Cost of illness in the Netherlands:
description, comparison and projection

ISBN 90-9014744-6

This thesis was partly realised with financial support of
the Department of Public Health, Erasmus University Rotterdam

Cover design: Interaxion, Amersfoort
Printed by: Drukkerij Gebrs. Verloop, Alblasserdam

Cost of illness in the Netherlands:
description, comparison and projection

Kosten van ziekten in Nederland:
beschrijving, vergelijking en projectie

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam op gezag van de
Rector Magnificus
Prof.dr.ir. J.H. van Bemmel
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
woensdag 10 oktober 2001 om 15.45 uur

door

Johannes Jacob Polder
Geboren te Dirksland

Promotiecommissie

Promotoren:	Prof.dr. P.J. van der Maas Prof.dr. F.F.H. Rutten
Overige leden:	Prof.dr. G.J. Bonsel Prof.dr. R.T.J.M. Janssen Dr. M.A. Koopmanschap

Voor Thea en Arthur

Publications

This thesis is based on the following publications*

Chapter 2	Meerding WJ, Bonneux L, Polder JJ, Koopmanschap MA, Maas PJ van der. Demographic and epidemiological determinants of health care costs in the Netherlands: cost of illness study. *British Medical Journal* 1998;317:111-115.
Chapter 3	Polder JJ, Meerding WJ, Koopmanschap MA, Bonneux L, Maas PJ van der. Kosten van ziekten in Nederland in 1994; grootste zorggebruik door hoge leeftijd en beperkende aandoeningen. *Nederlands Tijdschrift voor Geneeskunde* 1998;142(28):1607-1611.
Chapter 4	Polder JJ, Meerding WJ, Koopmanschap MA, Bonneux L, Maas PJ van der. Trends in Dutch health care costs 1988 – 1994 – 2050. *International Journal of Healthcare Technology and Management* 2000;2(5/6):512-522.
Chapter 5	Polder JJ, Bonneux L, Meerding WJ, Maas PJ van der. Age-specific increases in health care costs. *European Journal of Public Health* (in press).
Chapter 6	Polder JJ, Meerding WJ, Bonneux L, Maas PJ van der. Costs of intellectual disability in the Netherlands - a cost-of-illness perspective. (submitted)
Chapter 7	Polder JJ, Balen R van, Steyerberg EW, Cools HJM, Habbema JDF. Early discharge from hospital after hip fracture does not reduce societal costs. (submitted)
Chapter 8	Polder JJ, Meerding WJ, Bonneux L, Maas PJ van der. A cross-national perspective on cost of illness. (submitted)

---

* *Reprinted with kind permission of BMJ Publishing Group (Chapter 2), Nederlands Tijdschrift voor Geneeskunde (Chapter 3), Inderscience Enterprises Limited (Chapter 4), Oxford University Press (Chapter 5).*

Contents

Introduction 1

1.1 Cost-of-illness studies

Over the past decades health economics has emerged as a new scientific discipline. From the very beginning the field has continued to expand and take on increasing significance. An important focus is on the economic evaluation of health care facilities within the area of Medical Technology Assessment (MTA) or Health Technology Assessment (HTA). Other topics studied by health economists regard among others the demand for care, the role of health insurance, the industrial organisation of the health care sector and the international comparison of health care systems.

Cost-of-illness (COI) studies have also attracted the attention of health economists. Since the pioneering work of Dorothy Rice in the United States in the Sixties [Rice 1966], cost-of-illness data have been published for several countries. There is, however, some controversy about the results. Physicians and policymakers frequently ask what the often very large financial estimates for costs of specific diseases mean and how reliable, valid and useful they are. This thesis focuses on COI studies. We will start with a few definitions [Rice 1994].

1.2 Definitions

Disease-specific and general COI studies

Cost-of-illness studies so far can be divided into two types: disease-specific studies and general studies. In disease-specific COI studies, all relevant costs of one disease are combined to cover total costs of the disease. Disease-specific studies usually follow a bottom-up methodology using patient-based information on health care consumption and corresponding unit prices. Disease-specific studies may be cross-sectional or longitudinal. Cross-sectional studies use annual expenditure data from all health care sectors. Costs per disease category are estimated by aggregating these data for all patients in all sectors. In longitudinal

studies life long expenditures are estimated by following patients or patient groups during the course of time.

Most COI studies belong to the disease-specific category. Examples include the costs of migraine [Osterhaus 1992, Lissovoy 1994], depression [Greenberg 1993], asthma [Krahn 1996], rheumatoid arthritis [Magnusson 1996], diabetes mellitus [Warner 1996], and neck pain [Borghouts 1999]. Marc Koopmanschap compiled an overview of a number of major disease-specific COI studies [Koopmanschap 1998]. In some studies health care costs are further allocated to risk factors. These 'cost-of-risk-factor' studies usually include all costs of diseases that are caused by important risk factors as smoking [Barendregt 1997, 1999] and cholesterol [Bonneux 2000]. In this kind of studies also the costs and possible savings of preventing major diseases can be studied [Bonneux 1998].

General cost-of-illness studies describe total health care costs for different diseases using a common top-down methodology. These studies usually cover the whole range of diseases of the International Classification of Diseases (ICD). Because all diseases are aggregated in major categories, general COI studies use much broader disease definitions than disease-specific studies that in some cases only regard some particular ICD codes.

General COI studies are cross-sectional, describing the annual costs of all people with the disease in a certain year. The top-down methodology generally consists of four steps. First, total health care costs are broken down into more or less homogeneous sectors. Second, key variables are defined per sector, representing equal units of care, for instance hospital days and visits to outpatient clinics. In the third step, disease-specific data on health care utilisation is collected for each sector, for instance from national registries and surveys. The numbers are used for the construction of a 'probability map', which in the fourth step is applied to the sector costs, resulting in a distribution of costs by diagnosis. These basic steps of the top-down methodology will be explained further in Chapter 2 and appendix A.

This thesis focuses on general COI studies. Disease-specific studies only play a minor role in highlighting the findings of general studies and their comparisons.

Incidence-based or prevalence-based

In epidemiology distinction is made between incidence and prevalence of a disease. Disease incidence relates to the new cases of the disease in a certain year. Disease prevalence regards all cases of the disease in a certain year irrespective whether the patients got the disease in that particular year or earlier.

Cost-of-illness studies can be based on incidence or prevalence. Lifetime costs for a certain disease are represented by incidence-based COI figures, including all cases with onset of the disease in a given base year. All costs during the course of the disease, which might last for several years, are included and require longitudinal data. Prevalence-based COI studies estimate the economic burden of one or more diseases during a certain period of time, usually a year, as a result of

the prevalence of the disease. This approach measures the value of resources used during a specified period of time.

The approach adopted depends on the concept and the purpose of the study. General COI studies are always cross-sectional and therefore prevalence-based. Disease-specific studies can be either prevalence-based or incidence-based. If the results are to be used for an insight in the distribution of costs or for cost containment within a limited time span, the prevalence-based method is appropriate, since this approach identifies the main components of current health expenditure. If the analysis is aimed at making decisions about the choice of treatment or research strategy to implement from the perspective of efficiency, the incidence method is more appropriate because it provides the basis for predictions about the likely savings from programmes that reduce incidence or improve health status. Only a relatively small number of disease-specific studies, however, is incidence based [Koopmanschap 1998].

Disease and comorbidity

Another issue is whether the COI study regards only primary diagnosis or also for secondary diagnoses. Two categories must be distinguished.

The first category consists of diseases that are related by a common causal background, but are classified separately in the disease classification. A good example is diabetes mellitus, which is an underlying disease for heart disease, eye disorders and some other diseases as renal insufficiency. Hepatitis infections, which can cause acute liver insufficiency and cirrhosis, are another example. The existence of causal morbidity and mortality pathways is the main characteristic of this category. In a disease-specific COI study all costs will be attributed to, for instance, diabetes using primary and secondary diagnoses. In a general COI study, however, all diseases are included and only primary diagnoses are used in order to avoid double counting. As a consequence of the codification rules for morbidity, costs of heart diseases, for instance, are classified among heart diseases, whether they are caused by diabetes or not. According to the International Classification of Diseases (ICD), morbidity registrations are based on the diseases that are held responsible for the actual health care need and use. So in hospital registrations heart diseases or eye disorders are registered as causes of health care use, irrespective of underlying diseases such as diabetes. As a result cost estimates of general and disease-specific COI studies can differ substantially. It is important to mention that mortality registrations are based on different rules. According to the ICD always the underlying disease must be mentioned as primary cause of death. So in the example of diabetes all deaths must be registered under diabetes, while substantial parts of health care use and costs are attributed to heart disease and others.

The second category consists of diseases that are not causally related. Two variants can be distinguished: diseases that mutually influence the medical prognosis and diseases without such an interaction. In most cases this type of

comorbidity will increase health care needs and health care consumption. In some cases it is clear whether health care consumption relates to a particular disease or another. In other cases the distinction is less obvious. But in all cases costs are attributed to primary diagnosis. Hospital costs, for instance, are allocated to disease categories according diagnoses at discharge. In this way all costs from admission until discharge are attributed to primary diagnosis, although some costs might be caused by comorbid conditions or complications of treatment. As a result the costs of, for instance, chronic ulcers of the skin, sepsis and chronic disabling diseases such as dementia are underestimated, while costs of more acute diseases are overestimated. In theory disease-specific COI studies could reckon with this problem using detailed data on health care consumption per patient. In practice it would be very difficult to disentangle the different causes of health care use from hospital registrations. In general COI studies this problem can partially be solved by specifying some well-known complications as chronic ulcers of the skin as second axis for diagnosis. In general, however, COI studies can not deal with this problem, and hence will always incorporate some opacity that is inherent to their concept and methodology.

In this thesis comorbidity mainly refers to the second category consisting of diseases that coincide without a causal pathway.

Direct and indirect costs

Health economics theory distinguishes direct and indirect costs. Direct costs relate to the resources for which investments are made, whether they are paid or not. So direct medical costs relate to the value of all resources that are employed in the health care system, including informal care, because these resources are directly involved in the process of care-giving, such as prevention, diagnostics, treatment, rehabilitation and nursing. Direct costs may also include non-health care costs such as, for instance, travelling costs paid by patients.

Indirect costs consist of investments indirectly related to the disease and also to resources that are lost or assumed to be lost due to the disease. These costs refer to, for instance, costs of specialised schools for children with intellectual disabilities and judicial costs of criminals with mental disorders. Most attention is given to the economic consequences of lost productivity and absence from work due to morbidity, disability and mortality. Health economists generally adopt two approaches to estimate these so-called 'productivity costs': the human capital method [Scitovsky 1987], and the friction-cost method [Koopmanschap 1995]. Other, less dominant approaches estimate indirect costs in terms of willingness-to-pay [Mishan 1971] or quality-of-life [Gold 1996, Brouwer 1997].

Disease-specific COI studies usually include both direct and indirect costs. In these studies the human capital method is favourite for estimating indirect costs. Some general COI studies, too, provide estimates of indirect costs, for instance for Canada [Moore 1997] and Sweden [Jacobson 1996]. Other studies only deal with direct medical costs, for instance for Australia [Mathers 1998], or at the most

specify absence from work and mortality as quantities, as has been done for the Netherlands [Koopmanschap 1991, Polder 1997]. In this thesis, we focus on direct medical costs, ignoring direct non-health care costs and indirect costs.

In summary this thesis regards: 1) general cost-of-illness studies that; 2) are prevalence based; 3) focus on primary diagnosis; and 4) only comprise direct medical costs.

1.3 Overview of published COI studies

Dorothy Rice published the first general cost-of-illness study [Rice 1966]. She allocated the United States' health expenditure in 1963 to 16 major disease categories in accordance with the International Classification of Diseases (8th revision, ICD-8). This pioneering study was updated and extended for the United States in 1972 [Cooper 1976] and in 1980 [Hodgson 1984, Rice 1985].

In Europe the first COI study was performed by Björn Lindgren and his colleagues. In 1981 Lindgren published COI estimates for Sweden in 1964 – 1975 [Lindgren 1981]. The figures were updated for 1980 [Lindgren 1990] and 1991 [Jacobson 1996]. Other countries followed. Hemminki constructed COI figures for Finland in 1972 [Hemminki 1977]. In Germany, COI estimates were published for 1980 [Henke 1986], 1990 [Henke 1997] and 1994 [Schneider 1999].

In Canada, COI figures were published for 1986 [Wigle 1991] and 1993 [Moore 1997]. In Australia, COI studies were performed for 1989 – 90 [AIHW 1996] and 1993 – 94 [Mathers 1998]. COI figures for England in 1993 – 94 were published within the scope of a broader burdens-of-disease study [NHS 1996]. The OECD Health Data further contain COI estimates for Japan, Korea and Spain [OECD 1998].

In the Netherlands a study group in Rotterdam compiled COI estimates for health expenditure in 1988 [Koopmanschap 1991, 1994]. By comparison their study was very comprehensive in two respects. First, total health expenditure was included in the COI study. In other words: the results added up to known totals. Second, all costs were simultaneously and by the same methods allocated to diagnosis, age and sex. The study was updated and extended for 1994 [Polder 1997, Meerding 1998]. At the time of finishing this thesis (Spring 2001), a new study is being performed in co-operation with the National Institute for Health and Environment (RIVM). In this study COI estimates for 1999 will be constructed, including topics such as comorbidity and health care costs in the last year of life.

1.4 Objectives of COI studies and possible applications

The objectives of COI studies and their applications can be summarised under three headings: description, comparison and projection [e.g. Black 1975, Hodgson 1989, Davey 1992, Drummond 1992, Ament 1993, Rice 1994, Roijen 1997, Koopmanschap 1998, Byford 2000, and Rice 2000].

Description

The first and major objective is to identify and measure all costs of a disease.

We have seen in the above that disease-specific studies focus on one or more particular diseases, whereas general studies assign the whole health care budget to disease categories and in this way provide a kind of epidemiological description of total health expenditure. By using monetary value as a universal numerator COI studies give a summarising overview of health care utilisation and provide a single index of the economic burden of disease (BOD) complementary to other estimates based on incidence or mortality.

COI studies tell how much society is spending on one or more diseases. Some authors argue that COI studies by implication give an idea about the amount of money that would be saved if the diseases were eradicated [Byford 2000]. Although complete eradication of major diseases is unlikely, COI studies combined with information on prevention or curability of diseases can help to identify the main cost components of health expenditure as well as the areas where savings can be made. These savings, however, must be interpreted very carefully, because the eradication itself requires investments that can become quite high. Furthermore the prevention of fatal diseases likely will result in more chronic disabling conditions with high costs [Bonneux 1998].

In combination with data on effectiveness of treatment and normative views on health care and its objectives COI studies can also be used to justify the actual health care budget or expenditure on specific treatment programs for particular diseases. COI data thus provide a basis for health care policy and might assist planning of health care facilities.

COI studies furthermore provide a kind of Pandora's box that can be used and misused by numerous stakeholders. Patients' associations adopt COI figures to advocate their interests, whereas the health care industry, especially pharmaceutical companies, use COI data for marketing purposes. COI figures are then employed to demonstrate potential benefits of new drugs that are claimed to replace more expensive conventional treatment.

COI studies also provide an economic framework for program evaluation. Mainly incidence-based studies estimate baseline data that can be used to undertake more sophisticated and more expensive economic and clinical evaluations.

It is also claimed that COI figures can help policy makers to determine priorities in medical research [Black 1975]. Although cost data can not be

substituted for important other aspects, such as a knowledge of scientific opportunities, the American National Institutes of Health optimistically stated that 'COI estimates can help decision-makers in Congress and Administration anticipate and respond to public interests' [Varmus 2000, Rice 2000].

Comparison
Since more COI studies are available results can be compared. Comparisons can be made between studies performed at different periods in a particular country. In this way trends in health care costs can be studied from an epidemiological and demographic perspective. Comparisons can also be made across countries trying to trace potential differences in the prevalence of diseases and the way they are treated.

Projection
COI figures can be employed in demographic and epidemiological scenarios to make projections of future health care costs. A prerequisite is that the COI study distinguishes sufficient age and sex categories. In combination with population forecasts a demographic projection of future health care costs can be performed assuming no changes in epidemiology and health care technology. Epidemiological models such as multi-state lifetables can be used for more sophisticated projections that reckon with changes in incidence and prevalence of certain diseases. In these models COI figures can be used to calculate the consequences of the assumed developments on health expenditure.

COI studies, in summary, are primarily aiming at describing health care costs from an epidemiological and demographic perspective. Insights become better if comparisons over time and across countries are made. COI estimates can also be used in a prospective way by combining estimates for one particular year with demographic and epidemiological forecasts to project future health care costs. The results of COI studies can play an important role in more normative debates on health care and its future.

1.5 Objectives of this thesis

The objectives of this thesis are:
1. To explain the construction, application and interpretation of general cost-of-illness studies;
2. To discuss the advantages and limitations of general cost-of-illness studies with respect to the objectives of description, comparison and projection.

1.6 Outline of this thesis

This thesis contains seven chapters that, with the exception of Chapter 7, all relate to the research project 'Costs of illness in the Netherlands 1994', which was financially supported by the Ministry of Health.

Because the chapters in this thesis were designed as independent papers and are reprinted here without alterations, some overlap was inevitable, especially between Chapters 2 – 4 and 6.

Outline

This thesis consists of four parts. The focus in Part I is on general descriptions, comparisons and projections. Chapter 2 summarises cost of illness in the Netherlands in 1994. In Chapter 3 a comparison is made with the earlier study on 1988 [Koopmanschap 1991]. This chapter focuses on developments per disease category. Chapter 4 deals with the determinants of increases in health expenditure, and provides a simple projection for future health care costs.

Part II contains more detailed studies. In Chapter 5 further comparisons between 1988 and 1994 are made, now focusing on age-specific trends. These trends are demonstrated with comprehensive and detailed data on hospital admissions, interventions and length of stay per age category. Chapter 6 deals with the costs of intellectual disability, one of the disease categories with highest costs. Chapter 7 reports on the costs of treatment and rehabilitation after hip fracture. This chapter was written within the scope of a cost-effectiveness analysis in which alternative discharge policies from hospital after hip fracture were studied. Chapter 7 contains the unabridged, original paper. The implications of this study for the COI field will be discussed in Chapter 9.

In part III the COI study for the Netherlands is compared to similar studies for five other countries (Chapter 8). Part IV contains a general discussion on cost of illness given the objectives of this thesis and the findings in Chapters 2 – 8 (Chapter 9).

Part I

General descriptions, comparisons and projections

Abstract

Objectives To determine the demands on health care resources caused by different types of illnesses and variation with age and sex.

Design Information on health care use was obtained from all health care sectors of the Netherlands. Most important sectors (hospitals, nursing homes, inpatient psychiatric care, and institutions for the mentally disabled people) have national registries. Total expenditures for each sector were subdivided into 21 age groups, sex, and 34 diagnostic groups.

Setting The Netherlands, 1994.

Outcome measures Proportion of health care budget spent on each category of disease and cost of health care per person at various ages.

Results After the first year of life, costs per person for children were lowest. Costs rose slowly throughout adult life and increased exponentially from age 50 onwards till the oldest age group (95+). The top five areas of health care costs were mental retardation, musculoskeletal disease (predominantly joint disease and dorsopathy), dementia, a heterogeneous group of other mental disorders, and ill-defined conditions. Stroke, all cancers combined, and coronary heart disease ranked 7, 8 and 10, respectively.

Conclusions The main determinants of health care use in the Netherlands are old age and disabling conditions, particularly mental disability. A large share of the health care budget is spent on long-term nursing care, and this cost will inevitably increase further in an ageing population. Non-specific cost containment measures may endanger the quality of care for the old and mentally disabled people.

Key messages

1. Little is known about demands for health care outside acute sectors.
2. In the Netherlands health costs are strongly age dependent, increasing exponentially after age 50.
3. The five highest health care costs are for mental retardation, musculoskeletal disease, dementia, other mental disorders and ill-defined conditions.
4. Coronary heart disease, all cancers, and stroke accounted for only 9% of costs.
5. The main health care costs are for care not cure; costs are likely to increase rapidly in an ageing society.

British Medical Journal 1998;317:111-115.

Cost of illness in the Netherlands 1994

2

2.1 Introduction

The debate on containing the cost of health care is mainly focused on the supply side and the financing of health care [Aaron 1990]. Little attention is given to changes in population health, which is another important determinant of costs. This may be because the relation between disease and costs is not straightforward and relevant data are often lacking. We therefore subdivided total health care costs in the Netherlands by health care sector, diagnosis, age and sex to determine which illnesses and age groups have the greatest demand for care. The Dutch health care budget is ideal for this type of analysis since the country is small, more than 99% of its population has full health insurance coverage, and, because of a longstanding administrative tradition, most health care sectors have excellent registries, of which the most important are national. The completeness of Dutch health care data has enabled not only acute care sectors but also those sectors that deliver long-term care to disabled people to be included. Long-term care is rarely included in other studies [Lubitz 1995, NHS 1996, Moore 1997], which consequently underestimate the high costs of disabling disease.

2.2 Methods

We performed a prevalence-based cost-of-illness study including all direct medical costs in the Netherlands. We used data on health care costs for each care sector from the Ministry of Health for 1994 (table 2.1) [Ministerie VWS 1996]. Additional personal expenditures, such as over the counter medication and spectacles (6% of all costs) were not included.

We clustered the diagnoses of the International Classification of Diseases (ICD, 9th revision) into 34 diagnostic groups, which can be regrouped into the 17 chapters of the ICD (table 2.2) [WHO 1977]. We defined groups of diagnoses to minimise misclassification between diagnostic groups and so that each group would be large enough to describe a sufficiently large proportion of health care

costs. Conditions that could not be related to a specific diagnostic group but that are unambiguously related to a specific functional system (cardiovascular, respiratory, mental, etc.) were assigned to the remainder group of that specific ICD chapter. Ill-defined conditions which could not be related to a specific ICD chapter were classified as 'Symptoms and ill-defined conditions' (ICD chapter 16). This is particularly relevant in primary health care, where patients present with problems, not diagnoses and physicians function as gatekeepers. To avoid double counting, we have considered only primary diagnoses.

Table 2.1 *Percentage of health care budget spent on different sectors of care in the Netherlands, 1994*

Health care sector	% of total *
Hospital care	32.1
Nursing homes	8.9
Homes for the elderly	
- medical costs	3.7
- living costs	5.4
Psychiatric care	7.1
Institutions for mentally and physically disabled people	8.6
Primary medical and paramedical services (excluding dental care)	5.7
Dental care	4.0
Pharmaceutical care	8.8
Home care and other small sectors	10.4
Health care administration	5.3

* *Health care spending in 1994 was 59.5 billion guilders (£ 21.3 billion, $ 32.7 billion), 9.7% of gross national product.*

Of all health care costs, 8.1% could not be allocated to any diagnostic group because of insufficient information from some smaller health care sectors and 5.3% are for health care administration and are not related to specific health problems. Together with the living costs in homes for the elderly, these costs were assigned to non-specific health care costs.

For each health care sector we identified key variables that are representative of health care use in that sector, such as days of stay for nursing costs in hospitals and nursing homes, or outpatient visits for costs of outpatient hospital care. We divided each sector by sex, 21 age groups (0, 1 – 4, 5 – 9, 10 – 14, ..., ≥95 years), and 34 diagnostic clusters to give 1428 cells. We considered the distribution of the costs to be the same as the distribution of the key variable for that sector. Thus, for each health care sector costs for each combination of age, sex and diagnostic group were calculated as the proportion of the key variable in the relevant cell times the total costs for the sector.

Table 2.2 *Diagnostic groups used in the study and corresponding ICD-9 code*

ICD chapter		Diagnostic group	ICD codes
I	Infectious and parasitic	Infections	1-139
II	Neoplasms	Cancers	140-208
		Benign neoplasms	210-239
III	Endocrine, metabolic and	Diabetes	250
	nutritional diseases	Other endocrine diseases	240-279
IV	Blood and blood-forming	Blood diseases	280-289
V	Mental disorders	Dementia	290
		Schizophrenia	295
		Depression/anxiety	296, 300
		Alcohol/drugs	291-2, 303-5
		Mental retardation [A]	317-319, 758.0
		Other mental disorders	remainder 290-316
VIa	Nervous system	Neurologic diseases	320-359
VIb	Sense organs	Eye disorders	360-379
		Ear disorders	380-389
VII	Circulatory system	Hypertension	401-405
		Coronary heart diseases	410-414
		Heart failure	428-429
		Stroke	430-438
		Other circulatory diseases	remainder 390-459
VIII	Respiratory system	Asthma & COPD	490-496
		Other respiratory diseases	460-489, 497-519
IX	Digestive system	Dental diseases	520-529
		Gastro-intestinal diseases	531-569
		Liver, gall and pancreas dis.	570-579
Xa	Urinary system	Urinary diseases	580-599
Xb	Genital organs	Genital diseases	600-629
XI	Pregnancy & childbirth [B]	Pregnancy	630-676
XII	Skin diseases	Skin diseases	680-709
XIII	Musculoskeletal system	Musculoskeletal diseases	710-739
XIV/XV	Perinatal/congenital [B]	Perinatal/congenital dis.	740-779
XVI	Symptoms, ill-defined	Ill-defined conditions	780-899
XVII	Accidents	Falls	E880-888
		Other accidents	E800-879, E890-999
		Not allocated	
		Non-specific [C]	

A. Down's syndrome is classified in ICD chapter XV, code 758.0.

B. Hospital costs of healthy babies (boys and girls) after childbirth were assigned to pregnancy and childbirth (women).

C. Costs of health care administration and living costs in homes for the elderly.

The probability distribution of key variables was derived from sector specific registries and sample surveys. Detailed information about the registries and the key variables used is available in a report (in Dutch) [Polder 1997] and in appendix A.

2.3 Results

Total health care costs, representing 9.7% of the Dutch gross national product, were £ 1381 ($ 2124) per capita in 1994, £ 1613 ($ 2481) for women and £ 1144 ($ 1760) for men. The distribution is strongly age dependent (figure 2.1).

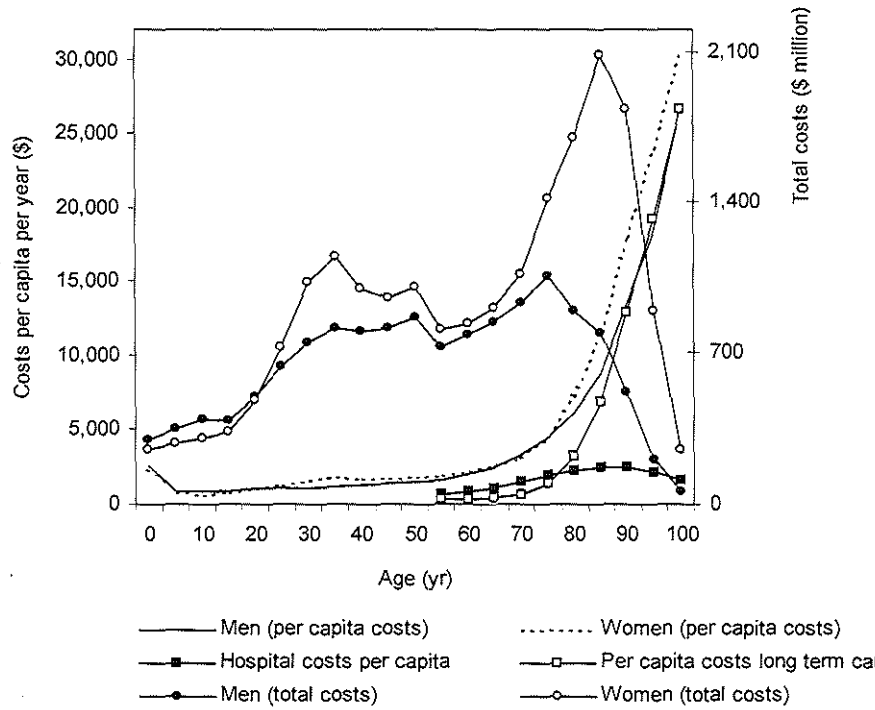


Figure 2.1 *Total and per capita health care costs by age and sex for hospital and long-term care in the Netherlands, 1994. Long-term care includes nursing homes, homes for the elderly, institutional care for disabled people, and appliances to assist disabled people. In 1994: $ 1= £ 0.65 ($1 ≈ € 0.83).*

Table 2.3 *Health care costs by diagnostic group and sex, the Netherlands 1994, ranked by share (in % of total health care costs)*

Rank	Diagnostic group [A]	Men	Women	Total
1	Mental retardation, Down's syndrome	11.0	6.0	8.1
2	Musculoskeletal diseases	5.4	6.4	6.0
3	Dementia	2.9	7.4	5.6
4	Other mental disorders	5.4	4.7	5.0
5	Ill-defined conditions	4.6	5.0	4.8
6	Dental diseases	4.9	3.8	4.2
7	Stroke	3.0	3.4	3.2
8	Cancers	3.7	2.8	3.2
9	Pregnancy	0.0	4.3	2.6
10	Coronary heart diseases	3.9	1.5	2.5
11	Neurologic diseases	2.6	2.3	2.4
12	Other circulatory diseases	2.8	2.1	2.4
13	Other respiratory diseases	2.9	1.9	2.3
14	Other accidents	2.8	1.9	2.3
15	Depression and anxiety	1.8	2.6	2.3
16	Falls	1.3	2.4	2.0
17	Gastrointestinal diseases	2.4	1.6	1.9
18	Asthma & COPD	2.4	1.2	1.7
19	Eye disorders	1.7	1.7	1.7
20	Liver, gall, and pancreas diseases	1.7	1.6	1.7
21	Skin diseases	1.7	1.6	1.6
22	Genital diseases	0.9	1.9	1.5
23	Schizophrenia	2.1	1.0	1.4
24	Urinary diseases	1.3	1.3	1.3
25	Infections	1.5	1.2	1.3
26	Hypertension	1.3	1.3	1.3
27	Diabetes	1.1	1.4	1.2
28	Ear disorders	1.4	0.9	1.1
29	Heart failure	1.1	1.1	1.1
30	Perinatal / congenital diseases	1.4	0.9	1.1
31	Alcohol and drugs	1.4	0.4	0.8
32	Benign neoplasms	0.5	0.9	0.7
33	Other endocrine diseases	0.4	0.8	0.6
34	Blood diseases	0.3	0.3	0.3
	Not allocated	7.2	8.8	8.1
	Non-specific [B]	9.1	11.7	10.7
Total		100.0	100.0	100.0
Share of men and women in total costs (%)		41.0	59.0	100.0

A. See table 2.2 for ICD codes of all diagnostic groups.

B. Costs of health care administration and living costs in homes for the elderly.

Costs are relatively high in the first year of life, reflecting the high costs of perinatal care, but than drop to the lowest levels in childhood. During adulthood costs increase slowly, and after age 50 they start to increase exponentially up to the highest age group (≥95). The higher share in total costs of women (59%) is predominantly caused by their longer life expectancy, the higher prevalence of women in nursing homes and homes for elderly people, and the high costs of reproduction (including contra-conception and diseases of the genital organs).

Table 2.3 shows the share in total costs of diagnostic groups by sex. A high proportion of health care costs are for mental disorders. Mental retardation ranks 1, dementia ranks 3, depression and anxiety ranks 15, schizophrenia 23, alcohol and drug misuse 31, and the heterogeneous remainder group of mental disorders ranks 4. All mental disorders together cover 28.4% of the health care budget that could be allocated to diagnostic groups. Ill-defined conditions, which include many psychosomatic problems, rank 5. Musculoskeletal diseases (predominantly all types of arthritis) rank 2. Dental diseases (predominantly dentists' costs) rank 6. The main causes of death –that is, stroke, all cancers combined, and coronary heart disease– rank 7, 8 and 10, respectively. Among women, costs of reproduction rank 6.

Table 2.4 shows the 15 diagnostic categories with the highest health care expenditure for five age groups. In all age groups either mental retardation or dementia is the main health care cost. In children cognitive disability ranks second but congenital diseases also cover many mentally disabling conditions. Among younger adults (age 15 – 44) the heterogeneous remainder group of mental disorders is second and schizophrenia, depression, and alcohol and drug related problems all rank among the top 15. Musculoskeletal diseases rank among the top five in all age groups after age 14, and ill-defined conditions rank among the top 6 in all age groups. In the oldest age group (≥85) stroke is second and accidental falls (predominantly hip fractures) third. All cancers reach the top five only in the 65 – 84 age group and coronary heart disease only in middle age (age 45 – 64).

2.4 Discussion

In the Netherlands health care costs are dominated by old age and by disability, particularly mental disability and musculoskeletal diseases. The amount of the health care budget spent on the main fatal diseases is relatively modest: all cardiovascular diseases and all cancers, which together cause 67% of all deaths, account for only 17% of all health care costs that can be allocated to a diagnostic group.

These results have to be interpreted with caution. Less attention should be paid to the exact share of costs spent on each separate diagnostic group than to the patterns of distribution which emerge from this data. Firstly, the key variables

Table 2.4 *Fifteen diagnostic groups* accounting for the highest percentage of health care costs for five groups, the Netherlands 1994*

	age 0-14		age 15-44		age 45-64		age 65-84		age ≥85	
Rank	Diagnostic group	%	Diagnostic group	%	Diagnostic group	%	Diagnostic group	%	Diagnostic group	%
1	Perinatal/congenital	10.2	Mental retardation	16.5	Mental retardation	9.4	Dementia	9.5	Dementia	22.2
2	Mental retardation	9.7	Other mental dis.	8.6	Musculoskeletal dis.	8.3	Stroke	6.7	Stroke	6.6
3	Other respiratory	6.3	Pregnancy	8.5	Dental diseases	6.3	Musculoskeletal	5.8	Falls	5.9
4	Other mental	6.0	Dental diseases	6.6	Ill-defined conditions	5.8	Cancer	5.6	Musculoskeletal	4.3
5	Ill-defined cond.	5.5	Musculoskeletal	6.3	Coronary heart dis.	5.0	Ill-defined conditions	4.6	Ill-defined cond.	3.7
6	Ear disorders	5.2	Ill-defined conditions	4.7	Other mental disorders	4.9	Coronary heart	4.0	Heart failure	2.9
7	Dental disorders	4.6	Schizophrenia	3.5	Cancer	4.6	Other circulatory	3.9	Cancer	2.1
8	Infection	4.0	Depression/anxiety	3.4	Depression/anxiety	3.4	Neurologic diseases	2.9	Other respiratory	2.1
9	Neurologic diseases	2.8	Other accidents	3.1	Other circulatory	3.3	Other mental dis.	2.6	Neurologic.	2.0
10	Other accidents	2.3	Genital diseases	2.3	Gastrointestinal	2.7	Falls	2.5	Other circulatory	1.7
11	Eye disorders	2.2	Skin diseases	2.2	Neurologic diseases	2.7	Asthma & COPD	2.5	Other mental	1.5
12	Asthma & COPD	2.3	Other respiratory diseases	2.0	Liver, gall and pancreas diseases	2.5	Eye disorders	2.3	Liver, gall and pancreas diseases	1.3
13	Musculoskeletal	1.9	Neurologic diseases	2.0	Hypertension	2.5	Diabetes	2.2	Eye disorders	1.2
14	Gastrointestinal	1.6	Alcohol/drugs	1.6	Asthma & COPD	2.2	Gastrointestinal	2.2	Urinary diseases	1.2
15	Skin diseases	1.6	Gastrointestinal diseases	1.6	Other accidents	2.2	Heart failure	2.1	Other accidents	1.1
% share in total costs		7.9		29.3		20.7		30.6		11.6
% share in population		18.4		46.0		22.5		11.8		1.3

* *See table 2.2 for ICD codes of all diagnostic groups.*

used to break down costs are generally not collected for epidemiological purposes, but in the Netherlands there is no financial incentive to register one diagnosis rather than another. We considered only primary diagnoses. It is beyond the limits of the method used to assign costs appropriately to the primary as well as each secondary diagnosis. Valid information about secondary diagnoses is generally lacking or incomplete. As a result, costs of diagnoses that are more often registered as secondary or tertiary, such as diabetes, are slightly underestimated. However, the registered primary diagnosis is generally the more important diagnosis for the health care sector concerned and the main reason why health care is needed –for example, what the internist calls osteoporosis, is for the surgeon a hip fracture, for the ambulance service an accidental fall, and for the nursing home a demented patient. The advantage of our method is that each guilder is allocated to only one combination of age, sex and diagnostic group, avoiding double counting.

Secondly, the key variables used to break down costs for each health care sector do not represent exactly equal amounts of resources. Not all days of stay in hospitals or nursing homes are equally expensive, some hours of care are more labour intensive than others, and outpatient visits or primary care consultations can vary in length. As a result, costs of some diagnoses may be biased. For example, because hospital nursing costs are broken down by bed days without any differentiation, costs of diagnoses for which relatively more days are spent in intensive care will be slightly underestimated and vice versa. These limitations, however, will not affect our main findings, such as the exponential increase in per capita costs by age or the heavy burden of mental disorders.

2.5 Comparability

Our study's biggest strength is its comprehensiveness. This explains why our results seem at variance with an American (Medicare) study that shows decreasing costs at the oldest ages [Lubitz 1995]. The American study did not include long-term home care for elderly people or in nursing and homes for the elderly. It is these costs which cause the exponential increase in costs in old age. Like the American study we found that costs for acute admissions in hospital decrease at the oldest ages (figure 2.1). Most of these patients are already admitted to a nursing home or are too old or too ill to consider hospital admission useful. A Swedish study, which is older and less complete, showed the same results [Lindgren 1990].

Our findings correspond to a large extent with those of our earlier study in 1988 [Koopmanschap 1991, 1994]. Studies that are more or less comparable have been published in England [NHS 1996], Australia [Mathers 1998] and Canada [Moore 1997]. These studies show basically similar cost patterns, but with lower shares particularly for mental retardation and dementia (see Chapter 8). However,

they either did not consider all health care, particularly long-term psychiatric care, or could not assign these costs to diagnoses. Apart from the degree of comprehensiveness, many other methodological and country-specific issues may cause differences in cost distributions. A serious international comparison of distribution of cost of illness would require specifically designed cross-national studies.

Our study considered only medical costs and not costs of informal care. It has been estimated that if informal care in the Netherlands was entirely substituted by professional care it would double the current costs of professional home care [Groenenboom 1995]. Informal care mainly substitutes for simple forms of professional care. If these costs had been included the total costs of chronic, disabling conditions such as dementia and musculoskeletal disease would have been even more dominant, thus strengthening our conclusions that the main determinants of health care use in the Netherlands are old age and disabling conditions.

The share of costs accounted for by fatal diseases is relatively small because care stops at death. Disability is the main reason why people use health care. The pattern of epidemiological causes of costs that we found is remarkably consistent with Murray and Lopez's estimates of the main causes of disability in the developed world. [Murray 1996, 1997]. In 1990 they estimated that mental disorders (including dementia and hereditary disorders of the central nervous system) accounted for 35.5% of life years lived with disability. In our study, the same disorders, including congenital anomalies, caused 28.4% of all health care costs that could be allocated to diagnostic groups. Musculoskeletal diseases, including arthritis and dorsopathy, caused 7.3% of the allocated health care costs, while Murray and Lopez estimated that osteoarthritis covered 6.1% of the life years lived with disability.

The costs presented here are grouped in cross sectional figures. Each age group contains people with low or no costs and those with high costs due to costly interventions, severe disability or impending death. In higher age groups more people have high costs, causing costs per person to rise. The cost distribution by age is informative, especially for societies that face a further ageing of the population. Since the distribution of costs is determined by the current prevalence of disease and disability, future health care costs will depend (among other things) on the evolution of the risk of disability and death by age.

We conclude that health care costs in the Netherlands are strongly determined by age and disability. Further ageing undoubtedly increases health care needs and costs. Talking about cost containment in health care one must be aware that large shares of the budgets are not spent on cure, but on care. Long-term care of old, frail and mentally disabled people will always be labour intensive and expensive but is the hallmark of a civilised society [Dunning 1991].

Abstract

Objective To estimate the costs of health care in 1994, the development of the costs assigned to specific diseases, and the future costs.

Design Descriptive.

Setting Erasmus University, Department of Public Health, Rotterdam, the Netherlands.

Method For each health care sector, costs were allocated to 62 diagnostic groups, age and sex making maximal use of national registries and other sources with data on health care use in the Netherlands.

Results More than 80% of the 60 billion Dutch guilders that were spent on health care in 1994 could be assigned to specific diseases. Most costs are made for non-fatal diseases like mental deficiency, dementia and musculoskeletal disease. Except for cardiovascular disease, the share of major causes of death share in the total costs was not significant. Average costs per inhabitant were low during youth and adulthood but increased exponentially with age from age 50 onwards. Between 1988 en 1994 health care costs experienced an annual growth rate of 5.2%, caused by price and wage increases (one half), ageing (a quarter) and other effects on health care costs such as epidemiological and technological change (a quarter).

Conclusions The main determinants of health care use in the Netherlands were old age and disabling conditions. Due to ageing and other influences, real health care costs in the years to come will increase by an average annual rate of 2.4%.

Nederlands Tijdschrift voor Geneeskunde 1998;142:1607-11.

Developments between 1988 and 1994

3

3.1 Introduction

The costs of health care are usually described on the basis of the national spectrum of available health care sectors. A description based instead on health care use and underlying features such as diagnosis, age and sex could therefore offer important new insights. This article describes the total costs of health care, broken down according to these three underlying variables [Polder 1997]. A comparable analysis had previously been performed for the year 1988 [Koopmanschap 1991, 1994, Roijen 1992], allowing for a comparison. In this chapter we: a) describe the health care costs in 1994 by diagnosis, age and sex; b) describe the cost development in the period 1988 – 1994 from a cost-of-illness perspective; and c) make projections of future health care costs.

3.2 Methods

We performed a prevalence-based COI-study including all direct medical costs in the Netherlands. Health care costs were broken down according to diagnosis, age and sex via a top-down method, in which 22 more or less homogenous health care sectors were distinguished of which the total costs were either known or able to be calculated [Ministerie VWS 1996]. A breakdown of these costs was subsequently made per sector with the help of distributive codes containing information on health care use according to diagnosis, age and sex. Maximum advantage was taken of the data sources available in the Netherlands, the most important of which were national in scope. Appendix A provides a complete overview of the data sources used and a detailed description of the cost allocation method applied. The costs of nursing care provided by hospitals and nursing homes were allocated based on the number of days of nursing care provided, as reported in the files of SIG Zorginformatie [LMR 1994, SIVIS 1994]. Other distributive codes included: number of consultations (general practitioner, outpatient clinic) and number of residents at reference date (homes for the elderly). The key variables were

assumed to constitute a plausible estimate of the distribution of costs. Two sectors were subjected to a more refined method. The costs of clinical procedures in hospitals were calculated via the rates charged per type of procedure. The costs of pharmaceutical care were assigned to diagnoses via the costs and number of prescriptions per drug type. Combining the data of the separate sectors together ultimately yielded the distribution of total health care costs by diagnosis, age and sex.

The division into diagnostic groups was based on the International Classification of Diseases (ICD-9) [WHO 1977]. The seventeen chapters of this classification were broken down into 62 diagnostic groups, in which death, burden of disease, economic consequences and expectations regarding future developments in epidemiology and treatment were taken as selection criteria. All costs were allocated to the primary diagnosis to avoid double counts between diagnostic groups.

3.3 Results

Costs of health care in 1994 by diagnosis, age and sex

Of the 59.5 billion guilders spent on health care in 1994, over 80% could be attributed to specific diagnostic groups. The other 20% consisted largely of costs that could not be allocated to a particular disease (health care administration, room and board in homes for the elderly) and of costs that were not yet allocable due to lacking data (home help, psychosocial assistance).

In distributing the costs across the 17 chapters of the ICD-9, a more or less similar spread was found for men and women (figure 3.1). Mental disorders were accountable by far for the highest proportion of costs, namely for 23% of the total costs (13.7 billion guilders). This included the costs of dementia (5.6%) and cognitive handicaps (8.1%). These disorders were followed by coronary heart disease (11%) and diseases of the digestive system (7.8), the latter chiefly due to the costs of dental care (2.4 billion). Cancer related costs (neoplasms, 3.9%) were surprisingly low, considering that this disease, responsible for 28% of the total mortality figure, was the second most important cause of death. Apparently non-fatal diseases, with the exception of coronary heart disease, account for the bulk of health care costs.

Health care use and costs were shown to be strongly associated with age (figure 3.2). From the first year of life until approximately the fiftieth, the average per capita costs were low, and more or less stable. They then surge rapidly upward, to over 55,000 guilders in the highest age group. Table 3.1 shows this distribution of the costs over the ICD chapters for four different age groups. The share of men and women in the total costs amounted respectively to 41% and 59%. The difference was caused by the costs of reproduction that were allocated to the mother and by the longer life expectancy of women.

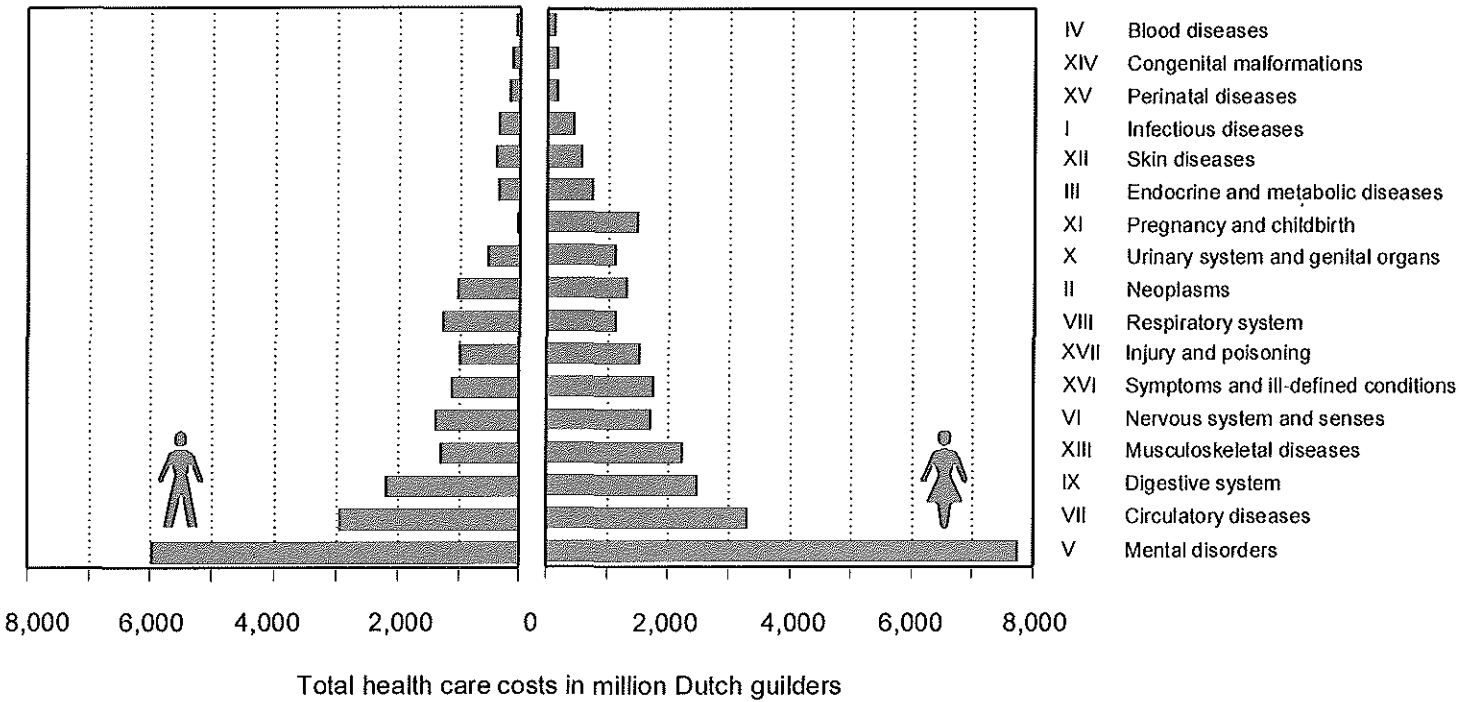


Figure 3.1 *Health care costs (million Dutch guilders) for the Netherlands in 1994 by chapters of the ICD-9*

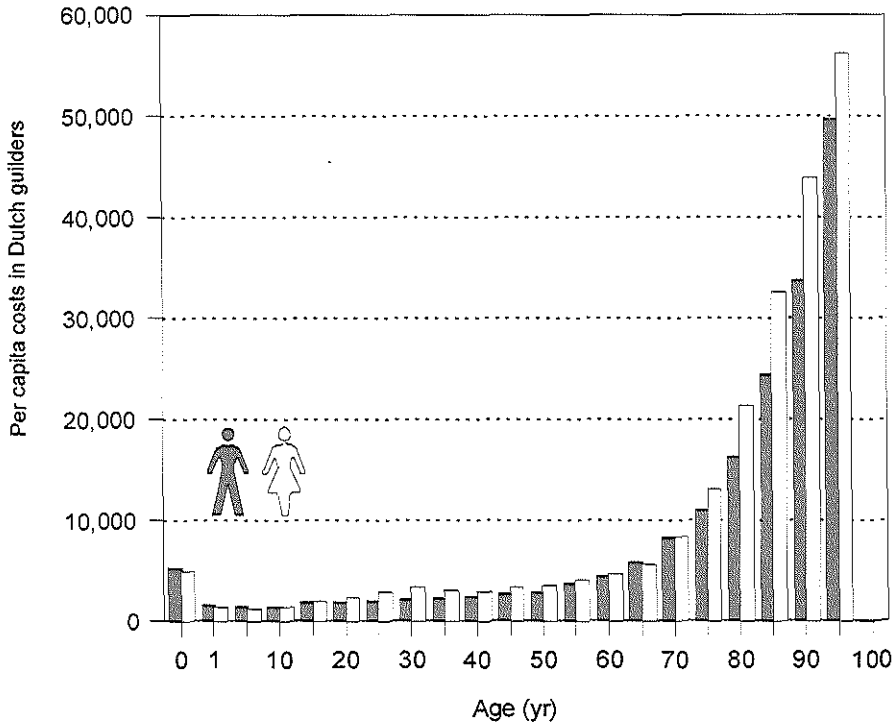


Figure 3.2 *Per capita health care costs in the Netherlands by age and sex (1994)*

Disease specific development in costs 1988 – 1994
Between 1988 and 1994, health care costs increased by an average rate of 5.2% per year. Wage and price developments were responsible for 52% of these rising costs; other causes were demographic changes (26%) and other factors (22%), including epidemiological change and technological innovations. With the help of the health care cost surveys from both years, it became possible to establish the share contributed by the different diagnostic groups to the overall rise in health care costs. For the purpose of this comparison, adjustments were made for methodological differences between both studies. Adjustment proved impossible for 3 sectors (GPs, pharmaceutical aid, homes for the elderly and part of the care provided to the disabled). These sectors were therefore not included in the description of the disease-specific development in costs throughout the period 1988 – 1994.

Table 3.1 *Health care costs (million Dutch guilders) for the Netherlands in 1994 by chapters of the ICD-9 and age (share in total costs per age category between brackets)*

ICD chapter		Age category in years								Total	
		0-14		15-44		45-74		75≥			
I	Infectious diseases	181	(3.8)	279	(1.6)	212	(1.0)	102	(0.6)	775	(1.3)
II	Neoplams	37	(0.8)	302	(1.7)	1,345	(6.6)	650	(3.9)	2,335	(3.9)
III	Endocrine and metabolic	30	(0.6)	144	(0.8)	504	(2.5)	430	(2.6)	1,108	(1.9)
IV	Blood	16	(0.3)	28	(0.2)	69	(0.3)	76	(0.4)	189	(0.3)
V	Mental disorders	740	(15.7)	5,907	(33.9)	3,579	(17.5)	3,503	(20.8)	13,729	(23.1)
VI	Nervous system and senses	469	(10.0)	699	(4.0)	1,153	(5.6)	790	(4.7)	3,111	(5.2)
VII	Circulatory system	15	(0.3)	342	(2.0)	3,285	(16.0)	2,573	(15.3)	6,214	(10.5)
VIII	Respiratory system	393	(8.4)	509	(2.9)	921	(4.5)	579	(3.4)	2,402	(4.0)
IX	Digestive diseases	317	(6.7)	1,641	(9.4)	2,106	(10.3)	595	(3.5)	4,658	(7.8)
X	Urinary and genital organs	70	(1.5)	560	(3.2)	733	(3.6)	311	(1.8)	1,675	(2.8)
XI	Pregnancy and childbirth	109	(2.3)	1,409	(8.1)	11	(0.1)	0	(0.0)	1,528	(2.6)
XII	Diseases of the skin	72	(1.5)	383	(2.2)	341	(1.7)	176	(1.0)	973	(1.6)
XIII	Musculoskeletal diseases	88	(1.9)	1,098	(6.3)	1,583	(7.7)	777	(4.6)	3,546	(6.0)
XIV	Congenital malformations	136	(2.9)	118	(0.7)	45	(0.2)	6	(0.0)	305	(0.5)
XV	Perinatal conditions	336	(7.2)	0	(0.0)	0	(0.0)	0	(0.0)	336	(0.6)
XVI	Symptoms	251	(5.3)	834	(4.8)	1,127	(5.5)	665	(3.9)	2,877	(4.8)
XVII	Injury and poisoning	167	(3.5)	668	(3.8)	704	(3.4)	980	(5.8)	2,519	(4.2)
Not allocated		714	(15.2)	1,061	(6.1)	1,592	(7.8)	1,477	(8.8)	4,843	(8.1)
Non-specific		562	(12.0)	1,428	(8.2)	1,191	(5.8)	3,159	(18.7)	6,340	(10.7)
Total		4,703	(100.0)	17,412	(100.0)	20,502	(100.0)	16,847	(100.0)	59,463	(100.0)

The costs of the following diagnostic groups increased the most: dementia (9.4%), AIDS and HIV infections (8.9%), perinatal conditions (8.7%), coronary heart diseases (8.6%), diseases of the respiratory system (7.0%), stroke (7.0%) and colorectal cancer (7.0%). Relatively little to no increase, or even a decline, was seen in the costs of: diseases of the female genital tract (-0.2%), blood diseases (1.4%), appendicitis (1.5%), traffic accidents (1.9%), eye disorders (2.0%) and inguinal hernias (2.2%).

The cost development could be interpreted for several diagnostic groups, e.g. the rising costs of dementia may be ascribed to the ageing population, of coronary heart diseases to the increased number of cardiac operations and coronary angioplasty procedures performed. In the case of other diagnostic groups, including that of diseases of the female genital tract and that of eye disorders, no explanation for the development in costs was available without further research.

Table 3.2 shows the distribution of these costs over the sectors for a number of important diagnostic groups. To safeguard reliability, this comparison was limited to major care sectors, which meant that noteworthy alterations in e.g. clinical, outpatient and day treatment were not able to be described. On the other hand, the share of the costs contributed by the hospitals as a whole underwent considerable growth for a number of diagnostic groups (musculoskeletal diseases, nervous system and senses and circulatory diseases). Conversely, care was provided for pregnancy and pregnancy-related disorders more frequently on an extramural basis. The share of the total costs for dementia accounted for by nursing homes increased significantly. This was partly due to the expansion in capacity achieved in this sector.

Projection of costs 1994 – 2035

Using the mean health care costs by age and sex, it became possible to make a demographic projection of the cost of health care in the future, assuming epidemiological steady state per age. On the basis of the CBS population forecast of 1996 (the so-called medium variant), the costs (in constant prices of 1994) would annually increase by an average of 0.9 – 1.0 % per year between 1994 and 2015, and an average of 1.0 – 1.1% per year in the period 2015 – 2035 [CBS 1997]. Next to this demographic projection, figure 3.3 also offers a projection of developments from the period 1988 – 1994. The middle line indicates the expected cost development if costs were to continue to rise unchecked by an annual 1.1 – 1.2% due to other causes. Furthermore, allowance is made in the upper curve for the difference in inflation in health care and the rest of the economy (0.3% per annum) [CBS 1996, 1996a].

In this projection, costs will experience an annual growth of 2.4% over the coming decades. This percentage is based on constant prices, to which inflation must still be added.

Table 3.2 *Share of health care sectors in health care costs of 15 major disease categories in 1988 and 1994*

Diagnostic group [A]	Share of sectors in total costs per diagnostic group								Share of diagnostic groups in total costs	
	Hospitals		Outpatient care [B]		Nursing homes		Other sectors [C]			
	1988	1994	1988	1994	1988	1994	1988	1994	1988	1994 [D]
Psychiatric conditions [E]	15.6	18.3	1.0	0.7	8.8	2.3	74.6	78.7	9.9	9.7
Musculoskeletal diseases	50.9	55.6	29.8	25.8	13.6	13.2	5.7	5.4	7.1	6.4
Intellectual disability	0.1	0.1	0.0	0.0	0.0	0.0	99.9	99.9	6.3	6.3
Dental disorders	2.2	2.0	97.8	97.9	0.0	0.0	0.0	0.1	4.6	4.8
Dementia	4.2	2.5	2.1	1.5	87.6	93.1	6.1	2.9	3.6	4.6
Neoplasms	90.1	88.6	4.6	5.2	5.2	4.5	0.1	1.7	4.8	4.6
Stroke	43.4	43.3	3.1	3.3	53.4	53.3	0.0	0.1	3.0	3.3
Nervous system and senses	51.7	53.6	5.1	7.4	32.0	28.4	11.2	10.5	3.5	3.1
Respiratory system	80.5	80.0	5.1	3.9	11.8	12.2	2.7	3.8	2.7	3.0
Pregnancy and childbirth	70.1	67.7	29.9	32.1	0.0	0.0	0.0	0.2	3.2	3.0
Coronary heart disease	94.3	96.2	1.7	1.3	4.0	2.3	0.0	0.2	2.1	2.5
Other circulatory diseases	79.5	85.0	3.1	2.9	10.6	7.2	6.8	4.9	2.4	2.7
Gastro-intestinal diseases	92.1	90.0	0.6	0.5	7.2	9.3	0.0	0.2	1.1	1.2
Perinatal conditions	99.8	99.7	0.2	0.1	0.0	0.0	0.0	0.2	0.9	1.1
Infectious diseases	61.1	65.5	2.5	1.9	9.1	9.7	27.2	22.8	0.8	0.8

A. Selection from ICD chapters and more detailed diagnostic categories

B. Dental care, paramedical care, maternity services, psychosocial assistance, home care. General Practitioners excluded

C. Psychiatric hospitals, intramural services for disabled people, prevention, transportation, and health care administration. Pharmaceutical care, homes for the elderly excluded.

D. Figures differ from table 3.1 because adjustments had been made to allow for comparison between 1988 and 1994.

E. Intellectual disability and dementia excluded.

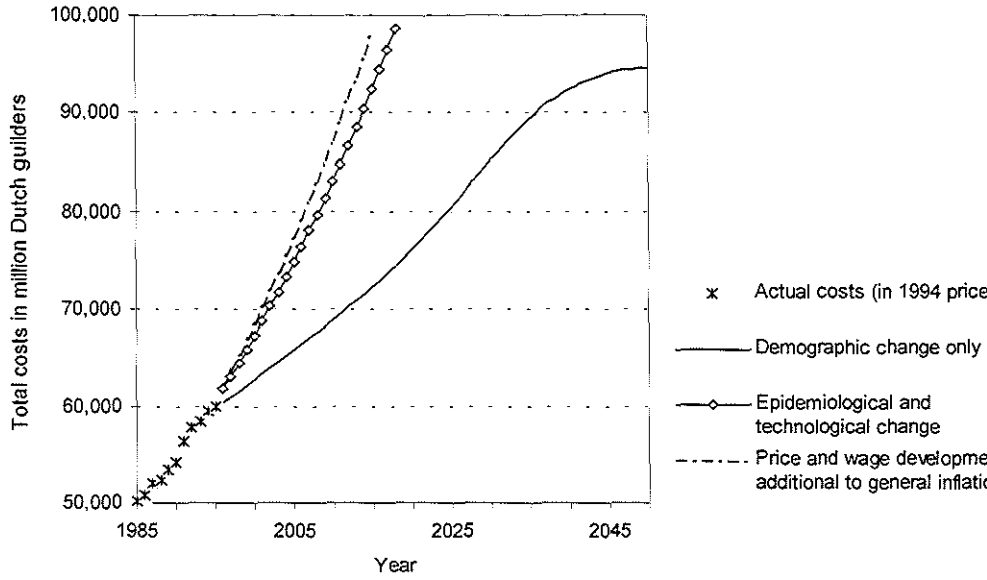


Figure 3.3 *Per capita health care costs in the Netherlands by age and sex (1994)*

3.4 Discussion

Over the past years, the economic consequences of morbidity have become the object of growing interest. A lot of disease-specific cost-of-illness studies were performed, mostly based on a bottom-up methodology. This yielded very substantial amounts that, when totalled, led to an overestimation of the total health care costs. An important cause of this is the fact that many patients, in particular elderly patients, suffer from more than a single disease at the same time (comorbidity). In this chapter we described the results from a general COI study covering the total health care budget. We used a top-down methodology based on primary diagnoses only. A coherent overview of direct medical costs was outlined for all diseases, excluding double counts and allowing for comparison.

The top-down method, however, has also some drawbacks. Because only primary diagnoses were looked at, no notice was taken of comorbidity, while this certainly plays a role in the older age groups. As a consequence the costs of some, mostly acute, diseases were overestimated while the costs for some chronic diseases were underestimated. The use of primary diagnoses further results in an underestimation of costs for diseases as for instance diabetes that are causally related to other diseases. According to the registration principles of the

International Classification of Diseases the health care use for these distant diseases is coded separately from the underlying disease.

Moreover, for the sake of completeness it was necessary, due to the fact that certain data were lacking, to make a number of crucial assumptions. In the analysis of the costs of care provided by GPs in 1994, for example, use was made of a very small data source that, lacking better data, was assumed to be representative for the Netherlands. Furthermore, when allocating the costs of outpatient care use was made of the 'Polikliniek Informatiesysteem (POLIS)' developed by SIG Zorginformatie. As this contains no diagnostic information, the consultation data per treating specialisation were allocated to the diagnostic groups on the basis of the GP referral data from 1988. It was assumed that the referral pattern for specific diagnoses of GPs to the various medical specialists had remained unchanged between 1988 and 1994. The costs of clinical nursing care in hospitals were allocated to diagnostic groups on the basis of the national medical register (LMR). This meant that no account was taken of the higher costs of intensive care (IC), as the data from the LMR did not permit this to be done. As a result the costs of particular diagnostic groups were more or less underestimated. Nor did the data on pharmaceutical drug use in 1994 provide information about the diagnosis. The costs were allocated to diagnoses by coupling data from the Drug Information Project (GIP) via the anatomical therapeutical chemical (ATC) code to the prescription data of general practitioners in 1988. It was assumed that the distribution of the number of prescriptions per type of drug over the different diagnostic groups had remained unchanged between 1988 and 1994.

The results of this study are important for analyses of the relation between health care and public health and for compiling future scenarios for expected care use. Simple projections indicate that demographic developments alone (the ageing population) will cause costs to increase around 1% annually over the coming decades. If other cost increasing factors, such as epidemiological and technological developments, are also considered, the projected real cost increase is 2.4% per year. Due to the extrapolation of historic trends and the inherent assumptions this figure is less reliable than the demographic growth rate. Even so there are no conceivable reasons for this percentage to drop markedly lower over the decades to come. After all, this growth was realised during a period in which a plethora of extensive cost control measures were implemented. If the government should nonetheless strive for an increase in health care costs of significantly less than 2.4% per year, this implies resorting to considerably more drastic measures than the cost-cutting measures hitherto taken.

Acknowledgement

This paper was presented at the annual meeting of the European Public Health Association (Pamplona, November 1997). All participants are gratefully acknowledged for inspiring discussions.

Abstract

During the past decades health care costs in all Western countries have continuously increased. An adequate health care policy must be based on realistic expectations about the development of health care costs in the years to come. In this paper some projections of future health care costs in the Netherlands are made, using cost-of-illness data for 1994, population forecasts and quantitative insight in the cost development in the past. It is concluded that Dutch health care costs will increase in future decades by an annual rate of 2.4%. This projected cost increase consists of increasing health care use due to demographic change (0.9 – 1.0%), developments in epidemiology and technology (1.1 – 1.2%) and of price and wage developments in health care which exceed general inflation by 0.3%.

International Journal of Healthcare Technology and Management 2000;2(5/6):512-522.

Trends in Dutch health care costs 1988 – 1994 – 2050

4

4.1 Introduction

During the past decades health care costs in all Western countries have continuously increased. In almost all countries government has tried to halt this development by cost containment measures. In the Netherlands, official governmental health policy has shifted from national planning to managed competition and from managed competition to a stepwise change of the health care system. However, sectoral budgeting is still the primary governance structure. In the middle of the nineties, health care costs were limited to an annual real increase of approximately 1.3%. This tight budget constraint was heavily discussed and questions raised about its assumptions. In this chapter projections of future health care costs are made using cost-of-illness data for the Netherlands in 1994 as presented in the previous chapters to contribute to a realistic growth rate considering the ageing of the population and the historical cost development.

4.2 Causes of cost increase in health care

From 1985 to 1995 Dutch health care costs increased by 40% from approximately US$ 23,000 million to US$ 33,000 million (1 US$ = ƒ 1.82, exchange rate 1994). In the same period, the share of health care costs in the Gross Domestic Product (GDP) dropped from 9.7% to 9.5% due to an economic growth that exceeded the growth of health expenditures. Figure 4.1 shows the annual fluctuations around this average development.

Increasing volumes as well as an increasing average price of delivered care determine the development of health care costs. The volume of health care consumption increases by demographic and epidemiological changes and developments in health care provision and technological change. Prices in health care are closely related to the general price level but also have their own dynamics because increases in average wages have a greater impact due to the labour intensive nature of care giving [Baumol 1993].

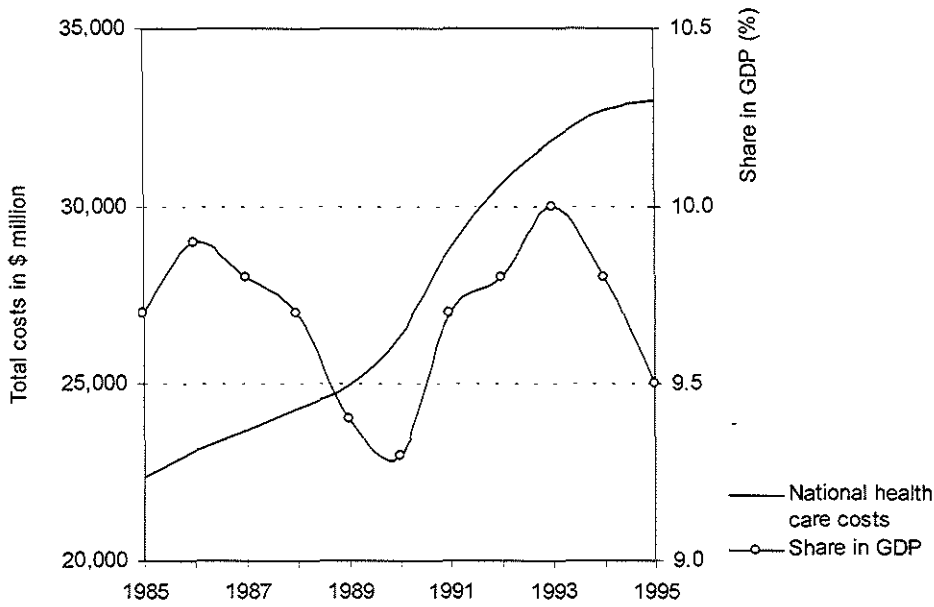


Figure 4.1 *Health care costs in the Netherlands 1985 – 1995 (total costs in US$ 1 million (current prices) and share in Gross Domestic Product in %)*

4.3 Cost of illness in the Netherlands in 1994

Projections of future health care costs require detailed information about the distribution of health expenditures by the main dimensions of health care use. General cost-of-illness (COI) studies, in which health care costs for all diseases are reported, provide this information [Rice 1994]. The projections in this paper are based on a COI study for the Netherlands in 1994 in which health care costs were subdivided according to health care sector, disease, age and sex [Polder 1997, Meerding 1998]

In 1994, total health care costs in the Netherlands amounted to US$ 32,672 million. With a population numbering 15.4 million, this amounts per capita to US$ 2,150 spent on health care. This average, however, conceals a wide variation between the different age groups. Average costs are low in youth and during adulthood but show a sharp increase from age 55 onwards toward an average of US$ 20,000 for women in the oldest age group (table 4.1).

Table 4.1 *Average health care costs per inhabitant in the Netherlands in 1994 by age and sex (US$)*

Age group	Men	Women
0	2,930	2,670
1 - 14	839	706
15 - 24	1,043	1,169
25 - 44	1,238	1,688
45 - 64	1,842	2,068
65 - 74	3,862	3,836
75 - 84	7,129	9,130
85+	15,171	20,190
Average	1,759	2,481

Exchange rate (1994): US$ 1 = f 1.82.

The distribution of costs by disease category also shows a large dispersion. Table 4.2 summarises the results for the 17 chapters of the International Classification of Diseases (ICD-9) [WHO 1977]. Most costs relate to mental disorders (23% of national health care costs) in which, according to the ICD-9, dementia (5.6%) and mental disabilities (8.1%) are included. The share of circulatory diseases and diseases of the digestive system in health care costs amounted to 10.5% and 7.8% respectively. The latter category mainly consists of the costs of dental care (US$ 1,300 million). Musculoskeletal diseases and diseases of the nervous system and the sense organs rank 4 and 5 respectively, followed by symptoms and ill-defined conditions (4.8%), injuries and poisoning (4.2%) and neoplasms (cancer, 3.9%). Most costs relate to non-fatal, chronic diseases. The major causes of death have only modest implications for health care costs, circulatory diseases excluded due to survivals from stroke and myocardial infarctions. The share of all cancers in total mortality amounts to 28% while the share in national health care costs is less than 4%.

4.4 Demography and health care costs

Demographic developments consist of changes in size and composition of the population. According to recent population forecasts the Dutch population will grow until 2035. After that year the number of inhabitants slowly will diminish [CBS 1996]. Based on an average cost of US$ 2,150 per inhabitant, the lowest curve in figure 4.2 represents the corresponding projection of total health care costs (in 1994 prices).

Table 4.2 *Health care costs in the Netherlands in 1994 by disease category (US$ 1 million, share in total health care costs (%), male/female ratio (%))*

Disease category (Chapters of ICD-9)	Health care costs		
	US$ 1 mln*	Share (%)	male/female ratio (%)
Infectious and parasitic diseases	426	1.3	46/54
Neoplasms	1,283	3.9	44/56
Endocrine diseases	609	1.9	33/67
Diseases of the blood	104	0.3	39/61
Mental disorders	7,544	23.1	44/56
Nervous system and sense organs	1,709	5.2	45/55
Diseases of the circulatory system	3,414	10.5	47/53
Diseases of the respiratory system	1,320	4.0	54/46
Diseases of the digestive system	2,559	7.8	47/53
Diseases of the genitourinary system	920	2.8	33/67
Pregnancy and child birth	840	2.6	0/100
Diseases of the skin	535	1.6	41/59
Diseases of the musculoskeletal system	1,948	6.0	37/63
Congenital abnormalities	168	0.5	50/50
Perinatal diseases	185	0.6	53/47
Symptoms and ill-defined conditions	1,581	4.8	39/61
Injury and poisoning	1,384	4.2	40/60
Not allocated	6,144	18.8	35/65
Total	32,672	100.0	41/59

** Exchange rate (1994): US$ 1 = f 1.82.*

Population ageing rather than population growth will determine the development of health care expenditures in the coming decade. The large post-war birth cohorts are getting older, which coincides with the lower birth-rate since the end of the sixties (figure 4.3). Given the steep rise of health care costs with age (table 4.1), this development has major consequences for the national health care costs (figure 4.2, second curve). This projection shows total health care costs rising to US$ 40,000 million in 2015 and to approximately US$ 50,000 in 2035 (in 1994 prices). The corresponding annual growth rate is 0.9 – 1.0% for 1994 – 2015 and 1.0 – 1.1% for 2015 – 2035.

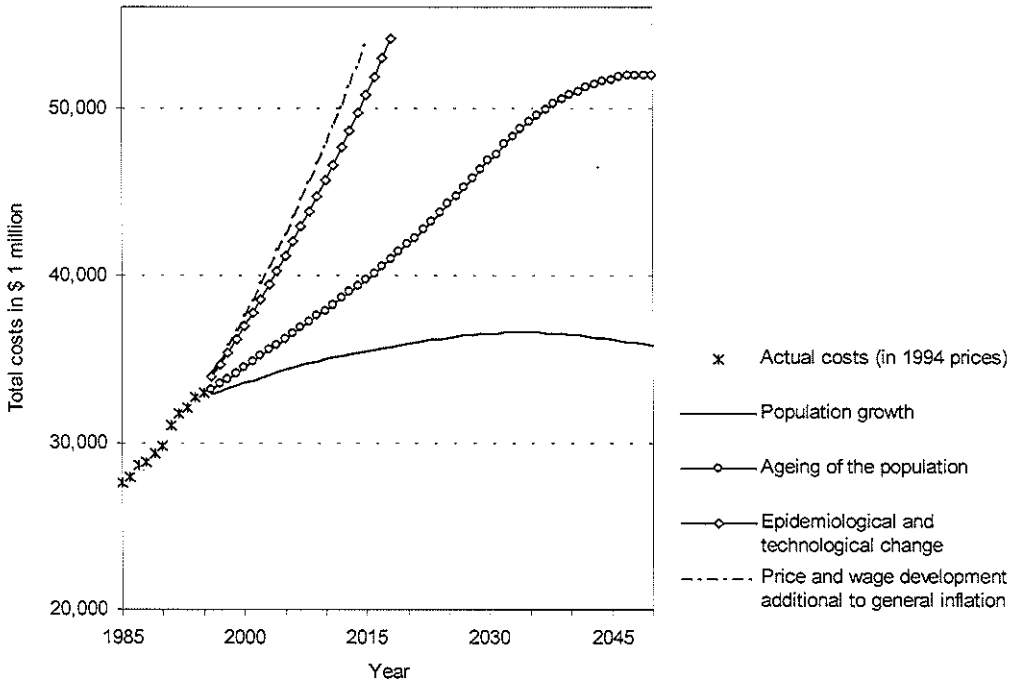


Figure 4.2 *Projections of future health care costs in the Netherlands (in US$ million, constant prices of 1994)*

Figure 4.4 shows the impact of the demographic change on the total costs per age group. For the age group 20 – 40 total costs will decrease, while from age 40 onwards the projected costs increase steeply.

The demographic cost projection is based on two important assumptions. First, the middle variant of the population forecasts is used. Although this forecast can be seen as the most likely variant, a high and a low variant are also distinguished in the Dutch population forecasts. Taking these variants into account, the projected annual growth rate of future health care costs may vary from 0.6% to 1.2% in the period 1994 – 2015 and from 0.6% to 1.5% in 2015 – 2035.

Second, average costs per inhabitant are assumed to remain constant within each age group in the future. Because the population forecast is based on the assumption of decreasing mortality, the assumption of constant average costs is not entirely correct [Beer 1997]. Some authors demonstrated that the highest

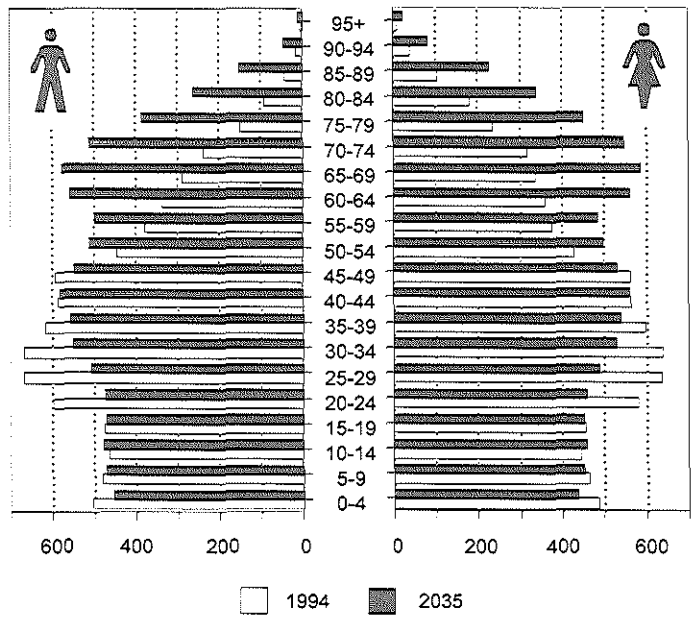


Figure 4.3 *Dutch population by age and sex in 1994 and 2035 (in 1,000 persons)*

Figure 4.4 *Demographic projection of health care costs in the Netherlands 1994 – 2035 by age (total costs in $ million)*

health care costs per unit time occur in the last year of life [Lubitz 1995, WRR 1997]. A decline of mortality in each age group, except the highest, will result in lower average costs per age group but the effect on total costs, however, is presently still unclear because average lifetime costs and costs in the last year of life are only partly available. Furthermore the costs of attaining the expected mortality reduction are not known at all.

4.5 Epidemiology and health care costs

Demographic projections are based on the assumption that the incidence and prevalence of all diseases remain constant within each age and sex group. For some diseases, however, incidence and prevalence per age group will change over the course of time. These epidemiological developments can have an enormous impact on total health care costs due to large cost differences between disease groups (table 4.2). Unfortunately, this influence can not easily be calculated. Epidemiological developments are quite uncertain in the long run. In the seventies, for instance, a surprising epidemic of heart diseases occurred that could not be fully explained until now [Mheen 1997]. Although epidemiological forecasts have been published for some diseases, the information available for epidemiological projections of health care costs is still insufficient [Ruwaard 1997].

4.6 Technology and health care costs

The relation between technological change and health care costs is complex. Cost reductions are possible by utilisation of more efficient interventions. Hip replacements and some vaccinations are the main examples. Costs can also decrease by the application of technologies that improve labour productivity and reduce the relative utilisation of highly trained expensive personnel. Day-care treatment is a good example here. In spite of these examples, however, the overall impact of technological change in health care will increase rather than decrease costs. Three major influences can be distinguished [Mheen 1997].

First, many new health care technologies can be characterised as 'half-way technologies' that reduce age specific mortality but do not cure the patients. The resulting transition from mortality to morbidity will increase costs due to the higher average lifetime costs per inhabitant [Weisbrod 1983]. The successes of treating myocardial infarctions resulted in declining mortality from coronary heart disease, but simultaneously in increasing numbers of patients with heart failure and stroke.

Second, costs increase when the patient categories that are eligible for that intervention increase. Due to refined technologies complications will decrease and

people will be treated who before would be rejected on medical indications. A well-known example concerns the transition from conventional to laparoscopic removal of the gallbladder. Because the new technology is less invasive, more patients are treated [Legoretta 1993]. The same holds for other minimal invasive treatments and especially for the decreasing numbers of contra-indications due to improvements in anaesthetic technology. As a result more people with a lower health status and relatively high health care needs survive causing a further cost increase.

Third, diagnostic improvements go faster than effective therapeutic advances. The average number of medical procedures per patient increases, resulting in higher average and total costs.

Technological change and epidemiological developments are partly correlated. Successful treatment generally leads to a better survival but often also to replacing one disease for another. Even in the case of decreasing average treatment costs total costs are likely to increase due to increasing average lifetime costs. In our projections we estimated the simultaneous influence of technology and epidemiology on health care costs using trends from the past. This was possible because cost-of-illness data were available for 1994 as well as for 1988 [Koopmanschap 1991, 1994].

4.7 Epidemiology, technology and health care costs in 1988 – 1994

Health care costs in the Netherlands increased by an average annual rate of 5.3% in the period 1988 – 1994. After correction for demographic change and developments in prices and wages a residual average overall growth rate of 1.1 – 1.2% represents the combined influence of epidemiological and technological change. The growth rates differed substantially between diseases. Costs of dementia increased more than average due to changes in health care supply. The costs of AIDS and HIV-infections increased due to expansion of the disease and the development of new expensive drugs. Costs of perinatal diseases increased due to technological change and increased treatment possibilities of children in neonatal care. New and expensive treatment options in cardiology caused a more than average increase in costs of circulatory diseases. Diseases of the female genital tract, traffic accidents and disorders of the eye experienced a less than average cost increase. The latter development was probably caused by a transition from inpatient to outpatient ophthalmic care.

Figure 4.2 (third curve) shows an estimated 1.1 – 1.2% growth rate projected on top of the demographic projection.

4.8 Wages, prices and health care costs

Until now, we have described cost projections based on developments in the volume of care. Yet developments in wages and prices also have a large impact on health care costs. About half of total cost increase in the period 1988 – 1994 was due to wages and prices. In projections of future costs, inflation is usually left out of because it is determined by the macro-economic development that can not easily be predicted. By formulating the projections in constant prices this problem is avoided. One must, however, take into account sectoral differences in inflation. In health care and other sectors where personal services are delivered prices and wages increase more than average. According to Baumol's law average costs in the service industry increase more steeply compared to other sectors in the economy because the possibilities for labour saving technologies and improvement of labour productivity are small while average wages keep more or less pace with wages in industrial sectors [Baumol 1993]. The difference between general and sectoral inflation must be incorporated in the projection of future health care costs. After all constant prices relate to current dollars and not to 'health care dollars'. The additional wage and price development for the Dutch health care sector can be calculated from national accounts and price surveys published by Statistics Netherlands [CBS 1996, 1996a]. Between 1988 and 1994, inflation was 0.3 percent points higher than the annual general inflation. The upper line in figure 4.2 represents the corresponding projection of health care costs. We opted for the trend in the period 1988 – 1994 because the other developments were also derived from this period. If a longer period is chosen, health care prices will diverge even more from average inflation (0.4 percent points for 1975 – 1995).

4.9 Concluding remarks

Changes in health care costs have many determinants. With cost-of-illness data as collected in this study, population forecasts and cost developments from the past, it is possible to make robust projections. According to these projections, Dutch health care costs will increase in future decades by an annual rate of 2.4%, apart from general inflation. This projected cost increase consists of increasing health care use due to demographic change (0.9 – 1.0%) and developments in epidemiology and technology (1.1 – 1.2%) and of price and wage developments in health care which depart by 0.3% from general inflation.

The projected cost increase is much higher than the budget allocated at the time of this study by the Dutch government (1.3% annual growth). Only an extremely stringent health policy both regarding the volume and price of health care might succeed in containing the costs within the proposed budget. One may doubt, however, the feasibility and desirability of such a policy in an affluent society such as the Netherlands at present. A more ample health care budget

would seem a more appropriate policy, especially in a humane society that cares for the old, disabled and care dependent inhabitants.

Part II

More detailed descriptions, comparisons and projections

Abstract

Background The escalating costs of health care raise questions about demographic, epidemiological and technological determinants and future projections. The objectives of this paper are to describe the age pattern of health care costs, to analyse the age-specific cost changes and to project future health care costs in an ageing population.

Methods Comprehensive cost-of-illness data for the Netherlands in 1988 and 1994 are compared by age and type of care. National data on all hospital admissions, nursing days and clinical interventions for the period 1988 – 1994 are used to describe trends in hospital care. Population forecasts are used to project the age distribution of future health care costs.

Results The distribution of health care costs per capita depends strongly on age. The growth rate of per capita costs increases by age for acute care but decreases by age for long-term care. Both combined cause an average annual growth rate of 4.6%, nearly constant with age.

Conclusions Ageing will result in increasing health care demands and costs. Secular trends in acute and long-term care indicate major shifts in costs from younger to older people and from long-term to acute care.

European Journal of Public Health (in press).

Age-specific increases in health care costs

5

5.1 Introduction

The rapid growth in health care expenditure is of increasing concern for governments and health authorities in the industrialised countries. Many factors contribute to rising health care costs: ageing of the population, the development of new therapeutic and diagnostic modalities, and the inflation of provider costs in relation to average price levels in the economy [Schneider 1990, Polder 1995, Scitovsky 1985].

Per capita health care costs are strongly age dependent [Gibson 1979, Mendelson 1993, Meerding 1998, Lubitz 1995]. Demographic increases in the number of elderly people result in higher total costs. This total cost increase is reinforced by increasing age-specific per capita costs for the elderly, resulting from the growing survival rate of frail elderly, augmenting medical technologies and expanding per capita demands [Bonneux 1998, Scitovsky 1994].

These influences are interrelated. A decline in acute coronary heart disease mortality resulting from the introduction of thrombolysis, for instance, yields a higher number of patients at risk of chronic cardiovascular disease such as congestive heart failure or stroke [Bonneux 1994, Niessen 1993]. Other improvements in medical science enlarge the potential therapeutic options for these and other elderly patients. In earlier days, general anaesthesia was a major hazard to elderly persons; nowadays major complications or death from this cause are rare events. This has opened up a whole vista of surgical possibilities, which further increases the chance of survival. Because absolute risks of disease are high among the elderly, they will potentially benefit most from risk reduction. Long-term preventive pharmacotherapy, such as antihypertensive or cholesterol lowering drug therapy, is expensive and its use among elderly persons is rapidly increasing, at least in the Netherlands [ZFR 1998].

The cycle of intertwined technological and epidemiological changes suggests that developments in health care costs depend on age, and that average per capita costs in the course of time diverge between younger and older people. Our objective is to describe the age pattern of health care costs in 1994, to analyse the

age-specific cost changes in the period 1988 – 1994, and to project future health care costs in an ageing population by the year 2015.

5.2 Data and methods

We used comprehensive data on cost of illness in the Netherlands in 1988 and 1994 [Meerding 1998, Koopmanschap 1994] In these studies health care costs are split into health care sector, gender, age and diagnosis. Data on health care costs in both years for each sector were obtained from the Ministry of Health [Ministerie WVC 1993, Ministerie VWS 1996]. Use was made of the 17 chapters of the International Classification of Diseases (ICD, 9th revision) subdivided into 62 diagnoses, and clustered age into 18 groups (0 – 4, 5 – 9, ..., 80 – 84, 85+) [WHO 1977]. For each health care sector, key variables were identified that were representative of health care use in that sector, such as days of stay for nursing costs in hospitals and nursing homes, and costs per procedure for diagnostic and therapeutic interventions in clinical and day-care settings. The probability distribution of key variables was derived from sector specific registries and sample surveys, of which the most important have national coverage of 95% and over. These studies have been described in more detail previously [Meerding 1998, Koopmanschap 1994, Koopmanschap 1991, Polder 1997], and more details are also available in appendix A.

The Dutch health care budget is particularly suitable for this type of analysis since the country is small, the health system is comprehensive, and more than 99% of the population has full health insurance coverage with registration of nearly all utilisation.

To avoid bias caused by data sources and methodological differences between both time periods and studies, only sectors with national coverage and identical methods of registration in 1988 and 1994 were compared. The present study includes acute care (general and academic hospitals) and long-term care (psychiatric hospitals, nursing homes, elderly homes and institutions for disabled people). These accounted for 60.1% of all costs in 1988 and 60.0% in 1994. It excludes general practitioners, pharmaceutical care, physical therapy, maternity services and home care. Here, the study performed for 1988 and that regarding 1994 had to use smaller samples or regional registries with varying coverage. Day-care in hospitals was partially excluded because no reliable data on 1988 were available. In 1988, however, day-care was rare, and therefore we could use 1994 data to indicate some major transitions of clinical treatment to day-care interventions. Hence, acute hospital care and long-term institutional care can reliably be compared in both periods.

We calculated average health care costs per inhabitant for both sectors (acute care and long-term care) using data on the Dutch population in 1988 and 1994 [CBS 1997]. The cost figures were corrected for inflation using the national price

indices [CBS 1996]. Changes in per capita costs were calculated as absolute differences and rates. The cost development in acute care (hospitals) was analysed in more detail using comprehensive data on all hospital admissions and interventions in 1988 and 1994 by age, sex and type of intervention. These figures were age-and sex-standardised using the sum of the 1988 and 1994 populations as reference population.

We combined Dutch population forecasts with the observed levels and growth rates for per capita costs to make projections for total health care costs in 2015 [Beer 1997]. A demographic projection was made in which per capita costs per age and sex group were multiplied by the population forecasts per age and sex group. For each age group the observed annual growth rates for acute and long-term care in 1988 – 1994 were added to make a projection that also includes the age-specific trends in health care use. All projections were based on the assumption of a constant epidemiological burden per age-sex category.

5.3 Results

Per capita health care expenditure in the Netherlands amounted to Euro 1,362 and 1,786 in 1988 and 1994, respectively (table 5.1). Total costs in current prices increased by 36.6% between 1988 and 1994. The inflation between both periods was 16.6%. The annual growth rate corrected for inflation was 2.6%.

Table 5.1 *Per capita health care costs by age and type of care, 1988 – 1994 (€), and cost increase between both years (€, index (1988=1.0))*

	Per capita costs (€)		Cost increase	
	1988	1994	absolute difference (€)	rate (1988 = 1.0)
Total health care	1,362	1,786	424	1.31
men	1,139	1,494	356	1.31
women	1,580	2,071	491	1.31
Acute care	413	540	127	1.31
men	375	497	122	1.33
women	451	582	131	1.29
Long-term care	413	532	119	1.29
men	296	383	87	1.29
women	528	677	150	1.28
Other types of care	536	714	178	1.33
men	468	614	147	1.31
women	602	812	210	1.35

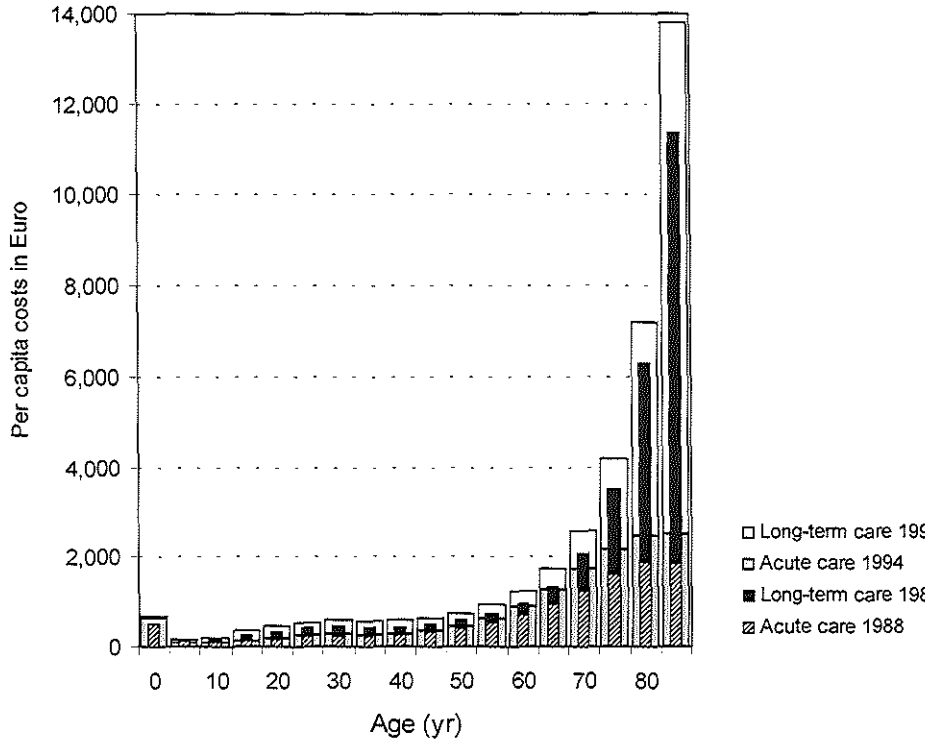


Figure 5.1 *Per capita health care costs in 1988 and 1994 by age (acute care costs and the sum of acute and long-term care in € (other types of care (see table 1) excluded))*

Table 5.1 shows changes by sex and health care sector. Sex differences in growth rates are small. Nominal cost increase of women is higher than for men due to more utilisation growth of institutionalised care, especially in the long-term care sector (nursing homes and homes for the elderly) and other care (maternity services). Unfortunately it was not possible to include the other care in the age-specific comparisons. Higher growth rates for acute care costs were seen in men.

Figure 5.1 shows the age pattern of total costs per inhabitant for acute and long-term care. Total costs are high at birth and drop to their lowest levels in youth and young adulthood. From age 55 onwards, per capita health care costs increase exponentially. The high costs at birth consist almost entirely of acute care

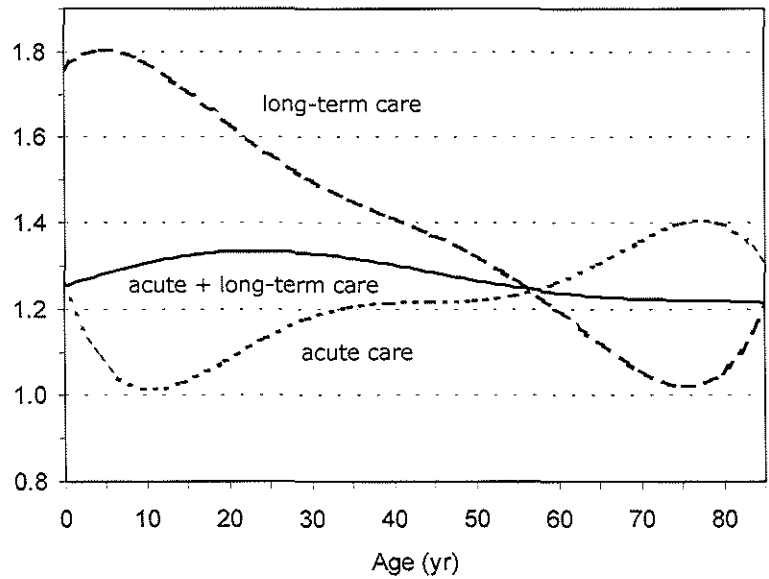


Figure 5.2 *Change in per capita health care costs between 1988 and 1994 (1988 = 1.0), by age and acute care (- - - -) versus long-term care (— —) and both (——), corrected for inflation.*

costs. In childhood acute care costs are very low, thereafter they gradually increase with age. Acute care costs reach their maximum in the age group 80 – 84, after which they decline slightly [see also Lubitz 1995, Perls 1996, Perls 1997]. Long-term care costs are concentrated in population groups with chronic conditions and disabilities, particularly people from age 75 onwards.

Figure 5.2 shows the age-specific growth rate of acute and long-term care. While the total growth rate is nearly identical for all ages, the growth rate for acute care increases with age whereas the growth rate for long-term care decreases by age. A balancing effect was observed between trends in acute care and long-term care. A lower growth rate for acute care among younger people was compensated by a higher rate of long-term care. Among the elderly, the opposite was observed. Both phenomena together resulted in a nearly stable growth rate for total costs across all ages. Depending on the absolute cost levels (figure 5.1) the importance of these trends increases by age.

The growth rate for long-term care results from higher expenditures in chronic care for younger people with disabilities and mental disorders and from relatively smaller investments in nursing home care for older people [Ministerie VWS 1996].

The investments in long-term care for disabled children most likely resulted from catching up backlogs in this sector in combination with the development of a more individualistic provision of care rather than increasing health care needs among these children.

The lower growth rate for long-term care with the older age groups results from societal choices to postpone chronic institutionalisation of the elderly for as long as possible. More disabled elderly are now cared for at lower costs in homes for the elderly or at home [Schreurs 1995]. Unfortunately home care was excluded from this comparison. Due to the observed trend, the severity of health care needs among the population in nursing homes and homes for the elderly increased on average as did the intensity of care. Furthermore a part of former professional care shifted on to informal care-givers.

The age pattern in the growth rate of acute care is mainly caused by increasing numbers of interventions at older ages (figure 5.3). At age 0 – 24 the number of clinical interventions declined by 0.7: from 4.4 to 3.7 interventions per 100 inhabitants (age standardised). The intervention rates for the age groups 25 – 44 and 45 – 64 changed only slightly. The older age groups experienced a substantial growth in clinical interventions, especially in the age group 75 – 84, where intervention rates increased from 17.5 per 100 inhabitants per year to 22 per 100 inhabitants per year (annual growth rate 3.8%).

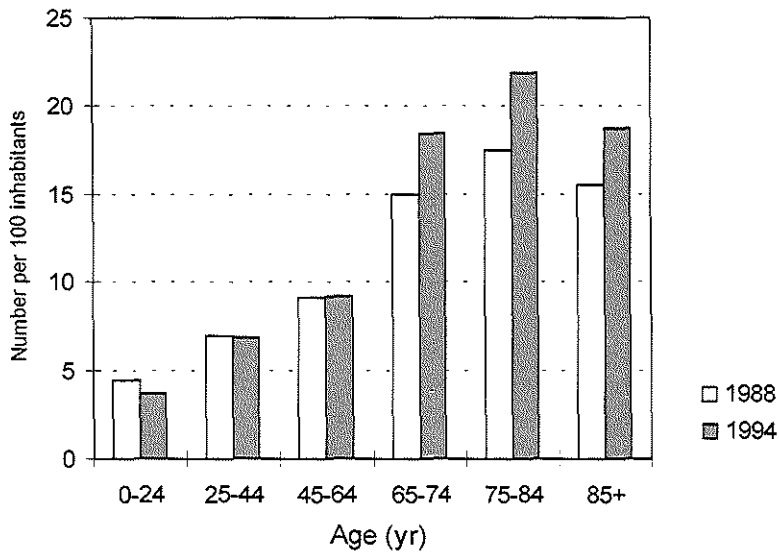


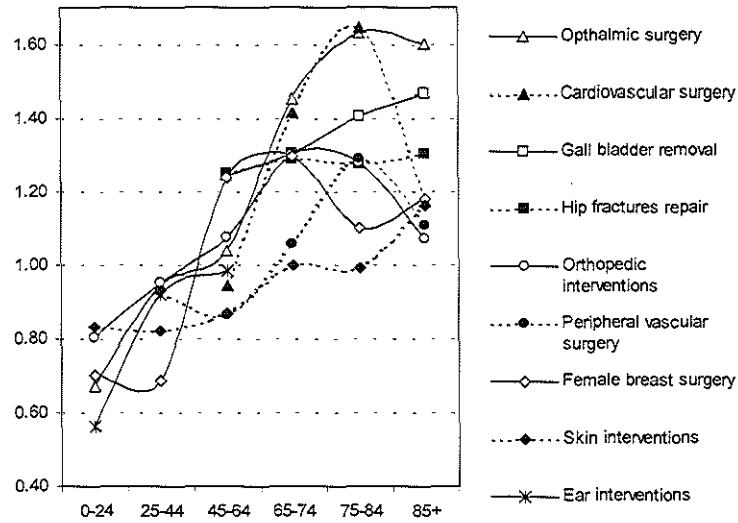
Figure 5.3 *Clinical intervention rates per 100 inhabitants by age, 1988 – 1994 (age standardised).*

Table 5.2 *Characteristics of 15 intervention groups: intervention rates in 1994 (number per 100,000 inhabitants and %), changes in intervention rates in 1988-1994 (number per 100,000 inhabitants and index (1988=1)), share of clinical interventions in total of clinical and day-care interventions in 1994 (%), average duration per admission 1988-1994 (hospital days), average costs per intervention in 1994 (€, weighed by numbers of different interventions within each group)*

Intervention group	Clinical intervention rate (age standardised per 100,000 inhabitants)					Average number of inpatient hospital days per admission		Cost per intervention (weighed average in €, nursing days excluded)
	Number in 1994	(%)	Changes in 1988-1994		Share of clinical interventions in total of clinical and day-care interventions (%)			
			Number	Index (1988=1)		1988	1994	
Group A								
Ophthalmic surgery	402	(5.1)	82	1.26	75	6.1	3.6	516
Cardiovascular surgery	181	(2.3)	26	1.17	100	13.4	12.9	3,715
Gall bladder removal	168	(2.1)	43	1.34	97	15.5	10.1	829
Hip fractures repair	156	(2.0)	34	1.28	100	26.5	20.9	1,207
Orthopaedic interventions	879	(11.0)	-1	1.00	72	12.0	9.9	614
Peripheral vascular surgery	312	(3.9)	-1	1.00	85	14.7	12.8	885
Female breast surgery	192	(2.4)	-16	0.92	83	8.2	6.6	769
Skin	258	(3.2)	-37	0.88	71	11.2	10.1	241
Ears	122	(1.5)	-52	0.70	20	6.6	4.7	698
Group B								
Childbirth	490	(6.2)	75	1.18	97	7.3	6.0	461
Tonsillectomy	135	(1.7)	-37	0.79	27	3.6	3.4	115
Male genital tract	215	(2.7)	-58	0.79	60	9.2	7.4	586
Female genital tract	374	(4.7)	-172	0.68	67	8.0	7.9	718
Appendectomy	112	(1.4)	-21	0.84	100	7.9	6.4	466
All other	3,962	(49.8)	400	1.11	71	11.9	10.1	484
Total	7,958	(100.0)	266	1.03	70	11.3	9.6	625

Group A. Interventions that contribute to higher interventions rates and costs at older ages and/or lower rates and costs at younger ages.
Group B. Interventions with decreasing rates at all ages or increasing rates at younger ages.

A. *Interventions that contribute to higher intervention rates and costs at older ages and/or lower rates and costs at younger ages*



B. *Interventions with decreasing rates at all ages or increasing rates at younger ages*

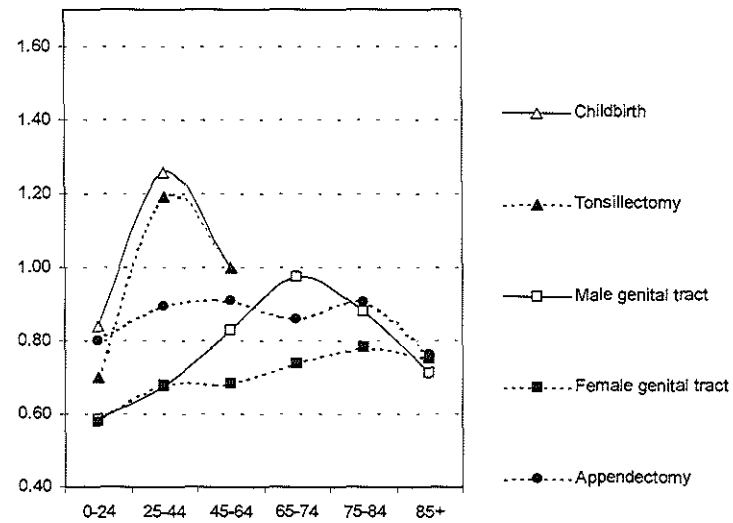


Figure 5.4 *Change in clinical intervention rates per 100 inhabitants by age and intervention group, 1988 – 1994 (age standardised, index (1988=1))*

Figure 5.4 and table 5.2 show the characteristics of the 14 most frequent intervention groups, which represent 50.2% of the total number of clinical interventions in 1994, and 60.4% of total intervention costs. The interventions can be divided into two groups. Interventions in the first group contributed to the pattern of increasing intervention rates and costs at older ages and decreasing rates and costs at younger ages in the period 1988 – 1994. Interventions in the second group do not contribute to this pattern. The first category represents 33.6% of all interventions (66.8% of the selected interventions). The intervention rates for ophthalmic surgery, cardiac interventions (CABG, PTCA and other), gall bladder surgery, and hip fracture interventions showed the strongest growth (table 5.2). With the exception of ophthalmic surgery these intervention groups belong to those medical services with the highest average treatment costs, the largest number of hospital days per admission and hardly any possibilities for day-care (table 5.2). The strong increase in ophthalmic interventions among the oldest old is caused by cataract extraction, which shifted partly to day-care. Total clinical intervention rates for peripheral vascular disease and orthopaedic conditions remained the same, with a small shift from younger to older ages. Day-care increased. Clinical costs and hospital days are average (orthopaedic surgery) or higher (vascular disease). Diseases of the skin showed a 12% decline in the total clinical intervention rate, mainly due to increased day-care treatment. Female breast surgery decreased by 8%. Figure 5.4 shows a slightly different age-pattern compared to other interventions. Due to the Dutch breast cancer-screening program for women in the age group 50 – 70 intervention rates increased most sharply in this age group [Koning 1995]. The age standardised number of clinical ear interventions declined by 30%, mainly due to myringotomy, which shifted to day-care and was partially substituted by antibiotic treatment. The resulting cost reduction among younger persons increased the slope of the age-specific acute care costs curve.

The second group consists of interventions that do not contribute to the sharper increase of interventions and costs among the elderly. This group represents 16.7% of the total number of interventions (33.2% of selected interventions). Two subcategories can be distinguished. Interventions in the first subcategory are strongly bound to younger people: childbirth and tonsillectomy. Both interventions show the same pattern of decreasing rates among the youngest age group and increasing rates among people of age 24 – 44. The number of interventions related to childbirth increased sharply (18%). The impact on total costs is substantial due to the large number of interventions in combination with moderate average costs and number of inpatient days of hospital stay. Tonsillectomy saw a strong shift to day-care, especially among the youngest age group [Wasowicz 1998]. Clinical interventions in the second subcategory decreased at all ages. Important groups are the operations on male and female genital organs. The number of clinical prostatectomies declined because transurethral prostate resections were partially replaced by day-care surgery. In

the Netherlands, the number of hysterectomies dwindled. Clinical appendectomies declined by 16% in the observed period. This development was not associated with a transition to day-care. Although the average duration of hospital admissions also declined, the cost effects remained rather modest, mainly due to the relatively low rate of appendectomies compared to other interventions.

We combined the age patterns in average costs and age-specific growth rates with population forecasts to project future health care costs in constant prices [CBS 1995, Beer 1997]. Table 5.3 shows national costs of acute and long-term care in 1994 and two projections for 2015. In the demographic projection, per capita costs of 1994 are multiplied by the population forecasts per age and sex group. In this constant-per-capita-costs scenario, national costs will increase by 1.1% per year, mainly due to the increasing number of elderly with high long-term costs. In this projection, costs will shift from the younger to the older age groups. In 1994 some 53.3% were accounted for by the age group 65+, a percentage that will rise to 59.6% in 2015.

Assuming the age-specific 1988 – 1994 trends in acute and long-term costs persist in future decades, total costs will increase by an annual rate of 2.7%, mainly due to the increasing average acute care costs among the elderly, and the increasing average long-term costs among the younger population.

Table 5.3 *National health care costs in 1994 and projections for 2015 by age and health care sector (€ 1 million, share of age groups in %, annual growth rate)*

	Age group				Total		Annual growth rate
	0 – 64		65+				
	€ 1 mln	(%)	€ 1 mln	(%)	€ 1 mln	(%)	
1994							
Acute care	4,560	(54.9)	3,742	(45.1)	8,302	(100)	
Long-term care	3,129	(38.3)	5,051	(61.7)	8,180	(100)	
Total	7,689	(46.7)	8,793	(53.3)	16,482	(100)	
2015 – I							
Acute care	5,105	(49.4)	5,232	(50.6)	10,337	(100)	1.1%
Long-term care	3,298	(31.5)	7,175	(68.5)	10,473	(100)	1.2%
Total	8,402	(40.4)	12,408	(59.6)	20,810	(100)	1.1%
2015 – II							
Acute care	6,101	(40.5)	8,977	(59.5)	15,078	(100)	2.9%
Long-term care	7,058	(51.2)	6,724	(48.8)	13,781	(100)	2.5%
Total	13,158	(45.6)	15,701	(54.4)	28,859	(100)	2.7%

2015 – I *Demographic projection*
2015 – II *Demographic projection and age-specific trends*

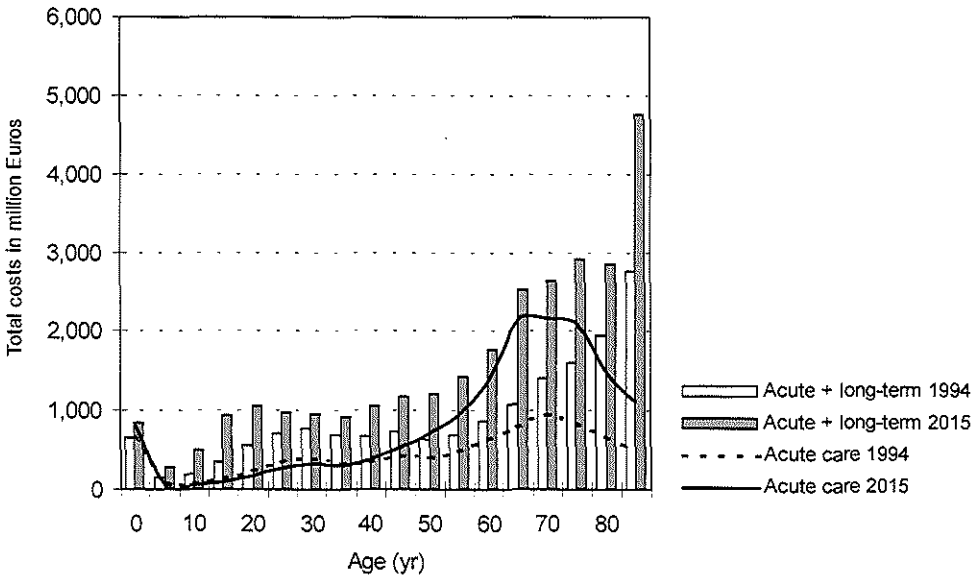


Figure 5.5 *National costs for total care and acute care by age in 1994 and projected costs in 2015 using the 1996 population forecasts and the age-specific growth rates of figure 2 (costs in € 1 million, constant prices of 1994).*

In this projection the distribution of total costs over age groups will change slightly, due to the balancing effect of the age-specific trends (figure 5.5). Of the total costs, 54.4% will be spent on the group aged 65+, due to an increasing share in acute care costs (from 45.1% in 1994 to 59.5% in 2015) and a decreasing share in long-term costs (from 61.7% in 1994 to 48.8% in 2015, table 5.3).

Because the projection of future health care costs is in constant 1994 prices, the actual monetary value in 2015 will be much higher than the figures in table 5.3. Over the period 1988 – 1994 increasing prices were responsible for more than a half of the cost increase in current prices. More important than general inflation, however, is the increase of health care specific prices. As Baumol has argued, prices in labour intensive sectors such as health care and education will rise more rapidly compared to general price levels (Chapter 4) [Baumol 1993]. This effect renders the figures in table 5.3 conservative estimates of real costs, ceteris paribus the population forecasts and the age-specific trends in intervention rates and technology utilisation.

5.4 Discussion

We described age-specific developments in per capita health care costs of acute and long-term care in the Netherlands. Our data support the idea of diverging average costs between younger and older people. A nearly constant growth rate at all ages, consisting of an increasing growth rate for acute care and a decreasing rate for long-term care is the driver for this split. Effective medical interventions apparently have different consequences at different age groups. Assuming a constant epidemiological burden by age an sex in the observed period, technological change causes a relative reduction in costs at younger age groups, which is offset by additional care for people with disabilities and psychiatric conditions. In the older age groups, technological change causes increasing numbers of interventions and a more than average growth rate for acute care, which is compensated by a less than average growth rate for long-term care.

In future decades, total health care costs will increase. Given the age pattern of per capita costs, total costs will increase due to the expansion of the elderly population. This development is reinforced by increasing health care needs of the elderly, resulting from the growing survival rate of frail elderly, augmenting medical technologies and expanding per capita demands.

The changes in the age pattern are caused by high levels of long-term care costs with a low growth rate, and the high growth rate of expensive clinical interventions particularly in cardiovascular diseases. Health care costs will not only expand but will also shift from younger to older ages and from care to cure.

The validity of these findings may be considered high, in the light of a number of important characteristics of the Dutch health care system. First, the health care system covers nearly all medical services and sectors, including homes for the elderly. Second, the sector definitions were identical for 1988 and 1994. Third, the same registry and the same case definitions were used for each sector to allocate costs in both years. Fourth, the main registries have national coverage of about 95% and higher. Fifth, the same methodology was used for the cost calculations in both years.

Because of the relatively short period of six years, no major changes are expected in the codification of medical care in either year. Because the retrospective remuneration of all health services the codification is not biased by financial incentives, as for instance DRG-based health systems are.

Notwithstanding these advantages two aspects may hamper interpretation. First, the intervention rates relate only to clinical treatment. Day-care interventions were excluded because of incomplete data for 1988, making comparison impossible. However, in 1988 day-care was rare, and the 1994 data supports the plausibility of the age-pattern found (table 5.2). Second, the analysis was based on 60% of total health care costs. General practitioners, pharmaceuticals, physical therapy and home care among some smaller sectors were excluded. Although age-specific trends could not be quantified for these

sectors, there are indications that the differences with the included sectors are rather small. The trend in long-term care costs, however, might be somewhat underestimated due to the exclusion of home care. This trend indicates a transition of institutionalised care to home care and informal care.

The age-specific trends reflect the influence of governmental health care policies. In the observed period large investments in institutionalised care for the elderly were withheld, while in psychiatric care and institutions for disabled people backlogs were removed by additional investment. The influence of health care policy on the calculated growth rate, therefore, seems to be relatively large, especially for long-term care where costs are contained by fixed budget constraints. In acute care, the Dutch government also contains costs by budget constraints, but these constraints do not apply to physicians. The physicians, therefore, have much more possibilities to influence the volume of care and the application of interventions. As a result the distribution of acute care costs is much more driven by epidemiological and technological developments.

In the Eighties the health care system left some possibilities for a more rational and frugal management, but after the cost containment policies of 1988 – 1994 much of the proliferation has been stopped and left little budgetary elbowroom. The projections, therefore, must be understood to be a conservative estimate of future costs, which can be used as a rationale for new health care policies.

It is concluded that ageing as well as technological and epidemiological changes reinforce the age pattern in health care costs. In future decades the share of the elderly in total health care costs will increase, imposing a strong responsibility on government and society for an appropriate allocation of sufficient resources.

Acknowledgement

This paper was presented at the annual meeting 1999 of the European Public Health Association (Prague, December 1999). All participants are gratefully acknowledged for inspiring discussions.

Abstract

Background Health care costs are continuously increasing and impose a strong responsibility on governments for an adequate allocation of resources among health care provisions and patients.

Objectives To describe the health care costs of intellectual disability and other mental disorders in the context of total costs of all other diseases. To determinate the future need of health care resources especially for intellectual disability and mental disorders.

Methods We performed a top-down cost of illness study comprising all health care costs of the Netherlands in 1994. For all 22 health care sectors data on health care use were obtained and used to ascribe costs to disease (62 groups), age (21 groups) and sex.

Results Costs of mental disorders are by far the largest in the Dutch health care system. 25.8% of total disease specific costs could be ascribed to mental disorders (psychiatric conditions 10.6%, intellectual disability 9.0%, dementia 6.2%). There are large differences between age-sex groups. Costs of intellectual disability and schizophrenia are higher among men; costs of dementia and depression are higher among women. The age pattern shows two peaks. The first at age 25 – 35 (intellectual disability and psychiatric conditions), the second at age 75 – 85 (dementia). Time trends between 1988 and 1994 show an average annual growth rate of 5.2% for total health care costs (psychiatric conditions 4.8%, intellectual disability 5.4%, dementia 9.4%). Demographic projections suggest a less than average cost increase for intellectual disability and psychiatric diseases (annual growth rate of 0.2% and 0.4% respectively) compared to costs of dementia and total health care (annual rate of 1.6% and 0.9% respectively).

Conclusions Intellectual disability and mental disorders represent a large part of health care use in the Netherlands. The costs will inevitably increase due to the ageing of the population and increasing life expectancy among disabled people. Non-specific cost containment measures may endanger the quality of care for vulnerable people at younger and older ages.

Health care costs of intellectual disability

6

6.1 Introduction

The care provided to people with intellectual disabilities* has received an increasing amount of attention in the past decades [Aspray 1999]. Whereas long-term residential care used to be predominant , nowadays community oriented services running on 'ordinary life' principles are gaining ground. This transition caused benefits in all areas of functioning. Social abilities, social networks and opportunities for integrated activities all increased [May 2000]. The reported costs were comparable to the costs of residential care [Howe 1998], higher [Felce 1998, Dockrell1995] or slightly lower [Knobbe 1995, Stancliffe 1998] mainly depending on the case-mix and the levels of staffing [Davies 1991, Shiell 1993].

The past decades also saw the start of the ongoing debate on cost containment. Governments in western countries were confronted with rising health care costs that in most periods exceeded economic growth. The need for cost containment gave rise to several policies to allocate health care resources in a more rational and efficient way. The debate and the policy measures focussed on the supply side of health care and their finance systems and the scope was mainly limited to specific health care sectors. However, an adequate health care policy for future decades must also have attention for the demand side and the perspective of population health. Until now, however, little note has been taken of the demographic and epidemiological determinants of health care costs. This may be because the relation between disease and costs is not straightforward, and relevant data are often lacking. We performed a cost-of-illness study for the Netherlands in 1994 and reported the results elsewhere (Chapter 2) [Meerding 1998]. The present chapter highlights the costs of intellectual disability from the perspective of total costs of all diseases and makes specific comparisons with other areas of mental health care.

---

* In this chapter 'intellectual disability' refers to 'mental handicap', 'mental retardation' or 'learning disability' (code 317-319 and 758.0 in the ICD-9) according to the terminology used by psychiatrists in the United Kingdom and the Journal of Intellectual Disability.

In this cost-of-illness study we divided total health care costs in the Netherlands by health care sector, diagnosis, age and sex, to determine the illnesses and age groups in which the demand for care is the highest. We performed our study from a health care perspective: only direct medical costs were included. The Dutch health care system is ideal for this type of analysis since the system is very comprehensive and more than 99% of the population has full insurance coverage. Furthermore, as a result of a longstanding administrative tradition most health sectors have excellent patient-based registries, most of which are national. Thus acute care but also long-term care to disabled people could be analysed. As intellectual disabilities predominantly are associated with lifelong diseases with little room for treatment, we are happy to present its costs from the perspective of population health and total health care.

6.2 Materials and methods

We used data on health care costs for each sector from the Dutch Ministry of Health for 1994 [Ministerie VWS 1996]. We clustered the diagnoses of the International Classification of Diseases (ICD, 9th revision) into 5 categories of mental disorders (intellectual disability, dementia, depression, schizophrenia and other psychiatric conditions) and 15 categories of somatic diseases (mainly chapters of the ICD-9). We defined groups of diagnoses to minimise misclassification between diagnostic groups and to ensure that each group would be large enough to describe a sufficiently large proportion of health care costs. To avoid double counting, only primary diagnoses were taken into account.

For each health care sector, we identified key variables representing equal units of health care use, such as days of stay for nursing costs in hospitals and inpatient care for disabled and elderly people, or outpatient visits for costs of outpatient care. We divided each sector by diagnoses, sex and age (5-year groups). The distribution of the costs were considered to be the same as the distribution of the key variable for that sector. Thus, for each health care sector costs for all combinations of age, sex and diagnostic group were calculated as the proportion of the key variable times the total sector costs. For some sectors with a heterogeneous health care supply, more sophisticated methods were employed, using additional variables that related costs to different types of care.

The probability distribution of key variables was derived from sector-specific registries and sample surveys. Detailed information about the registries and the key variables used is available in appendix A.

Our top-down approach and the use of cross-sectional data have some drawbacks. Without advanced modelling it is impossible to estimate costs at individual level, and the use of only primary diagnoses will result in an underestimation of underlying diseases and comorbid conditions. Furthermore our figures exclude the costs of family, informal care-givers and specialised schools.

6.3 Results

Costs by sector

The Dutch health care system is extremely comprehensive. Total health care costs in 1994 amounted to € 26,983 million, representing 9.7% of the gross national product. Average per capita costs were € 1,453 for men and € 2,049 for women. Table 6.1 summarises the distribution of costs among the different health care sectors. Hospitals represent the largest share, accounting for 32.1% of total health care costs, and 39.2% when psychiatric care is included. The costs for long-term care are also substantial. Care for people with disabilities represents 8.6% of the total budget. Several types can be distinguished. Most costs relate to the care provided to persons with intellectual disabilities and within this group the major item is that of permanent residential care.

Table 6.1 *Health care costs in the Netherlands by sector (1994). Costs in € 1 million, share in total costs (%). Capacity of major facilities in number of beds/places (absolute numbers and rate per 1,000 inhabitants (rounded to thousands).*

Health care sector	Costs in 1994		Capacity	
	€ 1 mln	%	Absolute number of beds/places	Rate (per 1,000 inhabitants)
Care for disabled people	(2,324)	(8.6)		
Intellectual disabilities				
- institutions for 24 hours care	1,430	5.3	34,000	2,1
- activity centres (9 a.m. - 5 p.m.)	266	1.0	16,000	1,0
- family homes (5 p.m. - 9 a.m.)	364	1.3	17,000	1,1
- home care and other	64	0.2	50,000	3,1
Physical and sensory disabilities	199	0.7	6,000	0,4
Psychiatric care	1,910	7.1	33,000	2,1
Nursing care	(6,308)	(23.4)		
Nursing homes	2,409	8.9	55,000	3,4
Homes for the elderly	2,445	9.1	114,000	7,1
Home care	1,454	5.4	-	-
Other health care sectors				
Hospital care	8,658	32.1	61,000	3,8
Primary care	2,940	10.9	-	-
Pharmaceutical care	2,386	8.8	-	-
All other care and administration	2,458	9.1	-	-
Total	26,983	100.0		

Activity centres (day care from 9 a.m. – 5 p.m.) and family homes (5 p.m.– 9 a.m.) are relatively modest in cost, namely 1.0% and respectively 1.3% of total health care costs. Costs for home care and other facilities for people with intellectual disabilities are low (0.2% of total costs), in absolute levels, but also in relation to the number of people that is cared for.

The figures must be interpreted with caution. In line with the transition from residential care to community care as mentioned in the introduction, the Dutch government allowed providers of disability care to substitute some provisions by other within the existing budget system. So institutions for residential care could provide ambulatory support and home care to people living at home. Hence the care for disabled people was more community oriented than the institutional cost figures suggest.

Unlike the system in most other countries, homes for the elderly in the Netherlands are included in the health care system. The total costs of these homes amount to 9.1% of health care costs, which is slightly higher than nursing home costs (8.9%). The population of the homes for the elderly consists mainly of frail elderly people, which by assumption have the same distribution of diseases and impairments as people in nursing homes, but less severe. Together with home care (district nursing) total nursing care represents 23.4% of Dutch health care costs in 1994. Primary care, pharmaceutical care and a group of all other provisions represent each about one tenth of total health care costs, and are relatively small compared to hospital care and long-term care.

Costs by diagnosis

Figure 6.1 shows the distribution of health care costs among the 17 chapters of the ICD-9. Mental disorders represent by far the largest share in total costs, at great distance followed circulatory, digestive and musculoskeletal diseases. Costs of cancer are relatively low, despite interventions with high per item costs such as surgery, radiation and chemotherapy. The main reason for these low costs is the short period of clinical care compared to the long-term nature and residential care of mental disorders. Costs for congenital diseases are low, because major groups such as Down's syndrome and fragile-X are classified as intellectual disabilities within the ICD chapter of mental disorders. As a result of the top-down character of the study using only primary diagnoses, however, the relatively high costs of heart disease among people with Down's syndrome are attributed to the ICD-chapter 'circulatory diseases'.

Table 6.2 distinguishes 20 disease categories. Compared to figure 6.1 the mental disorders have been split up into five categories (intellectual disability, dementia, depression, schizophrenia and other psychiatric conditions) while some other ICD chapters have been combined. Symptoms, ill-defined conditions and costs that could not be assigned to specific categories due to data problems were classified as 'other'. The category 'non-specific costs' consists of health expenditure without any relation to diagnosis such as expenditure on health care

administration and living costs in homes for the elderly. The disease categories are ranked from highest to lowest shares in total costs. Intellectual disabilities rank first with a share of 9.0% in total disease-specific costs. Large differences between age and sex groups exist (rank 1 among age group 0 – 64; rank 16 among the elderly). Focusing upon mental disorders, dementia ranks 5 (only ≥65, mainly women), depression has nearly the same share in total costs as all diseases of the nervous system together, and costs for schizophrenia are higher than total costs of all infectious diseases. These categories also reveal interesting sex differences: costs of depression are high among women while men have more costs for schizophrenia. This finding corresponds to epidemiological data on the prevalence of diseases [Bijl 1998, Murray 1994]. All other psychiatric diseases together rank 4, accounting for 6.7% of total costs mainly among age group 0 – 64 (rank 2). Costs of men are higher due to addiction of drugs and alcohol. From the other categories we mention musculoskeletal diseases (the only disease that appears in the top 5 of both age groups), stroke (that ranks 3 among elderly), dental abnormalities (ranks 4 among age group 0 – 64), accidents (ranks 5 among elderly, mainly consisting of falls) and respiratory diseases (nearly the same ranking across age groups, higher costs for men due to smoking-related chronic pulmonary diseases).

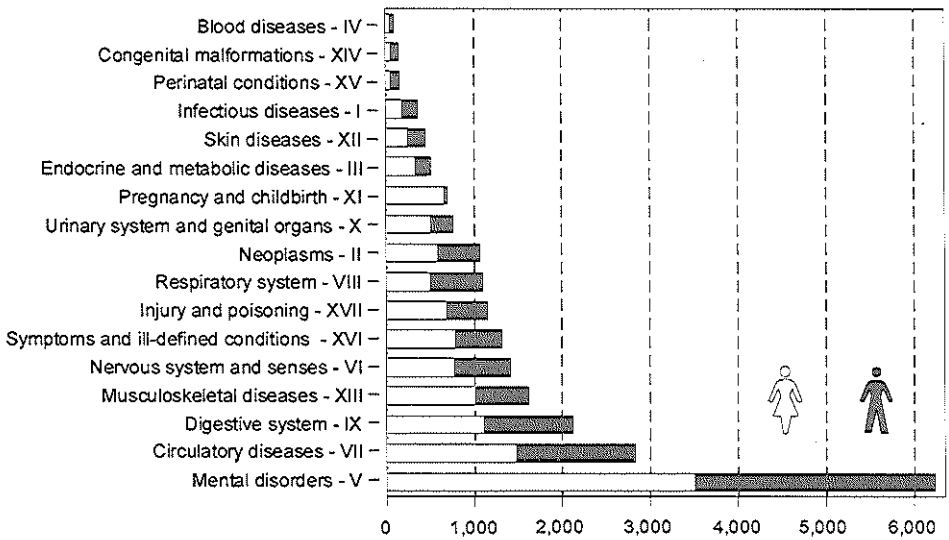


Figure 6.1 *Dutch health care costs by ICD-9 chapter and sex (1994, € 1 million, not allocated costs excluded).*

Table 6.2 *Disease specific health care costs by diagnosis, age and sex. Share in total disease specific costs per age-sex group (%), ranking from high to low costs, ranking numbers for age groups 0 – 64 and ≥65*

Diagnostic groups (ICD chapter and codes)	Whole population Share in total costs (%)	Age 0-64				Age ≥65			
		Men	Women	Total		Men	Women	Total	
		%	%	%	Rank	%	%	%	Rank
1. Intellectual disability (V: 317-319, 758.0)	9.0	17.2	11.6	14.2	(1)	1.9	1.1	1.3	(16)
2. Heart and vessels (VII: 390-429, 440-459)	8.1	7.0	4.0	5.4	(5)	16.3	10.0	12.1	(2)
3. Musculoskeletal (XIII: 710-739)	6.7	6.9	7.0	7.0	(3)	4.0	7.4	6.2	(4)
4. Other psychiatric (V: 291-316, excl. 295-6, 300.4)	6.5	10.0	8.0	8.9	(2)	2.6	3.0	2.9	(11)
5. Dementia (V: 290)	6.2	0.2	0.2	0.2	(20)	9.2	18.2	15.1	(1)
6. Dental (IX: 520-529)	4.7	6.7	6.9	6.8	(4)	2.8	1.1	1.7	(13)
7. Accidents (XVII: 800-999)	4.7	4.7	3.0	3.8	(9)	4.1	7.2	6.1	(5)
8. Respiratory (VIII: 460-519)	4.5	4.9	3.9	4.4	(7)	7.7	3.2	4.7	(7)
9. Cancer (II: 140-239)	4.4	2.7	3.9	3.3	(11)	8.6	4.6	6.0	(6)
10. Digestive (IX: 531-579)	4.0	4.4	3.5	3.9	(8)	4.9	3.9	4.2	(8)
11. Stroke (VII: 430-438)	3.6	0.9	0.6	0.8	(19)	8.0	7.7	7.8	(3)
12. Urinary and genital (X: 580-629)	3.2	1.8	4.8	3.4	(10)	3.8	2.2	2.7	(12)
13. Sense organs (VI: 360-389)	3.1	3.6	2.9	3.2	(13)	3.1	2.9	3.0	(10)
14. Pregnancy (XI: 630-676)	2.9	0.0	9.0	4.8	(6)	0.0	0.0	0.0	(20)
15. Nervous system (VI: 320-359)	2.7	2.6	2.5	2.5	(14)	3.6	2.8	3.1	(9)
16. Depression (V: 296, 300.4)	2.5	2.4	4.0	3.2	(12)	1.1	1.7	1.5	(14)
17. Skin (XII: 680-709)	1.8	2.1	2.2	2.1	(16)	1.3	1.4	1.4	(15)
18. Schizophrenia (V: 295)	1.6	3.3	1.8	2.5	(15)	0.2	0.2	0.2	(18)
19. Infectious (I: 001-139)	1.5	2.0	1.8	1.9	(18)	0.8	0.8	0.8	(17)
20. Perinatal / congenital (XIV, XV: 740-779, excl. 758.0)	1.2	2.2	1.8	2.0	(17)	0.1	0.1	0.1	(19)
All other	16.9	14.4	16.6	15.6		16.0	20.6	19.0	
Total	100.0	100.0	100.0	100.0		100.0	100.0	100.0	
Total disease specific costs (€ 1 million)	24,106	6,700	7,693	14,393		3,321	6,393	9,714	
Non-specific costs	2,877	644	589	1,233		389	1,255	1,644	

Costs of mental disorders by age and sex

Table 6.2 shows that mental disorders (ICD chapter V) represent 25.8% of total disease specific costs, with a substantial difference among large age groups (age 0 – 64: 29%, age ≥65: 21%). Figure 6.2 shows the whole age-sex picture of this ICD chapter. The costs of mental disorders are expressed as the fraction of total costs per age-sex group. The curve shows a mountain-like pattern with peaks at age 20 – 25 and 85 – 94, and the lowest point at age 70 – 74. In men aged 15 – 39, the costs of mental disorders represent more than 40% of the total costs in this group. Compared to men, the costs of mental disorders (as a fraction of the total costs) in women are 10% – 15% points lower in this age group. There are two main causes: lower costs among women for intellectual disabilities and higher total costs. Costs in 15 – 39 year women are dominated by high costs for pregnancy and childbirth

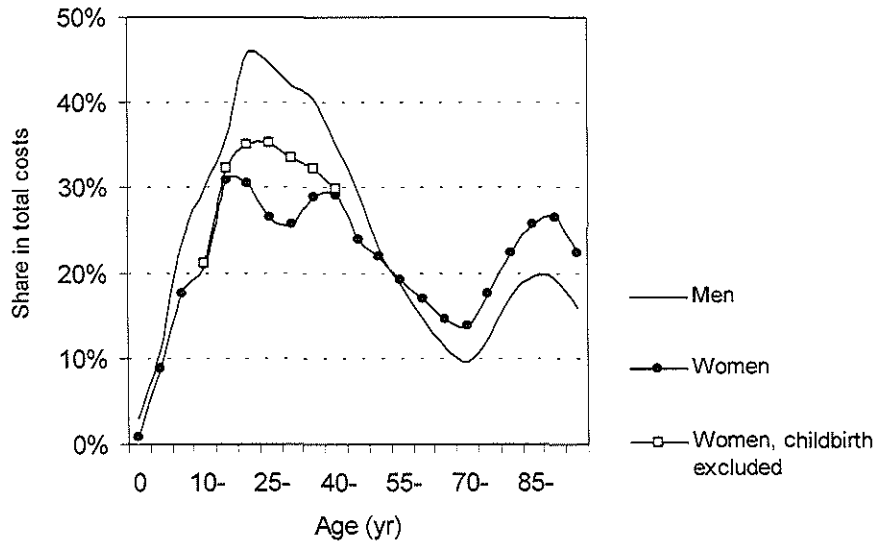


Figure 6.2 *Costs of mental disorders (ICD chapter V) by age and sex (share in total health care costs per age-sex group in %)*

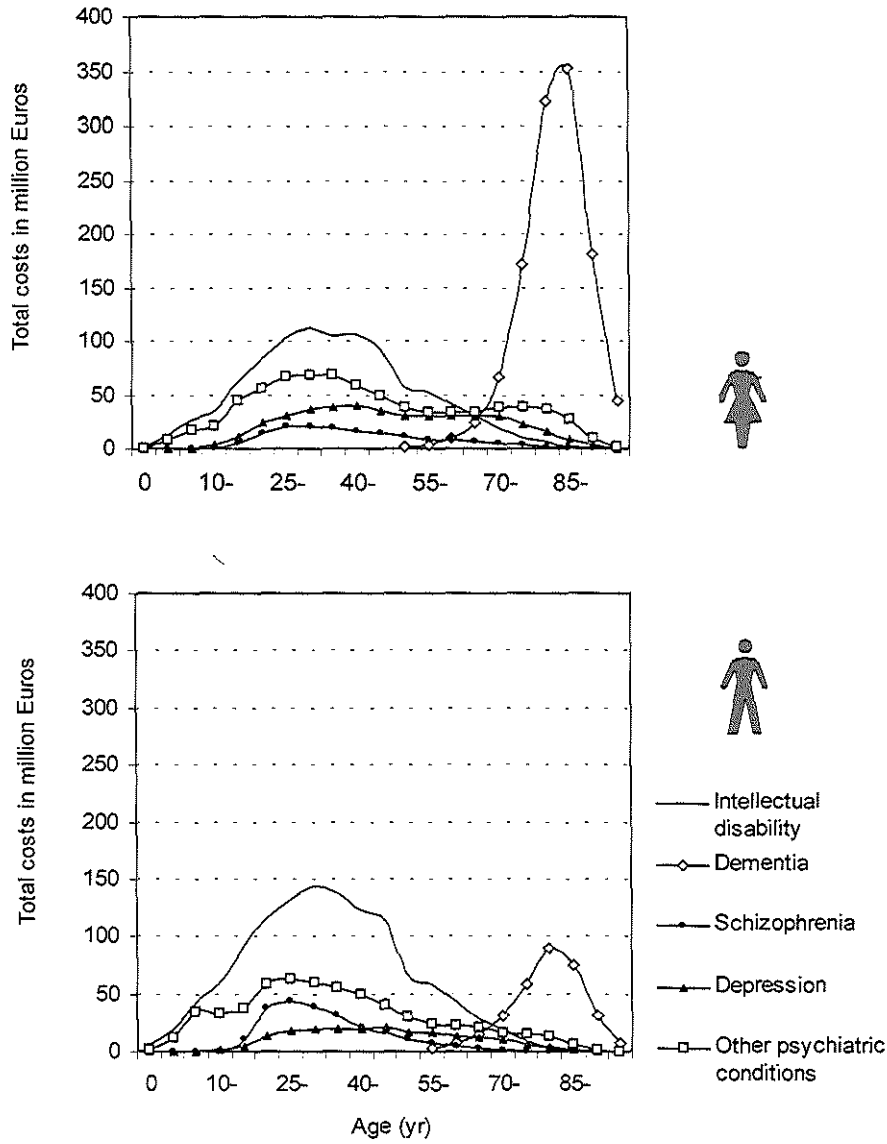


Figure 6.3 *Costs of intellectual disability, dementia en psychiatric conditions by age and sex (€ 1 million)*

which also revert the peak into a local minimum for women aged 25 – 34. Figure 6.2 reveals one more interesting difference: between the age of 0 – 49 the proportion of mental disorders is higher for men compared to women, while from 50 onwards the opposite holds. There are four reasons: 1) the prevalence of intellectual disability is higher in men; 2) women fall pregnant (high other costs at younger ages); 3) the incidence of circulatory diseases is high among men compared to women (high 'other' cost for men at age 50 – 74); 4) women get old (high costs for dementia).

Figure 6.3 gives the age-sex distribution for four specific mental disorders and a group of other psychiatric conditions. The curves affirm the higher costs for intellectual disability among men, and higher costs for dementia among women, as well as the age patterns of both diseases. The figure also shows that the higher costs for schizophrenia among men are mainly visible in early adulthood, while higher costs for depression in women show a more proportional age pattern with costs more evenly distributed among the age groups form young to old. Lastly, the curve for other psychiatric conditions shows an upward shift in costs for men at age 15 – 24 which is caused by addiction related health care.

Trends and projections

Health care costs change in the course of time. Several influences can be distinguished, related to demographic, epidemiological, technological and economic changes (Chapter 4). Between 1988 and 1994 Dutch health care costs increased by an average annual rate of 5.2% (table 6.3). The growth rate for intellectual disabilities was slightly higher (5.4%) and for psychiatric conditions slightly lower (4.8%). Dementia experienced the sharpest increase (9.4%). This growth could partly be assigned to demographic change. The annual cost increase resulting from population growth and ageing amounted to 1.5% for all diseases, with notable differences for mental disorders. The demographic growth rate for intellectual disability was lowest (0.6%) and for dementia the highest (2.4%). Compared to all other diseases the non-demographic cost increase of intellectual disabilities and dementia was quite large. This was caused by relatively large investments in care for the disabled and an increasing share of demented elderly in the nursing homes (Chapter 5).

Cost-of-illness data can be used in combination with population forecasts for projections of future health care costs [Beer 1997]. We made a demographic projection for 2015. In the period 1994 – 2015 costs are expected to increase by an annual rate of 0.9% due to demographic changes (constant prices and all other trends excluded, table 6.3). Due to the ageing of the population, the costs of diseases that are prevalent at older ages will increase more, and those of diseases at younger ages will increase less. Our projections show an annual increase of 1.6% for dementia and 0.2% for intellectual disability. For psychiatric diseases, we projected an annual cost increase of 0.4% which is also lower than for the somatic diseases (1.0%). As a result, the share of dementia in total cost of illness will

increase, while the amounts accounted for by intellectual disabilities and psychiatric conditions are expected to decrease. The sex distribution changes slightly to higher costs for men.

Our demographic projections neglect increasing life expectancy. We assumed that costs for each combination of age, sex and disease group remain constant and multiplied these figures with changing cohorts in the population forecasts. As result of this method, future costs are underestimated. The costs of intellectual disability, in particular, are underestimated because life expectancy in this group continues to rise relative to the remainder of the population. The effects of longevity could be analysed using specific life-tables for this population. The cross-sectional static character of the cost data, however, likely causes problems here. Given the high prevalence of heart diseases in elderly people with Down's syndrome, the static costs data would underestimate the real costs also in a scenario with increasing life expectancy. In fact, longitudinal data for the costs in the last year of life are needed.

Table 6.3 *Cost increase of mental disorders and all other diseases. Nominal and demographic development between 1988 and 1994, projection for 2015 (annual growth rate in %)*

	Annual growth rate (%)			Share in total costs (%)	
	1988 – 1994		1994 – 2015		
	total	demo*	demo*	1994	2015
Intellectual disability	5.4	0.6	0.2	9.0	7.8
Men	5.5	0.6	0.2	(55.9)	(55.8)
Women	5.1	0.7	0.2	(44.1)	(44.2)
Psychiatric diseases	4.8	1.3	0.4	10.6	9.6
Men	5.3	1.2	0.4	(46.2)	(45.4)
Women	4.4	1.3	0.5	(53.8)	(54.6)
Dementia	9.4	2.4	1.6	6.2	7.2
Men	10.2	1.6	2.3	(21.5)	(25.0)
Women	9.2	2.6	1.4	(78.5)	(75.0)
All other diseases	5.0	1.6	1.0	74.2	75.4
Men	5.1	1.3	1.3	(41.0)	(43.3)
Women	5.0	1.7	0.8	(59.0)	(56.7)
Total health care	5.2	1.5	0.9	100.0	100.0
Men	5.3	1.3	1.1	(41.7)	(43.2)
Women	5.2	1.7	0.8	(58.3)	(56.8)

* *demo = demographic*

6.4 Discussion

In the Netherlands a large share of total health care costs deals with mental health care (25.8%). Five groups can be distinguished: intellectual disability, depression, schizophrenia and other psychiatric conditions (all at younger ages), and dementia (at old age).

The Dutch health care system is very comprehensive and due to the availability of national registries containing data on health care use, all medical costs were included in our study and nearly all costs could be assigned to disease categories. This is important for the mental disorders which have much lower costs in other studies, partly because the specific types of care does not exist at all, are not seen as a part of the health care system, or are excluded from van cost-of-illness analysis due to data problems [Lubitz 1995, Moore 1997, Mathers, 1998]. As a result, international comparisons of cost-of-illness data, especially for mental disorders, are difficult to interpret. An advantage of our data is that costs are incorporated, which are more or less hidden in other countries. In an international context, therefore, our figures can be interpreted as an estimate of the share of mental disorders in total health care costs if the system is as comprehensive as the Dutch is.

We performed our study from a health care perspective. Only direct medical costs were included. From a societal perspective, costs of informal care and indirect costs are also important [Drummond 1997]. Indirect costs relate to expenditure on specific schools as well as to productivity losses due to illness and disability. For mental disorders, especially intellectual disability and some psychiatric conditions, these costs will be very high, especially if the estimates are based on the human capital approach. Although the appropriateness of calculating productivity losses for people who are not expected to have paid work during their whole life is disputable, it is clear that the social burden of intellectual disability exceeds the cost estimates in this paper, particularly when non-economic aspects are included.

General cost-of-illness studies are based on a top-down methodology using cross-sectional data on primary diagnoses. There are several problems here. First, it is difficult to detect some kinds of intellectual disabilities as for instance fragile X and Turner syndromes. Costs can be underestimated if diagnoses are not properly classified. Second, many people with Down's syndrome develop serious heart and renal diseases as well as dementia caused by vascular disorders. Due to the top-down approach hospital costs for Down's syndrome are underestimated since these costs are allocated to the somatic diseases that were responsible for the hospital admission. Third, more in general mental disorders are classified as secondary diagnosis if people also suffer from somatic diseases. As a result all costs are allocated to the somatic disease. Fourth, mental disorders can delay the recovery from somatic diseases. In these cases health care costs increase, but are still attributed to the somatic disease according to primary diagnosis.

Due to the cross-sectional approach, costs can not be related to individual persons, but only to all persons within a specific disease-age-sex group. Although lifetime costs can be estimated using the figures per age-sex combination in life-tables, a real dynamic analysis of, for instance, the costs in the last year of life is not possible. Such analyses require longitudinal data on individual persons.

Our study is also static in another way. We used data on health care use in one particular year. In demographic projections, the cost-of-illness figures are extrapolated according to population forecasts. These projections are based on two important assumptions. First life expectancy is assumed to be constant over time. The future costs for intellectual disability are underestimated because life expectancy among this population continues to rise more. Second, health care use per individual in a particular disease-age-sex group is assumed to remain the same. This is a bold assumption. A detailed analysis of the changes in cost of illness in the period 1988 – 1994 revealed major trends in health care costs that could be attributed to developments in health technology and health care policy (Chapter 5). These developments will, in some way or another, also influence future health care costs. If the trends in long-term care persist, the costs of intellectual disability will increase above average rather than below average, as was indicated in the demographic cost projection. The care for the intellectually disabled, however, is undergoing fundamental change. Each cost projection, using either static figures from a certain year, or trends from a period in the past, must therefore be interpreted with care.

We conclude that costs for mental disorders in general and intellectual disability in particular, represent a large share in the health care cost of civilised countries. In times of rapidly changing health care services the scarcity of resources imposes a strong responsibility upon society for an efficient and fair distribution of resources among health care services and patients. Long-term care for disabled and old people will always be labour intensive and thus expensive. It is also the hallmark of a civilised country.

Acknowledgement

Professor Luis Salvador Carulla and participants of the workshop on 'Health Economics and Mental Retardation' at the second European Congress on Mental Health and Mental Retardation (London, September 1999) are gratefully acknowledged for inspiring discussions.

Abstract

It is widely assumed that health care costs can be reduced considerably by providing care in appropriate health care institutions without unnecessary technological overhead. This assumption has been tested in a prospective study. Conventional discharge after hip fracture surgery was compared with an early discharge policy in which patients were discharged to a nursing home with specialised facilities for rehabilitation. We compared costs for both strategies from a societal perspective, using comprehensive and detailed data on type of residence and all kinds of medical consumption during a 4-month follow-up period.

As expected, early discharge reduced the hospital stay (with 13 days, p=0.001). More patients were discharged to a nursing home (76% versus 53%). Total medical costs during follow-up were reduced from an average of € 15,338 to € 14,281, representing relatively small and not significant savings (p = 0.3). There are two explanations for this unexpected result. First, hip fracture patients were relatively cheap while in hospital. Hence nursing home costs almost equalled hospital costs per admission day. Second, compared to the conventionally discharged group early discharged patients received more medical procedures during the first post-operative days. We conclude that: 1) early discharge shifted rather than reduced costs; 2) the details of costing have a major influence on the cost-effectiveness of alternative discharge policies.

Costs after hip fracture | 7

7.1 Introduction

Health technology assessment (HTA) is employed to optimise medical treatment in an economic way. Distinction is made between cost-effectiveness analysis (CEA) and cost-minimisation analysis (CMA). CEAs deal with the question whether new or additional treatment provides value for money compared to conventional treatment. CEAs have been applied in the fields of prevention and treatment by comparing costs and effects for alternative medical procedures and pharmaceuticals. In CMAs it is studied to what extent less intensive treatment is worthwhile regarding medical outcomes. It is assumed that optimising the chain of care can reduce health care costs, for instance by replacing more expensive health care institutions with cheaper ones, without worsening medical outcomes. We performed a prospective study to compare the societal costs of a conventional discharge policy after hip fracture repair with the costs of an early discharge policy in which patients were rehabilitated in a specialised nursing home as example of a CMA.*

Hip fracture incidence rises exponentially with age. All over the world ageing has important consequences for costs of treatment and rehabilitation [Melton 1993, 1996, Boyce 1985, Laet 1996, Johnell 1996, Hollingworth 1995]. The rehabilitation process is focussed in the first 4 months after hip fracture repair with estimated costs of around US$ 11,000 per patient [Cameron 1994, Borquist 1991]. Since a substantial part of these costs (50%) is made in the orthopaedic department of the hospital several strategies have been described to shorten hospital stay [Borquist 1991]. These strategies include joint orthopaedic-geriatric rehabilitation [Murphy 1987, Kennie 1988] and hospital-at-home schemes [Pryor

* This chapter is based on the paper 'Early discharge from hospital after hip fracture does not reduce societal costs' and belongs to a set of publications based on a clinical trial in which the benefits and costs of early discharge after hip replacement were assessed. The present chapter highlights the main findings of that study from a general economic perspective. In Chapter 9 the meaning and implications of these findings for cost-of-illness studies will be discussed.

1988]. Because functional outcome is expected to be similar, cost-effectiveness of early discharge depends on costs, and boils down to cost-minimisation.

Shortening the length of the hospital stay could be expected to generate substantial cost savings, even with a similar total stay within institutions such as nursing homes and homes for the elderly, because of the higher costs per hospital day. Early discharge is also attractive because it provides possibilities for reducing backlogs and the waiting period for hip surgery. Potential drawbacks of early discharge, apart from medical outcomes, regard an unjustifiable shift to informal care and high capacity costs for the continuous availability of nursing home beds.

Although several prospective studies reported the costs of hip fracture, few described the consequences of a change in treatment program [Cameron 1994, Farnworth 1995, Hollingworth 1993, and Strömberg 1997]. We compared the costs between a conventional discharge policy and a strategy in which patients were discharged earlier to a nursing home after day five of admission, if medically possible. We checked for equivalence of medical outcome in terms of functional status and cognitive performance. Costs were studied in detail, since there are indications that costs are highest during the first post-operative days, and decrease thereafter [French 1995]. Using average charges or even average costs per hospital day would lead to an overestimate of the real costs per hospital admission, and by consequence to an overestimation of potential cost savings.

7.2 Data and methods

We performed a prospective study in a university and a general hospital in Rotterdam, the Netherlands. A "before and after" study design was chosen. Randomisation of patients was not considered feasible since the change from conventional discharge to early discharge arrangements required such organisational adjustments that both service models could not be offered simultaneously.

Patients, procedures and medical outcomes

Between October 1996 and October 1998 we invited for participation in both hospitals all patients, aged 65 years and older, with a fresh hip fracture. Excluded were patients with a hip fracture due to metastatic cancer or as part of a multi-trauma. The first 130 eligible patients formed the conventional discharge group of which 102 patients (78%) consented to participate in the study. Early discharge was proposed to the next 124 eligible patients, of whom 106 (85%) consented to participate. There were no clear differences in age and sex between participants and non-participants although slightly more non-participants lived at home before admission (85% versus 60%).

Patients with conventional discharge stayed in hospital till rehabilitation was finished. The treatment consisted of physical therapy, which was given two times

per day by the hospitals' physical therapists under supervision of the ward physicians. Early discharge was implemented by a discharge protocol that started five days postoperatively. Administrative procedures were speeded up and the number of beds available on the rehabilitation ward of the participating nursing home was increased. Physical therapists, occupational therapists and social workers were involved in the rehabilitation process, supervised by a physician trained in geriatric medicine.

Clinical equivalence was checked for functional outcome and cognitive status using the Rehabilitation Activities Profile (RAP) and the Mini Mental State Examination (MMSE) [Bennekom 1995, Folstein 1975]. The RAP is based on the International Classification of Impairments, Disabilities and Handicaps (ICIDH) and measures disabilities in communication, mobility and personal care.

Costs: methods

Costs were studied from a societal perspective using a bottom-up methodology [Drummond 1997]. First, real costs were estimated based on a detailed measurement of investments in manpower, equipment, materials, housing and overhead. Fees and charges were only used in case of uncommon interventions and standard laboratory analyses. Second, all medical costs were included as well as the costs borne by the patient and the family, for instance costs of informal care and travelling. Costs of absence from work and related productivity losses were not taken into account, because all patients were old and retired from work.

Costs were calculated for the participating centres only. Hospital costs were estimated separately for a general and an academic hospital. Only one nursing home participated in the study. This nursing home had the disposal of a specialised rehabilitation ward with 30 beds. Because this ward existed already when our study started, we did not consider the investment costs of such a specialised rehabilitation ward. All capacity related costs were allocated to bed days using the real investments in the past and annual production figures. These figures included the occupation of nursing home beds. So the availability costs of these beds were discounted in the average costs per inpatient day.

We calculated integral costs per patient. All medical costs during a certain period were included, although from a differential point of view – comparison of the two discharge strategies – some items were not relevant. For these items, including the hip replacement itself, we used charges instead of real cost estimates.

We distinguished six categories of care (table 7.1): 1) inpatient days (in hospitals, nursing homes and elderly homes); 2) nursing (in hospitals, nursing homes and at home); 3) health practitioner activities (physicians, therapists and other); 4) medical procedures (therapeutic, diagnostic and laboratory); 5) travelling (ambulance, taxi and other); and 6) informal care and other costs as meal service at home and adjustment of the housing conditions.

Table 7.1 *Cost categories and data used in cost calculations*

Cost category	Parameter	Data collection volume of care*			Cost estimate (unit price)
		H	S	Q	
Inpatient days					
Hospital	days		*		real costs
Nursing home	days		*		real costs
Home for the elderly	days		*		real costs
Care					
Hospital	minutes		*		real costs
Nursing home	minutes		*		real costs
Home care	minutes			*	real costs
Health practitioners					
Physician (inpatient)	minutes		*		real costs
Physician (outpatient)	visits		*		real costs
General practitioner	visits			*	fees
Physical therapist	minutes		*		real costs
Psychologist/social worker	visits		*	*	real costs
Other health professionals	visits		*	*	fees
Medical procedures					
Hip replacement	number by type (3)		*		charges
Other therapy	number by type (30)	*			charges
X-ray hip	number		*		charge
X-ray thorax	number		*		charge
Other radiology	number by type (30)	*			charges
Laboratory	number by type (125)	*			charges
Travelling					
Ambulance	rides			*	charge
Taxi	rides			*	charge
Other	rides			*	real costs
Informal care and other costs					
Informal care	minutes			*	shadow price
Day care (hospital)	number			*	charge
Day care (nursing home)	number			*	charge
Other costs	various			*	various

* *H = hospital registry, S = study registry, Q = questionnaire*

Costs were estimated for a 7-month period, 3 months pre-operatively and 4 months post-operatively. We distinguished seven periods based on the location of the patient: 1) before hospital admission; 2) from admission to day five after hip surgery; 3) from day 6 until discharge form hospital; 4) nursing home; 5) elderly home; 6) home; 7) readmission to hospital or nursing home. For each period we calculated total costs per patient for the six categories mentioned before.

Costs were calculated by multiplying the volumes of health care use with the corresponding unit prices and are reported in 1998 Euros. Discounting was not relevant because of the limited time horizon.

Costs: volume of health care use

The volume of health care was observed in much detail. A research assistant registered for each patient the number of inpatient days, the time needed for nursing, care and therapy as well as the time spent by physicians and other health practitioners per admitted patient. Nursing time was registered in the patient files by the nurses in the hospitals and the nursing home. The research assistant took care of the completeness of the data. She also interviewed all caregivers about their time investments per patient and furthermore registered the type of hip surgery, the number of X-rays and the number of outpatient visits to physicians and general practitioners. Detailed information on medical consumption in hospital was derived from the hospital information systems of the participating hospitals. These data included medical interventions other than hip replacement (30 categories), radiology (30 categories) and laboratory analyses (125 types). Data on nursing time and costs of home care were obtained from the largest provider covering 65% of the included patients. Data on outpatient care were collected by questionnaires.

Medical consumption in hospital and nursing home was registered on a daily basis. Discharged patients were visited by the research assistant one month after inclusion and at the end of the follow-up period. She assisted the patients with questionnaires on medical consumption. If needed, for instance because demented people could not answer the questions, the research assistant gathered information from personnel in the nursing home or elderly home in which the patients lived, or otherwise from the relatives of patients at home.

Costs: unit prices and cost calculation

Unit prices for inpatient days were estimated as real, basic costs per day using detailed information from the financial accounts of the hospitals, nursing home and elderly home that participated in the study. These estimates included overhead and indirect costs but excluded all direct costs that were analysed separately. Hence nursing costs and cost of all diagnostic and therapeutic interventions and laboratory examinations, as well as all costs of health practitioners that are normally included in average day prices were calculated separately. We calculated average costs per hospital day for each patient in the

study population by summing up all costs per category of health care use. For readmissions in hospitals and nursing homes, partly not participating in the study, no detailed data on health care use per inpatient day were available. For these readmissions we therefore used all-in average prices per inpatient day.

The salary schemes of hospitals and other health care suppliers were used to estimate costs per hour for each type of care giver. Taxes, social securities and vacations were all included, as well as the costs for the time that could not be assigned to individual patients.

In the Netherlands a detailed 'fee for service' system is used for the remuneration of medical interventions and diagnostic procedures. For these categories we used the fees as a proxy of real costs. There are several reasons for not calculating real costs. First, the hip replacement as such was not the focus of our study but the discharge strategy after surgery. Second, the list of diagnostic procedures is long, but total costs are relatively small and the Dutch charges for laboratory procedures can be seen as a good proxy of real cost [Oostenbrink 2000].

Bottom-up cost estimates were made. In this chapter we will reverse the order of presentation. First, estimates on average costs at aggregate level are presented, and the cost differences between conventional and early discharge analysed (using the Mann-Whitney U test). Second, we show detailed figures for different periods and categories.

Explanatory factors

This chapter will also deal with a number of explanatory factors, including age, number of comorbidities, cognitive status, functioning before fracture, residence before admission and costs before admission. These factors were tabulated to indicate the major determinants of health care costs within this population. These factors were further analysed with multiple linear regression.

7.3 Results

Patient characteristics

The baseline characteristics of the two groups of patients were similar (table 7.2). Patients averaged 83 years of age, were predominantly female (79%) and most of them were living without partner (74%). All patients could walk before fracture, most of them without assistance or walking aids. The RAP score averaged 9.6 for all patients with small, not statistically significant differences between conventionally and early discharged patients. Many patients (41%) were institutionalised before fracture, and 94% had one or more comorbid conditions at time of hospital admission.

Table 7.2 *Characteristics of conventionally and early discharged hip fracture patients*

	Discharge policy		Total
	conventional (n=102)	early (n=106)	(n=208)
Demography			
Mean age (years)	83	84	83
Median age (years)	83	84	84
25th - 75th percentile (years)	77 - 88	79 - 90	78 - 89
Men/women	16/84%	26/74%	21/79%
With/without partner	24/76%	27/73%	26/74%
Residence before fracture			
Nursing home	16%	14%	15%
Home for the elderly	27%	25%	26%
Own home	57%	61%	59%
Walking ability			
Not	0%	0%	0%
With help	3%	5%	4%
With walking frame	26%	23%	24%
With crutches	8%	17%	12%
Without walking aids	64%	56%	60%
RAP score (0 - 36)	9.3	9.9	9.6
Fracture type			
Cervical	43%	51%	47%
Trochanteric	49%	47%	48%
Sub-trochanteric	8%	2%	5%
Number of comorbidities			
0	6%	6%	6%
1	27%	24%	25%
2	20%	29%	25%
3	30%	26%	28%
4 and more	17%	15%	16%
Average number	2.4	2.2	2.3

Medical outcomes

Medical outcomes at 4 months after hip fracture repair were equivalent for conventionally and early discharged patients. Nearly 20% of all patients died, with no difference between both groups (table 7.3). Differences in residence (nursing home, home for the elderly and own home), walking ability, RAP score and MMSE were small and not statistically significant ($p < 0,05$ Mann Whitney U test).

Table 7.3 *Medical outcomes at 4 months after hip fracture repair*

	Discharge policy		Total
	conventional	early	
Status at 4 months	(n=102)	(n=106)	(n=208)
Died	20%	19%	20%
Hospital	0%	0%	0%
Nursing home	28%	26%	27%
Home for the elderly	17%	14%	15%
Own home	36%	41%	38%
Walking ability	(n=82)	(n=86)	(n=168)
Not	15%	21%	19%
With help	10%	8%	9%
With walking frame	42%	37%	39%
With crutches	7%	14%	10%
Without walking aids	27%	20%	23%
RAP score (0 – 36)	14.5	14.9	14.7
MMSE score (0 – 29)	20.8	20.6	20.7

RAP = Rehabilitation Activities Profile (higher figures indicate worse health status)
MMSE = Mini-Mental State (higher figures indicate better cognitive status)

Inpatients days and type of residence during 4-month follow-up
Early discharged patients stayed an average of 13.5 days less in hospital than conventionally discharged patients (12.7 versus 26.2 days, table 7.4). The total time spent in a health care institution, however, was the same for both groups (75.7 days for early discharged and 79.3 days for conventionally discharged patients). The main cause was the longer average stay in nursing homes of the early discharged group (46.4 versus 34.7 days).

Table 7.4 also shows the destination of patients at discharge from hospital. Most patients in the early group were discharged to a nursing home for rehabilitation (76%). Conventionally discharged patients were rehabilitated in hospital and discharged after their (longer) hospital stay, relatively more frequently to their own home or an home for the elderly compared to early discharged patients (42% versus 23%). Nevertheless, a good 53% of the patients in the conventional group were discharged to a nursing home, which is high given that before fracture only 16% of these patients lived in a nursing home.

At four months after hip fracture, these differences in residence had completely disappeared. Most patients lived in their own homes (36% and 41% among the conventionally and early discharged group, respectively, table 7.3), although the

number remained low compared to the living situation before fracture (57% and 61% respectively, table 7.2).

Table 7.4 *Average number of inpatient days in hospital, nursing home and elderly home, and discharge arrangements for conventionally and early discharged patients*

	Discharge policy	
	conventional (n=102)	early (n=106)
Inpatient days		
Hospital	26.2	12.7
Nursing home	34.7	46.4
Home for the elderly	16.5	12.2
Readmission to hospital / nursing home	1.9	4.4
Total days in institutions	79.3	75.7
Destination at discharge		
Died in hospital	6%	0%
Nursing home	53%	76%
Home for the elderly	17%	9%
Own home	25%	14%

Costs per patient

Average costs during the 4 months after incidence of hip fracture amounted to € 14,281 for early discharged patients, which is € 1,057 less compared to conventionally discharged patients (€ 15,338, table 7.5). There was a wide variation in costs within both groups. Among conventionally discharged patients costs at 25th – 75th percentiles were € 3,511 – € 18,144. The variation among early discharged patients was somewhat smaller (€ 3,986 – € 16,968). Due to the large variation the difference in cost between the two discharge strategies failed to reach statistical significance ($p = 0.3$).

Table 7.5 shows that early discharge causes a shift in costs from hospital to nursing home. Hospital costs were reduced by € 2,812 ($p<.01$), nursing home costs increased on average by € 1,290 ($p<.001$). The conventionally discharged patients incurred 47% of costs in the hospital, 33% in the nursing home, 12% in the home for the elderly and 6% at home. For early discharged patients these figures were respectively 31%, 44%, 10% and 5%. These figures exclude

readmissions in hospital or nursing home. Because early discharged patients have a greater chance of readmission, this can bias the results in favour of early discharge. Table 7.5 shows a cost difference of € 952, resulting almost entirely from readmissions to hospital. When these costs are included the savings in hospital costs per early discharged patient decrease to around € 1,800. A second important shift in costs shown in table 7.5 regards an increase of hospital costs during the first days after surgery among early discharged patients. Compared to the conventionally discharged group, average costs increased by € 399 ($p<.01$). Apparently the prospect of a short hospital stay cause physicians to speed up diagnostic and laboratory procedures. More or less substantial differences existed for the periods outside hospital and nursing home. These differences, however, neither reached statistical significance nor changed the general finding that the cost savings achievable with early discharge were limited.

Costs up to 3 months before admission amounted to € 4,517 in the conventional group and € 4,705 in the early group. After correcting for this pre-admission costs, the adjusted costs difference after hip fracture increased slightly to € 1,162 ($p = 0.25$). The costs caused by hip fracture in addition to the costs of care the patients received before the fracture, were estimated at € 9,316 for conventionally discharged and € 8,008 for early discharged patients.

Table 7.5 *Average costs (€, 1998) per patient by period and discharge policy, cost difference between early and conventional discharge*

Period	Discharge policy		Difference	
	conventional (n=102)	early (n=106)	(early – conventional)	
Before fracture (3 months)	€ 4,517	€ 4,705	€ 188	n.s.
Hospital	7,235	4,423	-2,812	**
(≤ 5 days after surgery)	(2,665)	(3,064)	(399)	**
(≥ from day 6 until discharge)	(4,570)	(1,359)	(-3,211)	***
Nursing home	4,990	6,280	1,290	*
Home for the elderly	1,767	1,436	-331	n.s.
Home	847	692	-155	n.s.
Readmission in hospital or nursing home	498	1,450	952	n.s.
Total costs after fracture	15,338	14,281	-1,057	n.s.

*$p < .05$ **$p < .01$ ***$p < .001$
n.s. = not statistically significant

Costs per inpatient day

Average costs per inpatient day are shown in Table 7.6. These figures are based on the real medical consumption as registered in the study. The first 5 hospital days immediately after surgery were more expensive than later days due to more nursing time, more supervision by physicians and additional diagnostic and laboratory procedures. Average hospital costs for early discharged patients were higher than for conventionally discharged patients, as explained before. Average costs per inpatient day in nursing homes (about € 140) and homes for the elderly (about € 100) were substantially lower in comparison with hospitals.

In the Dutch health care system inpatient days are remunerated on daily basis by charges that represent average costs over all patients. These charges do not differentiate between types of care other than IC-units versus common nursing wards. Charges per hospital day vary among general and university hospitals from € 235 until € 350 [Oostenbrink 2000]. Our detailed cost estimates show higher costs for the first post-operative days and lower costs for the remainder of the hospital stay. Hence, early discharge seems unprofitable from the perspective of hospital financing. It must be noted, however, that most of the included interventions and examinations can be charged separately. So also the first days after surgery will not cause a financial loss for hospitals.

Table 7.6 *Average costs and charges paid by the health care system (€, 1998) per inpatient day in hospital and nursing home*

	Real costs in study population*				Charges in the Dutch health care system
	Conventional discharge		Early discharge		
	AC	(SD)	AC	(SD)	
Hospital					235 – 350
≤ day 5 after surgery	422	(110)	456	(186)	-
≥ from day 6 until discharge	237	(128)	264	(105)	-
Nursing home	143	(36)	134	(30)	130
Home for the elderly	101	(26)	119	(35)	60

** AC = Average costs, SD = Standard deviation*

Costs by categories

Table 7.7 shows the average costs per patient by category, period and discharge policy. Costs before fracture were mainly incurred in the categories inpatient days, care, informal care and other costs, with only slight differences between both

Table 7.7 *Average costs (€, 1998) per patient by period, cost category and discharge policy (conventional versus early)*

Period	Inpatient days		Nursing		Health practitioners		Medical procedures		Travelling		Informal care and other		Total costs per patient			
	conv	early	conv	early	conv	early	conv	early	conv	early	conv	early	conventional		early	
Before fracture	2,516	2,492	1,115	1,261	73	85	0	0	0	4	812	863	4,517		4,705	
Hospital																
≤ 5 days after surgery	763	821	505	479	107	124	1,268	1,615	23	25	0	0	2,665	17%	3,064	21%
≥ day 6 until discharge	2,330	675	1,350	293	212	74	566	150	113	169	0	0	4,570	30%	1,359	10%
Nursing home	2,518	3,414	2,008	2,163	421	633	0	0	28	62	15	8	4,990	33%	6,281	44%
Home for the elderly	1,125	829	571	529	45	40	0	0	14	3	12	35	1,767	12%	1,436	10%
Home	0	0	285	324	73	104	0	0	18	27	472	237	847	6%	692	5%
Readmission	477	1,437	–	–	–	–	–	–	21	13	0	0	498	3%	1,449	10%
Total after fracture	7,213	7,176	4,717	3,787	858	975	1,833	1,765	217	299	499	280	15,338	100%	14,281	100%
(Share)	47%	50%	31%	27%	6%	7%	12%	12%	1%	2%	3%	2%	100%		100%	

– *Not available (costs included in inpatient days).*

discharge groups. Total costs after hip fracture could mainly be attributed to inpatient days (50%, € 7,200) and nursing (30%, € 4,000).

Costs for health practitioners (physicians, physical therapists and other) were limited to only 6 – 7% of total costs. This figure excludes hip surgery and all other medical procedures including diagnostic and laboratory assessment, that represented 12% of total costs. Costs of travelling were modest (1 – 2%). Informal care and other costs represented 2 – 3% of total costs. On aggregate level differences between both discharge policies were rather limited. Major differences were only observed in average costs from day 6 until discharge for inpatient days in hospital (lower costs for early discharge) and nursing home (higher costs for early discharge). The shorter stay in hospital and longer stay in nursing home explain this finding. Costs of medical procedures shifted to the first 5 days after surgery in the early discharge group, as mentioned before. Readmissions were more frequent in the early discharge group (16 versus 8 patients), but most were not directly related to the hip fracture. If these costs were excluded, a somewhat larger difference between both groups was observed, with borderline statistical significance (€ 2,008, p=0.06).

Volumes of health care use

During the 4 month follow-up period, patients stayed on average a similar time in a health care institution (hospital, nursing home or elderly home): 79 days when conventionally discharged and 76 days when discharged early (table 7.8).

Table 7.8 *Average number of inpatient days, hours of care and time invested by health practitioners, number of medical procedures per patient by period and discharge policy*

Period	Inpatient days (number)		Nursing (hours)		Health practitioners (hours)		Medical procedures (number)	
	conv	early	conv	early	conv	early	conv	early
Before fracture	36.2	34.7	43.2	48.9	1.6	1.9	0.0	0.0
Hospital								
≤ 5 days after surgery	6.5	7.0	11.1	10.5	2.2	2.6	54.0	74.1
≥ day 6 until discharge	19.7	5.7	29.7	6.4	5.7	2.1	61.5	17.5
Nursing home	34.7	46.4	61.4	66.1	13.2	19.8	0.0	0.0
Home for the elderly	16.5	12.2	17.5	16.0	1.2	1.1	0.0	0.0
Home	0.0	0.0	11.0	12.5	1.8	2.8	0.0	0.0
Readmission	1.9	4.4	-	-	-	-	-	-
Total after fracture	79.4	75.7	130.7	111.6	24.0	28.4	115.6	91.6

– *Not available*

Nurses spent around 131 hours caring for patients in the conventional discharge group and 112 hours for early discharged patients. The difference is wholly attributable to the longer hospital stay in the conventional group. All health practitioners together – physicians (supervision only, medical procedures excluded), physical therapists and other – spent a total of 24 hours on each conventionally discharged patient and 28 hours on each early discharged patient. Most time was invested in physical therapy. The number of medical procedures differed between the two discharge groups, mainly due to additional diagnostic and laboratory assessments among early discharge patients in the days immediately after surgery.

Explanatory factors
Relationships between several variables and average costs per patient are shown in Table 7.9. The difference between patients admitted to the general or to the university hospital was € 1,219 ($p = 0.26$) with higher costs for the university hospital. A larger number of co-morbid conditions, diminished cognitive status, deteriorated functioning before fracture, increased costs before admission, the presence of diagnosis dementia and the pre-fracture residency in a home for the elderly or nursing home were all associated with increased costs (table 7.9). In a multivariable analysis, the pre-fracture residency in an elderly home ($p = 0.005$), the number of comorbidities ($p = 0.04$), functioning before fracture (RAP-score, $p = 0.06$) and dementia ($p= 0.06$) were the most important explanatory factors for costs after fracture.

7.4 Discussion

We compared two discharge policies after hip fracture repair. Because the patients in both groups had on average the same characteristics before fracture and medical outcomes were equivalent, it was possible to perform a cost-minimisation analysis (CMA). We found that early discharge of hip fracture patients from hospital led to a limited, statistically non-significant reduction of total costs. We used a detailed calculation method to estimate real costs from a societal perspective. Therefore we were able to present estimates of costs in different categories and for different periods after hip fracture. Hence it was possible to observe some important shifts in costs. Finally, we identified a number of explanatory factors for costs after fracture.

Total costs: early discharge versus conventional discharge
Contrary to our expectations, early discharge did not significantly reduce costs. This was mainly due to the shift of costs from hospital to the nursing home. The total number of inpatient days in all institutions together was almost the same within both groups, and costs per day in a nursing home differed little from costs

Table 7.9 *Average costs (€, rounded to hundreds, 1998) per patient according to explanatory factors*

Explanatory factor	Costs per patient		Number of patients	Significance of difference
	Euros	SD		
Hospital				
General hospital	14,100	7,100	90	n.s
University hospital	15,300	8,100	118	
Age in years				
65 - 79	14,100	8,400	67	n.s
80 - 89	14,900	7,900	101	
≥90	15,800	5,900	40	
Number of comorbidities				
0	6,700	4,200	12	**
1	13,600	7,800	53	
2	15,200	7,100	51	
3	17,000	8,100	59	
4 and more	15,000	6,600	33	
MMSE score after 1 week				
Missing	15,500	6,400	18	***
0 - 12	18,300	8,000	48	
13 - 18	15,400	6,300	30	
19 - 22	16,300	7,100	31	
23 - 29	11,700	7,500	81	
Dementia				
No	13,900	7,400	166	**
Yes	18,400	7,900	42	
RAP score before fracture				
0 - 4	12,200	7,500	78	***
5 - 14	15,100	6,900	68	
15 - 36	17,800	7,800	62	
Residence before fracture				
Home	12,900	7,500	124	
Home for the elderly	17,700	5,800	53	**
Nursing home	17,300	9,200	31	**
Costs before fracture				
< € 4,540	12,800	7,400	116	***
> € 4,540	17,400	7,300	92	
Discharge policy				
Conventional discharge	15,300	7,800	102	n.s
Early discharge	14,300	7,600	106	

*** p <.01 ***p < .001*

n.s.: not statistically significant

in hospital after the first 5 days post-operative. During the first days in hospital, the costs were initially high due to hip surgery, diagnostic and other medical procedures and intensive post-operative care, but subsequently decreased substantially [Strömberg 1997].

Although the reduction in hospital stay by the early discharge programme was larger than in some Australian studies [Cameron 1994, Hollingworth 1993, and Sikorsky 1993], we did not observe significant cost savings. Adjustment for costs incurred before hip fracture did not change this outcome.

Cost savings in the Australian studies resulted from a shorter hospital stay and were relatively modest (about € 650 per patient [Cameron 1994, Hollingworth 1993]) or only reached statistical significance when costs per recovered patient were calculated separately [Cameron 1994]. We found a difference of € 1.057 per patient in favour of the early discharge programme but due to a wide variation in costs the cost savings were not statistically significant. Another cost-cutting strategy was early discharge of patients to a 'hospital-at-home' scheme [Strömberg 1997]. Again, the savings resulted from shorter stays in orthopaedic and geriatric wards, while costs at home did not increase substantially. The hospital-at-home scheme, however, was only suitable for about 40% of total patients in this study, while in another part of England only 18% of patients fitted the selection criteria [Cathain 1994].

In Sweden, the substitution of hospital care by geriatric care resulted in a cost decrease of 12% [French 1995]. In that study, the number of hospital days was approximately halved by earlier discharge to geriatric wards.

Hospital and incremental costs

Hospital costs in our study (€ 7,235 for conventionally discharged patients and € 4,432 for early discharged patients) fitted well within the range of costs reported by others. These range from € 3,600 – 8,400 in Great Britain [Farnworth 1994, Strömberg 1997, Parker 1992], € 5,300 – 8,700 in Sweden [Borquist 1991, French 1995, Sembo 1993] to € 10,300 in the United States [Brainsky 1997]. Costs during the 4-month follow-up are more difficult to compare. Our estimate of € 15,000 is high compared to Borquist's estimate for Sweden (€ 10,700) [Borquist 1991], which, however, only included patients coming from home.

We estimated costs in the three months before fracture at € 4,600. Incremental costs attributable to hip fracture were therefore € 9,300 for conventionally discharged and € 8,000 for early discharged patients. These figures are in line with the € 8,600 of additional costs during the first year after hip fracture reported by De Laet for the Netherlands [Laet 1999] and with the estimate of € 8,910 by Cameron et al. [Cameron 1994]. Others, however, found much higher figures: € 12,000 – 14,000 for the United States in 1993 [Brainsky 1997] and € 17,000 in Sweden in 1994 [Zethraeus 1997]. This difference may partly be explained by higher hospital costs and more admissions to geriatric departments and nursing homes in the latter two studies.

Explanatory factors
The most important explanatory factors were the pre-fracture residency, the number of comorbidities, level of functioning (RAP score) before fracture and dementia. These factors also explain survival, which influences the cost estimates. For example, patients with dementia incurred higher costs, while their survival was worse compared to non-demented patients. On average, for surviving and deceased patients we estimated costs at € 15,300 and € 12,700 respectively.

The higher costs among institutionalised patients are in line with data from Sweden [Zethraeus 1997] but were not demonstrated in Scotland [Farnworth 1995]. We could not confirm the relation with type of fracture or gender that was reported by Borquist [Borquist 1991].

Explanations for the disappointing cost savings
Owing to the detailed cost analyses available, we are able to provide some explanations for the disappointing cost reduction. First, comorbidity played an important role in our study population. People were old and had multiple diseases (table 7.2). Comorbidity was an important explanatory factor for high costs (table 7.9). The large variation in costs between patients within both groups also indicate that hip fracture is but one cause of health care costs. People were old and needed care for different diseases and disorders. The total number of inpatient days was on average the same for both groups, irrespective whether the care was supplied by a hospital or a nursing home.

Second, in hospital the number and costs of medical interventions and examinations was higher among the early discharged group. Apparently hip fracture patients need a certain amount of medical procedures, mainly diagnostic and laboratory, which can not simply be skipped. Early discharge resulted in a concentration of medical procedures during the first post-operative days, which partially cancelled out its potential benefits. In addition the early discharged patients received more physical therapy in nursing home than the conventionally discharged received in hospital. This also decreased the cost difference between both groups.

Third, we confirmed that hospital costs per inpatient day decrease after day five [Hollingworth 1995, Farnworth 1994]. Shortening the hospital stay will always save the less costly days. Calculations that do not reckon with this phenomenon will overestimate the potential savings. The use of charges would even increase the difference, since for hip fracture patients the Dutch charges exceed real hospital costs but remain under real costs in nursing homes and homes for the elderly (table 7.6).

Real costs in the real world
We estimated real costs in the setting of the study. In the real world things might be different. It is assumed that early discharge causes a shift from formal to informal care. We could not confirm this assumption. Costs of informal care were

relatively low. Costs among early discharged patients were rather lower than higher, although the difference reached not statistical significance. The large number of inpatient days plays an important role here. On average patients, whether early discharged or not, remained more than half of the 4-month study period in a health care institution. At the end of this period 54% of all patients stayed in a nursing home or elderly home, an increase of one third compared to the situation before fracture.

In our study the investment and capacity costs of a specialised rehabilitation ward in a nursing home were rather low. The ward already existed at onset of study, and due to an efficient planning of patients the occupation of these ward was high. Investment costs and capacity costs were integrated in the average costs per admission day. In real life, costs will be higher if specialised wards must be newly built. Capacity costs can also become high, if the ward is too large for an efficient occupation of beds, or too small for an efficient employment of physical therapists and other personnel. National application of early discharge would therefore require a careful planning of rehabilitation wards.

Limitations of the study

Our study has some limitations. First, the sample size was relatively small (102 and 106 patients). The difference in hospital stay (13 days), however, should have been large enough to show any clear economic advantage of the early discharge programme. Second, the design was not randomised and it is possible that some variables such as the duration of hospital stay and discharge destination changed during the study independently from the intervention. Third, it is difficult to generalise the results for patients living in other countries because geriatric rehabilitation and long-term care of the elderly differ between countries. The rehabilitation ward of a Dutch nursing home probably compares best with a geriatric rehabilitation ward in a hospital or a Skilled Nursing Facility in the US.

7.5 Conclusions

This study shows that the details of costing highly influence the outcomes in a cost-minimisation analysis. Costs shifted from hospital to the nursing home because total institutional length of stay was similar and there was only a small difference in costs per inpatient day between hospital and nursing home. This latter phenomenon was caused by the relatively less intensive care of hip fracture patients among the hospital population and relatively more intensive care compared to other people in nursing and elderly homes. Furthermore, the early discharge regime evoked a concentration of diagnostic procedures in the few days prior to discharge, resulting in higher average costs that cancelled out some of the potential savings.

Our study emphasises the importance of a detailed cost analysis based on real resource use. Standard charges or average all-in prices would raise expectations about cost savings that can not be realised. This conclusion is not limited to our study or other early discharge studies but has relevance for the whole field of cost analysis in health care. The implications for cost-of-illness studies will be discussed in Chapter 9.

Acknowledgement
Margreet Ribbers is gratefully acknowledged for assistance with data collection.

Part III

International comparison

Abstract

Since 1998 the OECD Health Data contain figures on cost of illness (COI). The large differences between countries are striking. We compared a Dutch COI study with similar data for Australia, Canada, England, Germany and Sweden. The distribution of health care costs over major disease categories shows similar patterns for all countries as well as some remarkable differences, mainly caused by health care systems. Comparisons for hospitals and pharmaceutical care showed differences that could in part be related to epidemiological and methodological factors. We concluded that the current scope of COI studies is more or less limited to national levels, because health care systems dominate the magnitude and distribution of health care costs. Cross-national comparisons might be possible if data and methods are standardised and COI estimates are made for a common comparable package.

A cross-national perspective on cost of illness

8

8.1 Introduction

In the decades after the pioneering work of Dorothy Rice several cost-of-illness (COI) studies have been published, for the United States as well as for other countries [Rice 1966, Cooper 1976, Rice 1985, Lindgren 1981, Koopmanschap 1991, Wigle 1991, Henke 1997]. Recently some countries updated their COI estimates while others launched their first contribution in this field [Mathers 1998, Moore 1997, Jacobson 1996, NHS 1996, Schneider 1999, and Polder 1997]. Since 1998 the key figures of most COI studies are summarised in the OECD Health Data [OECD 1998]. These figures, however, show a wide variation that can not easily be explained.

This paper addresses the question of cross-national comparability of COI data. Our objectives are: 1) to construct a comparable dataset; and 2) to explain major cross-national differences in cost of illness.

8.2 Methods

We selected six countries according to the following criteria: a) the study should report on one of the years in the period 1991 – 1995; b) a background report with detailed information on data and methods should be available, since the OECD Health Data only contained data with a small glossary. The countries were: Australia, Canada, Netherlands, Sweden, United Kingdom and Germany [Mathers 1998, Moore 1997, Polder 1997, Jacobson 1996, NHS 1996, Schneider 1999].

We distinguished six explanatory factors for cross-national differences. First, health care supply differs between countries. The Dutch homes for the elderly, for instance, have no equivalent in other countries. Another example regards the German 'Kurorte' from which this 'Kurort-argument' derived its name. Second, given health care supply the definition of health expenditure differs between countries. In Australia, for instance, care for disabled people belongs to the

welfare services while in most other countries it is included in the health care system. Third, total cost-of-illness deviates from total health expenditure, while in addition the extent of this deviation differs per country. Fourth, data and methods employed in the COI studies differ. Fifth, health care utilisation and costs differ due to differences in health status and health care needs caused by epidemiological and demographic variables. Sixth, cross-national variations in medical practice cause differences in costs.

The ranking of these factors is not arbitrarily chosen. Epidemiological and demographic explanations are only interesting or even possible if the definitions of health care, health expenditure and total COI are the same. Before looking at real causes of difference it is also needed to investigate whether differences might be caused by the characteristics of the COI studies. Due to the ranking of these arguments the analysis of cross-national differences should start with studying differences in health care and health expenditure. This has been done in the common comparable package literature [Mosseveld 1998, OECD 2000a]. From a COI perspective, however, it was unfortunately not possible to start the analysis here, since published COI data did not fit into the definitions of a common comparable package.

We therefore started with published COI data and with help of additional data on health care systems and health expenditures we cancelled out all differences between health care expenditure and total COI. The resulting dataset, however, still incorporated differences in health care and differences in COI methodology, while in addition the variation in not allocated costs was large. We therefore disaggregated the national COI data to sectoral figures. Five sectors were distinguished: hospitals and physicians, other health practitioners, pharmaceutical care, institutional care and all other care. The COI studies of four countries allowed for a sectoral breakdown. We tried to explain the differences by COI methodology, epidemiology and demography, and medical practice variations using data from COI reports and medical literature.

8.3 Cost of illness and national health expenditure in 6 countries

OECD Health Data

Table 8.1 shows the COI figures for these countries as reported by the OECD [OECD 1998, 2000]. The cross-national differences within disease categories are expressed by the coefficient of variation (standard deviation relative to the mean). At least five issues attract attention: 1) The overall pattern was roughly the same: high costs for mental disorders, circulatory, digestive and musculoskeletal diseases; low costs for congenital malformations, perinatal conditions and infectious diseases; 2) There were remarkable differences for some major disease categories, especially mental disorders, circulatory diseases, digestive diseases and musculoskeletal diseases; 3) Some ICD chapters were missing for the UK; 4) The

percentage of non-allocated costs differed substantially; 5) The Canadian and UK figures totalled 93.8% and 95.3% in stead of 100% as in the other countries.

Table 8.1 *Cost of illness in six countries according to OECD Health Data (Share of ICD chapters in total costs and coefficient of variation. Total costs in billions of national currency units (NCU))*

Chapters ICD-9	AUS * 1993	CAN 1993	UK 1993	GER 1994	NETH 1994	SWE 1991	Coeff. of variation
Infectious	2.7	1.8	3.7	1.9	1.3	2.0	36%
Neoplasms	6.1	7.3	8.3	5.2	3.9	5.6	26%
Endocrinal	3.1	3.0	2.9	3.9	1.9	3.4	23%
Blood	0.6	0.6	1.6	0.6	0.3	0.5	71%
Mental	8.4	11.4	14.4	10.9	23.1	18.4	38%
Nervous	7.4	5.1	3.4	8.4	5.2	5.8	31%
Circulatory	11.7	16.7	25.7	12.4	10.5	16.9	36%
Respiratory	8.0	8.6	9.8	5.2	4.0	7.7	30%
Digestive	11.8	7.5	8.3	15.9	7.8	4.6	43%
Genito-urinary	5.3	5.1	6.8	5.0	2.8	3.8	29%
Pregnancy	3.3	4.6	-	2.5	2.6	1.6	38%
Skin	3.0	2.0	3.1	2.3	1.6	2.0	26%
Musculoskeletal	9.5	5.6	7.3	12.6	6.0	5.4	36%
Congenital	0.6	0.7	-	0.4	0.5	1.2	44%
Perinatal	0.8	1.2	-	0.3	0.6	0.6	43%
Symptoms	4.3	4.2	-	4.7	4.8	5.6	13%
Accidents	8.3	7.1	-	7.9	4.2	5.6	26%
Not allocated	5.1	1.2	-	0.0	18.8	9.2	111%
Total costs	100.0	93.8	95.3	100.0	100.0	100.0	
NCU (billion)	31.4	41.4	18.0	344.7	59.5	104.4	

** AUS = Australia, CAN = Canada, UK = United Kingdom, GER = Germany, NETH = Netherlands, SWE = Sweden, SD = standard deviation.*

Cost of illness and national health care expenditure

Table 8.2 provides some characteristics of the COI studies based on the background reports and shows the relation between national health expenditure and cost of illness.

All COI studies employed a top-down methodology using provider data to allocate costs to diseases. Disease categories were in all studies based on the 9th edition of the International Classification of Diseases (ICD-9) [WHO 1977]. The Swedish study distinguished 18 groups including one rest category for costs that could not be allocated to the 17 chapters of the ICD-9. The other studies also distinguished more detailed disease categories (table 8.2).

Table 8.2 *Health expenditures and cost of illness in five countries*

Country Year	Australia 1993	Canada 1993	England 1993	Germany 1994	Netherlands 1994	Sweden 1991
National health expenditure						
National currency units (NCU)	36,495	71,743	32,731	344,618	59,463	125,215
US$ [a]	24,882	55,615	48,852	208,859	32,672	20,697
Share in gross domestic product	8.5%	10.2%	6.9% [b]	10.0%	9.7%	8.7%
Average per inhabitant (US$)	1,395	1,824	1,112 [b]	2.350	2,124	2,402
Direct cost of illness						
Direct medical costs (NCU)	31,397	51,062	27,821	344,618	59,463	104,443
US$	21,359	39,583	41,524	208,859	32,672	17,263
% of health expenditure included	86%	71%	85%	100%	100%	83%
Number of health sectors	13	7	6	1	22	3
A. Diagnosis						
Classification of diseases	ICD-9	ICD-9	ICD-9	ICD-9	ICD-9	ICD-9
Number of diagnostic groups	21	25	36 – 108 [c]	47	62	18
% of included expenditure allocated	95%	94%	94%	92%	81%	91%
% of total expenditure allocated	81%	67%	80%	92%	81%	76%
B. Age and sex						
Number of age groups	7	4 [d]	0	0	21	0
% of included expenditure allocated	100%	100%	0%	0%	100%	0%
% of total expenditure allocated	86%	71%	0%	0%	100%	0%
Male/female ratio in total costs	43/57	44/56	n.a.	n.a.	41/59	n.a.
Indirect cost of illness (US$)	n.a.	65,987	n.a.	157,640	n.a.	27,339
% allocated to diseases		93%		0%		98%

n.a. = not available

1. US$ 1 = AUS$ 1.47; CAN$ 1.29; UK£ 0.67; DM 1.65; NLf 1.82; SEK 6.05.

2. United Kingdom.

3. The number of diagnostic categories varies per sector, from 36 to 108 categories for pharmaceutical care and hospital costs, respectively.

4. In the Canadian study costs were not simultaneously allocated to diagnosis and age as in the Australian and Dutch studies.

Some studies also included demographic variables. In the Dutch and Australian study, health care costs were simultaneously broken down according to diagnosis, age and sex. The Canadian study provided estimates for age and sex without disease specific information.

Some COI studies further estimated indirect costs. These costs relate to absence from work (productivity costs) due to morbidity (morbidity costs) and life years lost (mortality costs). These costs were included in the Canadian and Swedish study, while the German study provided an estimate of total indirect costs without any allocation to diseases. In this paper, we focus on direct medical costs and do not compare indirect costs.

Despite the common characteristics of a top-down approach using the ICD-9, the COI studies can not easily be compared, because in most countries total COI did not match with total health expenditure. Only in Germany and the Netherlands total COI equalled national health expenditure. In the other countries, some parts of health care costs were excluded from the COI study. Compared to table 8.1 total COI in Canada, United Kingdom and Germany changed. Based on the original research report [Moore 1997] we adjusted the Canadian figures for: a) an additional category of not-allocated costs ('well patient care', all V-codes of the ICD-9); and b) an additional CAN$ 7 billion that could be allocated to specific ICD chapters such as mental disorders (treatment in institutions), digestive diseases (dental care) and nervous system and sense organs (eye care and hearing aids). After these corrections total COI amounted to CAN$ 51.1 billion (71% of national health care costs).

The OECD figures for COI in the UK (total £ 18.0 billion, table 8.1) were quite different from the estimates in the burden-of-disease report, in which an amount of £ 32.7 billion (table 8.2) was given for England alone [NHS 1996]. Our further comparisons were based on these latter estimates.

The German figures changed slightly. In the OECD data all costs were allocated to disease categories (table 8.1), including the costs of health administration (8.1%). In the other countries these costs were assigned to the category 'not-allocated'. We adjusted the German figures in a similar way using the background document [Schneider 1999]. Table 8.2, therefore, shows that 92% of the costs included could be allocated to diseases.

After fitting total cost of illness to national health expenditure we calculated the share of total expenditure that was assigned to diseases. Table 8.2 shows a large variation (67% – 92%), mainly due to the inclusion or exclusion of major health care facilities.

National COI figures adjusted to national health expenditure

Table 8.3 shows the recalculated COI figures on the aggregate level. Compared to table 8.1, a new category 'not included' has been added in order to fit total cost of illness to total health expenditure. The adjustments improved comparability. The coefficient of variation decreased in 11 disease categories between the countries

(table 8.3, last column), especially for circulatory diseases due to the better (lower) estimates for the UK. Although the other disease groups experienced a modest increase in variation the overall pattern is more homogeneous than in the OECD figures (table 8.1). Even so, there were some important differences.

For some disease categories there is a reasonable epidemiological explanation. The higher costs of cancer and skin diseases in Australia were likely caused by a higher prevalence [Mathers 1998a]. Higher costs for endocrine diseases in Germany could be explained by a higher prevalence of diabetes [OECD 1998, Eurostat 2000]. The costs of accidents were high in Australia and Germany, mainly due to the higher number of road accidents in both countries. However, for most other cross-national differences no clear disease- or demography-related explanations were available.

Table 8.3 *Recalculated cost of illness in six countries (Share of ICD chapters in total costs. Change in coefficient of variation compared to table 8.1. Total costs in billions of national currency units (NCU).*

Chapters ICD-9	AUS* 1993	CAN 1993	ENG 1993	GER 1994	NETH 1994	SWE 1991	Coefficient of variation	
							%	change
Infectious	2.3	1.1	0.9	1.7	1.3	1.7	34%	-4
Neoplasms	5.2	4.5	3.9	4.8	3.9	4.7	12%	-14
Endocrinal	2.6	1.9	1.5	3.6	1.9	2.9	32%	11
Blood	0.5	0.4	0.5	0.6	0.3	0.4	23%	-42
Mental	7.1	8.2	15.8	10.0	23.1	15.3	45%	8
Nervous	6.4	5.1	8.0	7.7	5.2	4.9	22%	-8
Circulatory	10.2	10.3	11.5	11.4	10.5	14.1	13%	-23
Respiratory	6.9	5.3	5.9	4.8	4.0	6.5	19%	-11
Digestive	10.2	11.2	7.9	14.6	7.8	3.8	40%	-3
Genito-urinary	4.5	3.1	3.4	4.6	2.8	3.2	21%	-7
Pregnancy	2.9	2.8	3.1	2.3	2.6	1.4	24%	-14
Skin	2.6	1.2	1.6	2.1	1.6	1.7	27%	1
Musculoskeletal	8.2	3.4	7.4	11.5	6.0	4.5	42%	6
Congenital	0.4	0.4	0.4	0.4	0.5	1.0	46%	1
Perinatal	0.7	0.8	0.7	0.3	0.6	0.5	30%	-18
Symptoms	3.6	2.6	3.9	4.3	4.8	4.6	20%	8
Accidents	7.1	4.4	3.6	7.2	4.2	4.6	30%	4
Not allocated	4.4	4.6	5.0	8.1	18.8	7.7	68%	-43
Not included	14.2	28.8	15.0	0.0	0.0	16.6	88%	
Total costs	100.0	100.0	100.0	100.0	100.0	100.0		
NCU (billion)	36.6	71.7	32.7	344.7	59.5	125.2		

** AUS = Australia, CAN = Canada, ENG = England, GER = Germany, NETH = Netherlands, SWE = Sweden, SD = standard deviation.*

There are three reasons for the still disappointing comparability. First, the large differences in not-included and not-allocated costs cause also a large variation in the costs per ICD chapter. In Canada, for instance, the costs of mental disorders and musculoskeletal diseases were relatively low because most health care institutions, physical therapists and other allied health professionals were not included in the cost-of-illness study.

Second, the definitions of health expenditure differ. So the costs of the nervous system and the senses were relatively low in the Netherlands because the high co-payments for ophthalmic services and hearing aids were not included in expenditure data. In Australia costs for mental disorders were relatively low because institutions for people with intellectual disabilities did not belong to the health care system. In the Netherlands these diseases ranked highest because not only nursing homes were included in the health care system but also homes for the elderly. By consequence of these differences there was a large variation in per capita health expenditure (table 8.2). Figure 8.1 shows the age distribution of per capita costs for the three countries that provided age-specific COI figures, and confirms the role of included and excluded sectors, mainly for the elderly in the Netherlands.

Third, the comparability of aggregate COI figures could be hampered by differences in data and methods employed in the different countries.

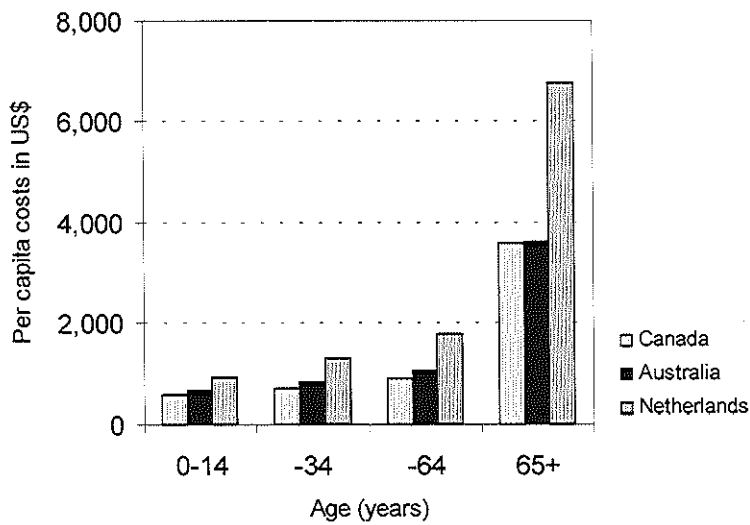


Figure 8.1 *Health care costs attributed to age groups in Australia, Canada and the Netherlands 1993 – 1994 (costs per capita in US$)*

These problems can partially be solved by disaggregating national COI to more-or less homogeneous sectors. Per sector insight in methodological differences can help to determine whether the remaining differences in COI can be explained by health status and health care needs in the population or by medical practice variations.

8.4 Data and methods of COI studies in 4 countries

COI and a common comparable package

Four COI studies, the Swedish and German excluded, provided detailed figures for different health care sectors (6 – 22, table 8.2) that allowed for regrouping the COI data into more or less comparable sectors. Unfortunately it was not possible to construct a common comparable package [Mosseveld 1998], nor to fit the figures into the System of Health Accounts (SHA) proposed by the OECD [OECD 2000a]. When breaking down COI data for Australia, Canada, England and the Netherlands we distinguished five sectors: hospitals and physicians, other health practitioners, pharmaceutical care, institutional care and all other care.

Data and methods in cost-of-illness studies

Table 8.4 shows some details about data and methods in the four COI studies for which a sector breakdown was possible. Total costs of hospitals and physicians varied from 42.5% of national health expenditure in the Netherlands to 58.0% in Canada. The Dutch share is low because of the comprehensive nature of the health care system and because costs per inhabitant were highest (table 8.2). In all countries the majority of costs could be allocated to diseases (84.5% – 97.4%, table 8.4). All studies used a top-down methodology mainly based on the number of inpatient days and outpatient visits. However, some major differences were revealed. In the Canadian study all hospital costs were allocated by the number of bed-days, weighed by resource intensities, while in Australia and the Netherlands medical services and ambulatory care were allocated separately from nursing days. The Australian study was based on diagnostic related groups (DRGs). The Dutch study used detailed information on medical interventions (>1,000 categories) that were weighed by individual fees and charges. Only the English study did not adjust the number of hospital days for differences in resource costs. Expenditure on physicians was allocated in nearly the same manner in all countries.

Pharmaceutical care represented around 10% of total health care costs in the four countries (table 8.4). The share in total costs was higher in Australia and Canada, while per capita costs were higher in the Netherlands. In Australia and the Netherlands respectively 97.0% and 93.2% of pharmaceutical expenditures were allocated to ICD chapters. This percentage was substantially lower for Canada and England. In England, expert opinions were used for the attribution of costs to diagnoses. The other studies used the diagnoses for groups of drugs as

prescribed by physicians. Australia and Canada used therapeutic groups weighed by expenditures. In the Dutch study, 250 groups and their expenditures were used based on the ATC-classification and retail prices per drug [WHO 1994].

The costs of health practitioners varied substantially (7.6 – 11.7%, table 8.4). This was mainly caused by differences in the number of practitioners and the classification in the health system, especially for England. This sector includes dentists, physical therapists, midwives and other professionals, such as speech therapists. Costs of dental care were allocated to digestive diseases in all countries, and to age and sex in the Netherlands and Australia by the number of visits. Costs of other therapists were allocated using diagnoses from registries of paramedical care (Netherlands) or referral diagnoses (Australia). Expert opinions were used in England, while in Canada the costs were excluded from the COI study. In both countries, the percentage of costs that could be allocated to ICD chapters was relatively low.

International differences were largest for institutional care. In the Netherlands, nursing homes and homes for the elderly were included as well as institutions for people with intellectual and physical disabilities. In the other countries, homes for the elderly did not exist or were excluded from the COI study. In Australia institutions for people with intellectual disabilities did not belong to the health care system. In England nursing homes were included in the COI study, but the definition and service provision was quite different from the Netherlands. This heterogeneity rendered COI comparisons next to useless, especially in the light of the large differences in the methods of allocation costs to diseases.

All other costs were classified as other care. The differences between the countries, regarding both the item included and the methods used to allocate costs (table 8.4) were considerable. In the Canadian study, only the costs of hearing aids and ophthalmic services were included. These costs were allocated to diseases of the nervous system and the senses. The English study used disability surveys to allocate a much wider range of expenditure. In the Netherlands, epidemiological data and results from other studies were used, such as cost-effectiveness analyses on cancer screening. The Australian COI study also used data from cancer screening programmes. Due to the heterogeneity in data and methods, all further cost comparisons were irrelevant.

Table 8.4 *Main categories of health care costs (% of total expenditure), costs included in cost-of-illness study (% of total expenditure) and data and methods used for allocation of costs to disease (and demographic) categories*

	Australia	Canada	England	Netherlands
1. Hospitals and physicians [A]				
Costs (% of total expenditure)	58.0%	50.8%	54.4%	42.5%
Allocated to diseases	86.5%	92.2%	84.5%	97.4%
Allocation				
- Medical services	Number weighed by DRG costs [C]	-	-	Number by type (1.000) and charge
- Hospital stay and day care	Number of days weighed by DRG costs	Number of days weighed by resource intensity	Number of days	Number of days
- Ambulatory care	Number of visits	-	Number of referrals from GP's	Number of visits by referral diagnosis
- General practitioners	Weighed number of visits	Fee-for-service expenditure	Weighed number of visits	Weighed number of visits
2. Pharmaceutical care				
Costs (% of total expenditure)	11.1%	13.8%	9.3%	10.2%
Allocated to diseases	97.0%	69.8%	66.4%	93.2%
Allocation	Prescriptions weighed for therapeutic groups by relative utilisation and costs	Prescription diagnoses and expenditures by therapeutic class	Expert opinion	Prescription diagnoses and expenditures by ATC-code (250 groups)
3. Other health practitioners				
Costs (% of total expenditure)	8.9%	8.4%	11.7% [B]	7.6%
Allocated to diseases	93.0%	77.6%	79.3%	94.9%
Allocation				
- Dentists	Number of visits	Expert opinion	Expert opinion	Weighed number of visits
- Other practitioners	Number of visits by referral diagnosis	-	Disability surveys and expert opinions	Number of visits by diagnosis

Table 8.4 <continued>

	Australia	Canada	England	Netherlands
4. Institutional care				
Costs (% of total expenditure)	8.1%	9.8%	8.9%	26.7%
Allocated to diseases	89.4%	11.1%	95.5%	79.4%
Allocation		Expert opinion		
- Disability homes	-	-	Number of days	Number of days
- Nursing homes	Number of residents	-	Expenditure on income support	Number of days
- Home for the elderly	-	-	-	Number of Residents
5. Other health services				
Costs (% of total expenditure)	13.9%	17.2%	15.7%	13.1%
Allocated to diseases	36.4%	11.3%	60.0%	17.5%
Allocation	Various, including data on screening programmes	Expert opinion for ophthalmic services and hearing aids	Disability surveys	Various, including surveys on prevalence of impairments and data on screening programmes and use of home nursing and ambulance services
Total allocated to diseases	81.4%	66.6%	80.0%	81.2%

n.a. *Not available.*
- *Not separately allocated.*
A. *Psychiatric hospitals included.*
B. *Including community health services.*
C. *DRG = Diagnostic Related Group.*

8.5 Cost of illness in 4 countries according to sector, revised data

Hospitals and physicians

The variation in COI for hospitals and physicians (table 8.5) decreased further compared to the aggregate figures (table 8.3). The variation declined for mental disorders, digestive and musculoskeletal diseases due to the more homogeneous sector definition. However, for some diseases, differences remained or even increased.

Although sector differences between COI studies were eliminated as much as possible, the remaining differences in cost shares per ICD category still had to do with characteristics of the health care systems and COI studies. The high costs of nervous diseases in the Netherlands were caused by specialised hospitals for people with epileptic disorders. The high costs of mental disorders in the Netherlands resulted from the comprehensive services provided by psychiatric hospitals. The lower costs for cancer in England were caused by the English COI methodology, which failed tot take resource intensities for hospital care into account. Probably also undertreatment plays a role here.

There was some evidence for the influence of epidemiological factors on the costs of infectious diseases (Australia), respiratory diseases (England and Canada), musculoskeletal diseases (Canada) and accidents (Australia and Canada) [OECD 1998].

Other differences were likely caused by variations in health care practice. The lower hospital costs for pregnancy and childbirth in the Netherlands were at least partially caused by the typical Dutch practice of childbirth at home, assisted by midwifes and nurses instead of physicians. In England and the Netherlands, the costs of digestive and cardiovascular diseases were relatively low compared to Canada which probably resulted from substitution of hospital care by pharmaceutical care (table 8.5, right panel) and relatively low costs per intervention for CABG and PTCA.

Pharmaceutical care

The variation in COI for pharmaceutical care (table 8.5) increased compared to aggregate cost of illness (table 8.3). A problem here, is that pharmaceutical prices differ enormously over the world. Furthermore methodological differences played a role. The English estimates, for instance, were based on expert opinions instead of prescription data, and underestimated the costs of diseases for which generic medicines are usually prescribed. Another methodological difference regards the allocation of contraceptive medicine. In the Dutch COI study, these costs were allocated to pregnancy and childbirth causing relatively high costs for this ICD chapter. In the other countries these costs were not-included or not-allocated to a specific disease category. The low pharmaceutical costs of cancer were striking in view of the costly chemical and hormonal therapies invoked. These therapies,

Table 8.5 *Costs of hospitals and physicians and of pharmaceutical care by diagnosis in four countries. Share of ICD chapters in total costs per sector (%)*

Chapters ICD-9	Hospitals and physicians					Pharmaceutical care				
	AUS	CAN	ENG	NETH	Coeff. of Variation	AUS	CAN	ENG	NETH	Coeff. of Variation
Infectious	2.6	1.4	1.5	1.7	35%	4.8	2.3	1.4	3.7	55%
Neoplasms	7.5	8.0	6.2	7.6	13%	1.3	2.4	2.9	1.8	38%
Endocrinal	2.2	2.2	1.4	1.9	23%	7.6	5.1	3.0	5.3	41%
Blood	0.7	0.6	0.8	0.6	17%	0.6	0.3	-	0.4	44%
Mental	6.8	12.2	11.5	20.1	49%	4.9	6.1	5.2	7.8	26%
Nervous	5.6	4.8	5.4	7.2	21%	6.1	4.5	4.3	5.0	19%
Circulatory	10.2	15.7	12.3	12.8	21%	17.7	15.9	18.4	20.9	14%
Respiratory	6.9	7.7	7.8	5.2	21%	19.4	9.8	11.8	13.1	36%
Digestive	6.4	7.5	5.4	5.9	17%	6.8	5.9	14.0	12.7	47%
Genito-urinary	6.5	5.1	4.9	4.6	19%	3.5	4.0	3.7	3.3	10%
Pregnancy	4.6	5.4	5.0	3.3	24%	0.3	0.4	-	2.8	116%
Skin	2.7	1.7	2.4	2.9	26%	6.4	2.8	2.3	2.8	59%
Musculoskeletal	8.1	5.4	6.4	7.8	22%	6.8	5.0	-	4.9	24%
Congenital	0.6	0.8	0.7	1.0	27%	0.0	0.1	-	0.5	118%
Perinatal	1.0	1.5	1.2	1.3	20%	0.0	0.1	-	0.0	231%
Symptoms	4.3	4.2	5.5	7.2	31%	7.5	3.4	0.8	7.0	72%
Accidents	9.7	8.0	6.0	6.4	27%	3.1	1.9	-	1.1	57%
Not allocated	6.4	7.8	5.6	2.6	45%	3.0	2.8	33.6	6.8	121%
Not included	7.1	0.0	9.9	0.0	114%	0.0	27.4	0.0	0.0	159%
Total costs	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	

** AUS = Australia, CAN = Canada, ENG = England, GER = Germany, NETH = Netherlands, SWE = Sweden, SD = standard deviation.*

however, were applied in hospitals and therefore all COI studies reported the costs as part of hospital costs.

For the three remaining countries (England excluded), the overall distribution among ICD chapters was roughly the same. Some major epidemiological-based differences regarded infectious diseases, diabetes, respiratory diseases and diseases of the skin [Looper 1998]. Other differences were caused by variations in medical practice, as for instance the lower costs for digestive diseases (acid inhibitors) and circulatory diseases (anti-hypertensive and cholesterol lowering medicine) in Australia and Canada likely due to cost containment policies.

Health practitioners

Among health practitioners international variations in health systems and COI studies played a major role (table 8.6). In the Canadian study, costs of digestive diseases were high because only dental care was allocated. In England, costs for mental disorders, nervous system and senses and circulatory diseases were high because of expenditure on psychiatrists, ophthalmologists and cardiologists which in other countries was included in hospital costs.

As a result only a bilateral comparison between Australia and the Netherlands was reasonable. The overall pattern for both countries was almost the same. Some important differences regarded diseases of the nervous system, pregnancy, musculoskeletal diseases and symptoms and were caused respectively by more outpatient ophthalmic care in Australia, childbearing at home assisted by midwives in the Netherlands, a substantial number of Cesar and Mensendieck therapists in the Netherlands, and a high frequency of symptoms registered by physical therapists in the Netherlands. So most differences were caused by differences in the health care systems.

The costs for endocrine diseases were high in Australia and probably resulted from a higher prevalence of diabetes among the aboriginal population. In this sector it was the only disease for which a possible epidemiological cause could be distinguished.

Institutional care

Cross-national differences were largest for institutional care and all could be explained by differences in health systems (table 8.6). Due to the comprehensive sector of health institutions, the costs of mental disorders (intellectual disability and dementia) and circulatory diseases (stroke) were high in the Netherlands. The costs of musculoskeletal diseases and diseases of the nervous system were low in the Netherlands, mainly due to the specialised institutions for rehabilitative care and people with epileptic disorders that belong to the hospital sector. The high share of unallocated costs in the Dutch study regarded living costs in homes for the elderly.

Table 8.6 *Costs of health professionals (physicians excluded) and institutions by diagnosis in four countries. Share of ICD chapters in total costs per sector (%)*

Chapters ICD-9	Health professionals					Institutional care				
	AUS	CAN	ENG	NETH	Coeff. of Variation	AUS	CAN	ENG	NETH	Coeff. of Variation
Infectious	0.5	-	0.0	0.1	132%	0.4	-	0.1	0.4	63%
Neoplasms	0.4	-	0.5	0.1	69%	1.1	-	0.8	0.9	20%
Endocrinal	1.7	-	0.4	0.1	113%	1.6	-	1.7	0.9	38%
Blood	0.0	-	0.0	0.0	-	0.2	-	0.4	0.1	76%
Mental	2.5	-	15.5	0.9	119%	24.2	11.9	48.7	50.4	61%
Nervous	7.0	-	10.4	1.1	81%	17.0	-	12.5	4.8	61%
Circulatory	1.2	-	9.8	0.5	124%	19.8	-	8.4	10.3	55%
Respiratory	1.1	-	0.8	0.8	24%	3.6	-	2.0	1.7	49%
Digestive	56.8	77.6	27.4	53.3	44%	1.2	-	1.9	0.5	65%
Genito-urinary	0.5	-	0.1	0.1	92%	1.1	-	1.8	0.4	70%
Pregnancy	0.2	-	3.7	11.0	108%	0.0	-	0.0	0.0	-
Skin	1.7	-	0.2	0.1	124%	0.2	-	0.4	0.2	51%
Musculoskeletal	12.8	-	7.9	16.5	42%	14.5	-	12.9	2.1	75%
Congenital	0.0	-	0.1	0.1	115%	0.4	-	0.1	0.2	68%
Perinatal	0.0	-	0.0	0.0	-	0.1	-	0.0	0.0	115%
Symptoms	1.8	-	1.3	6.3	90%	0.2	-	2.6	2.0	82%
Accidents	4.9	-	0.5	3.9	80%	3.8	-	1.3	3.6	55%
Not allocated	1.4	0.0	15.0	5.1	119%	0.0	-	4.5	21.6	118%
Not included	5.6	22.4	6.7	0.0	108%	10.6	88.1	0.0	0.0	151%
Total costs	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	

** AUS = Australia, CAN = Canada, ENG = England, GER = Germany, NETH = Netherlands, SWE = Sweden, SD = standard deviation.*

8.6 Discussion

Reported cost-of-illness figures showed a wide variation in costs for different diseases. We distinguished six explanatory factors for cross-national differences: 1) health care services; 2) the definition of health expenditure; 3) deviations between cost-of-illness and health expenditure; 4) data and methods employed in the COI studies; 5) health care utilisation due to differences in health status and health care needs caused by epidemiological and demographic variables; 6) variations in medical practice. Unfortunately it was not possible to correct for factors 1 – 4 and to explain remaining differences completely by factors 5 – 6, since COI figures could not be adjusted to a common comparable package. In fact, such a package had not been defined for the six countries in our study. Although the comparability increased a lot by adjusting COI data to national health expenditures, it was only possible to indicate some major epidemiological explanations for the remaining differences.

For four countries further improvements could be made by disaggregating COI figures to more or less comparable health care sectors, especially hospitals and physicians and pharmaceutical care. Due to differences in health system as well as in the data and methods employed in the COI studies, several unexpected variations in COI figures remained. The differences in COI methodology did not regard the overall top-down method that was used in all studies, but the more detailed properties of, for instance, the use of resource intensity weights and expert opinions. As a result, also at disaggregate level only major epidemiological explanations could be distinguished. Differences in health care systems, health care provision and COI methods provided more satisfactory explanations.

In the Dutch and Australian study, health expenditure was simultaneously allocated to age and sex, while in the Canadian study estimates for age and sex separated from the allocation to diseases. Demographic cost estimates are useful for the projection of future health care costs. Within the scope of cross-country comparisons there is additional benefit. The cost estimates per age and sex category provide a framework with borderline statistics for the interpretation of differences between health care sectors and disease categories. Moreover a simultaneous breakdown allows for the adjustment of COI estimates to differences in the age structure of the populations involved.

Recommendations

COI studies are primarily designed for national purposes. Hence the significance of a crude comparison of costs per ICD chapter as in the OECD Health Data is very limited. The findings of such comparisons are weak and the major conclusions only regard obvious aspects. At present, for a real insight into cross-national differences, it is much better to study either health care systems or epidemiology instead of their interaction in COI studies.

If, nevertheless, COI comparisons are desired, it would be better to compare disease specific studies. Such comparisons should contain detailed data on epidemiology of the disease and cross-national variations in the provision of health care. Given the differences in cost estimates for different diseases [Koopmanschap 1998], this approach would in fact require international collaboration from onset of the study.

If a comparison of general COI studies is what is wanted, some major conditions for success can be mentioned: 1) uniform sector definitions should be used [Mosseveld 1998, OECD 2000a, Eurostat 2000]; 2) many subsectors should be distinguished to allow for detailed adjustments of national data to international definitions; 3) a distinction should be made between sectors with multiple diagnoses (mainly hospitals, physicians, pharmaceutical care and probably nursing homes) and sectors which costs can be attributed to only one diagnosis (dental care, care for people with intellectual disabilities or psychiatric conditions); 4) a further standardisation of methods is necessary; 5) the inclusion of age and sex in the COI estimates would be very useful. In our opinion only a joint research project can fulfil these conditions.

8.7 Conclusions

We concluded that the scope of COI studies barely extents beyond national levels. Published COI studies could only be compared at a high level of aggregation. At this level, the overall distribution of costs among ICD chapters was roughly the same. There were, however, major deviations that in most cases could not solely be explained by epidemiological factors, the health care systems involved or characteristics of the study. Cross-national comparisons, therefore, should start with health care systems or epidemiology rather than COI studies. In the long run, COI comparisons might be successful if the scope is limited to sectors in which multiple diseases play a role, if methods are standardised at detailed level and the COI figures regard a common comparable package or any other international standard of health care supply.

Acknowledgements

We are grateful to Rachel Moore, Colin Mathers and Markus Schneider for background information on the Canadian, Australian and German study, respectively. Also Marc Koopmanschap and the participants of the Eurostat-meeting on Functional Health Accounts (Clervaux, September 2000) are gratefully acknowledged for useful discussions.

Part IV

General discussion

General discussion | 9

9.1 Introduction

This thesis deals with general cost-of-illness studies. In the previous chapters we demonstrated the construction, application and interpretation of COI studies (the first objective of this thesis, see 1.5). In this chapter we discuss the advantages and limitations of general COI studies (the second objective). First, the theoretical debate on COI studies is summarised and discussed. Second, the implications of more practical issues for the COI field will be discussed regarding the objectives of description, comparison and projection. We will finish with come conclusions and recommendations.

9.2 The cost-of-illness debate

In the literature, there has been some debate about the usefulness of cost-of-illness studies. Some criticisms regard the methods by which indirect or productivity costs are estimated. Because this thesis focuses on medical costs alone, we refrain from participating in that discussion, and instead concentrate on the qualities of general COI studies that include only medical costs.

Objectives of cost-of-illness studies and possible applications
The objectives and applications of COI studies mentioned in the literature can be summarised under three headings: description, comparison and projection (see 1.4) [e.g. Ament 1993, Black 1975, Byford 2000, Davey 1992, Drummond 1992, Hodgson 1989, Koopmanschap 1998, Rice 1994, Rice 2000, Roijen 1997].

General cost-of-illness studies are assumed:

Description

1. to provide a single index of the burden of illness;
2. to tell how much society is spending on one or more diseases, and by implication the amount that would be saved if the diseases were eradicated;
3. to raise cost-consciousness among policy-makers;
4. to identify the main components of health expenditure and areas where savings can be made;
5. to justify the present and future health care budget or the amount on specific intervention programs;
6. to assist in the allocation of research dollars on specific diseases.
7. to provide baseline data on which more detailed economic evaluations can be undertaken.

Comparison

8. to explain trends in health expenditure by comparing different years within a particular country;
9. to explain differences in health expenditure across countries.

Projection

10. to be employed in demographic and epidemiological scenarios to project future developments in health expenditure.

Criticisms on cost-of-illness studies

The above mentioned objectives have been criticised by some authors. The most firm and concise critique was described by Shiell et al., who stated that COI studies 'only confuse, mask and mislead' [Shiell 1987]. Their arguments and the criticisms of others regard objectives 1 – 6 and 10.

1. *General concept and use as index for burden of illness*

- COI studies rest on a fundamental misunderstanding of economic cost. In economics costs are defined as opportunity costs which measure the value of forgone benefits of the most favourable alternative use of the resources. In health care these opportunity costs should be measured in terms of quality-adjusted-life years (QALYs) [Shiell 1987].
- COI studies do not capture the whole burden of diseases, since they do not reckon with the consequences of the diseases for quality of life [Drummond 1992].
- COI estimates are difficult to interpret. Does the ranking of diseases according to costs yield a ranking according to disease severity or something else? Based on the Canadian COI study, in which the costs of coronary heart disease were

estimated at CAN$ 7.4 billion, compared to CAN$ 1.9 billion for motor vehicle traffic injuries [Moore 1997], it was questioned whether these data 'demonstrate that coronary heart disease is a "bigger" problem than motor vehicle traffic injuries, by a factor of four times, or mean that four times the resources ought to be allocated to coronary heart disease?' [Currie 2000].

2. *Savings resulting from eradication of diseases*
- In a policy context, total COI estimates are not appropriate, since they only indicate the benefits of totally eradicating the disease in question. As few diseases can be eradicated, at least in the short run to which COI estimates relate, potential cost savings are to a large extent illusory.
- Even if complete eradication is possible, COI studies do not say anything about the costs of eradication itself, and will overestimate potential savings. Costs of prevention, for instance, can be become quite high for certain diseases.
- Prevention particular diseases will always result in an increase of other diseases. People get older and will likely suffer from 'substituting' diseases. Especially from a longitudinal perspective cost savings are at least uncertain and likely unattainable. It was shown, for instance, that the prevention of fatal diseases will induce higher health care costs [Bonneux 1998].

3. *Cost-consciousness among policy-makers*
- By focussing on diseases with high costs, COI studies can implicitly divert the decision makers' attention from areas where important health gains can be made at low costs [Byford 2000]. A well-known example is phenylketonuria, which leads to severe intellectual disability but does not represent a substantial share in total cost of illness because incidence is low. However, this is not an argument against preventing the disease; it is, in fact, inexpensive to prevent while the health gain for the individual is great. Even so, costs of screening for this particular disease can become rather high if not performed in a joint screening programme.

4. *Identification of cost components and efficiency gains*
- COI studies usually do not include the costs of informal care, while from a societal perspective it is an important category. Cost savings are overestimated if a reduction in formal care causes a shift to informal care.
- COI studies focus on costs and not on efficiency, and consequently may lead to incorrect decisions. High expenditure as such does not provide enough information to suggest (technical) inefficiency and waste. High expenditure, in other words, does not imply that efficiency gains can be attained.
- Resource allocation and its efficiency are usually matters of scale. Policy-makers face questions about whether an existing program should be expanded or contracted. Decision-makers are interested in marginal analyses

that compare the expected change in benefits with the additional costs of the intervention that brings that change about [Shiell 1987]. Policy-makers, in other words, need cost-effectiveness analyses instead of cost-of-illness studies.

5. *Justification of the health care budget or the amount on specific programs*
- If inefficiencies and waste exist, the prioritising of programmes for diseases with high costs can introduce some circularity, which means that policy decisions perpetuate and amplify the original irrational spending [Shiell 1987, Koopmanschap 1998]. COI studies, therefore, can not justify any allocation of health care resources [Davey 1992, Byford 2000].

6. *Prioritising medical research*
- COI figures do not provide sufficient information for decisions about the allocation of resources for medical research. COI can at most indicate important research areas from perspective of health expenditure, but always additional data on research opportunities are required.

10. *Projecting future health care costs*
- COI studies usually show a cross-sectional picture and fail to estimate the influence of technological change on health care costs [Hodgson 1989]. For instance, the developments in therapy had a substantial influence on costs coronary heart disease [Hodgson 1994]. As a result projections based on a 'business as usual' assumption can be misleading.

Discussion

In the debate on the qualities of COI studies Hodgson argued that COI studies are not aiming at policy-making, but must be seen as policy-relevant by educating, informing and enlightening policy-makers [Hodgson 1989]. COI studies do not replace cost-effectiveness analyses (CEA) but can be seen as a baseline against which new, expensive clinical trials and CEAs can be performed [Drummond 1992]. Policy-makers can use COI studies in their considerations but mature decisions need more inputs. For decisions about the allocation of health care resources data on medical outcomes and cost-effectiveness is required. Equity arguments regarding distributive justice must also be considered [WHO 2000]. For decisions about the allocation of research funds, COI studies can be used to indicate important fields, but additional information on promising research areas is always required. In summary, COI studies as such are no aid to decision-making or priority setting. Similar conclusions were made regarding the policy-relevance of the global burden of disease estimates. [Williams 1999, 2000, Mooney 2000, Murray 2000].

The other shortcomings have not been addressed extensively in the literature. It is clear, however, that most arguments more or less explicitly relate to the

efficiency argument. It is also clear that COI studies represent a different aspect of health economics than studies in Medical Technology Assessment (MTA). From the perspectives of decision-making, priority setting and resource allocation, the above mentioned criticisms regard relevant shortcomings of the COI approach. In our opinion, the 'opportunity cost' argument mentioned in the first point only confuses benefits (numerator) and costs (denumerator). In health economics opportunity costs are usually estimated by the value of invested resources since market prices are hardly available.

It is true that COI studies do not estimate the whole burden of disease. Mortality, morbidity and quality of life are not included. COI studies only estimate the expenditure burden of disease. Due to the disappointing cross-national comparability, however, the meaning of the expenditure burden is nearly limited to national levels.

The issue of static descriptions in a dynamic sector is evident. This shortcoming, however, can at least partially be solved by repeating COI studies for several years and describing the developments in that period. We were able to compare COI studies for 1988 and 1994 and found interesting trends in health care costs by diagnosis and age (Chapter 3 and 5).

What cost-of-illness studies can not tell

The above mentioned limitations of COI studies can be summarised in four major points. COI studies can not tell us:

1. the value for money invested in health care.
2. whether or not more resources should be devoted to treating specific diseases;
3. whether or not more resources should be devoted to particular areas of medical research;
4. the total burden of disease.

What cost-of-illness studies really can tell

These shortcomings do not imply that COI studies do not have any value at all. They have their own worth as a numerator against which the dynamics of health status and health care can be described. While not appropriate for daily decision-making, this information is policy-relevant and can be used in combination with other information for developing a strategic perspective on health care. So the Dutch COI study played a role in the debate on the future of the health care system and the resources needed to comply with ageing [NZF 1997, Ministerie VWS 1998, 1998a, SER 1999].

According to Drummond, COI studies can fulfil an important task in 'highlighting the importance of diseases over and above the more usual epidemiological estimates' [Drummond 1992]. COI estimates can offer a new perspective on the population's health status as a whole, as well as on specific

diseases in particular. One of the key messages of the Dutch COI study on 1994 was that the main health care costs were made for chronic disabling diseases and not for the major causes of death (Chapter 2). The expenditure burden, in other words, was different from the mortality burden. A similar conclusion can be made for disease rankings based on incidence. Some infectious diseases have high incidence rates, for instance influenza, while costs are low compared to disorders with low incidence rates such as intellectual disability, some psychiatric conditions and congenital malformations.

In the Global Burden of Disease project (BOD) Murray and Lopez developed the DALY concept for the quantification of morbidity and mortality [Murray 1996]. Disability Adjusted Life Years (DALYs) integrate reduced life expectancy and increased disability in a single figure, using disability weights. Disability weights and DALYs were published for the Netherlands in 1994 [Stouthard 1997, Ruwaard 1997]. In some cases, the ranking based on DALYs was comparable to a ranking based on expenditure burden as estimated in the Dutch COI study, such as, for instance, for infectious diseases (low DALYs and low costs), schizophrenia (moderate DALYs and moderate costs) and COPD, coronary heart disease, stroke, dementia and intellectual disability (high DALYs and high costs). For other diseases, however, the rankings differed. Most cancers ranked high on a DALY-scale, with relatively low costs. By contrast hip-fracture and Down's syndrome ranked low in DALYs, while the costs were high.

We conclude that COI studies and other burden-of-disease estimates are complementary by focussing on different aspects of diseases: mortality, morbidity and costs. COI studies do not say much about disease severity, but estimate the resources dedicated to the prevention and treatment of all diseases, severe or less severe. The advantage of COI estimates is that they show how much society has invested in a particular disease compared to other diseases. In answer to the interpretation problems mentioned in the tenth shortcoming, we conclude that COI studies neither say whether one disease is a 'bigger problem' than another disease, nor indicate the resources society should invest in the specific disease. COI studies only disclose how much society has invested, given demography, epidemiology and medical technology. These insights, however, are worthwhile and complementary to the messages of the other burden of disease estimates. Especially when COI data for several years are available and time trends can be studied.

Another benefit of COI studies is that projections of future health expenditure can be made, provided that expenditure has been allocated to age and sex. In this way the consequences of demographic and epidemiological developments for the health care budget can be explored. In sensitivity analyses, the boundaries of health care costs can be estimated, including status quo (current levels and technology of care provision) as well as alternative scenarios regarding new technologies and policy measures.

A last benefit mentioned by Drummond, and not disproved by the critics of COI studies, regards the possibility of cross-national comparisons when estimates for different countries are available. An important condition here is that 'separate components of direct costs are identified'.

Conclusion
We conclude that cost-of-illness studies provide a suitable framework for the description, comparison and projection of health care expenditures from an epidemiological and demographic perspective, first of all as input for more detailed investigations.

9.3 Descriptive qualities

General cost-of-illness studies provide global descriptions of major patterns and trends. One of the key messages of the Dutch COI study was that most health expenditures relate to chronic disabling diseases rather than the major causes of death (Chapter 2). By including the whole health care system in the COI estimates the resources invested in, for instance, mental disorders and intellectual disability become clear (Chapter 6). Another striking element in the global picture regards the costs of digestive diseases which were very high, for instance compared to costs of cancer, mainly due to dental care. General COI studies are less appropriate for detailed descriptions due to data problems and methodological aspects.

Data problems
General COI studies depend on numerous data sources (appendix A). Data on health care use is needed for each sector. For a number of sectors, national registries are available, while for other sectors, surveys must be used. Cost estimates for some diseases can be biased due to lacking data. The Dutch hospital registry (LMR), for example, which covered nearly all hospital care in 1994 contained almost no specific data on renal dialysis provided in specialised hospital units. As a consequence, the costs of renal diseases were underestimated in the Dutch COI study [Wit 2001].

Lacking data also made it necessary for assumptions to be made. In the Dutch study on 1994, we made several assumptions, some of which were weak, such as the assumption that survey data from one year were representative of another year, and others strong, such as the hypothesis that the costs of care in homes for the elderly were distributed among disease categories in the same way as in nursing homes. Another strong assumption regarded the distribution of hospital costs among inpatient and ambulatory care. Because of data problems and substituting assumptions, general COI studies are suitable for broad descriptions rather than detailed analyses.

Top-down methodology

General COI studies are based on a top-down methodology. For each sector, health expenditure is ascribed to diseases using key variables that represent equal units of health care consumption. For some sectors, the units of health care use are weighed by resource intensities, as was the case for hospital interventions and pharmaceutical care in the Dutch study on 1994. For other sectors, each unit per key variable is given the same weight, although there are indications that resource intensities differ per disease category.

In Chapter 7, we described costs after hip fracture as estimated in a bottom-up study. These estimates were based on detailed data on health care use. For each type of care, several components were distinguished. For hospital care, therefore, a distinction was made between the fixed costs of inpatient days and the variable costs of nursing, care by physicians and allied health professionals, laboratory analyses and radiology. Volume data per component were collected and multiplied by unit costs for each patient. The results were striking. First, the difference in total costs between a general hospital and an academic hospital on the one hand and between hospitals and nursing homes on the other hand were modest. Secondly, hospital costs declined steeply for nearly all patients in the post-operative days and remained low until discharge. These results contradict the assumption of equal costs per hospital day as used in top-down COI studies. As a consequence, the costs of diseases that use considerable resources per inpatient day are systematically underestimated, while costs of other diseases are overestimated. General COI studies can be improved by distinguishing resource intensity weights for major care categories as inpatient day in hospitals and nursing homes. A first step would be to distinguish intensive care days from average inpatients days, which was not yet possible in the Dutch study on 1994. A second improvement would be to integrate care weights in the key variables. This, however, will only be possible if: 1) the registries contain information on the distribution or care weights among people with a certain disease; and 2) the relation between care weights and costs is clear.

Prevalence-based

General COI studies are cross-sectional, hence prevalence based. The estimated costs relate to all care for ill people in a certain year, irrespective whether people contracted the disease in that particular year or were already ill at the beginning of the year. As long as incidence is constant and costs are stable during the course of the disease, the cross-sectional approach will yield reliable cost-of-illness figures. In other cases, however, a bias might be introduced. Costs of cancer, for example, are high at onset of the disease, relatively low during the development of the disease, and high again in the final stage preceding death [Koopmanschap 1994a]. Other examples regard aids and diabetes mellitus [Postma 1998].

Cost estimates in general COI studies, therefore, mirror the distribution of disease stages in a certain year's population. As a consequence, COI figures can

only be divided by incidence rates to calculate costs per incident case as long as incidence, stage distribution and duration are constant.

Disease and comorbidity
In general COI studies, health expenditures are allocated to primary diagnoses only. A major advantage of this approach is that double counting is excluded by definition. Total cost of illness is equal to total health expenditure, and disease advocacy does not play a role, unlike some disease-specific COI studies.

A shortcoming of this approach is that the costs of diseases, which are prevalent as comorbid conditions, are underestimated. In Chapter 7 it was calculated that hip fracture patients with comorbidities had substantially higher costs compared to people without comorbidity. In general COI studies, these higher costs are all ascribed to the disease for which the patient was admitted to the hospital. For some diseases, this shortcoming can be corrected by specifying a separate axis for secondary diagnoses in hospital data. This will be the approach in the 1999 update of the Dutch COI study for sepsis and chronic ulcers of the skin.

In the same way costs of causally related diseases are underestimated by the use of primary diagnoses only. Diabetes is a good example here. Costs for diabetes were relatively low in the COI study for the Netherlands in 1994, because patients were admitted to hospital for heart disease, eye disorders, renal insufficiency and other diseases caused by diabetes. Since diseases in this category experience more or less complex causal relations with other diseases, the underestimation can not be solved by simply specifying a secondary diagnosis. For this category of causally related diseases epidemiological models should be used to study the dynamics in epidemiology and costs [Barendregt 1998]. Such models, however, analyse specific diseases and do not comprise health care as a whole. Rather than as an improvement on COI studies, this modelling approach should be seen as an independent scientific discipline, in which COI studies can be used as an input instead of the other way around [Barendregt 1997, Bonneux 1998].

9.4 Qualities of comparisons

Comparisons over time
The availability of COI estimates for two or more years allows for comparisons over time. Because the COI studies are based on the same population and the same health care system, the possibilities for comparison seem very good. Indeed the possibilities for comparison are nowhere better than here. However, there are some problems.
In the first place, there are the data problems. Registries evolve and change over time. In 1988 the Dutch hospital registry, for example, contained almost no data on day care, while in 1994 the coverage was nearly 100%. As a result, the COI studies for 1988 and 1994 were compelled to employ different methods for the

allocation of hospital care. For the purpose of comparison, the 1994 study was adjusted to 1988 methods (Chapter 2), but the missing data on day care hampered the explanation of trends (Chapter 5). Other data problems concern the availability of surveys. In 1988, the data on care for the disabled were poor. In 1994 the data were much better, but the data available for the 1999 update are again inferior in quality. Lacking data made allocation of pharmaceutical expenditure impossible for 1988, and hence no comparison could be made with 1994. Another example regards home care for which in 1988 a survey was available, which was also used for the 1994 update because of the lack of data for that particular year. For the allocation of general practitioners' expenditure in 1988 and 1994, two quite different surveys were used, which meant that this sector had to be excluded from comparisons. In conclusion, COI studies must be adjusted for differences in data and subsequent methods before comparisons can be made.

The second category of problems regards the influence of health care policy. Two aspects are important here. First, the definitions of health care sectors change over time. In 1988, for example, the expenditure for psychiatrists was classified in the same category as for medical specialists, while in 1994 this expenditure was included in the figures for psychiatric care. Another example regards the vaccination program, which was classified as home care in 1988 and as preventive care in 1994. Before comparisons can be made, these administrative differences must be identified and eliminated. A second influence of health care policy regards investments in specific health care facilities and cost containment measures in others. In 1988 – 1994, the Dutch government invested in health services for the disabled. The COI comparison between the two years mirrors these investments. In other cases, however, the influence of health policy is less obvious. To contain pharmaceutical costs, for instance, some drugs were excluded from remuneration, while for others co-payments were introduced. Consequently not only expenditure changed, but also the numerator on which the expenditure was predicated. Costs for physical therapy were almost the same in 1994 and 1999, mainly due to a restriction of the allowed number of insured sessions per patient. Because in these examples all aspects changed, e.g. expenditure, sector definition and volume of care, it is very difficult to untangle the contributions of epidemiology and health policy. We conclude that COI comparisons over time always include the effects of health care policy. In some cases the COI figures can be adjusted for one year or the other. In other cases the influence is more implicit and can not be removed. In these cases, health policy might introduce a bias in the COI comparisons. After all there was limited evidence for epidemiological causes of changes in COI between 1988 and 1994. The relatively short period was also crucial here.

Interesting time trends

Some of the most interesting time trends were described in Chapter 5. We demonstrated that the average growth rate in per capita costs was almost stable

over age. Underlying this development quite different trends for acute care and long-term care were observed. The growth rate for acute care costs increased with age, whereas the rate for long-term care decreased. The acute care trend took place within the fixed budget for hospital costs and was driven by technological innovations that caused an increase in day care, mainly among younger people, the broadening of indications for interventions among the elderly and an overall reduction in the average length of hospital stay. The trend in long-term care mainly resulted from specific investments in certain areas of health care, mainly facilities for disabled people. We conclude that from a societal perspective the developments in acute care are to a certain extent autonomous, while long-term care is more sensitive to policy measures.

Comparisons over countries

The availability of COI studies for different countries allows for cross-national comparisons (Chapter 8). Here the problems associated with comparisons within one particular country are intensified, in addition to the new problems that arise.

The first issue regards the definition of health care. Cross-national differences in per capita expenditure are quite large. The definition of total health care differs per country. In the Netherlands, for example, homes for the elderly are included in the health care system in contrast to all other countries. In Australia, institutions for people with intellectual disabilities are excluded from the health care system, while included in most other countries. Hence 100% of the health care budget has a different meaning for each country. Moreover, not all COI studies comprise 100% of the health care budget. In many cases, however, it will be possible to adjust for these differences.

The second issue concerns the scope and contents of health care institutions. Nursing homes are known to be quite different in the Netherlands and the United Kingdom. The definitions of hospitals also differ between countries, especially regarding psychiatric and rehabilitative care. Adjusting for these differences causes major problems that can not easily be solved.

The third aspect has to do with differences in data and methods. Some studies use expert opinions while others are based on data from registries and surveys. Due to such differences pharmaceutical costs of illness could not be compared between England and the other countries. Another difference regards the use of resource intensity weights to adjust the number of inpatient days for the intensity of care.

As a result of these problems, cross-national COI comparisons only reveal quite obvious epidemiological differences, such as, for instance, a high prevalence of skin diseases and diabetes in Australia (Chapter 8). Some indications of major differences in health care practice might also become evident. The hospital costs for childbirth in the Netherlands were low due to the Dutch practice of childbirth at home. High costs for digestive diseases in Germany were caused by the large number of dentists. In Canada, finally, pharmaceutical costs for circulatory

diseases were relatively low, probably due to a restrictive drug policy and substitution by hospital care.

We conclude that the value of COI studies is primarily restricted to national levels. A true insight into cross-national differences is better obtained by studying either health care systems or epidemiology rather than their interaction. If, nevertheless, cross-national comparisons are to be made, we recommend that: 1) uniform sector definitions be used; 2) many subsectors be distinguished to allow for detailed adjustments of national data to international definitions; 3) a distinction should be made between sectors with multiple diagnoses (mainly hospitals, physicians, pharmaceutical care and probably nursing homes) and sectors which costs can be attributed to only one diagnosis (dental care, care for people with intellectual disabilities or psychiatric conditions); and 4) methods be standardised. Furthermore, the inclusion of age and sex in the COI estimates would be very useful, as they provide a framework with borderline statistics for the interpretation of differences between health care sectors and disease categories and allow for adjusting COI estimates to demographic differences. Finally, it would be worthwhile to combine COI estimates and other burden-of-disease measures such as DALYs, in order to relate cost-differences to differences in health status. At this moment, this is unfortunately not yet possible.

9.5 Power of projections

Demographic projections

The allocation of health care costs to age groups by sex allows for projections of future health care costs. The Dutch COI figures were used in this way (Chapter 4) and the results were used by the government [Ministerie VWS 1998, 1998a]. Demographic projections, however, have some important shortcomings.

The first shortcoming is that demographic projections only take into account changes in cohorts. The changing numbers of people in each age-sex group are multiplied by the fixed costs per age-sex group as estimated in the COI study. The problem here is that population forecasts are not only based on birth rates, but also include some assumptions on ageing [Beer 1997]. As life expectancy is increasing it is not appropriate to fix per capita costs at constant levels [Spillman 2000]. This problem can be solved by estimating not only costs per age-sex group, but also the costs in the last year of life for all age and sex groups. There is some evidence of substantially higher costs in the year preceding death [Nord 1989, Lubitz 1993, WRR 1997], and therefore these costs will be specified in the 1999 update of COI in the Netherlands. By analysing these costs separately the influence of longevity can be distinguished from the influence of changing cohorts and the projections become more reliable.

A second shortcoming regards the assumption that costs per age and sex group are stable over time. Demographic projections extrapolate current medical practice

to the future and ignore the influence of epidemiological and technological change. In Chapter 4 and 5 we demonstrated a substantial impact of these variables, which was also the case for policy measures. The main advantage of demographic projections, therefore, is limited to a function as rough estimates of future costs and scenarios to which actual developments can be compared.

Epidemiological and other projections

Other projections can be used to deal with the shortcomings of demographic projections. If two or more COI studies are available, time trends can be studied and extrapolated. In Chapter 4, we prolonged the combined trend for epidemiology, technology and health care policy irrespective of age. We concluded that projected health care costs will increase much more steeply compared to a simple demographic projection. In Chapter 5 we made a projection based on age-specific trends. In this scenario, the total projected costs increase was even higher, but consisted of different projections for acute and long-term care. Both projections depended on the assumption that developments in the past are representative for the future, which is in fact a strong assumption. In 1988 – 1994, for example, day care in hospitals emerged as an important health care service. Although it is likely that the importance of day care will increase in the near future, it is far from clear whether this trend will remain constant in the same magnitude or will curve downward. Similar conclusions can be made for the influence of health policy. In conclusion, projections of future costs based on past trends must be interpreted as rough scenarios of developments that will undoubtedly be different.

Epidemiological models can be used to make more sophisticated projections for a particular disease or some related diseases. Unfortunately, integrated epidemiological models for the whole health care system and total health expenditure are not (yet) available. The Dutch COI studies were used to predict costs of cancer [Koopmanschap 1994a], smoking [Barendregt 1997] and circulatory diseases [Bonneux 1998]. In such studies COI estimates must be used with caution, as the estimates relate to all the costs of those with the disease in a certain year. We saw in the foregoing that the cost may vary during the course of the disease. Models based on the incidence-prevalence-mortality approach should take this aspect into account and in some cases should use adjusted COI figures, as Marc Koopmanschap did in the projection of the future costs of cancer [Koopmanschap 1994a]. Despite the sophisticated method of these models, it should be noted that they also assume that COI estimates per age and sex group are stable over time, which is still a strong assumption.

9.6 Conclusions: Are general cost-of-illness studies useful?

General COI studies are used by researchers and politicians for several purposes, but are they really useful? Based on the observations and discussion in this thesis we conclude that:

1. COI studies have, first and foremost, national value. In the future, however, cross-national comparisons might be possible and will reveal interesting insights if methods are standardised and the estimates regard a common comparable package.
2. COI studies disclose interesting information complementary to burden-of-disease estimates based on epidemiological criteria. The significance of COI figures mainly consists of the framework they provide for health care research and health care policy. They do not provide, however, simple criteria for decision making on the allocation of health care resources, research funds or whatever decisions can be made. They provide comprehensive insight into health care and must be seen as an input for cost-effectiveness analyses and policy measures, among many others.
3. COI studies can contribute to the understanding of major trends in health expenditure and underlying developments. Until now, these insights have been limited, but this may improve if data also improve and remain constant during a longer period.
4. COI studies provide an essential input for projections of future health care costs. The value of these projections is limited since COI estimates are static, but, as the understanding of trends improves, it might be possible to develop more sophisticated scenarios. A first real improvement would be the introduction of health care costs in the last year of life.

9.7 Recommendations

This thesis discussed the qualities of general COI studies. We concluded that COI studies are worthwhile but that their value should not be overrated. We finish with some general recommendations.

1. COI studies should distinguish between total health expenditure and a smaller definition of sectors in which multiple diagnoses are relevant, especially including physicians, hospitals, nursing homes and pharmaceutical care. This core sector must be defined in line with international standards for a common comparable package. As many subsectors as possible should be distinguished to allow for the adjustment of COI data to these standards.
2. International standards for COI methodology should be developed. Main aspects regard the use of registration data, surveys and expert opinions, as well as the methods for weighing inpatient days and other units of care to adjust for differences in resource use among disease categories. Because small

methodological differences can have a large impact, data and methods should be as similar as possible for the above mentioned core sectors. For other sectors, cross-national differences are less problematic. The definition of the common comparable package and the harmonisation of data and methods should be undertaken by international organisations such as the OECD and Eurostat.

3. National data sources should be improved and a constant quality must be guaranteed. Some data sources, however, change their definitions in course of time due to changing applications. For other data sources, the quality and the coverage in terms of included persons is not stable over time. Reliable comparisons call for constancy in definitions, quality and coverage of data constant over a longer period. A problem in this respect is the fact that COI studies make extensive use of administrative data, that are not primarily collected for scientific research in general, or COI studies in particular. As a consequence the data owners have no incentive to collect data for purposes beyond their own business. As individual researchers are thus confronted with a prisoner's dilemma, we recommend that governments initiate the definition of responsibilities for the availability of data that are suitable for health care research. In addition governments should provide rules for the use of data at reasonable prices.
4. In the Netherlands it is not possible to combine health care data from different sources on individual level, as is the case in, for instance, the Scandinavian countries. We recommend the introduction of a unique, identifying personal number in health care, comparable with the Dutch sofi-number. Such a number will encourage health care research in general and COI studies in particular, and will contribute to a better understanding of health status and health care in the population. Of course the privacy of patients should be protected, but that is a minor issue regarding the technological possibilities.

References

[Aaron 1990] Aaron H, Schwartz WB. Rationing health care: the choice before us. *Science* 1990;247:418-422.

[AIHW 1996] Australian Institute of Health & Welfare. *Australia's health 1996.* Canberra 1996.

[AIHW 1997] Australian Institute of Health and Welfare. *Health expenditure bulletin.* Canberra 1997

[Ament 1993] Ament A, Evers S. Cost of illness studies in health care: a comparison of two cases. *Health Policy* 1993;26:29-42.

[Aspray 1999] Aspray TJ, Francis RM, Tyrer SP, Quilliam SJ. Patients with learning disability in the community. *British Medical Journal* 1999;318:476-477.

[Barendregt 1997] Barendregt JJ, Bonneux L, Maas PJ van der. The health care costs of smoking. *New England Journal of Medicine* 1997;337:1052-1057.

[Barendregt 1998] Barendregt JJ, Bonneux L. *Degenerative disease in an aging population. Models and conjectures.* Thesis Erasmus University Rotterdam, 1998.

[Barendregt 1999] Barendregt JJ, Bonneux L, Baan CA. The effects and costs of smoking cessation. In: *Public Health Models: Tools for health policy making at national and European level.* Amsterdam: ISG/UvA, 1999.

[Baumol 1993] Baumol WJ. *Social wants and dismal science - the curious case of the climbing costs of health and teaching.* Economic Research Reports, New York University 1993.

[Beer 1997] Beer J de. Bevolkingsprognose 1996: minder bevolkingsgroei, meer vergrijzing. *Maandstatistiek van de bevolking (Population Statistics)* 1997:6-12.

[Bennekom 1995] Bennekom CAM, Jelles F, Lankhorst GJ. Rehabilitation Activities Profile: The ICIDH as a framework for a problem-oriented assessment method in rehabilitation medicine. *Disability Rehabilitation* 1995;17:169-75.

[Behrens 1988] Behrens C, Henke KD. Cost of illness: no aid to decision making? Reply to Shiell et al. *Health Policy* 1988;10:137-141.

[Bijl 1998a] Bijl RV, van Zessen G, Ravelli A, de Rijk C, Langendoen Y. The Netherlands Mental Health Survey and Incidence Study (NEMESIS): objectives and design. *Soc Psychiatry Psychiatr Epidemiol* 1998;33(12):581-6.

[Bijl 1998b] Bijl RV, Ravelli A, van Zessen G. Prevalence of psychiatric disorder in the general population: results of The Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Soc Psychiatry Psychiatr Epidemiol* 1998;33(12): 587-95.

[Black 1975] Black DAK, Pole JD. Priorities for medical resarch: indices of burden. *British Journal of Social and Preventive Medicine* 1975;29:222-227.

[Bonneux 1994] Bonneux L, Barendregt JJ, Meeter K, Bonsel GJ, Maas PJ van der. Estimating clinical morbidity due to ischemic heart disease and congestive heart failure: the future rise of heart failure. *American Journal of Public Health* 1994;84:20-8.

[Bonneux 1998] Bonneux L, Barendregt JJ, Nusselder WJ, Maas PJ van der. Preventing fatal diseases increases health care costs: cause elimination life table approach. *British Medical Journal* 1998;316:26-29.

[Bonneux 2000] Bonneux L. Cholesterol lowering therapy for smokers and non-smokers: a life table analysis. *Lancet* 2000;356:2004-06.

[Borghouts 1999] Borghouts J, Koes B, Vondeling H, Bouter L. Cost of illness of neck pain in The Netherlands in 1996. *Pain* 1999;80:629-636.

[Borquist 1991] Borquist L, Lindelow G, Thorngren KG. Costs of hip fracture. Rehabilitation of 180 patients in primary health care. *Acta Orthopeadica Scandinavica* 1991;62(1):39-48.

[Boyce 1985] Boyce WJ, Vessey MP. Rising incidence of fracture of the proximal femur. *Lancet* 1985;1(8421):150-1.

[Brainsky 1997] Brainsky A, Glick H, Lydick E, Epstein R, fox KM, Hawkes W, Kashner TM, Zimmerman SI, Magaziner J. The economic cost of hip fracture in community-dwelling older adults: a prospective study. *Journal of the American Geriatric Society* 1997;45(3):281-7.

[Brouwer 1997] Brouwer W, Koopmanschap M, Rutten F. Productivity costs measurement through quality of life? A response to the recommendations of the U.S. panel. *Health Economics* 1997;6:253-259.

[Byford 2000] Byford S, Torgerson DJ, Raftery J. Cost of illness studies. *British Medical Journal* 2000;320:1335.

[Cameron 1994] Cameron I, Lyle D, Quine S. Cost effectiveness of accelerated rehabilitation after proximal femoral fracture. *Journal of Clinical Epidemiology* 1994;47:1307-1313.

[CBS 1994] Centraal Bureau voor de Statistiek. *Gezondheidsenquête 1994 (National Health Survey)*, Den Haag.

[CBS 1996] Centraal Bureau voor de Statistiek. *Maandstatistiek van de prijzen (Statistics on prices)*, Voorburg/Heerlen 1996.

[CBS 1996a] Centraal Bureau voor de Statistiek. *Kosten en financiering van de gezondheidszorg 1995 (Costs and financing of health care)*, Voorburg/Heerlen 1996.

[CBS 1997] Centraal Bureau voor de Statistiek. Bevolkingsprognose 1996. *Maandbericht Bevolkingsstatistiek (Population statistics)*, Voorburg/Heerlen 1997.

[Cooper 1976] Cooper B, Rice D. The economic cost of illness revisited. *Social Security Bulletin* 1976.

[Currie 2000] Currie G, Kerfoot KD, Donaldson C, Macarthur C. Are cost of injury studies useful? *Injury Prevention* 2000;6:175-176.

[Davey 1992] Davey PJ, Leeder SR. The cost of migraine - More than just a headache? *Pharmacoeconomics* 1992;2(1):5-7.

[Davies 1991] Davies L, Felce D, Lowe K, Paiva S de. The evaluation of NIMROD, a community-based service for people with mental handicap: revenue costs. *Health Service Management Research* 1991;4:170-80.

[Dockrell 1995] Dockrell JE, Gaskell GD, Normand C, Rehman H. An economic analysis of the resettlement of people with mild learning disabilities and challenging behaviour. *Social Science in Medicine* 1995;40:895-901.

[Drummond 1992] Drummond M. Cost-of-illness studies - A major headache? *Pharmacoeconomics* 1992;2(1):1-4.

[Drummond 1997] Drummond M, O'Brien B, Stoddart G, Torrance G. *Methods for the economic evaluation of health care programmes (Second ed.)*. Oxford University Press 1997.

[Druschel 1996] Druschel C, Hughes JP, Olsen C. Mortality among infants with congenital malformations, New York State, 1983 to 1988. *Public Health Reports* 1996;111:359-65.

[Dunning 1991] Commissie Keuzen in de Zorg (Dunning). *Kiezen en delen*. 's-Gravenhage 1991.

[Edmonds 1990] Edmonds LD, James LM. Temporal trends in the prevalence of congenital malformations at birth based on the birth defects monitoring program, United States, 1979-1987. *Morbidity and Mortality Weekly Reports CDC Surveillance Summary* 1990;39:19-23.

[Enthoven 1988] Enthoven AC. *Theory and practice of managed competition in health care finance*. Amsterdam: North-Holland, 1988.

[Eurostat 2000] Eurostat. *Key data on health 2000 - Data 1985 – 1995*. Luxembourg: European Commission, 2000: 310.

[Farnworth 1994] Farnworth MG, Kenny P, Shiell. The costs and effects of early discharge in the management of fractured hip. *Age and Ageing* 1994;23 (3):190-4 and erratum 1995;24(4): 367.

[Felce 1998] Felce D, Lowe K, Perry J, Baxter H, Jones E, Hallam A, Beecham J. Service support to people in Wales with severe intellectual disability and the most severe challenging behaviours: processes, outcomes and costs. *Journal of Intellectual Disability Research* 1998;42:390-408.

[Feldstein 1963] Feldstein MS. Review of B.A. Weisbrod's 'The economics of public health: measuring the economic impact of diseases'. *Economic Journal* 1963;73:129-130.

[Fishman 1997] Fishman P, Von Korff M, Lozano P, Hecht J. Chronic care costs in managed care. *Health Affairs* 1997;16:239-47.

[Folstein 1975] Folstein MF, Folstein SE, McHugh PR. Mini-Mental State: A practical Method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 1975;12:189-198.

[French 1995] French FH, Torgerson DJ, Porter RW. Cost analysis of fracture of the neck of femur. *Age and Ageing* 1995;24:185-189.

[Gibson 1979] Gibson RM, Fisher CR. Age differences in health care spending, fiscal year 1977. *Social Security Bulletin* 1979;42:3-16.

[GIP 1994] Geneesmiddelen Informatie Project. *Data on prescribed drugs in 1994 from the Drugs Information Project)*. Ziekenfondsraad, Amstelveen.

[Gold 1996] Gold MR, Siegel JE, Russel LB, Weinstein M (eds.). *Cost-effectiveness in health and medicine.* Oxford University Press, New York, 1996.

[Greenberg 1993] Greenberg PE, Stiglin LE, Finkelstein SN. The economic burden of depression in 1990. *Journal of Clinical Psychiatry* 1993;54(11):405-418.

[Groenenboom 1995] Groenenboom GKC, Huijsman R. *Ouderenzorg in economisch perspectief – Kostenscenario's*. Stichting Toekomst Scenario's Gezondheidszorg, De Tijdstroom, Utrecht 1995.

[Hakkaart 1998] Hakkaart-van Roijen L. *Societal perspective on cost of illness,* Thesis Erasmus University Rotterdam, 1998.

[Heaney 2001] Heaney DC, Sander JW, Shorvon SD. Comparing the cost of epilepsy across eight European countries. *Epilepsy Research* 2001;43(2):89-95.

[Hemminki 1977] Hemminki K. The costs of diseases and violence in Finland in 1972. *Social Science in Medicine* 1977;11(17-18):827-30.

[Henke 1986] Henke KD, Behrens CS. The economic cost of illness in the Federal Republic of Germany in the year 1980. *Health Policy* 1986;6(2):119-43.

[Henke 1997] Henke KD, Martin K, Behrens CS. Direkte und indirekte Kosten von Krankheiten in der Bundesrepublik Deutschland 1980 und 1990. *Zeitschrift für Gesundheitswissenschaften* 1997;5(2):123.

[Hodgson 1982] Hodgson TA, Meiners MR. Cost-of-illness methodology: a guide to current practices and procedures. *Milbank Memorial Fund Q Health Soc* 1982;60(3):429-62.

[Hodgson 1983] Hodgson TA. The state of the art of cost-of-illness estimates. *Advanced Health Economics and Health Services Research* 1983;4:129-64.

[Hodgson 1984] Hodgson TA, Kopstein AN. Health care expenditures for major diseases in 1980. *Health Care Financing Review* 1984;5(4):1-12.

[Hodgson 1989] Hodgson TA. Cost of illness studies: no aid to decision making? Comments on the second opinion by Shiell et al. (Health Policy, 8(1987) 317-323). *Health Policy* 1989;11(1):57-60.

[Hodgson 1994] Hodgson TA. Costs of illness in cost-effectiveness analysis. A review of the methodology. *Pharmacoeconomics* 1994;6(6):536-52.

[Hoffman 1996] Hoffman C, Rice D, Sung H-Y. Persons with chronic conditions - their prevalence and costs. *Journal of the American Medical Association* 1996; 276:1473-1479.

[Hollingworth 1993] Hollingworth W, Todd C, Parker M, Roberts JA, Williams R. Cost analysis of early discharge after hip fracture. *British Medical Journal* 1993;307:903-906.

[Hollingworth 1995] Hollingworth W, Todd CJ, Parker MJ. The cost of treating hip fractures in the twenty-first century. *Journal of Public Health Medicine* 1995;17(3):269-76.

[Howe 1998] Howe J, Horner RH, Newton JS. Comparison of supported living and traditional residential services in the state of Oregon. *Mental Retardation* 1998;36:1-11.

[Ireys 1997] Ireys HT, Anderson GF, Shaffer TJ, Neff JM. Expenditures for care of children with chronic illnesses enrolled in the Washington State Medicaid program, fiscal year 1993. *Pediatrics* 1997;100:197-204.

[Jacobson 1996] Jacobson L, Lindgren. *Vad kostar sjukdomarna? Sjukvårdskostnader och produktionsbortfall fördelat på sjukdomsgrupper 1980 och 1991*. Stockholm: Socialstyrelsen 1996.

[Johnell 1996] Johnell O. The socioeconomic burden of fractures: today and in the 21st century. *American Journal of Medicine* 1996;103(2A):20S-25S; discussion 25S-26S.

[Kennie 1988] Kennie DC, Reid J, Richardson IR, Kiamari AA, Kelt C. Effectiveness of geriatric rehabilitive care after fractures of the proximal femur in elderly women: a randomised clinical trial. *British Medical Journal* 1988;297:1083-6.

[Knobbe 1995] Knobbe CA, Carey SP, Rhodes L, Horner RH. Benefit-cost analysis of community residential versus institutional services for adults with severe mental retardation and challenging behaviors. *American Journal of Mental Retardation* 1995;99:533-41.

[Koning 1995] Koning HJ de, Fracheboud J, Boer R, et al. Nation-wide breast cancer screening in the Netherlands: support for breast-cancer mortality reduction. *International Journal of Cancer* 1995;60:777-780.

[Koopmanschap 1991] Koopmanschap MA, Roijen L van, Bonneux L. *Kosten van ziekten in Nederland (Cost of illness in the Netherlands)*, Instituut Maatschappelijke Gezondheidszorg, Erasmus Universiteit Rotterdam 1991.

[Koopmanschap 1994] Koopmanschap MA, Roijen L van, Bonneux L, Bonsel GJ, Rutten FFH, Maas PJ van der. Cost of diseases in international perspective. *European Journal of Public Health* 1994;4:258-264.

[Koopmanschap 1994a] Koopmanschap M, Roijen L van, Bonneux L, Barendregt JJ. Current and future costs of cancer. *European Journal of Cancer* 1994;30A:60-65.

[Koopmanschap 1995] Koopmanschap MA, Rutten FFH, Ineveld BM van, Roijen L van. The friction cost method for measuring indirect costs of disease. *Journal of Health Economics* 1995;14:171-189.

[Koopmanschap 1998] Koopmanschap MA. Cost-of-illness studies - useful for health policy? *Pharmacoeconomics* 1998;14(2):143-148.

[Koopmanschap 1998a] Koopmanschap MA, Polder JJ, Meerding WJ, Bonneux L, Maas PJ van der. Costs of dementia in the Netherlands. In: Wimo A, Jönsson B, Karlsson G, Winblad B, eds. *Health economics of dementia.* Chichester: John Wiley & Sons, 1998: 207-215.

[Krahn 1996] Krahn MD, Berka C, Langlois P. Direct and indirect costs of asthma in Canada 1990. *Canadian Medical Assosciation Journal* 1996;154(6):821-831.

[Laet 1996] Laet CEDG de, Hout BA van, Hofman A, Pols HAP. Kosten wegens osteoporotische fracturen in Nederland; mogelijkheden voor kostenbeheersing. *Nederlands Tijdschrift voor Geneeskunde* 1996;140:1684-8.

[Laet 1999] Laet CE de, Hout BA van, Burger H, Weel AE, Hofman A, Pols HA. Incremental cost of medical care after hip fracture and first vertebral fracture; the Rotterdam study. *Osteoporosis International* 1999;1091:66-72.

[Legoretta 1993] Legoretta AP. Increased cholecystectomie rate after the introduction of laparoscopic cholystectomie. *Journal of the Amercian Medical Association* 1993;270:1420-1432.

[Lindgren 1981] Lindgren B. *Cost of illness in Sweden, 1964 – 1975.* Lund: Institutet for Hälsökonomi 1981.

[Lindgren 1990] Lindgren B. The economic impact of illness. In: Abshagen U, Munnich FE (editors). *Cost of illness and benefits of drug treatment.* W. Zuckschwerdt Verlag, Munich 1990, pp. 12-20.

[Lissovoy 1994] Lissovoy G de, Lazarus SS. The economic cost of migraine. *Neurology* 1994;44 Suppl. 4:55-62.

[LMR 1994] Landelijke Medische Registratie (National Hospital Registry). *Data on hospitalizations and medical procedures in 1994.* Health Care Information Centre (SIG, Prismant), Utrecht.

[Looper 1998] Looper MD, Bhatia K. *International health - how Australia compares.* Canberra: Australian Institute on Health and Welfare, 1998: 166.

[LRZ 1994] Landelijke registratie zorg- en dienstverlening aan mensen met een verstandelijke handicap. *Data from the national registry of services for the mentally retarded.* Nationaal Ziekenhuis Instituut, Utrecht.

[Lubitz 1993] Lubitz JD, Riley GF. Trends in Medicare payments in the last year of life. *New England Journal of Medicine* 1993;328(15):1092-6.

[Lubitz 1995] Lubitz J, Beebe J, Baker C. Longevity and Medicare expenditures. *New England Journal of Medicine* 1995;332:999-1003.

[Magnusson 1996] Magnusson S. Treatment of rheumatoid arthritis: does it affect society's cost for the disease? *British Journal of Reumatology* 1996;35:791-795.

[Mathers 1998] Mathers C, Penm R, Carter R, Stevenson C. *Health system costs of diseases and injury in Australia 1993-94 - An analysis of costs, services use and mortality for major disease and injury groups*. Australian Institute of Health and Welfare, Canberra 1998.

[Mathers 1998a] Mathers C, Penm R, Sanson-Fisher R, Carter R, Campbell E. *Health system costs of cancer in Australia 1993-94*. Canberra: Australian Institute of Health and Welfare, 1998.

[May 2000] May D, Hogg, J. Continuity and change in the use of residential services by adults with intellectual disability: the Aberdeen cohort at mid-life. *Journal of Intellectual Disability Research* 2000;44:68-80.

[Meerding 1998] Meerding WJ, Bonneux L, Polder JJ, Koopmanschap MA, Maas PJ, van der. Demographic and epidemiological determinants of health care costs in the Netherlands: cost of illness study. *British Medical Journal* 1998;317:111-115.

[Meerding 1998a] Meerding WJ, Polder JJ, Bonneux L, Koopmanschap MA, Maas PJ van der. Health-care costs of ageing (letter). *The Lancet* 1998;351:140.

[Melton 1993] Melton LJ. Hip fractures: a worldwide problem today and tomorrow. *Bone* 1993;14 Suppl 1:S1-8.

[Melton 1996] Melton LJ. Epidemiology of hip fractures: implications of the exponential increase with age. *Bone* 1996;18(3 Suppl): 121S-125S.

[Mendelson 1993] Mendelson DN, Schwartz WB. The effects of ageing and population growth on health care costs. *Health Affairs* 1993;12:119-25.

[Mheen 1997] Mheen PJ van de, Barendregt JJ. *Toekomstige zorgbehoefte in Nederland - een kwantitatieve verkenning*. Wetenschappelijke Raad voor het Regeringsbeleid, Den Haag 1997.

[Ministerie WVC 1993] Ministerie van Welzijn Volksgezondheid en Cultuur. *Financieel overzicht zorg 1994 (Financial survey of health care)*, Rijswijk 1993.

[Ministerie VWS 1996] Ministerie van Volksgezondheid Welzijn en Sport. *Jaaroverzicht zorg 1997 (Yearly survey of health care)*, Rijswijk 1996.

[Ministerie VWS 1998] Ministerie van Volksgezondheid Welzijn en Sport. *Met zorg zorg ramen*. Rijswijk, 1998.

[Ministerie VWS 1998a] Ministerie van Volksgezondheid Welzijn en Sport. *Jaaroverzicht zorg 1999 (Yearly survey of health care)*, Rijswijk 1998.

[Mishan 1971] Mishan E. Evaluation of life and limb - a theoretical approach. *Journal of Political Economy* 1971;79:687-705.

[Mooney 2000] Mooney G, Wiseman V. Burden of disease and priority setting. *Health Economics* 2000;9:369-372.

[Moore 1997] Moore R, Mao Y, Zhang J, Clarke K. *Economic burden of illness in Canada, 1993*. Minister of Public Works and Government Services, Toronto 1997.

[Mosseveld 1998] Mosseveld CJPM van, Son P van. *International comparison of health care data - methodology development and application*. Voorburg: Kluwer Academic Publishers, 1998.

[Murphy 1987] Murphy PJ, Rai GS, Lowy M, Bielawaska. The beneficial effects of orthopaedic-geriatric rehabilitation. *Age and Ageing* 1987;16:273-8.

[Murray 1994] Murray C, Lopez A, Jamison D. The global burden of disease in 1990: summary results, sensitivity analysis and future directions. *Bulletin of the World Health Organisation* 1994;72:495-509.

[Murray 1996] Murray CJL, Lopez AD. Global and regional descriptive epidemiology of disability (Chapter 4). In: Murray CJL, Lopez AD (editors). *The global burden of disease and injury series*. Harvard University Press, Harvard 1996, pp. 201-246.

[Murray 1997] Murray CJL, Lopez AD. Global mortality, disability and the contribution of risk factors. The global burden of disease study. *The Lancet* 1997;349:1436-42.

[Murray 2000] Murray C, Lopez A. Progress and directions in refining the global burden of disease approach: a response to Williams. *Health Economics* 2000;9:69-82.

[NHS 1996] NHS Executive. *Burdens of disease - a discussion document.* Wetherby: Office for National Statistics 1996.

[Niessen 1993] Niessen LW, Barendregt JJ, Bonneux L, Koudstaal PJ. Stroke trends in an ageing population. *Stroke* 1993;24:931-939.

[Nord 1989] Nord E, Hjort PF, Heiberg AN. Expenditures on health care in the last year of life. *International Journal of Health Planning and Management* 1989;4(4):319-22.

[NZF 1997] Nederlandse Zorgfederatie. *Gezondheidszorg in tel - 5*. Utrecht, 1997.

[NZI 1998] Nationaal Ziekenhuis Instituut. *Financiële statistiek academische ziekenhuizen, algemene ziekenhuizen en verpleeghuizen. (Financial data on hospitals and nursing homes)*. Utrecht 1998.

[O'Cathain 1994] O'Cathain. Evaluation of a Hospital at Home scheme for the early discharge of patients with fractured neck of femur. *Journal of Public Health Medicine* 1994;16(2):205-10.

[O'Connell 2000] O'Connell JB. The economic burden of heart failure. *Clinical Cardiology* 2000;23(3 Suppl):III6-10.

[OECD 1998]. Organisation for Economic Cooperation and Development. *OECD Health Data 1998*. Paris: OECD/CREDES 1998.

[OECD 2000] Organisation for Economic Cooperation and Development. *OECD Health Data 2000*. Paris: OECD/CREDES, 2000.

[OECD 2000a] Organisation for Economic Cooperation and Development. *A system of health accounts*. Paris: OECD/CREDES, 2000.

[Oostenbrink 2000] Oostenbrink J, Koopmanschap MA, Rutten FFH. *Handleiding voor kostenonderzoek*. Instituut voor Medische Technology Assessment, College voor Zorgverzekeringen, Rotterdam, Amstelveen 2000.

[Osterhaus 1992] Osterhaus JT, Gutterman DL, Platchetka JR. Healthcare resource and lost labour costs of migraine headache in the US. *Pharmacoeconomics* 1992;2:67-76.

[Parker 1992] Parker MJ, Myles JW, Anand JK, Drewett R. Cost-benefit analysis of hip fracture treatment. *Journal of Bone and Joint Surgery* 1992;74-B:261-264.

[Perls 1996] Perls TT. Acute care costs of the oldest old. *Archives of Internal Medicine* 1996;156:754-760.

[Perls 1997] Perls TT. Acute care costs of the oldest old. *Hospital Practice* 1997; 32:123-137.

[PIGGz 1994] Patiëntenregister Intramurale Geestelijke Gezondheidszorg (National information system for psychiatric care). *Data on hospitalizations in 1994*. Health Care Information Centre (SIG, Prismant), Utrecht.

[Polder 1995] Polder JJ. Medical technology and health-care expenditures: The Dutch experience in the period 1970-1990. *International Journal of Technology Management, Special publication on the role of management of technology in clinical and administrative health-care delivery* 1995;10:20-31.

[Polder 1997] Polder JJ, Meerding WJ, Koopmanschap MA, Bonneux L, Maas PJ van der. *Kosten van ziekten in Nederland 1994 (Cost of illness in the Netherlands 1994)*. Instituut Maatschappelijke Gezondheidszorg, Instituut voor Medische Technology Assessment, Erasmus Universiteit Rotterdam 1997.

[Polder 2001] Polder JJ, Meerding WJ, Koopmanschap MA, Bonneux L, Maas PJ van der. Trends in Dutch health care costs 1988-1994-2050. *International Journal of Health Care Technology and Management*, (in press).

[Postma 1998] Postma MJ, Jager JC, Ruwaard D, Loy NC van, Leidl RM. Disease-staging for modelling current and future health-care impact of disease: illustrations for diabetes mellitus and AIDS. *Health Policy* 1998;43(1):45-54.

[Pryor 1988] Pryor GA, Myles JW, Williams DRR, Anand JK . Team management of the elderly patient with hip fracture. *The Lancet* 1988;338:401-403.

[Rice 1966] Rice DP. *Estimating the cost of illness*. Rockville: Department of Health, Education and Welfare, Health Economic Series no. 6, DHEW pub no (PHS) 947-6, 1966.

[Rice 1985] Rice DP, Hodgson TA, Kopstein AN. The economic costs of illness: a replication and update. *Health Care Financing Review* 1985;7(1):61-80.

[Rice 1994] Rice DP. Cost-of-illness studies: fact or fiction? *The Lancet* 1994; 344:1519-1520.

[Rice 2000] Rice DP. Cost of illness studies: what is good about them? *Injury Prevention* 2000;6:177-179.

[Roijen 1992] Roijen L van, Koopmanschap MA, Bonneux L. Kosten van ziekten. *Nederlands Tijdschrift voor Geneeskunde* 1992;136(2):74-80.

[Roijen 1997] Roijen L van, Rutten FFH. 'Kosten van ziekte'-studies - beleidsrelevantie en methoden. *Tijdschrijft Sociale Gezondheidszorg* 1997;75(4):184-188.

[Roy 1994] Roy DL, McIntyre L, Human DG, et al. Trends in the prevalence of congenital heart disease: comprehensive observations over a 24-year period in a defined region of Canada. *Canadian Journal of Cardiology* 1994;10:821-826.

[Ruwaard 1997] Ruwaard D, Kramers PGN (editors). *Volksgezondheid Toekomst Verkenning 1997.* Rijksinstituut voor Volksgezondheid en Milieu (RIVM), Bilthoven 1997.

[Schneider 1990] Schneider EL, Guralnik JM. The ageing of America - Impact on health care costs. *Journal of the American Medical Association* 1990; 263:2335-2340.

[Schneider 1999] Schneider M, Martin K, Henke KD, Behrens C. *Kosten nach Krankheitsarten.* Wiesbaden: Statistisches Bundesamt 1999.

[Schreurs 1995] Schreurs M. Substitution in psychogeriatrics. A comparative study in nursing homes and substitution projects in Drenthe [Article in Dutch]. *Tijdschrift voor Gerontologie en Geriatratrie* 1995;26:16-23.

[Scitovsky 1985] Scitovsky AA. Changes in the costs of treatment of selected illnesses, 1971-1981. *Medical Care* 1985;23:1345-1357.

[Scitovsky 1987] Scitovsky AA, Rice D. Estimates of the direct and indirect costs of acquired immunodeficiency syndrome in the United States. *Public Healthb Reports* 1987;102:5-17.

[Scitovsky 1994] Scitovsky AA. "The high cost of dying" revisited. *Milbank Quarterly* 1994;72:561-91.

[SER 1999] Sociaal Economische Raad. *Gezondheidszorg in het licht van de toekomstige vergrijzing - Rapport van de Commissie Sociaal-Economische Deskundigen.* Den Haag, 1999.

[Sernbo 1993] Sernbo I, Johnell O. Consequences of a hip fracture: a prospective study over one year. *Osteoporosis International* 1993;3:148-53.

[Shiell 1987] Shiell A, Gerard K, Donaldson C. Cost of illness studies: an aid to decision-making? *Health Policy* 1987;8:317-323.

[Shiell 1993] Shiell A, Pettipher C, Raynes N, Wright K. A cost function analysis of residential services for adults with a learning disability. *Health Economics* 1993;2:247-56.

[Sikorsky 1993] Sikorsky JM, Senior J. The Domiciliary Rehabilitation and Support program. *Medical Journal of Australia* 1993;159:23-25.

[SIVIS 1994] SIG Verpleeghuis Informatie Systeem (Nursing homes information system). *Patient registration data in 1994.* Health Care Information Centre (SIG, Prismant), Utrecht.

[Spillman 2000] Spillman BC, Lubitz J. The effect of longevity on spending for acute and long-term care. *New England Journal of Medicine* 2000; 342(19): 1409-15.

[Stancliffe 1998] Stancliffe RJ, Lakin KC. Analysis of expenditures and outcomes of residential alternatives for persons with developmental disabilities. *American Journal of Mental Retardation* 1998;102:552-68.

[Stouthard 1997] Stouthard MEA, Essink-Bot ML, Bonsel GJ, et al. *Disability weights for diseases in the Netherlands.* Rotterdam: Department of Public Health, 1997.

[Strömberg 1997] Strömberg L, Ohlen G, Svensson O. Prospective payment systems and hip fracture treatment costs. *Acta Orthopaedica Scandinavica* 1997;68(1):6-12

[Tolpin 1983] Tolpin HG, Bentkover JD. Economic costs of illness: decision-making applications and practical considerations. *Advances in Health Economics and Health Services Research* 1983;4:165-198.

[Varmus 2000] Varmus H. *Disease-specific estimates of direct and indirect costs of illness and NIH support.* Washington: National Institutes of Health 2000.

[Vrieze 1995] Vrieze OJ, Boas GM, Janssen JHA. *A simulation model for the future analysis of cardiovascular disease*. International Books, Utrecht 1995.

[Warner 1996] Warner DC, McCandless RR, De Nino LA. Costs of diabetes in Texas 1992. *Diabetes Care* 1996;19:1416-1419.

[Wasowicz 1998] Wasowicz DK, Schmitz RF, Borghans HJ, Groot RRM de, Go PMNYH. Toename van chirurgische dagverpleging in Nederland. *Nederlands Tijdschrift voor Geneeskunde* 1998;42:1612-1615.

[Weisbrod 1983] Weisbrod BA. *Economics and medical research*. American Enterprise Institute, Washington 1983.

[WHO 1977] World Health Organisation. *International statistical classification of diseases, injuries and causes of death (ICD-9)*, Geneva 1977.

[WHO 1994] WHO Collaborating Centre for Drug Statistics Methodology. *Anatomical Therapeutical Chemical (ATC) classification index, including Defined Daily Doses (DDDs) for plain substances 1995*. World Health Organization, Oslo 1994.

[WHO 2000] World Health Organisation. *World health report 2000*. Geneva, 2000.

[Wigle 1991] Wigle DT, Mao Y, Wong T, Lane R. Economic burden of illness in Canada in 1986. *Chronic Diseases Canada* 1991;12(Supplement).

[Williams 1999] Williams A. Calculating the global burden of disease: time for a strategic reappraisal? *Health Economics* 1999;8:1-8.

[Williams 2000] Williams A. Comments on the response by Murray and Lopez. *Health Economics* 2000;9:83-86.

[Wit 2001] Wit GA de, Polder JJ, Jager KJ, Charro FT de. De maatschappelijke kosten van nierziekten in Nederland. *TSG Tijdschrift voor Gezondheidswetenschappen* 2001;79(1):49-54.

[WRR 1997] Wetenschappelijke Raad voor het Regeringsbeleid. *Volksgezondheidszorg*, Den Haag 1997.

[Zethraeus 1997] Zethraeus N, Stromberg l, Jonsson B, Svensson O, Ohlen G. The cost of a hip fracture. Estimates for 1709 patients in Sweden. *Acta Orthopaedica Scandinavica* 1997;68(1):13-7.

[ZFR 1998] Ziekenfondsraad (ZFR). *GIP Peilingen (Drugs Information Project)*, Amstelveen 1998.

Appendices

Data and methods used in the cost-of-illness study for the Netherlands in 1994

A

This appendix describes the top-down mapping procedure by which health care costs were assigned to age, sex, and diagnostic group in the cost-of-illness study for the Netherlands in 1994 [Polder 1997]. The study was prevalence-based using cross-sectional data, and only included direct medical costs. Table A.1 presents an overview of the data sources and the key variables used.

Since health care provision is heterogeneous we split up most health care sectors into more homogeneous subsectors with accompanying costs. Subsequently, total numbers of the key variables considered representative for health care use in any sector or subsector were mapped to all combinations of age, sex and diagnostic groups. The fraction of a key variable in each cell multiplied by the total costs of that sector or subsector, was considered to be a reliable estimate of the health care costs for that cell.

Hospital costs were split up into nursing costs, costs of medical procedures, and costs of outpatient care based on an analysis of Dutch hospital costs [Vrieze 1995]. Inpatient costs were allocated by the number of bed days and day cases from the national hospital registry [LMR 1994]. We could not differentiate between (expensive) days in intensive care and other days in hospital. As a result, the hospital costs of diagnoses frequently often requiring intensive care will be somewhat underestimated, and vice versa. Distributed costs of medical procedures were obtained by national age-, sex- and diagnosis-specific production figures for all interventions [LMR 1994], classified in about 1000 groups, that were weighed by the corresponding fees. The Netherlands has a refined fee system for remuneration of medical procedures. We combined data on diagnosis- and specialism-specific patient referrals in a large sample of general practitioners with data on the number of outpatient visits specified by specialism, to break down total outpatient hospital costs.

Costs of psychiatric institutions were allocated by the number of bed days and day cases from a national registry [PIGGz 1994]. Costs of residencies for psychiatric patients were allocated using data on the number of occupants. We used contacts by diagnosis, sex and age to map the costs of outpatient psychiatric care.

Costs of nursing homes and medical costs of homes for the elderly were allocated by bed days. The total number of bed days was available by age, sex and

diagnosis from the national registry of nursing homes, covering 88% of the Netherlands [SIVIS 1994].

Costs of several types of institutions for the intellectually disabled and physically handicapped were broken down by either days of residency or the number of occupants [LRZ 1994].

A regional primary care registry was used to allocate costs of general practitioners. Information on outpatient paramedical care was available from a sample registry of patient contacts.

Costs of dental care were split into costs of procedures and costs of contacts, using data on dental care use from the National Health Survey and remuneration fees [CBS 1994].

For outpatient midwife and maternity care, an important sector in the Netherlands where about 30% of the deliveries are at home, age- and sex-specific budgets from the Sickness Fund Council were available.

For ambulance services we used a regional registry of transports including diagnostic information. For household care sex- and age-specific national budgets from the Sickness Fund Council, the supervising agency of public health insurance, were used in combination with sample data on client contacts. Diagnosis-specific information was not available for this type of home care. Costs of home nursing care were allocated using diagnosis-specific contact data.

To map outpatient medication costs, a database of prescriptions by a representative and large sample of general practitioners, containing both diagnosis and Anatomical Therapeutical Chemical (ATC) classification of the prescribed product, related national costs for outpatient medication, available by ATC-code, age and sex, to diagnostic groups [GIP 1994].

National costs for aids and appliances (including insulin injections and incontinence material) were related to the prevalence of diseases and disabilities for which these appliances are relevant.

Costs for health care administration, of which only a small proportion could be attributed to diagnostic groups, were assumed to be proportionally distributed over age- and sex-categories.

Table A.1 *Survey of used data sources and an assessment of their informative value, and of the key variables used to break down costs, by health care sector*

Health care sector Type of expenditure	Data source	Type *	Year	Data availability **		Key variable
				diagnosis	age / sex	
Hospital care						
Nursing care	National hospital registry (LMR), Health Care Information Centre (SIG)	C, N	1994	+	+	bed days
Day care	LMR (SIG)	C, N	1994	+	+	day cases
Inpatient medical procedures	LMR (SIG)	C, N	1994	+	+	medical procedures weighed by fees
Outpatient treatment	National information system for hospital outpatient care (POLIS) (SIG)	C, N	1994	–	+	specialism-specific outpatient visits
	National Institute for Research on Primary Care (NIVEL)	I, S	1987-88	+	+	specialism-specific referrals of general practitioners
Specialised institutions	LMR (SIG)	C, N	1994	±	+	bed days
	National information system for rehabilitative care (LIVRE), National Hospital Institute (NZi)	C, N	1994	+	+	bed days
Psychiatric care						
Inpatient psychiatric care	National information system for psychiatric care (PIGGz) (SIG)	C, N	1994	+	+	days of stay and number of short stays
	National Association for Protective Residencies (NVBW)	I, N	1994	–	+	number of occupants
Outpatient psychiatric care	National Association of Outpatient Psychiatric Care (NVAGG)	Y, N	1994	–	+	number of patients
	IMTA/Trimbos-institute: research survey	I, S	1992 -93	+	±	patient visits

Table A.1 <continued>

Health care sector Type of expenditure	Data source	Type *	Year	Data availability **		Key variable
				diagnosis	age / sex	
Care for the addicted	National Information system for care for the addicted (LADIS) (SIG)	C, N	1994	+	+	contact hours
Care for the elderly						
Nursing homes	Nursing homes information system (SIVIS) (SIG)	C, Y	1994	+	+	days of stay
Homes for the elderly	Statistics Netherlands (CBS)	Y, N	1994	–	+	number of occupants
	Nursing homes information system (SIVIS) (SIG)	C, Y	1994	+	+	days of stay
Care for disabled people						
Institutions for mentally disabled	National registration of services for mentally retarded (LRZ) (NZI)	C, N	1994	+	+	days of stay
Institutions for sensory disabled	Central Accountancy for special health care costs (CAK/AWBZ)	C, N	1994	±	+	age/sex-specific total costs
Other care for people with disabilities	Dutch Federation of care for physically handicapped (NFVLG)	Y, S	1994	±	+	number of occupants
	Fiadt-Wdt	Y, S	1994	+	+	number of occupants
	Somma	Y, S	1994	+	±	number of clients
Primary care						
General practitioners	Regional Network Groningen (RNG)	C, R	1994	+	+	patient complaints
	Consumer Safety Institute	C, S	1994	+	+	emergency department visits
Paramedical care (physical therapists, logopedians)	NIVEL	I, S	1989 -94	+	+	consultations

Table A.1 <continued>

Health care sector Type of expenditure	Data source	Type *	Year	Data availability **		Key variable
				diagnosis	age / sex	
Dental care	Statistics Netherlands (CBS)	Y, S	1994	+	+	consultations and procedures
Midwives and maternity care	Sickness Fund Council	Y, N	1994	+	+	age/sex specific budgets
Social services	SYMBIOSE	Y, S	1994	–	+	consultations
Ambulance transport	Community health department (GGD), Dordrecht region	C, R	1994	+	+	transportations
Other patient transport	Sickness Fund Council	Y, N	1994	–	+	age/sex-specific budgets
Home care	Sickness Fund Council	I, N	1995	–	+	age/sex-specific budgets
- household care	Study survey	I, S	1994 -95	–	+	contact hours
- home nursing care	National Union home nursing (NKV)	Y, S	1988	+	+	patient contacts
- intensive home nursing care	Sickness Fund Council	C, N	1994	±	+	reimbursements
Pharmaceuticals, appliances						
Pharmaceutical care	Pharmaceuticals Information Project (GIP), Sickness Fund Council	C, S	1994	–	+	national costs per ATC-code
	NIVEL	I, S	1987 –88	+	+	diagnosis-specific prescriptions by general practitioners
Appliances	Sickness Fund Council	C, N	1994	–	–	national costs by type of appliance
	Statistics Netherlands (CBS)	I, S	1987 -88	±	+	prevalence of disabilities, diabetes and chronic pulmonary disease

Table A.1 <continued>

Health care sector Type of expenditure	Data source	Type *	Year	Data availability **		Key variable
				diagnosis	age / sex	
Public health						
Breast cancer screening programme	National evaluation team breast cancer screening (LETB)	C, N	1994	+	+	attendance rate
Public health institutions (a.o. child preventive care)	Statistics Netherlands (CBS)	C, N	1994	–	+	population in young age groups and general population
Administration						
Health care administration and other costs	Statistics Netherlands (CBS)	C, N	1994	n.a.	+	general population

* *Datasource*

- *C* - *continuous registration*
- *I* - *incidental registration*
- *Y* - *yearly registration*
- *N* - *national registration*
- *R* - *regional registration*
- *S* - *sample registration*

** *Data availability*

- \+ - *available*
- ± - *partially available*
- – - *not available*
- *n.a.* - *not applicable*

Detailed results from the cost-of-illness study for the Netherlands in 1994

B

Table B.1 *Diagnostic groups in the Dutch cost-of-illness study for 1994. Operationalisation in the International Classification of Diseases (9th edition, ICD-9). Total costs in US$ and share of each group in total costs. Share of age and sex groups within each diagnostic group.*

ICD chapters Disease categories	ICD-9	Health care costs US$ 1 mln * (share in %)		Share (%) age groups 0-24/-64/65+	Share (%) men / women
I. Infectious diseases	**001-139**	**426**	**(1.3)**	**33/45/22**	**46/54**
AIDS en HIV-infections	042-044	15	(0.0)	14/80/6	73/27
Other infectious diseases		411	(1.3)	33/77/23	45/55
II. Neoplasms	**140-239**	**1,283**	**(3.9)**	**3/42/55**	**44/56**
Oesophagus	150	24	(0.1)	0/32/68	64/36
Stomach	151	43	(0.1)	0/25/75	57/43
Colon and rectum	153-154	132	(0.4)	0/25/75	46/54
Pancreas	157	26	(0.1)	0/28/72	42/58
Trachea, bronchus & lung	162	123	(0.4)	0/36/64	79/21
Female breast	174	139	(0.4)	0/51/49	0/100
Prostate	185	66	(0.2)	0/15/85	100/0
Lymphoma	200-208	85	(0.3)	11/40/49	50/50
Benign neoplasms	173, 210-39	237	(0.7)	8/67/25	28/72
Other neoplasms		408	(1.2)	3/40/57	44/56
III. Endocrine diseases	**240-279**	**609**	**(1.9)**	**5/35/60**	**33/67**
Diabetes mellitus	250	403	(1.2)	3/33/64	35/65
Other endocrine diseases		206	(0.6)	9/37/54	27/73
IV. Diseases of the blood	**280-289**	**104**	**(0.3)**	**12/30/58**	**39/61**
V. Mental disorders	**290-319**	**7,543**	**(23.1)**	**16/51/33**	**44/56**
Dementia	290	1,818	(5.6)	0/2/98	21/79
Schizophrenia	295	460	(1.4)	18/77/6	60/40
Affective psychoses	296, 300	740	(2.3)	9/67/23	32/68
Alcohol and drugs	291-2, 303-5	267	(0.8)	9/81/9	72/28
Mental retardation	317-9, 758.0	2,632	(8.1)	26/68/6	56/44
Other mental disorders		1,626	(5.0)	24/57/19	44/56

Table B.1 <continued>

ICD chapters Disease categories	ICD-9	Health care costs US$ 1 mln * (share in %)		Share (%) age groups 0-24/-64/65+	Share (%) men / women
VI. Nervous system	**320-389**	**1,709**	**(5.2)**	**23/36/42**	**45/55**
Parkinson's disease	332	159	(0.5)	0/9/91	42/58
Multiple sclerosis	340	86	(0.3)	1/67/32	37/63
Epilepsy	345	167	(0.5)	52/37/11	53/47
Disorders of the eye	360-379	547	(1.7)	17/32/51	40/60
Disorders of the ear	380-389	362	(1.1)	47/33/21	53/47
Other nervous diseases		388	(1.2)	10/47/44	43/57
VII. Circulatory system	**390-459**	**3,414**	**(10.5)**	**1/31/69**	**47/53**
Hypertension	401-405	412	(1.3)	0/48/52	41/59
Coronary heart disease	410-414	814	(2.5)	0/46/54	65/35
Heart failure	428-429	355	(1.1)	0/9/91	40/60
Stroke	430-438	1,054	(3.2)	0/13/87	38/62
Other circulatory diseases		779	(2.4)	2/39/59	49/51
VIII. Respiratory system	**460-519**	**1,320**	**(4.0)**	**23/35/42**	**54/46**
Acute respiratory infections	460-6, 480-7	395	(1.2)	32/39/30	52/48
Asthma and COPD	490-496	568	(1.7)	14/36/50	58/42
Other respiratory diseases		357	(1.1)	27/30/43	49/51
IX. Digestive system	**520-579**	**2,559**	**(7.8)**	**14/59/27**	**47/53**
Dental abnormalities	520-529	1,385	(4.2)	19/67/15	47/53
Gastric and peptic ulcer	531-534	207	(0.6)	1/55/44	51/49
Appendicitis	540-543	58	(0.2)	45/45/11	47/53
Inguinal hernia	550-553	133	(0.4)	12/46/41	67/33
Other gastrointestinal dis.	555-569	229	(0.7)	12/45/43	42/58
Diseases of liver and gall	570-576	154	(0.5)	3/55/42	39/61
Other digestive diseases		393	(1.2)	8/46/46	44/56
X. Genitourinary system	**580-599**	**920**	**(2.8)**	**10/55/35**	**33/67**
Nephritis nephrotic syndrome	580-589	47	(0.1)	10/47/43	54/46
Infections of kidney and urinary tract	590,595, 597,599.0	104	(0.3)	14/36/50	30/70
Other genitourinary		287	(0.9)	9/43/47	42/58
Hyperplasia of prostate	600	69	(0.2)	0/21/79	100/0
Male genital organs	601-608	52	(0.2)	31/49/21	100/0
Female genital organs	610-627, 629	330	(1.0)	10/76/14	0/100
Infertility	628	32	(0.1)	7/93/0	8/92
XI. Pregnancy, child birth	**630-676**	**840**	**(2.6)**	**22/78/0**	**0/100**
XII. Diseases of the skin	**680-709**	**535**	**(1.6)**	**20/50/30**	**41/59**

Table B.1 <continued>

ICD chapters Disease categories	ICD-9	Health care costs US$ 1 mln * (share in %)		Share (%) age groups 0-24/-64/65+	Share (%) men / women
XIII. Musculoskeletal dis.	**710-739**	**1,948**	**(6.0)**	**8/54/38**	**37/63**
Rheumatoid arthritis	714	177	(0.5)	2/39/59	23/77
Diseases of back	720-724	618	(1.9)	6/74/20	45/55
Other musculoskeletal		1,154	(3.5)	10/46/44	35/65
XIV. Congenital abnormalities	**740-759** *minus* **758.0**	**168**	**(0.5)**	**58/37/6**	**50/50**
XV. Perinatal diseases	**760-779**	**185**	**(0.6)**	**100/0/0**	**53/47**
XVI. Symptoms, ill-defined conditions	**780-799**	**1,581**	**(4.8)**	**16/46/38**	**39/61**
XVII. Injury and poisoning	**E800-E999**	**1,384**	**(4.2)**	**16/32/52**	**40/60**
Traffic accidents	E800-848, E929.0-1	222	(0.7)	32/43/25	57/43
Other accidents	E850-869, E890-928, E929.2/4-9 E970-999	185	(0.6)	31/46/22	59/41
Falls	E880-888, E929.3	638	(2.0)	9/17/74	27/73
Complications, violence and suicide	E950-959, E960-969 E870-879, E930-949	339	(1.0)	10/46/44	41/59
Not allocated		**2,661**	**(8.1)**	**20/35/45**	**36/64**
Non-specific		**3,483**	**(10.7)**	**15/27/57**	**35/65**
Total health care costs		**32,672**	**(100.0)**	**15/43/42**	**41/59**

** Exchange rate (1994): US$ 1 =ƒ 1.82 (US$ ≈€ 0.83)*

Summary

Cost of illness in the Netherlands: description, comparison and projection

Introduction

Health economics is an emerging discipline. Much attention has been paid to the economic evaluation of health care facilities, but cost-of-illness (COI) studies have also gained recognition since the pioneering work of Dorothy Rice. Several types of COI studies can be distinguished. Disease-specific studies estimate costs for a particular disease mostly based on a bottom-up method and sometimes including indirect morbidity and mortality costs. General COI studies focus on the national health care budget and how it is related to the prevalence of all diseases clustered in categories. This thesis deals with general COI studies. Our objectives are:

1. To explain the construction, application and interpretation of general cost-of-illness studies;
2. To discuss the advantages and limitations of general cost-of-illness studies with respect to the objectives of description, comparison and projection.

Cost of illness in the Netherlands 1994

We performed a general COI study for the Netherlands in 1994. Total health expenditure, amounting 60 billion Dutch guilders, was allocated to diagnostic groups and simultaneously to age and sex. A cross-sectional, top-down methodology was used in which key variables such as nursing days and ambulatory care visits represented equal units of care. Information on health care use was obtained from all health care sectors of the Netherlands, for the most important (hospitals, nursing homes, inpatient psychiatric care, institutions for the mentally disabled people) of which national registries were available.

Health care costs were strongly age dependent. After the first year of life, costs per person for children were lowest. Costs rose slowly throughout adult life and increased exponentially from age 50 onwards till the oldest age group (95≥). The top five areas of health care costs were mental retardation, musculoskeletal

disease (predominantly joint disease and dorsopathy), dementia, a heterogeneous group of other mental disorders, and ill-defined conditions. Stroke, all cancers combined, and coronary heart disease ranked 7, 8 and 10, respectively. Thus, old age and disabling conditions rather than the major causes of death were the main determinants of health expenditure in the Netherlands.

Developments between 1988 and 1994

Between 1988 and 1994, health care costs increased by an average rate of 5.2% per year. Wage and price developments were responsible for about a half of these rising costs; other causes were demographic changes (a quarter) and other factors including epidemiological change and technological innovations (another quarter).

Health expenditure increased steeply for dementia, AIDS and HIV infections, perinatal conditions, coronary heart diseases, diseases of the respiratory system, stroke and colorectal cancer. Relatively little to no increase, in some cases even a decline, was seen in the costs of diseases of the female genitals, blood diseases, appendicitis, traffic accidents, eye disorders and inguinal hernias.

The cost development could be clarified for several diagnostic groups, e.g. the rising costs of dementia may be ascribed to the ageing population, of coronary heart diseases to the increased number of cardiac operations and coronary angioplasty procedures performed. In the case of other diagnostic groups, including that of diseases of the female genital tract and that of eye disorders, no clear explanation for the development in costs was available without further research.

Trends in Dutch health care costs

Health care costs have many determinants: demographic, epidemiological, technological and economic. Reliable detailed forecasts of future health care costs are not feasible. Using cost-of-illness data for the Netherlands, population forecasts and cost developments from the past, a rather robust projection of future health expenditure could be made. According to this projection Dutch health care costs will increase in future decades by an annual rate of 2.4%, apart from general inflation. This projected cost increase consists of increasing health care use due to demographic change (0.9 – 1.0%) and developments in epidemiology and technology (1.1 – 1.2%) and of price and wage developments in health care which exceed general inflation by 0.3%.

Age-specific increases in health care costs

The distribution of health care costs per capita depends strongly on age. We demonstrated age-specific trends in health expenditure for the Netherlands. For 1988 – 1994 we observed a growth rate for acute care that increased by age and was compensated by a decreasing rate for long-term care. A kind of balancing effect thus resulted in an average growth rate that was nearly stable for all ages.

These age-specific trends reflected the influence of technological change in surgery. Day-care treatment became increasingly common for younger people, while among the elderly the age boundaries for treatment shifted upwards. There was also an influence of governmental health care policies. During the observed period, large investments in institutionalised care for the elderly were withheld, while backlogs in psychiatric care and institutions for the disabled were eliminated by additional investments. Our analysis indicated that long-term care was more sensible for cost-containment policies than acute care.

We concluded that ageing as well as technological and epidemiological changes reinforced the age pattern in health care costs. Health care costs not only expanded but also shifted from younger to older ages and from care to cure.

Costs of intellectual disability

Mental disorders in general and intellectual disability in particular represent a large share in the expenditure on health care in civilised countries. In the Netherlands, 25.8% of total disease-specific costs in 1994 could be ascribed to mental disorders (psychiatric conditions, intellectual disability, and dementia). There were large differences between age-sex groups. Costs of intellectual disability and schizophrenia were higher among men; costs of dementia and depression were higher among women. The age pattern showed two peaks. The first at age 25 – 35 (intellectual disability and psychiatric conditions), the second at age 75 – 85 (dementia). Demographic projections suggested a less than average cost increase for intellectual disability and psychiatric diseases (annual growth rate of 0.2% and 0.4% respectively) compared to the costs of dementia and total health care (annual rate of 1.6% and 0.9% respectively). Expenditure on intellectual disability, however, is likely to increase more sharply than demographic projections suggest because life expectancy of the disabled continues to rise.

Costs after hip fracture

It is widely assumed that health care costs can be reduced considerably by providing care in appropriate health care institutions without unnecessary technological overhead. This assumption has been tested in a prospective study. Conventional discharge after hip fracture surgery was compared with an early discharge policy in which patients were discharged to a nursing home with specialised facilities for rehabilitation. We compared costs for both strategies from a societal perspective, using comprehensive and detailed data on type of residence and all kinds of medical consumption during a 4-month follow-up period.

As expected, early discharge reduced the length of hospital stay. More patients were discharged to a nursing home (76% versus 53%). Total medical costs during follow-up were reduced by € 1,057, representing small and not significant savings. There were two explanations for this unexpected result. First, hip fracture patients are relatively cheap while in hospital. Hence nursing home costs almost equalled

hospital costs per admission day. Second, compared to the conventionally discharged group, early discharged patients underwent more medical procedures during the first post-operative days. We concluded that: 1) early discharge shifted rather than reduced costs; 2) the details of costing have a major influence on the cost-effectiveness of alternative discharge policies.

A cross-national perspective on cost of illness

Since 1998, the OECD Health Data have included figures on cost of illness. The large differences between countries are striking. We recalculated the COI estimates for six countries using the original research reports in order to construct a comparable dataset and to explain some of the differences. The following countries were included: Australia, Canada, England, Germany, Netherlands and Sweden. The distribution of health care costs over major disease categories showed similar patterns for all countries as well as some remarkable differences that were mainly caused by health care systems. Comparisons for hospitals and pharmaceutical care showed differences that could in part be related to epidemiological and methodological factors.

At present, the scope of COI studies is virtually limited to national levels, because health care systems dominate the magnitude and distribution of health care costs. Cross-national comparisons might be possible if data and methods are standardised and COI estimates are made for a common comparable package.

Discussion

In health economics literature the meaning and value of cost-of-illness studies have been debated. Opponents stated that COI studies are based on a misunderstanding of economic cost and have no policy relevance since they do not study cost-benefit-ratios. Other critics have pointed at the scope for misunderstanding of COI figures and the risk of high costs diverting the attention of policy-makers from diseases with low costs, which might have important aspects other than costs.

Advocates of COI studies have argued that these studies are not aimed at policy-making, but must be seen as policy-relevant in that they can educate, inform and enlighten policy-makers. The major value of COI studies is that they provide a simple indication of the burden of disease (BOD) that covers the whole spectrum of diseases and is complementary to other BOD-estimates. The availability of more COI studies will further allow for studying time-trends and cross-national differences.

We concluded that COI studies say nothing about: 1) the value of money invested in health care; 2) whether or not more resources should be devoted to treating specific diseases; 3) whether or not more resources should be devoted to particular areas of medical research; 4) the total burden of disease. Despite these shortcomings, COI studies have their own worth and provide a suitable framework for studying health expenditure from an epidemiological and demographic

perspective. Obviously, improvements can be made. Methods must be refined and standardised. It is also important that the availability of good quality data is guaranteed for a longer period of time. From a cross-national perspective the harmonisation of COI figures with a common comparable package should be recommended.

Conclusions

1. COI studies have, first and foremost, a national scope. In the future, however, cross-national comparisons might be possible and will reveal interesting insights if methods are standardised and the estimates regard a common comparable package.
2. COI studies disclose interesting information complementary to burden-of-disease estimates based on epidemiological criteria. The significance of COI figures mainly concerns the framework they provide for health care research and health care policy. They do not provide, however, simple criteria for decision making on the allocation of health care resources, research funds or whatever decisions can be made. They provide a comprehensive insight into health care and must be seen as input for cost-effectiveness analyses and policy measures among many others.
3. COI studies can contribute to the understanding of major trends in health expenditure and underlying developments. Until now these insights have been limited but these might improve as data also improve and remain constant over a longer period.
4. COI studies provide essential input for projections of future health care costs. The significance of these projections is limited since COI estimates are static, but, as the understanding of trends improves, it might be possible to develop more sophisticated scenarios. A first real improvement would be the introduction of health care costs in the last year of life.

Samenvatting

Kosten van ziekten in Nederland: beschrijving, vergelijking en projectie

Inleiding

De gezondheidseconomie is sterk in ontwikkeling. Veel aandacht wordt geschonken aan de economische evaluatie van gezondheidszorgvoorzieningen binnen het vakgebied van de Medical Technology Assessment (MTA). Sinds het baanbrekende werk van Dorothy Rice in de jaren zestig zijn er binnen de gezondheidseconomie ook verschillende kosten-van-ziekten (KVZ) studies gepubliceerd. Er kan onderscheid worden gemaakt tussen studies die zich op een specifieke ziekte richten en studies die het gehele domein van alle ziekten beschrijven. Deze generieke KVZ studies nemen het nationale zorgbudget als uitgangspunt en beschrijven hoe de kosten zijn verdeeld over ziektecategorieën, leeftijd en geslacht. Dit proefschrift gaat over generieke KVZ studies en de manier waarop deze de kosten van de gezondheidszorg beschrijven, vergelijken en projecteren. Dit proefschrift beoogt:

1. Toe te lichten hoe generieke kosten-van-ziekten studies worden gemaakt, toegepast en geïnterpreteerd;
2. Inzicht te geven in de voordelen en beperkingen van generieke kosten-van-ziekten studies gelet op de doelstellingen van beschrijving, vergelijking en projectie.

Alle hoofdstukken in dit proefschrift zijn gebaseerd op het onderzoek 'Kosten van ziekten in Nederland 1994', met uitzondering van hoofdstuk 7 over de kosten van patiënten met een heupfractuur. Dat hoofdstuk is gebaseerd op een MTA studie naar de kosten en effecten van alternatieve procedures voor ontslag uit het ziekenhuis na een heupoperatie.

Kosten van ziekten in Nederland 1994

De kosten van de Nederlandse gezondheidszorg die in 1994 ongeveer 60 miljard gulden bedroegen, werden toegewezen aan een zestigtal diagnosegroepen met een simultane uitsplitsing naar leeftijd en geslacht. Deze toewijzing vond plaats volgens een top-down methode waarin een groot aantal sleutelvariabelen werd gebruikt die elk een vaste zorg- en kosteneenheid vertegenwoordigden. Voorbeelden hiervan zijn: verpleegdagen in ziekenhuizen en verpleeghuizen en consulten aan de huisarts, de fysiotherapeut en alle andere aanbieders van zorg. Gegevens over het zorggebruik werden per sector ingewonnen bij de houders van zorgregistraties. Voor de belangrijkste sectoren waren nationale gegevens beschikbaar met een hoge dekkingsgraad.

De kosten van gezondheidszorg bleken sterk afhankelijk te zijn van de leeftijd. Na het eerste levensjaar waren de kosten laag voor kinderen en jongvolwassenen en namen geleidelijk toe met de leeftijd. Vanaf de leeftijd van 50 jaar stegen de kosten steeds sneller tot zij hun maximum bereikten bij de 95-plussers. Het grootste deel van de kosten hield verband met zwakzinnigheid, aandoeningen van het bewegingsstelsel, dementie, psychiatrische stoornissen en een heterogene groep met symptomen en slecht omschreven ziektebeelden. Beroerte, kanker en coronaire hartziekten kwamen in rangorde van kosten pas op de zevende, achtste en tiende plaats. Uit deze gegevens blijkt dat de kosten van de Nederlandse gezondheidszorg veel meer worden bepaald door ouderdom en chronische, invaliderende aandoeningen dan door de belangrijkste doodsoorzaken.

Ontwikkelingen tussen 1988 en 1994

In de periode 1988 – 1994 stegen de kosten van de Nederlandse gezondheidszorg gemiddeld met 5,2% per jaar. De helft van deze stijging kwam voor rekening van loon- en prijsontwikkelingen. Daarnaast droegen demografische veranderingen bij aan de stijging van de kosten, als ook de combinatie van epidemiologische, technologische en overige factoren.

Voor de volgende diagnosegroepen stegen de kosten relatief sterk: dementie, AIDS en HIV-infecties, perinatale aandoeningen, coronaire hartziekten, aandoeningen van de luchtwegen, beroerte en darmkanker. Een geringe kostenstijging of zelfs een daling werd waargenomen voor aandoeningen van de vrouwelijke geslachtsorganen, bloedziekten, blindedarmontsteking, verkeersongevallen, gezichtsstoornissen en buikbreuken.

De meeste kostenstijgingen kunnen verklaard worden. De stijgende kosten van dementie hangen bijvoorbeeld samen met de vergrijzing van de bevolking. Verder zijn de kosten van hartziekten gestegen vanwege de toename van kostbare interventies als CABG en PTCA. Voor enkele andere diagnosegroepen is echter geen sluitende verklaring beschikbaar. Nader onderzoek zal moeten uitwijzen wat de precieze reden van de kostenstijging of –daling is geweest. Mogelijk hebben verschillen tussen databronnen hierbij een rol gespeeld.

Trends in de kosten van de Nederlandse gezondheidszorg
De kosten van de gezondheidszorg worden door meerdere factoren beïnvloed: demografische, epidemiologische, technologische en economische. Zeer nauwkeurige voorspellingen van toekomstige zorgkosten zijn niet mogelijk. Wel kunnen kosten-van-ziekten gegevens gebruikt worden om een tamelijk robuuste schatting te maken. Uitgaande van de bevolkingsprognose en de ontwikkelingen in de periode 1988 – 1994 is een projectie gemaakt voor de zorgkosten in de komende decennia. Volgens deze projectie zullen de kosten van de zorg in constante prijzen met gemiddeld 2,4% per jaar toenemen. Deze stijging is voor ongeveer 1% het gevolg van demografische veranderingen (bevolkingsgroei en vergrijzing). De combinatie van epidemiologische, technologische en overige factoren zal naar verwachting een groei van ruim 1% veroorzaken. Het resterende deel (0,3%) vloeit voort uit de Wet van Baumol die zegt dat de lonen en prijzen in de gezondheidszorg verhoudingsgewijs sterker stijgen dan in de rest van de economie.

Leeftijdspecifieke kostenstijgingen in de gezondheidszorg
Niet alleen de verdeling van de zorgkosten is sterk afhankelijk van de leeftijd, maar ook de kostenstijging. In de periode 1988 – 1994 stegen de gemiddelde kosten per inwoner van Nederland in absolute zin het meest voor de leeftijdsgroepen met de hoogste kosten. De groeivoet bleek echter voor alle leeftijden min of meer gelijk te zijn, waarbij zich een opmerkelijk verschil voordeed tussen de curatieve zorg en de chronische zorg. De groeivoet van de curatieve zorg was laag voor jongeren en nam met de leeftijd toe. Voor chronische zorg gold het omgekeerde.

Deze trends waren onder meer het gevolg van veranderingen in het zorgaanbod. Gewezen kan worden op de toename van dagbehandeling vooral onder jongeren, en het oprekken van het indicatiegebied en van leeftijdsgrenzen voor bepaalde operaties bij ouderen. Daarnaast werden deze trends sterk beïnvloed door het gezondheidszorgbeleid. In deze periode hebben met name in de gehandicaptenzorg additionele investeringen plaatsgevonden, met als gevolg de hoge groeivoet voor chronische zorg bij de jongere leeftijdsgroepen. De verschillende trends suggereren dat vooral chronische zorg gevoelig is voor het overheidsbeleid, terwijl de curatieve zorg zich meer volgens de relatief autonome ontwikkelingen van epidemiologie en medische technologie ontwikkelt.

Wij concluderen dat het leeftijdspatroon in de kosten van de gezondheidszorg wordt versterkt door demografische, epidemiologische en technologische ontwikkelingen. Als gevolg vindt er een absolute verschuiving plaats van jongeren naar ouderen en relatieve verschuiving van chronische naar curatieve zorg.

Kosten van zwakzinnigheid
Een groot deel van de zorgkosten houdt verband met psychische stoornissen. Van alle kosten van de Nederlandse gezondheidszorg in 1994 die aan ziekten konden

worden toegerekend, had ruim een kwart te maken met zwakzinnigheid, dementie en psychiatrische aandoeningen. Er waren grote verschillen tussen verschillende leeftijds- en geslachtsgroepen. De kosten van zwakzinnigheid en schizofrenie waren hoger voor mannen, terwijl voor vrouwen de kosten van depressie en dementie hoger waren. Het leeftijdspatroon vertoonde twee pieken. De eerste deed zich voor bij de leeftijdsgroep 25 – 35 jaar en werd veroorzaakt door hoge kosten van zwakzinnigheid en psychiatrische aandoeningen. De tweede piek viel in de leeftijdsklasse 75 – 85 jaar en was geheel het gevolg van hoge kosten voor dementie.

Overeenkomstig demografische projecties zullen de kosten van zwakzinnigheid en psychiatrische stoornissen in de toekomst achterblijven bij de algemene kostenontwikkeling en de verwachte kostenstijging bij dementie. Dit komt door de vergrijzing en ontgroening van de bevolking. Omdat de levensverwachting van mensen met een handicap nog steeds toeneemt, zal de feitelijke kostenontwikkeling waarschijnlijk hoger uitvallen dan in de demografische projectie wordt voorgesteld.

Kosten na een heupfractuur

In het algemeen wordt aangenomen dat de kosten van de gezondheidszorg gereduceerd kunnen worden door de juiste zorg op de juiste plaats aan te bieden. In een prospectief onderzoek hebben wij deze hypothese onderzocht voor patiënten met een heupfractuur. De normale ontslagprocedure werd vergeleken met een versnelde procedure waarin patiënten in een verpleeghuis werden gerevalideerd in plaats van in het ziekenhuis. Van beide patiëntengroepen werden de kosten gedetailleerd in kaart gebracht, uitgaande van het maatschappelijk perspectief.

Zoals verwacht daalde de gemiddelde opnameduur aanzienlijk. De gemiddelde kosten per patiënt voor een periode van vier maanden daalden met € 1.057 hetgeen veel minder was dan vooraf werd verwacht. Er zijn twee mogelijke verklaringen. In de eerste plaats bleken de ziekenhuiskosten van patiënten met een heupfractuur verhoudingsgewijs laag te zijn ten opzichte van andere patiëntengroepen in het ziekenhuis. Mede als gevolg van de gedetailleerde berekeningswijze was er tussen ziekenhuis en verpleeghuis slechts een gering verschil in de kosten per verpleegdag. Ten tweede ontvingen de versneld ontslagen patiënten aanzienlijk meer zorg in de eerste dagen na de operatie in vergelijking met de patiënten die langer in het ziekenhuis bleven.

Uit deze studie volgt: 1) dat vervroegd ontslag niet altijd tot kostenbesparingen hoeft te leiden maar ook een verschuiving in de kosten tot gevolg kan hebben; en 2) dat de mate van detail in de kostenschattingen een doorslaggevende rol kan spelen bij de beoordeling van de kosten-effectiviteit.

Internationale vergelijking van kosten van ziekten
Sinds 1998 staan er in de OECD Health Data schattingen over de kosten van ziekten. Het is opvallend hoezeer de cijfers tussen de verschillende landen verschillen. Uitgaande van de originele onderzoeksverslagen hebben wij de KVZ schattingen voor zes landen opnieuw berekend teneinde een vergelijkbare dataset te construeren en inzicht te krijgen in de belangrijkste internationale verschillen. De volgende landen werden in deze vergelijking betrokken: Australië, Canada, Duitsland, Engeland, Nederland en Zweden. De grote patronen in kosten van ziekten bleken voor de verschillende landen hetzelfde te zijn. Tegelijkertijd waren er grote verschillen die voor het grootste deel verband hielden met verschillen in de manier waarop de zorg werd georganiseerd en slechts in mindere mate werden veroorzaakt door epidemiologische of demografische factoren.

Vanwege al deze verschillen hebben KVZ-studie op dit moment vooral een nationale betekenis. Internationale vergelijkingen kunnen zinvol zijn, maar een voorwaarde is dat de KVZ schattingen op exact hetzelfde zorgpakket betrekking hebben. Verder is standaardisatie van gegevens en methoden een noodzaak om tot vergelijkbare cijfers te komen. Verder verdient het aanbeveling om de sectorindeling van KVZ studies aan te laten sluiten op internationale definities van een 'common comparable package'.

Beschouwing
De betekenis en waarde van KVZ studies zijn uitgebreid besproken in de gezondheidseconomische literatuur. Volgens de tegenstanders baseren KVZ studies zich op een verkeerd kostenbegrip en hebben zij geen praktische waarde omdat ze geen marginale analyse van kosten en effecten toepassen. Anderen hebben gewezen op de mogelijke verkeerde interpretaties en het gevaar dat de aandacht van beleidsmakers wordt afgeleid van ziekten met lage kosten waar mogelijk wel andere belangwekkende aspecten aan vast zitten.

Volgens de voorstanders zijn KVZ studies primair niet bedoeld voor concrete beleidsbeslissingen. Zij moeten veel meer gezien worden als studies met relevantie voor het beleid in de zin dat zij beleidsmakers informeren over belangrijke aspecten van volksgezondheid en gezondheidszorg. De belangrijkste betekenis van KVZ studies is dat zij een eenvoudige benadering van de ziektelast geven die het gehele spectrum van aandoeningen omvat, en die bovendien complementair is aan andere schattingen van ziektelast zoals incidentie, prevalentie en sterfte. Verder is gewezen op de mogelijkheden van vergelijking over de tijd en tussen landen indien er meerdere KVZ studies beschikbaar zijn.

Wij concluderen dat KVZ studies: 1) geen inzicht geven in de opbrengst van het geld dat in de gezondheidszorg wordt geïnvesteerd; 2) niet de informatie geven die nodig is voor beslissingen over de allocatie van het zorgbudget, of 3) het onderzoeksbudget; en 4) geen schatting geven van de totale ziektelast in de bevolking. Dit neemt niet weg dat KVZ studies hun eigen betekenis hebben, en een geschikt raamwerk bieden voor de bestudering van de zorgkosten vanuit een

epidemiologisch en demografisch gezichtspunt. Uiteraard zijn verbeteringen mogelijk. Methoden kunnen verder worden verfijnd en gestandaardiseerd. Ook is het van belang dat de benodigde gegevens over langere perioden beschikbaar zijn, zonder dat de kwaliteit al te veel fluctueert. Ten behoeve van internationale vergelijkingen is het verder wenselijk dat de sectorindelingen in KVZ studies worden geharmoniseerd met een internationaal gestandaardiseerd zorgpakket.

Conclusies

1. KVZ studies hebben op dit moment in de eerste plaats een nationale betekenis. In de toekomst zullen internationale vergelijkingen ongetwijfeld mogelijk zijn en belangwekkende inzichten opleveren. Een vereiste daarvoor is wel dat de sectorafbakening en de methoden verder worden gestandaardiseerd.
2. KVZ studies bieden interessante inzichten die complementair zijn aan andere benaderingen van de volksgezondheid die onder meer gebaseerd zijn op epidemiologische criteria. De betekenis van KVZ studies bestaat vooral in het raamwerk dat zij bieden voor onderzoekers en beleidsmakers binnen de gezondheidszorg. Zij bieden echter geen simpele criteria voor besluitvorming over de aanwending van het zorgbudget of van onderzoeksgelden. Zij geven wel een samenhangend en samenvattend inzicht in de volksgezondheidszorg en kunnen gezien worden als een 'input' voor onder meer economisch evaluatieonderzoek in de gezondheidszorg.
3. KVZ studies kunnen inzicht geven in de belangrijke trends in de kosten van de gezondheidszorg en de achterliggende factoren. Op dit moment zijn deze inzichten beperkt, maar reële verbeteringen zijn mogelijk wanneer de kwaliteit van de gegevens beter wordt en over een langere periode constant blijft.
4. KVZ studies bieden essentiële informatie voor ramingen van toekomstige zorgkosten. De betekenis van deze ramingen moet echter niet worden overschat, omdat de KVZ gegevens een statisch karakter hebben. Wanneer het inzicht in de historische trends toeneemt moet het echter mogelijk zijn om meer realistische scenario's te ontwerpen. Een eerste belangrijke verbetering zou zijn om de kosten in het laatste levensjaar te onderscheiden van de kosten van de overige patiënten en afzonderlijk mee te nemen in de projectie van de toekomstige zorgkosten.

Curriculum vitae

Johan Polder (1966) graduated in economics from Erasmus University Rotterdam in 1991. He joined the Department of Industrial Organisation of the same university and studied the organisation of health care systems in co-operation with the Prof. Dr G.A. Lindeboom Institute. In 1994 he went to the Department of Public Health and was involved in cost-effectiveness analyses and cost-of-illness studies. With John van Leerdam he developed some Christian perspectives on economics, and described with Hugo van der Wal the health care supply in the Dutch Reformed Denomination. He is board member of Stuurgroep Zicht op Zorg in de Gereformeerde Gezindte, Vereniging van Organisten der Gereformeerde Gemeenten and Stichting Ontmoeting. He participates in the editorial board of the bulletin of the Dutch Flemish association for Health Economics (VGE) and is freelancer of Reformatorisch Dagblad, Christelijke Hogeschool De Driestar and Christelijke Hogeschool Ede. In leisure time and on Sundays he is playing church organ. Johan Polder is happily married with Thea van de Pol and proud father of Arthur (1998) to whom this thesis is gratefully dedicated.

Selected publications outside this thesis

Research projects (Department of Public Health, Erasmus University Rotterdam)

- Lugtenburg PJ, Eijkemans MJC, Polder JJ, et al. *Diagnostische waarde van Somatostatine Receptor Scintigrafie bij de stagering van maligne lymfomen.* Rotterdam, 1998.
- Wildhagen MF, Os TAM van, Polder JJ, Kate LP ten, Habbema JDF. Explorative study of costs, effects and savings of screening for female Fragile X premutation and full mutation carriers in the general population. *Community Genetics* 1998;1(1):36-47.
- Polder JJ, Joung IMA, Maas PJ van der. *Raming zorggebruik Academisch Ziekenhuis Rotterdam 2000 – 2020.* Rotterdam, 1999.

- Koning HJ de, Ridder JG de, Agt HME van, Polder JJ, et al. *Vroegtijdige onderkenning van taalontwikkelingsstoornissen 0-3 jaar - Een gerandomiseerd onderzoek naar de effecten, kosten en mogelijkheden van toepassing van het VTO-taal signaleringsinstrument.* Rotterdam, 2000.

Professional autonomy and cost containment in health care (Department of Industrial Organisation, Prof. Dr G.A. Lindeboom Institute)

- Polder JJ, Hoogland J, Jochemsen H. *Professie of profijt?* Lindeboomreeks nr. 9. Amsterdam: Buijten & Schipperheijn, 1996.
- Polder JJ, Hoogland J, Jochemsen H, Strijbos S. Profession, practice and profits: Competition in the core of health care system. *Systems Research and Behavioral Science* 1997;14(6):409-421.
- Polder JJ, Jochemsen H. Professional autonomy in the health care system. *Theoretical Medicine and Bioethics* 2000;21(5):477-491.

Health care in the Dutch Reformed Denomination

- Polder JJ. Marktverkenning Reformatorische ouderenzorg, 1995 – 2020. *Zicht* 1996;22(5):181-192.
- Polder JJ, Wal H van der. *Zicht op zorg in de gereformeerde gezindte.* Putten: Oikonomos Foundation, 2000.

Christian perspectives on economics

- Polder JJ, Leerdam J van, et al. *Tussen beginsel en belang - Normatieve gedachten over economie, markt en samenleving.* Houten: Den Hertog, 1998.

Acknowledgements

Gottlob! Nun geht das Jahr zu Ende,
Das neue rücket schon heran.
Gedenke, meine Seele, dran.
Wieviel dir deines Gottes Hände
im alten Jahre Guts getan!
Stimm ihm ein frohes Danklied an;
So wird er ferner dein gedenken
Und mehr zum neuen Jahre schenken.

These words were sung on New Year's Eve 1725 in Leipzig where Johann Sebastian Bach was performing a new cantata (BWV 28). When finishing this thesis my first desire is to join the choir in thanking the Lord.

Writing a thesis on a multidisciplinary subject is a task that could not be accomplished by a single person. I am grateful to many people.

First, I would like to thank my promotores Paul van der Maas and Frans Rutten for the scientific and personal guidance provided over several years. The Department of Public Health furnished a scientific environment in which a lot of work in combination with a lot of intellectual and organisational freedom stimulated my career as health economist.

Special thanks to my colleagues involved in the cost-of-illness research (Willem Jan Meerding, Luc Bonneux and Marc Koopmanschap), and to all other colleagues for the pleasant co-operation in different research projects (especially, Jan Barendregt, Erwin Birnie, René Eijkemans, Dik Habbema, Harry de Koning, Ida Korfage, Pieta Krijnen and Ewout Steyerberg). I am also grateful to Romke van Balen and Herman Cools who co-authored the paper on costs after hip fracture, to Gouke Bonsel who read the entire manuscript in detail and suggested many improvements, to Karen Gribling who improved the English language, and to Edwin Schalk and his Interaxion-colleagues who made this thesis a collectors item by providing the beautiful cover.

I wish to thank many persons from other institutions and organisations for their pleasant co-operation: National Institute for Health and Environment (Dirk Ruwaard, Loek Stokx, Jean Takken, Ardine de Wit and Inge Wolff); Institute for Medical Technology Assessment (Werner Brouwer, Jan van Busschbach, Jan Oostenbrink); Ministry of Health (Rob van Puijenbroek, Philip ten Cate, Jan Poelert and many others); Prismant (Willem Hoogen Stoevenbeld, Leo Vandermeulen and others) and all participants of the Werkgroep Economie en Zorg.

Activities outside Erasmus University taught me that health economics and health research represent only a small part of the world. Thanks to everyone of Economos, the Reformatorisch Dagblad, the Reformatorisch Maatschappelijke Unie, Stichting Ontmoeting, the Vereniging van Organisten der Gereformeerde Gemeenten, the Noaber Foundation and the Stuurgroep Zicht op Zorg in de Gereformeerde Gezindte (especially Jaap Hoekman, Henk Jochemsen and Hugo van der Wal) in whom I have gained new acquaintances. At risk of forgetting some people, I would like to thank Geert Bierling for teaching me to play the organ, Jan Wisse for discussing music, John van Leerdam for discussing economics and Jan Schippers for discussing everything one can discuss and for drawing my attention to the above-mentioned Bach cantata.

A word of thanks to my parents, all other family and friends for their support and enthusiasm. I especially mention Klaus, Francien and Naomi Markus and Klaas and Simone Speksnijder with their children for the hospitality and friendship we received in Bergambacht.

Finally, I want to thank Thea and Arthur. Your love and support exceed everything else on earth.

In Western countries every year a lot of money is spent on health care. This thesis describes how health expenditure can be assigned to epidemiological and demographic variables. It is demonstrated that the main health care costs relate to old age and chronic disabling conditions, rather than the major causes of death.

Comparisons over time reveal interesting trends, and more detailed analyses of specific diseases throw a new light on the cost-of-illness debate. From a cross-national perspective the meaning of cost-of-illness studies seems rather limited, but standardisation might improve the international comparability.

It is concluded that cost-of-illness studies are worthwhile because they provide a single estimate of the burden of disease and offer a framework for more sophisticated analyses. Cost-of-illness studies can also be used for the assessment of major trends and for the projection of future health expenditure.