focuses on inpatients. 18.3 million patients were treated by 154,000 medical and 975,000 non-medical staff (FTE). The workload ratio, that is to say the average number of beds to be cared for per FTE, was 13.2 for medical staff, 6.2 for nursing staff and 14.3 for medico-technical staff.

Table 4 Beds, treatment cases, and personnel in general hospitals 2000 to 2011

Year	Facilities	Beds	Treatment cases	Days of care (in 1000)	Full-time equivalents (annual average)		Workload ratio per full-time equivalent*		
					medical staff*	non-medical staff	medical staff*	nursing staff	medico-technical staff
2011	2045	502 029	18 342 989	141 676	154 244	974 884	13.9	6.2	14.3
2010	2064	502 749	18 032 903	141 942	148 696	964 263	14.4	6.3	14.8
2009	2084	503 341	17 817 180	142 414	143 967	952 553	14.8	6.4	15.1
2008	2083	503 360	17 519 579	142 535	139 294	938 918	15.2	6.5	15.5
2007	2087	506 954	17 178 573	142 893	136 267	931 020	15.5	6.5	15.7
2006	2104	510 767	16 832 883	142 251	133 649	930 728	15.7	6.5	15.8
2005	2139	523 824	16 539 398	143 244	131 115	932 039	16.1	6.5	15.9
2004	2166	531 333	16 801 649	146 746	129 817	942 029	17.0	6.5	16.2
2003	2197	541 901	17 295 910	153 518	128 853	967 567	18.3	6.5	16.8
2002	2221	547 284	17 432 272	159 937	126 047	986 374	19.3	6.7	17.5
2001	2240	552 680	17 325 083	163 536	123 819	977 537	20.2	6.7	18.0
2000	2242	559 651	17 262 929	167 789	122 062	978 409	21.0	6.9	18.5
*) only physicians and dentists with main job in the hospital									
**) average number of beds to care for per full-time equivalent per day									
Source: Federal Statistical Office of Germany, Hospital statistics - basic data 2000-2011									

The hospital sector experienced marked changes in the last decades. Cost cutting policies and the introduction of the DRG system increased the pressure to strengthen the productivity. Hospitals were consolidated, the number of beds was reduced to increase the occupation rate of beds, and the average length of stay declined markedly. In total the days of care declined from 168 million in 2000 to 142 million in 2011. The decline in total hospital days combined with an increase in particular of medical staff results in declining workload ratios. But the DRG-system has also the incentive to

increase the number of treatment cases in particular in DRGs with high profit margins (Felder; Mennicken; Meyer 2013). The number of inpatients increased by 1.1 million between 2000 and 2011, which cannot be explained by demographic change only.

Beside the psychiatric departments in general hospitals clinics with solely psychiatric beds exist. In the last decade an increase in people with psychiatric illnesses can be observed. Patients with psychiatric illnesses treated in hospitals or in special clinics stay on average much longer in institutions, on average 3 to 4 weeks. They need special treatments and therapies. In Germany 247 special clinics for psychiatric illnesses exist with 41,000 beds. In 2011 some 560,000 patients were treated by 5,700 medical and 47,000 non-medical staff (FTE). The workload was higher than in general hospitals (Table 50 in appendix).

Occupations

The health personnel account provides information on the number of employees in hospitals by occupations, sex and age-groups. In 2011 some 1.1 million persons were employed in acute care hospitals, 0.27 million men and 0.86 million women (Table 5). The occupational structure of male and female employees in hospitals differs markedly. Nearly one third of males were physicians, but only 8 % of females. Females have in the majority nursing and assistant occupations, more than 73 %, but only one third of males.

The share of older employees (aged 50+) is in general higher for males than for females. In particular female physicians are on average younger than male physicians. That is in line with the increasing share of females among students and graduates in general and also in medicine during the last decades.

Due to the high share of part-time employment the number of full-time equivalents working in hospitals was with 826,000 significantly lower than the number of employed persons. In the last decade the following trends can be observed (Table 6):

- The number of FTE declined by 9,000, thereof 6,000 men and 3,000 women.
- The reduction in employment was concentrated in other professions in health care and health craftsmen (an effect of outsourcing of housekeeping and cleaning activities), whilst in particular the number of physicians (FTE) increased.
- The increase was with 68 % higher for female physicians than for males (14 %).
- The feminisation of health workforce, in particular among high qualified employees (physicians) continued. The exception is the employment of nursing staff where the male employment increased and the share of female employment declined.

Table 5 Employees in hospitals (incl. psychiatric clinics) by occupations, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
		Age-structure in %				Age-structure in %				Age-structure in %		
Total of health care personnel	1 137	30.8	40.5	28.7	273	27.4	39.4	33.3	864	31.9	40.8	27.2
health service professions	902	31.3	41.0	27.8	194	27.6	40.3	32.8	708	32.3	41.1	26.4
physicians, pharmacists, psych. psychotherapists, dentists	164	24.2	38.2	36.5	89	18.8	38.3	42.6	75	30.8	38.1	29.2
physicians	154	25.1	38.3	35.2	86	19.1	38.0	41.2	69	32.3	38.1	27.3
physicians spec. in general medicine, paediatrists, internists	23	1.9	42.6	54.6	15	1.6	38.7	59.7	8	2.5	50.0	45.0
surgeons, orthopedists	20	0.0	53.3	44.0	16	0.0	50.0	46.7	4	0.0	66.7	33.3
gynecologists/obstetricians	5	0.0	47.4	52.6	2	0.0	28.6	71.4	3	0.0	60.0	40.0
neurologists, psychiatrists	9	0.0	41.6	50.1	5	0.0	38.5	53.8	4	0.0	45.5	45.5
general practitioners	71	52.7	28.3	17.6	30	52.4	28.6	19.0	40	54.2	28.8	16.9
other medical specialists	26	3.1	47.5	51.1	17	2.6	46.2	53.8	9	4.2	50.0	45.8
pharmacists	2	23.9	43.0	33.1	1	21.1	42.1	36.8	1	26.8	43.9	29.3
psychological psychotherapists	6	5.3	33.1	67.3	2	0.0	27.3	81.8	4	8.0	36.0	60.0
dentists	1	30.7	78.9	87.0	1	10.0	37.5	52.5	1	20.7	41.4	34.5
remaining health service professions	738	32.8	41.6	25.8	105	35.1	42.1	24.4	633	32.5	41.5	26.1
medical assistant/dental assistant	48	45.0	34.7	20.3	1	50.0	25.0	25.0	47	44.9	34.9	20.2
incl. dental assistants	4	45.0	34.9	20.1	0				4	44.9	34.8	20.2
assistant dieticians	3	46.2	38.5	15.4	0				3	46.2	38.5	15.4
non-medical practitioners	1	18.5	44.4	37.0	0				1	18.5	44.4	37.0
nurses	547	31.5	42.9	25.8	83	33.6	42.9	24.4	464	31.2	42.9	26.1
incl. midwives	10	33.3	42.9	23.8	0				10	28.6	42.9	23.8
health care and nursing aid	55	31.4	37.1	31.3	10	39.8	36.1	22.9	45	29.5	37.3	33.2
physiotherapists, masseurs, medical bath attendants	23	40.1	40.1	20.3	6	39.3	39.3	23.2	17	40.4	40.4	19.2
incl. physiotherapists	20	39.7	39.7	20.6	4	40.0	36.0	24.0	16	39.6	40.5	19.8
medical laboratory assistants	48	30.9	40.2	29.9	4	37.5	37.5	25.0	45	29.7	39.6	29.7
pharmaceutic-technical assistants	2	46.2	35.4	18.5	0				2	46.2	35.4	18.5
therapeutic professions not named elsewhere	10	45.0	42.6	22.4	2	31.3	43.8	25.0	9	43.0	37.6	19.4
social professions	34	30.2	36.9	29.7	5	31.5	28.9	18.4	29	30.0	38.3	31.7
geriatric nurses	32	30.5	38.3	31.0	4	39.3	36.1	23.0	28	29.2	38.6	32.1
remedial therapists	1	42.9	35.7	21.4	0				1	50.0	30.0	20.0
orthopaedagogues	1	25.0	41.7	33.3	0				0			
health craftsmen	1	38.5	36.5	25.0	0				0			
other special professions in health care	4	31.3	37.5	31.3	1	26.5	38.2	35.3	3	33.9	37.1	29.0
incl. pharmaceutic-commercial employees	2	35.7	35.7	26.2	0				2	36.6	36.6	26.8
other professions in health care	197	28.6	38.9	32.6	73	26.6	37.7	35.7	124	29.8	39.5	30.8

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

- A trend to higher qualified medical staff can be observed due to the increase in physicians and a decline in nurses.
- The share of part-time employed continued to increase. The reduction in average working time leads to the contrary trend in employment measured in headcounts compared to FTE. While the number of employed persons increased by 28,000 persons, the number of FTE declined.

Table 6 Changes in hospital employment between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE							2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons		
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females
Total of health care personnel	826	-9	-6	-3	-1	-3	-1	0.42	1 137	28	-3	31
physicians, pharmacists, psych. psychotherapists, dentists	146	35	10	25	32	14	68	9.13	164	31	9	70
assistants (medical, deantal, laboratory, pharmaceutical)	69	4	-1	5	6	-25	8	1.81	101	13	2	12
nurses, geriatric nurses, health care and nursing aid	450	-5	5	-10	-1	7	-3	-1.29	634	30	10	20
physiotherapist, therapeutic prof., therapists	24	1	0	1	4	0	6	1.27	31	5	1	4
health craftsmen, other professions in health care	136	-44	-21	-23	-24	-26	-23	1.06	258	-56	-22	-34

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

2.2.3 Characteristics of personnel in rehabilitation institutions

In Germany medical rehabilitation is mainly carried out in rehabilitation institutions and financed by the health care insurance or by the pension system (measures to ensure that employees are able to stay – longer - in the labour market). Rehabilitation can be provided as full-time stay (overnight stays) or part-time stay (staying in an institution only for treatments, without board and lodging). The Federal Statistical office provides a statistics on rehabilitation treatments and personnel, but only for institutions with at least 100 beds. That means that small special clinics are not included. In 2011 1,200 facilities with in total 170,000 beds were recorded (Table 7). In these institutions (with more than 100 beds) some 1.9 million people were treated by 8,200 medical and 82,500 non-medical staff (FTE). The average length of stay was 25 days. Normally rehabilitation measures with a length of stay of 3 weeks were financed by the health or pension system, extension is possible upon request in severe cases. The ratio of beds to FTE is higher than in hospitals or psychiatric clinics.

Between 2000 and 2011 the number of facilities, the number of beds, but also the number of treatment cases and treatment days declined. The reduction in beds can be partly traced back to changes in the regulation of rehabilitation provision. The average number of provided rehabilitation days was reduced, and the eligibility criteria were changed. The decline in capacity is also a result of measures to increase the efficiency like reorganisation and increase in occupation rates.

Table 7 Beds, treatment cases, and personnel in prevention and rehabilitation institutions* 2000 to 2011

Year	Facilities	Beds	Treatment cases	Days of care (in 1000)	Full-time equivalents (annual average)		Workload ratio per full-time equivalent***		
					medical staff**	non-medical staff	medical staff**	nursing staff	medico-technical staff
2011	1233	170 544	1 926 055	48 981	8 237	82 514	81.1	31.9	27.6
2010	1237	171 724	1 974 731	50 219	8 214	84 142	83.4	32.4	28.0
2009	1240	171 489	2 005 491	51 126	8 252	84 152	84.5	33.0	28.8
2008	1239	171 060	2 009 526	50 886	8 242	83 611	84.2	32.8	28.8
2007	1239	170 845	1 942 566	49 483	8 193	82 827	82.4	31.9	28.7
2006	1255	172 717	1 836 681	47 011	8 117	82 372	79.0	30.9	27.7
2005	1270	174 479	1 813 990	46 774	8 073	83 474	79.0	30.5	27.3
2004	1294	176 473	1 889 362	47 442	7 995	84 949	80.9	31.1	27.6
2003	1316	179 789	1 899 558	49 204	8 229	88 291	81.5	31.3	27.4
2002	1343	184 635	2 041 272	52 107	8 347	90 593	85.1	32.4	28.4
2001	1388	189 253	2 096 904	53 514	8 441	90 856	86.5	33.5	29.1
2000	1393	189 822	2 046 227	52 852	8 299	89 547	86.8	34.3	29.7
*) with more than 100 beds									
**) only physicians with main job in the prevention and rehabilitation facility									
***) average number of beds to care for per full-time equivalent per day									
Source: Federal Statistical Office of Germany, Rehabilitation statistics - basic data 2003-2011, Hospital and rehabilitation statistics - basic data 2000-2002.									

Occupations

While the rehabilitation statistics provides an overview of the number of facilities, beds and the patients for rehabilitation institutions with more than 100 beds, the HLA provides an overview of the personnel employed in all rehabilitation institutions (also in small once). The total employment amounts to 170,000 measured in headcounts respectively 130,000 measured in FTE in 2011. Medical rehabilitation requires in the majority of cases therapeutically treatments and nursing care. Thus, the share of physicians is lower than in general hospitals (only 10%), but the share of remaining health service professions, in particular physiotherapists, and other therapists, is higher (around 20%). The employment in remaining health professions and social professions amounts to 100,000, while only 16,000 physicians are employed in rehabilitation institutions (Table 8).

As female employment is concentrated in nursing care and also in therapeutically professions the employment in rehabilitation institutions is dominated by females. The share of female employment is 75%, among nurses 90% and among therapists around 80%. Males are more concentrated in medical professions. Around one fifth of male employees are doctors (but only 7% of females), another fifth therapist, and 10 % have social professions.

Table 8 Personnel in rehabilitation institutions by occupations, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
		Age-structure in %				Age-structure in %				Age-structure in %		
Total of health care personnel	170	31.5	39.3	28.7	41	27.8	37.8	32.3	128	32.9	40.1	27.8
health service professions	99	33.2	39.8	27.0	22	28.6	39.1	33.0	77	34.6	40.0	25.4
physicians, pharmacists, psych. psychotherapists, dentists	17	20.3	37.8	41.3	8	13.8	37.1	49.2	9	26.0	38.5	34.3
physicians	16	21.0	36.2	35.1	7	15.8	38.5	44.5	8	28.3	38.8	31.1
physicians spec. in general medicine, paediatrists, internists	4	2.1	44.4	52.3	2	1.6	38.7	59.7	2	2.5	50.0	45.0
surgeons, orthopedists	1	0.0	50.0	46.7	1	0.0	50.0	46.7	0			
neurologists, psychiatrists	2	0.0	42.0	49.7	1	0.0	38.5	53.8	1	0.0	45.5	45.5
general practitioners	6	53.6	28.7	17.6	2	52.4	28.6	19.0	4	54.2	28.8	16.9
other medical specialists	2	3.4	48.1	49.8	1	2.6	46.2	53.8	1	4.2	50.0	45.8
psychological psychotherapists	2	4.0	31.6	70.9	1	0.0	27.3	81.8	1	8.0	36.0	60.0
remaining health service professions	82	35.9	40.2	24.1	14	37.0	40.2	23.7	68	35.7	40.1	24.2
medical assistant/dental assistant	4	44.9	34.9	20.2	0				4	44.9	34.9	20.2
assistant dieticians	2	23.1	19.2	7.7	0				1	46.2	38.5	15.4
non-medical practitioners	1	18.5	44.4	37.0	0				1	18.5	44.4	37.0
nurses	26	31.4	42.9	25.9	3	33.6	42.9	24.4	23	31.2	42.9	26.1
health care and nursing aid	12	31.2	37.1	31.4	2	39.8	36.1	22.9	10	29.5	37.3	33.2
physiotherapists, masseurs, medical bath attendants	26	40.1	40.1	20.3	7	39.3	39.3	23.2	19	40.4	40.4	19.2
incl: physiotherapists	18	39.7	39.5	20.7	4	40.0	36.0	24.0	14	39.6	40.5	19.8
medical laboratory assistants	3	19.8	26.4	19.8	0				2	29.7	39.6	29.7
therapeutic professions not named elsewhere	9	45.2	43.2	22.8	2	31.3	43.8	25.0	8	43.0	37.6	19.4
social professions	18	32.5	41.8	31.2	4	34.8	40.3	24.5	14	31.8	42.2	33.1
geriatric nurses	9	30.4	38.4	31.1	1	39.3	36.1	23.0	8	29.2	38.6	32.1
remedial therapists	2	75.0	42.5	32.5	1	50.0	25.0	25.0	2	50.0	30.0	20.0
orthopaedagogues	7	23.0	46.0	31.0	2	25.0	50.0	25.0	5	22.2	44.4	33.3
health craftsmen	1	0.0	0.0	0.0	0				0			
other professions in health care	51	28.9	39.0	32.2	14	26.6	37.7	35.7	37	29.8	39.5	30.8

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

Between 2000 and 2011 the number of full-time equivalents increased slightly (Table 9). Contrary to general hospitals a shift to nursing and therapeutic staff employment can be observed. The number of physicians (FTE) declined by 1,000, but the number of nurses increased by 6,000, and the number of therapeutic staff increased by 9,000 FTE. The share of females was more or less constant with a slightly increase among physicians and a marginal

decline among therapeutic professions. The declining trend of working hours can also be seen in rehabilitation institutions, resulting in an increased by 2,000 FTE whilst the number of employed persons increased by 18,000.

Table 9 Changes in employment in rehabilitation institutions between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE								2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons			
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females	
Total of health care personnel	130	2	-1	3	2	-3	3	1.21	170	18	2	15	
physicians, pharmacists, psych. psychotherapists, dentists	15	-1	-1	0	-6	-13	0	3.33	17	0	-1	0	
assistants (medical, dental, laboratory, pharmaceutical)	6	0	0	0	0	-	0	0.00	9	2	0	0	
nurses, geriatric nurses, health care and nursing aid	37	6	2	5	19	50	19	-0.09	47	12	2	10	
physiotherapist, therapeutic prof., therapists	36	9	3	5	33	43	25	-4.63	45	13	4	11	
health craftsmen, other professions in health care	37	-11	-4	-8	-23	-25	-25	-1.80	60	-8	-3	-6	

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

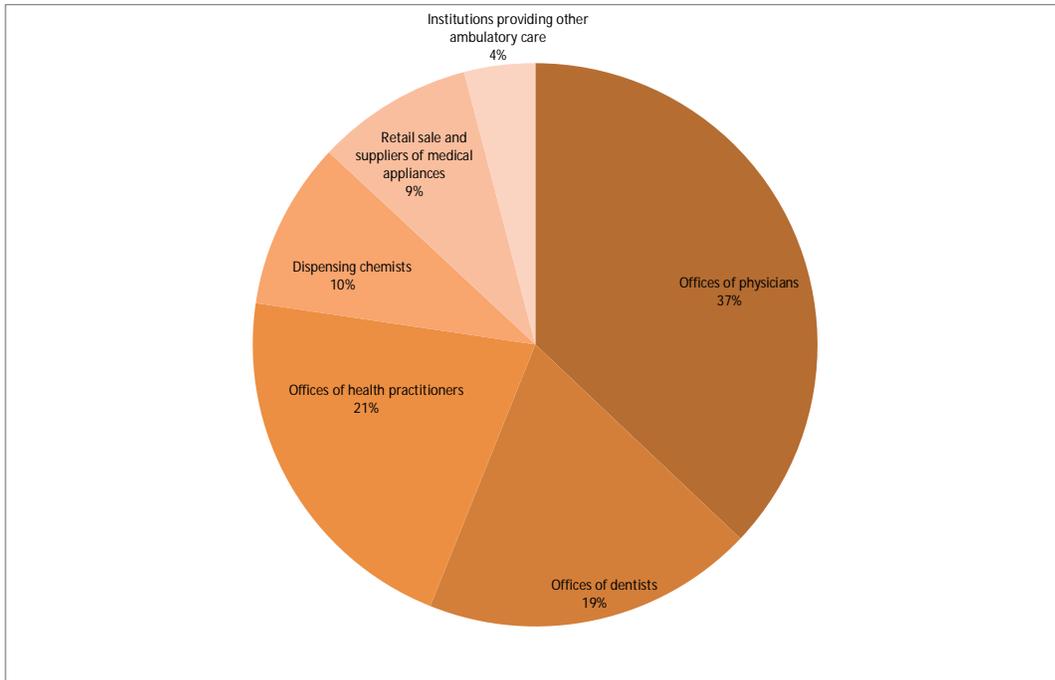
2.2.4 Personnel in ambulatory care by occupation and field of activity

In Germany ambulatory health care is provided in the majority of cases by practising general practitioner, specialists, dentists and other health practitioners most in their own office or in shared offices. In the last years ambulatory health care centres were established, but they still play a minor role. In 2011 some 1.9 million persons were employed respectively self-employed in ambulatory acute health care services, 37 % in offices of physicians, 19 % in offices of dentists, 21 % in offices of health practitioners, 10 % in pharmacies, 9 % in retail sale and supplier of medical appliances, and 4 % in institutions providing other ambulatory care (Figure 3).

Offices of physicians

In 2011 about 143,000 physicians - 85,000 men and 58,000 women - were engaged in offices of physicians (Table 10). 124,000 physicians were practising and only 19,000 were employed. They were assisted by 375,000 medical (laboratory) assistants, 35,000 nurses or geriatric nurses, and 8,000 therapists. Additional 130,000 other professions in health care are employed in offices of physicians. The ratio of assistants and nurses to physicians was 2.44 and the ratio of total employees to physicians 3.24. As in other areas of acute health care are the majority of assistants, of nurses and of therapists' females (97 %).

Figure 3 Distribution of personnel in ambulatory acute health care services 2011



Source: Federal Statistical Office, Health personnel account, calculation of DIW Berlin.

Table 10 Personnel in offices of physicians by occupations, gender and age-groups in 2011

	Total				Men			Women				
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
Total of health care personnel	692	32.0	35.9	32.1	120	9.8	31.4	58.0	573	36.6	36.8	26.6
health service professions	547	32.7	35.1	32.2	95	5.4	30.1	64.6	451	38.5	36.2	25.5
physicians, pharmacists, psych. psychotherapists, dentists	143	1.8	34.1	64.1	85	1.0	29.7	69.3	58	2.8	40.7	56.5
physicians	143	1.8	34.2	64.0	85	1.0	29.7	69.3	58	2.8	40.7	56.5
physicians spec. in general medicine, paediatrists, internists	67	0.5	33.7	65.8	41	0.4	28.5	71.1	25	0.7	43.6	59.9
surgeons, orthopedists	13	0.1	36.0	63.8	11	0.1	34.5	65.4	2	0.5	45.9	53.6
gynecologists/obstetricians	11	0.3	36.7	63.1	4	0.1	21.9	84.7	7	0.4	45.1	50.8
neurologists, psychiatrists	11	0.2	27.3	70.9	6	0.2	25.5	72.1	5	0.2	29.6	69.6
general practitioners	14	13.4	27.1	55.9	5	11.4	20.8	67.9	9	14.5	30.6	49.2
other medical specialists	28	0.9	38.6	59.2	18	0.7	35.1	63.6	10	1.1	43.8	52.5
remaining health service professions	404	43.6	35.4	20.9	10	42.3	33.8	24.3	394	43.7	35.5	20.8
medical assistant/dental assistant	359	45.0	34.8	20.2	4	50.0	25.0	25.0	355	44.9	34.9	20.2
incl. dental assistants	31	44.9	34.8	20.2	0				31	44.9	34.8	20.2
nurses	16	31.5	42.9	25.9	2	33.6	42.9	24.4	14	31.2	42.9	26.1
health care and nursing aid	3	42.8	49.4	40.8	1	39.8	36.1	22.9	3	29.5	37.3	33.2
physiotherapists, masseurs, medical bath attendants	7	45.8	45.8	23.1	2	39.3	39.3	23.2	6	40.4	40.4	19.2
incl. physiotherapists	4	49.6	49.5	25.8	1	40.0	36.0	24.0	4	39.6	40.5	19.8
medical laboratory assistants	16	30.2	39.4	29.4	1	37.5	37.5	25.0	15	29.7	39.6	29.7
therapeutic professions not named elsewhere	1	43.0	37.6	19.4	0				1	43.0	37.6	19.4
social professions	16	30.5	38.3	31.0	2	39.3	36.1	23.0	14	29.2	38.6	32.1
geriatric nurses	16	30.9	38.3	30.9	2	39.3	36.1	23.0	14	29.2	38.6	32.1
other professions in health care	130	29.0	38.9	31.4	22	26.6	37.7	35.7	107	29.8	39.5	30.8

Source: Federal Statistical Office; health personnel account; German Medical Association; calculations of DIW Berlin.

One fact which may be important for the development of ambulatory health care provision is the high proportion of elderly physicians. According to the statistics of physicians of the German Medical Association 25 % of practising physicians in

ambulatory care are at least 60 years old and only 5 % are aged 35 to 40 years (Bundesärztekammer 2012). That means that during the next 5 years around 31,000 practising physicians are expected to exit the labour market. Some 51,200 practising physicians in ambulatory care are aged 50 to 60 years. They will exit the labour market until 2025. The high share of elderly is an indicator for the challenges in ambulatory care.

Between 2000 and 2011 the employment in offices of physicians has increased by 14 %, and the number of FTE by some 7 % (Table 11). The shift to female employment and part-time employment can also be seen in offices of physicians. The ratio of assistants and nurses to physicians was nearly constant over time, but a slightly shift to nurses can be observed.

Table 11 Changes in employment of offices of physicians between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE							2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons		
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females
Total of health care personnel	531	33	1	31	7	1	8	0.9	692	84	8	77
physicians, pharmacists, psych. Psychotherapists	125	8	-1	10	7	-1	26	5.9	143	15	2	13
assistants (medical, laboratory)	277	16	2	13	6	100	5	-1.0	375	45	3	42
nurses, geriatric nurses, health care and nursing aid	28	9	3	9	47	150	56	5.1	35	13	2	11
physiotherapist, therapeutic prof., therapists	6	3	0	3	100	0	150	16.7	8	5	1	4
other professions in health care	94	-3	-1	-2	-3	-5	-3	0.4	130	7	-1	7

Source: Federal Statistical Office, Health personnel accounts: calculation fo DIW Berlin.

Offices of dentists

In offices of dentists are 355,000 persons employed, thereof 66,000 dentists and 211,000 dental assistants (Table 12). Males are predominately working as dentists and other professions in health care. Females are predominately engaged in assistant occupations, only 9 % are dentists. In 2011, the ratio of assistants and nurses to dentists was 3.2; the total ratio including other staff was 4.4.

Table 12 Personnel in offices of dentists by occupations, gender and age-groups in 2011

	Total				Men				Women			
	Total	under 35	35 - 50	50 a. m.	Total	under 35	35 - 50	50 a. m.	Total	under 35	35 - 50	50 a. m.
	in 1000	Age-structure in %			in 1000	Age-structure in %			in 1000	Age-structure in %		
Total of health care personnel	355	31.7	39.1	29.3	55	17.0	38.1	46.8	300	34.4	39.2	26.1
health service professions	281	31.8	39.0	28.9	40	11.3	37.6	51.1	241	35.2	39.2	25.2
dentists	66	14.2	38.5	44.3	38	10.0	37.5	52.5	27	20.7	41.4	34.5
remaining health service professions	215	37.2	39.2	24.1	2	36.4	39.7	23.8	214	37.0	39.0	24.0
dental assistants	211	44.9	34.9	20.2	1	50.0	25.0	25.0	210	44.9	34.9	20.2
nurses	1	31.2	42.9	26.1	0				1	31.2	42.9	26.1
health care and nursing aid	1	29.5	37.3	33.2	0				1	29.5	37.3	33.2
medical laboratory assistants	2	29.7	39.6	29.7	0				2	29.7	39.6	29.7
health craftsmen	12	38.2	36.2	24.9	6	35.6	35.6	28.8	6	40.8	36.8	21.1
dental technicians	12	33.3	37.7	29.0	6	32.3	35.5	32.3	6	34.3	40.0	25.7
other professions in health care	63	29.3	39.2	31.6	10	26.6	37.7	35.7	53	29.8	39.5	30.8

Source: Federal Statistical Office; health personnel account; calculations of DIW Berlin.

The employment in offices of dentists has increased by some 9 % (FTE) in the last decade (Table 13). As in other areas of health care the increase was dominated by female employment. In offices of dentists male employment declined slightly (FTE) due to the decline in the number of male dentists. More than 50 % of male dentists in ambulatory care were at least 50 years older, some 20 % were at least 60 years old (German Dental Association). Thus, it is expected that in the next 10 to 15 years the number of practising male dentists will decline markedly.

Table 13 Changes in employment in offices of dentists between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE							2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons		
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females
Total of health care personnel	275	22	-1	24	9	-2	12	2,4	355	50	0	50
dentists	61	3	-1	4	5	-3	20	4,9	66	5	-1	5
assistants (dental, laboratory)	156	17	1	16	12	-	12	-0,6	213	38	1	37
nurses, health care and nursing aid	2	0	0	1	0	-	100	50,0	2	0	0	1
physiotherapist, therapeutic prof., therapists	0	0	0	0	-	-	-	-	0	0	0	0
health craftsmen, other professions in health care	55	1	0	2	2	0	5	2,3	75	8	1	7

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

Personnel of other ambulatory facilities

In offices of dispensing chemists (Table 51 in appendix) health practitioners (Table 52 in appendix), retail sale and supplier of medical appliances and institutions providing other ambulatory care are in total 820,000 persons employed (Table 14). The employment in these health services depends partly on the activities of physicians and dentists. Physicians and dentists prescribe pharmaceuticals, cure, aids and appliances, and make out referrals to therapists. The occupation structure of the pooled subsector is determined by the underlying activities with pharmacists, therapists, health craftsmen and other professions in health care.

Table 14 Personnel in other ambulatory facilities* by occupations, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
		Age-structure in %				Age-structure in %				Age-structure in %		
Total of health care personnel	820	33.0	38.3	27.9	248	29.3	37.0	31.6	573	34.6	38.8	26.2
health service professions	451	34.0	38.9	26.4	99	29.5	38.6	30.0	352	35.3	39.0	25.3
physicians, pharmacists, psych. psychotherapists, dentists	79	18.3	39.5	42.8	25	13.5	35.7	49.8	55	20.2	40.5	38.8
physicians	1	17.3	40.9	41.8	1	13.0	39.6	47.9	1	23.3	42.7	34.0
pharmacists	52	25.1	43.3	31.6	16	21.1	42.1	36.8	36	26.8	43.9	29.3
psychological psychotherapists	26	5.5	33.3	66.7	8	0.0	27.3	81.8	18	8.0	36.0	60.0
remaining health service professions	370	37.5	39.0	23.0	74	35.0	39.5	23.4	296	38.2	38.9	22.9
medical assistant/dental assistant	10	40.4	31.4	18.2	0				9	44.9	34.9	20.2
incl: dental assistants	1	44.9	34.8	20.2	0				1	44.9	34.8	20.2
assistant dieticians	5	46.2	38.5	15.4	1	0.0	0.0	0.0	5	46.2	38.5	15.4
non-medical practitioners	28	17.2	45.6	37.1	6	12.5	50.0	37.5	22	18.5	44.4	37.0
nurses	34	31.5	42.9	25.8	5	33.6	42.9	24.4	29	31.2	42.9	26.1
incl: midwives	11	28.6	42.9	23.8	0				11	28.6	42.9	23.8
health care and nursing aid	55	32.0	36.3	29.6	16	39.8	36.1	22.9	38	29.5	37.3	33.2
physiotherapists, masseurs, medical bath attendants	114	40.4	40.4	20.6	33	39.3	39.3	23.2	82	40.4	40.4	19.2
incl: physiotherapists	68	39.7	39.7	20.6	12	40.0	36.0	24.0	56	39.6	40.5	19.8
medical laboratory assistants	2	29.7	39.6	29.7	0				2	29.7	39.6	29.7
pharmaceutic-technical assistants	58	46.3	35.9	17.8	2	50.0	50.0	0.0	56	46.2	35.4	18.5
therapeutic professions not named elsewhere	62	41.8	39.2	20.6	10	31.3	43.8	25.0	53	43.0	37.6	19.4
social professions	32	32.2	37.5	30.0	5	41.5	33.9	23.4	28	29.4	36.9	30.1
geriatric nurses	28	30.7	38.3	30.8	4	39.3	36.1	23.0	24	29.2	38.6	32.1
remedial therapists	3	50.0	28.3	21.7	1	50.0	25.0	25.0	2	50.0	30.0	20.0
orthopaedagogues	1	22.2	44.4	33.3	0				1	22.2	44.4	33.3
health craftsmen	94	38.9	35.7	24.0	43	35.8	34.8	29.5	50	42.3	37.1	19.9
opticians	35	45.1	34.7	20.1	12	38.9	33.3	27.8	23	48.4	35.5	16.1
orthopaedic mechanics	5	33.3	26.7	13.3	3	44.4	33.3	22.2	1	33.3	33.3	0.0
dental technicians	39	33.3	37.9	28.7	18	32.3	35.5	32.3	21	34.3	40.0	25.7
other health craftsmen	15	40.5	34.9	24.6	10	35.7	35.7	28.6	5	50.0	33.3	16.7
other special professions in health care	44	32.8	37.1	25.7	3	13.9	25.5	21.3	41	34.1	37.9	26.0
health engineers	8	19.4	38.9	19.4	0				7	22.2	44.4	22.2
health-protecting professions	2	8.3	19.4	19.4	1	16.7	38.9	38.9	0			
health technicians	1	25.0	37.5	25.0	1	25.0	37.5	25.0	0			
pharmaceutic-commercial employees	35	35.5	35.5	26.1	1	0.0	0.0	0.0	34	36.6	36.6	26.8
other professions in health care	198	28.4	38.9	33.3	96	26.6	37.7	35.7	103	29.8	39.5	30.8
*) Other ambulatory facilities comprises offices of health practitioner, dispensing chemists, retail sale and supplier of medical appliances and institutions providing other ambulatory care.												
Source: Federal Statistical Office; health personnel account; calculations of DIW Berlin.												

This pooled sector realized a high dynamic in particular in female employment. The number of health care and nursing aid as well as the number of physiotherapists and therapeutic professionals increased significantly (Table 15). A lot of new practices of health practitioners were established in the last decade. This was driven by changes in rehabilitation measures (shift from institutional rehabilitation to ambulatory measures like physiotherapy) and the ageing of population with increasing demand on therapeutic treatments, but also by the increase in preventive measures.

Table 15 Changes in employment in other ambulatory care facilities between 2000 and 2011

Occupations	2011 FTE 1000	Changes 2011/2000 FTE							2011 persons 1000	Changes 2011/2000		
		in 1000			in %			in 1000 persons				
		Total	Males	Females	Total	Males	Females	Share females		Total	Males	Females
Total of health care personnel*	610	119	25	95	24	14	31	3,4	794	204	43	163
physicians, pharmacists, psych. Psychotherapists*	42	1	-3	1	2	-18	4	0,9	53	3	0	5
assistants (medical, laboratory, pharmaceutical)	56	14	2	13	33	-	32	-1,2	75	22	2	20
nurses, geriatric nurses, health care and nursing aid	91	39	11	32	75	100	84	3,8	117	54	13	42
physiotherapist, therapeutic prof., therapists	148	71	17	58	92	74	114	7,4	208	111	23	93
health craftsmen, other professions in health care	269	-8	-3	-5	-3	-2	-3	-0,3	336	11	5	6
*) Without psychological psychotherapists												
Source: Federal Statistical Office, Health personnel accounts; calculation fo DIW Berlin.												

2.2.5 Personnel in other acute health care facilities

The personnel in other acute health care facilities like ambulances or intermediate consumption industries are also influenced by the activities of hospitals and ambulatory health care services. In ambulance 55,000 persons are employed, in public health and administration 237,000 persons, and in intermediate consumption industries 502,000 (2011). Ambulance services employ mostly health care and nursing aid and nurses (Table 53 in appendix). In 'public health and administration' 10,000 physicians, 1,000 pharmacists, 1,000 dentists, 71,000 remaining health and social professions, and in the majority (136,000) other professions in health care are employed (Table 54 in appendix). Half of the employees in intermediate consumption industries have other professions in health care (256,000), but also health service professions, in particular nurses, therapists and technical assistants, play a role (171,000 in total) (Table 55 in appendix). The share of females is lower than in the other acute health care services.

In the last decade the employment in ambulances increased by 15 % (Table 16). In particular the number of rescue missions due to internist emergency cases and other emergency cases increased in the past. This may be influenced by the increasing number of elderly patients.

Table 16 Changes in employment in ambulances between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE							2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons		
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females
Total of health care personnel	45	6	3	2	15	10	20	1,0	55	11	7	4
physicians, pharmacists	0	0	0	0	-	-	-	-	0	-1	0	0
assistants (medical, laboratory, pharmaceutical)	0	0	0	0	-	-	-	-	0	0	0	0
nurses, health care and nursing aid	44	8	5	2	22	19	20	-0,5	55	13	8	5
physiotherapist, therapeutic prof., therapists	0	0	0	0	-	-	-	-	0	0	0	0
health craftsmen, other professions in health care	0	-2	-2	-1	-	-	-	-	1	-2	-2	-1

Source: Federal Statistical Office, Health personnel accounts: calculation fo DIW Berlin.

The employment in public health declined only slightly between 2000 and 2011 (Table 17). The employment in administration was reduced due to measures to increase the productivity of administrative staff by organisational innovations and increased use of IT. In total 15 % of staff in administration was discharged. Together with the decline in public health the reduction amounted to 29,000 FTE. The reduction of male employment was higher than of female employment.

Table 17 Changes in employment in public health and administration between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE							2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons		
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females
Total of health care personnel	193	-29	-18	-11	-13	-14	-12	0,5	237	-19	-13	-9
physicians, pharmacists, psych. Psychotherapists	10	1	0	1	11	0	20	4,4	12	1	1	1
assistants (medical, laboratory, pharmaceutical)	7	-3	0	-3	-30	-	-30	0,0	10	-2	0	-3
nurses, health care and nursing aid	37	8	3	5	28	60	22	-3,6	45	10	4	7
physiotherapist, therapeutic prof., therapists	12	3	1	3	33	100	50	8,3	15	5	0	6
health craftsmen, other professions in health care	124	-39	-23	-16	-24	-20	-35	-4,0	151	-36	-17	-16

Source: Federal Statistical Office, Health personnel accounts: calculation fo DIW Berlin.

The employment in intermediate consumption industries of health care increased significantly (Table 18). The intermediate consumption industries comprise pharmaceutical, medico-technical and ophthalmic industries as well as medical laboratories and wholesale trade. The demand on pharmaceutical and other medical aids and appliances are driven by the ageing of the population, but also by medical pharmaceutical innovations.

The increase in employment was - as in other industries – higher for females than males. Nevertheless, the share of female employment is still lower than in other fields of health care employment.

Table 18 Changes in employment in intermediate consumption industries and other providers between 2000 and 2011

Occupations	2011	Changes 2011/2000 FTE							2011	Changes 2011/2000		
	FTE	in 1000			in %			Share	persons	in 1000 persons		
	1000	Total	Males	Females	Total	Males	Females	females	1000	Total	Males	Females
Total of health care personnel	402	59	18	43	17	9	28	4,2	502	104	34	70
physicians, pharmacists, psych. Psychotherapists	22	5	3	3	29	33	38	2,9	26	6	3	4
assistants (medical, laboratory, pharmaceutical)	29	7	0	5	32	0	25	-4,7	37	10	-1	10
nurses, health care and nursing aid	50	27	5	21	117	125	111	-2,6	65	36	8	29
physiotherapist, therapeutic prof., therapists	32	16	3	12	100	75	92	-3,1	43	22	4	19
health craftsmen, other professions in health care	269	6	8	0	2	5	0	-0,8	329	26	21	5

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

2.3 Shortness of health professions

The current situation on health workforce shows the realized employment on the health care labour market. However, the observed employment may not be identically with an equilibrium on the labour market (particularly not in each local labour market), which would mean that the employment meet the demand for health care services and workforce. While the employment in health care increased, a shortness of nurses as well as a shortness of physicians in some rural areas of Germany is reported. According to the Labour Union of Physicians (Marburger Bund) currently 12,000 jobs for physician in hospitals are vacant and could not be reoccupied (Focus online, 11.03.2013), in some regions offices of general practitioner are vacant.

This situation was driven by factors influencing the demand on health services and factors on the supply side. Kopetsch (2010) identified as main factors (shortness by increasing workforce)

- The medical-technological progress
- The ageing of the population and the prolongation of the life span
- The increase in female employment and the decline in average working hours.

The factors are not independently from another; for example, the increase in life expectancy can be traced back to new medical and pharmaceutical treatments methods and measures. People are living longer, but the additional life span is only partly a time in good health. Elderly suffer often from more than one disease, they are multi-morbid. Thus, they need disproportionally more health care activities.

Ad a) New and better medical and pharmaceutical treatments have supported the increase in life expectancy. The medical-technological progress reduces the mortality of several diseases, but the new treatments are often cost and personnel intensive. Nevertheless, if new treatment measures are available, doctors want to use the new methods to treat their patients, and patients want to be treated according the newest standards. The range of available treatment methods increased, and in general a shift to more labour intensive treatment measures has taken place.

Ad b) The number of elderly patients increased due to the ageing of the baby boomer. Due to a high share of elderly with chronic diseases, they visit more often a doctor, and they are staying more often in hospitals.

Ad c) The feminisation of the health care workforce continued. The share of female employment increased in particular in the occupations requiring a higher education level. Females are still the main person responsible for caring children and elderly family members. Part-time employment is one strategy to combine work and family life. Thus, the feminisation of the workforce leads to a reduction of the average working time, beside the general trend on declining working hours.

The feminisation of the health workforce has also (but not alone) an effect on the required infrastructure. The availability of places in kindergarten, the distance to schools and shops, but also the presence of cultural infrastructure is essential for choosing a place to work and for living.

The current shortage of the health workforce is expected to expand in the future due to the high share of physicians and other health staff who will retire during the next 10 to 15 years. In the following sections the future development of the demand for and supply of health workforce is calculated. Based on these results the challenges on the health labour market will be shown.

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 specialties, 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, the economic growths (in particular in public tax financed 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 appears: 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 are the result of an agreement between health care providers and funding institutions (health insurance funds of government). 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 the 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 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 modeling 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: Easily 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 it requires only a minimal set of data and can be easily used.

Cons: This approach may lead to insufficient results if 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 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. Maybe 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 kind of services or occupations is provided.

3.4 Conclusion: preferred methods and data bases

To estimate the future supply of health workforce the flow model is typically used. However, in this NEUJOBS working paper 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”, R90-92 “Creative, arts and entertainment activities”, R93 “Sports activities”, and S94 “Activities of membership organisations”. Thus, we must take into account the development of the pooled sector by estimating the supply of health workforce in our WP (see chapter 6.1). Our suggestion is to disentangle the pooled sector employment and to check the results with a kind of flow model for health workforce.

For the estimation of the demand we use the utilization methods. We collect utilization data for institutional care and ambulatory care and we 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 demand for human health care personnel depends on the development of people in need for health care and their level of morbidity as well as other non-demographic factors. The nearness to death is the main driver of need for health care services. As the probability to die increases with the age, the need for curative health care is (indirect) related to age. Thus, the expected ageing of the population with the huge increase in the number in particular of the oldest old will raise the demand for health care and therefore for health professionals.

As we apply the utilization approach the population projection is combined with utilization data. In the case of institutional health care we calculated the age-specific prevalence rates for hospitals (including psychiatric clinics) and rehabilitation institutions. For ambulatory care information on utilization by age-groups and gender is available from one of the German health insurance funds. We used the number of visits to a doctor and the number of visits to dentists as a proxy for utilization of ambulatory care. Additional, information on the prescriptions of therapeutically measures as well as medical aids and appliances exists from this health insurance fund by age-groups and gender. They are used as proxy for the demand for therapeutically measures like physiotherapy, and for the demand on intermediate consumption industries. For the other fields of acute health care, for example public health or ambulance services no utilization data are available. We assume that the level of employment in these fields depends on the activities carried out in institutions or by

practising physicians and dentists. Thus, the demand for goods and services of these fields will change in line with the activities in hospitals and ambulatory health care.

4.1 Population development

WP10 of NEUJOBS carried out two population projections – tough and friendly - which are based on the EUROPO2010 projection from Eurostat as a reference scenario (Europop2010, D10.1 and D10.2). The population projection is based on assumptions concerning fertility, life expectancy and net migration. The tough scenario assumes that the fertility behaviour will not change during the forecast period (constant fertility rates), and that the increase in life expectancy will be more moderate than in the past decades (lower linear increase than in the Europop scenario). As in particular the migration flows are influenced by the economic development and the framework conditions of the socio-ecological transition (high pressure on the environment), the migration flows have in general a lower level in the tough scenario compared to the Europop and friendly scenario.

The friendly scenario assumes that the fertility rates will increase in the future and will converge to the fertility rate observed in Sweden. Until 2030 the current difference in fertility rates will be halved. The increase in life expectancy will follow a linear trend with France and Italy as benchmark countries. The West-European countries will converge to 15%, the East-European countries to 50%. Due to the higher economic growth and the expected shortage on the labour market the migration flows will realize a higher level than in the tough scenario. Table 19 provides an overview of the assumptions of the demographic scenarios.

Table 19 Assumptions on fertility, life expectancy and net migration flows (Germany)

2010	2030		
	Friendly	Tough	Europop
Fertility rates			
1.39	1.70	1.39	1.43
Life expectancy at birth males			
78.0	83.9	80.1	80.8
Life expectancy at birth females			
83.0	87.6	84.6	85.4
Net migration per year (1000)			
-10.7	366.2	-100.3	133.0

Source: Eurostat, Europop; NEUJOBS D10.1 (March 2013).

The demographic scenarios show in general the same trend: a decline in total population and an increase in the number of the elderly people (Table 20 and Figure 4).

The future development is influenced by the ageing of the baby boomer, persons born in the early sixties. In 2010 the baby boomer cohort dominates the age-groups 40-45 and 45-50. Until 2025 the peak of the baby boomer cohort will shift to higher ages and dominates the age-groups 55-70.

In the tough scenario the number of inhabitants will decline markedly by some 6.5 million as a result of the underlying assumptions. The continuing low fertility rate leads to a steady decline in the number of new-borns and has an influence on the size of young population. The number of children under 15 year will decline by 1.5 million. The net migration outflow has an impact in particular on the labour force. The number of persons in the young working-age groups (15-49 years) is expected to shrink by 8.1 million.

Table 20 Population projections for Germany until 2025

Age-groups	2010	2025		
		tough	friendly	Europop
in 1000 persons				
0-14	11 023	9 515	10 594	9 934
15-34	18 961	15 836	16 970	16 437
35-49	19 132	14 114	14 826	14 704
50-64	15 785	17 781	18 203	18 169
65+	16 902	18 005	19 489	19 834
total	81 802	75 250	80 082	79 078
age-structure in %				
0-14	13.47	12.64	13.23	12.56
15-34	23.18	21.04	21.19	20.79
35-49	23.39	18.76	18.51	18.59
50-64	19.30	23.63	22.73	22.98
65+	20.66	23.93	24.34	25.08
total	100	100	100	100

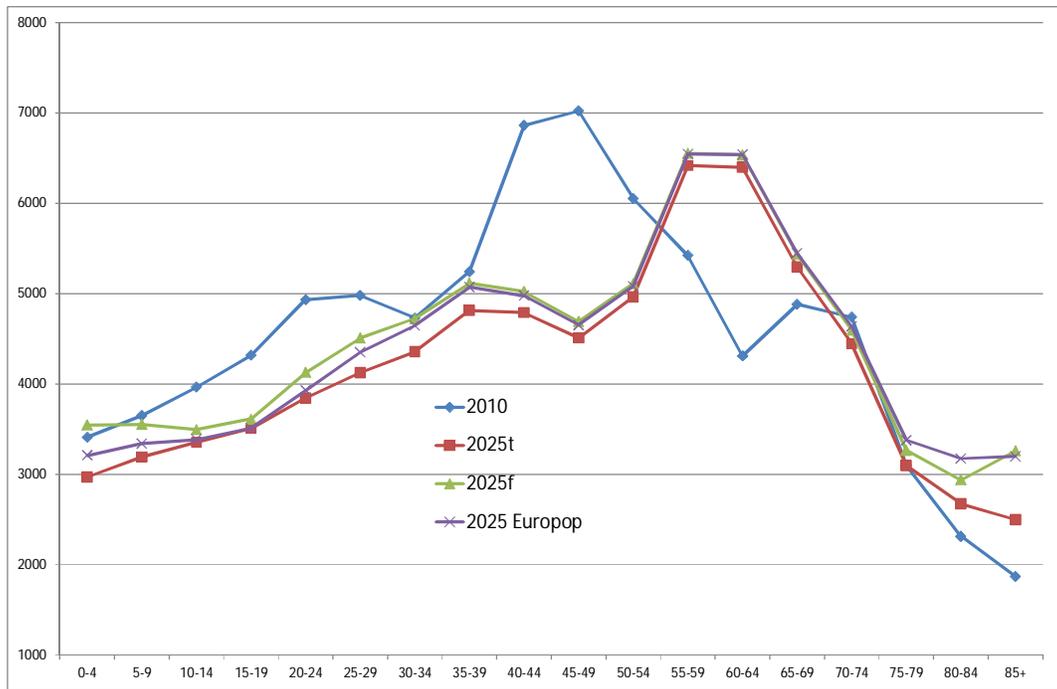
Source: Eurostat; Europop2010; D10.2; calculation of DIW Berlin.

As the expected reduction in mortality rates is concentrated in older age-groups, the increase in life expectancy influences in particular the number of the elderly (65+) and the oldest old (80+). The number of the elderly increases by 1.1million. In 2025 the share of the elderly amounts to 24 %, which is nearly the same share as of the people in older working-age (50-64 years).

In the friendly scenario the population will decline too, but to a lower degree. Compared to 2010 the population will shrink by 1.7 million, but compared to the tough scenario the number of inhabitants will be 4.8 million higher in 2025. This difference is mainly caused by the assumed high net inflow of about 300,000 persons per year (summed up to some 4.5 million net migration), which have a significant impact on the number of people in working age. The higher fertility rates (compared to the tough

scenario) have an effect on the number of the young; the higher life expectancies for males and females have an impact on the number of elderly (65+) and particular the oldest old (80+).

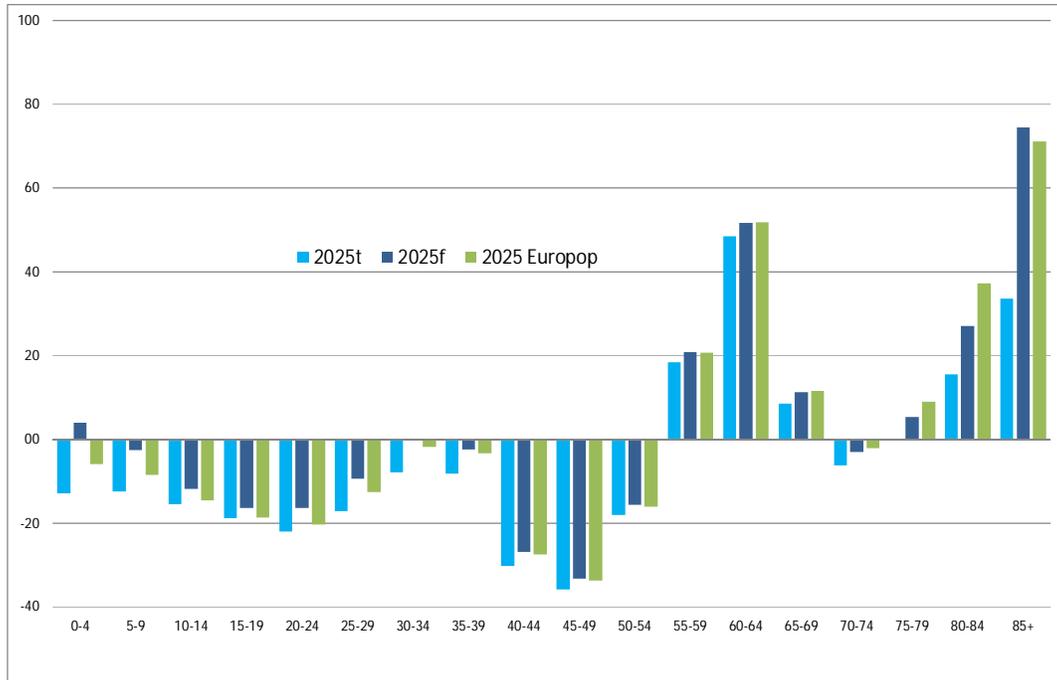
Figure 4 Age-profile of the population in Germany 2010 and 2025



Sources: Eurostat, Europop2010; D10.2; calculation by DIW Berlin..

The continuing low fertility rates and the expected increase in life expectancy influence the changes in the age-structure. The number of young people will decline as well as the number of people in the middle age-groups. An increase is expected for people aged 55 and older. In particular the number of the oldest old (people aged 80 and older) is expected to increase significantly (Figure 5).

Figure 5 Population by age-groups – changes between 2010 and 2025 (%)



4.2 Impact of demographic change on health care demand

The impact of demographic changes on health care demand is shown for six fields of acute health care: hospital activities, rehabilitation measures, activities of practising physicians, activities of dentists, therapeutic cure activities by physiotherapists, speech therapists, ergo therapists, podologists, as well as activities of other therapists. Additional aids prescriptions (for example eye glasses, hearing aids, incontinence aids) are used to show the utilization of health goods. The prescription of drugs is a proxy for utilization of dispensing chemists. The demand for other health care activities or related goods and services will be calculated in line with the changing demand in these six fields of acute health care.

4.2.1 Utilization data: Hospitals

Hospitals

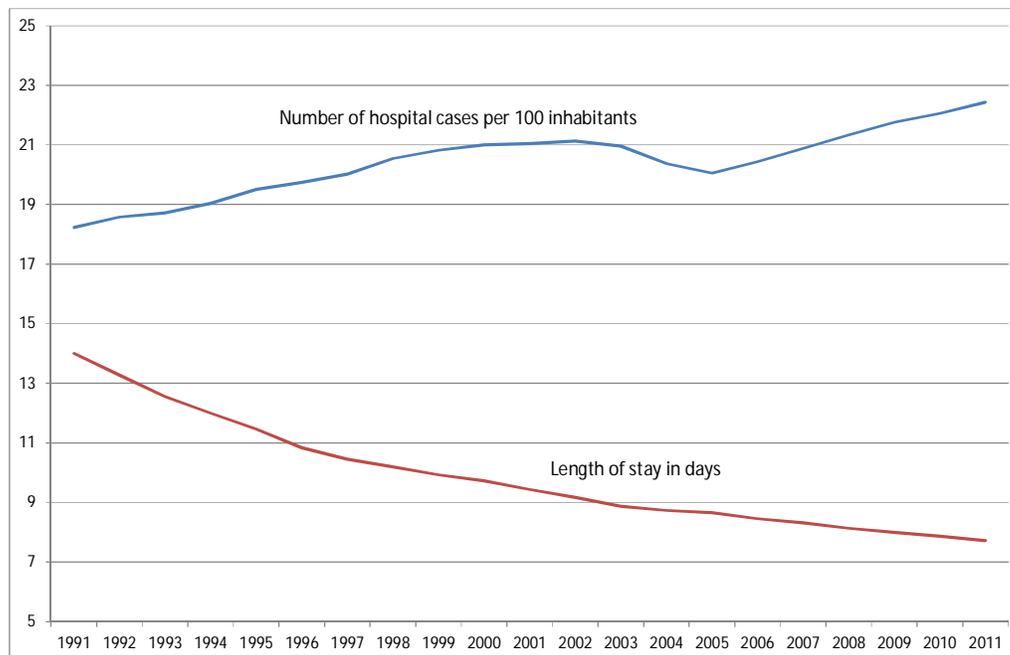
The hospital diagnosis statistics includes all hospitals, general hospitals as well as psychiatric clinics. Institutions with solely day- and night care places are excluded. Since 2003 day cases and since 2004 healthy new-borns are included. Since 2003 in general hospitals a DRG system is used for the inpatient classification. DRGs combine all activities to treat a patient with a specific morbidity. For measuring the resources needed to treat a patient it is a better classification system as the diagnosis

classification. The disadvantage is that not all inpatients and not all treatments are included in the DRG system; in particular inpatients in institutions with solely psychiatric beds are excluded. Germany has also introduced a kind of DRG system for psychiatric clinics. However, this system started in 2013 and the participation of psychiatric clinics is voluntary in the next two years. Thus, our analysis is built on the classification of inpatients according the International Classification of Diseases, version 10 (ICD10). This has the advantage that for the majority of EU countries hospital data by diagnosis are available, so that the statistics provide information that is comparable between European countries.

The statistics provide information on two indicators: the number of discharges of inpatients and the length of stay, subdivided by diagnoses, gender and age-groups. Based on this information the prevalence rates by age-groups and gender are calculated. Multiplied with the average length of stay the hospital utilization in bed-days per person (by age and gender) is calculated. The demand for hospital activities can be measured by the number of total hospital days needed to treat patients.

In 2011, 18.9 million people were treated in German hospitals. Between 1991 and 2011, the average number of hospital cases per 100 inhabitants (prevalence rates) increased, while the average length of stay declined markedly from 14 days in 1991 to 7.7 days in 2011 (Figure 6).

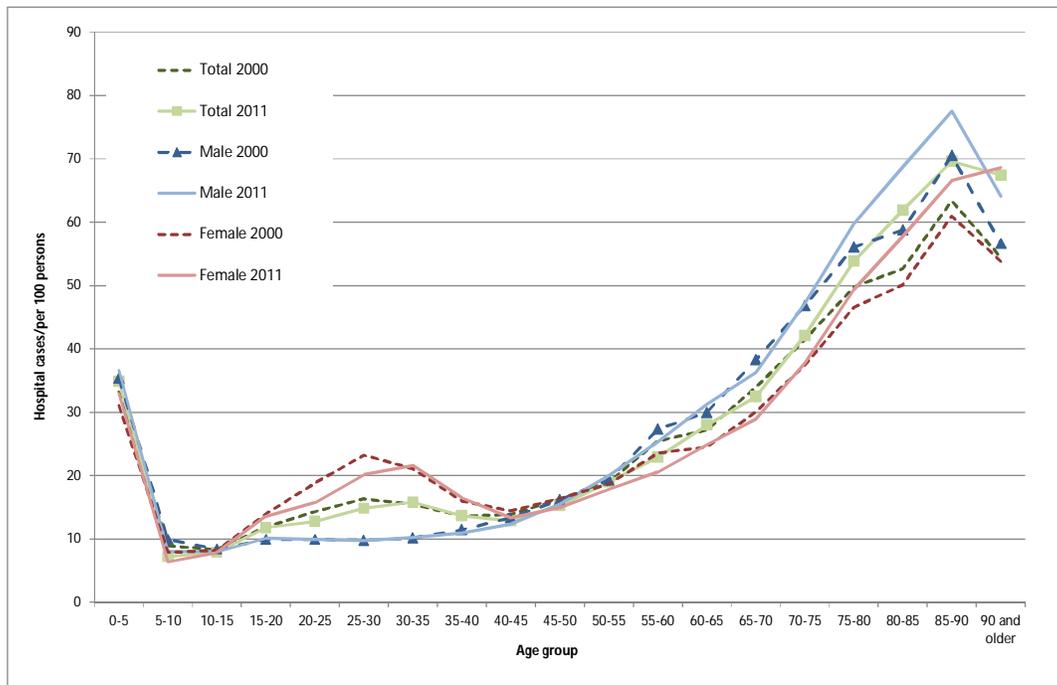
Figure 6 Hospital cases per 100 inhabitants and length of stay 1991 to 2011



Source: Federal Statistical Office, basic data on hospitals, calculation by DIW Berlin.

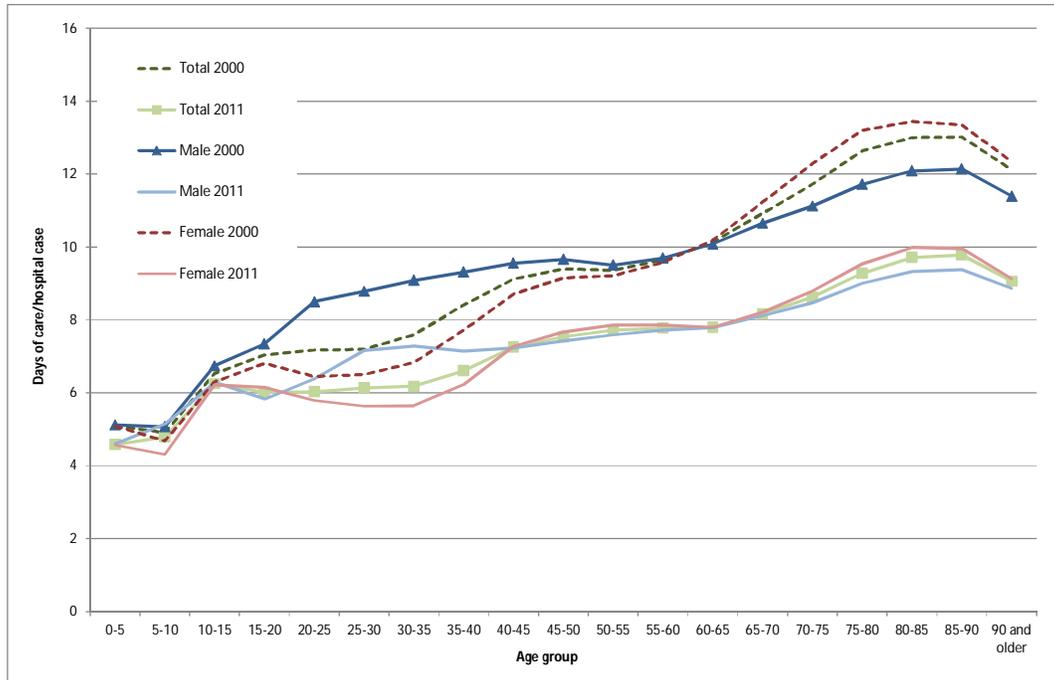
Elderly are more often treated in hospitals than younger people. The number of hospital cases per 100 inhabitants is high for the new-borns, is under 10 for the age-group 5 to 15, increases for females in the birth giving ages, and increases thereafter with age for both gender (Figure 7). The highest percentage of hospitalized people is observed for the age-group 85-90 years. The figure for the oldest age-group (90 and older) is influenced by the uncertainty of the size of population and by the selection process. Only relatively healthy people will reach the highest ages. Between 2000 and 2011 the number of hospital cases per 100 inhabitants increased in the older ages, in particular for males.

Figure 7 Hospital discharges – treatment cases per 100 persons by sex and age-groups 2000 and 2011



Source: Federal Statistical Office, hospital diagnosis statistics, calculation by DIW Berlin.

The average length of stay increases with age for males as well as for females. However, in 2011 the average length in each age-group is lower than in 2000 (Figure 8).

Figure 8 Average length of stay in hospitals by sex and age-groups 2001 and 2011

Source: Federal Statistical Office, hospital diagnosis statistics, calculation by DIW Berlin.

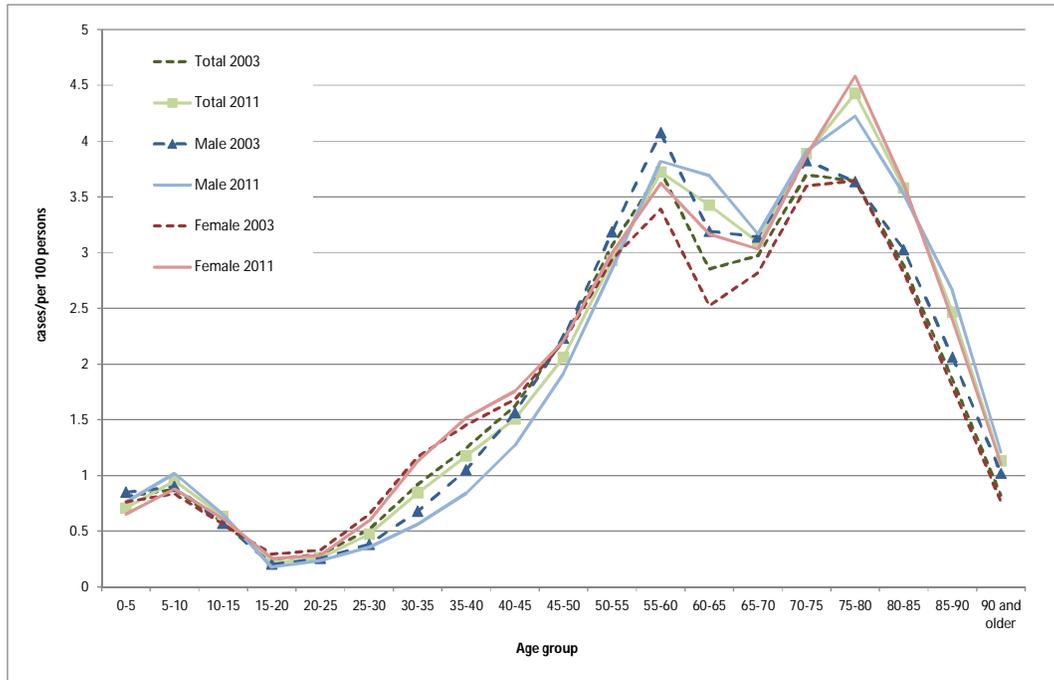
4.2.2 Utilisation data rehabilitation

The Federal Statistical Office provides a statistic of treatment cases and length of stay in rehabilitation institutions with more than 100 beds. Small institutions, often clinics for special treatments, for example treatments of psychiatric diseases, are not included.

The need for medical treatments in rehabilitation facilities increases in general with age. In the younger ages we observe a small peak in the early school years, among adults there is a peak in the later working ages just before the retirement or in the first years in which benefits from the early retirement schemes are available (Figure 9). That is due to the fact that the majority of rehabilitation measures are financed by the pension funds with the aim to retain the ability to work and prevent early retirement. Elderly people in working age have often problems with musculoskeletal diseases, and the rehabilitation measures are designed to help them to stay longer in the labour market.

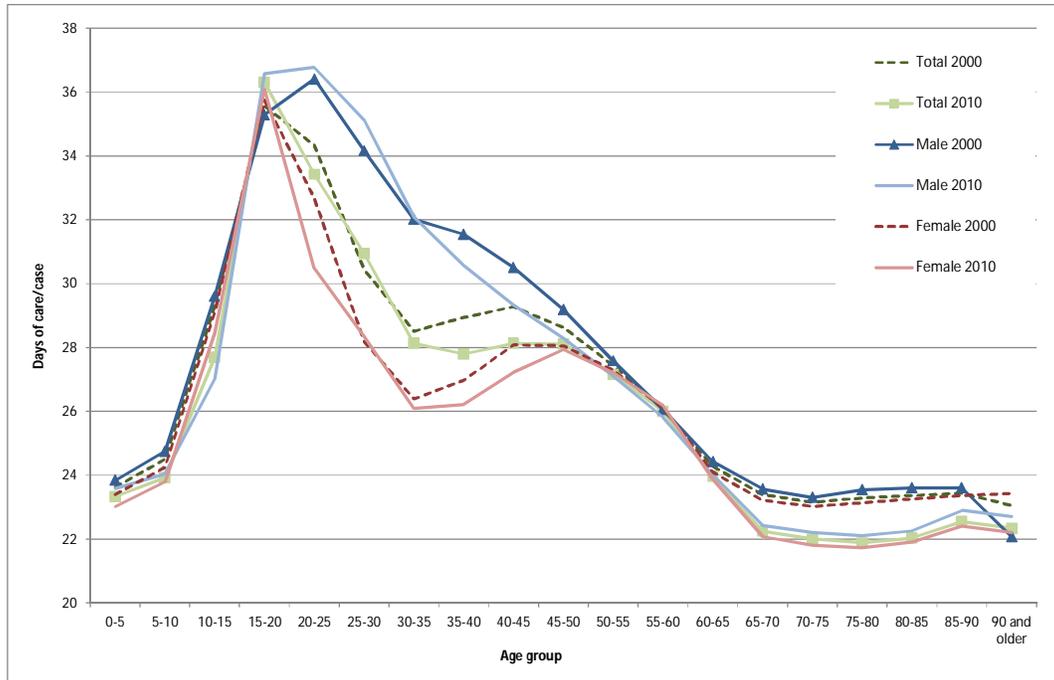
In the age-group 75-80 years another peak can be seen. In 2011 the peak is higher than in 2003. This development is influenced by the increasing importance of rehabilitation measures for the old people, who suffer from impairments in ADL. The Social Code Book XI (Law on Long-term care insurance) regulates that rehabilitation measures have the priority as against long-term care benefits. They are also used to allow beneficiaries to stay at a low impairment level for as long as possible.

Figure 9 Treatment cases per 100 inhabitants in prevention and rehabilitation facilities 2003 and 2011



Source: Federal Statistical Office, rehabilitation institutions diagnosis statistics, calculation by DIW Berlin.

On average people stay around 3.5 weeks (25 days) in rehabilitation institutions. The duration of treatment is highest for the age-group 15-20; for men also in the age-group 20-25 years (Figure 10). Rehabilitation patients in these ages-brackets are often treated after road accidents. After this peak the length of stay declines with age. In the older ages the average treatment period is 3 weeks. Between 2003 and 2011 the average length of stay shows no obvious trend; however, in the older ages the length of stay declined. Assuming that the health outcome is the same, a shorter stay in rehabilitation indicates an increase in productivity.

Figure 10 Length of stay in prevention and rehabilitation facilities 2003 and 2011

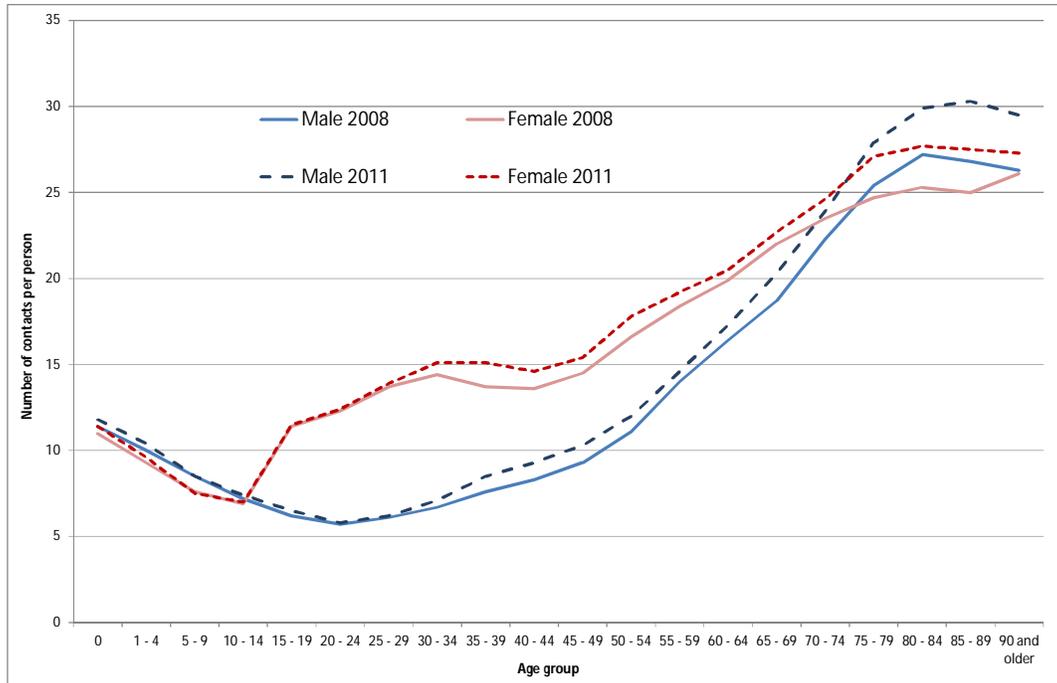
Source: Federal Statistical Office, rehabilitation institutions diagnosis statistics, calculation by DIW Berlin.

4.2.3 Utilisation ambulatory care physicians and dentists

The demand for ambulatory health care services is measured by the number of visits to a doctor or dentist. Data are available from one health care insurance fund, the Barmer GEK, which has 9 million insurant. Data on consultations of doctors are available for the years 2008 to 2011, consultations of dentists only for the year 2010. Treatment cases by type of specialists are also available, but not by age-groups of patients (see Table 56 in appendix).

The average number of doctors' consultations increases with age, and is in general higher for females than males except in the highest ages (75+) (Figure 11). Compared to males have females another healthy behaviour: they use more often health prevention measures, and they visit a doctor also for common diseases like cold. Between 2008 and 2011 the average number of contacts to a doctor increased for both males and females.

Figure 11 Contacts to a doctor 2008 and 2011



Sources: Barmer-GEK, Arztreport 2010 bis 2013 (Report on Physicians), calculation of DIW Berlin.

The number of consultations of a dentist is high in the school ages (5-9 and 10-14 years), shows a decline during the next 10 years of age, and increases thereafter (Figure 12). The highest number of consultations can be observed in the age-group 65-69 years for both men and women. The older age groups show a lower number of dentists' consultations. Again, females visit a dentist more often than males.

Figure 12 Number of contacts to a dentist by sex and age-groups in 2010

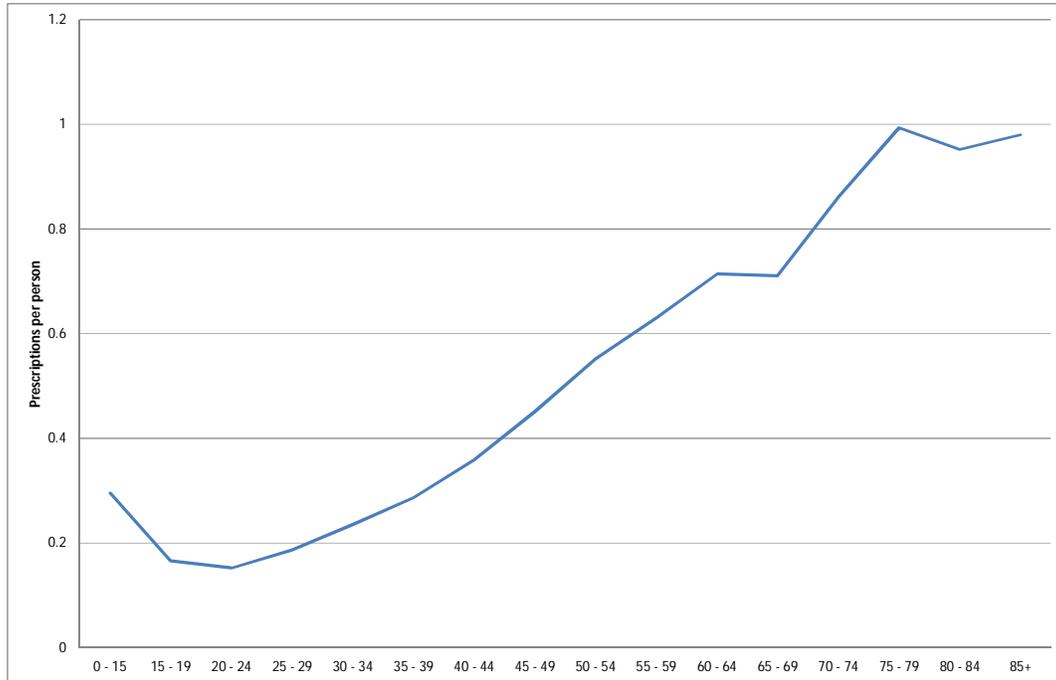
Sources: Barmer-GEK, Zahnarztreport 2012 (Report on Dentists), calculation of DIW Berlin.

4.2.4 Utilization ambulatory care physiotherapists and other therapists

The statutory health insurance funds provide a statistics on the cure prescriptions by age-groups of the patients but not by sex. The cure measures are in the majority prescribed by general practitioners and orthopaedic specialists. In total the statutory health insurance members received 33.3 million prescriptions, thereof 28.6 million for physiotherapeutic treatments, 2 million prescriptions for ergo therapy, followed by 1.5 million prescriptions for speech therapy, and 1.2 million prescriptions for feet therapy. The statutory health insurance covers the majority of the population, some 70 million persons are insured with one of the statutory health insurance funds. As there is no information on the prescriptions for the private insured persons, the age-specific utilization rate of the statutory health insured persons will be used for the total population.

The number of prescriptions per insured person is high for the young ages, and increases from the age 20 onwards with age (Figure 13). Cure treatments for the young are ergo therapeutic measures and speech therapy. In the elderly ages physiotherapeutic treatments and to a with age increasing share of feet therapeutic treatments dominate.

Figure 13 Prescriptions of cure measures per insured person of the statutory health insurance (GKV) by age-groups 2011



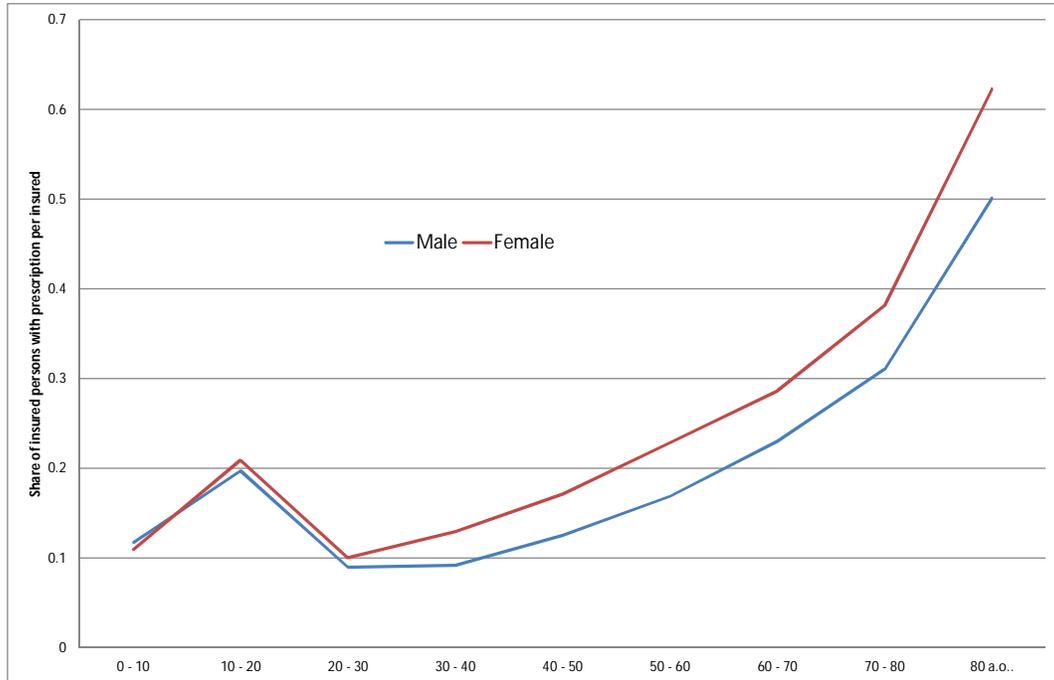
Source: GKV (statutory health insurance), statistics on cure prescriptions.

4.2.5 Utilization other facilities

The Barmer GEK provides also information on the prescriptions of medical aids and appliances by age-groups and gender of their members. In 2011, the insurant received in total 1.9 million prescriptions for medical aids. The most prescribed aids were inlays for shoes (6.4 % of insured received this kind of aids), bandages (4.2 %), aids for compression therapy (3.2 %), incontinence aids (2.5 %), walking aids (2.1 %) and hearing aids (0.8 %). The prescriptions for aids are used as a proxy for the demand on goods and services of the intermediate consumption industries. As the health insurance reimburse only a part of the costs for aids and not all kind of aids or only a limited number of aids during a period, the total demand expands the prescriptions which are registered by the health insurance fund. But the data of the Barmer GEK are the only ones providing information on aids prescriptions by age-groups and gender.

The share of insurant who received prescriptions of aids increases in general with age. An exception is the age-group 10 to 15 years (Figure 14). School pupils receive often inlays for shoes and other orthopaedic goods. The need for hearing aids, incontinence aids, walking aids, and aids for compression therapy is strongly related to age.

Figure 14 Share of insured persons with medical aids and appliances prescriptions by age-groups and sex 2011

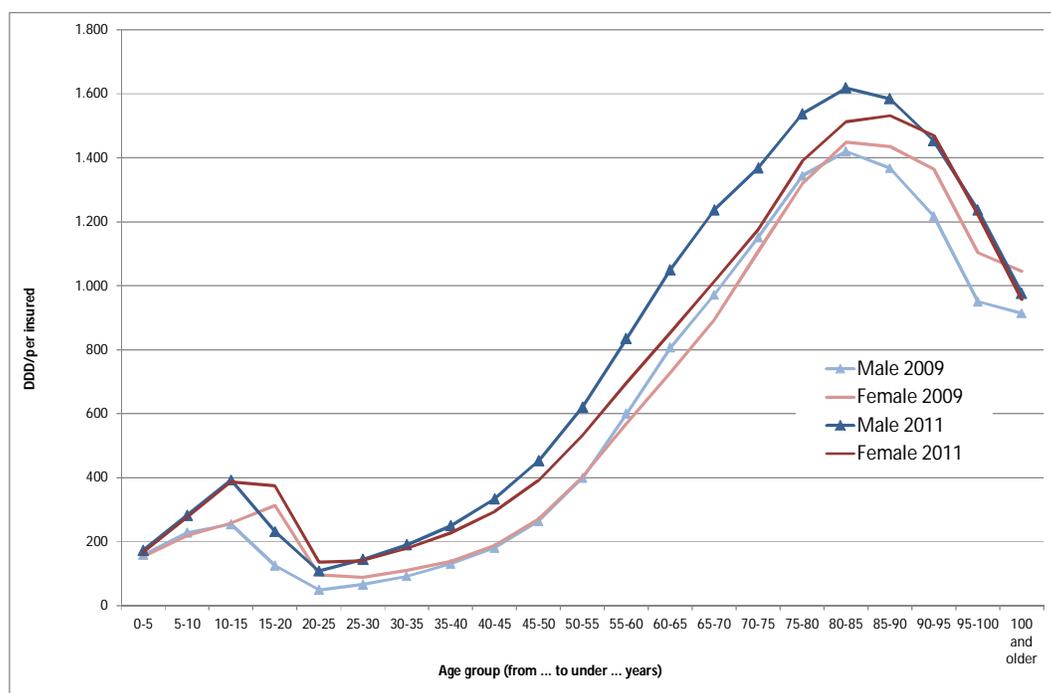


Source: Barmer GEK report on cure and aids prescriptions; demographic scenarios WP10; calculation of DIW Berlin.

The prescription of pharmaceutical is one of the most cost driving factors in health care. Drugs are prescribed by general practitioners, specialist, or therapeutic professions as well as dentists. The prescribed number of drugs measured in Defined Daily Doses (DDD) per insurant increases significant with age. Due to the fact that elderly people suffer from more than one disease they receive prescription of more than one type of drugs. Often elderly receive prescriptions from different physicians, overmedication and incompatibilities are the result.

In addition to the described drugs people consume over the counter pharmaceuticals which can be purchased without prescriptions and are paid out-of-pocket. About half of the total drug expenditures relate to such over the counter drugs.

Remarkable is the decline in drug consumption among the oldest old (80+) (Figure 15). The probability to suffer from impairments in Activities of Daily Living (ADL) increases significantly from the age 80 onwards. In 2011 about 2.5 million people got benefits from the long-term care insurance, that is to say they have at least considerable impairments in ADL. Maybe these often not mobile persons have a lower consume of drugs.

Figure 15 Prescribed drugs in DDD per insured person 2009 and 2011

4.3 Changes in demand for health care activities

The changes in demand for health care activities can be shown by combining constant age- and sex-specific utilization rates with the changes in population of the three population scenarios. The results show the pure demographic effect on the demand on health care services. To take the changes in morbidity and in productivity into account, time trend analyses were carried out. For hospitals and rehabilitation institutions are the age- and gender-specific changes in utilization 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 a treatment which needs a shorter stay is more effective and efficient; an equal health outcome supposed.

In the case of ambulatory care by physicians, dentists, and therapists no distinction between changes in morbidity and productivity can be made. The changes in age- and gender specific utilization can be driven by both effects and they cannot be separated. Another problem is that the reimbursement system changed. For some diseases flat rates were introduced which reimburse the doctors for the whole activities done to treat the patient independently from the number of visits needed to treat them. Thus, a reduction in the number of visits over time can be partly traced back to the changing reimbursement mechanism.

4.3.1 Status-quo-scenario

The status-quo-scenario shows the pure demographic effect on changes in health care demand. The demographic effect is characterized by a decline in population size (higher decline in the tough as in the friendly scenario) and the ageing of the population. Both effects have an impact on the demand for hospital services, however in some cases with a contrary development. A high decline in population size lead to declining hospital cases, the population ageing leads to an increase in the average length of stay. As a result, the total number of hospital cases declines slightly in the tough scenario (-0.4 %), and increases in the friendly (7.7 %) as well as in the Europop scenario (7.5 %) (Table 21). The total number of hospital days will increase in all scenarios between 1.6 % (tough) and 10.4 % (Europop) due to the increase in the average length of stay. The share of elderly inpatients will increase in hospital cases as well as in total hospital days caused by population ageing. Also the mean age of patients will increase by 3.0 years (tough) to 3.9 years (Europop).

Table 21 Changes in hospital cases and total hospital days between 2010 and 2025 - constant utilisation rates

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Hospital cases in million	18.5	18.4	19.9	19.9	-0.1	1.4	1.4	-0.4	7.7	7.5
Cases per 100 inhabitants	22.6	24.5	24.9	25.1	1.9	2.3	2.5	8.3	10.0	11.2
Hospital days in million	145.5	147.8	160.1	160.6	2.3	14.5	15.1	1.6	10.0	10.4
Average length of stay	7.9	8.0	8.0	8.1	0.2	0.2	0.2	2.0	2.1	2.7
Share women in cases	0.53	0.52	0.52	0.51	0.0	0.0	0.0	-1.6	-2.0	-3.0
Share women in hospital days	0.53	0.52	0.52	0.52	0.0	0.0	0.0	-1.5	-2.0	-3.0
Share of elderly in cases	0.43	0.47	0.48	0.49	0.0	0.0	0.1	9.0	11.3	13.8
Share of elderly in hospital days	0.50	0.54	0.55	0.56	0.0	0.0	0.1	7.1	9.6	11.5
Mean Age of patients	54.0	57.1	57.2	58.0	3.0	3.2	3.9	5.6	5.9	7.3

Source: Federal Statistical Office, hospital statistics; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

The demographic development has a smaller impact on the demand on rehabilitation activities in institutions (Table 22). The total rehabilitation cases will decline by -0.7 % in the tough scenario and will increase in the friendly (4.4 %) and Europop scenario (4.6 %). The increase in the total number of rehabilitation days is also lower compared to hospital days. The average length of stay declined as well as the share of female patients, whilst the share of elderly increased. The mean age of patients will rise by 2 (tough) to 2.4 years (Europop).

Table 22 Changes in rehabilitation cases and total rehabilitation days 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
Rehabilitation cases in million	1.7	1.6	1.7	1.7	0.0	0.1	0.1	-0.7	4.4	4.6
Cases per 100 inhabitants	2.0	2.2	2.2	2.2	0.2	0.1	0.2	7.9	6.6	8.2
Rehabilitation days in million	41.8	40.9	43.0	43.0	-0.8	1.2	1.3	-2.0	2.9	3.0
Average length of stay	25.2	24.8	24.8	24.8	-0.4	-0.4	-0.4	-1.5	-1.4	-1.5
Share women in cases	0.54	0.53	0.53	0.53	0.0	0.0	0.0	-1.5	-2.0	-2.4
Share women in rehabilitation days	0.53	0.53	0.52	0.52	0.0	0.0	0.0	-1.3	-1.8	-2.2
Share of elderly in cases	0.37	0.39	0.39	0.40	0.0	0.0	0.0	5.2	6.9	8.9
Share of elderly in rehabilitation days	0.32	0.34	0.35	0.36	0.0	0.0	0.0	6.7	8.5	10.8
Mean Age of reha patients	56.6	58.6	58.7	59.1	2.0	2.0	2.4	3.5	3.6	4.3

Source: Federal Statistical Office, rehabilitation statistics; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

The demand for ambulatory health care by physicians shows for the tough scenario a similar result as for institutional utilization with a decline by 2.9 %, while the demand in the friendly and Europop scenario will increase by 3.6 % and 3.3 % respectively (Table 23). The share of females will decline, but the share of elderly will increase.

Table 23 Changes in the number of visits to a doctor 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
Visits in million	1 199	1 164	1 242	1 238	-34	43	40	-2.86	3.61	3.33
Average number of visits per person	14.8	15.5	15.5	15.7	1	1	1	4.54	4.77	5.82
Share women (%)	58.9	58.0	57.7	57.3	-1	-1	-2	-1.41	-2.00	-2.65
Share of elderly (%)	35.4	39.0	39.8	40.7	4	4	5	10.26	12.63	15.16
Mean Age of patients	52.1	54.9	55.1	55.6	3	3	3	5.36	5.62	6.71

Source: Barmer GEK Report on Physicians; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

As expected the number of contacts to a dentist will decline in all demographic scenarios (Table 24). The decline is lowest in the friendly scenario with -1.8 % and highest in the tough scenario with -6.9 %. In 2025 between 26.8 % (tough) and 27.9 % (Europop) of visits take place by elderly patients. The mean age of patients is currently and will be also in the future lower than in the case of visits to a physician.

Table 24 Changes in the number of contacts to a dentist – constant utilization rates

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Visits in million	178	166	175	173	-12	-3	-4	-6.89	-1.78	-2.52
Average number of visits per person	2.2	2.2	2.2	2.2	0	0	0	1.18	0.29	0.80
Share women (%)	54.6	54.3	54.1	53.9	0	0	-1	-0.46	-0.86	-1.25
Share of elderly (%)	23.8	26.8	27.2	27.9	3	3	4	12.69	14.00	16.99
Mean Age of patients	46.7	49.1	49.0	49.5	2	2	3	5.29	5.10	6.17

Source: Barmer GEK Report on Physicians; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

The number of prescriptions of therapeutically measures as a proxy for the utilization of offices of practitioners, that is to say the demand for physiotherapists and other therapists will increase by 1.3 % (tough) to 5.5 % (friendly) (Table 25). The share of elderly will increase by 8 % to 13 %.

Table 25 Changes in the number of prescriptions of therapeutically measures – constant utilization rates

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Prescriptions in million	38.4	37.9	40.4	40.3	-0.5	2.0	1.9	-1.26	5.12	5.04
Average number of prescriptions per person	0.6	0.5	0.5	0.5	-0.1	-0.1	-0.1	-12.81	-12.78	-11.74
Share women (%)										
Share of elderly (%)	38.2	41.3	42.2	43.1	3.1	4.1	4.9	8.14	10.63	12.81
Mean Age of patients	54.6	57.2	57.4	57.9	2.6	2.8	3.3	4.78	5.13	6.06

Source: GKV Report on cure prescriptions; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

The number of people receiving prescriptions of medical aids and appliances is expected to decline by -1.7 % in the tough scenario, and to increase in the friendly (5.5 %) and Europop scenario (5.3 %) (Table 26).

This moderate increase is influenced by the fact, that information is only available for the number of patients receiving prescriptions, not for the number of prescriptions. As elderly patients receive a higher number of prescriptions the development is underestimated. Additional, medical aids and appliances are to a high share privately financed. This over-the-counter demand is not included in the data of the statutory health insurance fund.

Table 26 Changes in the number of persons receiving prescriptions of medical aids and appliances – constant utilization rates

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Persons with prescriptions in million	16.4	16.1	17.3	17.3	-0.3	0.9	0.9	-1.65	5.46	5.29
Share women (%)	58.4	58.3	58.1	57.7	-0.1	-0.3	-0.7	-0.13	-0.54	-1.18
Share of elderly (%)	46.1	53.6	54.4	55.3	7.5	8.3	9.2	16.32	18.01	19.99
Mean Age of patients	53.6	56.8	57.2	57.8	3.2	3.6	4.2	5.98	6.80	7.88

Source: Barmer GEK Report on aids prescriptions; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

In 2010 40.6 billion DDD were prescribed, on average 520 DDD per person. The number of prescribed DDD is expected to increase in all scenarios: at 4.1 % in the tough, by 11.2 % in the friendly, and by 12 % in the Europop scenario (Table 27). The ageing of the population has a significant effect on the amount of prescribed pharmaceuticals. The average number of DDD per person will increase by 8.2 % in the tough and 8.5 % in the friendly scenario. Thus, both scenarios show a similar effect of ageing on the drug consume.

Table 27 Changes in the number of prescribed pharmaceuticals in DDD –constant utilization rates

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
DDD in million	40 601	42 286	45 139	45 460	1 685	4 538	4 859	4.15	11.18	11.97
Average number of DDD per person	519.6	561.9	563.7	574.9	42	44	55	8.15	8.48	10.64
Share of elderly (%)	55.0	56.6	57.7	58.5	2	3	3	2.84	4.95	6.27
Mean Age of patients	62.6	64.5	64.9	65.2	2	2	3	2.96	3.55	4.12

Source: Barmer GEK Report on Physicians; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

4.3.2 Changes in length of stay in institutional health care

The estimation taking into account the decline in average length of stay changes the picture markedly. We calculated the average yearly age- and gender-specific growth rate for the years 2000 to 2011, and we used this growth rates to calculate the future demand. The underlying assumption is that the medical-technological progress will be continuing and that this trend will have also an impact on the average length of stay. As a result, the total number of hospital days will decline in all demographic scenarios due to the reduction in the average length of stay by around 2 days (Table 28).

Table 28 Changes in hospital cases and days between 2010 and 2025 – projection taking into account decline in average length of stay

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Hospital cases in million	18.5	18.4	19.9	19.9	-0.1	1.4	1.4	-0.4	7.7	7.5
Cases per 100 inhabitants	22.6	24.5	24.9	25.1	1.9	2.3	2.5	8.3	10.0	11.2
Hospital days in million	145.5	105.7	114.4	114.6	-39.9	-31.1	-30.9	-27.4	-21.4	-21.2
Average length of stay	7.9	5.7	5.7	5.8	-2.1	-2.1	-2.1	-27.1	-27.0	-26.7
Share women in cases	0.53	0.52	0.52	0.51	0.0	0.0	0.0	-1.6	-2.0	-3.0
Share women in hospital days	0.53	0.52	0.52	0.51	0.0	0.0	0.0	-1.8	-2.3	-3.3
Share of elderly in cases	0.43	0.47	0.48	0.49	0.0	0.0	0.1	9.0	11.3	13.8
Share of elderly in hospital days	0.50	0.51	0.52	0.53	0.0	0.0	0.0	1.0	3.5	5.5
Mean Age of patients	54.0	57.1	57.2	58.0	3.0	3.2	3.9	5.6	5.9	7.3

Source: Federal Statistical Office, hospital statistics; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

As the length of stay stands for the changes in productivity, the figure underlines the importance of productivity change for the projection of demand for health care services.

Between 2003 and 2011 the average length of stay in rehabilitation institutions declined in particular in the age-groups 20 to 50 years and in the oldest ages. Taken into account this development also for the coming 15 years reduces the demand for total rehabilitation days (Table 29). The total rehabilitation days will decline by 2 % (friendly and Europop) respectively 7 % (tough). A further reduction in the length of stay may be realized due to new rehabilitation methods and the efforts to treat patients as soon as possible at home by ambulatory services or in practice of therapeutically professions (shift from institutional to ambulatory care).

Table 29 Changes in rehabilitation cases and total rehabilitation days between 2010 and 2025 – projection taking into account decline in average length of stay

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Rehabilitation cases in million	1.7	1.6	1.7	1.7	0.0	0.1	0.1	-0.7	4.4	4.6
Cases per 100 inhabitants	2.0	2.2	2.2	2.2	0.2	0.1	0.2	7.9	6.6	8.2
Rehabilitation days in million	41.8	38.9	40.9	40.9	-2.8	-0.9	-0.9	-6.8	-2.1	-2.1
Average length of stay	25.2	23.6	23.6	23.6	-1.5	-1.6	-1.6	-6.1	-6.2	-6.4
Share women in cases	0.54	0.53	0.53	0.53	0.0	0.0	0.0	-1.5	-2.0	-2.4
Share women in rehabilitation days	0.53	0.53	0.52	0.52	0.0	0.0	0.0	-1.0	-1.5	-1.9
Share of elderly in cases	0.37	0.39	0.39	0.40	0.0	0.0	0.0	5.2	6.9	8.9
Share of elderly in rehabilitation days	0.32	0.33	0.33	0.34	0.0	0.0	0.0	1.7	3.5	5.7
Mean Age of reha patients	56.6	58.6	58.7	59.1	2.0	2.0	2.4	3.5	3.6	4.3

Source: Federal Statistical Office, rehabilitation statistics; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

4.3.3 Changes in prevalence rates in institutional health care

The number of hospital cases per 100 inhabitants (prevalence rates) increased in the past. Thus, taking into account this kind of changes has a contrary effect to the reduction in the length of stay. We calculated the average age- and sex specific yearly growth rates of hospital cases per 100 inhabitants for the years 2000 to 2011. For the projection we assume that the future growth rate will be half of the growth rates in the past. The underlying hypothesis is that the morbidity driven increase in hospital utilization will be extenuated by the medical-technological progress that also allows more patients to be treated in ambulatory facilities. Another fact is, that with the introduction of the DRG system an incentive was set to increase the number of patients in particular in DRGs with a high profit margins (Felder; Mennicken; Meyer 2013). It is assumed that measures will be undertaken to reduce this inefficient incentive effect.

Under these assumptions the total number of hospital days will decline by about 20 % (friendly and Europop) and 26 % (tough) depending on the demographic scenario (Table 30). The share of the elderly in hospital days will increase moderately.

Table 30 Changes in hospital cases and hospital days between 2010 and 2025 – projection taking into account decline in average length of stays and changes in prevalence

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Hospital cases in million	18.5	18.7	20.3	20.2	0.2	1.8	1.8	1.1	9.6	9.5
Cases per 100 inhabitants	22.6	24.9	25.3	25.6	2.2	2.7	3.0	9.9	12.0	13.3
Hospital days in million	145.5	107.7	116.9	117.2	-37.9	-28.7	-28.3	-26.0	-19.7	-19.5
Average length of stay	7.9	5.8	5.8	5.8	-2.1	-2.1	-2.1	-26.9	-26.7	-26.4
Share women in cases	0.53	0.52	0.52	0.51	0.0	0.0	0.0	-1.8	-2.2	-3.3
Share women in hospital days	0.53	0.52	0.52	0.51	0.0	0.0	0.0	-1.9	-2.4	-3.5
Share of elderly in cases	0.43	0.48	0.49	0.50	0.1	0.1	0.1	12.0	14.5	17.1
Share of elderly in hospital days	0.50	0.52	0.54	0.55	0.0	0.0	0.0	3.8	6.5	8.5
Mean Age of patients	54.0	57.8	58.0	58.7	3.7	3.9	4.7	6.9	7.3	8.6

Source: Federal Statistical Office, hospital statistics; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

Rehabilitation institution experienced a high increase in the number and share of elderly and oldest old patients due to the measures of strengthening the rehabilitation and prevention treatments of persons with impairments in activities of daily living.

Table 31 Changes in rehabilitation cases and total rehabilitation days between 2010 and 2025 – projection taking into account decline in average length of stays and changes in prevalence

	2010	2025			changes 2025/2010			changes 2025/2010 in %		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
Rehabilitation cases in million	1.7	1.7	1.8	1.8	0.0	0.1	0.1	1.8	7.3	7.7
Cases per 100 inhabitants	2.0	2.2	2.2	2.3	0.2	0.2	0.2	10.7	9.6	11.4
Rehabilitation days in million	41.8	39.5	41.6	41.7	-2.3	-0.2	-0.1	-5.4	-0.5	-0.3
Average length of stay	25.2	23.4	23.3	23.3	-1.8	-1.8	-1.9	-7.1	-7.2	-7.4
Share women in cases	0.54	0.55	0.55	0.55	0.0	0.0	0.0	2.4	1.8	1.3
Share women in rehabilitation days	0.53	0.55	0.54	0.54	0.0	0.0	0.0	3.1	2.5	2.0
Share of elderly in cases	0.37	0.41	0.42	0.43	0.0	0.1	0.1	13.0	15.3	17.4
Share of elderly in rehabilitation days	0.32	0.36	0.36	0.37	0.0	0.0	0.0	10.5	13.0	15.2
Mean Age of reha patients	56.6	60.1	60.2	60.6	3.5	3.6	4.0	6.1	6.4	7.0

Source: Federal Statistical Office, rehabilitation statistics; NEUJOBS demographic scenarios D10.2; calculations of DIW Berlin.

Due to the positive effects it can be expected that this trend will continue. More elderly patients will stay in rehabilitation institutions but for fewer days as in the past. Under the same assumption as for hospitals (half of past yearly growth rates) the amount of total rehabilitation days will decline by -0.3 % (Europop) up to -5.4 % in the tough scenario (Table 31). The effect of declining length of stay will be partly compensated by changes in prevalence.

Although also in ambulatory care changes in prevalence rates have taken place in the past, no scenario with changing prevalence can be carried out due to missing data. Comparable information of contacts to a doctor is available only for three years, for the contact to dentists and physiotherapists only for one year.

4.4 Impact on health care workforce demand

The demographic driven changes in the demand for acute health care activities summarises Table 32. Only the demand for hospital care measured as total hospital days will increase in all scenarios; in the tough scenario by 1.6 % and in the friendly and Europop scenario by about 10 %. In the tough scenario, the demand for all other counted health activities will decline due to the significant reduction of the population at about 6.5 million persons. In the friendly and Europop scenarios a slightly decline in population is expected. In these scenarios the ageing of the population has a higher (and increasing) effect on the demand for health services than the reduction in population size. One exception is dental care. In all scenarios a decline in dentists' consultations is expected.

Table 32 Changes in demand for acute health care activities between 2010 and 2025 - constant utilization rates

	2010	2025			changes 2025/2010			changes 2025/2010		
		tough	friendly	Europop	tough	friendly	Europop	tough	friendly	Europop
	in million				in %					
Hospital days	146	148	160	161	2.3	14.5	15.1	1.6	10.0	10.4
Rehabilitation days	42	41	43	43	-0.8	1.2	1.3	-2.0	2.9	3.0
<i>Ambulatory care</i>										
Doctors' consultations	1 199	1 164	1 242	1 238	-34.2	43.2	39.9	-2.9	3.6	3.3
Dentists' consultations	178	166	175	173	-12.3	-3.2	-4.5	-6.9	-1.8	-2.5
<i>Prescriptions</i>										
Person with prescriptions of medical aids and appliances	16	16	17	17	-0.3	0.9	0.9	-1.7	5.5	5.3
Cure prescriptions	38	38	40	40	-0.5	2.0	1.9	-1.3	5.1	5.0
Pharmaceuticals in DDD	40 601	42 286	45 139	45 460	1 685	4 538	4 859	4.2	11.2	12.0
Source: Schulz 2013c.										

The changing demand for acute health care services and related goods require also changes in the personnel needed to meet the demand. For the scenario using constant utilization rates information on age- specific demand on health care activities are available for offices of physicians, offices of dentists, offices of practitioners, for

institutional care (hospitals and rehabilitation institutions), and for intermediate consumption industries. In 2010, in these services in total 2.3 million employees are engaged, that is to say 76 % of the total health care workforce measured as FTE. The share of covered employees is highest for assistants (89 %), followed by physicians, dentists, pharmacists (84 %), nurses (80 %), and therapists (80 %). Health craftsman and other occupations are covered to 62 % (Table 33). Thus, the estimation in the mentioned areas shows the development of the majority of health care activities.

Table 33 Personnel (FTE) in facilities and activities with information on utilization 2010

	Public health-Administration	Offices of physicians	Offices of dentists	Other ambulatory care facilities	Thereof Offices of practitioner	Hospitals	Preventive care/ rehabilitation facilities	Ambulance	Intermediate consumption industries+ other providers	Thereof intermediate consumption industries	Total	Share of personnel with utilization data
Utilization	-	visists (in million)		-	Prescriptions (in million)	total days (in million)		-		Persons with Prescriptions (in million)		
		1199	178		38.4	145.5	41.8			16.4		
Total of health care personnel	195	529	272	620	284	812	132	43	397	257	3000	0.76
physicians, pharmacists, psych. Psychotherapists	10	124	61	64	18	141	15	0	22	7	437	0.84
assistants (medical, laboratory, pharmaceutical)	7	276	153	55	11	66	6	0	27	16	590	0.89
nurses, geriatric nurses, health care and nursing aid	37	28	2	90	63	440	37	42	49	13	725	0.80
physiotherapist, therapeutic prof., therapists	11	6	0	144	134	23	35	0	32	2	251	0.80
health craftsmen, other professions in health care	127	94	56	266	60	142	39	1	268	220	993	0.62

Source: Federal Statistical Office, Health personnel accounts: calculation of DIW Berlin.

The pure demographic effect on the demand for acute health care personnel can be shown using the changes in demand for health services based on constant utilization rates as well as constant ratios of personnel needed to provide the services in each field of activities. The latter is calculated out of the demand for health services and realized employment in the single facilities in the base year (2010). The changes in the demand in the fields of health services for which no utilization data are available is calculated using the average change in the accounted activities. In this approach, goes the change in needed health workforce in line with the changes in the demand for health services.

In the tough scenario with a declining demand for health services also the needed health personnel will decline. In total about 38,000 FTE less are needed to meet the demand (Table 34). That is a decline of 1.3 %. Only in hospitals additional personnel is required: in total 13,000 FTE, thereof 7,000 nurses, 2,000 physicians, and 1,000 assistants as well as 2,000 other staff. A decline of needed personnel is expected in particular in offices of dentists (-18,000 FTE) and offices of physicians (-16,000 FTE). In these areas of ambulatory care fewer numbers of assistants are required, in total 18,000 FTE.

Table 34 Changes in the demand for health care personnel (1000 FTE) between 2010 and 2025 – constant utilization rates – demographic scenario though

	Offices of physicians	Offices of dentists	Offices of practitioner	Hospitals	Preventive care/ rehabilitation facilities	Intermediate consumption industries	Total counted activities	Total human health care services	Total change in %
Total of health care personnel	-16	-18	-2	13	-3	-3	-29	-38	-1.27
physicians, pharmacists, psych. Psychotherapists	-4	-4	0	2	0	0	-6	-7	-1.67
assistants (medical, laboratory, pharmaceutical)	-8	-10	0	1	0	0	-18	-20	-3.35
nurses, geriatric nurses, health care and nursing aid	-1	0	-1	7	-1	0	4	5	0.72
physiotherapist, therapeutic prof., therapists	0	0	-2	0	-1	0	-2	-3	-1.13
health craftsmen, other professions in health care	-3	-4	-1	2	-1	-3	-9	-15	-1.51

Source: Estimation of DIW Berlin.

In the friendly scenario additional personnel is needed to meet the increasing demand for health services. In total, 172,000 additional personnel measured as FTE is required (Table 35). Around half of the additional personnel are needed to meet the increasing demand for hospital activities (81,000 FTE), thereof 44,000 nurses. Also offices of physicians (18,000 FTE) and offices of practitioners (17,000 FTE) need additional personnel, in particular assistants (10,000 FTE, 1,000 FTE respectively). In contrast, office of dentists will not need additional personnel (under constant utilization rates).

Table 35 Changes in the demand for health care personnel (1000 FTE) between 2010 and 2025 – constant utilization rates – demographic scenario friendly

	Offices of physicians	Offices of dentists	Offices of practitioner	Hospitals	Preventive care/ rehabilitation facilities	Intermediate consumption industries	Total counted activities	Total human health care services	Total change in %
Total of health care personnel	18	-4	17	81	4	15	131	172	5.73
physicians, pharmacists, psych. Psychotherapists	4	-1	1	14	0	0	19	23	5.29
assistants (medical, laboratory, pharmaceutical)	10	-2	1	7	0	1	16	18	2.98
nurses, geriatric nurses, health care and nursing aid	1	0	3	44	1	1	50	62	8.60
physiotherapist, therapeutic prof., therapists	0	0	7	2	1	0	11	13	5.26
health craftsmen, other professions in health care	3	-1	3	14	1	12	33	54	5.43

Source: Estimation of DIW Berlin.

In the Europop scenario the demand is expected to be similar to the friendly scenario (Table 36). Additional 168,000 personnel (FTE) are required, hospitals will have the highest additional demand (84,000), but also offices of physicians are expected to need 16,000 FTE in the next 15 years. In total 22,000 additional physicians are required and 64,000 nurses. Currently some 6,000 vacancies for physicians in hospitals cannot be

filled, and it is reported that jobs for nurses cannot be filled, too. The calculation of the changing demand shows the challenges in particular for hospital treatments, and for the labour market of physicians and nurses.

Table 36 Changes in the demand for health care personnel (1000 FTE) between 2010 and 2025 – constant utilization rates – demographic scenario Europop2010

	Offices of physicians	Offices of dentists	Offices of practitioner	Hospitals	Preventive care/ rehabilitation facilities	Intermediate consumption industries	Total counted activities	Total human health care services	Total change in %
Total of health care personnel	16	-7	16	84	4	15	128	168	5.61
physicians, pharmacists, psych. Psychotherapists	4	-2	1	15	0	0	19	22	5.12
assistants (medical, laboratory, pharmaceutical)	9	-4	1	7	0	1	13	15	2.52
nurses, geriatric nurses, health care and nursing aid	1	0	3	46	1	1	51	64	8.83
physiotherapist, therapeutic prof., therapists	0	0	7	2	1	0	10	13	5.24
health craftsmen, other professions in health care	3	-2	3	15	1	12	32	52	5.28

Source: Estimation of DIW Berlin.

The demand for health personnel in FTE and in head counts in 2025 shows Table 37 and the changes in needed personnel in FTE as well as in head counts Table 38. In 2025 between 2.96 million (FTE, tough scenario) and 3.17 million (FTE, friendly scenario) health personnel is needed. Measured in headcounts the demand is higher due to the high share of part-time employment in particular of women. In 2010 3.9 million persons were employed in acute health care, thereof about 1 million nurses, geriatric nurses and family nurses. In 2025, the needed health workforce is 3.86 million (headcounts) in the tough scenario, 4.14 million in the friendly scenario, and 4.13 million in the Europop scenario.

Measured in headcounts in the tough scenario 9,000 physicians less are needed, while in the friendly scenario additional 19,000 physicians are required to meet the demand. In all scenarios additional nursing staff is required: in the tough scenario 8,000, in the friendly scenario 85,000 and in the Europop scenario 88,000 (nurses, headcounts). Markedly differences between the scenarios in the need for assistance can be seen. In the tough scenario 27,000 assistants less are required, whilst in the friendly scenario additional 28,000 assistants and in the Europop scenario 21,000 additional assistants are required (headcounts). Similar differences are expected for physiotherapists and other therapists as well as for craftsmen and other professions in health care. In the tough scenario less employment is needed (-4,000 therapists and -18,000 craftsmen and other professions); in the both other scenario additional 19,000 therapists and about 69,000 other professions are required.

Table 37 Demand for acute health care personnel in 2025

	Headcounts in 1000 persons				FTE in 1000			
	2010	2025			2010	2025		
		tough	friendly	Europop		tough	friendly	Europop
Total of health care personnel	3910	3862	4139	4133	2996	2962	3172	3168
physicians, pharmacists, psych. therapists	496	487	515	521	437	430	460	459
assistants (medical, laboratory, pharmaceutical)	810	783	838	831	590	570	608	605
nurses, geriatric nurses, health care and nursing aid	985	993	1070	1073	725	730	787	789
physiotherapist, therapeutic prof., therapists	349	345	368	368	251	248	264	264
health craftsmen, other professions in health care	1270	1252	1339	1338	993	978	1047	1045

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

In total, during the next 15 years additional 229,000 (friendly) or 223,000 (Europop) personnel measured in headcounts is needed under the pure demographic scenario. In the tough scenario 48,000 less personnel is required.

Table 38 Changes in the demand for acute health care personnel between 2010 and 2025

	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, geriatric 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.

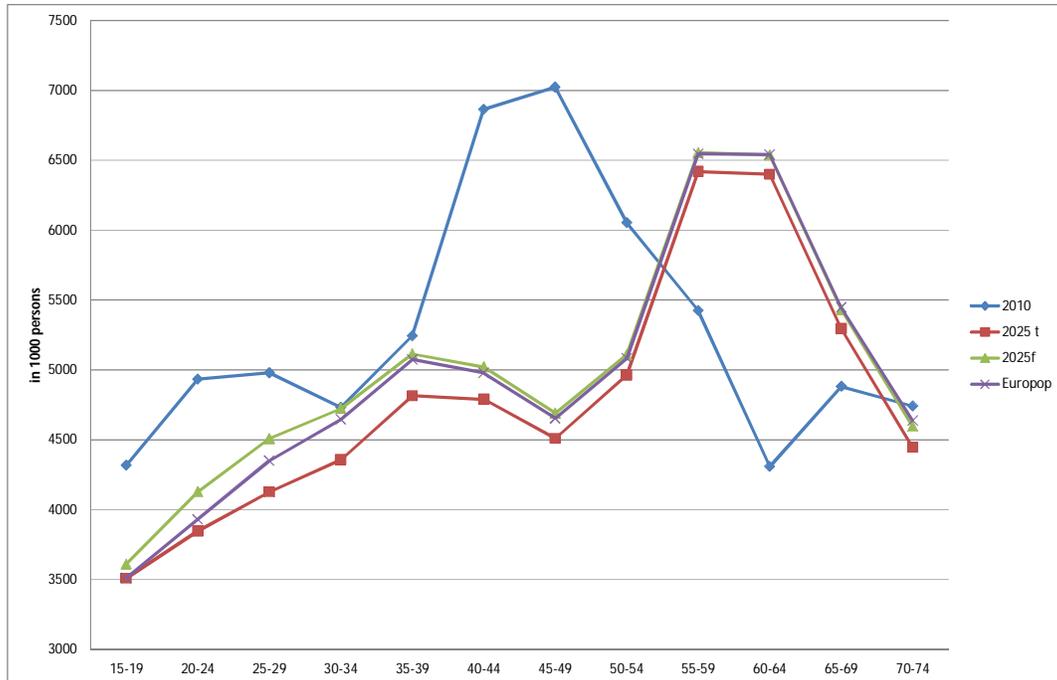
5 Estimation of labour supply

Section 4 calculated the demand for health personnel based on the current realized employment in health care facilities and the changes in the demand for health services. In the next two sections we calculate the supply of health care personnel to get an idea if it is possible to realize the needed employment. The supply of health care personnel depends on the overall development of the population in working age, the labour force participation, and the proportion of people who choose a health care occupation or a profession related to the health care market. The following section 5 shows in the first subsection (5.1) the development of population in working age based on the tough, friendly and Europop scenario. The second subsection discusses the development of labour force participation of males and females taken the education level into account. Based in the results in subsection 5.1 and 5.2 an estimation of the total labour force in 2025 is carried out (section 5.3). The total labour force consists of employed and unemployed people. One group of the total employment is the health workforce. Estimations of the employment in health care are shown in the next section 6.

5.1 Working age population

In international studies comparing the development of the population in working age or the employment people aged between 15 and 64 years are defined to be in working age. In Germany, focussing only on people under the age of 65 is no longer adequate as the normal retirement age will by law increase up to 67 years in the next two decades. Additional, in particular self-employed people, like practising physicians, dentists or therapists are often working beyond 65 years. Thus, this section focusses on the age-group 15-74 years. In 2010, 63.5 million inhabitants were 15 to 74 years old.

In general a decline in the number of people in working age is expected in all demographic scenarios. In 2025, the population in working age is smaller and older. The number of people aged 15-74 years will decline to 57.5 million in the tough scenario, to 60 million in the friendly scenario, and to 59.4 million in the Europop2010 scenario. The baby-boomer which dominates the age-group 40 to 49 in 2010 will shift to higher age and dominates the age-group 55-64 in 2025 (Figure 16).

Figure 16 Development of people in working age in Germany

Sources: Europop2010, WP10 tough and friendly population scenario D10.2.

The share of the elderly (55+) in total working age population is expected to increase by 8.8 %-points in the tough scenario, by 8 %-points in the friendly scenario, and by 8.5 %-points in the Europop scenario (Table 39). The share of females in total working age population will be nearly constant in all scenarios. The trend to higher education is expected to continue. Thus, the share of higher educated people, who have completed tertiary education (ISCED level 5+6), will increase in the tough scenario by 1.8 %-points and in the friendly scenario by 5.6 %-points. In total 24 % (tough) and about 28 % (friendly) of working age population will have tertiary education (for the Europop2010 scenario no distinction of population by education level is available). The gap in tertiary educated people between males and females is expected to be reduced. In 2010, the share of females with high education was 6.5 %-points lower than for men; the gap will shrink to 2.5 %-points in the tough and 3.9 %-points in the friendly scenario.

Table 39 Population aged 15-74 years in 2010 and 2025

	2010	2025			Changes 2025/2010*		
	Base year	tough	friendly	Europop	tough	friendly	Europop
		constant activity rates					
Population aged 15-74 in millions	63,50	57,47	60,03	59,40	-6,03	-3,47	-4,10
men	31,78	28,74	30,10	29,80	-3,04	-1,69	-1,98
women	31,72	28,73	29,93	29,59	-2,99	-1,79	-2,12
Share females (%)	49,95	49,99	49,86	49,82	0,04	-0,09	-0,13
Share 55+ (%)	30,48	39,25	38,52	39,01	8,77	8,04	8,54
men	29,36	38,38	37,81	38,35	9,02	8,44	8,98
women	31,59	40,12	39,23	39,69	8,53	7,64	8,10
Share higher educated (%)	22,09	23,93	27,72		1,84	5,62	
men	25,36	25,19	29,66		-0,17	4,30	
women	18,81	22,66	25,76		3,85	6,95	

*) Changes of population in millions; changes of share in %-points.
Source: D10.2 population projection; Eurostat, Europop; calculation of DIW Berlin.

5.2 Changes in labour force participation rates

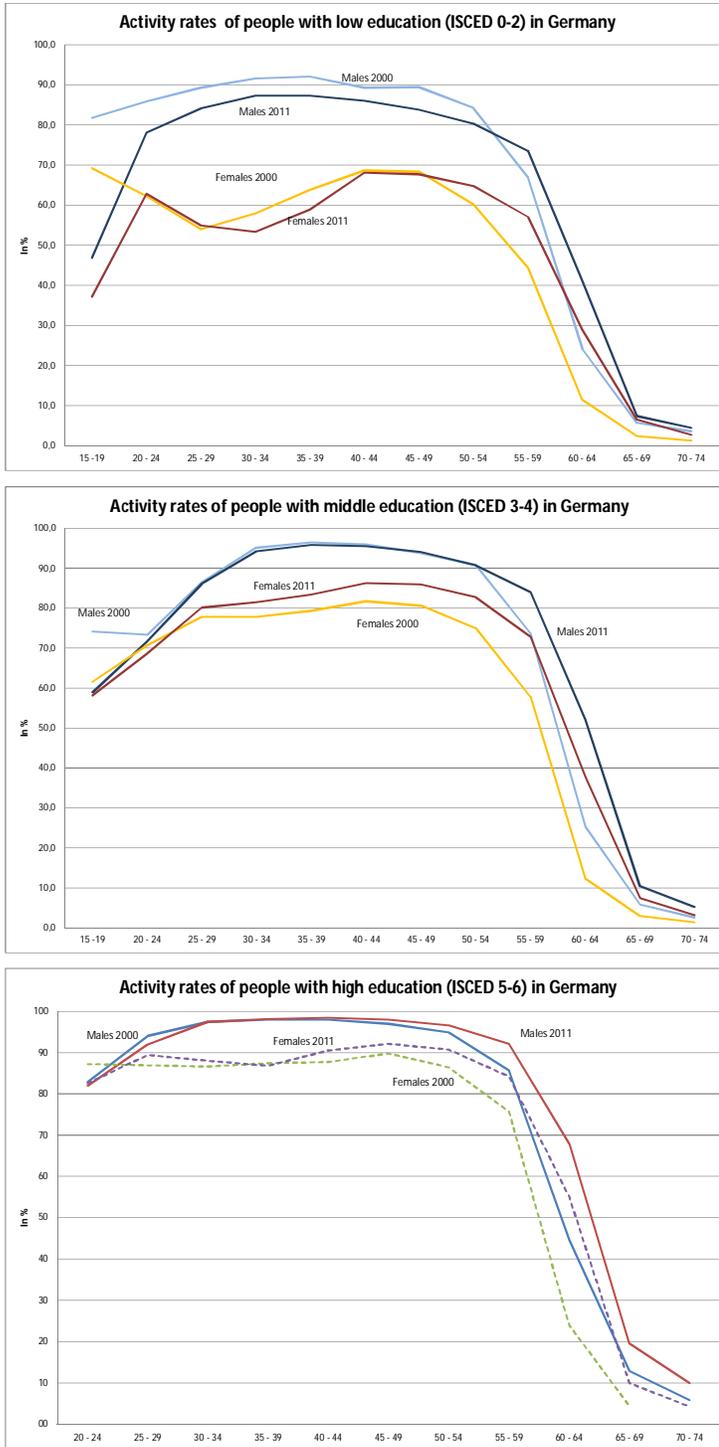
EU LFS provides information on employment and unemployment differentiated by age-groups, gender and education level. The labour force participation rate or activity rate is the ratio of employed and unemployed people to population (differentiated by age-groups, gender and education level). According to the definition of the International Labour Organization (ILO) people are counted as employed if they are working at least one hour a week. Thus, also marginal employment is included in the total employment. In Germany, the data base for the EU LFS is the so called micro-census. The micro-census is a mandatory household survey of 1 % of all households. The selected households are surveyed 4 years, in a manner that 25 % of surveyed households are replaced each year. It is reported that people in marginal employment are underrepresented in the micro-census. This must be kept in mind by interpreting and comparing the results of the EU LFS (in particular in contrast to the employment in National Accounts).

The activity rates differ between males and females showing markedly differences in particular among low educated people. In general lower educated people realized lower activity rates, for both males and females. But in particular the labour participation behaviour of females depends on the achieved education level. In 2011, low educated females realized in the birth giving ages an activity rate of only 55 %, while middle educated females had activity rates of around 80% (between 25-34 years) and high educated women around 85% (Figure 17).

Between 2000 and 2011, the activity rates were characterized by following trends:

- An increase in activity rates of males and in particular females with middle and higher education levels (ISCED 3-4, ISCED 5-6)
- A decline in activity rates of males and females with low education in the younger and middle age-groups (females under age 49, males under age 55)

Figure 17 Activity rates of males and females with by education level in 2000 and 2011



Source: Eurostat; LFS activity rates by education level; calculation of DIW Berlin.

- A general increase in labour force participation of males and females in all education levels in the older working ages.

The behavioural change of older individuals was partly driven by changes in the retirement law. Deductions for early retirement were introduced and several early retirement schemes were phased out by increasing the earliest possible age for drawing a pension. The normal retirement age of females increased from 60 years to 65 years. Until 2029 it will increase further up to 67 years for both men and women.

As the retirement age will continue to increase stepwise during the forecast period until 2025 a further increase in participation rates of older persons is expected. It is also assumed that the changes in female labour participation will continue with a convergence to male participation in the younger and middle ages. Thus, the increase in labour force participation will mitigate the demographic decline.

5.3 Development of total labour force

The total labour force is calculated using the population in working age (15-74 years) differentiated by age-groups, gender and education level and combining these data with the labour force participation rates in the same distinction in two scenarios: a) constant activity rates; b) increasing activity rates.

The shrinking of the population in working age will dominate the further development of the total labour force in Germany. The total labour force will decline from 41.8 million in 2010 to 38.4 million in the friendly scenario, 36.2 million in the tough scenario, and 37.7 million in the Europop scenario in 2025, constant activity rates assumed (Table 40). Taking changes in labour force participation rates into account changes the picture. In the tough scenario still a decline in labour force is expected (41.2 million in 2025), but in the both other scenarios an increase is calculated. In the friendly scenario the labour force will be 43.3 million, and in the Europop scenario 42.6 million. The increase in activity rates leads to a growth in female labour force, whilst the male labour force will still decline. That means the increase in male activity rates in older ages will not compensate the decline in population.

Compared to the scenario with constant activity rates, the scenario with increasing activity rates shows the following results

- a) the share of females will increase by about 2 %-point (nearly constant shares under constant activity rates)
- b) the share of the elderly workforce (aged 55+) will increase by 12.3 %-points (tough), 11.5 %-points (friendly) and 11.9 %-points (Europop) scenario, that is to say about 5%-points more than under constant activity rates.
- c) The share of higher educated labour force shows a slightly decline in the tough scenario, while under constant activity rates a small increase is expected. In the friendly scenario a lower increase (about 1 %-point less) than under constant activity rates is expected. The lower growth in the share of high educated labour force can be traced back to the higher number of elderly which have on average a lower education level.

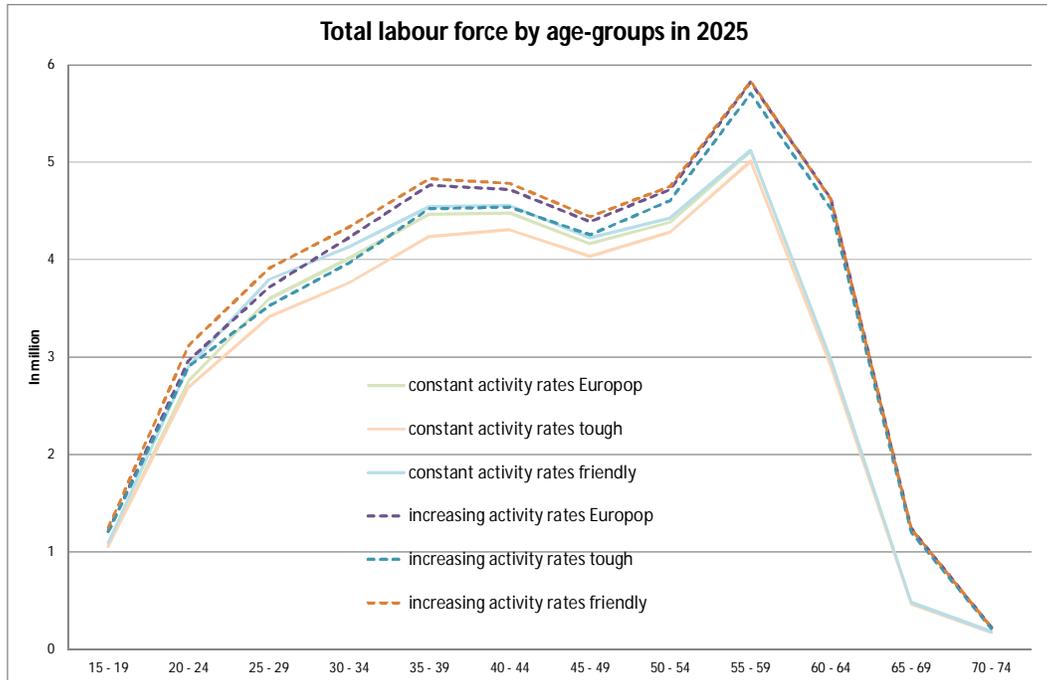
Table 40 Development of labour force in Germany

	2010	2025			Changes 2025/2010*		
	Base year	tough	friendly	Europop	tough	friendly	Europop
		constant activity rates					
Labour force in millions	41.98	36.35	38.42	37.66	-5.63	-3.55	-4.31
men	22.82	19.78	20.89	20.53	-3.04	-1.94	-2.30
women	19.15	16.56	17.53	17.14	-2.59	-1.62	-2.02
Share females (%)	45.63	45.57	45.64	45.50	-0.05	0.01	-0.13
Share 55+ (%)	16.04	23.54	22.77	23.22	7.50	6.73	7.19
men	16.59	24.33	23.67	24.10	7.74	7.08	7.51
women	15.38	22.58	21.70	22.17	7.21	6.32	6.80
Share higher educated (%)	26.30	27.36	32.61		1.05	6.31	
men	27.94	27.46	33.50		-0.48	5.56	
women	24.36	27.23	31.55		2.88	7.19	
		increasing activity rates					
Labour force in millions	41.98	41.17	43.32	42.62	-0.80	1.35	0.65
men	22.82	21.51	22.65	22.31	-1.31	-0.17	-0.51
women	19.15	19.66	20.67	20.31	0.50	1.52	1.16
Share females (%)	45.63	47.75	47.72	47.65	2.12	2.09	2.02
Share 55+ (%)	16.04	28.29	27.49	27.94	12.25	11.46	11.91
men	16.59	28.62	27.93	28.38	12.03	11.34	11.79
women	15.38	27.93	27.01	27.46	12.55	11.64	12.09
Share higher educated (%)	26.30	26.20	31.08		-0.10	4.78	
men	27.94	26.65	32.29		-1.29	4.36	
women	24.36	25.71	29.75		1.35	5.39	

*) Changes of labour force in millions; changes of share in %-points.
Source: D10.2 population projection; Eurostat, activity rates by education level; calculation of DIW Berlin.

The impact of changing activity rates in particular in the older working ages shows Figure 18. The increase in activity rates leads to a higher labour force of 14 % in the age-group 55-59, of 56 % in the age-group 60-64, and of 158 % in the age-group 65-69 years. If an increase in participation rates can be realized then it is expected that about 3 million more elderly workers (55+) stay in the labour market (compared to the scenario with constant activity rates).

Figure 18 Age-profile of labour force in Germany 2025



Source: WP10 population scenario D10.2, Eurostat, Europop2010, estimation of DIW Berlin

6 Estimations of employment in curative health care

The estimated decline in the German workforce has an effect on all industry sectors of the economy, but not to the same degree. Different estimations are carried out to show the effect of demographic change on the employment in total and in the sector 'human health care and social work'.

6.1 NEUJOBS employment projection using the NEMESIS model

The NEUJOBS WP9 carried out projections of the economic growth, unemployment and employment using the NEMESIS model (Boitier, Fougeyrollas and Le Mouël 2013). The NEMESIS model is based on National Account Data. 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 and for some countries also by industries according the NACE2 classification aligned with the economic development and the structural change in industries according the assumptions of the socio-ecological transition in the friendly and tough scenarios. The NEMESIS model provides data for all EU27 countries and 30 NEMESIS sectors. One of the NEMESIS

sectors is the sector 'non-market services'. The non-market sector comprises 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 countries for which input-output-tables are available a downscaling of the employment to NACE2 sectors are carried out. That was done for 11 countries, thereof Germany. Thus, for Germany data for the NEMESIS sector 'non-market services' as well as for the NACE2 sectors Q86 'human health care' and Q87+88 'Residential care and social services without accommodation' are available from the NEMESIS model.

The National Accounts provide data on employment and unemployment and economic activities for the economy in total and for sectors. In Germany the total employment in the National Account Data is with 40.5 million (2010) higher than the figures provided by the Labour Force statistics with 38.7 million, although both statistics mention to use the official ILO definition of employment.

The difference can be explained by the different methods of data collection. The data in National Accounts are collected from institutions, the data of the Labour Force Statistics are collected by a household survey called micro-census, which covers 1% of all households and is mandatory. Studies show that the difference in employment is mainly due to the difference in marginal employment (Fuchs, Söhnlein 2003). It is stated that the micro-census underestimates the number of people with marginal employment (Körner et al 2011). However, the labour force statistics provides additional useful information on employment by age-groups, sex, occupations, sectors, and education level and is used for the forecast of the labour force in the previous section. We have to keep the differences in mind by comparing the total employment and the total labour force of the two mentioned sources.¹

According to the NEMESIS model the total labour force amounted to 43.6 million in 2010 (Table 41). The labour force is estimated to decline to 40.9 million in the tough and 42.6 million in the friendly scenario (Boitier et al 2013). This is a decline of 6 % in the tough and 2.3 % in the friendly scenario. The estimation of the NEMESIS model can be compared with the results of our own calculations carried out in section 5.3. Under constant activity rate a decline by 5.6 % in the tough and 3.6 % in the friendly scenario is calculated. The results under are in general in line with the NEMESIS results, which also use constant activity rates.²

¹ The problem of different accounting in employment appears not in the data used for the calculation of the demand driven need for health care workforce. The analysis of the current employment situation in health care is based on the Health Labour Account (HLA) which is comparable with the National Accounts.

² The NEMESIS model uses an older version of the demographic scenarios, which shows slightly different results for persons in working age. May be that explains partly the differences.

The labour force is the sum of employed and unemployed people. The unemployment is estimated to increase from 3.1 million in 2010 to 3.7 million in the tough scenario, while in the friendly scenario a decline to 2.9 million is expected (Boitier et al 2013). The total employment is estimated to decline in both scenarios: from 40.5 million in 2010 to 37.3 million in the tough and to 39.7 million in the friendly scenario. The change in economic activities with a shift to service industries is expected to continue. In 2010 the NEMESIS sector 'non-market services' had a share in total employment of 29 %. This share is expected to increase up to 32 % in the tough and 34 % in the friendly scenario in 2025.

In 2010 the employment in sector Q amounted to 4.1 million. The downscaling of the NEMESIS sectors provides for Germany the results for both NACE2 sectors Q 86 and Q87+88 at 2025. In both scenarios an increase in employment in sector Q is expected, in the tough scenario by 8.3 % and in the friendly scenario by 14.2 %. The dynamic in sector Q is higher in the tough scenario, but slightly lower in the friendly scenario compared to the development in the NEMESIS sector 'non-market services'. In 2025 the employment in NACE2 sector Q is estimated to amount 4.5 million in the tough and 4.7 million in the friendly scenario.

Sector Q can be distinguished into the sector Q86 human health care and the pooled sector Q87+88 residential care and social work without accommodation. The employment is expected to increase in both sectors, but the dynamic will be different. In human health care the increase is expected to be higher than in the total sector Q for the friendly, but not for the tough scenario. The contrary result shows the development in residential care and social work with a higher increase in the tough and a lower increase in the friendly scenario. In human health care (Q86) the employment is projected to rise from 2.4 million in 2010 to 2.6 million in the tough (8 %) and to 2.8 million (15.6 %) in the friendly scenario in 2025. In the friendly scenario in particular the employment of high skilled people is expected to increase significantly. Due to the high dynamic the share of employment in human health care is expected to increase from 6 % in 2010 to about 7 % in both scenarios, tough and friendly.

For the sector Q87+88 residential care and social work a higher increase in the tough scenario, 8.7 % and a lower increase in the friendly (12.1 %) is expected compared to the sector Q86. The development in residential care and social work is dominated by the expected change in employment of persons with middle education levels. In particular in the friendly scenario the increase in employment is driven by the employment of high educated people. This explains partly the difference to human health care, in which a higher share of employment I high educated employment.

Table 41 Employment in Germany – Results of the NEMESIS model

	2010	2025		changes 2025/2010			
		tough	friendly	tough	friendly	tough	friendly
	in 1000			in %			
Employment							
total	40 480	37 254	39 701	-3 226	- 779	-7.97	-1.92
high skilled	11 452	10 945	13 390	- 507	1 938	-4.43	16.92
low skilled	29 027	26 309	26 311	-2 718	-2 716	-9.36	-9.36
Unemployment	3 086	3 667	2 868	581	- 218	18.83	-7.06
Labour force*	43 565	40 921	42 570	-2 644	- 995	-6.07	-2.28
Population	81 802	77 486	77 824	-4 316	-3 978	-5.28	-4.86
Share labour force (%)	53.26	52.81	54.70				
Employment							
non market services	11 611	11 877	13 284	266	1673	2.29	14.41
share in total employment (%)	28.68	31.88	33.46				
Employment in							
health care and social work (Q)	4 154	4 498	4 743	344	589	8.28	14.18
share in total employment (%)	10.26	12.07	11.95				
Employment							
human health care (Q86)	2 424	2 618	2 803	194	379	8.00	15.64
share in total employment (%)	5.99	7.03	7.06				
Employment in residential							
care and social work (Q87+88)	1 730	1 880	1 940	150	210	8.67	12.14
share in total employment (%)	4.27	5.05	4.89				
*) Labour force definition: employment + unemployment.							
Source: Boitier, B., Lancesseur, N. and Zagamé, P. "Global scenarios for European socio-ecological transition", NEUJOBS Deliverable D9.2, 2013, for scenarios results.							

6.2 Estimation of labour force and employees by major occupational fields (BIBB/IAB)

The results of the NEMESIS model which take into account the framework assumptions of the SET scenarios tough and friendly can be compared with some other projections carried out for Germany.

The Federal Institute for Vocational Education and Training (BIBB) and the Institute for Employment Research (IAB) have developed models which allow for projections of the labour demand and labour supply broken down by major occupational fields and qualifications (Helmrich/Zika 2010). In total the models differentiate 54 occupational fields which are based on the official German classification of occupations (KIdB 92) and four qualification levels based on ISCED classification. Results of the projections are reported on the level of the aggregated to 12 major occupational fields. One major occupational field comprises occupations related to the health and nursing care and social activities and body care (major field 11).

The projection of the labour demand is based on a macro-economic projection and simulation model. The IAB/INFORGE model is disaggregated by 59 economic sectors; take into account the inter-industrial relations and the international integration. The core of the projection model is a macro-model and an input-output-model. This model was expanded by the occupational fields.

This model was used to estimate the labour demand by economic sectors and major occupational field until 2025 (Hummel, Thein, Zika 2010). In 2005, the base year of the projection, the branch health and social work (NACE Rev1.1 branch N) had 4,036 million employees. It is estimated that the number of employees will increase until 2025 up to 5,063 million. The average yearly growth rate amounts to 0.9 %. The share of the health and social work sector in total economy will increase from 10.4 % in 2005 to 12.8 % in 2025.

The estimation by occupational fields shows the same trend. The employees with a health, social or other personal service occupation (major field 11) increases from 4.275 million in 2005 (4.710 million in 2010) to 5.258 million in 2025. The proportion of this occupational field in total employees will rise from 11.2 % in 2005 to 13.5 % in 2025 (Table 42).

The labour supply was estimated using two different models.

- A) The Fraunhofer Institute for Applied Information Technology (FIT) estimates the development of the workforce based on the basic labour force by occupational fields and calculations of the number of people entering the labour market by occupational field and leaving the labour market by occupational fields (Kalinowski, Quinke 2010). It is a kind of flowmodel, using data on the stock of employment by occupation fields, the inflows as well as the outflows. The core model is a transition model from the vocational training to the labour market (including transitions between different vocational training activities). They estimated that the labour supply will decrease from 43.276 million in 2005 to 39.308 million in 2025. In the major occupational field 11, health and social occupations, body care, a contrary trend is expected. Taking into account that not all people who had a vocational training in one of the mentioned occupations will stay and work in this occupation the labour supply (with flexibility) the number of employees will be nearly constant. In 2025, the labour supply in occupational field 11 is estimated to amount 4.8 million people that are only 45,000 people more than 2005.
- B) The Federal Institute for Vocational Education and Training (BIBB) carried out calculations of labour supply using a model with the demographic development, changes in educational qualifications, changes in participation rates and changing vocational choice as modules (Drosdowski, Wolter, Helmrich, Maier 2010). This DEMOS model was expanded by the occupational fields (BIBB-DEMOS). Based on the demographic projection of the Federal Statistical Office the population by educational qualification is calculated. In a next step the labour participation rates differentiated by qualifications are estimated and the workforce is calculated. The choice of the vocational training is modelled in the next step. The result is the labour supply differentiated by the occupations learned. According to this BIBB-DEMOS model the labour force in the major occupation field 11 will decline from 4.735 million in 2005 to 4.616 million in 2025. But in view of the declining trend of

the total labour force that proportion of health and social workers will increase by one percentage-point.

In 2012 an updated version of the projection was published (Helmrich et al 2012). In the new report the authors distinguish between 4 education levels. They take into account the development of increasing activity rates in particular of elderly and the realized demand for workers by education levels. The new projection shows that in 2030 in general the supply of labour force will meet the demand. Differentiated by education levels the supply will not meet the demand for persons with middle educations. They expect a gap in particular in the main occupation field 11 health and social care occupations. In 2030 a shortness of about 0.4 million in health and social workers is expected.

Table 42 Demand and supply of labour force in the major field of occupation 11 (health and social occupations) in Germany 2005 to 2025

Year	2005	2010	2015	2020	2025
	in 1,000				
<i>Demand for employees/labour force (IAB/INFORGE model)</i>					
Total	38 851	39 788	40 193	40 230	39 694
Major occupational field 11: health and social occupations	4 275	4 710	4 969	5 163	5 258
<i>Supply side: Labour force (BIBB-FIT model)</i>					
Total	43 277	43 152	42 502	41 180	39 308
Major occupational field 11: health and social occupations	4 736	4 897	4 964	4 904	4 781
<i>Supply side: Labour force (BIBB-DEMOS model)</i>					
Total	43 277	43 658	43 301	42 254	40 435
Major occupational field 11: health and social occupations	4 735	4 905	4 936	4 823	4 616

Source: Helmrich and Zika (2010); Estimation which takes the changes between learned and practiced occupation into account (with flexibility).

6.3 Projection of demand and supply of health care personnel (PWC/WIFOR)

The Pricewaterhousecooper (PWC) together with the WIFOR institute carried out an estimation of the demand for and supply of health care workforce in Germany until 2030 (PWC 2010; PWC 2012). They focus on medical professionals like physicians, dentists, pharmacists, and on non-medical professionals like nurses and therapists. They calculated the personnel needed in stationary and ambulatory care facilities, namely hospitals, rehabilitation institutions, offices of physicians, offices of practitioners and other ambulatory health facilities. The supply side is calculated by a flow model. Based on the current employment of physicians (and other medical professionals) and non-medical professionals the number of exits from the labour market due to retirement are calculated using different retirement ages. The entrances are calculated using data

on medical students and data on vocational trainings of nurses and geriatric nurses. Migration is not taken into account. The demand side is projected under the assumption that the future demand is determined by changes in age-structure and morbidity. Based on the current employment, the mentioned shortness of personnel, the calculated difference of entrances and exits from the labour market (supply side) and the additional need due to changes in morbidity and age the number of health workforce needed is calculated.

Table 43 Demand and supply of health professionals (FTE) in 2010, 2020 and 2030 (PWC/WIFOR)

	Year	Supply			Demand			Difference		
		medical professionals	non-medical	total	medical professionals	non-medical	total	medical professionals	non-medical	total
Hospitals	2010	131	503	634	140	512	652	9	9	18
	2020	145	478	623	169	612	781	24	134	158
	2030	139	381	520	218	729	947	79	348	427
Rehabilitation	2010	13	56	69	18	43	61	5	-13	-8
	2020	15	58	73	14	43	57	-1	-15	-16
	2030	14	50	64	12	44	56	-2	-6	-8
Other institutions (nursing homes)	2010		72	72		85	85	0	13	13
	2020		66	66		114	114	0	48	48
	2030		51	51		149	149	0	98	98
Offices of physicians	2010	122	315	437	124	317	441	2	2	4
	2020	107	348	455	139	351	490	32	3	35
	2030	77	324	401	164	510	674	87	186	273
Offices practitioners	2010		160	160		128	128	0	-32	-32
	2020		162	162		139	139	0	-23	-23
	2030		142	142		175	175	0	33	33
other ambulatory facilities (incl. LTC services)	2010		346	346		336	336	0	-10	-10
	2020		349	349		340	340	0	-9	-9
	2030		296	296		413	413	0	117	117
total	2010	266	1452	1718	283	1422	1705	17	-30	-13
	2020	267	1459	1726	322	1600	1922	55	141	196
	2030	229	1235	1464	395	2021	2416	166	786	952

Source: PWC and WIFOR 2010.

PWC and WIFOR expect that the future demand will exceed the supply markedly, in particular between 2020 and 2030 the gap will widen significantly. In 2010 about 17,000 physicians are missing, in 2020 some 55,000, and in 2030 some 166,000 (Table 43). While in 2010 the supply of non-medical staff is calculated to exceed the demand by some 30,000 FTE, the ratio will reverse in the future. In 2020 it is expected that 141,000 non-medical staff is missing and that the gap will widen up to 786,000 in 2030. In 2030 in total around 950,000 FTE are missing in sector Q human health and social work (acute care and long-term care).

Contrary to the results of the NEMESIS model, the calculation of PWC and WIFOR shows only a marginal increase in the supply of health care personnel until 2020 (by 8,000 employees), and thereafter a markedly decline from 1.3 million in 2020 to about 1.5 million in 2030. That is due to the high percentage of health care personnel which is expected to retire during the forecast period. But PWC and WIFOR took no migration into account and no changes in the skill mix of total employment. They focus only on health care personnel not taken into account the development in other sectors of the economy.

6.4 Calculation of the development in the number of physicians (Kopetsch)

Kopetsch (2010) carried out a calculation of the development of physicians employed in ambulatory and stationary health care until 2020. His calculation is based on data of members of the German Medical Association, the membership is mandatory for active physicians. The main influencing factor of the future number of physicians is the currently high average age of practising physicians and physicians employed in institutions. In particular general practitioners (family doctors) are to a high proportion at least 60 years old. Kopetsch estimated that between 2010 and 2020 some 23,700 general practitioner will retire. As the number of graduates will be lower than the number of retirees a decline in practising physicians and active physicians in institutions is expected. In 2010 some 51,000 general practitioner are practising, until 2020 the number is expected to decline to 44,900. Kopetsch expected also a decline in the number of practising specialists. For ophthalmologist he expect a decline from 5,112 (2010) to 4,856 persons (2020), for neurologist a decline from 4,622 to 4,391, for gynaecologists a relative constant number of 9,880 persons, and for dermatologists a decline from 3,334 to 3,290 persons. Kopetsch mentioned that additional some 20,000 physicians employed in hospitals are expected to retire until 2020, but he provides no information on the development of the total number of employed physicians in hospitals. Thus, Kopetsch show only the development on the supply side and only for a part of physicians. He provides only an impression of the possible development in selected occupations.

6.5 Comparing national estimations of health workforce with the NEMESIS results

The projections of PWC/WIFOR as well as of Kopetsch expect a decline in health workforce supply due to the high share of employees who are expected to retire during the next 15 years. These estimations do not take changes in the economic framework conditions or changes in industrial structure into account. They are focussing on in- and outflows of the health workforce, whereby the PWC/WIFOR do not take migration flows into account. The BIB-FIT or BIBB-DEMOS models are also based on a flow model, but they take into account changes in occupational structures, changing

vocational choice, behaviour and changes in occupational fields during the working life (flexibility). They also take into account migration flows. The demand side is estimated using the IAB/INFORGE model. That is a macro-economic model differentiated by 59 industrial sectors, and is more comparable with the NEMESIS model.

All national forecasts expect a shortage of health workforce in the future. That is in contrast to the results of the NEMESIS model. This can be traced back, under other things, on the different approaches and on the different assumptions. The NEMESIS model takes changes in economic development and the inter-industrial relations as well as the international interactions into account. Thus, changes in employment in health and social services depend also on the changes in employment in total and in other industries. The employment is calculated under the framework conditions of the two NEUJOBS scenarios, tough and friendly. The scenarios represent two possible pathways of a socio-ecological transition, including also changes in politics. The national forecasts are status-quo scenarios assuming no changes in framework conditions or politics.

To sum up, all scenarios, the national forecasts as well as the NEMESIS forecast, show possible developments on the health labour market, but under different future pathways of the economic and politic development. The national forecasts provide a likely future development if – beside demography – nothing will change. The NEMESIS model provides results under the preconditions of two pathways of a socio-ecological transition. In particular the friendly scenario gives an idea of the employment change under a high economic dynamic.

7 Summary and discussion

According to the calculation of the demand for health workforce based on the utilization approach, a moderate change in needed health workforce in acute health care services is expected. In 2025, the needed health workforce will be 3.9 million in the tough scenario, and about 4.1 million in the friendly and Europop scenario. Thus, in the tough scenario a decline in demand for health workforce by 1.2 % is calculated. In the both other scenarios the demand will increase by 5.9 % (friendly) and 5.7 % (Europop).

This estimation has some limitations. First, constant utilization rates are assumed as well as constant ratios of employees in service provision to patients. Second, no changes of health care provision between facilities are taken into account (shift from institutional full-time care to outpatient care in hospitals, shift to ambulant surgery). Third, no new treatment and diagnostic methods are taken into account, no new diseases. The projection shows the pure demographic effect.

For hospitals and rehabilitation institutions changes in utilization and changes in productivity can be taken into account. The employment in these two subsectors amounts to one third of the total acute health workforce. Taken changes in length of

stay (proxy for productivity) and changes in utilization (proxy for need for care) into account will lead to a reduction in the need for personnel in acute health care institutions, with a higher decline in hospital inpatient care. In hospitals the total care days will decline by -26 % (tough) respectively -20 % (friendly) until 2025, in rehabilitation institutions the decline is expected to be -5% (tough) and -0.5 % (friendly).

The high decline in hospital inpatient days is due to the significant reduction in the length of stay in the last decades. In particular the minimal invasive treatment methods have influenced the reduction in length of stay, but also reorganisation and increase in efficiency due to the changes in incentives of holding patients for a long time in hospitals (reimbursement methods changes from flat rates per day to flat rates for the whole treatment of a patients based on the DRG system).

The projected change in employment based on the NEMESIS model is in both scenarios higher than the change in the demand for health care personnel (Table 44). To compare both results the demand for health workforce excludes the personnel not accounted under sector Q. Those are in particular the employees in the intermediate consumption industries. The demand for health workforce in sector Q is expected to increase by around 6 % in the friendly scenario compared to the expected increase in employment by 15.6 %. In the tough scenario a decline in health workforce needed by -1 % is calculated compared to the expected increase in employment by 8 %. While the demand side shows the pure demographic effect, the NEMESIS model takes also the economic growth and the changes in industrial structure into account. Under the framework conditions of the friendly scenario a high economic growth is expected and a shift to a green economy. The economic development is a precondition of the possibility to increase public spending on education and research (also in universities), and to increase the number of places in medicine courses. The increase in public and private spending on research and development may support medical-technological innovations that increase the possibility to treat people. The experience in the past was that new medical treatment methods increased the demand for these new treatments as well as the supply. Both have an impact on the health workforce.

Table 44 Demand for health workforce and NEMESIS employment

	2010	Changes 2025/2010		Changes 2025/2010	
		tough	friendly	tough	friendly
		in 1000		in %	
Health care personnel without health craftsmen	2 640	-30	160	-1.12	6.06
NEMESIS	2 424	194	379	8.00	15.64

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

A high economic growth may increase the demand for health care services due to the increase in treatment possibilities and due to the income related demand for services that require co-payments or are financed privately. The employment in health services can be also supported by the following measures:

- Increase in retirement age, that is to say physicians and other health care personnel stay longer in the health market.
- Increase in the share of students studying medicine and the number of graduates.
- Decline in the share of students which do not finalize the medicine study
- Decline in the share of graduates who prefer to work in other areas of the economy (administration, pharmaceutical industry)
- In view of the declining overall workforce the health care sector is more and more in competition to other sectors of the economy. Thus, it is essential to increase the attractiveness of taking over an office or to work in hospitals. This includes not only the financial aspects (wages, reimbursement of self-employment practising physicians), but also the reconciliation of family and working life, in particular in view of the increasing share of females among physicians.
- Improvement of working conditions, for example reduction of the currently high workload in hospitals and practices, and the introduction of flexible working times. The reduction of workload requires additional personnel, and a reorganization of tasks between different employee groups, for example between physicians and qualified nurses, and qualified nurses and nurse assistants.
- Encouragement of males to be engaged in traditionally female employment areas, like nursing, caring and assistant activities.
- Increase in the number of foreign physicians and other health professions. Currently some 23,000 foreign physicians are working in Germany.

The realization of the mentioned measures depends also on the financial situation and the amount of money available to increase the employment in hospitals and ambulatory health services. In the friendly scenario is the financial scope higher than in the tough scenario.

Appendix

Table 45 Health Personnel Account and NACE Rev2

Health Personnel Account Germany	
<i>Included sectors NACE Rev2</i>	<i>Share</i>
21.10 Manufacture of basic pharmaceutical products	100%
21.20 Manufacture of pharmaceutical preparations	100%
26.60 Manufacture of irradiation, electromedical and electrotherapeutic equipment	100%
32.50 Manufacture of medical and dental instruments and supplies	100%
46.18 Agents specialised in the sale of other particular products	100%
46.46 Wholesale of pharmaceutical goods	100%
47.73 Dispensing chemist in specialised stores	100%
47.74 Retail sale of medical and orthopaedic goods in specialised stores	100%
47.78 Other retail sale of new goods in specialised stores	100%
65.12 Non-life insurance	100%
72.11 Research and experimental development on biotechnology	partial
72.19 Other research and experimental development on natural sciences and engineering	partial
84.12 Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security	partial
84.30 Compulsory social security activities	partial
85.42 Tertiary education	partial
Sector Q Human Health and social Work Activities	
<i>without</i>	
87.30 Residential care activities for the elderly and disabled	
88.10.2 Other social work activities without accommodation for the elderly and disabled	
Source: Federal Statistical Office; Health Personnel Account Department (Ms Afentakis).	

Table 46 Share of female employment in health care employment (without LTC) 2011(%)

Type of facility	2000	2011	Changes in %-points
Facilities total	69.5	71.2	1.7
Public health	66.7	65.9	-0.8
Ambulatory care	75.7	77.5	1.7
Offices of physicians	81.6	82.8	1.2
Offices of dentists	82.0	84.5	2.5
Offices of health practitioners	74.8	76.6	1.8
Dispensing chemists	82.9	77.8	-5.1
Retail sale and suppliers of medical appliances	38.1	43.1	5.0
Institutions providing other ambulatory care	71.9	75.0	3.1
Stationary/semi-stationary health care	75.0	75.9	0.9
Hospitals	75.1	76.0	0.9
Preventive care/rehabilitation facilities	74.3	75.3	1.0
Ambulance services	29.5	30.9	1.4
Administration	40.2	39.8	-0.4
Other providers	57.1	63.8	6.6
intermediate consumption industries of the health care sector	45.5	46.1	0.6
pharmaceutical industry	46.9	50.9	4.0
medicotechnical and ophthalmic industry	44.1	43.7	-0.5
medical laboratories and wholesale trade	43.7	44.0	0.4

Source: Federal Statistical Office of Germany; Health personnel accounts; calculation of DIWBerlin.

Table 47 Share of part-time employment in health care (without LTC) 2000 and 2011 in %

Type of facility	2000			2011			Changes in %-points		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Facilities total	23.7	6.8	31.0	27.9	9.9	35.1	4.2	3.1	4.1
Public health	21.4	7.1	28.6	26.8	15.4	37.0	5.4	8.2	8.5
Ambulatory care	22.6	6.0	27.9	28.6	9.9	34.0	6.0	3.9	6.1
Offices of physicians	23.5	6.3	27.4	29.0	9.2	33.2	5.5	2.9	5.7
Offices of dentists	22.3	3.6	26.4	28.7	7.3	32.3	6.4	3.6	5.9
Offices of health practitioners	25.2	10.5	30.2	31.7	15.1	36.8	6.5	4.5	6.7
Dispensing chemists	26.8	3.7	30.9	29.4	7.5	35.7	2.6	3.8	4.8
Retail sale and suppliers of medical appliances	11.9	4.8	23.4	16.8	7.4	29.2	4.9	2.6	5.7
Institutions providing other ambulatory care	25.0	11.1	30.4	31.6	15.0	36.8	6.6	3.9	6.4
Stationary/semi-stationary health care	28.7	8.3	35.6	30.5	9.9	36.9	1.7	1.6	1.3
Hospitals	28.9	8.0	35.9	30.3	9.5	36.9	1.5	1.6	1.0
Preventive care/rehabilitation facilities	27.6	10.3	33.6	31.2	12.2	36.7	3.5	1.9	3.1
Ambulance services	15.9	6.5	30.8	21.8	10.5	41.2	5.9	4.1	10.4
Administration	15.9	6.2	29.1	20.4	10.3	35.9	4.5	4.1	6.8
Other providers	19.6	8.3	29.7	27.0	10.4	36.4	7.4	2.1	6.8
intermediate consumption industries of the health care sector	15.7	5.8	27.7	19.6	8.8	32.2	3.8	3.0	4.5
pharmaceutical industry	16.8	6.7	28.3	20.8	9.6	31.5	3.9	2.9	3.2
medicotechnical and ophthalmic industry	13.7	5.4	26.7	18.3	8.3	30.9	4.5	3.0	4.2
medical laboratories and wholesale trade	16.9	5.1	29.0	20.2	10.6	35.1	3.3	5.5	6.1

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

Table 48 Personnel in health care (without LTC) – Full-time equivalents 2000 and 2011

Type of facility	2000			2011			Changes between 2000 und 2011					
	in 1000 FTE			in 1000 FTE			Changes in 1000 FTE			Changes in %		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Facilities total	2809	968	1839	3036	997	2039	227	29	200	8.1	3.0	10.9
Public health	36	11	25	34	11	23	-2	0	-2	-5.6	0.0	-8.0
Ambulatory care	1242	343	898	1440	376	1064	198	33	166	15.9	9.6	18.5
Offices of physicians	498	106	393	531	107	424	33	1	31	6.6	0.9	7.9
Offices of dentists	253	53	199	275	52	223	22	-1	24	8.7	-1.9	12.1
Offices of health practitioners	183	51	131	295	79	216	112	28	85	61.2	54.9	64.9
Dispensing chemists	130	26	104	138	35	103	8	9	-1	6.2	34.6	-1.0
Retail sale and suppliers of medical appliances	152	99	53	142	86	56	-10	-13	3	-6.6	-13.1	5.7
Institutions providing other ambulatory care	26	8	18	59	17	42	33	9	24	126.9	112.5	133.3
Stationary/semi-stationary health care	963	274	689	956	267	689	-7	-7	0	-0.7	-2.6	0.0
Hospitals	835	237	598	826	231	595	-9	-6	-3	-1.1	-2.5	-0.5
Preventive care/rehabilitation facilities	128	37	91	130	36	94	2	-1	3	1.6	-2.7	3.3
Ambulance services	39	29	10	45	32	12	6	3	2	15.4	10.3	20.0
Administration	186	120	66	159	102	57	-27	-18	-9	-14.5	-15.0	-13.6
Other providers	94	44	50	143	57	87	49	13	37	52.1	29.5	74.0
intermediate consumption industries of the health care sector	249	147	101	259	152	107	10	5	6	4.0	3.4	5.9
pharmaceutical industry	97	57	41	85	46	39	-12	-11	-2	-12.4	-19.3	-4.9
medicotechnical and ophthalmic industry	90	54	36	105	64	41	15	10	5	16.7	18.5	13.9
medical laboratories and wholesale trade	62	37	24	69	42	27	7	5	3	11.3	13.5	12.5

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

Table 49 Personnel in health care (without LTC) by age-groups and share of elderly employment 2011

Type of facility	under 35 years			35- under 50 years			50 years and older			Share of employees 50+		
	in 1000 persons			in 1000 persons			in 1000 persons			in %		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Facilities total	1276	303	974	1539	437	1104	1151	403	748	29.0	35.3	26.5
Public health	12	4	8	15	5	11	13	5	8	32.5	35.7	29.6
Ambulatory care	621	96	527	699	153	546	547	173	374	29.3	41.0	25.8
Offices of physicians	222	12	210	253	40	213	218	68	150	31.5	56.7	26.2
Offices of dentists	128	9	119	131	21	110	97	25	71	27.2	45.5	23.7
Offices of health practitioners	130	30	101	155	35	120	112	28	84	28.2	30.1	27.5
Dispensing chemists	62	10	52	69	15	54	48	14	34	26.8	35.9	24.3
Retail sale and suppliers of medical appliances	57	29	28	62	35	27	47	31	17	28.3	32.6	23.6
Institutions providing other ambulatory care	22	6	17	29	7	22	25	7	18	32.9	35.0	31.6
Stationary/semi-stationary health care	417	91	326	538	132	407	351	91	260	26.9	29.0	26.2
Hospitals	362	79	283	470	115	355	305	79	226	26.8	28.9	26.2
Preventive care/rehabilitation facilities	55	12	43	68	17	52	46	12	34	27.2	29.3	26.4
Ambulance services	20	15	5	20	14	7	15	9	6	27.3	23.7	33.3
Administration	55	31	24	75	44	30	66	42	24	33.7	35.9	30.8
Other providers	55	17	37	72	25	47	58	24	34	31.4	36.4	28.8
intermediate consumption industries of the health care sector	96	49	47	120	64	56	101	59	42	31.9	34.3	29.0
pharmaceutical industry	32	15	17	40	19	21	35	18	16	32.7	34.6	29.6
medicotechnical and ophthalmic industry	39	21	18	48	27	21	39	24	15	31.0	33.3	27.8
medical laboratories and wholesale trade	25	13	12	32	18	14	27	16	11	32.1	34.0	29.7

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

Table 50 Beds, treatment cases, and personnel in psychiatric clinics 2000 to 2011

Year	Facilities	Beds	Treatment cases	Days of care (in 1000)	Full-time equivalents (annual average)		Workload ratio per full-time equivalent**		
					medical staff*	non-medical staff	medical staff*	nursing staff	medico-technical staff
2011	247	41 007	559 833	13 876	5 713	46 987	33.1	7.3	24.2
2010	245	40 292	547 098	13 562	5 587	45 440	33.1	7.3	25.3
2009	245	40 165	548 863	13 538	5 495	44 778	33.6	7.5	25.8
2008	243	39 072	526 303	13 111	5 290	43 314	33.8	7.5	26.8
2007	239	38 785	508 028	12 950	5 209	42 676	33.9	7.5	27.6
2006	235	38 481	493 430	12 706	5 156	42 517	33.6	7.3	28.0
2005	234	38 869	494 808	12 684	5 119	43 112	33.8	7.2	28.1
2004	281	41 900	517 903	13 544	5 308	47 590	34.8	7.0	25.9
2003	276	42 116	499 519	13 481	5 151	48 765	35.7	6.8	25.4
2002	274	42 600	498 690	13 708	5 174	50 085	36.1	6.7	25.8
2001***	196	36 438	410 438	11 819	4 301	42 174	37.5	6.7	30.4
2000***	194	36 537	390 319	11 826	4 261	42 108	37.8	6.7	30.9

*) only physicians and dentists with main job in the hospital
 **) average number of beds to care for per full-time equivalent per day
 ***) without hospitals with solely neurological beds.

Source: Federal Statistical Office of Germany, Hospital statistics - basic data 2000-2011

Table 51 Personnel in dispensing chemists by occupation, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
	Age-structure in %				Age-structure in %				Age-structure in %			
Total of health care personnel	180	35	39	26	40	27	40	34	140	37	39	24
health service professions	109	36	39	24	18	25	43	32	92	38	38	22
pharmacists	50	25	43	32	15	21	42	37	35	27	44	29
remaining health service professions	59	46	36	18	3	45	48	8	56	46	35	19
assistant dieticians	1	40	41	20	0.5	34	43	24	0.5	46	38	15
nurses	1	32	43	25	0.5	34	43	24	0.5	31	43	26
pharmaceutic-technical assistants	57	46	36	18	2	50	50	0	55	46	35	18
other special professions in health care	41	35	38	26	1	75	25	25	40	34	38	26
health engineers	8	19	39	19	0				7	22	44	22
pharmaceutic-commercial employees	34	38	36	27	1	75	25	25	33	37	37	27
other professions in health care	29	28	40	35	21	27	38	36	9	30	40	31

Source: Federal Statistical Office; health personnel account; calculations of DIW Berlin.

Table 52 Personnel in offices of health practitioners by occupation, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
	Age-structure in %				Age-structure in %				Age-structure in %			
Total of health care personnel	397	33	39	28	93	30	38	30	304	34	40	27
health service professions	296	34	39	27	70	32	39	29	226	35	40	26
psychological psychotherapists	21	6	34	66	6	0	27	82	15	8	36	60
remaining health service professions	275	36	40	24	64	35	40	24	211	37	40	24
medical assistant/dental assistant	9	40	31	18	0				8	45	35	20
incl: dental assistants	1	45	35	20	0				1	45	35	20
assistant dieticians	5	46	38	15	1	0	0	0	5	46	38	15
non-medical practitioners	26	18	47	39	6	13	50	38	21	19	44	37
nurses	28	32	43	26	4	34	43	24	24	31	43	26
incl: midwives	11	29	43	24	0				11	29	43	24
health care and nursing aid	42	32	36	29	13	40	36	23	28	30	37	33
physiotherapists, masseurs, medical bath attendants	106	40	40	20	31	39	39	23	75	40	40	19
incl: physiotherapists	63	40	40	21	12	40	36	24	51	40	41	20
medical laboratory assistants	1	30	40	30	0				1	30	40	30
therapeutic professions not named elsewhere	58	41	39	20	9	31	44	25	49	43	38	19
social professions	14	32	38	30	2	39	36	23	12	30	38	31
geriatric nurses	12	31	38	31	2	39	36	23	10	29	39	32
remedial therapists	1	50	30	20	0				1	50	30	20
orthopaedagogues	1	22	44	33	0				1	22	44	33
other professions in health care	87	29	39	32	20	27	38	36	67	30	40	31

Source: Federal Statistical Office; health personnel account; calculations of DIW Berlin.

Table 53 Personnel in ambulances by occupation, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
	Age-structure in %				Age-structure in %				Age-structure in %			
Total of health care personnel	55	35.9	36.3	25.3	38	38.6	35.4	22.3	17	29.8	38.3	31.9
health service professions	55	35.9	36.3	25.3	38	38.6	35.4	22.3	17	29.8	38.3	31.9
remaining health service professions	54	36.5	36.9	25.8	38	38.6	35.4	22.3	17	29.8	38.3	31.9
nurses	4	31.8	42.9	25.6	1	33.6	42.9	24.4	3	31.2	42.9	26.1
health care and nursing aid	51	36.2	35.8	25.3	36	39.8	36.1	22.9	14	29.5	37.3	33.2
other professions in health care	1	0.0	0.0	0.0	0				0			

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

Table 54 Personnel in public health and administration by occupations, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
		Age-structure in %				Age-structure in %				Age-structure in %		
Total of health care personnel	237	27.3	36.9	31.6	130	25.7	37.0	34.3	105	29.8	37.6	28.8
health service professions	66	30.1	35.5	26.6	17	29.2	35.4	29.3	48	31.0	36.3	26.3
physicians, pharmacists, psych. psychotherapists, dentists	12	18.9	32.0	32.4	6	18.9	37.8	44.2	6	18.9	26.3	20.6
physicians	10	22.7	38.4	38.9	4	28.3	56.7	66.3	6	18.9	26.3	20.6
physicians spec. in general medicine, paediatrists, internists	2	4.1	88.7	104.7	2	1.6	38.7	59.7	2	2.5	50.0	45.0
general practitioners	4	53.3	28.7	18.0	2	52.4	28.6	19.0	2	54.2	28.8	16.9
other medical specialists	2	2.6	46.2	53.8	2	2.6	46.2	53.8	0			
pharmacists	1	26.2	42.6	31.1	0				0			
dentists	1	14.5	39.1	44.9	0				0			
remaining health service professions	53	33.2	37.0	25.8	11	34.8	34.2	21.1	42	32.8	37.7	27.1
medical assistant/dental assistant	5	35.9	27.9	16.2	0				4	44.9	34.9	20.2
assistant dieticians	1	46.2	38.5	15.4	0				1	46.2	38.5	15.4
non-medical practitioners	1	18.5	44.4	37.0	0				1	18.5	44.4	37.0
nurses	7	36.0	49.0	29.5	1	33.6	42.9	24.4	7	31.2	42.9	26.1
health care and nursing aid	26	32.7	36.9	30.0	8	39.8	36.1	22.9	18	29.5	37.3	33.2
physiotherapists, masseurs, medical bath attendants	3	40.4	40.4	19.2	0				3	40.4	40.4	19.2
incl. physiotherapists	2	39.6	40.5	19.8	0				2	39.6	40.5	19.8
medical laboratory assistants	4	22.3	29.7	22.3	0				3	29.7	39.6	29.7
therapeutic professions not named elsewhere	5	40.7	38.9	20.5	1	31.3	43.8	25.0	4	43.0	37.6	19.4
social professions	18	29.5	36.7	28.2	3	21.4	28.7	16.0	15	31.1	38.3	30.7
geriatric nurses	12	30.1	38.4	31.4	1	39.3	36.1	23.0	11	29.2	38.6	32.1
remedial therapists	3	33.3	20.0	13.3	0				2	50.0	30.0	20.0
orthopaedagogues	3	23.1	46.3	30.6	1	25.0	50.0	25.0	2	22.2	44.4	33.3
health craftsmen	2	40.0	36.4	22.1	1	0.0	0.0	0.0	1	0.0	0.0	0.0
opticians	1	44.9	34.7	20.4	0				0			
other health craftsmen	1	38.1	38.1	23.8	0				0			
other special professions in health care	14	13.8	36.6	36.6	10	15.0	38.3	38.3	5	8.6	25.7	25.7
health engineers	1	20.8	41.7	41.7	1	0.0	33.3	33.3	0			
health-protecting professions	11	17.5	43.5	43.5	9	16.7	38.9	38.9	3	14.3	42.9	42.9
other professions in health care	136	27.7	38.5	34.6	99	26.6	37.7	35.7	38	29.8	39.5	30.8

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

Table 55 Personnel in intermediate consumption industries and other providers by occupations, gender and age-groups in 2011

	Total				Men				Women			
	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.	Total in 1000	under 35	35 - 50	50 a. m.
		Age-structure in %				Age-structure in %				Age-structure in %		
Total of health care personnel	502	30.6	38.5	30.9	238	28.3	37.4	34.1	264	32.2	38.6	27.5
health service professions	171	32.9	39.2	28.0	35	29.5	39.1	32.0	136	33.3	38.6	26.5
physicians, pharmacists, psych. psychotherapists, dentists	26	21.3	39.4	39.3	13	16.3	38.6	46.1	13	26.6	40.5	32.8
physicians	18	22.2	39.2	38.6	10	17.0	39.0	44.4	9	25.6	35.0	27.7
physicians specialised in general medicine, paediatrists, internists	4	2.0	43.7	54.3	3	1.6	38.7	59.7	2	2.5	50.0	45.0
surgeons, orthopedists	1	0.0	51.7	48.3	1	0.0	50.0	46.7	0			
neurologists, psychiatrists	1	0.0	78.1	21.9	0				0			
general practitioners	7	53.4	28.7	17.8	3	52.4	28.6	19.0	4	54.2	28.8	16.9
other medical specialists	4	3.2	47.0	49.9	3	2.6	46.2	53.8	2	4.2	50.0	45.8
pharmacists	6	24.9	43.3	31.8	2	21.1	42.1	36.8	4	26.8	43.9	29.3
psychological psychotherapists	2	3.8	29.7	66.6	1	0.0	27.3	81.8	1	8.0	36.0	60.0
remaining health service professions	145	35.0	39.1	25.9	23	35.7	37.7	22.7	122	34.3	38.7	26.1
medical assistant/dental assistant	7	44.9	34.9	20.2	0				5	44.9	34.9	20.2
assistant dieticians	1	46.2	38.5	15.4	0				1	46.2	38.5	15.4
non-medical practitioners	1	18.5	44.4	37.0	0				1	18.5	44.4	37.0
nurses	23	31.7	42.8	25.5	6	33.6	42.9	24.4	17	31.2	42.9	26.1
health care and nursing aid	42	31.0	37.2	31.7	6	39.8	36.1	22.9	36	29.5	37.3	33.2
physiotherapists, masseurs, medical bath attendants	31	40.0	40.0	20.0	7	39.3	39.3	23.2	25	40.4	40.4	19.2
incl. physiotherapists	20	39.7	39.9	20.4	3	40.0	36.0	24.0	17	39.6	40.5	19.8
medical laboratory assistants	23	30.7	39.8	29.6	2	37.5	37.5	25.0	21	29.7	39.6	29.7
pharmaceutic-technical assistants	6	46.2	35.4	18.5	0				6	46.2	35.4	18.5
therapeutic professions not named elsewhere	11	41.8	38.2	19.9	1	31.3	43.8	25.0	9	43.0	37.6	19.4
health craftsmen	40	39.8	35.9	24.3	22	37.7	34.5	27.8	18	39.5	35.0	18.1
opticians	14	44.7	34.7	20.6	5	38.9	33.3	27.8	8	48.4	35.5	16.1
orthopaedic mechanics	7	45.0	35.0	20.0	6	44.4	33.3	22.2	1	33.3	33.3	0.0
dental technicians	16	33.3	37.7	29.0	7	32.3	35.5	32.3	7	34.3	40.0	25.7
other health craftsmen	5	38.6	35.2	26.2	4	35.7	35.7	28.6	1	50.0	33.3	16.7
other special professions in health care	33	30.6	38.5	30.8	20	29.2	35.1	31.4	14	28.4	37.9	25.7
health engineers	3	10.0	50.0	40.0	2	0.0	33.3	33.3	1	22.2	44.4	22.2
health-protecting professions	11	16.7	41.7	41.7	8	16.7	38.9	38.9	3	14.3	42.9	42.9
health technicians	7	24.0	52.0	24.0	6	25.0	37.5	25.0	1	0.0	100.0	0.0
pharmaceutic technicians	7	56.3	21.9	21.9	4	75.0	25.0	25.0	3	50.0	25.0	25.0
pharmaceutic-commercial employees	5	36.6	36.6	26.8	0				5	36.6	36.6	26.8
other professions in health care	256	27.8	38.4	33.9	161	26.6	37.7	35.7	96	29.8	39.5	30.8

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

Table 56 Treatment cases of specialists 2011

Specialist title	Treatment cases cases per insured	Costs in Euro per insured	Costs in Euro per treatment case
General practitioner	2.067	112.34	54.36
Practitioner internist	0.728	41.67	57.24
Specialist for internal medicine	0.409	52.06	127.16
Specialist for gynaecology	0.703	30.24	42.99
Specialist for paediatrics and youth medicine	0.374	24.24	64.73
Specialist for surgery	0.225	16.09	71.51
Specialist for orthopaedics	0.355	19.19	53.99
Ophthalmologist	0.445	20.73	46.63
Otorhinolaryngologist (Ear,Nose, Throat)	0.284	12.14	42.81
Dermatologist	0.333	11.80	35.44
Urologist	0.18	8.89	49.27
Neurologist	0.258	23.68	91.75
Psychologist, Psychotherapist	0.059	24.01	406.55
Specialist for radiology, nuclear medicine	0.318	34.10	107.16
Specialist for laboratory medicine	0.734	18.19	24.78
Specialist for pathology	0.169	4.06	23.96
Other	0.128	12.36	96.53
unknown	0.455	19.23	42.26
Total	8.226	485.01	58.96
age-standardized with population 2011.			
Source: BARMER GEK Arztreport 2013.			

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