Regional variation in hospital admission rates in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen

M. van Noordt
P.P. Groenewegen
J. van der Zee

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Nederlands instituut voor onderzoek van de eerstelijnsgezondheidszorg
(NIVEL)
Postbus 1568 3500 BN UTRECHT
Tel. 030-319946

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CONTENTS

INTRODUCTION

1.1. Aim of the study

This report presents the results of a study into regional variations in hospital admission rates in four health care systems. The aim of the study is to compare health care systems. Most comparative studies of health care systems are of a qualitative nature. They are either edited volumes with contributions about a number of health care systems, like Raffels book on comparative health systems (Raffel, 1984) or descriptive studies of particular aspects of health policy, such as manpower policies (Roemer and Roemer, 1981) or professional reimbursement systems (e.g. Glaser, 1970). Quantitative studies in this field are rare.

An important problem in the quantitative analysis of health care systems is that it is very difficult to collect data about a sufficient number of health care systems to make statistical analysis possible. The number of units of analysis is usually to small. There are two possible solutions to this problem. The first is to study regional variations within health care systems and to compare the determinants of regional variations between health care systems. This idea was the point of departure of a series of studies done by NIVEL of which the current study is part (the next section briefly describes the results of these studies).

The second possible solution is to analyse time series data and to compare developments in time in different health care systems. The problem with this option is that it is difficult to collect comparable time series data over a sufficient period of time within different health care systems. The number of points in time must be sufficient to allow for statistical analysis.

However, from the current study a combined strategy emerges of time series and cross-regional data within a number of health care systems. The possibilities of this combined strategy will be explored in the years to come.

If one chooses a quantitative strategy based on the analysis of regional variation in a number of health care systems, the scope of the analysis cannot be as broad as the usual comparative studies of health care systems. The analysis has to be restricted to a specific phenomenon that is relevant for health policy and for which comparable data are available. In this study hospital admission rates have been chosen as the central phenomenon to be studied. Hospital admissions play a key role in the costs of health care. Cost containment is a central issue in health policy

discussions in most western european health care systems and restriction of (the growth of) hospital bed supply is a common feature in health policy. Moreover data about hospital admission rates are available at a regional level in most health care systems.
The analysis of regional (or small area) variations in hospital utilization is a thriving field of health services research (Sanders and McPherson, 1988). Most of these studies look at hospital utilization for specific diagnostic groups or specific surgical interventions. Although analysis of diagnosis specific or intervention specific hospital utilization allows for the testing of more detailed hypotheses about causal mechanisms, data problems are still large. Hence, in this study we will focus on hospital admission rates in general.
In the current study data about four health care systems will be compared: the Netherlands, Belgium, France (more specific the northern regions of France) and the Federal Republic of Germany (more specific Nordrhein-Westfalen). Within each of these health care systems approximately 40 regions will be analysed. Although the regions studied in the four health care systems are adjacent, there are important differences in the structure of the health care systems. Differences in the demand for health care, the insurance system and supply of health care providers and hospital facilities will be described in the report and the consequences for differences in hospital admission rates will be explored.

1.2. Previous studies of regional variation in hospital admission rates

As we mentioned above, the current study is part of series of studies. In this section we will briefly describe the design and results of these studies.
The first study only included data for one year, 1974, and two health care systems, Belgium and the Netherlands. Successively this was extended in time as well as in space. The first extension was to 1979 data for the Netherlands and Belgium. The next was to 1982 data for the Netherlands, Belgium and the North of France. Finally, in this report the study has been extended to Nordrhein-Westfalen with data on 1974, 1979 and 1982.
The original idea of these studies was that influences on hospital admission rates can be divided in two groups. The first group consists of variables that are supposed to have the same influence on regional variation in hospital admission rates in all western industrialised countries. Among these variables are indicators on the demand side, such as the percentage of

elderly and the mortality rate, and indicators on the supply side, such as the number of hospital beds and the number of beds in long-term care institutions. The second group consists of variables that either have a specific influence, depending on the particular health care system, such as the density of 'common specialists' (gynaecologists, paediatricians, general internists) that might influence hospital admission rates in health care systems with direct access to these specialists, and variables that are only meaningful in the context of a specific health care system, such as the percentage of publicly insured people in the case of The Netherlands.

The statistical analyses in line with this distinction between general and specific variables have shown that the additional explanatory power (in terms of an increase of the coefficient of determination, R2) of the specific variables is relatively small. The most important variables in the statistical explanation of variation in hospital admission rates are mortality rates and the number of hospital beds per 1000 of the population.

Comparing The Netherlands, Belgium and the north of France (with data for 1982) the influence of the supply of hospital beds on the hospital admission rate differs: it is strongest in the case of the north of France and weakest in The Netherlands, with Belgium having an intermediate position. Comparing The Netherlands and Belgium in the course of time it turns out that the influence of the supply of hospital beds decreases in the case of The Netherlands, whereas it is more or less constant in Belgium.

These results of previous studies have influenced the analyses that will be presented in this report. The idea of a stepwise analysis of first general variables and next health care system specific variables has been left. Attention is now mainly directed towards the different and in the course of time changing relationship between the supply of hospital beds and the admission rate.

With this change of direction Roemer's law, "a bed built is a bed filled", becomes the central topic of the analysis. It seems as if the empirical generalization contained in Roemer's law is only conditionally valid, depending on time and place. It might be the case that 'bed supply dominance' is a feature specific for the period that hospital costs increased in most OECD countries (1960-1990). At the end of this period most OECD countries shifted from cost expansion to cost control, by means of substantial bed reduction measures. A decrease of 'bed supply dominance' in the period 1974-1982 in the Netherlands and Belgium give rise to the hypothesis that the variable bed supply is an indicator of the dynamics of a health care system, indicating a trend in hospital (health care) costs.

1.3. Extension of the study with data of Nordrhein-Westfalen

Nordrhein-Westfalen is one of the eleven states (Länder) of West-Germany (preference is given to the name West-Germany in stead of Germany, because all data refer to the period before the reunion). The industrial 'Ruhr-area' in Nordrhein-Westfalen is the highest populated region in West-Germany. The region of Nordrhein-Westfalen borders in the west with the Netherlands and Belgium and forms as such a geographical extension of the previous study areas. This geographically united study area, however, is subdivided by administrative borders between the four different health care systems.

In a way the West-German health care system is comparable with the Dutch health care system. The major characteristics of this type of health care system are an employment-based health insurance, usually with wage ceilings and some barrier between the hospital sector and the ambulatory sector. The Belgian and French health care systems are comparable in the sense that they can both be characterized by a universal health insurance coverage (with co-payment rates) and a less marked difference between the ambulatory and hospital sector. These differences in the field of 'hospital admission incentives' might contribute to the explanation of regional variation in admission rates between the four countries in our study.

1.4. Contents

Since this study is meant to be a sequel in the series of international comparison of health care systems done by NIVEL, the structure of this study is more or less equal to the others. Differences may be due to the alteration of the research model.
In describing relevant aspects of the four health care systems (chapter 2), we will mainly focus on the West-German health care system, which applies to the new extended region, Nordrhein-Westfalen. Different from the previous studies is the inclusion of chapter 3 in which the relation between the number of hospital admissions and possible explaining variables is formulated in several hypotheses. At the end of this chapter, an overview of the research model is presented.
In chapter 4, a description of the included variables in the regression model is given. The geographical variation of each variable in all four areas in the

study is presented by means of a map as well as a frequency distribution of the variables in each country. In the last section, the results of the regression analysis will be presented, followed by a discussion on the results and ending with a recommendation on further research in this field.

2. GENERAL CHARACTERISTICS OF THE BELGIAN, DUTCH, FRENCH AND WEST-GERMAN HEALTH CARE SYSTEM

2.1. Introduction

In this section general characteristics of the Belgian, Dutch, French and West-German health care system will be described. In previous studies by Groenewegen & van der Zee (1985) and Gloerich et al.(1989) a description of the Belgian, Dutch and French health care system can be found. As this study is intended to be comparable with these previous ones, the framework of these studies as well as the years to which the data refer are used to implement data from the West-German case.
The structure of this study is derived from a scheme developed by the Canadian health economist R. Evans (1981), who states that the use of health services is a function of interactions between five major actors in the health care system:
- Consumers of health care
- Primary health care providers
- Secondary health care providers
- Insurance agencies
- Government

As in the previous studies mentioned, the five actors in the health care system (according to Evans), are discussed in the following subsections: Consumers of health care, (primary and secondary) **providers** of health care and **the health insurance system and health care costs.** Governmental aspects will be referred to briefly.
With respect to the data used in these subsections the following remarks have to be taken into account: data about different kinds of aspects of the French and West-German health care system do not match the boundary of our study areas, Northern France and Nordrhein-Westfalen. Statistics of health status indicators are most often restricted to the national level. For example, data of the health status of the Northern French population are not available. The regional division of Northern France does not correspond to the administrative units on which health status statistics are available. As a consequence, national data of health status indicators are presented in order to give an indication of the national trend. If available, data of Northern France and Nordrhein-Westfalen will be used.
In Section 2.3, the supply of health care facilities in the French and West-

German health care system will be illustrated by both national and regional data, whereas characteristics of the insurance system (Section 2.4) deals with national data.

2.2. Consumers. Indicators and determinants of the health status of the population

The demand side of a health care system will be described by indicators and measurements of the health status of a population. Data in this field are restricted to indirect measures. Direct measures (for example morbidity of the population) are hardly comparable and moreover are very difficult to obtain.

For this reason the following indirect indicators are chosen:

- life expectancy;
- infant mortality rates
- (age-standardized) death rates
- demographic composition
- life style indicators (alcohol and tobacco consumption)

Furthermore, two socio-economic factors, indicating the propensity to seek medical care, are chosen:

- income
- degree of urbanization

2.2.1. Life expectancy

Life expectancy has been regarded and used as a general level of health and welfare in a society.

Life expectancy in all countries increased between 1970 and 1980, with the highest increases for life expectancy rates at age 60 in the Netherlands and the FRG. In spite of this trend West-German figures are 'lower' than the Dutch and French rates. Belgium still has the lowest life expectancy rates for the three various classes in 1981. Moreover, Table 2.1 displays the increasing differences in life expectancy rates between the sexes.

In Figures 2.a and 2.b, one can see the index-rates for the Netherlands, France and the FRG related to the Belgian rates. In 1970 West-German rates for all categories were lowest, whereas Belgium had the lowest rates in 1980.

In Figure 2.c life expectancy index-rates of the Netherlands and France,

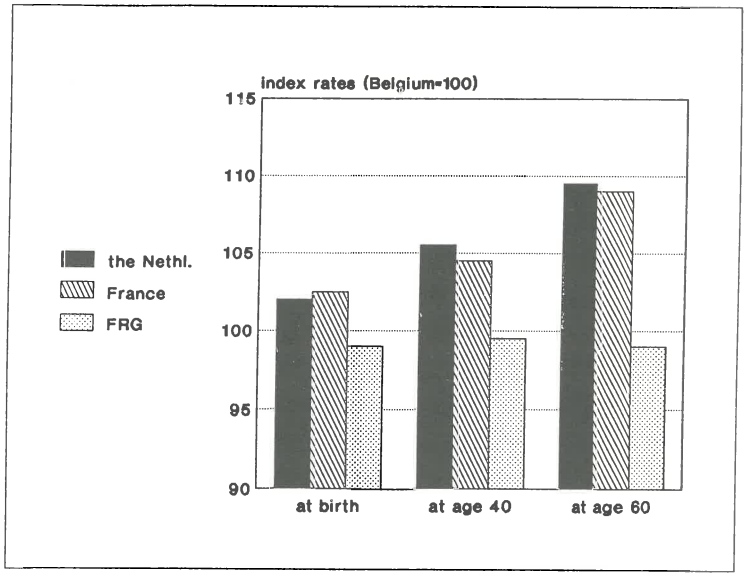
related to the FRG, are presented. 1986 data of Belgian life expectancy rates were not available. In 1986, the Netherlands still shows the highest life expectancy rates for all categories (with only small differences compared to the French rates). Life expectancy rates at age 60 differ largely between France and the Netherlands on the one hand and the FRG on the other.

Table 2.1: Life expectancy figures for Belgium, the Netherlands, France and FRG 1970, 1981, 1986 (M=Males, F=Females)

life expectancy	at birth	at age 40	at age 60
Belgium			
M '70	67.8	31.7	15.3
'81	70.0	33.0	16.5
F '70	74.2	36.9	19.2
'81	76.8	38.8	20.9
Netherlands			
M '70	70.9	33.7	16.9
'81	72.7	34.8	17.5
'86	73.1	35.4	18.0
F '70	76.6	38.7	20.7
'81	79.3	40.8	22.6
'86	79.6	41.5	23.3
France			
M '70	69.1	32.7	16.6
'81	70.4	33.4	17.3
'86	71.5	34.3	18.0
F '70	76.7	39.1	21.4
'81	78.5	40.4	23.2
'86	79.7	41.4	23.2
FRG			
M '70	67.3	31.7	15.2
'81	70.2	33.1	16.5
'86	71.8	34.0	17.3
F '70	73.6	36.6	19.0
'81	76.9	38.8	20.9
'86	78.4	39.9	21.7

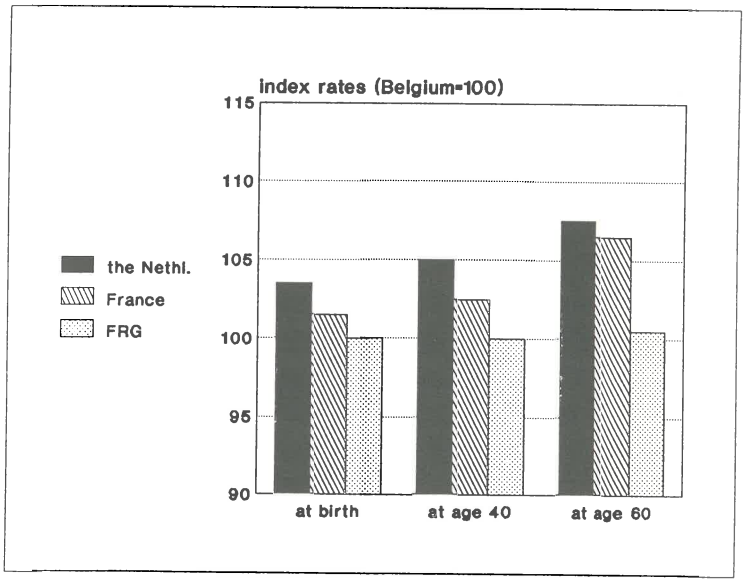
Source: OECD; Health Care Systems in Transition, 1991, Table 50-57.

Figure 2.a: Index-rates of life expectancy 1970, corresponding to Table 2.1 (Belgium 1970=100)



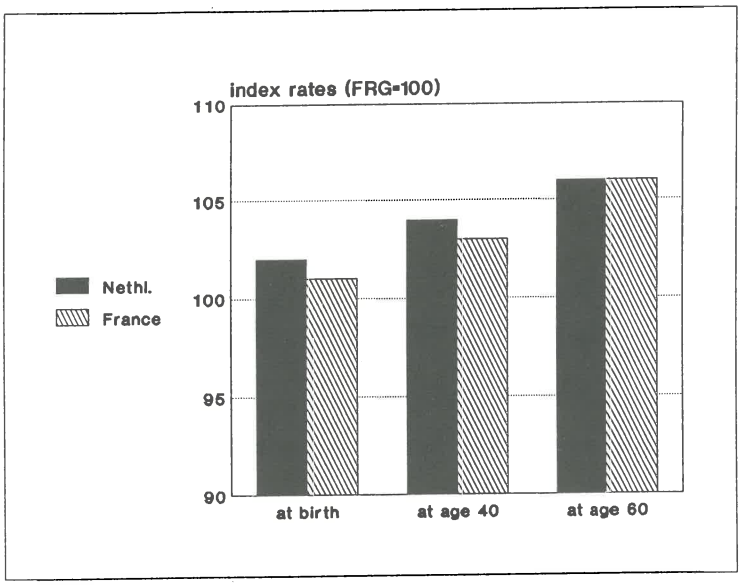
Source: OECD; Health Care Systems in Transition, 1991, Table 50-57.

Figure 2.b: Index-rates of life expectancy 1981, corresponding to Table 2.1 (Belgium 1970=100)



Source: OECD; Health Care Systems in Transition, 1991, Table 50-57.

Figure 2.c: Index-rates of life expectancy 1986, corresponding to data of Table 2.1 (FRG 1986=100)



Source: OECD; Health Care Systems in Transition, 1991, Table 50-57.

2.2.2. Mortality

Both infant mortality rates and age-standardized mortality rates are presented as indicators of the health status of the population.

Table 2.2: Infant mortality rates in Belgium, the Netherlands, France and FRG (1970, 1982, 1987)

infant mortality per 1000 live births	B	Nthl	F	FRG	(Index B 1970=100)			
					B	Nthl	F	FRG
1970	21.1	12.7	18.2	23.4	100	60	86	111
1982	11.7	8.3	9.3	10.9	55	39	44	50
1987	9.7	6.4*	7.6	8.3	46	30	36	39

* 1986

Source: OECD Measuring Health Care, 1960-1983, Table F2.
OECD Health Care Systems in Transition, Table 58.

In both Belgium and France infant mortality almost halved in the period 1970-1982. Although infant mortality rates in the FRG more than halved, this rate is still high, compared with the Dutch and French rates. The data indicate 'the best' health status for the Dutch population.

Age-standardized mortality is another potential indicator of a population's general level of health. These rates are available for Northern France and Nordrhein-Westfalen.

Table 2.3: Age-standardized* death rates per 1,000 population in Belgium, the Netherlands, France and Nordrhein-Westfalen ('74, '79, '82)

	age-standardized death rates			
	Belgium	the Netherlands	France	Nordrhein-Westfalen
1974	10.68	9.16	-.-	11.41**
1979	9.96	8.52	-.-	10.20
1982	9.69	8.25	9.62	9.83

* crude death rates of all countries separately have been standardized on one standard population i.e. the Netherlands, 1982.

** 1975

Sources: Belgium: Regionaal Statistisch Jaarboek 1983 (National Institute of Statistics)
The Netherlands: Statistisch Jaarboek 1982 (Central Bureau of Statistics)
France: Institut National de la Statistique et des Etudes Economiques (INSEE) (National Institute of Statistics and Economic Studies)
NR-WF: Beiträge zur Statistik des Landes Nordrhein-Westfalen (Regional Institute of Statistics, Nordrhein-Westfalen), 1975,1979,1982.

The age-standardized death rates in Nordrhein-Westfalen decreased to a large extent in the period 1975-1982 to about the same level as Belgium and France; compared to the Dutch rates the difference is considerable.
A high age-standardized death rate is expected to correlate positively with a high health care demand. The causes of death, however, differ between the four health care systems.
In the FRG, diseases of the circulatory system and malignant neoplasms were responsible for respectively 50.4% and 21.0% of all deaths in the FRG (Euro-Health Handbook,1985).
Diseases of the circulatory system present the highest rates in the FRG, whereas Belgium has (of all four countries) the highest rates of death caused by malignant neoplasms and diseases of the respiratory system.
The index-rate of diseases of the digestive system in France is twice as

high as the Dutch rate. This is due to differences in life style (Section 2.2.4).

Table 2.4: Index-rates (the FRG=100) of age-standardized death rates by cause per 1000 in Belgium, France, the Netherlands and the FRG, 1984 (France;1983)

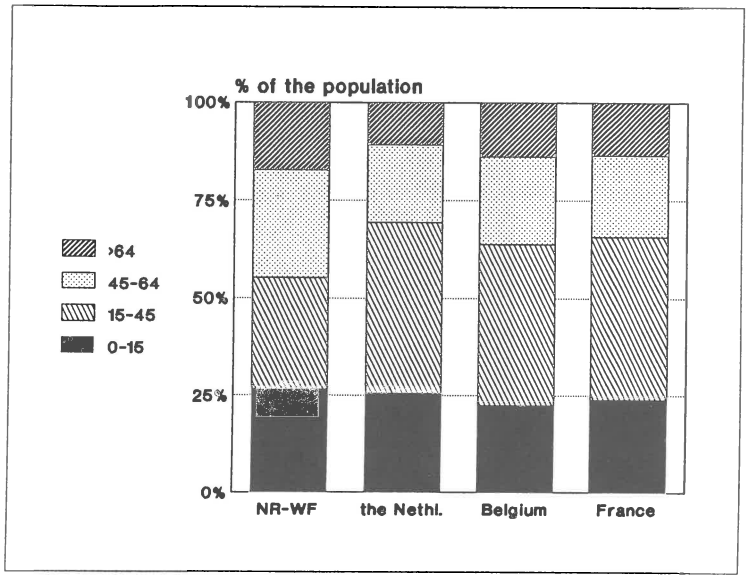
Causes of death	Belgium	France	Netherlands
Infectious & parasitic diseases	100	167	67
Malignant neoplasm	121	100	107
Diseases of the circulatory system	89	65	81
Diseases of the respiratory system	123	98	102
Diseases of the digestive system	81	126	63
Injury & poisoning	124	151	73
All causes	105	94	89

Source: OECD Financing and Delivering Health Care 1960-1983, Table 15.

2.2.3. Demographic composition

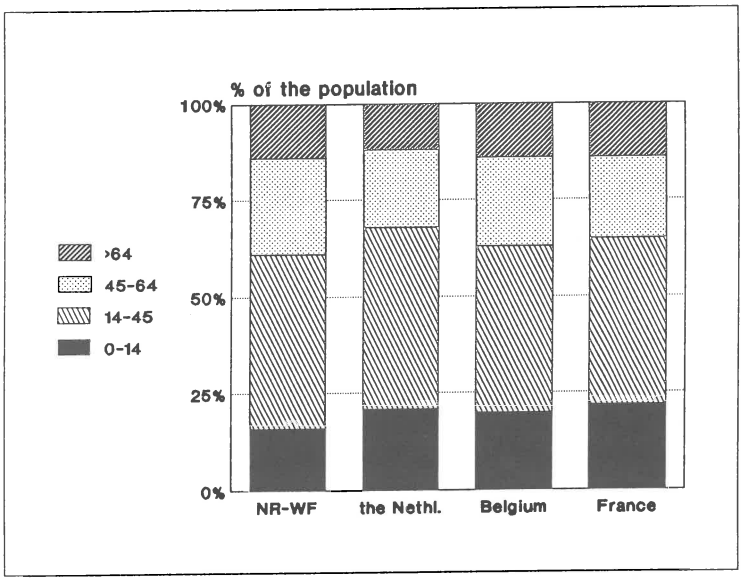
The age distribution figures of Belgium, the Netherlands, France and Nordrhein-Westfalen show the proportional increase of the aging population (Figures 2.d and 2.e). The population of Nordrhein-Westfalen is relatively old; the percentage of the population of 65 and over is relatively high and for the class 0-14 the percentage is relatively low. Generally speaking, the higher the number of elderly, the higher the health care demand. Dutch figures show considerable differences, compared with the other figures; the Dutch population is relatively young.

Figure 2.d: Age distribution in percentages of the population of Belgium, the Netherlands, France and Nordrhein-Westfalen 1974 (France=1975)



Sources:- Belgium: Regionaal Statistisch Jaarboek 1983 (National Institute of Statistics)
- The Netherlands: Statistisch Jaarboek 1982 (Central Bureau of Statistics)
- France: Institut National de la Statistique et des Etudes Economiques (INSEE) (National Institute of Statistics and Economic Studies).
- Ministère de la Solidarité, de la Santé et de Protection sociale; Annuaire des Statistiques Sanitaires et des Sociales, 1989.
- Nordrhein-Westfalen: Beiträge zur Statistik des Landes Nordrhein-Westfalen (Regional Institute of Statistics, Nordrhein-Westfalen, 1975,1982)
- Eurostat, yearbook of Regional Statistics, 1983
- Eurostat, Review 1975-1984

Figure 2.e: Age distribution in percentages of the population of Belgium, the Netherlands, France and Nordrhein-Westfalen 1982



Sources:- Belgium: Regionaal Statistisch Jaarboek 1983 (National Institute of Statistics)
- The Netherlands: Statistisch Jaarboek 1982 (Central Bureau of Statistics)
- France: Institut National de la Statistique et des Etudes Economiques (INSEE) (National Institute of Statistics and Economic Studies).
- Ministère de la Solidarité, de la Santé et de Protection sociale; Annuaire des Statistiques Sanitaires et des Sociales, 1989.
- Nordrhein-Westfalen: Beiträge zur Statistik des Landes Nordrhein-Westfalen (Regional Institute of Statistics, Nordrhein-Westfalen, 1975,1982)
- Eurostat, yearbook of Regional Statistics, 1983
- Eurostat, Review 1975-1984

2.2.4. Life style

Life style is used to indicate to what extent health-threatening habits influence the consumption of health care. Data about health-threatening habits for all four countries, however, are hard to obtain. For the sake of comparability, consumption statistics of alcohol and tobacco are used.

Table 2.5: Alcohol and tobacco consumption in Belgium, the Netherlands, France and the FRG (1982)

	B	NTHL	France	FRG
Alcohol (estimated total alcohol consumption per head of population (litres)	11.1	8.7	15.5	10.9
Tobacco (consumption per person aged 15 years and over (grammes)	3726	3508*	2247	2843*
Alcohol and Tobacco consumption (0/00 GDP**)	3.3	2.3	2.0	2.8

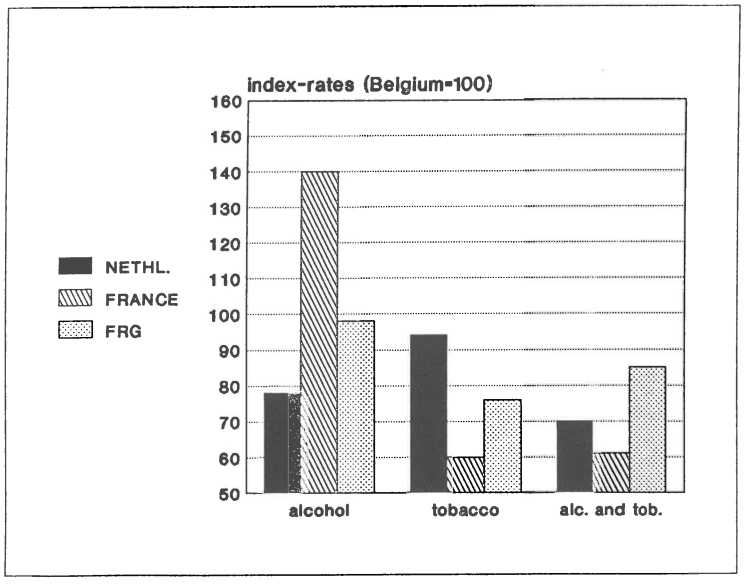
* 1979

** Gross Domestic Product

source: OECD Measuring Health Care, 1960-1983, Tables F7, F8, F9.

The index-rates (Figure 2.f) show considerably higher rates of alcohol and tobacco consumption in Belgium. However, France has a higher alcohol consumption per head of the population and FRG rates are slightly less, in spite of its world record consumption of beer.

Figure 2.f: Index-rates (Belgium=100) of alcohol and tobacco consumption 1982



Source: OECD; Measuring Health Care, 1960-1983, Tables F7, F8, F9

2.2.5. Income distribution and urbanization

In addition to indicators of the health status of a population, socio-economic factors may also be associated with health care demand. We hypothesize that the number of hospital admissions relates negatively to the socio-economic composition of a region. The socio-economic composition of a region is a parameter indicating differences in the propensity to seek medical care, largely determined by differences in health status or because of differences in accessibility to health care services.

Finally, the degree of urbanization is expected to be critical in the explanation of regional variation of hospital admissions, because of differences in access to health care facilities between rural and urban areas (distance bias). The degree of urbanisation is supposed to correlate positively with hospital admission rates. As a consequence higher hospital admission rates are expected in the metropolitan areas.

Information about differences in income and the degree of urbanization can be found in section 4.3.1.

2.2.6. Conclusion

Most indicators of health status show worse figures for Belgium and the FRG (life expectancy, infant mortality rates, age-standardized death rates). The Belgian and Nordrhein-Westfalen population are also older than respectively the French and the Dutch population. Given the relatively 'worse' indirect indicators of the health status in Belgium and Nordrhein-Westfalen, one may expect a greater need for health care.

2.3. Providers of health care

This section deals with differences between the health care systems of our study with respect to the number of physicians and the supply of hospital facilities.

In addition to these differences, the accessibility to specialist care, the remuneration system of physicians and the hospital payment system are considered to be possible determinants of the use of health care facilities.

This section is mainly focused on different aspects of the supply side of the **West-German health care system**; the relevant features for the Dutch, Belgian and French situation will be mentioned briefly. More details can be found in Groenewegen and van der Zee (1985) and Gloerich et al.(1989).

2.3.1. Ambulatory- and hospital-based physicians

In describing the supply side of a health care system, we usually make a distinction between primary (ambulatory) and secondary (hospital-based) health care suppliers. This division is based on the degree of accessibility. Primary health care suppliers are directly accessible, whereas secondary health care providers can be consulted by referral only.

In the Netherlands, medical specialists can only be consulted after referral from a general practitioner. The general practitioner functions as a 'gatekeeper' to specialist care. At the same time, the general practitioner forms a barrier to hospitalization as he cannot treat his patients in the hospital and as nearly all medical specialists work in the second echelon. In Belgium and France medical specialists can work in both an ambulatory and a hospital setting. Patients in Belgium and France are free to choose their doctor, either specialist or general practitioner, and doctors are free to refuse their patients. In theory patients can 'shop around' and see as many doctors as they wish. General practitioner and specialist are both directly accessible, although direct access is most common to so-called 'popular specialists' (pediatricians, gynaecologists and internists). Access to hospital care in these health care systems is less restricted, because one and the same (directly accessible) medical specialist can treat a patient both in private practice and in hospital.

Specialistic care in the FRG is characterized by a strict division between ambulatory- and hospital-based specialists. Ambulatory specialistic care is directly accessible, whereas hospital specialists, who only treat patients in the hospital, are accessible by referral only (Eichhorn, 1984). An exception to this strict division is formed by the so-called "Belegärzte". Approximately 4.3% of all doctors in private practice have at the same time disposal of hospital beds for the in-patient treatment of their clients (Eichhorn, 1984).

In the FRG, physicians working in the primary health care sector (Niedergelassene Ärzte) are self-employed, practising in independent private practice and providing ambulatory care in the community. In general, all physicians with a private practice can be ordinary general practitioners (praktische Ärzte), qualified general practitioners, who have followed a four year (postgraduate) education programme (Allgemeinärzte), or all kinds of specialists (Fachärzte/Gebietsärzte).

The education programme for "Allgemeinmedizin" is voluntary; only 30% of all qualified doctors or doctors who did not finish the education programme for specialists have received an "Allgemeinarzt" training (Deppe, 1986, No. 1 and 2).

However, the propensity to refer patients to the hospital is also influenced by the remuneration system of primary care physicians. In the Netherlands, the flow of patients to the hospital is expected to be influenced by the capitation payment system for publicly insured patients (privately insured, approximately 30% of the population in 1982, pay the general practitioner on a fee-for-service basis). The income of the general practitioner under this remuneration system is irrespective of the number of services rendered by a general practitioner, but it might influence their amount of free-time. In effect, the system implies an incentive for general practitioners to refer the patient to the hospital (Glaser, 1970).
In the three other health care systems, general practitioners are remunerated on a fee-for-service basis, forming an incentive to treat their patients in their own practice.

The remuneration system of hospital-based specialists varies within all health care systems. In the Netherlands, most medical specialists are self-employed entrepreneurs in a hospital. As a rule, they hire practice-room in the hospital and are remunerated by the health insurance funds (or directly by private patients) on a fee-for-service basis. Belgian specialists operate on a fee-for-service basis, with cost-sharing arrangements with the hospital. Both in the FRG and France hospital physicians are salaried by the hospital, with the addition that physicians working in private hospitals in France can work at the same time in private practice, where they are paid a fee-for-service.

In the Dutch health care system, a steady trend towards partnership practice can be found. In 1987, 45% of all general practitioners practice in a partnership or group practice.
In Belgium, private group practices are rare. 95% of all general practitioners operate predominantly from their own premises. Medical specialists work together in providing ambulatory care in out-patient departments of hospitals or in the polyclinics of the sick-funds, but not on a private basis. Group practice in France has not developed to a great extent. About 70% of the private practitioners work in single handed practice. Among the remaining 30%, one-half only share their premises with another physician (Crombie, et al., 1990).
Single-handed practice is predominant in the FRG, but in the last twenty years group practice has advanced. In 1980, 30% of general practitioners and ambulatory specialists were working in group practice. Group practices can assume the following forms (Federal Minister for Youth, Family Affairs, Women and Health, 1988):

- Collective practice: A group of two or more doctors who form a single economic unit and present collective accounts to the Association of Statutory Health Insurance Physicians (Kassenärztliche Vereinigungen) for the services they render.
- Associated practice: common consulting rooms and/or joint use of reception and waiting rooms.
- An equipment-sharing association: a group of doctors making joint use of equipment for diagnosis and therapy.
- A laboratory-sharing association: a special form of the previous category exclusively for laboratory diagnosis services.
- Shared hospital services: an association of practitioners with in-patient facilities (hospital beds).

Medical cooperation in the ambulatory sector is mainly concentrated on the joint use of equipment for technical laboratory diagnosis. More than 16% of all free practising doctors in the FRG were in laboratory partnership (Eichhorn, 1984). Compared to single practice, a group practice can offer a greater range of services, which results in a greater continuity in medical care for the patient.
Since most ambulatory working specialists have all the necessary facilities for diagnosis and treatment available (X-ray equipment, ECG machine, etc.), they can, to a certain extent, form a substitute for hospital-based physicians.

In Table 2.6 the number of general practitioners and specialists is summarized. Data of all health care systems, as well as for Northern France and Nordrhein-Westfalen, were used.

Table 2.6: The number of general practitioners and specialists in the Netherlands, Belgium, France, the FRG, Northern France and Nordrhein-Westfalen, 1982

	the Nethl.		Belgium		France	
	number	rate	number	rate	number	rate
G.P.	5,492	(3.8)	9,097	(9.2)	46,606	(8.6)
Specialist	9,813	(6.8)	10,147	(10.3)	45,085	(8.3)

	N-France		FRG		Nordr.-Westf.	
	number	rate	number	rate	number	rate
G.P.	6,607	(7.2)	28,268	(4.6)	6,384	(3.8)
Specialist	5,311	(5.8)	64,614	(10.4)	17,650	(10.4)

( ) = rate per 10,000 inhabitants.

Source: Gloerich et al. (1989) table 2.5
Beitrage zur Statistik des Landes Nordrhein-Westfalen (Regional Institute of Statistics, Nordrhein-Westfalen), 1982.
Eichhorn, S., 1984.

As can be concluded from Table 2.6, there are more than twice as many general practitioners in Belgium as in the Netherlands, calculated per 10,000 inhabitants.
The number of specialists is relatively high in Belgium, the FRG and Nordrhein-Westfalen.
Northern France and Nordrhein-Westfalen rates, for both general practitioners and specialists, are lower than their national average rate.

Typical of the West-German health care system is the high proportion of ambulatory working specialists. In 1982, 54.4% of all physicians working in the primary health care sector are specialists (Eichhorn, 1984). Most of them are internists or gynaecologists (table 2.7). Until 1960 there were twice as many general practitioners as ambulatory working specialists (Sturm, 1985). An increasing number of physicians tend to obtain specialized qualifications, because of several incentives (more opportunities in a hospital for training as a specialist than as a general practitioner, more earnings and fewer working-hours).

Table 2.7: Proportion of ambulatory physicians, according to their specialty, 1984

Allgemeinärzte/ praktische Ärzte	43.8 %	(in 1975; 52%)
Fachärzte	56.2 %	
of whom:		
Internists	16.1 %	
Gynaecologists	8.4 %	
Paediatricians	5.0 %	
Ophthalmologists	4.7 %	
Orthopedists	3.8 %	
Ear Nose and Throat specialists	3.5 %	

Source: Deppe, 1986, No.2, Figure 6.

Research at the 'Wissenschaftliches Institut der Ortskrankenkassen' and the 'Zentral Institut für die Kassenärztliche Versorgung in der Bundesrepublik Deutschland' showed that the decrease in the number of consultations of 'Allgemeinärzte/praktische Ärzte' in the period 1979 to 1984 was compensated for by a strong increase in the number of consultations of specialists (Deppe, 1986, No.2).
In conclusion, people tend increasingly to make use of specialistic care, instead of consulting the general practitioner. This increase in the use of specialistic care has been a major cause of the increase in health care costs.

2.3.2. The supply of hospital facilities

The hospital sector in the FRG can be divided into three types of hospital facilities; hospitals for acute cases (Allgemeinkrankenhäuser), special hospitals (Sonderkrankenhäuser) and "Kurkrankenhäuser".
General acute care hospitals dispose of 60.8% of all beds (First, 1985). These hospitals cover all aspects of acute care but may have specialized units, dedicated to specific disciplines. Acute care hospitals can also be specialized hospitals. These hospitals are defined as institutions concerned with one particular aspect of acute care; e.g. pediatric care or treatment of respiratory diseases, rheumatic disorders, cardiovascular or circulatory disorders.
Hospitals regarded as special hospitals provide medical treatment and nursing care for certain groups of patients. These include mental hospitals, hospitals for tubercular patients, hospitals for neurology, rheumatic hospitals, hospitals for geriatrically and chronically ill, and hospitals for rehabilitation. The average duration of hospitalization is usually quite lengthy, 64.3 days.

The third type of hospital facilities is the so-called "Kurkrankenhäuser". These are a major feature of the German health care system. "Kur" clinics combine therapeutic treatment with rest and/or physical exercise. The duration of stay is fixed according to the type of treatment, but normally lies between three and six weeks. Patients who attend a "Kurkrankenhaus" can be patients who need rehabilitation after an accident, patients with a chronic or a serious disease condition, older patients who want to maintain their health and continue working, and those who need a rest cure after retirement. Treatment in a "Kurkrankenhaus" is paid for either by the pension scheme or, if it concerns a non-retired person, by the health insurance funds.
It is worth noting that there is a large geographical variation in the location of these Krankenhäuser. 74.3% of all Kurkrankenhäuser beds are located in the states of Baden-Würtemberg, Bayern and Hessen (First, 1985).
In addition, care institutions for chronically ill patients (e.g. nursing homes) exist. However, these institutions are not covered under the statutory health insurance funds. They can be covered by the public (welfare) fund of the city or they can be paid by the patient him/herself.

Another division of hospitals is by ownership. Hospitals in the FRG can be publicly owned (belonging to the local authorities, Federal Government or sickness funds or they are teaching hospitals), independent, non-profit organizations (belonging to churches, the German Red Cross or other charitable organizations) or can be privately owned.
The three types of owners cover different market shares: most of the large-size, heavily equipped hospitals are run by public authorities; the voluntary non-profit institutions provide mainly medium-sized hospitals for acute care; private owners run rather small hospitals specializing in certain types of care (often in non-acute care).
In Nordrhein-Westfalen most hospitals are voluntary, non-profit hospitals. Private hospital beds per 1000 of the population are relatively few, whereas publicly owned beds are also less than the average rate in the FRG (Table 2.8).

Table 2.8: Hospitals and beds by types of ownership in percentages of the total in the FRG and Nordrhein-Westfalen, 1981

	FRG		Nordrhein-Westfalen	
	number of hosp	bed cap.	number of hosp	bed cap.
Public hospitals	36.4%	51.7%	23.3%	34.4%
Voluntary, non-profit hospitals	34.2%	35.6%	66.9%	62.4%
Private hospitals	29.4%	12.7%	9.8%	3.2%

Source: First, 1985.

Belgian hospitals can be divided into five categories: acute general hospitals, geriatric hospitals, special hospitals, psychiatric hospitals and sanatoria. The Belgian health care system is structured in such a way that not only the patient's family doctor, private specialist or hospital doctor can request an admission, but also the patient him/herself. The division between the first and the second echelon is apparently not based on the referral system. In the Netherlands, on the contrary, a hospital admission only takes place after referral by a general practitioner. In an emergency, the referral is approved afterwards.

In the Netherlands one can make a distinction between short-term general hospitals (including academic hospitals) on the one hand and mental institutions and nursing homes on the other. In addition to these institutions, a few specialized hospitals exist. These hospitals cover all institutions concerned with one particular aspect of acute care, e.g. pediatric care, the treatment of respiratory diseases etc.. Over 80% of Dutch hospitals are run on a private, non-profit-making basis (Table 2.9).

The French hospital sector is characterized by the relative importance of a strong private sector. Private hospitals predominate in number, but in terms of capacity the public sector is prominent. Private hospitals can be non-profit institutions or profit-making institutions. The first are run by religious orders, insurance funds, research funds etc. Profit-making institutions are either clinics providing predominantly surgical and maternity facilities, or specialized medium/long- stay care institutions.

Table 2.9: Percentage of hospitals by ownership in Belgium, France and the Netherlands, 1987

	Belgium	France	Netherlands
Voluntary, non-profit	60	---	80
Public	40	55	20
Private, non-profit	---	20	---
Private, for-profit	---	25	---

Source: Beske et al., 1987.

The private hospitals can choose voluntarily to form part of the public hospital service. In that case, certain duties, such as 24-hour accessibility, are required. Hospitals that prefer to stay outside the public hospital sector may still conclude a partial contract of association with the public service covering such fields as joint training of staff, pooling of equipment etc. The total bed capacity of general hospitals in France rose 8.12% between 1972 and 1979. In 1981 there were a total of 888 public general hospitals, with a bed capacity of 435,898, of which 306,050 (70%) in the hospital sector, and 129,848 (30%) in annexes and attached hospices. The majority of these non-medical beds are directed towards the provision of geriatric facilities. In addition, in 1980, there were a total of 3223 hospices for the aged and nursing home hospitals (First, 1985).

Each public general hospital in France is classified in one of the following four categories (1982).

a. Hôpitaux Locaux. These must contain at least a medical or a maternity ward (the majority of the facilities in these hospitals are given over to simple long-stay treatment). These rural hospitals are staffed on a part-time basis by local general practitioners, who are responsible for the daily management and care of the patients. Urban general practitioners are allowed but not encouraged to visit their patients in hospital and to discuss the treatment with the appropriate specialist (29 establishments).
b. Hôpitaux. These must contain at least general medical and surgical services, maternity and radiology wards, a pediatric section, a biological laboratory, dental care and out-patient facilities (181 establishments).
c. Centres Hôpitaliers Généraux. These must contain all the facilities described above, as well as oto-rhino-laryngological, ophthalmological and stomatological wards, a pediatric ward and facilities for medium- and long-term treatment for the chronically ill, convalescents and those requiring rehabilitation care (319 establishments).
d. Centres Hôpitaliers Régionaux. These are distinguishable from the

Centres Hôpitaliers by the number and nature of specialized wards available (359 establishments; First, 1985).

The differing scope of these establishments is shown by their average size (respectively 55, 220, 600, 2600 beds; Beske et al., 1987).

Hospitals have their own interest in the choice to treat a patient on an in-patient or an out-patient basis. The per-diem reimbursement system for hospitals is considered to induce a longer average stay per admission and more in-patient instead of out-patient treatments (Beske et al., 1987). Halfway through the eighties, the retrospective per-diem reimbursement system was replaced by a prospective budgeting system in all four areas of our study. By means of itemized and global budgeting, control over the increasing hospital costs was intended. The itemized system is based on unit of service, whereas the global financing system is based on overall service volume. All four health care systems of this study can be captured under the itemized financing system, although the Netherlands and France have shifted considerably in favour of global financing.

In the Netherlands, the per-diem rate approach in hospitals was replaced by a budgetary approach in 1984. In the French public and non-profit hospitals, the global budget approach is favoured. A negotiated all-encompassing budget is paid to these hospitals, according to their patient days.

In Belgium the list of itemized services is extensive, whereas the financing of hospitals in the FRG is described as a dual system, differentiating between investment costs and operating costs. The investment costs are covered by public funds. The operating costs are paid by the health insurance funds. The payment unit (a lump sum daily rate) for the financing of operating costs forms an incentive for an increase in service volume. With hospital costs high in the first days after an admission, but low afterwards, a lump sum daily rate identical for all patients sets incentives for an extension of the average length of stay.

The number of acute care hospital beds is highest in Nordrhein-Westfalen. In 1982 the rate per 10,000 inhabitants was about twice as high as in the Netherlands or Belgium. The rates for the FRG as a whole are slightly less (7.7) (First, 1985). In Northern France the smallest hospitals are found. This might be due to the operationalization of the term 'average hospital size'. The average number of hospital beds per hospital for each district is considered to be an index for hospital size. In Northern France all hospitals are taken into account (not just acute hospitals).

With respect to the number of long-term beds, the following remark has to be made. In both Belgium and France long-term care facilities consist of geriatric hospitals, departments within the general hospital or rest homes. In the Netherlands, these facilities are mainly located in special institutions outside the general hospital. In Nordrhein-Westfalen, the number of long-term beds corresponds to the number of beds in special hospitals (Sonderkrankenhäuser). These can be hospitals for chronic and geriatric patients. Sanatoria and neurological facilities are likewise designed for long-term patient stays. In addition to these hospitals, long-term care beds in Nordrhein-Westfalen can also be located in special wards of acute care hospitals.
Taking these remarks into account, the relatively low rates in Belgium are notable.
Propositions on the influence of the supply side of one health care system on the regional variation in hospital admission rates will be postponed to Chapter 3, in which the design of the study will be introduced.

Table 2.10: Supply of hospital facilities in the Netherlands, Belgium, France, Northern France, the FRG and Nordrhein-Westfalen, 1982

	the Netherlands		Belgium		France	
	number	rate	number	rate	number	rate
Acute medical and surgical beds	64,076	(4.5)	54,776	(4.8)	214,497*	(4.0)
Mean size of hospitals	330		173			
Long-term (geriatric) beds	47,647	(3.3)	12,449	(1.3)	182,423**	(3.3)

	N-France		FRG		Nordr.-Westf.	
	number	rate	number	rate	number	rate
Acute medical and surgical beds	51,496	(5.6)	473,804	(7.7)	136,582	(8.5)
Mean size of hospitals	136		254			
Long-term (geriatric) beds	32,598***	(3.6)	46,730	(5.3)		

* 1980 ('short-term-beds')
** 1984 (only 'medical beds')
*** Moyens et Longs Sejours
Source: idem Table 2.6
First, Eurohealth Handbook, 1985.

2.4. The health insurance system and health care costs

In this section we will mainly refer to health care insurance in the FRG. The relevant features for the Dutch, Belgian and French situation are taken from a study by Van der Zee, Groenewegen, Gloerich and Hamers (1989). Further details of the Netherlands and Belgium can be found in Van der Zee and Groenewegen (1985).

2.4.1. The Netherlands

Dutch patients are insured against the costs of illness in the following way:

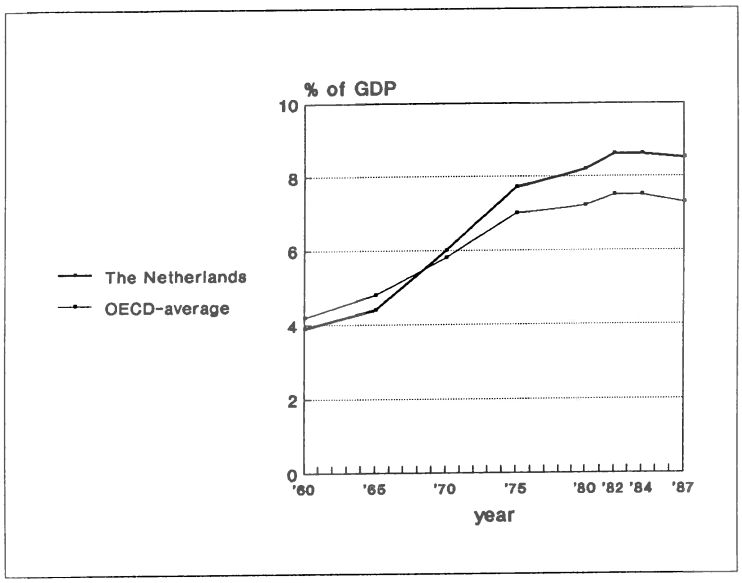
a. Compulsory public insurance for employees with an income below a certain level (per 1-1-1980: Hfl. 40,250) and those who are in receipt of social benefits. It covered approximately 70% of the population. Others use private insurance.
b. Voluntary public insurance for non-wage-earners under a certain income level (self employed and those receiving general assistance).
c. Private insurance for all above the income level mentioned under a.

Since 1985 the insurance classification has been changed. In that year the voluntary public health insurance was abolished; approximately half of the voluntarily insured population (especially those who receive some kind of public benefits) moved over to the compulsory scheme, the other half to private insurance. The proportion of publicly insured dropped to 62%.
In 1988 the income level for the compulsory public insurance was Hfl.49,650.
The private health insurance includes many forms of health insurance. Many insured use substantial co-payment rates or exclusion of general practitioners' services in exchange for lower premiums.
Besides these two insurance schemes, the General Exceptional Medical Expenses Act (AWBZ) applies to all Dutch citizens and covers exceptional medical costs (e.g. a stay of more than one year in hospital, nursing homes or institutions for the mentally retarded), not covered by the sickness insurance schemes. Since 1989 all forms of psychiatric care (in psychiatric hospitals, the psychiatric departments of general and academic hospitals and polyclinical psychiatric treatment) as well as home health care have been covered under this scheme.
In 1986 the AWBZ was financed as follows:
86.6% by premiums (equal contributions by employers and employees)
2.7% by government grants
10.3% by private contributions

0.4% by other sources of income (De Klein and Collaris, 1987).

In the Netherlands, health care costs were lower than the OECD average in 1960, increased dramatically in the period 1965-1975, but were curbed successfully in the following decade (Fig.2.g).

Figure 2.g: Health Care Expenditures in percentages of GPN, 1960-1987, the Netherlands and the OECD average



Source: OECD, Health Care Systems in Transition, 1989.

In 1980 the total medical consumption was financed as follows:
43.6% by the public health insurance schemes
24.9% by the AWBZ
25.5% by private contributions and private insurance funds
5.3% by government grants
0.7% by other sources of income (Heesters and Kessene, 1985).

The type of insurance can influence medical consumption. Under the public insurance scheme, there were (until recently) no financial transactions between consumers and providers; all services are delivered in kind. Privately insured patients, however, have to pay first and get a reimbursement afterwards, according to their insurance conditions.
The public health insurance contains, among other things, free hospital care (up to a maximum of one year), dental care, general practitioners' services, ambulatory obstetric care, paramedical care, co-payment for pharmaceuticals and maternity care.

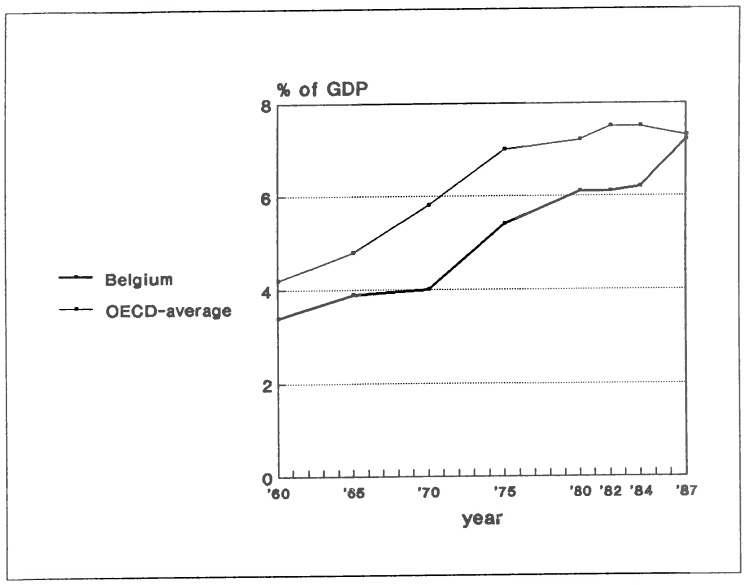
2.4.2. Belgium

The Belgian health insurance system differs in many respects from the Dutch health care system. There are two public insurance schemes, which cover 99% of the population.

a. A general scheme, for all wage-earners and their dependents and pensioners, covering all medical costs (apart from co-payment and several prosthetic appliances, which are not covered).
b. A special scheme for non-wage-earners (mostly self-employed persons; 1/6 of the population), covering only substantial medical costs such as hospital stay. This can be supplemented by a voluntary insurance.

A second subdivision is between the so-called 'active' and 'non-active' part of the population. Non-actives' (WIGW widows, disabled, old-age pensioners and orphans) have lower co-payment rates or even receive care free of charge, if their income is below a fixed level.
The financing of the insurance schemes is mainly based on the contributions of employers and employees (60%) and the state (40%) (De Klein and Collaris, 1987).

Figure 2.h: Health Care Expenditures in percentages of GDP, 1960-1987, Belgium and the OECD average



Source: OECD, Health Care Systems in Transition, 1989.

The share of health care expenditures in the national expenditures has always been lower than the OECD average, but the increase in the decade 1970-1980 was steeper than the average (Figure 2.h).
However, Heesters and Kessene (1985) found higher health care expenditure rates (7.53 in 1980). Possibly costs of the OCMW (Public Centres for Social Welfare) were not taken into account in the OECD rates. OCMWs can be hospitals, institutes for home care, laboratories, public health institutes, homes for the elderly or nursing services, set up by local governments (usually big cities).

In 1980 total medical expenditure was financed as follows:
57% by the health insurance schemes
25% by direct government grants
18% by private contributions and voluntary and supplementary insurances (De Klein and Collaris, 1987).

There is a system of fee-for-service and co-payment for ambulatory care. For specialistic in-patient care fees are usually paid directly to the provider. The money is then reimbursed by the local branch of the insurance funds. The bills for hospital admissions are usually paid directly by the health

insurance funds. The co-payment is charged directly to the patient. The co-payment ('ticket modérateur') has been initiated to prevent excessive demand for services.

The major co-payments are:
- a personal 25% contribution towards the costs of consultation of general practitioners and specialists, dental care, nursing services and ambulatory mental health care. 40% contribution towards the costs of physical therapy.
- a personal 0, 25, 50 or 100% contribution of the costs of drugs (depending on the type of drug; the division is based on the so-called social and therapeutical value of the pharmaceutical).
- a charge for hospital care (for the 'non-actives' smaller than for other patients) This fee (200 BF) is calculated starting with the first day of hospitalization (Heesters and Kessene, 1985).

Another feature of the Belgian health care system is the vertical integration of public insurance funds. They can own out-patient clinics, pharmacies, institutions for social work and hospitals

2.4.3. France

France, as compared to other E.C. countries, was relatively slow to start a kind of insurance against the costs of medical care. Not until 1928 was any initiative taken in organizing limited coverage for the very poor. In 1945, all wage earners were included and the coverage was further extended in 1967 to 70% of the population (including farmers and artisans) under a general scheme of insurance.
There is no uniformity, so that patients' contributions vary according to the category of worker (industrial, commercial and agricultural) and the degree of illness or the risk involved.
Patients can be insured in the following way:

a. Compulsory insurance through the general scheme ('régime général'), including all employees, pensioners, unemployed persons and their dependents. In 1991, 80% of the population is covered by the general scheme.
b. Special schemes for agricultural workers, miners, seamen, civil servants and railway employees.
c. Mutual societies and private insurers, by which many people supplement their insurance. There are two types of private insurance companies: those that are aimed at profit- making and the non-profit companies or

the so-called mutualities. About 75% of the population is supplementarily insured by the private insurers and the mutualities (1990).
The mutualities have two important functions: in the first place they insure the co-payments and in the second place they provide a supplementary insurance for those risks not covered by the public insurance.

d. Social aid programmes financed by the central and local government. These support about 1% of the population, enabling them to have completely free medical care.

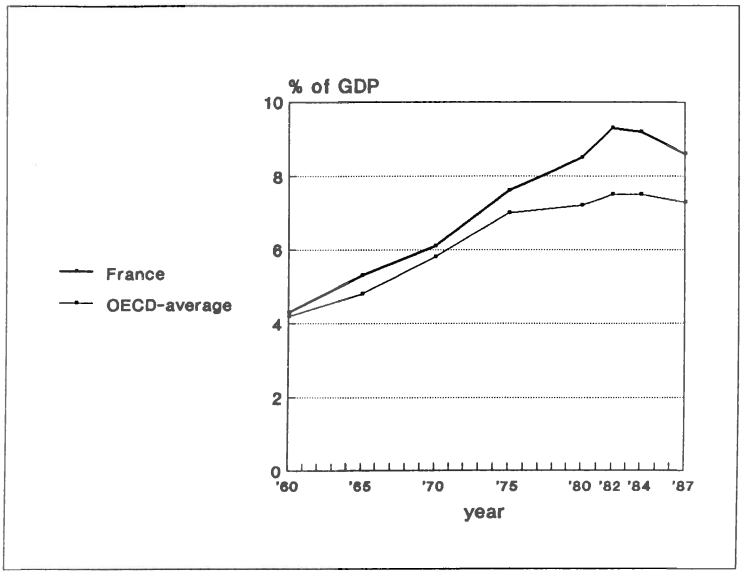
The financing of the sickness insurance (the general scheme) is mainly based upon the contributions of employers and employees. The share paid by the employer is larger. In 1982 the sickness insurance schemes are financed as follows (First, 1985):

92.9% by contributions from employers and employees (respectively 68.2% and 24.7%)
0.5% by special taxes
3.5% by government subsidies
2.0% by transfers
1.6% by other resources

The share of the state is relatively small but more than doubled between 1980 and 1983. The share of health expenditure in national expenditure in France is relatively high as compared with other European countries. In 1990 this percentage was 8.1% of the GDP (OECD average; 7.5). Only Sweden and the U.S.A. have a higher percentage.
The total expenditure increased by 7.4% in 1990 and by an average of 5% in the period 1975-1987.

In 1990 health care expenditures were financed as follows (First, 1985):
74.0% by the social health insurance schemes
1.1% by the state and local government
18.7% by private payments
6.2% by private insurance schemes and mutualities.

Figure 2.i: Health Care Expenditures in percentages of GDP, 1960 to 1987, France and the OECD average



Source: OECD, Health Care Systems in Transition, 1989.

The French medical benefits cover (para)medical services, dental services, the cost of drugs and the cost of hospital services. The insurance system is based on the reimbursement principle; the patients pay directly and then claim a refund. In the case of a third party payment, patients only pay directly for the co-payment (the 'ticket modérateur'). Also, the cost of (public) hospital treatment is paid directly by the insurance funds. Reimbursement varies according to the type of care received.

The amount of co-payment is set by the government. In 1986, medical costs are reimbursed as follows (De Klein and Collaris, 1987):

- 75% of the agreed tariff of fees of general practitioners and dentists.
- 65% of the costs of paramedical treatment;
- 100%, 70% or 40% of the costs of drugs (depends on the type of pharmaceutical);
- 80% of the costs of hospital treatment (based on the agreed 'hospital day price'). In general the patient must pay 20% of all hospital costs up to 30 days' in-patient treatment. Thereafter all payments are waived.
- 65% of the costs of tests and general care.

In certain cases the reimbursement by the insurance funds is 100%. This is the case with a course of very extensive treatment or when the patient cannot afford the costs. For dental services, reimbursement remains low;

household contributions reach 59% of expenditure.
In 1990, 74% of reimbursements carried out under the 'Régime Général' were met in total by the insurance fund compared with 55.2% in 1970 (First, 1985).

Complete population coverage for health care cost has increased administrative control over health care delivery. A set of agreements ('conventions') has successfully set the rule for dealings between physicians, patients and the funds. The basic principle underlying these successive agreements was to give physicians in private practice certain privileges in exchange for giving up freedom to set their own fee. According to the conventions, the participant physicians in private practice receive compensation on a fee-for-service basis, directly after the service rendered. The fees are established for each procedure by agreement between administrators of the Health Insurance Funds and representatives of physicians. In 1982, 98.2% of the physicians in private practice accepted the convention. Within the convention over 12% of the physicians are allowed to bill additional charges, because they are considered to be so excellent and outstanding, either by way of qualification or general talent. In contrast to their colleagues, who totally subscribe to the convention, this group cannot benefit from certain tax privileges (Jaury, 1983).
In 1990, 75% of the physicians accepted the Health Insurance Fund's fee-for-service reimbursement, whereas 25% billed additional charges. The consumer is only reimbursed on the basis of the fee-for-service reimbursement set by the Health Insurance Funds.

The French fee schedule ('nomenclature générale des actes professionels') classifies medical procedures by so-called 'key-letters', with a coefficient to indicate the relative importance of each procedure. Thus the physician mentions on the remuneration-bill the code for the type of procedure performed, instead of its actual name. Specialists are able to charge higher fees than general practitioners.

In order to make physicians more sensitive to the financial consequences of their activities, the Health Insurance Funds send physicians on a regular basis a list of the amount that was billed for the services prescribed. He/she can compare these rates with the average amount billed by all the physicians working in that area. These 'profiles' might encourage the physicians to 'control' their own method of practice.

2.4.4. The Federal Republic of Germany

The German social benefits associations are among the oldest in Europe. The first national health insurance law was already enacted by the "Reichstag" in 1883. By now, more than ninety percent of the German population is covered by the official statutory health insurance scheme, compulsory or voluntary. The insurance is compulsory for employees with an annual salary up to 48,600 DM (de Klein and Collaris,1984). By government regulation all of the following and their dependents are also compulsorily insured: self-employed farmers, persons physically or mentally diseased or disabled, students, unemployed persons and pensioners. Voluntarily insured are white-collar workers and some blue-collar workers who have salaries above the ceiling. They can remain a member of their insurance funds, but on a voluntary basis, or they can join the so-called "Ersatzkassen" or "substitute funds". Nearly all persons not covered by these programmes have private insurance (7%) (de Klein and Collaris, 1987). The largest group with private insurance against sickness costs consists of civil servants. Only one-third of the self-employed are privately insured. They can choose to be a voluntary member of the "Ersatzkassen" or to be privately insured. In addition, approximately 8% of the population use private insurance on a supplementary basis in order to be covered against additional, optional hospital services (one-bed room, telephone,etc.).

In 1987 in Nordrhein-Westfalen, 82,8% of the population is compulsorily (52% voluntarily) covered under the statutory health insurance scheme. 9.2% of the population have a private insurance. 2.7% have other insurances (IDIS, 1988).

Table 2.11: Number of insured according to the Statutory Sickness Funds and Private Insurance Companies in the Federal Republic of Germany

	members (in millions)
Statutory Sickness Funds	
Ortskrankenkassen	(16.5)
Betriebskrankenkassen	(4.3)
Innungskrankenkassen	(1.8)
Bundesknappschaftskrankenkassen	(1.0)
Landwirtschaftskrankenkassen	(0.86)
Seekrankenkassen	(0.06)
"Ersatzkassen":	
-White-collar employees	(19.0)
-Blue-collar employees	(0.43)
Private Insurance Companies	
only of sickness costs	(7.69)
supplementary insurance	(11.89)

Source: Eichhorn, S., In: Raffel, M.W.(ed), Comparative Health Systems,1984.

The total number of health insurance funds has been falling. In 1987 the total number was 1163, compared with 1262 in 1983 and 1826 in 1970. They are more and more consolidated into national associations.

Health insurance funds are organized by geographic district (national, regional or local level), by occupation or by enterprise. The largest number of funds are those for workers in individual factories (Betriebskrankenkassen). Other funds are especially for craftsmen (Innungskrankenkassen), farmers (Landwirtschaftliche Krankenkassen) miners (Bundesknappschaftskrankenkassen) or sailors (Seekrankenkassen). The largest number of people belong to a local fund (Ortskrankenkassen) for everyone not falling under these special funds. Competition between health insurance funds only takes place if it concerns voluntarily and private insured persons. Private insurers compete with the "Ersatzkassen" for voluntary members.

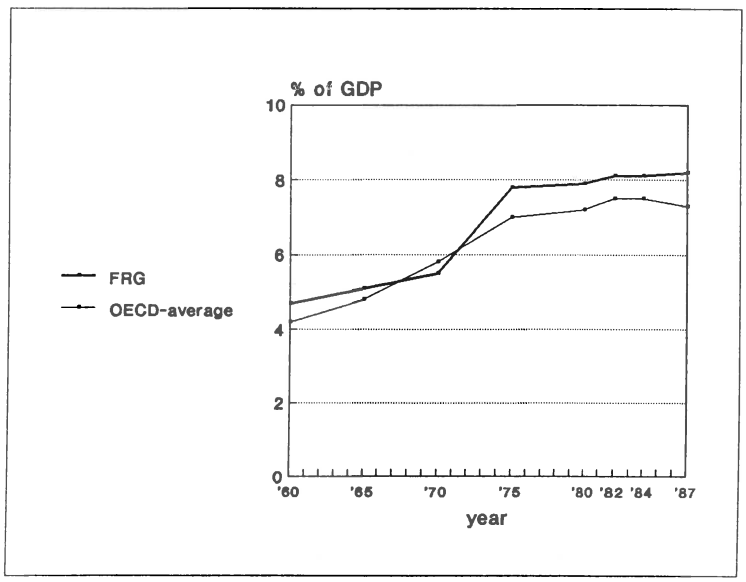
Because the FRG is a federal state, the sickness funds of each type are united at the level of the eleven states (Länder), such as the "Verband der Ortskrankenkassen Nordrhein-Westfalens". These eleven associations are united in a national association, such as the "Bundesverband der Ortskrankenkassen".

The West-German health insurance system is a good example of how government can enact the rules and then leave the doctors and the sickness funds to carry out the programme with little government interven-

tion. General guidelines are negotiated between the national sickness fund associations and health care providers.
The associations in each state (Land) negotiate with the state association of health insurance physicians (Kassenärztliche Vereinigung, KV) about the levels of payment to the individual health care providers in that state. The agreements made must be in accordance with general guidelines issued by the federal state. Within certain boundaries, each fund can fix its own rates of contribution. The result is national uniformity with provincial flexibility.

Between 1970 and 1975 the share of GDP absorbed by health **expenditures** increased (from 5.1% to 8.1%) and remained at a constant level until 1983 (8.2%) (Fig. 2.j)

Figure 2.j: Health Care Expenditures in percentages of GDP, 1960 - 1987, FRG and the OECD average



Source: OECD, Health Care Systems in Transition, 1989.

The health care expenditures are financed by the following means (Federal Minister for Youth, Family Affairs, Women and Health, 1988):

- 51.5% Health Insurance Funds:
  - 46.3% Statutory Scheme
  - 5.2% Private Scheme
- 29.9% Public budgets & Employers
- 8.4% Statutory Pension Scheme
- 3.3% Statutory Accident Insurance Scheme
- 7.9% Private budgets

Health care expenditures are mainly financed by contributions from employees and employers; the government only gives a partial subsidy. The statutory health insurance funds themselves determine the contributions to be paid. The amount varies according to the financial requirements of the individual funds.

Contributions to the statutory health insurance scheme are only slightly higher than those to the 'Ersatzkassen'. Interregional differences in contributions to a health insurance fund can differ greatly (Molinaro, 1986). In 1987 the average rate of contributions was 12.6% of earnings or basic wages below a certain ceiling. In 1970 this rate was 'only' 8.2% (Federal Minister for Youth, Family Affairs, Women and Health, 1988).

The second largest proportion of total expenditure was covered by public budgets and employers. Among other things, the public budgets finance investments for hospitals, the public health service, health research and educational establishments, and care and rehabilitation measures. The employers pay money for continued payment of wages to sick workers, for occupational medical services, for early retirement with a pension, for allowances and for other welfare measures.

The statutory pension scheme finances rehabilitation measures to improve or restore the working capacity of insured persons. It is their task to prevent people from becoming disabled or incapacitated. For this purpose, the statutory pension scheme provide health cure treatment (Kuren). In the case of unpromising or unsuccessful rehabilitation an insured person partly or wholly unable to return to working life receives a pension from the pension scheme for loss of working capacity

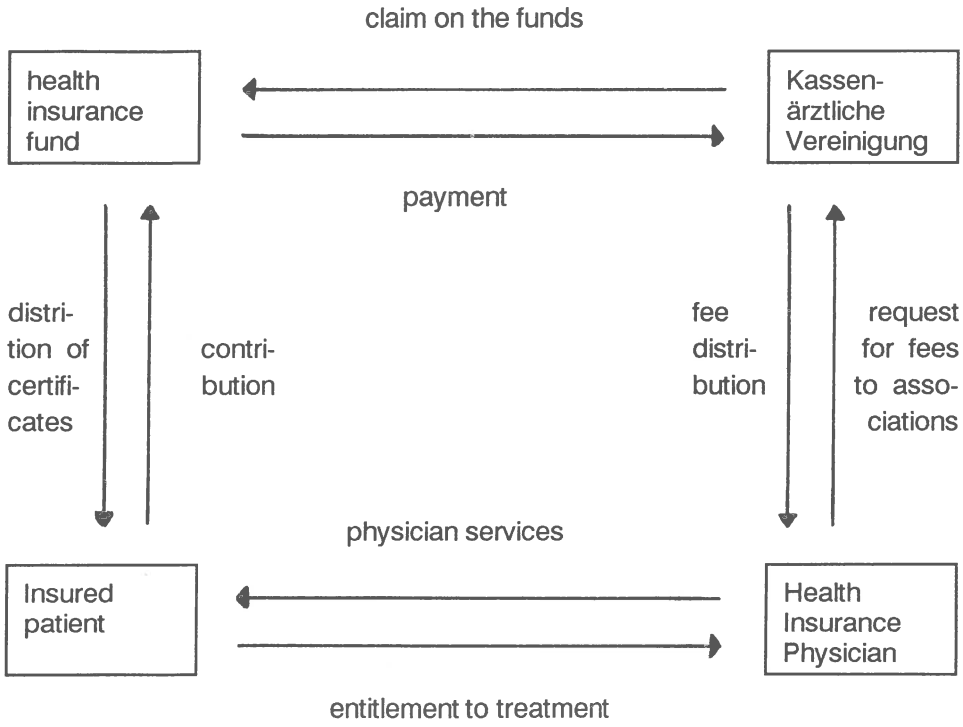
Benefits under the legal health insurance schemes include medical and dental treatment, maternity services, preventive services, pharmaceuticals, hospital care and home care.

In addition to these services, the statutory health insurance scheme also

provides cash benefits. These are for example money transfers from health insurance to employees, who are unable to earn an income because of illness. Costs are paid by the employer during the first 6 weeks. After this period benefits in cash are paid by the health insurance fund.
Other benefits in cash are the maternity support, which includes a maternity allowance, midwifery support and a contribution towards the costs of the baby's delivery.
Since 1982, there have been **personal charges** for pharmaceuticals (2.0 DM per medication prescribed), for in-patient hospital care (5 DM a day for the first 14 days) for dental treatment (40% of the costs) and for Kurkrankenhäuser (10 DM a day). For these individual costs one can take out a supplementary private insurance.

All physicians working in a private practice are **remunerated** on a fee-for-service basis. The method of payment for doctor's services depends on the patient's insurance status (Fig.2.k).
Members of the statutory health insurance scheme hand over a health insurance certificate to their doctor. This certificate is valid for three months. After this period, the doctor collects all the bills of the patients who gave him a certificate and hands these over to the Association of Statutory Health Insurance Physicians (Kassenärztliche Vereinigung, KV). This association is an intermediary between ambulatory working physicians and health insurance funds. After sending all the bills to the different health insurance funds, the KV receives a total lump sum, which it divides among the individual doctors. This distribution is done on a fee-for-service basis, according to the reimbursement levels, which are derived from the fee schedules negotiated by the Statutory Health Insurance Scheme and the "Kassenärztliche Vereinigung" (Stone, 1980).
In effect, there is no direct economic relationship between the doctor and the patient; the patient sees no bills.
Privately insured persons pay the doctor's bills directly before they send them to their health insurance company, which reimburses them in part or in full.

Figure 2.k: Remuneration system of physicians working on an ambulatory basis



Source: W. Thust, In: Sass, H.M., Health Care Systems, 1988.

Physicians working in a hospital are paid a salary and their salaries are covered by the per-diem rates negotiated between the sickness funds and the hospitals. They treat patients only as in-patients, not as out-patients. Privately insured patients pay an extra fee, usually received by senior physicians.

2.4.5. Conclusion

The four health care systems discussed in this section can roughly be divided into two groups of health care systems.
Characteristics of the 'Bismarck' system can be found in the Dutch and German health care system. Major characteristics of this system are an

employment-based health insurance, usually with wage-ceilings for the beneficiaries and some barrier between the hospital sector and ambulatory care. In the German health care system, this barrier implies the strict division between hospital-based physicians and ambulatory-based physicians. In the Dutch health care system indirect access to specialistic care forms a barrier between the hospital sector and ambulatory care.
The French and Belgian health care systems belong to the 'family' with universal public health insurance coverage, but with sharp co-payment rates and a less marked difference between the hospital and the ambulatory sector. French and Belgian patients finance respectively 22% and 18% of total medical expenditure by private contributions or by means of supplementary private insurances. The differences between the hospital and the ambulatory sector are only based on a difference between institutional and non-institutional care. If a patient is admitted to a hospital, he/she can be treated by both an ambulatory-based and a hospital-based physician. Specialistic care is offered on an ambulatory basis and is directly accessible.

In the period 1960-1982 health care costs in all four health care systems increased rapidly. Health care costs in France were the highest, whereas Belgian rates were lower than the average of all OECD countries (although the Belgian figures were disputed by Heesters and Kesenne (1905). From 1982 to 1987, health care expenditure rates in most OECD countries were stabilized or even decreased (France, the Netherlands).

3. DESIGN OF THE STUDY

In the analysis of regional variation in hospital admission rates between the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, we have analysed relevant differences of the health care systems concerned. In this chapter, the consequences of these differences will be summarized by means of several hypotheses. Next, the constructed research model will be introduced, including all operationalized variables.

3.1. Hypotheses and the operationalization of variables

3.1.1. 1982 data

Parallel to the structure of Chapter 2, we hypothesize that the regional variation in hospital admission rates is a function of supply and demand factors.

Several indicators on the **demand side** (life expectancy, infant mortality rates, age-standardized death rates and the demographic structure), gave rise to the conclusion that greater need for health care facilities is to be expected in Belgium and Nordrhein-Westfalen. The operationalization of the health status of the population poses some restrictions for us: information on the morbidity of the population (if available at all) is very difficult to compare between different countries. Most often a more indirect measurement of health status is used, i.e. mortality rates. These rates are recorded by age and sex on a regional level. Consequently, we used the age-standardized mortality rate as an internationally and intranationally comparable indicator of the health status of the population.

Furthermore, the proportion of the population over 65 years of age will be used in the analysis, expecting higher health care needs for this age group.

As far as the socio-economic position of the population is concerned, we expect a higher propensity to seek medical care in urbanized regions. The degree of urbanization is used because of differences in access to health care facilities between rural and urban areas (distance bias). The variable income is used likewise; regional data of the income level give an indication of differences in accessibility to health care services (socio-economic bias) and of differences in health status.

Apart from the health status and the socio-economic position of the population, the number of births is expected to exert a different influence on admission rates in the Dutch health care system, compared to the others. In the Netherlands in 1982, 35.4% of all deliveries took place at home (CBS,1982). If it comes to an admission, this usually involves a very short hospital stay, not counted as an admission in the analysis. In Belgium, Northern France and Nordrhein-Westfalen home-delivery is an exception. Regional differences in birth rates may, therefore, have less influence on hospital admission rates in the Netherlands than in the other health care systems. The variable "birth rate" is used to correct for this characteristic of the Dutch health care system.
The relations on the demand side of the model can be summarized in a few propositions:

- The higher the age-standardized mortality rates in a region, the higher the number of hospital admissions.
- The higher the proportion of elderly people in a region, the higher the number of hospital admissions.
- The higher the average income of the population of a region, the lower the number of hospital admissions.
- The more urbanized a region, the higher the number of hospital admissions.
- - Belgium, N.France and NR-WF: The higher the number of births, the higher the number of hospital admissions.
  - The Netherlands: No such relation is expected to be found.

In addition, several differences on the **supply side** are relevant for inclusion in the model for explaining regional variation in hospital admission rates.
The number of hospital beds has proved to influence the use of hospital facilities substantially (Van der Zee and Groenewegen, 1985, Gloerich et al., 1989, Clark, 1990, Kirkup et al, 1990). Compared to the other health care systems, Nordrhein-Westfalen has by far the highest bed density.
According to Roemer's law 'a bed built is a bed filled' (Roemer and Roemer, 1981) one would expect to find higher admission rates in Nordrhein-Westfalen regions. However, the correlation between bed supply and admission rates might be diminished by the relatively high average hospital stay rates in Nordrhein-Westfalen. In the case of a relatively high average hospital stay rate and a given number of available beds, the number of hospital admissions has to be lower. Therefore, the average mean stay rate will be included as a possible explanatory variable because

of this interrelated position between bed supply and hospital admission rates.

The average length of stay in acute beds might also be influenced by the number of alternative treatment facilities, such as long-term beds or home health care facilities. The more the possibilities of referring patients to alternative treatment facilities, the shorter the average length of stay in acute care beds. Operationalizing this proposition, however, is restricted by a lack of information about these facilities. Gloerich et al. (1989) demonstrated that the variable 'number of long-term hospital beds' does not contribute significantly to the prediction of admission rates in any of the three countries (the Netherlands, Belgium, Northern France). They stated that this result might be due to the fact that although (in the Netherlands) 50% of the admissions to long-term beds stem from acute hospitals, this only accounts for 2% of the discharge rates from the acute hospitals, because of the slow turnover in long-term hospitals.

The decision whether or not a patient will be admitted to a hospital in one region, might also be influenced by the availability of ambulatory treatment facilities. We hypothesize that the number of ambulatory physicians is a critical factor in the analysis of regional variation in admission rates. The operationalization of this variable differs between the four study areas. This classification is based on differences in access to specialistic care.

Table 3.1: Definition of the variable 'primary health care providers' in the analysis

		PRIMARY CARE PROVIDERS:
the Netherlands	-	General Practitioner
Belgium	-	General Practitioner +**"Common Specialist"** (pediatricians, gynaecologists and internists)*.
Northern France	-	idem
Nordrhein-Westfalen	-	General Practitioner + **Ambulatory Specialist.**

* Although in Belgium and Northern France all specialists are directly accessible, direct access is most common to pediatricians, gynaecologists and internists. These specialists are considered to be primary care providers.

Table 3.2: Primary health care physicians in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen

	the Nethl.	Belgium	N.France	NR-WF
G.P.	5,504 (3.9)			
G.P. + "Common" Spec		12,026 (11.7)	7,527 (8.0)	
G.P. + Amb. Spec				15,358 (8.0)

( ) = rate per 10.000 inhabitants
Sources: The Central Bureau of Statistics (CBS) (the Netherlands)
Leroy, 1987, Table 83 and Tables 86-88 (Belgium)
Centre de Recherches Economiques Sociologiques et de Gestion (CRESGE) (Northern France)
Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen (NR-WF)

As we already concluded in Section 2.3, Belgium has by far the highest rates of primary health care physicians, followed by Nordrhein-Westfalen and Northern France. This highest rate in Belgium might indicate a higher rate of alternative ambulatory facilities and, as a consequence, might correlate negatively with hospital admission rates in Belgium.
However, we hypothesize that the actual influence this variable has on hospital admission rates in a region depends largely on two factors:

1. whether or not the primary care physicians have access to hospital facilities and
2. to what extent they can form a substitute for hospital treatment.

Differences in this respect exist between Nordrhein-Westfalen on the one hand and the Netherlands, Belgium and Northern France on the other.
In the case of Nordrhein-Westfalen, fewer hospital admissions are to be expected in regions with a large number of ambulatory physicians. This expectation is based on the fact that almost no relation exists between the primary and secondary health care sector. Given the situation in which a primary care physician treats a patient in his own practice and has to decide whether or not to refer his patient to a hospital, two incentives are expected to be decisive; The fee-for-service remuneration system forms an incentive to treat the patient in his own practice instead of referring him to a physician in the hospital and, secondly, the fact that most primary health care physicians are well provided with facilities for diagnostic tests and treatment makes it possible to treat the patient on an out-patient basis. In

conclusion, primary care physicians are expected to form a substitute for hospital-based physicians.
In the Netherlands, primary physicians (mainly general practitioners) have no access to hospital facilities either. Compared to Nordrhein-Westfalen, primary physicians are less specialized and less equipped with diagnostic facilities to form a substitute for hospital care. Thus, no influence on this variable is to be expected in the Netherlands.
In Belgium, no such barrier between the primary and secondary health care sector is found. In this health care system, specialists can work on both an out-patient and in-patient basis and at both locations they are remunerated on a fee-for-service basis. Thus, no substitute effect is to be expected here.

In Northern France no correlation between the 'number of primary health care providers' and the 'number of hospital admissions' is to be expected, because a relatively small number of medical specialists practise in an ambulatory setting (ratio gp/amb.spec; 9:1, Table 3.3). The majority of medical specialists are salaried by hospital; only specialists working in a private, for-profit hospital can work at the same time in their own practice. No counterbalance effect of the primary health care sector versus the hospital sector is to be expected here either.

Table 3.3: Characteristics of the four health care systems (data refer to 1982)

	FRG	Nethl.	Belgium	France
RATIO GP / AMB.SPEC.	1 : 1,5	N.A.	4,1 : 1	9 : 1
RATIO PRIM-. / HOSP. PHYS.	1,2 : 1	1 : 1,4	1 : 2,39	1 : 4,6
REMUNERATION SYSTEM				
G.P.	fee-for-service	cap. fee fee-for-service	fee-for-service	fee-for-service
Amb.spec.	fee-for-service	fee-for-service	fee-for-service	fee-for-service
Hosp.spec.	salary	fee-for-service	fee-for-service	salary
ACCESSIBILITY				
Amb.spec.	direct	indirect	direct	direct
Hosp.spec.	indirect	indirect	direct	direct

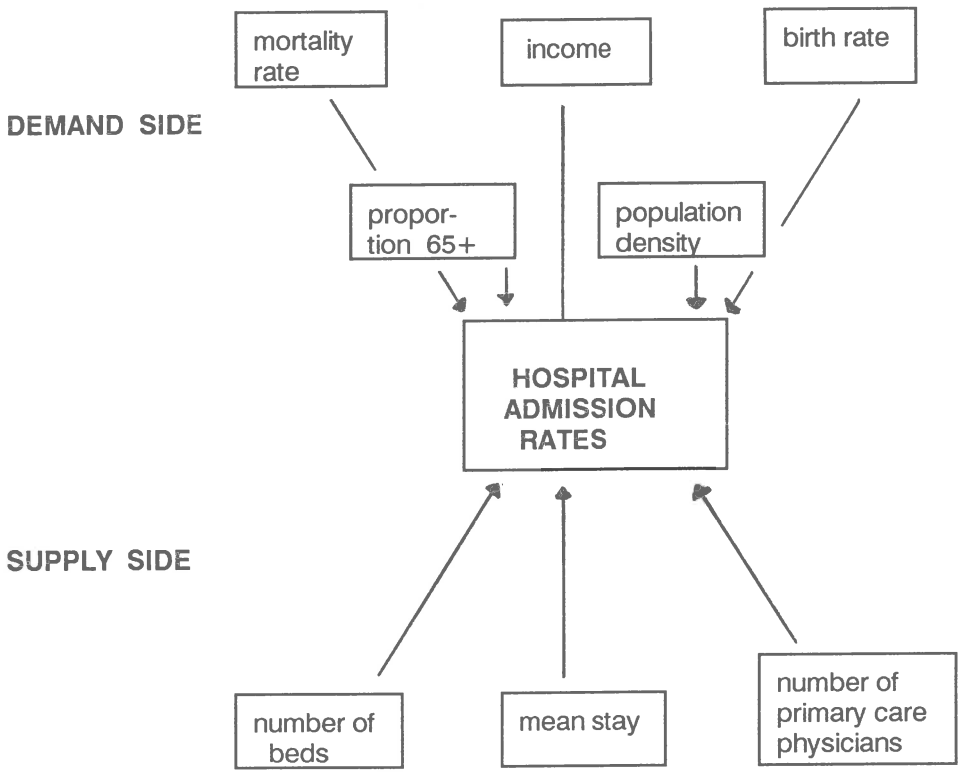
The relations on the supply side of the model can be summarized in a few propositions:

- Given the average length of stay in hospitals, the higher the number of hospital beds in a region, the higher the number of hospital admissions.
- - In Nordrhein-Westfalen; the higher the density of primary care physicians, the lower the number of hospital admissions.
  - In the Netherlands, Belgium and Northern France; no such relation is expected to be found.

3.1.2. 1974, 1979, 1982 data

In addition to these propositions, this study is intended to be a test for the validity of the results of the model over time. The two previous studies (Van der Zee and Groenewegen, 1985, Gloerich et al.,1989) pointed to the decreasing influence of the general explanatory variable 'bed supply' in the regression model. This trend might give an indication of the dynamics of a health care system during a period of change from an expanding hospital sector to a decreased growth in this sector. In most OECD countries, hospital expenditures form the largest proportion of total health care costs (Belgium; ± 37%, the Netherlands; ± 50%, France; ± 50%, FRG; ± 34%, Hospital Financing Systems, 1987).
Since hospital admission rates in Northern France are relatively high and since these admissions are largely determined by the number of beds and the average length of stay (Gloerich et al., 1989), it is not surprising to find health care costs in France to be among the highest in Europe (Fig. 2.i), although the validity of Northern French data to France as a whole is not clear yet.
Whether this proposition will be endorsed with respect to Nordrhein-Westfalen data will also be tested in this study.

Figure 3.a: The hypothesized relation of the independent variables with the dependent variable in the regression model



4. THE CHOICE OF THE UNIT OF ANALYSIS, THE SOURCES OF THE DATA AND THE OPERATIONALIZATION AND FREQUENCY DISTRIBUTION OF THE VARIABLES

4.1. The region (unit of analysis)

The choice of regions in the regional analysis of hospital admission rates largely depends on the kind of information one wishes to use. In this study both general (e.g. socio-economic and demographic information) and specific (e.g. hospital admissions) types of statistical information will be used. In this respect, administrative regions are more suitable than a specific one (e.g. hospital regions). The Dutch Central Bureau of Statistics offers a geographical division consisting of 80 or 43 regions. The first regional division is based on functional interactions with respect to residence, work, social and health facilities and social relationships. This type of region has by definition an urbanized core and surroundings of a more or less urbanized countryside. A major objection to this division is that it does not necessarily follow the administrative boundaries of the twelve Dutch provinces. Not all statistical information (e.g. age-standardized mortality rates) is therefore available at this geographical level.
We chose the 43-fold division, which is called the COROP region. This type of region follows the provincial boundaries and is therefore less empirical.

For Belgium we had data at our disposal that were published for arrondissements. Part of the Belgian data stems from Leroy (Leroy, 1987). This general division forms an administrative level between municipality and province. The 43 arrondissements in Belgium are fairly comparable with the Dutch COROP regions.

With respect to Northern France, relevant data were not available at one and the same level.

1. General data (e.g. death/birth rates) are available per community, arrondissement, departement or region.
2. Health data (e.g. admission rates, number of beds etc.) are collected per "secteur sanitaire". The 44 "secteurs sanitaires" do not exactly match the 51 arrondissements, that make up Northern France.
3. Medical demographic data are provided per geographic region, again different from the ones mentioned in 1 and 2.

It was decided to use the "secteurs sanitaires" as the regional unit for Northern France, as health data were considered to be the most important. The general and medical demographic data were aggregated to this level. Thus, a total of 44 regions was used for the analysis.
All Northern France data used in this study are provided by CRESGE (Centre de Recherches Economiques Sociologiques et de Gestion) (Lebrun et al., 1987).

The choice of the regions of Nordrhein-Westfalen was less difficult.
Nordrhein-Westfalen, one of the eleven states (Bundesländer) of West-Germany, consists of five main districts ("Regierungsbezirke"):
1. Düsseldorf
2. Köln
3. Münster
4. Detmold
5. Arnsberg.

Each "Regierungsbezirk" consists of several counties (Landeskreise and Kreisfreie Städte), an administrative level between the district and the municipalities (Gemeinden). Nordrhein-Westfalen consists of 54 "Kreise", comparable with the Dutch, Belgian and Northern French units of analysis. All data were available at this administrative level; no data had to be aggregated.

4.2. The dependent variable

In this section the operationalization and the sources of the dependent variable, the number of hospital admissions, will be described. In addition to the frequency distribution of this variable in the four research areas, the regional geographical variation will be shown on a map. All data refer to 1982.

4.2.1. Hospital admissions

The Netherlands:
The Dutch figures refer to the number of admissions to general, teaching (academic) and special hospitals among the inhabitants of a specific municipality, related to the number of inhabitants as of January 1st 1983.
From the Ministry of Public Health, Welfare and Culture we obtained data about the municipality of residence of admitted patients. Admissions to

psychiatric institutions were excluded. On the basis of these data we calculated the total number of admissions for each of the 43 COROP regions. The number of inhabitants per municipality was aggregated to the 43 COROP regions.

Belgium:
For Belgium the number of admissions to all hospitals per arrondissement are published by the Ministry of Public Health (Ministerie van Volksgezondheid, 1985). Included are, however, admissions to mental hospitals, as is not the case in Dutch admission data. Corrections were made on the basis of psychiatric admission rates at provincial level, published by the same Ministry. The number of psychiatric admissions were assigned to each arrondissement in proportion to the number of inhabitants.

Northern France:
For France we obtained data from the CRESGE (Centre de Recherches Economiques Sociologiques et de Gestion). These data contain the number of admissions per "secteur sanitaire" to general public and private hospitals. Within each hospital a distinction can be made between the short, medium and long stay beds. A stay becomes medium or long according to the number of days in the short-stay service. For reasons of comparability we took only the admissions to short (Surgery, Medicine and Gynaecology) stay beds. Long stay admissions are excluded because they mainly refer to geriatric patients. The number of admissions is related to the number of inhabitants per "secteur sanitaire" as of January 1st 1983. These data are also obtained from the CRESGE. Comparing French with Dutch, Belgian and Nordrhein-Westfalen data, one must bear in mind that in France a patient can be transferred within a single period of illness to another type of bed. This accounts for another (new) admission.

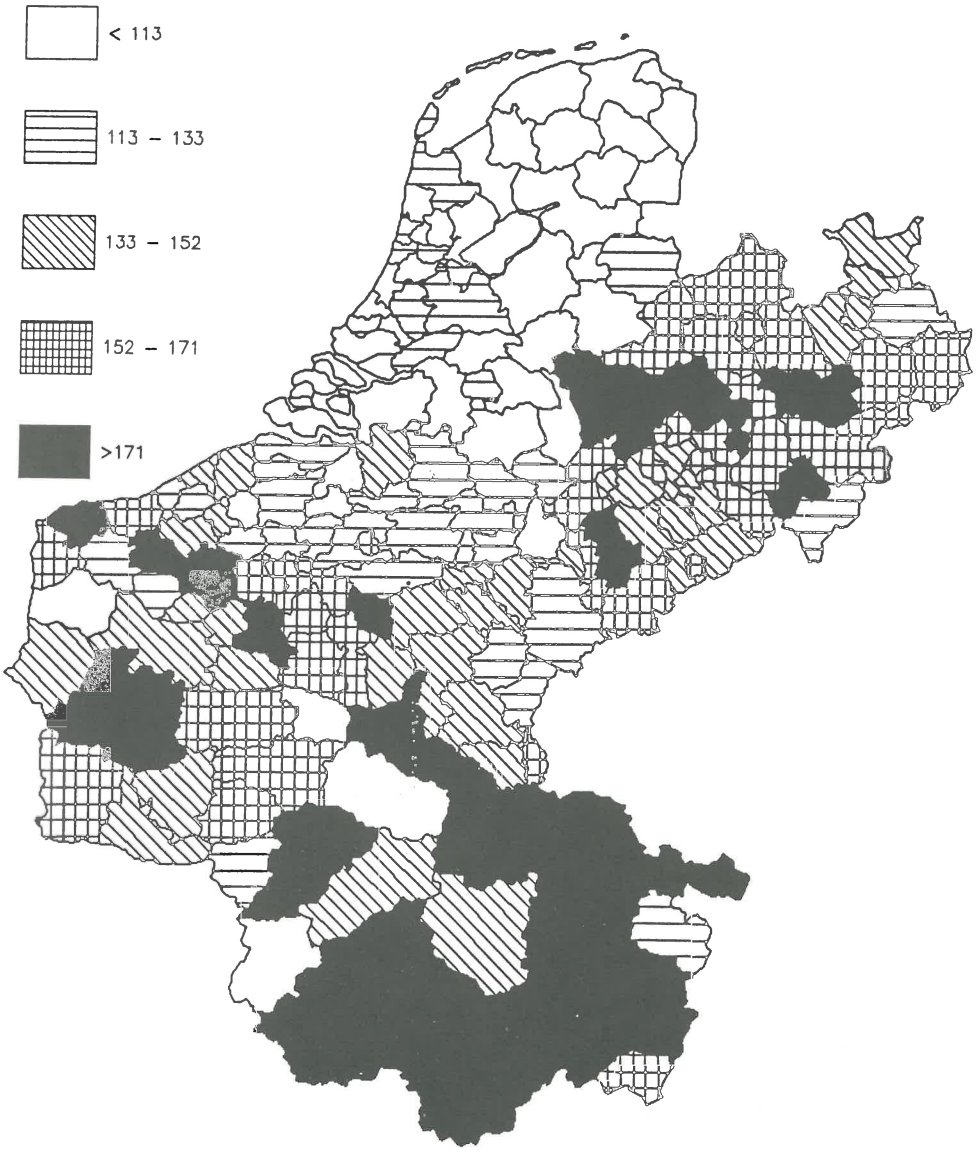
Nordrhein-Westfalen:
Data of Nordrhein-Westfalen were obtained from the "Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen". These data refer to the number of admissions per "Kreise" to so-called "Allgemeinkrankenhäuser". These can be general acute care hospitals (with or without specialized wards), teaching (academic) hospitals or specialized hospitals. The number of admissions is (just as the Dutch data) related to the residence of the admitted patients; the admission rate is composed of the total number of inhabitants of the region admitted to any hospital (inside or outside the region of residence).

The geographical distribution of regions with high or low hospital admission rates in different health care systems is shown in map 4.1.

	NR-WF	Nethl	Belg	N.Fr.
Mean	161.95	107.47	137.08	174.21
sd/mean	0.10	0.10	0.14	0.34

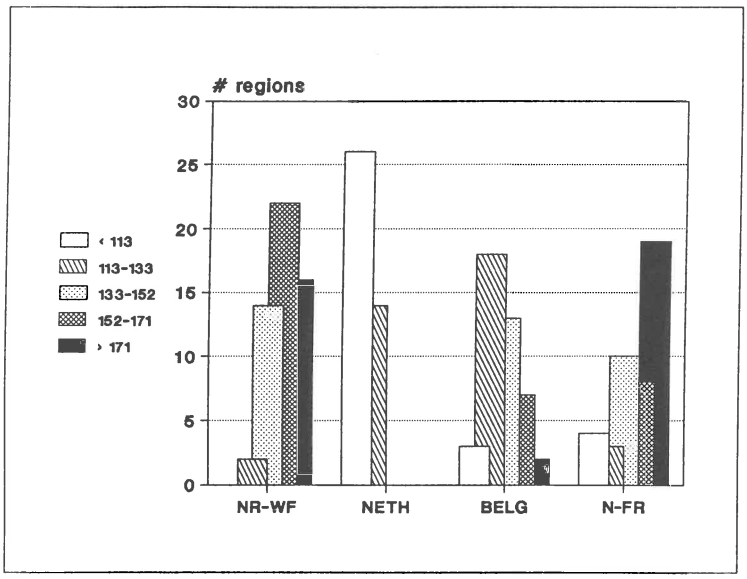
The highest rates can be found in the eastern part of Northern France (the district of Lorrain), in the district of Reims and various districts in the borderland of France and Belgium. The districts Ardennes-Sud, Romilly Sezanne and Lille show relatively low admission rates. The highest rates in Belgium can be found in the district of Charleroi and Mouscron; the lowest ones in the districts of St. Niklaas and Dendermonde.

Map 4.1: Geographical distribution of hospital admission rates in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (admissions/1000 inh.)



In Nordrhein-Westfalen the highest rate can be found in the region of Düsseldorf, but regional variation is relatively low. The Dutch admission rates are generally lower, with only small regional differences.

Figure 4.a: Frequency distribution of hospital admission rates (0/00) for 184 districts in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



4.3. The independent variables

The independent variables of the regression analysis can be divided into supply and demand variables. The demand side can be indicated by variables referring to the health status or to the socio-economic status of the population. We will discuss these variables firstly:

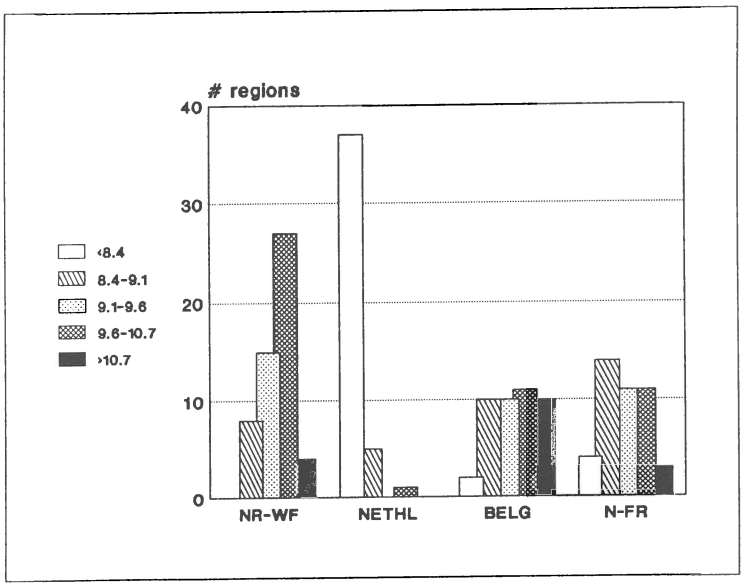
4.3.1. The demand side

We chose the following variables as indicators of the demand for health

care:
- age-adjusted death rates
- proportion of elderly in the population
- income distribution
- the degree of urbanization
- birth rate

The age-adjusted death rates
Death rates are considered to be useful indicators of the health status of a population, provided that these rates are standardized on the age distribution of the population. For the standardization of the death rates, age-specific mortality rates of all countries separately have been standardized on one standard population, i.e. the Netherlands in 1982.

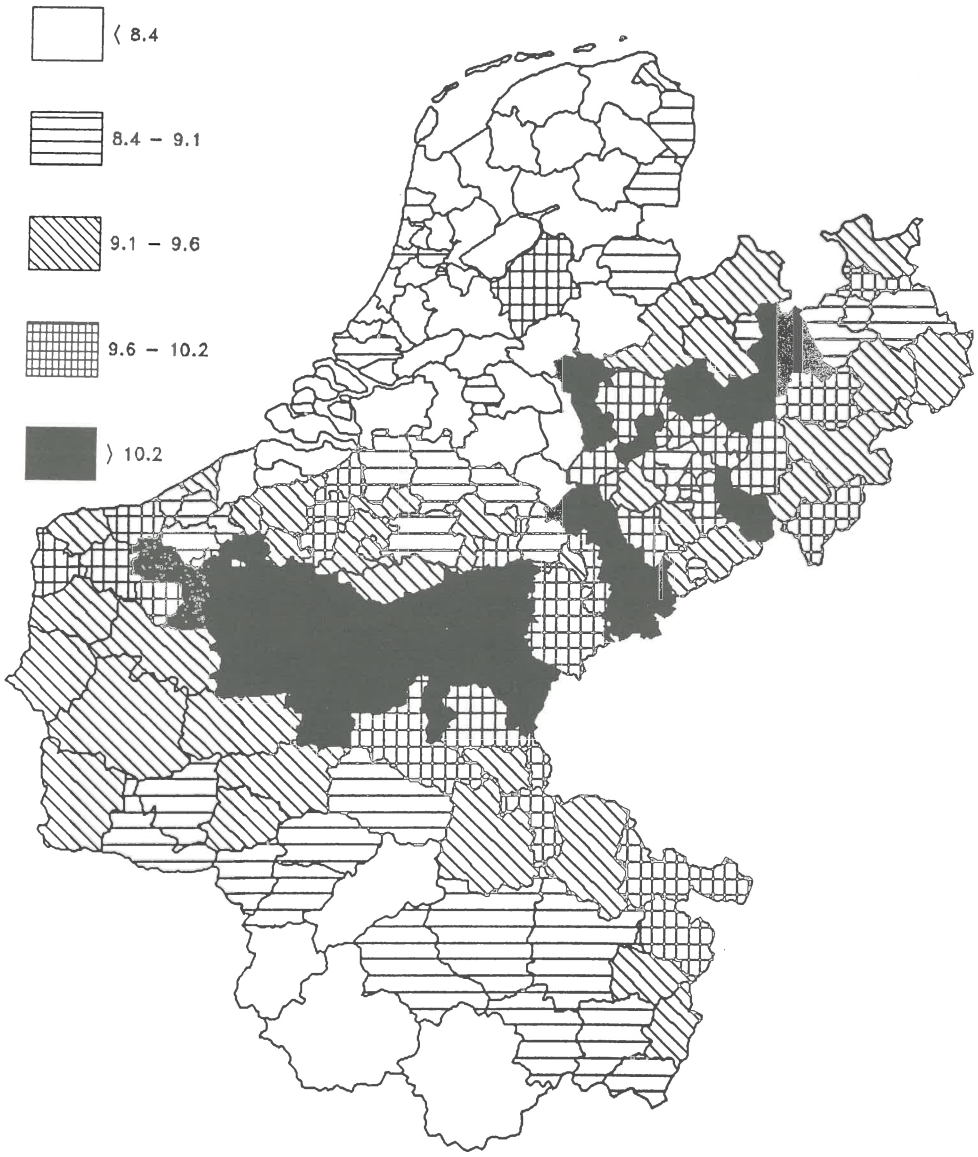
Figure 4.b: Frequency distribution of age/sex-adjusted death rates per 1000 inhabitants for 184 districts in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



	NR-WF	Nethl.	Belgium	N.France
Mean	9.86	8.13	9.83	9.42
sd/mean	0.06	0.07	0.09	0.08

Sources:
the Nethl: Dutch Central Bureau of Statistics (CBS).
Belgium: Belgian National Institute of Statistics (NIS).
N.France: Centre de Recherches Economiques Sociologiques et de Gestion (CRESGE, dept. of demographic studies).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen

Map 4.2: The age/sex adjusted death rates in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (death/1000 inh.)



The districts with the highest death rates in the Netherlands can be found in the area of the Veluwe, the urban areas of Amsterdam and Rotterdam, parts of the northern provinces, West Brabant and South Limburg. The industrial areas around Liège, Bastogne, Charleroi and Mons display the highest death rates in Belgium. In the regions of Northern France one can distinguish a North-South axis in the mortality rates, with high rates in the borderland of France and Belgium and low rates in the southern health care regions.
The highest death rates in Nordrhein-Westfalen are mainly found in the urban areas, i.e. the region between Aachen and Köln, the triangle Hamm, Lippstadt Gütersloh and the Northern part of the Ruhr District, Münsterland.

Proportion of people over 65
For the Netherlands data of the age distribution were available on the level of municipalities. These data were aggregated to the level of COROP regions.

	NR-WF	Nethl.	Belgium	N.France
Mean	14.24	11.48	13.97	12.82
sd/mean	0.13	0.21	0.14	0.15

The demographic composition of the four areas differs considerably. Nordrhein-Westfalen shows the highest rates. By far the lowest rates of elderly are found in the Dutch regions.
In the Netherlands the regions with the highest proportion of elderly are: Amsterdam, The Hague, the rural areas of the province of Zeeland and the northern provinces.
The highest proportion of elderly in Belgium is found in the area around Liège (district of Waremme) the province of Hainaut (districts Tournai, Ath and Mouscron) and districts around Brugge and Gent. The capital, Brussels, has a relatively old population as well. Relatively 'old' districts in Northern France are mainly found in the region Champagne-Ardennes (e.g. districts Romilly-Sézanne, Ardennes-Sud and Epernay).
The northern (rural) part of Nordrhein-Westfalen as well as the area around Dortmund and Essen (Ruhr District) show the highest proportion of elderly in Nordrhein-Westfalen.

Map 4.3: Proportion of elderly (65 years of age and older) in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (number of 65+/100 inh.)

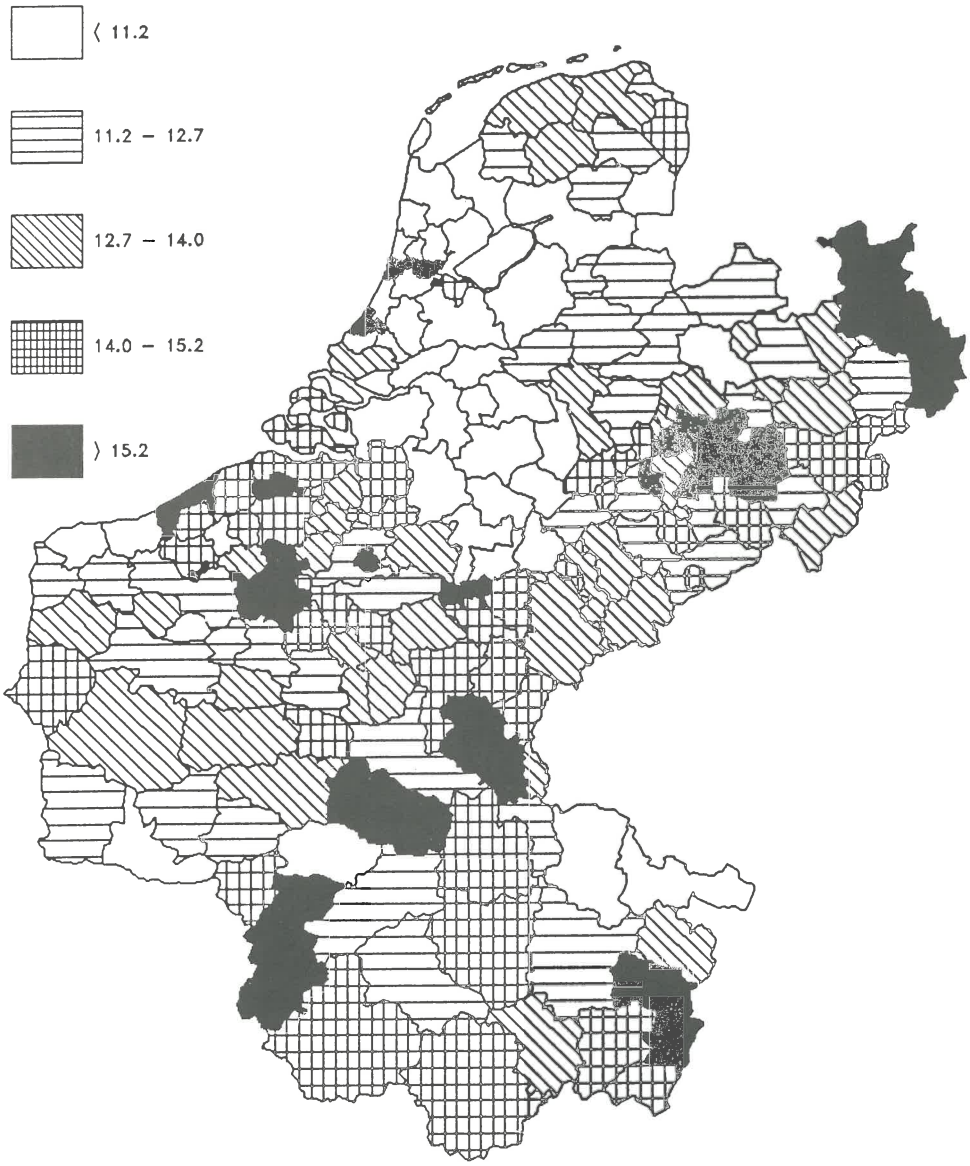
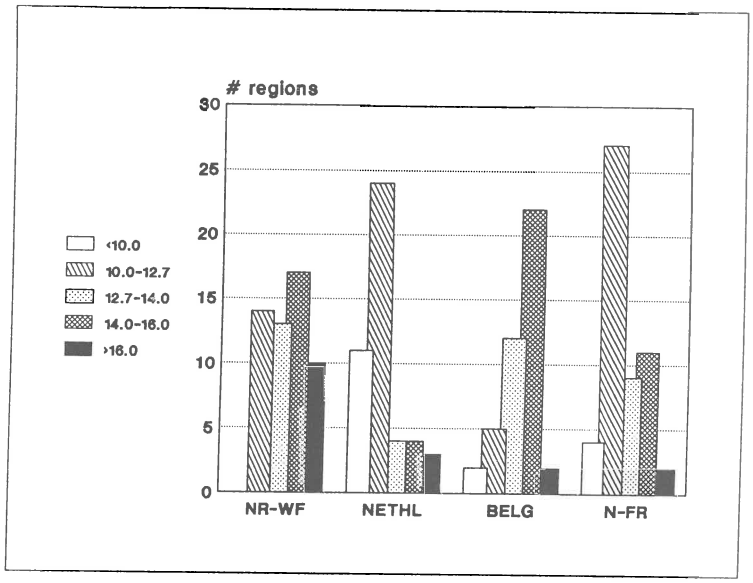


Figure 4.c: Frequency distribution of the proportion 65 years and older for 184 districts in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982

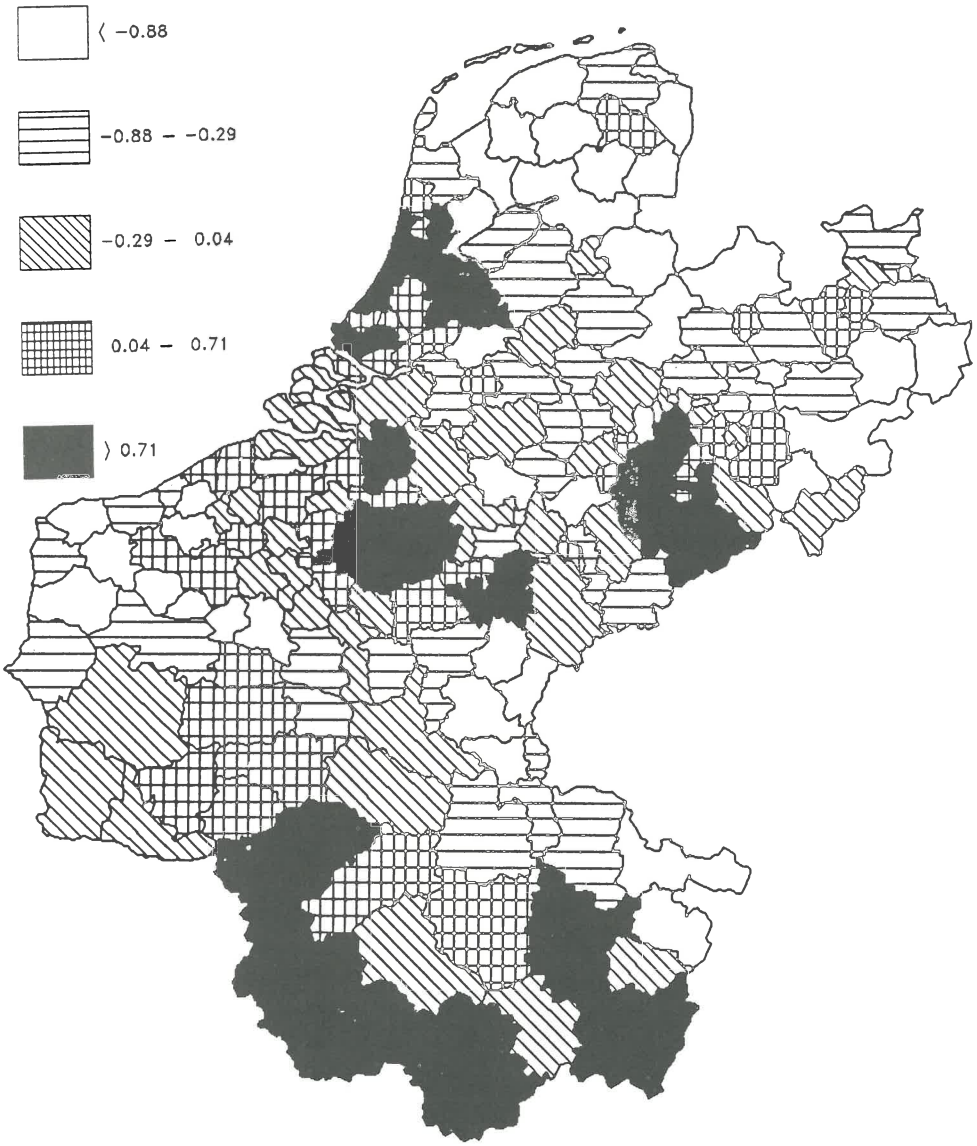


Sources:
the Nethl.: Dutch Central Bureau of Statistics (CBS).
Belgium: Belgian National Institute of Statistics (NIS).
N.France: Centre de Recherche Economiques Sociologiques et de Gestion (CRESGE).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen.

The distribution of income

Income is used as a rough indicator for differences in social class composition between the regions. Because these indicators cannot be compared directly, we have constructed a comparable index. Ideally one must look at the price-indices (using Purchasing Power Parities) for each country (OECD, 1985). Because the three countries do not differ essentially in this respect we choose a simple solution. The average income per region is standardized to a normal distribution. The standardized deviation from the mean is considered as an indicator of socio-economic differences between the regions (Z-scores).

Map 4.4: Standardized income in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (z-scores)

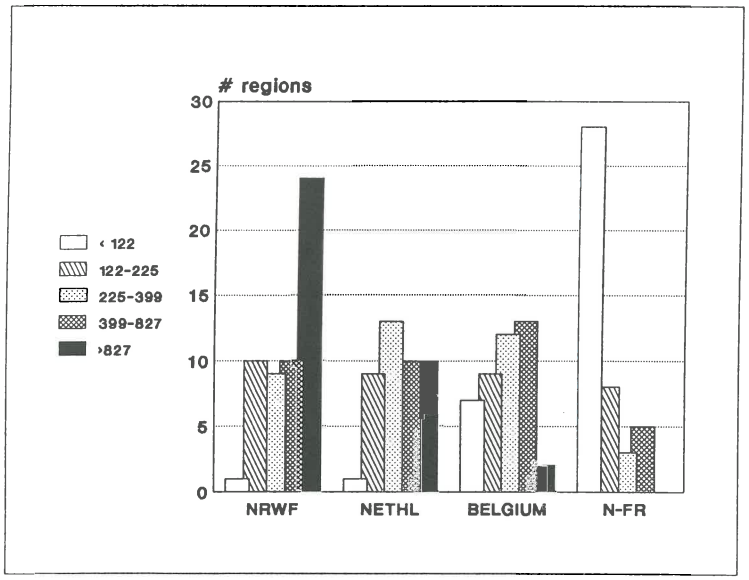


Sources:
the Nethl: the Central Bureau of Statistics (CBS).
Belgium: the National Institute of Statistics (NIS).
France: Centre de Recherches Economiques Sociologiques et de Gestion, personal communication (CRESGE).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen.

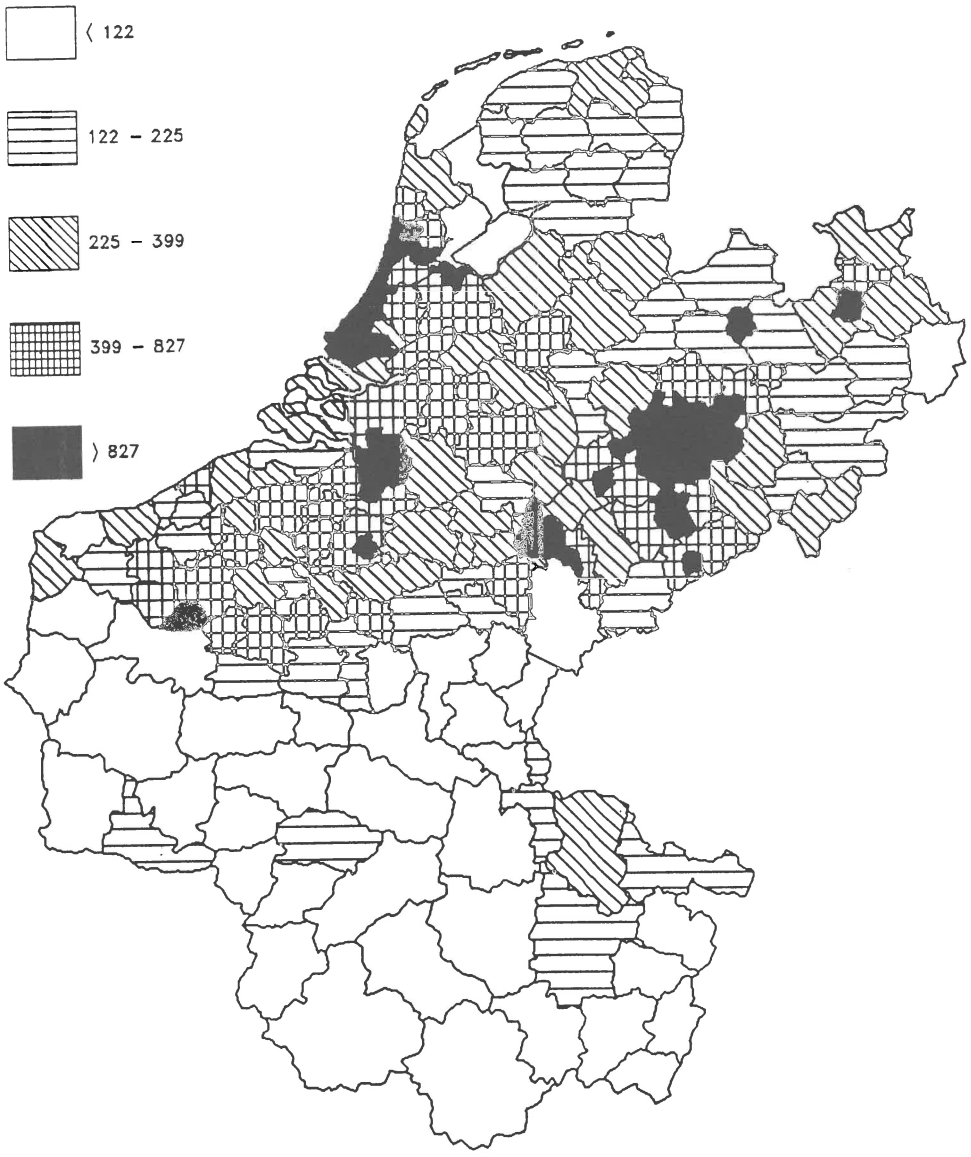
The low-income areas in the Netherlands are mainly found in the northern provinces. The province of Luxembourg shows the lowest rates in Belgium, as well as the Nord-Pas-de-Calais region in Northern France. In Nordrhein-Westfalen the lowest income areas are in the eastern part (Hochsauerland-kreis, Paderborn and Lippe).

Degree of urbanization
As an indicator for urbanization we chose the population density of the region (number of inhabitants per km²).

Figure 4.d: Frequency distribution of population density (inhabitants per km²) in 184 districts in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



Map 4.5: Population density in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (number of inhabitants per km²)



	NR-WF	Nethl	Belgium	N.France
Mean	1080.87	679.51	463.35	163.80
Sd/mean	0.89	1.19	1.96	1.25

Sources:
the Nethl.: the Central Bureau of Statistics (CBS).
Belgium: the National Institute of Statistics (NIS).
France: Centre de Recherches Economiques Sociologiques et de Gestion, (CRESGE).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen

The average population density in the Netherlands is four times as high as in Northern France. The Nordrhein-Westfalen rate is even six times higher. The most densely populated region in Nordrhein-Westfalen is the Ruhr District with big cities like Düsseldorf, Duisburg, Essen, Krefeld and Mönchengladbach. The other urban areas, the so-called "Kreisfreie Städte", are clearly shown on the map: Aachen, Köln, Bonn, Münster and Bielefeld. In the Netherlands the most populated area is the 'Randstad' (the conurbation of Western Holland). Belgium displays the largest variation in population density. Districts with the densest populations are the metropolitan area of Brussels, Antwerp and Liège. The rural areas of the province Luxembourg and the rural areas of the Ardennes are populated most sparsely.

Birth rate

The variable 'number of births' is expected to influence hospital admission rates in the four health care systems differently. In the Netherlands, a relatively high percentage of deliveries take place at home (34.5% in 1983). In the case of a hospital delivery, this involves a very short hospital stay, which is not counted as a hospital admission.
For the Netherlands, data of the number of 0-year-olds per 1000 inhabitants per municipality were available. These data were aggregated to the level of the COROP region.

	NR-WF	Nethl	Belgium	N.France
Mean	10.11	15.05	13.51	15.71
Sd/mean	0.10	0.15	0.07	0.09

Map 4.6: Birth rate in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (number of births per 1000 inh.)

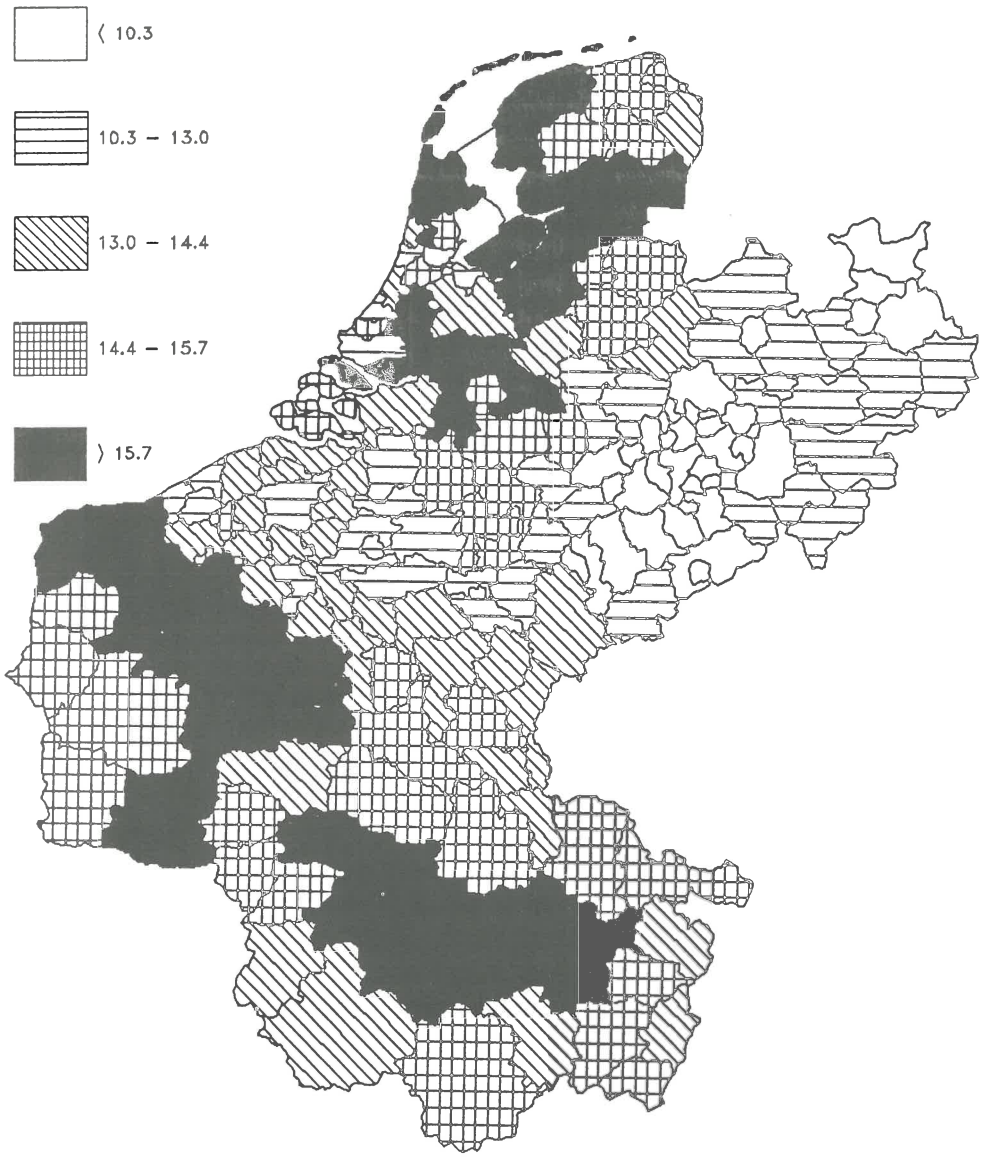
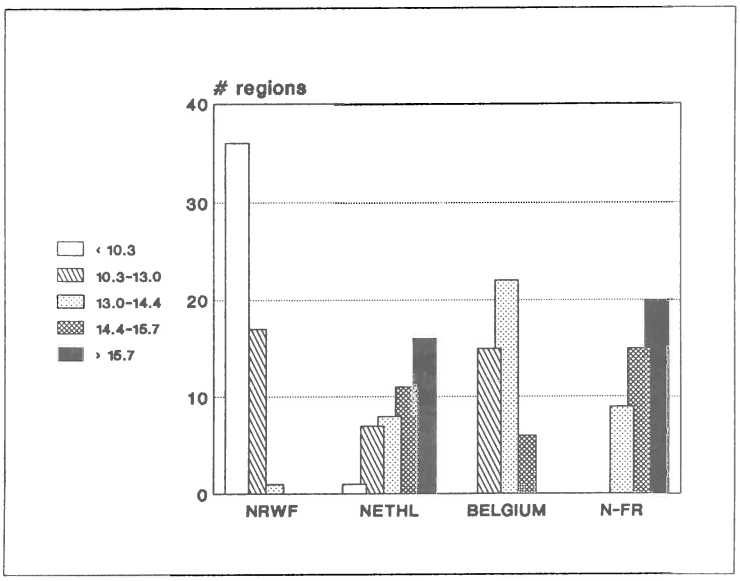


Figure 4.e: Frequency distribution of the number of births per 1000 inhabitants in 184 districts in the Netherlands, Belgium and Northern France, 1982



Sources:
the Nethl.: the Central Bureau of Statistics (CBS).
Belgium: the National Institute of Statistics (NIS).
France: Centre de Recherches Economiques Sociologiques et de Gestion, (CRESGE).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen

The highest rates in the Netherlands are found in the district of the IJsselmeerpolders (an area only recently reclaimed from the sea with a relatively young population structure).
In Belgium the districts Hasselt and Maaseik display relatively high rates.
Northern France shows in general higher birth rates than the Netherlands and Belgium, especially in the region Nord-Pas-de Calais. In Nordrhein-Westfalen most regions show less than 13.0 0-year olds per 1000 inhabitants. Only Borken displays a birth rate of 13.2 per 1000 inhabitants.

4.3.2. The supply side

The variables representing the supply side of the health care system are:
- the number of hospital beds
- the mean stay per admission
- the number of primary health care physicians

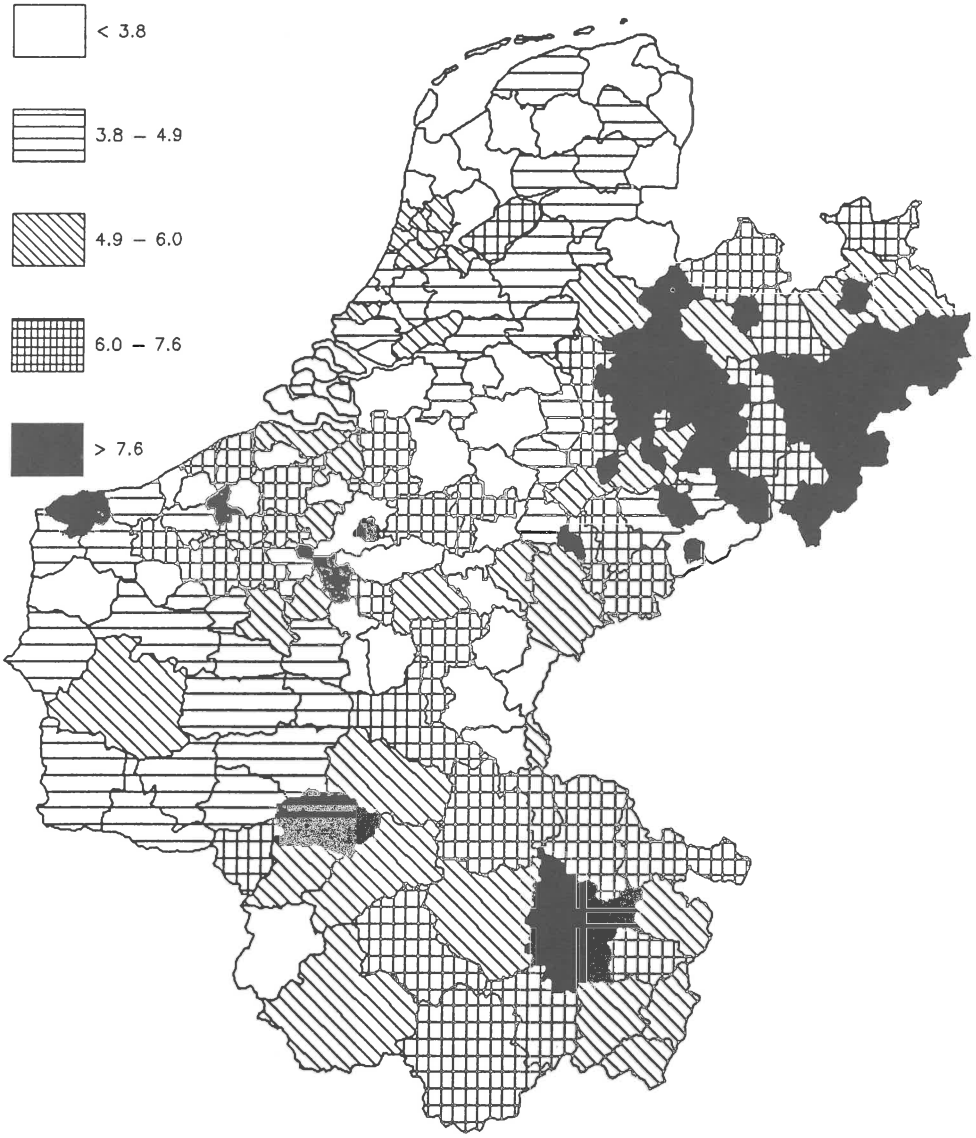
Hospital beds

For the Netherlands we considered the number of acute medical and surgical beds in general and teaching hospitals as of January 1st 1982. The number of beds were corrected with respect to the origin of patients, according to the following procedure: on the basis of the orientation of all COROP regions to COROP regions with hospitals we created a hypothetical hospital district for each 'hospital COROP'. We then assigned the number of hospital beds per 1000 inhabitants of the hypothetical hospital districts to the COROP regions incorporated in the hypothetical district. For the other countries this correction for origin of patients was not possible because of the lack of information

For Belgium, the number of beds in acute hospitals (hôpitaux aigus) is taken into account. These data were published per hospital, so all hospital beds were aggregated per district.
Hospital beds in Northern France include the number of acute medical and surgical beds ("court séjour") in both public and private (general hospitals). These data had to be aggregated per health region (secteur sanitaire) as well.
For Nordrhein-Westfalen, the number of beds in acute care hospitals ("Allgemeinkrankenhäuser") per region ("Kreis") were available.

Nordrhein-Westfalen has by far the highest bed-density rates (8.03 in 1982) compared to the Dutch rate of 4.30 in 1982. In 16 out of 54 regions more than 8.7 beds per 1000 inhabitants are available. In Hamm and Bonn bed density rates are respectively 14 and 15 beds per 1000 inhabitants!
Hospital beds in Belgium, Northern France and Nordrhein-Westfalen are less evenly distributed than in the Netherlands.
In the Netherlands the highest rates are found in the Gooi district and in the Zuidelijke IJsselmeerpolders (in the so-called new land, the first hospital opened its doors in mid 1981). The highest rates in Belgium are found in the capital, Brussels, Roeselaere and Soignies. The districts in Northern France with high rates are; Calais, Reims and Nancy-Pompey-Toul.

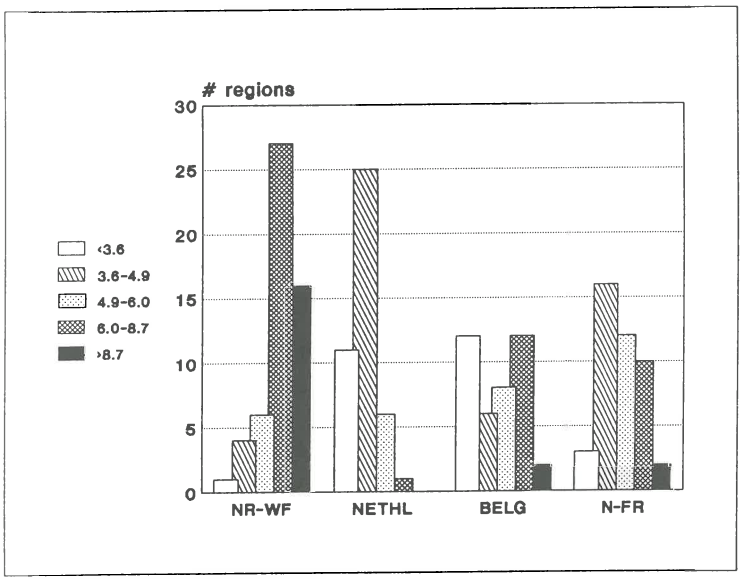
Map 4.7: Number of acute medical and surgical beds per 1000 inhabitants in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



	NR-WF	Nethl	Belgium	N.France
Mean	8.03	4.30	4.81	5.35
Sd/mean	0.28	0.18	0.45	0.27

Sources:
the Nethl.: the Central Bureau of Statistics (CBS).
Belgium: the National Institute of Statistics (NIS).
France: Centre de Recherches Economiques Sociologiques et de Gestion, (CRESGE).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen

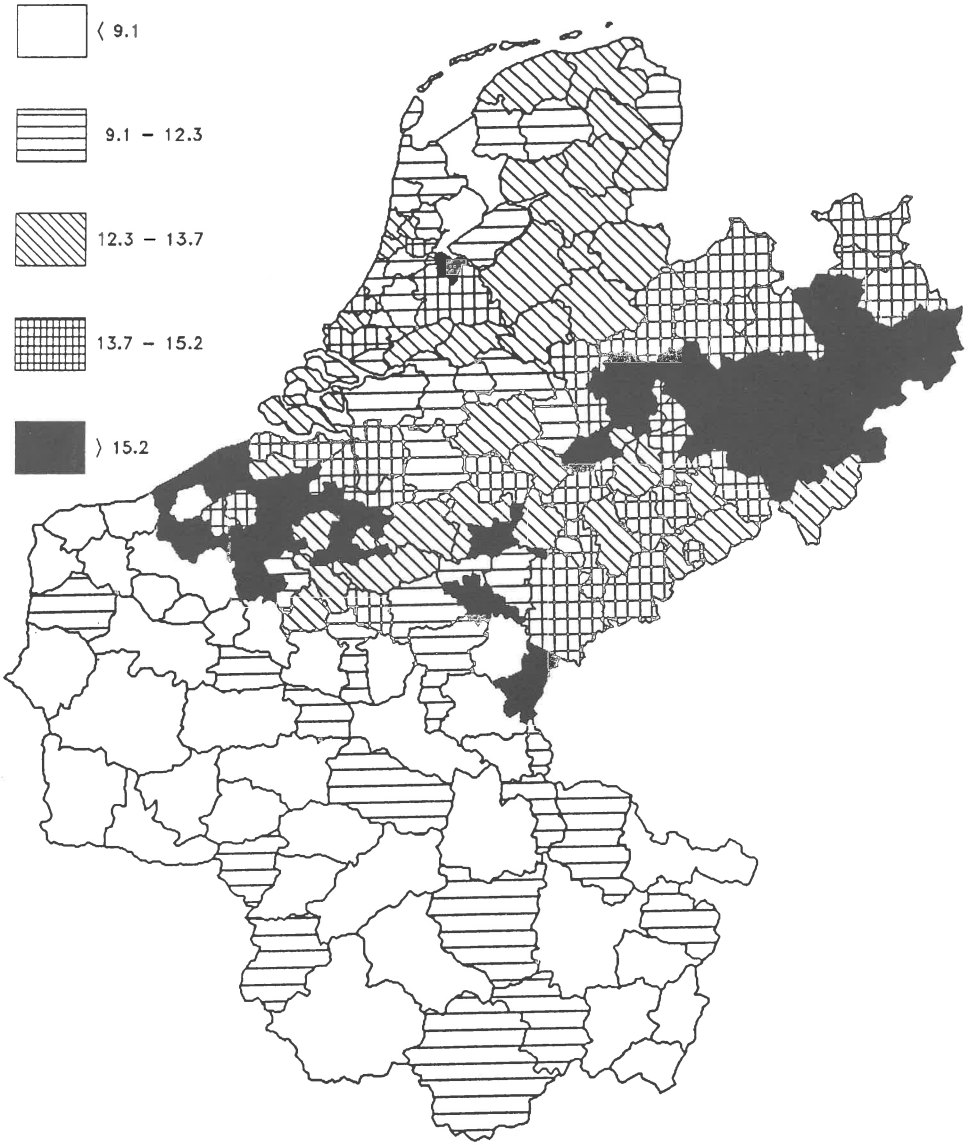
Figure 4.f: Frequency distribution of the number of hospital beds for 182 districts in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



Mean stay per admission

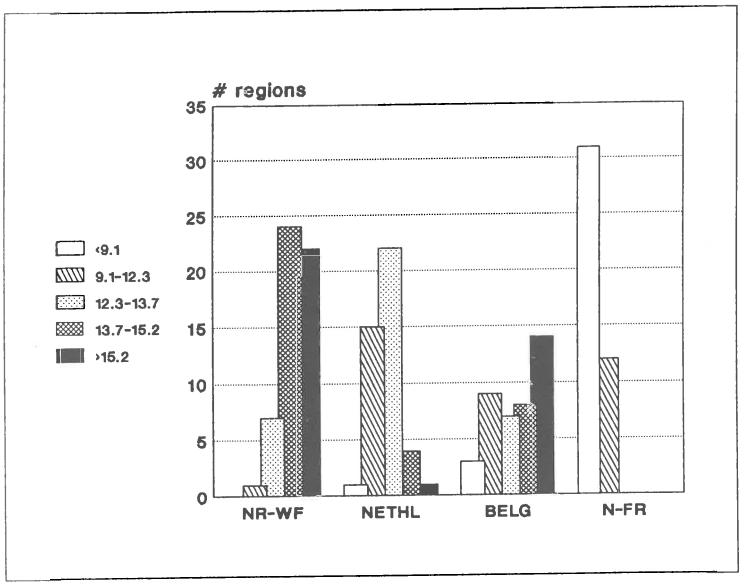
Information on the number of hospital days in the Netherlands is available per hospital, not per municipality or COROP region. The mean stay per admission is estimated by grouping all hospitals per COROP region, aggregating the number of bed days of general and teaching hospitals and dividing the total number of bed days by the number of admissions. The number of admissions is composed of the total number of inhabitants of the region admitted to any hospital (inside or outside the COROP region), whereas the number of hospital days is composed of the total number of days produced by the hospitals in that particular region. So the number of hospital days and the number of admissions do not apply to the same population. This procedure seems, however, appropriate, because no systematic error is expected.

Map 4.8: Mean stay per hospital admission in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982 (days per admission)



For Belgium and Northern France the mean stay per admission for respectively each arrondissement and health region was available.
With respect to Nordrhein-Westfalen we were provided with mean stay rates per region, calculated by dividing the total number of bed days (x 2) by the number of admissions and discharges. The numerator, the number of bed days, is composed of the total number of days produced by the hospitals in that particular region. The denominator, the number of admissions and discharges, is calculated, irrespective of the origin of the patients. Thus, the mean stay rate does not relate to the regional population as for example the variables mortality rate and income rate do. As for the Dutch procedure, no systematic error is expected.

Figure 4.g: Frequency distribution of the mean stay per admission for 182 districts in the Netherlands, Belgium*, Northern France and Nordrhein-Westfalen, 1982



	NR-WF	Nethl	Belgium	N.France
Mean	14.98	12.51	14.38	8.77
Sd/mean	0.08	0.12	0.28	0.13

* Two districts, Diksmuide and Philippeville, have no hospital beds.

Sources:
the Nethl.: the Central Bureau of Statistics (CBS).
Belgium: the National Institute of Statistics (NIS).
France: Centre de Recherches Economiques Sociologiques et de Gestion, (CRESGE).
NR-WF: Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen

The average hospital stay in Nordrhein-Westfalen differs significantly from the mean stay rate of Northern France (14.98 respectively 8.77).
Map 3.8 shows the highest rates in Nordrhein-Westfalen in the triangle Hamm, Lippstadt and Gütersloh, and the northern part of the Ruhr District. The highest rates in the Netherlands can be found in Het Gooi, Amsterdam, Rotterdam and Utrecht. In Belgium relatively low rates are found in the province of Luxembourg.

The number of primary health care providers

Primary health care providers are considered to be those physicians who are directly accessible for consultation. The mean number of primary health care providers per 1000 of the population is presented below.

Belgium is populated most densely by primary health care physicians, with highest rates in Brussels and Liège. In Nordrhein-Westfalen the highest rates can be found in several "Kreisfreie Städte", especially in Düsseldorf, Köln and Bonn.

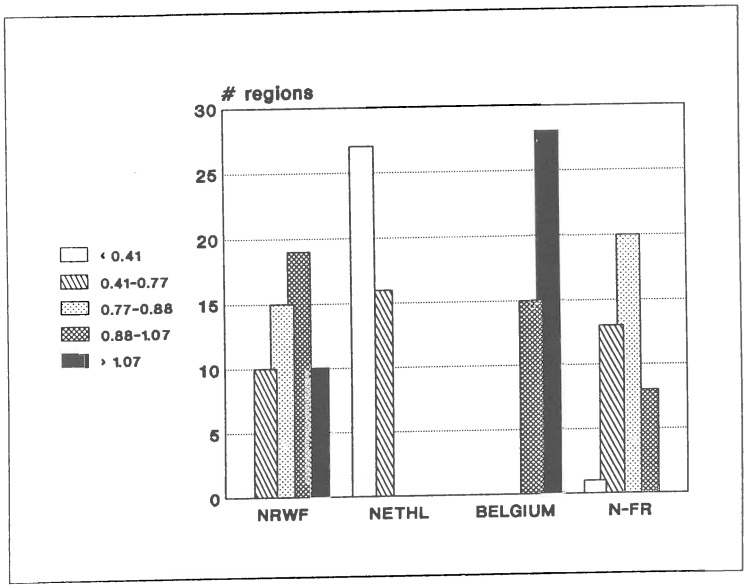
The regions of Calais, Nancy-Pompey-Toul and Cambrai have the highest density rates in Northern France. The number of physicians in the primary health care sector in the Netherlands (general practitioners), are relatively low, with only small differences between the different COROP regions. Amsterdam and the Zuidelijke IJsselmeerpolders show the highest rates.

	NR-WF	Nethl	Belgium	N.France
Mean	0.92	0.39	1.17	0.80
Sd/mean	0.25	0.08	0.19	0.25

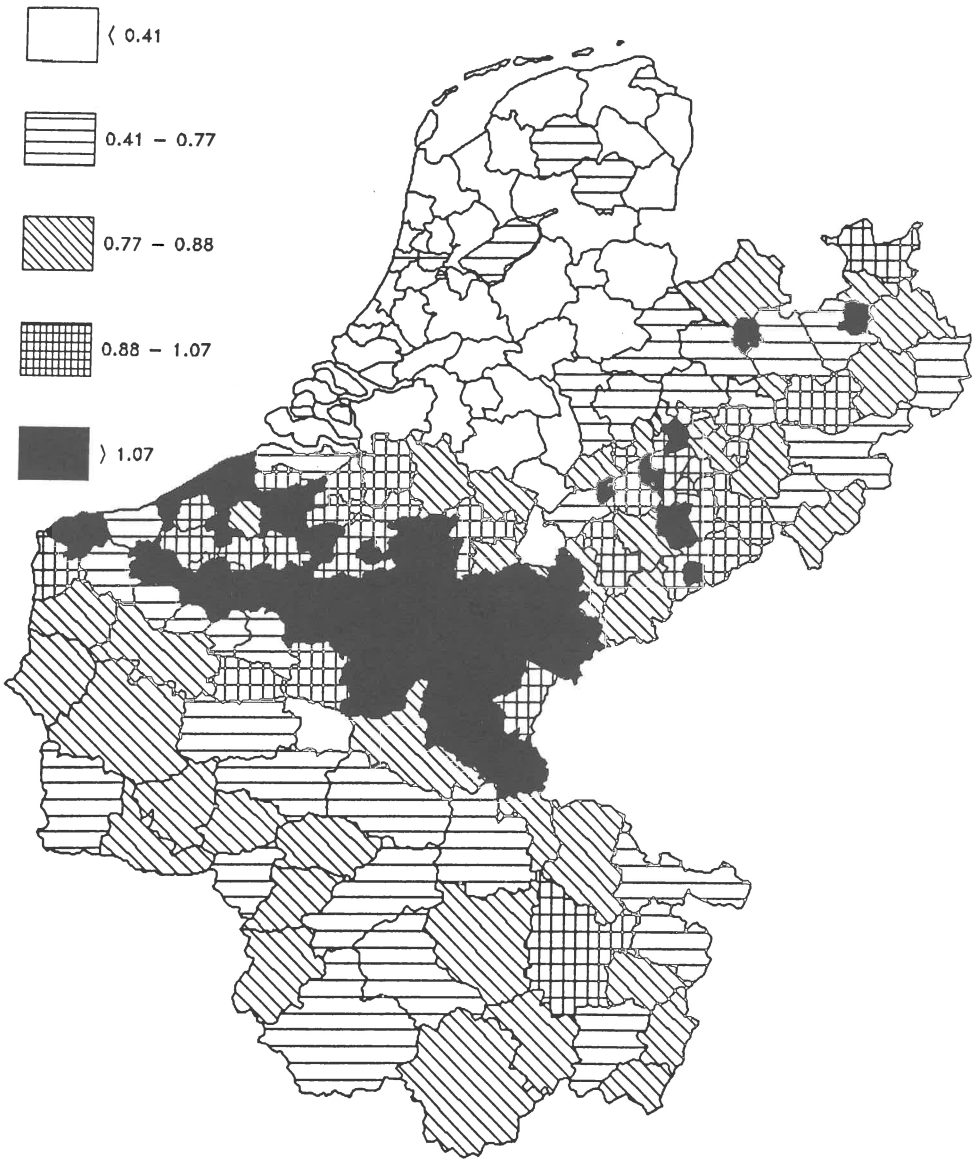
Sources:

the Nethl.:	the Central Bureau of Statistics (CBS).
Belgium:	Leroy, 1987, Table 83 and Tables 86-88
France:	Centre de Recherches Economiques Sociologiques et de Gestion (CRESGE).
NR-WF:	Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen

Figure 4.h: Frequency distribution of the number of primary health care providers in 184 districts in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



Map 4.9: The number of primary health care physicians in the Netherlands, Belgium, Northern France and Nordrhein-Westfalen, 1982



5. RESULTS OF THE ANALYSIS

5.1. Results of 1982 data

In the analysis to explain regional variation of admission rates, the general least squares regression procedure was used. The dependent variable in the regression equation is defined as 'the number of hospital admissions per 1000 inhabitants'. Furthermore, eight independent variables were chosen to explain regional variation of admission rates. In Table 5.1, correlation rates between the eight independent variables and the dependent variable are presented. These correlations are presented for the total number of 184 regions and for 43 regions in the Netherlands, 43 in Belgium, 44 in Northern France as well as for the 54 regions in Nordrhein-Westfalen.
The intercorrelations between the independent variables of the model can be found in Appendix A. Except for the correlation between the variable 'population density' and the variable 'income' in the Netherlands (0.76) none of the intercorrelations reach a level higher than 0.70. Thus, none of the independent variables had to be deleted from the equations for reasons of multicollinearity.

Table 5.1: Correlation rates between the number of hospital admissions and eight independent variables for regions in the Netherlands, Belgium, Northern France, Nordrhein-Westfalen separately and for the total of 184 regions, 1982 (r*100)

	Nethl.	Belg.	N.Fr.	NR-WF	Total
Mortality	26	40	- 8	53	71
Prop.65+	21	34	- 38	- 9	46
Income	30	- 8	9	- 34	- 5
Pop.density	26	15	2	22	26
Birth rate	- 43	5	13	17	- 68
Nb of beds	37	27	81	50	66
Mean stay	31	- 13	- 56	51	29
Prim.phys.	17	43	49	- 25	51

By comparing the sign of the correlations for all countries together and for each country separately, some interesting conclusions can be drawn. A negative correlation between the 'number of hospital admissions' and 'birth

rate' is found in the Netherlands, corresponding to the negative overall correlation. In the other three countries a weak positive correlation is found. Apparently, the overall negative correlation can be attributed to the higher birth rate and the lower hospital admission rate in the Netherlands. The same reasoning can be made for the differences between the negative correlation sign for the variable 'mean stay' in Belgium and Northern France and the positive correlation sign for the correlation with 184 regions. This might be due to the fact that in several regions in Nordrhein-Westfalen a highly positive linear association between the average length of stay and the number of hospital admissions exists, which influences the overall correlation to a large extent. Moreover, of the total number of 184 regions, most regions can be found in Nordrhein-Westfalen (54), thus overall correlations can be largely due to correlation coefficients of Nordrhein-Westfalen regions. Finally, the correlation between hospital admission rates and the number of primary care providers in Nordrhein-Westfalen differs in sign, compared to the overall correlation. The negative correlation between this variable and the number of hospital admissions, corresponds to the hypothesis we have formulated in Chapter 3.
To what extent these correlation results influence the interpretation of the regression equation will be shown in Table 5.2.

The general model seems to perform best in Northern France and Nordrhein-Westfalen with respectively 89% and 64% explained regional variation in admission rates. In Northern France, almost all regional variation is explained by the number of hospital beds and the average length of stay per admission. The results of Nordrhein-Westfalen can be interpreted as follows: the higher the (age-standardized) mortality rates, the higher the income level, the higher the number of births, the more hospital beds available and the lower the number of primary care physicians, the more hospital admissions take place.
In the Netherlands and Belgium, only respectively 19% and 26% of the variance in hospital admission rates is explained by the regression model used.

Table 5.2: Regression* on the number of hospital admissions 0/00 in Nordrhein-Westfalen, the Netherlands, Belgium and Northern France in 1982. Presented are B-coefficients and (T-statistics)

	NR-WF	N.Fr.	Nethl.	Belgium
DEMAND SIDE				
Mortality	10.82	0.94	7.26	4.89
	(4.09)	(0.15)	(2.00)	(1.41)
Income	5.01	3.13	1.93	- 1.26
	(2.27)	(0.73)	(0.65)	(- 0.32)
Prop.65+	- 1.09	- 2.00	- 0.60	3.15
	(- 1.00)	(- 0.82)	(- 0.55)	(1.61)
Pop.density	0.004	0.01	- 0.003	0.0002
	(1.60)	(0.70)	(- 0.98)	(0.07)
Birth rate	5.64	- 0.41	- 1.32	5.37
	(2.23)	(- 0.13)	(- 0.95)	(1.19)
SUPPLY SIDE				
Nb. of beds	3.95	5.38	2.30	2.30
	(4.34)	(11.15)	(1.95)	(1.61)
Mean stay	2.33	- 23.43	0.60	- 0.46
	(1.28)	(- 7.81)	(0.37)	(- 0.74)
Prim.care phys.	- 22.91	22.69	22.62	19.02
	(- 2.01)	(1.19)	(0.40)	(1.07)
Constant	- 35.74	225.40	38.11	- 54.55
	(- 0.59)	(2.40)	(0.63)	(- 0.69)
Adjusted R^2	0.64	0.89	0.19	0.26

* _____ : $p < 0.05$
_ _ _ : $0.05 < p < 0.10$

In the next step, only significantly explanatory variables were included in the regression analysis. This new regression model includes the variables: 'number of beds per thousand inhabitants', 'mean stay', 'mortality' and the 'number of primary health care providers'. The variables 'income' and 'birth rate' (although significantly explanatory variables in Nordrhein-Westfalen) are excluded because these variables correlate highly with the number of primary health care providers, especially ambulatory specialists. In this reduced regression model, the total explained variance is more or less the same.

Table 5.3: Regression* on the number of hospital admissions 0/00 in Nordrhein-Westfalen, the Netherlands, Belgium and Northern France in 1982, including four variables. Presented are B-coefficients and (T-statistics)

Variables	NR-WF	N.France	the Nethl.	Belgium
Nb. of beds 0/00	3.55	30.24	6.28	2.56
	(3.69)	(13.08)	(2.72)	(1.93)
Mean stay	1.75	- 24.64	0.83	0.51
	(1.01)	(- 9.24)	(0.74)	(- 0.88)
Mortality	9.61	2.42	7.76	6.09
	(3.76)	(0.60)	(2.62)	(1.90)
Prim. phys. 0/00	- 19.48	19.21	15.53	20.86
	(- 2.10)	(1.41)	(0.33)	(1.55)
Constant	30.38	190.34	1.06	47.55
	(0.76)	(3.63)	(0.03)	(1.52)
Adjusted R^2	0.56	0.89	0.23	0.24

* _____ : $p < 0.05$
_ _ _ : $0.05 < p < 0.10$

The supply of hospital beds is an explanatory variable in all four health care systems, although a remark has to be made about the very low explanatory power of the model in the Netherlands and Belgium. Age-adjusted death rates in Nordrhein-Westfalen, the Netherlands and to a lesser extent in Belgium relevantly explain hospital admission rates in these countries. In Northern France the supply indicators (bed supply and mean stay) are relevantly explanatory. The influence of the primary health care physicians is only relevant in Nordrhein-Westfalen; the more general practitioners and ambulatory specialists per 1000 inhabitants, the fewer hospital admissions take place. We can understand this result, if we take into account the strict division between ambulatory and hospital specialistic care and the fact that more than half of all primary health care providers in Nordrhein-Westfalen are specialists (Eichhorn, 1984). Moreover, these specialists are most often well equipped with all necessary facilities for diagnostic tests and treatment (Stone, 1980). As a consequence, they can, to a certain extent, form a substitute for hospital based physicians.

5.2. Results of the analysis over time

In the last part of the analysis, the question is raised how the results of the regression model with 1982 data relate to the results in previous years. A previous study (Van der Zee, Groenewegen, 1985) with data of Belgium and the Netherlands on three different points in time, 1974,1979 and 1982, showed a diminishing influence of the bed supply on the admission rates. The results of the regression analysis with data of Nordrhein-Westfalen (including the four most explanatory variables) corresponds to these results.

Table 5.4: Regression* on number of hospital admissions 0/00 in Nordrhein-Westfalen, the Netherlands and Belgium in 1974, 1979 and 1982. Presented are B-coefficients and (T-statistics)

	1974	1979	1982
NR-WF			
nb. of beds 0/00	5.66	3.63	3.55
	(7.50)	(4.79)	(3.69)
mean stay	- 2.58	1.31	1.75
	(- 2.59)	(0.96)	(1.01)
mortality	6.89	10.29	9.61
	(3.62)	(3.67)	(3.76)
prim.phys. 0/00	- 30.75	- 7.44	- 19.48
	(- 3.69)	(- 1.41)	(- 2.10)
constant	89.66	9.08	30.38
	(3.29)	(0.29)	(0.76)
adjusted R^2	0.67	0.53	0.56
the Netherlands			
nb. of beds 0/00	13.71	12.66	6.28
	(4.51)	(4.09)	(2.72)
mean stay	- 2.77	- 3.38	0.83
	(- 2.25)	(- 2.12)	(0.74)
mortality	3.53	1.88	7.76
	(1.24)	(0.54)	(2.62)
prim.phys. 0/00	52.79	45.42	15.53
	(0.94)	(0.86)	(0.33)
constant	33.39	65.57	1.06
	(0.93)	(1.61)	(0.03)
adjusted R^2	0.33	0.28	0.23
Belgium			
nb. of beds 0/00	3.25	5.75	2.56
	(2.54)	(3.02)	(1.93)
mean stay	0.98	- 0.03	- 0.51
	(0.76)	(- 0.09)	(- 0.88)
mortality	1.16	6.15	6.09
	(0.34)	(1.56)	(1.90)
prim.phys. 0/00	- 1.12	17.67	20.86
	(- 0.07)	(1.16)	(1.55)
constant	80.05	17.50	47.55
	(1.73)	(0.44)	(1.52)
adjusted R^2	0.12	0.22	0.24

* _____ : $p < 0.05$
_ _ _ : $0.05 < p < 0.10$

The influence of bed-supply is no longer significantly explanatory in 1982 in Belgium. Recent data might show a disappearance of this influence.

5.3. Conclusion

Various studies (Sanders et al. (1988), Van Doorslaer et al. (1989), Roemer et al. (1981), Groenewegen et al. (1985), Gloerich et al. (1989)) have already pointed to the predominant influence of supply factors on the use of hospital facilities. The more hospital beds provided, the more hospital beds being used, does indeed prevail in Northern France and Nordrhein-Westfalen. Dutch and Belgian figures show the same result, but the explanatory power of the model in these countries is unacceptably low. The hypothesized influence of primary health care physicians on the regional variation in hospital admission rates was found in Nordrhein-Westfalen only. The negative influence of this variable in the regression model corresponds to the idea of a counterbalance effect of the primary health care sector versus the hospital sector (Gloerich et al., 1991). The West German health care system is characterized by a steady trend to an increasing proportion of specialistic care in the primary health care sector. Moreover, the strict borderline between ambulatory and hospital care and the fee-for-service remuneration system in the primary health care sector involves an incentive for ambulatory specialists to treat patients in their own practice. However, this statement needs to be analysed at a lower aggregation level.

With respect to the results of the regression analysis on three points in time, we conclude that the explanatory power of the variable 'bed supply' in the model has decreased in Nordrhein-Westfalen and (with less reliability) in Belgium and the Netherlands. This trend might give an indication of the dynamics of a health care system during a period of change from an expanding hospital sector to a decreasing growth of the hospital sector. At the end of the seventies, health care policies in most OECD countries have shifted from cost expansion to cost control. As a consequence, bed reduction policies were carried out to control the high level of health care expenditures in these countries. In conclusion, Roemer's law 'a bed built is a bed filled' applies to a certain degree to all four health care systems but is conditioned by place and time.

6. DISCUSSION

The intention of this international comparative study was to analyse mechanisms in health care systems that exert an influence on hospital admission rates. By studying hospital admission rates in four different health care systems, this study is a tool for giving a more analytical description of health care systems. Secondly, it might contribute to the discussion about measures to control health care costs in developed nations.

In this study considerable differences in hospital admission rates were found (differing from 86 per 1000 inhabitants in Noord-Drenthe, the Netherlands, to 196 per 1000 inhabitants in Olpe in the FRG).
Northern France showed the highest average hospital admission rate and regional differences within Northern France were highest as well. The Dutch admission rates are generally lower, and regional differences are smaller.

Data in this study were taken from two different types of regions.
For the North of France, information about the use of health care facilities was available by "Secteur Sanitaire" (health service area). Health service areas have the advantage of allowing the matching of population and health care facilities; the geographically defined population receives its medical care within the boundaries of the health service area. Parameters of hospital use, for example hospital admission rates or average length of stay, can best be analysed on this unit of analysis. However, demographic data that were used in this study were not available on this unit of analysis. Therefore, we had to aggregate French demographic data to the level of health service areas.
For the other study areas data were collected on the level of administrative regions. This unit of analysis seems appropriate, except for when it comes to the calculation of the mean stay rate per admission. We calculated the mean stay per admission by grouping all relevant hospitals per region, aggregating the number of bed days per hospital, and dividing the total number of bed days by the number of admissions. This is not an ideal procedure, as the number of bed days produced by the hospitals in a certain region do not match the inhabitants of that region admitted to any hospital. As the residential area and the hospital service area of the population do not differ to any great extent, the misestimates are limited. (For the calculation of regional mean stay rates in Nordrhein-Westfalen, both

the number of hospital days and the number of admissions correspond to the hospitals belonging to the region.)

The positive relation between the number of hospital beds per capita and the number of admissions per capita (or hospital utilization in general) has been interpreted in the literature as an indication of 'permanent excess demand' or of 'supplier-induced-demand'. Supporters of the first interpretation argue that an increase in hospital utilization is caused by unmet or excess demand for hospitalization: excess demand induces an increase in supply.
The second interpretation turns this argument around by stating that suppliers are able to induce an increase in demand, since in most cases it is the physician who determines the demand by his/her patients. Results of a study by Harris (1975) on this subject supported the contention that hospital beds tend to create their own demand for utilization.
The positive influence of bed supply on hospital admissions is confirmed in the analysed health care systems of this study, but seems to differ in time and in space. The analysis showed that the lawlike mechanism 'a bed built is a bed filled', introduced by Roemer, is likely to be conditioned by characteristics of a country's hospital sector and changes in the financing of this sector.

During the sixties and seventies, health care policies were directed to the expansion of available resources for patients, in particular hospital beds. The concept of a 'bed mountain' was clearly shown in the West German health care system, with approximately 12 beds per 1000 inhabitants in 1979 (Eichhorn, 1984). By the 1980s, different cost-reducing measures were taken; influencing the demand (by introducing co-payment rates), limiting the supply of health care services (by bed reduction policies) and shifting from high-cost to low-cost health care sectors (emphasis on primary health care).
The results of our analysis showed the influence of bed reduction policies in Nordrhein-Westfalen in the period 1974-1982. In 1972, the hospital financing law (Krankenhausfinanzierungsgesetz, KHG) was passed. The law included regulations to give capital grants for hospitals from the national, provincial or local government. Before 1972, German hospitals were expected to get money for construction and for new equipment from their owners, from charitable donors, or savings from their daily charges.
Because under this law, the state decides which hospital is included or excluded from grants for hospital capital, it has a tool for directing health care planning policies. Even if smaller hospitals are excluded from the

government grants, they can survive, because the sickness funds are free to contract any hospital. Thus facilities planning and reimbursement of hospitals are not coordinated and are poorly connected with cost containment in the German health care sector.
Owing to the low explained variance of the regression model with Dutch and Belgian data in our study, we refrain from drawing firm conclusions in this respect. For previous results in this respect we refer to the study by Groenewegen and Van der Zee (1985) and Gloerich et al. (1989).
Van Doorslaer & Van Vliet (1989) used 1983-1984 data of the Netherlands in their study and found no relation between bed supply per capita and admission rates, after adjusting for age mix. This result is in contrast with results found in earlier studies on this subject in the Netherlands. The authors point to three major changes that have taken place in the provision of hospital services in the Netherlands: the abolition of the 90% occupancy rate requirement as the basis for the financing of hospitals, bed-reduction policies, and the introduction of hospital budgeting. These changes in hospital financing systems at the beginning of the eighties might have exerted an influence on bed supply and mean length of stay, thus weakening the relationship with the hospital admission rate.

6.1. Recommendations for further research

It is recommended to extend research in the field of international comparative studies in the direction of underlying conditions of 'supplier-induced demand' in different health care systems. In examining these conditions in different countries, one should take into account differences in health care resource (hospital, physician, specialist) characteristics. For the analysis of these conditions in time, one should also consider financial and legal changes that occurred in the provision of health care services.

An interesting result from our analysis, with Nordrhein-Westfalen data, is the influence of the primary health care sector on hospital admission rates. Our data showed fewer hospital admissions in regions with a high density of primary physicians. To what extent primary physicians are influenced by incentives to treat patients in their own practice instead of referring the patient to the hospital is questionable. This result needs further analysis at a lower aggregation level.

It is also recommended to extend this study in space, using other 'families'

of health care systems. Of the health care systems used in this study, the West German and the Dutch health care system, and the French and Belgian health care system, can be roughly grouped together. It would be interesting to extend the study with data of regions belonging to the health care system of Italy or England. Both countries have a National Health Service structure. In both systems the costs of health services are paid for through general taxation. In Italy, however, some 50% of the population pay for their own health care. Another country that has a health care system that could actually be called a system is Sweden. Characteristic of the Swedish health care system is that most health care is provided in a hospital setting, to a large extent in the out-patient departments of hospitals. The health care system of Sweden forms a contrast with the German health care system. As we have seen, no such service exists in (West) Germany. By analysing regional variation in hospital admission rates in different health care systems, more insight into the conditional character of Roemer's law could be obtained.

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APPENDIX


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Federal Republic of Germany

1. Düsseldorf
2. Duisburg
3. Essen
4. Krefeld
5. Mönchengladbach
6. Mülheim a.d.Ruhr
7. Oberhausen
8. Remscheid
9. Solingen
10. Wuppertal
11. Kleve
12. Mettmann
13. Neuss
14. Viersen
15. Wesel
16. Aachen ("Kreisfreie Stadt")
17. Bonn
18. Köln
19. Leverkusen
20. Aachen ("Kreise")
21. Düren
22. Erftkreis
23. Euskirchen
24. Heinsberg
25. Oberbergischer Kreis
26. Rhein.-Berg.Kreis
27. Rhein-Sieg-Kreis
28. Bottrop
29. Gelsenkirchen
30. Münster
31. Borken
32. Coesfeld
33. Recklinghausen
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35. Warendorf
36. Bielefeld
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38. Herford
39. Höxter
40. Lippe
41. Minden-Lübbecke
42. Paderborn
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46. Hamm
47. Herne
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The Netherlands

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3. Overig Groningen
4. Noord-Friesland
5. Zuidwest-Friesland
6. Zuidoost-Friesland
7. Noord-Drenthe
8. Zuidoost-Drenthe
9. Zuidwest-Drenthe
10. Noord-Overijssel
11. Zuidwest-Overijssel
12. Twente
13. Veluwe
14. Achterhoek
15. Arnhem/Nijmegen
16. Zuidwest-Gelderland
17. Utrecht
18. Kop van Noord-Holland
19. Alkmaar e.o.
20. IJmond
21. Agglomeratie Haarlem
22. Zaanstreek
23. Groot-Amsterdam
24. Het Gooi en de Vechtstreek
25. Agglomeratie Leiden en de Bollenstreek
26. Agglomeratie 's-Gravenhage
27. Delft en Westland
28. Oost-Zuidholland
29. Groot-Rijnmond
30. Zuidoost Zuid-Holland
31. Zeeuwsch-Vlaanderen
32. Overig Zeeland
33. West Noord-Brabant
34. Midden Noord-Brabant
35. Noordoost Noord-Brabant
36. Zuidoost Noord-Brabant
37. Noord-Limburg
38. Midden-Limburg
39. Zuid-Limburg
40. Zuidelijke IJsselmeerpolders
41. Amsterdam
42. Rijnmond
43. Stadsgewest 's-Hertogenbosch


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Belgium

1. Antwerpen
2. Mechelen
3. Turnhout
4. Brux.Cap./ Br.Hoofdstad
5. Halle-Vilvoorde
6. Leuven
7. Nivelles
8. Brugge
9. Diksmuide
10. Ieper
11. Kortrijk
12. Oostende
13. Roeselaere
14. Tielt
15. Veurne
16. Aalst
17. Dendermonde
18. Eeklo
19. Gent
20. Oudenaarde
21. Sint-Niklaas
22. Ath
23. Charleroi
24. Mons
25. Mouscron
26. Soignies
27. Thuin
28. Tournai
29. Huy
30. Liège
31. Verviers
32. Waremme
33. Hasselt
34. Maaseik
35. Tongeren
36. Arlon
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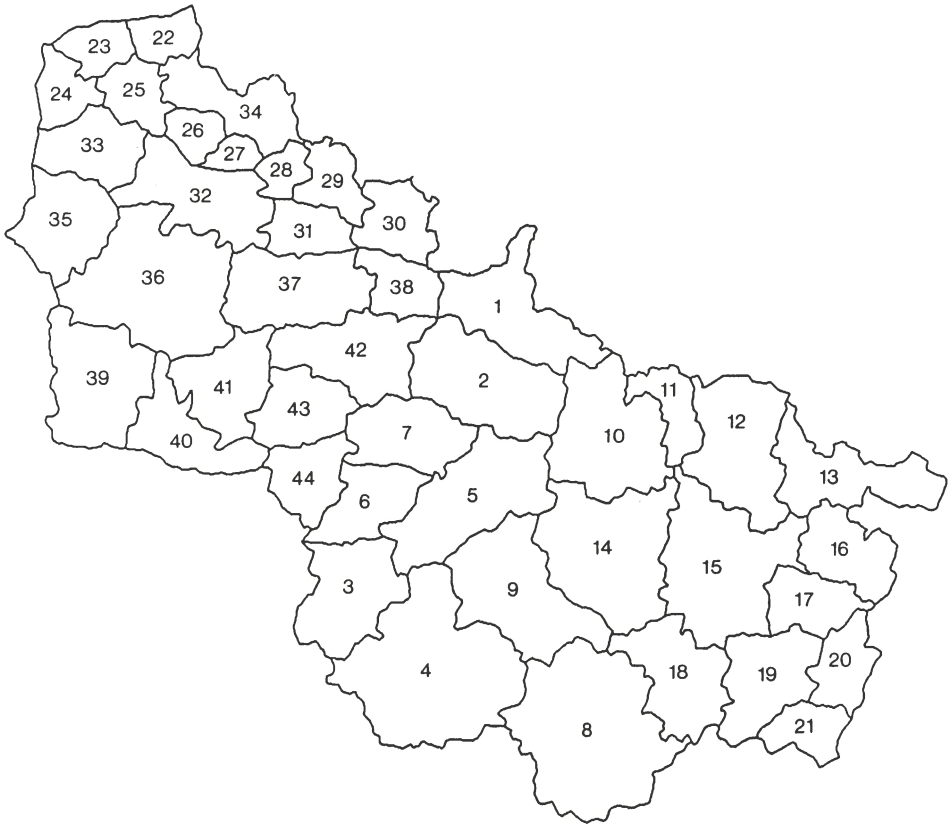
38. Marché-en-Famenne
39. Neufchateau
40. Virton
41. Dinant
42. Namur
43. Philippeville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Northern France

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2. Ardennes sud
3. Romilly-Sezanne
4. Troye-Bar sur Aube
5. Charlon/Marne
6. Epernay
7. Reims
8. Chaumont-Langres
9. Saint-Dizier
10. Verdun/Meuse
11. Briey
12. Metz-Thionville
13. Boulay-Forbach
14. Bar le Duc
15. Nancy-Pompey-Toul
16. Sarrebourg-Dieuze
17. Luneville
18. Neufchateau-Vittel
19. Epinal
20. Saint Dié
21. Remiremont-Gerardmer
22. Dunkerque
23. Calais
24. Boulogne
25. Saint Omer
26. Bethune
27. Lens
28. Douai
29. Valenciènnes
30. Maubeuge
31. Cambrai
32. Arras
33. Montreuil/Mer
34. Metropole
35. Abbeville
36. Amiens
37. Saint Quentin
38. Vervins
39. Beauvais
40. Creil
41. Compiègne-Noyon
42. Laon-Chauny
43. Soissons
44. Chateau-Thierry