

**Disease costing  
methodology used in the  
Disease Costs and Impact  
Study 1993–94**

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# **Disease costing methodology used in the Disease Costs and Impact Study 1993–94**

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Canberra**

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# Preface

The Australian Institute of Health and Welfare (AIHW) started the Disease Costs and Impact Study (DCIS) in 1992, with funding from the Health Advancement Program of the then Commonwealth Department of Health, Housing, Local Government and Community Services and from the National Health and Medical Research Council (NHMRC). Originally conceived as part of a broader approach to evaluation and referred to as the Macro Economic Evaluation Model, it was headed by Rob Carter at the Institute. The Macro Economic Evaluation Model estimated the economic impact of specific diseases and disease groups in Australia in 1989–90, both in relation to direct costs to the health system and a range of indirect costs. The study also developed a set of summary measures of disease impact in terms of potential years of life lost and health service use.

The project produced a series of reports in support of the National Health Goals and Targets program and NHMRC analysis of the potential impact of various health problems and review of preventive screening interventions in clinical practice (AIHW 1993; AIHW & NCHPE 1993a, 1993b, 1993c). Following completion of these reports, which estimated various disease and risk factor costs for 1989–90, Rob Carter moved to the National Centre for Health Program Evaluation in Melbourne, but continued collaboration with the Institute on the project. Work commenced on a comprehensive accounting of disease costs across all chapters of the ICD-9 Classification of Diseases and it became apparent that there were areas where the methodology required revision. It was decided to undertake a systematic revision of the methodology to address known problems, to make use of newly available data collections and to include additional sectors of the health system.

The Institute has decided to approach disease costing as a satellite national account and is currently undertaking a project to develop an explicit satellite national accounts framework for health and welfare expenditure. In updating cost estimates to 1993–94 data, the Institute's DCIS has focused on the direct costs of health services, so that the disease costings form a disaggregation of national health expenditure. This report describes the revised methodology and identifies differences from the 1989–90 methodology.

During 1998 the Institute will publish three reports on disease costs for 1993–94:

- *Health System Costs of Disease and Injury in Australia 1993–94*
- *Health System Costs of Cancer in Australia 1993–94* (in collaboration with the National Cancer Control Initiative)
- *Health System Costs of Cardiovascular Disease and Diabetes in Australia 1993–94.*

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We would also like to gratefully acknowledge the assistance of the Family Medicine Research Unit of the University of Sydney in providing a copy of all data contained in the 1990–91 Survey of Morbidity and Treatment in General Practice in Australia and helpful advice.

# 1 Introduction and overview

## 1.1 The Disease Costs and Impact Study

The Australian Institute of Health and Welfare (AIHW) started its disease costing analysis in 1992 as part of the Macro Economic Evaluation Model, which aimed to develop a broad macro-level approach to evaluation of health interventions. The Institute has continued this project as the Disease Costs and Impact Study (DCIS), in collaboration with the National Centre for Health Program Evaluation (NCHPE). It aims to measure health services utilisation and expenditure for specific diseases and disease groups in Australia.

This project has already produced reports and data that are of considerable interest to policy makers, evaluators and industry. Institute reports to date include:

- *The Cost of Diet-related Disease in Australia*
- *The Economic Costs of Disease in Australia: Interim Report for NHMRC Working Party on Prevention Programs*
- *The Economics of Cardiovascular Disease*
- *The Economic Cost of Cancer in Australia*
- *The Costs of Injuries in Australia – Preliminary Report*
- *Disease Costs of Tuberculosis and Syphilis in Australia*
- *Disease Costs of Hepatitis B in Australia.*

Sections on the costs of disease in Australia in 1989–90 have been included in *Australia's Health 1994* and *Australia's Health 1996* (AIHW 1994, 1996). Other reports which have used the 1989–90 results include the recent report by the National Health and Medical Research Council (1996a) on preventive health interventions in clinical practice.

This report outlines the methodology used to estimate the direct costs of diseases in Australia for 1993–94. Estimates of health system costs of disease for 1993–94 have been published in *Australia's Health 1998* (AIHW 1998) and a series of AIHW reports (see Preface).

## 1.2 The DCIS methodology

The basic methodology for estimating the direct costs of hospitals, medical expenditure, allied professionals, pharmaceuticals and nursing homes was developed by Ms Kathryn Antioch under Rob Carter's direction for the Macro Economic Evaluation Model (Antioch 1992; Crowley et al. 1992). The methodology was revised during 1993 to use 1989–90 health expenditure figures compiled by the Institute instead of estimates obtained by inflating the 1988–89 figures (also compiled by the Institute) by their relevant inflators (Conway et al. 1993). Where State breakdowns of expenditures were available, they were used instead of the national average figure.

In 1994, costings were extended to disease groups defined by all chapters of the Ninth Revision of the International Classification of Diseases (ICD-9) (WHO 1977) and it became possible to check that disease costs in each sector added to the totals from the AIHW Health Expenditure Database. This identified a number of areas where revisions to the attribution methods were needed. Additionally, the model did not include some major areas of expenditure such as hospital non-inpatient services. During 1995 and 1996 the methodology was revised by the authors to resolve these problems.

The basic approach for direct costs of health services has been to take known aggregate expenditures on health care and apportion these to disease categories using Australian data (hospital morbidity data, casemix data, the 1990–91 Survey of Morbidity and Treatment in General Practice in Australia undertaken by Professor Bridges-Webb and colleagues (GP survey), and the 1989–90 Australian Bureau of Statistics (ABS) National Health Survey). Recurrent expenditure on health care which has not yet been attributed includes expenditure on ambulance services, community health services, and most health promotion and illness prevention. The attribution of the direct costs of health services to disease is discussed in more detail in Section 1.5.

The disease costing methodology aims to disaggregate the total health expenditure in 1993–94 (\$31.4 billion for sectors included in the model) by the following dimensions:

- disease (defined by ICD-9 code groups)
- sector (hospital inpatient, non-inpatient, medical, drugs, etc.)
- program (treatment, prevention)
- sex (male, female)
- age (0–4, 5–14, 15–24...65–74, 75+).

Note that the DCIS has shifted from using the 10-year age groups, 0–9, 10–19...80+, to using 10-year age groups in line with Institute standards.

The revised methodology has increased the proportion of direct health expenditure included in the disease costings from around 70% to 92%. The disease costings are being updated to 1993–94 data and it is planned to publish reports on the costs of all diseases at ICD-9 chapter level, and on the costs of cardiovascular disease and cancer.

It is planned to measure disease impact directly (in terms of lost years of life, etc.) rather than through the calculation of indirect costs of premature death and morbidity. Indirect costs are discussed further in Section 1.4. The DCIS generates, as a by-product, estimates of health service utilisation by age–sex–disease group.

## 1.3 Cost of illness analysis

Cost of illness analysis is used to estimate the cost impact of disease on the community. By measuring the impact of disease in economic terms, it presents another picture of the way in which diseases affect the community. The main uses of cost of illness data are in providing an economic justification for disease control action and an input into evaluating the potential cost-effectiveness of interventions for the purpose of priority setting.

At a minimum, cost of illness studies are useful for identifying how resources are allocated between different types of costs, diseases and services. Cost of illness studies can also attempt to measure the value that illness subtracts from the productive potential of a large social unit, such as a nation (Gertstein 1991). For the health services sector, direct costs are the costs of forgone alternatives: if there was less illness, then a proportion of the resources spent on diagnosing and treating the sick could be put to other uses. Indirect costs are the value of the output that is lost because people are too ill to work or have died prematurely. Indirect costs are discussed in more detail in Section 1.4.

Cost of illness calculations can also provide the base against which new interventions can be assessed. Planners can compare the relative burden of different diseases in considering priorities for prevention. Cost of illness estimates can be used to model the ‘do nothing’ or current case option, and to investigate the potential impact of different treatment practices. The latter follows naturally from separately identifying the components of costs (such as hospital, medical, pharmaceutical, nursing home and allied health costs). Cost of illness studies can also be useful to health planners who wish to know the relationship between the

number of cases of a disease and the consequent use of health services. Planners may wish to identify what potential changes in use might be achieved by prevention or to estimate possible cost savings.

Such estimates need to be carefully interpreted. They are usually only indicative. They are not estimates of immediately realisable savings, but rather 'opportunity cost' estimates measuring resources devoted to the treatment of preventable disease that could be available for other purposes. Conversion of 'opportunity cost savings' into financial savings involves a number of other practical<sup>1</sup> and theoretical<sup>2</sup> considerations.

Cost of illness data can also be useful for researchers and planners who wish to know where in the health system expenditures are incurred, for example, by type of illness, and by age and sex. Such information can assist in analysing equity issues in the provision of health services.

## 1.4 Indirect costs of disease

Cost of illness analysis often attempts to measure the total economic cost to society of illness by including not only the direct costs of illness (the health sector costs of providing health services), but also the indirect costs, which usually focus on lost production due to sickness and premature death, but can include costs that have an impact outside the health care sector (such as police and court costs associated with drug abuse).

The 1989-90 methodology used the human capital approach to value the lost production associated with morbidity and mortality. In this method, an individual is perceived as producing a stream of output over time that is valued at market earnings. These market earnings can also be imputed for the value of unpaid household work (Hodgson & Meiner 1982; Max, Rice & MacKenzie 1990). The 1989-90 methodology estimated the indirect costs associated with morbidity in terms of absenteeism, and with receipt of hospital and medical services (a prevalence-based approach), and the indirect costs associated with mortality using an incidence-based approach in terms of the discounted stream of potential lifetime earnings (including an imputed value for unpaid household work) from age at death (Antioch 1992).

The indirect costs of disease can be defined in several ways, depending on the perspective and objective of analysis. If indirect costs are conceptualised in terms of the opportunity costs of lost production (whether for paid or unpaid labour), then the human capital approach will usually drastically overestimate the costs of lost production. The actual loss of production will be restricted to a so-called friction period needed to adapt to the changed situation (Koopmanschap & van Ineveld 1992; Koopmanschap et al. 1995). The friction period is the period needed to effectively replace the sick or dead worker, whether by recruiting someone else or by training someone to replace the lost worker. The friction cost method explicitly takes into account the short- and long-run processes in the economy which reduce production losses substantially as compared with the potential upper limit given by the human capital method. Such indirect costs will depend on the labour market situation and will also vary in

- 
1. There are a range of practical issues such as professional interests, workforce restructuring, management policies, political acceptability and/or public reaction.
  2. The theoretical issues relate to the cost characteristics of the production function, involving issues such as the mix of 'variable costs' and 'fixed costs', and 'lumpiness' in the expansion/contraction of capital equipment and assets. Variable costs are avoidable, in that, by definition, they vary directly with the level of production. Fixed costs, as their name implies, are fixed for a period of time (or may even be 'sunk' or non-redeemable if very specialised assets are involved). A financial objective of asset liquidation, financial savings or expenditure restraint, therefore, can have very different implications from one of making best use of available resources. Assuming a hospital ward or health service continues in operation but treats different patients is very different from downsizing or cessation of activities.

different segments of the labour market. Indirect costs estimated using the friction cost method will be lower in countries with high levels of unemployment than in countries with low unemployment.

On the other hand, indirect costs of disease may be defined in terms of the economic value that society, including the individual concerned, places on human life and on the avoidance of other 'intangibles' such as pain, suffering, anxiety or bereavement. From this perspective, the main criticism of the human capital methodology is that it excludes important intangibles, only counts earnings (whether actual or imputed), and places a low value on some groups such as low income earners, the unemployed and people not in the labour force, such as children (Max, Rice & MacKenzie 1990).

It is commonly argued that the best way to value human life is by the willingness-to-pay approach, which values life and health according to what people would be willing to pay for a change that reduces the probability of illness or death (Schelling 1968; Acton 1975; Max, Rice & MacKenzie 1990). Lifetime earnings, as calculated by the human capital approach, provide a lower bound to the value of human life as measured by willingness to pay (Linnerooth 1979).

One objection to the willingness-to-pay method is that the value of individual lives depends on income distribution, with the rich able to pay more than the poor. This can be resolved by using appropriately agreed population averages. More importantly, it is very difficult for individuals to place a value on small reductions in the probability of death (Rice, Hodgson & Kopstein 1985; Goss 1997). The willingness-to-pay approach is thus very difficult to operationalise, although Goss (1997) has suggested that good contingent valuation approaches may provide better estimates than generally realised. Also, willingness-to-pay estimates can be derived from the revealed preferences of government decision makers (George, Harris & Mitchell 1997).

Most economic evaluations in the health area prefer not to cost the value of life, but rather to compare the ratios of direct costs to 'life years gained' or 'quality-adjusted life years gained' (QALYs) so that the decision index is dollars per QALY. This goes to the heart of the differences between cost-benefit, cost-effectiveness, and cost-utility analyses (Linard 1992; Mathers 1996; Dowie 1997). Inclusion of indirect cost estimates is more widely accepted in cost of illness studies than in economic evaluations. Most cost of illness studies address indirect costs in terms of lost production, rather than through valuing human life and suffering.

The inclusion of indirect costs in cost of illness studies remains an area of debate and controversy (Collins & Lapsley 1991; Koopmanschap et al. 1995). Since the two major objectives in measuring indirect costs lead to different methodologies (and very different magnitudes of estimates), and these methodologies are either contentious and/or at an early stage of development, the Institute has decided to focus on the analysis of direct health system costs in the DCIS and to include in reports, where appropriate, more direct measures of disease impact in health status terms, rather than the impact in dollars.

## **1.5 Estimation of direct costs**

Direct costs are the costs of forgone alternatives; if there were no illness, the money spent on diagnosing, treating and caring for the sick, and the money spent on prevention, could be put to other uses. The direct costs of illness are calculated in the DCIS by apportioning estimates of recurrent health expenditure (published in the AIHW Health Expenditure Bulletins) to

categories of disease using Australian data on disease prevalence and health service utilisation. The areas of health expenditure used in the AIHW Health Expenditure Database are shown in Table 1.1.

**Table 1.1: Total recurrent health expenditure 1993–94, by area of expenditure<sup>(a)</sup>**

Area of expenditure	Expenditure \$ millions	As per cent of total
Hospitals		
Recognised public hospitals	9,655	28.3
Private hospitals	2,333	6.8
Repatriation hospitals	357	1.0
Public psychiatric hospitals	473	1.4
Nursing homes	2,647	7.8
Medical services	6,884	20.2
Dental services	1,831	5.4
Other professional services	1,244	3.6
Pharmaceuticals	4,042	11.7
Ambulance	484	1.4
Other institutional (nec)	121	0.4
Community/public health	1,558	4.6
Aids and appliances	770	2.3
Administration	1,099	3.2
Research	534	1.6
Other non-institutional	109	0.3
<b>Total recurrent health expenditure</b>	<b>34,141</b>	<b>100.0</b>

(a) Areas of expenditure as defined in AIHW Health Expenditure Database.

Source: AIHW 1996.

A prevalence-based costing approach is used. The prevalence-based approach provides estimates of the direct costs of health services for preventing, diagnosing and treating illness incurred as a consequence of the prevalence of illness during the specified period, usually one year. Most cost of illness studies employ the prevalence-based approach (Rice, Kelman & Miller 1991).

The DCIS reorganises areas of expenditure used in the AIHW Health Expenditure Database to split hospital costs into inpatient and non-inpatient costs, to include in-hospital private medical costs with inpatient costs, and to split pharmaceuticals expenditure into prescription drugs and over-the-counter medicines (Table 1.2). Note that private hospital expenditure has increased because of the inclusion of in-hospital medical services, whereas public hospital expenditure has been split between inpatient services (including private medical services) and non-inpatient services.

The health sector expenditures (Table 1.2) are attributed to disease, age and sex using available data on the distribution of service utilisation and, where available, relative costs of services. The data sets used and the basic method of attribution are summarised in Section 1.6 and described in detail in chapters 2 to 8. The revised methodology ensures that the direct costs across all diseases are consistent with the total health expenditures published in the AIHW Health Expenditure Bulletins and regrouped as shown in Table 1.2.



**Table 1.2: Total recurrent health expenditure 1993-94, by DCIS area of expenditure**

DCIS area of expenditure	Expenditure \$ millions	As per cent of total
Hospital inpatients		
Recognised public hospitals	7,652	22.4
Private hospitals	3,221	9.4
Repatriation hospitals	295	0.9
Public psychiatric hospitals	473	1.4
Hospital non-inpatients	2,421	7.1
Nursing homes	2,647	7.8
Out-of-hospital medical services	5,640	16.5
Dental services	1,831	5.4
Allied health services	1,244	3.6
Pharmaceuticals		
Prescription drugs	2,972	8.7
Over-the-counter drugs	1,070	3.1
Cancer-related public health programs <sup>(a)</sup>	69	0.2
Research	534	1.6
Other institutional (nec)	121	0.4
Administration	1,099	3.2
Other non-institutional	109	0.3
<i>Total included in DCIS costings</i>	<i>31,397</i>	<i>92.0</i>
Not included in DCIS costings		
Ambulance	484	1.4
Community/public health <sup>(b)</sup>	1,490	4.4
Aids and appliances	770	2.3
<b>Total recurrent health expenditure</b>	<b>34,141</b>	<b>100.0</b>

(a) Includes costs of breast, cervix, lung and skin cancer public health programs.

(b) Community health services and public health services apart from breast, cervix, lung and skin cancer programs.

## 1.6 Attribution of costs to age-sex-disease groups

Total recurrent health expenditures for 1993-94 (Table 1.2) are apportioned by sector using hospital morbidity and casemix data for 1993-94, Medicare and Pharmaceutical Benefits Scheme data for 1993-94, and data from the 1990-91 Survey of Morbidity and Treatment in General Practice in Australia (GP survey) and the ABS 1989-90 National Health Survey. Table 1.3 summarises the attribution methods and the data used for each of the health sectors included in the DCIS.

**Table 1.3: Summary of DCIS methodology, 1993–94**

Health sector	Basis of cost attribution to age–sex–disease groups	Data sources
<b>Hospitals</b>		
Acute hospital inpatients	Separations weighted by DRG cost weight and length of stay	AIHW National Hospital Morbidity Database 1993–94
Repatriation hospital inpatients		
Public psychiatric hospital inpatients	Bed days	AIHW National Hospital Morbidity Database 1993–94
Hospital non-inpatients	At chapter level: number of visits in last two weeks. Sub-chapter level according to inpatient separations by site.	1989–90 ABS National Health Survey AIHW National Hospital Morbidity Database 1993–94
<b>Medical services</b>		
In-hospital medical services for private, compensable and other patients	Separations weighted by DRG-based estimated medical service cost weights.	Medicare data on fees charged for eligible in-hospital medical services in 1993–94 AIHW National Hospital Morbidity Database 1993–94
Out-of-hospital medical services	GP encounters weighted by Medicare data on fees charged. Specialist referrals by GPs, weighted by Medicare data on fees charged.	Medicare data on fees charged for eligible out-of-hospital medical services in 1993–94 1990–91 Survey of Morbidity and Treatment in General Practice in Australia
<b>Pharmaceuticals</b>		
Prescription drugs	Prescriptions weighted by relative utilisation and average prescription cost for therapeutic drug group.	Pharmaceutical Benefits Scheme Utilisation and Cost Data for 1993–94 1990–91 Survey of Morbidity and Treatment in General Practice in Australia
Over-the-counter medicines	Use of non-prescription medications in the last two weeks.	1989–90 ABS National Health Survey
<b>Allied health services</b>	Reported visits in the last two weeks, together with referrals by GPs.	1989–90 ABS National Health Survey 1990–91 Survey of Morbidity and Treatment in General Practice in Australia
<b>Nursing homes</b>	For ICD-9 chapters: number of residents by main disabling condition. Attribution to sub-chapter level on basis of distribution of transfers from acute hospitals.	1993 Survey of Disability, Ageing and Carers AIHW National Hospital Morbidity Database 1993–94
<b>Other<sup>(a)</sup></b>		
Public health	Estimated costs for breast and cervix cancer national screening programs and for lung and skin cancer prevention programs. Costs of other public health programs not included as yet.	Harris & Scott 1995; Richardson et al. 1996; Carter, Marks & Hall 1997 Medicare data on fees charged for Pap smears and PSA tests in 1993–94 Scollo 1998
Research	Estimated expenditure for major disease groups from Nichol, McNeice & Goss. Distributed to detailed age–sex–disease groups in proportion to NHMRC and other relevant grant distributions.	Nichol, McNeice & Goss 1994 NHMRC 1996
Other institutional (nec), Administration and Other non-institutional	Allocated to age–sex–disease groups in proportion to total expenditure in other categories.	n.a.

It must be emphasised that the cost estimates for 1993–94 are based on attribution of total health expenditures to diseases based on available information on the mix of diseases treated and the costs of treatment. For medical and allied health services, and to some extent for drugs, utilisation data relate to 1989–90 or 1990–91, and so costs reported for these sectors will not reflect changes in clinical practice or disease patterns between then and 1993–94. The only exceptions to this are for pathology screening tests for cervix and prostate cancer where

1993–94 Medicare data were used. Also, costs of specialist medical services are estimated using 1990–91 data on referral patterns by general practitioners and costed at the average cost within specialist type. For example, this means that all pathology tests (apart from Pap smear and prostate specific antigen (PSA) tests) are assumed to have the same average cost.

Although the cost estimates reported here provide a broad picture of the health system resources used by age, sex and disease, they should be interpreted with caution for specific diseases. Detailed bottom-up costing of the treatment costs of a specific disease, calculated by adding up actual costs for a cohort of patients, may in some cases give more accurate estimates than the top-down approach of the DCIS, but the latter ensures consistency of estimates and complete coverage of all diseases, and ensures that cost estimates for individual diseases and age–sex groups add to the known total health expenditures.

Recurrent expenditure on health care which has not yet been attributed includes expenditure on ambulance services, community health services, health promotion and illness prevention (apart from public health programs relating to breast, cervix, lung and skin cancer), and aids and appliances. Other types of direct costs not yet attributed to disease categories are capital expenditure (\$1.5 billion in 1989–90) and costs not counted within the national accounts context. These include costs incurred by families and friends in caring for patients, travel costs of patients and welfare service costs. The current estimates of direct costs are therefore conservative.

### **1.6.1 Hospital inpatient services**

This sector includes inpatient (admitted patient) costs for recognised public hospitals (including public psychiatric hospitals), repatriation (Department of Veterans' Affairs) hospitals and private hospitals. The proportions of total public acute hospital expenditure which relate to inpatients are given by the inpatient fractions estimated for each State and Territory by the National Health Ministers' Benchmarking Working Group (1996).

Disease costs for inpatient services are estimated by apportioning the total inpatient expenditure for each State or Territory to individual episodes of hospitalisation, with an adjustment for resource intensity of treatment for the specific episode (using diagnosis related groups (DRGs)). Medical costs for private, compensable and other non-public patients in public, repatriation and private hospitals are estimated using DRG-derived medical cost weights and age–sex-specific information from the Health Insurance Commission on in-hospital private medical charges for various categories of service.

Public psychiatric hospital data for New South Wales and Victoria are used to allocate public psychiatric hospital inpatient costs. These costs all fall in the mental health chapter of ICD-9. Refer to Chapter 2 for full details of the methodology for hospital inpatient costs.

### **1.6.2 Outpatient and casualty services**

The 1989–90 ABS National Health Survey is used to allocate total expenditure on non-inpatient services for 1993–94. Total visits to outpatient clinics (including casualty or accident and emergency departments) for each age–sex–disease group are estimated from the National Health Survey data on numbers of outpatient visits in the two weeks prior to interview. Expenditure is allocated assuming that all visits have the same cost.

Refer to Chapter 3 for full details of the methodology for non-inpatient costs.

### **1.6.3 Nursing homes**

The distribution of the main disabling health condition of nursing home residents in the 1993 Australian Survey of Disability, Ageing and Carers is used to allocate total nursing home expenditure for 1993–94 to age–sex–disease categories at ICD-9 chapter level. This expenditure is apportioned to specific disease groups at the sub-chapter level according to the distribution of diagnoses for patients in that age–sex group who transfer from acute hospitals (around 60% of nursing home admissions).

Refer to Chapter 4 for full details of the methodology for nursing home costs.

### **1.6.4 Medical services**

This sector includes expenditure on all private medical services apart from those for hospital inpatients. It includes consultations with general practitioners and specialists, as well as pathology tests and screening and diagnostic imaging services. The GP survey is used to allocate age–sex-specific out-of-hospital expenditure on medical services to disease diagnoses. This allocation is done separately for general practitioners (based on encounters surveyed in the GP survey) and for 17 categories of specialists (based on the pattern of referrals to each category of specialist in the GP survey).

Age–sex-specific out-of-hospital expenditure on medical services is derived from Medicare and Department of Veterans' Affairs data. This expenditure covers all charges for which a Medicare or Department of Veterans' Affairs claim has been made. It is adjusted to include expenditure for which claims have not been made, using an inflation factor derived from the AIHW Health Expenditure Database on total expenditure on medical services.

This methodology assumes that the pattern of general practitioner services by diagnosis in 1993–94 is the same as that collected in 1990–91, that the pattern of diseases managed by each type of specialist in 1993–94 reflects the pattern of referrals to that specialist type from general practitioners in 1990–91, and that each referral to a specialist of a given type generates services with equal cost. Estimates of the number of services and costs for pathology screening tests for cervix and prostate cancer were adjusted to reflect total Medicare claims and charges for 1993–94 for Pap smears and PSA tests respectively. Utilisation and costs for Pap smears were adjusted upwards by a factor of 1.38 to take account of Pap smears read in public laboratories (Dankiw 1994).

All other screening and diagnostic tests apart from screening mammography (see Section 1.6.7) were costed based on the 1990–91 pattern of referrals by general practitioners, using the overall average charge per pathology test in 1993–94.

Refer to Chapter 5 for full details of the methodology for out-of-hospital medical services.

### **1.6.5 Allied health services**

The GP survey and the National Health Survey are used to allocate total Australian expenditure on allied health practitioners to age–sex–disease groups. Total visits to allied health practitioners in 1993–94 for each age–sex–disease group are estimated from the National Health Survey data on visits to 14 types of allied health practitioners in the two weeks prior to interview. Annual visits to other types of allied health practitioner are estimated from referrals by general practitioners in the GP survey. Expenditure is allocated assuming that all visits have the same cost. The methodology covers all allied health professionals except pharmacists (see Section 1.6.6).

Refer to Chapters 6 and 7 for full details of the methodology for allied health service costs.

### 1.6.6 Pharmaceuticals

Total pharmaceutical expenditure is decomposed into two components: expenditure on prescription drugs and non-prescription (over-the-counter) pharmaceuticals. Data from the GP survey, together with 1993–94 estimates of total costs and numbers of prescriptions for 40 categories of drugs, are used to allocate total Australian expenditure on prescription pharmaceuticals to age–sex–disease groups. Expenditure on over-the-counter pharmaceuticals is attributed to age–sex–disease groups using information from the National Health Survey. The methodology addresses all pharmaceutical costs apart from the cost of pharmaceuticals dispensed in hospitals, which are included in estimates of hospital costs.

For each of 40 therapeutic drug groups (Pharmaceutical Benefits Pricing Authority 1994), the relative distribution of prescriptions by disease, age and sex for all community prescriptions in 1993–94 is assumed to be the same as that for prescriptions by general practitioners in 1990–91. For diseases where a significant proportion of prescriptions are made by medical specialists, this assumption may have limited validity. Detailed estimates of 1993–94 utilisation and expenditure for the 40 drug categories are used as a starting point for attribution to age–sex–disease groups. This takes into account differences in average drug costs across therapeutic categories, average numbers of repeats, and relative changes in utilisation and costs across drug categories between 1989–90 and 1993–94.

Refer to Chapter 8 for full details of the methodology for pharmaceutical drug costs.

### 1.6.7 Public health programs

Community and public health programs in general are not yet included in the estimates of disease costs due to the difficulties in obtaining comprehensive casemix data for these health sectors. However, estimates of the costs for breast and cervix cancer national screening programs and for lung and skin cancer prevention programs have been included in the 1993–94 costs to provide a more complete picture of health system costs for cancer in Australia.

Costs of mammographic screening for breast cancer under the National Program for the Early Detection of Breast Cancer are funded outside the Medicare scheme on an equal dollar-for-dollar basis by the Commonwealth and the States and Territories. The total cost of this program is estimated as double the expenditure by the Commonwealth Department of Human Services and Health in 1993–94 (Richardson et al. 1996) and the age distribution of screening obtained from evaluation data (Commonwealth Department of Human Services and Health 1994).

Costs for taking and reading Pap smears under the Organised Approach to Cervical Cancer Screening in Australia are covered by Medicare (Harris & Scott 1995) and are estimated using Medicare data as described in Section 1.6.4. The additional costs of recruitment, coordination, registry and quality control reporting are funded on an equal dollar-for-dollar basis by the Commonwealth and the States and Territories. These additional costs are estimated as double the expenditure by the Commonwealth Department of Human Services and Health in 1993–94 (Richardson et al. 1996) and are included under the 'Public health' sector.

Public health program costs associated with the prevention of lung cancer have been estimated as a proportion of the total costs of anti-smoking programs in Australia in 1993–94. Scollo (1998) has estimated that total State and Territory and non-government expenditure on anti-smoking health education programs comprised \$14.9 million in 1993–94. To this estimate has been added an estimated \$2 million for tobacco legislation enforcement at State and Territory level, and \$1.1 million in Commonwealth expenditure. The latter figure comprises an estimated \$0.17 million in tobacco-specific programs under the National Drug Strategy

and 50% of the National Drug Strategy funding of \$1.9 million for school and other general drug education programs (total expenditure on the National Drug Strategy amounted to \$31.1 million in 1993–94).

Total 1993–94 expenditure on anti-smoking activity was thus estimated at \$18.0 million. Lung cancer accounts for around 25% of the total disease burden attributable to tobacco smoking (English et al. 1995), so 25% of \$18.0 million, or \$4.5 million, was identified as public health expenditure related to lung cancer. The other \$13.5 million is not included in the disease cost estimates for other diseases at this stage (the costs attributable to prevention of other smoking-related cancers are quite small). The 'lung cancer' expenditure of \$4.5 million is allocated to age–sex groups in proportion to the number of smokers in each age–sex group in 1993.

Public health program costs for the prevention of skin cancer in 1993–94 are based on estimates by Carter, Marks & Hall (1997).

### **1.6.8 Research**

Estimated total Australian expenditure on health and medical research for major disease and population groups in 1991 (Nichol, McNeice & Goss 1994) was used to estimate total research spending for males and females by ICD-9 chapter. Chapter-level expenditure was allocated to age–sex–disease groups at sub-chapter level in proportion to total health expenditure for other health sectors. In the case of cancer and cardiovascular disease, it was considered that this process did not give reasonable estimates of the distribution of research costs by type of cancer or type of cardiovascular condition. For these two groups of conditions, an analysis was carried out of the distribution of National Health and Medical Research Council grants for 1996 (NHMRC 1996b) and of grants by the New South Wales Cancer Council and the Victorian Anti-Cancer Council. These data were used to make preliminary estimates of the distribution of research funding across cancer sites and across disease groups within the cardiovascular chapter.

### **1.6.9 Other institutional, non-institutional and administration**

Other institutional health expenditure (the Red Cross Blood Transfusion Service), other non-institutional health expenditure (Family Planning Services) and administration expenditure (Commonwealth and State and Territory health authority administration expenses and management expenses of Medicare and registered private health insurance funds) are allocated to age–sex–disease groups in proportion to total health expenditure for other health sectors.

It may be possible to refine this attribution process through analysis of the types of expenditure comprising these categories. For example, almost half of 'Administration' expenditure is for administration of health insurance funds, and it may be possible to allocate this according to the distribution across sectors of health insurance funds expenditure. At this stage, a simple overall pro rata allocation process has been used for the three sectors combined.

## **1.7 Disease categories used in the DCIS**

Disease is classified using the International Classification of Diseases, Ninth Revision, Clinical Modification (or ICD-9-CM). The list of diseases costed for 1993–94 is based on the minimum set needed to cost each chapter of ICD-9 in total and to initially explicitly cost sub-chapter-level disease groups for cardiovascular disease and cancer. Where other classifications of disease are encountered, such as the International Classification of Primary Care (ICPC), these are mapped across to the ICD-9-CM.

### **1.7.1 Chapter-level disease categories**

The disease categories used for costing disease at the chapter level of ICD-9-CM are defined in Table 1.4. This table also specifies the ICPC codes and the National Health Survey condition codes mapped to each chapter. Costs are split between two categories for each chapter – treatment and prevention. There are also general categories for treatment (disease unspecified) and prevention (general health examinations and screening) in the eighteenth category, 'Other contact with health services'.

### **1.7.2 Disease categories used for cancer costs**

Cancers have been classified by site according to ICD-9 (Table 1.5). For most of the costs reported for 1993–94, cancer sites are defined to include malignant neoplasms, benign neoplasms, in situ neoplasms and neoplasms of uncertain behaviour, since much of the cost associated with screening and treatment of benign and in situ neoplasms is associated with excluding malignancy.

The term 'cancer' is generally used to refer to invasive (malignant) neoplasms and excludes in situ carcinomas, benign neoplasms and neoplasms of uncertain behaviour. The most common cancer in Australia is non-melanocytic skin cancer. Incidence data for this cancer are not collected on a routine basis by cancer registries and are often excluded from statistics relating to 'cancers'.

The categories used for costing neoplasms by site and type are defined in Table 1.5. Where other classifications of disease are encountered (such as the ICPC), these are mapped across to the ICD-9 codes. ICPC code mappings for individual cancer sites are documented in Appendix A of the report on cancer costs (Mathers et al. 1998). Costs are split between two categories for each type of neoplasm – treatment and prevention. For some cancers, screening and diagnostic tests may not be specific to a particular site, or indeed to cancer as opposed to other diseases. This problem arises because the ICPC is based on organ system rather than diagnosis and it is not always possible to know whether diagnostic tests for a body system (for example, respiratory system, digestive system) relate to cancer or other diseases. Additionally, the ICPC codes do not always distinguish between preventive and diagnostic screening. As a result, some cancer prevention activities in primary care will be costed in the general prevention category and the general treatment category (in the 'Other' category of Table 1.4) and will not be included in the cancer costs reported for specific sites or for all cancers).

For final reporting of costs of disease at sub-chapter level, expenditure for the 'Unspecified sites' category is distributed pro rata to the specific site categories.

**Table 1.4 : Classification system for diseases and injury at chapter level of ICD-9, 1993-1994**

DCIS group ICD chapter	ICD-9	ICPC	NHS
<b>1. Infections and parasitic diseases</b>			
1.1 Treatment	001-139, V71.2, V12.0	A70-A78, A92, B90, D22, D70-D73, F86, N70, N71, <sup>(a)</sup> N72, R70-R72, S03, S70-S76, S95, T70, X70-X73, X90-X91, Y70-Y72, Y75, <sup>(b)</sup> Y76	043, 044, 045
1.2 Prevention and screening	V01-V07, V18.8, V64.0, V73-V75	A44, D44, N44, R44, B25, X23, Y25	083, 074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>2. Cancers</b>			
2.1 Treatment	140-239, V58.0, V58.1, V66.1, V66.2, V67.1, V67.2, V71.1, V10, V15.3	A79, B72-B75, D75-D78, F74, H75, K72, L71, N74-N76, R84-R86, S77-S82, T71-T73, U75-U79, W72, X75-X81, Y77-Y79	073
2.22 Prevention and screening	V16, V76	A26, B26, D26, L26, N26, R26, S26, T26, U26, X25, X26, Y26	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>3. Endocrine, nutritional, metabolic and immunity disorders</b>			
3.1 Treatment	240-279, V12.1, V12.2	T11, T12, T15, T28, T81-T99	001, 002, 078, 106, 003, 108, 004
3.2 Prevention and screening	V18.0, V18.1, V77	T27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>4. Diseases of blood and blood-forming organs</b>			
4.1 Treatment	280-289, V12.3	B71, B78, B79, <sup>(i)</sup> B80-B84, B99	046
4.2 Prevention and screening	V18.2, V18.3, V78	B27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>5. Mental disorders</b>			
5.1 Treatment	290-319, V11, V15.4, V40, V65.2, V66.3, V67.3, V71.0	N02, P01-P03, P06-P19, P21-P24, P28, P50-P59, P63-P69, P29, P70, <sup>(c)</sup> P71-P99, T06	005, 006, 205, 206, 306
5.2 Prevention and screening	V17.0, V18.4, V79	P27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>6. Diseases of the nervous system and sense organs</b>			
6.1 Treatment	320-389, V12.4, V41, V43.0, V43.1, V53.0, V53.1, V53.2	F01-F18, F28, F29, F70-F73, F82-F85, F91-F99, H01-H13, H28, H29, H70-H74, H77, H81-H99, N04, N71, <sup>(d)</sup> N73, N86-N99, P70, <sup>(e)</sup> N28	007, 008, 009, 010, 011, 012, 013, 014, 086, 107, 109, 110
6.2 Prevention and screening	V17.2, V19.0-V19.3, V72.0-V72.1, V80	F27, H27, N27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>7. Cardiovascular diseases</b>			
7.1 Treatment	390-459, V12.5, V15.1, V42.1, V42.2, V43.2, V43.3, V43.4, V45.0, V45.8, V53.3, V71.7	K28-K29, K70, K71, K74-K80, K82, K83, K84, K86-K96, K99	015, 016, 017, 018, 019, 072, 082, 119, 182, 219
7.2 Prevention and screening	V17.1, V17.3, V17.4, V81.0, V81.1, V81.2	K24-K27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>8. Respiratory system diseases</b>			
8.1 Treatment	460-519, V12.6	R09, R73-R83, R90-R97, R99	020, 021, 022, 023, 071, 075, 081, 084
8.2 Prevention and screening	V17.5, V17.6, V81.3, V81.4	R27	074, <sup>(w)</sup> 097 <sup>(x)</sup>

(continued)



**Table 1.4 (continued): Classification system for diseases and injury at chapter level of ICD-9, 1993-1994**

DCIS group ICD chapter	ICD-9	ICPC	NHS
<b>9. Digestive system diseases</b>			
9.1 Treatment	520-579, V12.7, V53.4, V58.5	D02, D04, D11, D12, D14-D16, D20, D28, D82-D95, D97-D99, L07, D19	024, 025, 026, 027, 029, 030
9.2 Prevention and screening	V18.5, V72.2	D27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>10. Genitourinary system diseases</b>			
10.1 Treatment	580-629, V13.0, V13.2, <sup>(p)</sup> V42.0, V45.1, V56	U04, <sup>(u)</sup> U06, U28, U70-U72, U88-U95, U99, X01-X09, X10-X15, X16, <sup>(h)</sup> X18-X21, X74, X84, X85, X87, X88, X89, X99, Y01, Y02, Y04-Y07, Y10, Y16, Y29, Y73-Y75, <sup>(i)</sup> Y81, Y85, Y86, Y99, W15	031, 032, 033, 085
10.2 Prevention and screening	V18.6, V18.7, V72.3, V81.5, V81.6	U27, X24, X27, Y24, Y27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>11. Complications of pregnancy, childbirth and the puerperium</b>			
11.1 Treatment	630-676, V13.1, V13.2 <sup>(p)</sup>	W03, W05, W17-W20, W28, W29, W70, W71, W73, W76, W77, W80-W84, W92-W99, W32-W44, W46, W47, W50-W59, W63-W69	047, 087 <sup>(y)</sup>
<b>12. Skin and subcutaneous tissue diseases</b>			
12.1 Treatment	680-709, V13.3	B70, D05, S02, S9-S11, S20, S22-S24, S29, S84-S94, S96-S99, X16 <sup>(j)</sup>	034, 035, 036, 037
12.2 Prevention and screening	V19.4, V82.0	S27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>13. Musculoskeletal system and connective tissue diseases</b>			
13.1 Treatment	710-739, V13.4, V13.5, V54	L01-L03, L08-L20, L28, L29, L70, L83-L95, L97-L99	038, 039, 040, 042, 070, 089, 111, 112
13.2 Prevention and screening	V17.7, V17.8, V82.1, V82.2	L27	074, <sup>(w)</sup> 097 <sup>(x)</sup>
<b>14. Congenital anomalies</b>			
14.1 Treatment	740-759, V13.6	A90, B79, <sup>(m)</sup> D81, F80, F81, H80, K73, L82, N85, R89, S83, T78, T80, U85, X83, Y82-Y84	048
14.2 Prevention and screening	V19.5, V19.7, V82.3, V82.4		
<b>15. Perinatal problems</b>			
15.1 Treatment	760-779, V13.7	A93, A94, B79 <sup>(n)</sup>	
<b>16. Symptoms, signs and ill-defined conditions</b>			
16.1 Treatment	780-799	A01-A11, A14, A29, A91, A95, A96, B02-B04, B28, B29, B85-B87, D01, D03, D06-D10, D13, D17, D18, D21, D24, D25, D29, D96, K01, K02-K07, K81, K85, L04-L06, N01, N03, N05-N19, N29, P04, P05, P20, R01-R08, R21, R22, R23, R24, R25, R29, R98, S01, S04-S08, S21, S28, T01-T05, T07-T10, T29, U01-U02, U04, <sup>(k)</sup> U05, U07, U13, U14, U29, U98, X17, X28, X29, X86, Y03, Y08, Y28	051, 052, 053, 054, 055, 056, 057, 058, 059, 060, 061, 062, 064, 080

(continued)

**Table 1.4 (continued): Classification system for diseases and injury at chapter level of ICD-9, 1993-1994**

DCIS group ICD chapter	ICD-9	ICPC	NHS
<b>17. Injury and poisoning</b>			
17.1 Treatment	E800–E999, V14, V15.0, V15.5, V15.6, V66.4, V67.4, V71.3, V71.4, V71.5, V71.6	A12, A13, A80–A88, B76, B77, D79–D80, F75–F79, H76, H78, H79, L72–L81, L96, N79–N81, R87–R88, S12–S19, U80, W75, X82, Y80	049, 050
17.2 Prevention and screening	V82.5		
<b>18. Other contact with health services</b>			
18.1 Fertility control, reproduction, development	V15.7, V20–V28, V30–V39, V45.5, V72.4	W01–W02, W10–W14, W27, W30, W31, W45, W48, W49, W60–W62, W78, W79, W90, W91, Y13, Y14	087, <sup>(y)</sup> 074, <sup>(w)</sup> 097, <sup>(x)</sup> 076
18.2 Elective plastic surgery	V50	H15	
18.3 General prevention, screening, health examination	V19.8, V19.6, V60, V61, V62, V65.3, V65.4, V68, V70, V72.5, V72.6, V72.7, V72.8–V72.9, V82.6, V82.8, V82.9	A97, P25, Z01–Z29; _30: _31, _45, _48: _49, _60: _62 (where _ is all letters except W)	077, <sup>(z)</sup> 091, 074, <sup>(w)</sup> 097 <sup>(x)</sup>
18.4 Treatment and aftercare, unspecified disease	V13.8, V13.9, V15.2, V15.8, V15.9, V42.3–V42.9, V43.5–V43.8, V44, V45.2, V45.3, V45.4, V45.6, V46–V49, V51, V52, V53.5–V53.9, V55, V57, V58.2–V58.4, V58.8, V58.9, V59, V63, V64.1–V64.3, V65.0, V65.1, V65.5, V65.8, V65.9, V66.0, V66.5–V66.9, V67.0, V67.5, V67.6, V67.9, V71.8, V71.9	A89, A32–A43, A46, A47, D32–D43, D46, D47, N32–N43, N46, N47, R28, R32–R43, R46, R47; _32: _44, _46, _47 (where _ is B, F, H, K, L, P, S, T, U, X, Y, Z) _50: _59, _63: _69 (where _ is all letters except P, W)	077, <sup>(z)</sup> 092, 074 <sup>(w)</sup>

- (a) N71 also includes 320–323.  
 (b) Y75 also includes 607.1, so 50% assigned here.  
 (c) P70 also includes Alzheimers disease.  
 (d) N71 also includes 036, 047, 062–064, so 50% assigned here.  
 (e) P70 also includes 290, was assigned to dementia.  
 (g) U04 also includes 788.3, so 50% assigned here.  
 (h) X16 also includes 698.1, so 50% assigned here.  
 (i) Y75 also includes 112.2, so 50% assigned here.  
 (j) X16 also includes 624.9, so 50% assigned here.  
 (k) U04 also includes 625.6, so 50% assigned here.  
 (l) B79 also includes congenital anomalies and perinatal problems, so assigned 1/3 here.  
 (m) B79 also includes blood diseases and perinatal problems, so assigned 1/3 here.  
 (n) B79 also includes blood diseases and congenital anomalies, so assigned 1/3 here.  
 (p) Part of the ICPC code, attributed to DCIS categories in proportion to hospital inpatient costs.  
 (w) 074 is distributed among prevention categories and category 18.4 in proportion to total treatment costs for those categories.  
 (x) 097 is distributed equally among all prevention categories in proportion to total treatment costs for those categories.  
 (y) 087 is distributed equally between categories 11.1 and 18.1.  
 (z) 077 is distributed equally between categories 18.3 and 18.4.

**Notes**

- ICPC codes for non-specific symptoms/diseases (A0, A00, A15–A25, A27, A28, A99) are excluded from the database prior to analysis. This effectively distributes their encounters (where no other diagnosis specified) pro rata to all other categories.
- NHS categories 041, 090, 098, 102, 103, 104, 105, 113 and 998 are excluded from the calculations, effectively distributing them pro rata across all categories.

### 1.7.3 Categories used for cardiovascular disease

Disease categories used at the sub-chapter level for cardiovascular disease are defined in Table 1.6. Unlike cancer, prevention and screening costs are treated as a single category and not apportioned to disease groups at the sub-chapter level.

For final reporting of costs of disease at sub-chapter level, expenditure for the 'Unspecified treatment and aftercare' category 7.9 is allocated pro rata to disease-specific categories within the chapter.

**Table 1.5: Classification of cancer sites in terms of ICD-9 codes for neoplasms**

Cancer site	Malignant neoplasms	Benign, in situ and of uncertain behaviour	Prevention activities
Head and neck <sup>(a)</sup>	140–149	210, 212.0, 230.0, 235.0, 235.1	V76.42
Oesophagus	150	211.0, 230.1, 235.5, <sup>(p)</sup> 239.0 <sup>(p)</sup>	
Stomach	151	211.1, 230.2, 235.2, 239.0 <sup>(p)</sup>	
Colorectal <sup>(b)</sup>	153–154	211.3, 211.4, 230.3–230.6, 239.0 <sup>(p)</sup>	V76.41
Liver	155	211.5, 230.8, 235.3	
Pancreas	157	211.6–211.7, 235.5, <sup>(p)</sup> 239.0 <sup>(p)</sup>	
Lung <sup>(c)</sup>	162	212.2, 212.3, 231.1, 231.2, 235.7, 239.1	V16.1, V76.0
Melanoma	172	216, <sup>(q)</sup> 232, <sup>(q)</sup> 238.2 <sup>(q)</sup>	V76.43
Non-melanoma skin <sup>(d)</sup>	173	216, <sup>(q)</sup> 232, <sup>(q)</sup> 238.2 <sup>(q)</sup>	
Breast <sup>(e)</sup>	174	217, <sup>(p)</sup> 233.0, 238.3, 239.3	V16.3, V76.1
Cervix	180	219.0, 219.9, 233.1–233.2, 236.0 (50%)	V76.2
Uterus	179, 182	218, 219.1–219.8, 236.0 (50%)	
Ovary	183	220, 233.3, 236.2	
Prostate	185	222.2, 233.4, 236.5	
Bladder	188	223.2, 223.3, 233.7, 236.7, 236.99, 239.4	V76.3
Kidney	189.0, 189.1	223.0–223.1, 236.91	V16.5
Brain & CNS <sup>(f)</sup>	191–192	225, 237.5, 239.6	
Lymphoma <sup>(g)</sup>	200–203	228, 229, 238.5–238.6	V16.7
Leukaemia	204–208	238.7	V16.6
Other neoplasms	Balance 140–208	Balance 210–239	Balance V16, V76
Unspecified sites <sup>(h)</sup>	V58.0, V58.1, V66.1, V66.2, V67.1, V67.2, V71.1, V10, V15.3		V16.9, V76.9

(a) Includes neoplasms of the lip, oral cavity and pharynx.

(b) Includes neoplasms of the colon and rectum (bowel).

(c) Includes neoplasms of the trachea, bronchus and lung.

(d) Includes all neoplasms of the skin apart from melanoma.

(e) Includes female breast cancer only. Male breast cancer is included in the category 'Other neoplasms'.

(f) Includes all neoplasms of the brain and nervous system.

(g) Includes Hodgkin's disease, non-Hodgkin's lymphoma and multiple myeloma.

(h) Costs in this category are distributed pro rata across the site-specific categories for this report.

(p) Codes that fall across several categories are distributed in proportion to costs for malignant neoplasms for those sites.

(q) Costs apportioned to melanocytic and non-melanocytic neoplasms in proportion to the costs for malignant neoplasms.

**Table 1.6: Classification system for cardiovascular disease, 1993–1994**

DCIS sub-group	ICD-9	ICPC
7.1 Rheumatic heart disease	390–398	K71
7.2 Hypertensive disease	401–405	K86, K87
7.3 Ischaemic heart disease	410–414	K74–K76
7.4 Diseases of pulmonary circulation	415–417	K82, K93
7.5 Other forms of heart disease	420–429	
– cardiac dysrhythmias	426–427	K78–K80, K84 <sup>(n)</sup>
– heart failure	428–429	K77
– other	420–425	K70, K84, <sup>(n)</sup> K83
7.6 Cerebrovascular disease	430–438	K89, K90
7.7 Diseases of arteries, arterioles and capillaries	440–448	K91, K92, K99 <sup>(n)</sup>
– atherosclerosis	440	K91
– peripheral vascular	441–444	K92
– other	446–448	K99 <sup>(n)</sup>
7.8 Diseases of veins, lymphatics and other diseases of the circulatory system	451–459	K88, K94–K96, K99 <sup>(n)</sup>
7.9 Unspecified treatment and aftercare	V12.5, V15.1, V42.1, V42.2, V43.2, V43.3, V43.4, V45.0, V45.8, V53.3, V71.7	K28–K29
7.10 Prevention and screening	V17.1, V17.3, V17.4, V81.0, V81.1, V81.2	K24–K27

## 1.8 Results

The health system costs of disease and injury in Australia in 1993–94 are summarised at the broad disease group level according to ICD-9 chapters (Table 1.7). They are ranked in descending order of total costs. Digestive system diseases are the second most expensive group, following cardiovascular diseases, in part because of the large expenditure on dental services, included in the ‘Allied health services’ sector. It is interesting to note that mental disorders and musculoskeletal disorders, which include many long-term chronic disorders with relatively low fatality rates, rank highly in the direct cost estimates.

More detailed results for disease costs in 1993–94 will be published by the Institute during 1998 in the following reports:

- *Health System Costs of Disease and Injury in Australia 1993–94*
- *Health System Costs of Cancer in Australia 1993–94*
- *Health System Costs of Cardiovascular Disease and Diabetes in Australia 1993–94.*

**Table 1.7: Health system costs for cancers and other diseases, by ICD-9 chapter and health sector, 1993-94 (\$ million)**

ICD-9 chapter	Total costs	Hospitals <sup>(a)</sup>	Medical <sup>(b)</sup>	Pharmaceuticals	Allied health services	Nursing home	Other <sup>(c)</sup>
Circulatory	3,719	1,657	503	715	40	587	218
Digestive <sup>(d)</sup>	3,715	1,070	284	275	1,849	35	202
Musculoskeletal	3,002	1,207	518	276	416	430	154
Injury	2,601	1,663	393	127	160	112	146
Mental	2,586	1,007	432	198	83	718	147
Respiratory	2,521	833	624	784	37	107	135
Nervous system	2,334	766	431	248	227	503	159
Cancer	1,904	1,327	261	53	12	32	219
Genitourinary	1,662	997	383	143	17	32	90
Symptoms	1,334	478	426	302	57	5	66
Complications of pregnancy	1,051	941	32	11	6	0	60
Endocrine	966	235	222	309	54	47	98
Skin	956	336	247	259	56	6	53
Infectious	849	246	316	193	15	13	65
Perinatal	239	221	1	0	0	3	14
Blood	192	101	42	24	1	5	18
Congenital	159	116	18	2	0	13	8
Other <sup>(e)</sup>	1,607	859	505	122	44	0	77
<b>Total</b>	<b>31,397</b>	<b>14,062</b>	<b>5,640</b>	<b>4,042</b>	<b>3,075</b>	<b>2,647</b>	<b>1,932</b>

(a) Public and private acute hospitals, repatriation hospitals and psychiatric hospitals. Includes hospital non-inpatient costs.

(b) Medical services for private patients in hospitals are included under 'Hospitals'.

(c) Includes breast, cervix, lung and skin cancer public health programs, research and other institutional, non-institutional and administration expenditure. Does not include other public health services, community health services, ambulances, or medical aids and appliances.

(d) Dental costs are classified to Diseases of the Digestive System and included under the Allied Health Services sector.

(e) Other contact with health services: fertility control, reproduction and development, cosmetic surgery, general health examination, and treatment for unspecified disease.

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# 2 Hospital inpatients

## 2.1 Summary

This methodology estimates acute hospital inpatient costs by disease category, age and sex by apportioning the total inpatient expenditure to individual episodes of hospitalisation, with an adjustment for resource intensity of treatment for the specific episode (using diagnosis related groups (DRGs)). Medical costs for private, compensable and other non-public patients in public and private hospitals are estimated for age-sex-disease groups using a set of private medical weights for DRGs and age-sex-specific information from the Health Insurance Commission on in-hospital private medical charges for various categories of service.

Public psychiatric hospital data for New South Wales and Victoria are used to allocate public psychiatric hospital inpatient costs to disease, age and sex.

### Box 2.1: Key assumptions and limitations

- *The proportion of total public acute hospital expenditure that relates to inpatients is given by the inpatient fractions estimated for each State and Territory by the National Health Ministers' Benchmarking Working Group.*
- *The cost of inlier days for a hospital episode is proportional to the DRG weight for that episode, using AN-DRG-1 or AN-DRG-2 national cost weights for public hospitals, repatriation hospitals and private hospitals.*
- *The average medical cost component included in AN-DRG cost weights relates entirely to public patients.*
- *Half of the average pathology and imaging costs per DRG relate entirely to public patients, the other half relate to all patients.*
- *Outlier days of hospital inpatient stays are low cost 'nursing care' days.*
- *The average cost per outlier bed day is \$110, based on the figure used in the Victorian casemix funding formula.*
- *In-hospital private medical expenditures are assumed to vary with DRG in accordance with the DRG cost weight components shown in Table 2.5 for the various categories of medical service.*
- *Medical charges for compensable and ineligible hospital inpatients are assumed to be the same as those for a private patient in the same DRG and type of hospital.*
- *The components of the DRG hospital cost weight that are assumed to be independent of length of stay are theatre, critical care, pathology, imaging and those components of medical cost relating to obstetrics, surgery, anaesthetics and assisting at operations. The components assumed proportional to length of stay are nursing, drugs, catering, depreciation (private hospitals), other medical costs and other costs.*
- *Inpatient casemix for public psychiatric hospitals in New South Wales and Victoria is representative of the national casemix.*
- *All inpatient bed days in public psychiatric hospitals have the same average cost.*



**Box 2.2: Data sources**

- *AIHW Health Expenditure Database.*
- *Tabulations of total in-hospital eligible medical charges by service category and State/Territory (Commonwealth Department of Human Services and Health).*
- *AIHW National Hospital Morbidity Database 1993–94.*
- *AN-DRG-1 and AN-DRG-2 cost weights (KPMG Peat Marwick 1993, 1994).*
- *National Health Ministers' Benchmarking Working Group 1996.*
- *Victorian Hospital Comparative Data 1994–95 (Rainbow Hospital Indicators 1996).*

## 2.2 Overview of hospital inpatient methodology

Hospital costs are the biggest single contributor to recurrent health expenditure, accounting for approximately 38% of the total in 1993–94. Public acute hospitals account for 28%, private hospitals for 7%, repatriation hospitals for 1% and public psychiatric hospitals for around 1.5% of total recurrent expenditure.

Public hospitals treat inpatients (admitted patients) and non-inpatients (outpatients and casualty or accident and emergency patients). The proportions of total public acute hospital expenditure which relate to inpatients are given by the inpatient fractions estimated for each State and Territory by the National Health Ministers' Benchmarking Working Group (1996). Total public acute hospital expenditure is split into inpatient and non-inpatient components on a State-by-State basis and non-inpatient expenditures attributed to diseases using the methodology outlined in Chapter 3 (Figure 2.1). Recurrent expenditure for public psychiatric hospitals included in the AIHW Health Expenditure Database relates entirely to inpatients. Outpatient expenditures by public psychiatric hospitals are included with other non-inpatient psychiatric services in the 'Community and public health' sector.

The basic approach to estimating acute hospital inpatient costs by disease category, age and sex is to apportion the total inpatient expenditure to individual episodes of hospitalisation, with an adjustment for resource intensity of treatment for the specific episode (using DRGs). The AIHW National Hospital Morbidity Database contains information on all inpatient episodes for public hospitals, repatriation hospitals and private acute hospitals in Australia in 1993–94. DRGs are coded using Version 1 or Version 2 of the Australian National DRG (AN-DRG) coding system (Table 2.1).

Total estimated hospital inpatient expenditure for each State and Territory is separately mapped to age–sex–disease groups using the methodology outlined below. Inpatient expenditure for all repatriation hospitals is similarly mapped to age–sex–disease groups as if 'repatriation' were an additional State/Territory. All estimated costs are then added across States and Territories (and repatriation hospitals) to produce national estimates.

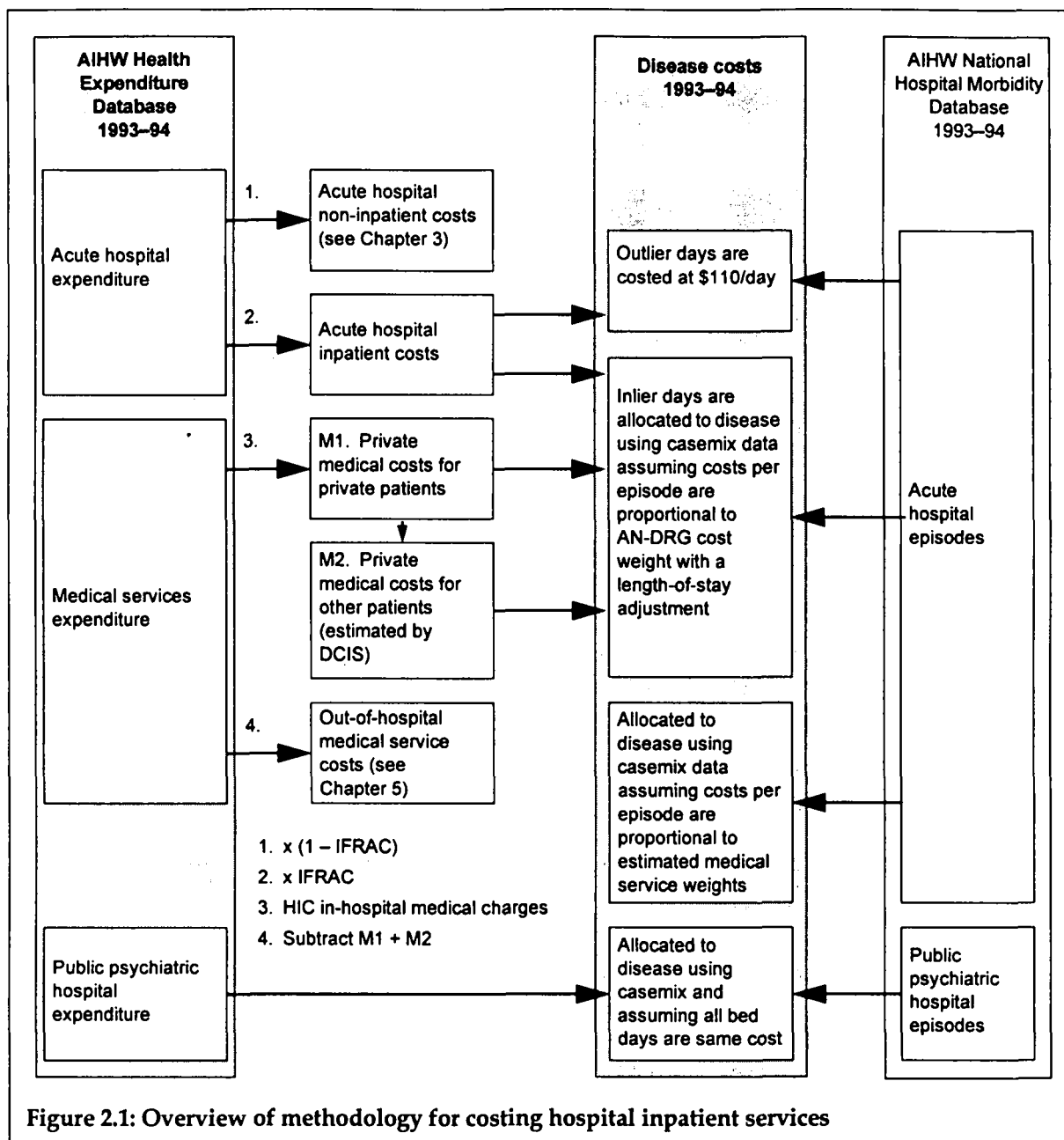


Figure 2.1: Overview of methodology for costing hospital inpatient services

Patient episodes with atypically long lengths of stay are usually excluded from analysis of casemix lengths of stay and costs using DRGs. To model the costs of patients with abnormally long lengths of stay, it is assumed that all excess or 'outlier' days are nursing home type days and costed at a separate rate, representing the lower cost of nursing home type care in hospitals. The cost of inlier days for a hospital episode is assumed to be proportional to the DRG weight for that episode, with an additional adjustment for length of stay to reflect the fact that some components of the cost of the episode (for example, ward nursing care, meals) are proportional to length of stay whereas others are more or less independent of length of stay (for example, theatre costs for a surgical DRG).

Medical costs for private, compensable and other non-public patients in public and private hospitals are included in the AIHW Health Expenditure Database as part of the 'Medical services' sector rather than the 'Hospital' sector. Medical costs of treating eligible private patients in public and private hospitals are paid by Medicare (75%), the patients, and health

insurance funds. Medical services for compensable and ineligible patients are also privately charged to the patient or compensation agency. The Health Insurance Commission is able to provide data on total medical charges for private patients in hospital where a Medicare benefit was paid. This total does not include in-hospital medical expenditure for compensable and ineligible patients.

A set of private medical weights for DRGs has been constructed by assuming that various types of in-hospital private medical expenditures (surgical, obstetric, etc.) vary with DRG in accordance with certain DRG cost weight components (Table 2.5). Medical charges for compensable and ineligible hospital inpatients are assumed to be the same as those for a private patient in the same DRG and type of hospital. This enables the estimation of the total in-hospital medical expenditure for such patients, which is allocated to disease as part of the hospital inpatient costing, and subtracted from the total medical expenditure before attribution of total out-of-hospital medical costs (see Figure 2.1 and Chapter 5).

The AIHW National Hospital Morbidity Database for 1993–94 includes public psychiatric hospital data for New South Wales and Victoria only. These data are used to allocate public psychiatric hospital inpatient costs to disease, age and sex, assuming that all bed days in psychiatric hospitals are of the same cost.

## 2.3 Acute hospital inpatient methodology in detail

### 2.3.1 Calculation of hospital sector inpatient cost weights

The AIHW National Hospital Morbidity Database holds complete unit record data for separations from public acute hospitals and private hospitals for all States and Territories in 1993–94 (apart from Northern Territory private hospitals and around 19% of Victorian private hospital episodes). All episodes are classified to DRGs using either Version 1 or 2 of the AN-DRGs (Table 2.1).

Table 2.1: AN-DRG versions used for 1993–94 hospital morbidity data

State/Territory	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
AN-DRG	1	1	2	2	2	1	1	2

For AN-DRG Version 1, national cost weights are available for public acute hospitals and for private hospitals (KPMG Peat Marwick 1993). For AN-DRG Version 2 (KPMG Peat Marwick 1994), cost weights are also available for public acute hospitals by type (teaching, non-teaching, metropolitan, non-metropolitan) and by State (New South Wales, Victoria, Queensland, Western Australia, South Australia only). These cost weights include component cost weights (Table 2.2).

**Table 2.2: AN-DRG cost weight components**

Component	Hospital sector	Description
Nursing	Public and private	Average ward nursing costs (excluding nursing costs reported under pathology, imaging, theatre, critical care, allied health)
Medical	Public only	Average medical costs (excluding medical costs reported under pathology and imaging)
Pathology	Public only	Average pathology costs (including medical costs)
Imaging	Public only	Average imaging costs (including medical costs)
Theatre	Public and private	Average theatre costs (excluding medical costs)
Drugs	Public and private	Average pharmacy costs
Criticare	Public and private	Average critical care costs (including intensive care, neonatal intensive care and coronary care units and excluding medical costs)
Allied	Public and private (AN-DRG-1) Public only (AN-DRG-2)	Average allied health costs
Medsurg	Public and private	Average medical and surgical supply costs
Catering	Private only (AN-DRG-1) Public and private (AN-DRG-2)	Average patient catering costs
Depreciation	Private only	Average depreciation cost
Overhead	Public and private	Average allocated overhead costs
Other	Public and private	Average of all other costs (including costs in final cost centres not elsewhere classified)

The medical cost component for public hospital DRG cost weights includes the costs of salaried and visiting medical officers who treat public patients only. Medical services for private patients are paid through a combination of Medicare benefits and health insurance. Medical services for compensable and ineligible patients are also privately charged to the patient or compensation agency.

In calculating the medical cost component of the DRG cost weights, the DRG costing study allocated public hospital medical costs to all episodes irrespective of whether the patient was a public or private patient, although these medical costs actually applied only to public patients. To obtain a more accurate estimate of the DRG cost weights for public patients, the medical cost component was inflated using the average proportion of public hospital episodes in 1993-94 where the patient was a public patient:

$$Medical' = \frac{Medical}{\bar{p}}$$

where:  $\bar{p}$  = Proportion of public hospital episodes where patient was a public patient

This factor  $\bar{p}$  was calculated as an average for New South Wales, Victoria, Tasmania and Australian Capital Territory combined for AN-DRG Version 1 weights, and for Queensland, South Australia, Western Australia and Northern Territory combined for AN-DRG Version 2 weights.

Similar considerations apply to pathology and imaging cost components. These services are privately billed for all patients in private hospitals, and also to a large extent for private and other non-public patients in public hospitals. As it is not known what proportion of pathology and imaging costs in public hospitals relate to private patients, it has been assumed that one-

half of the total costs of imaging and pathology services per DRG apply to both public and private patients, and that the other half apply only to public patients, although they have been averaged across all patients.

The adjusted cost components for imaging and pathology services for public patients are then:

$$Pathology' = \frac{Pathology}{\frac{1}{2} + \frac{1-p}{2}}$$

$$Imaging' = \frac{Imaging}{\frac{1}{2} + \frac{1-p}{2}}$$

In the following equations,  $t$  denotes hospital sector (1 = public, 2 = private) and  $p$  denotes patient type (1 = public, 2 = private, 3 = other). The adjusted total cost weight for public patients ( $p = 1$ ) in public hospitals ( $t = 1$ ) for DRG  $i$  is thus:

$$W_{ipt} = Nursing + Medical' + Pathology' + Imaging' + Theatre + Drugs + Critcare + Allied + Medsurg + Catering + Overhead + Other$$

The adjusted total cost weight for private, compensable and ineligible patients ( $p > 1$ ) for DRG  $i$  is:

$$W_{ipt} = Nursing + \frac{1}{2} \times Pathology' + \frac{1}{2} \times Imaging' + Theatre + Drugs + Critcare + Allied + Medsurg + Catering + Depreciation + Overhead + Other$$

for public hospitals ( $t = 1$ )

and

$$W_{ipt} = Nursing + Theatre + Drugs + Critcare + Allied + Medsurg + Catering + Depreciation + Overhead + Other$$

for private hospitals ( $t = 2$ )

(2.1)

#### Assumptions

- The average medical cost component included in AN-DRG cost weights relates entirely to public patients.
- Half of the average pathology and imaging costs per DRG relate entirely to public patients, the other half relate to all patients.

#### Data sources

- AN-DRG-1 cost weights (KPMG Peat Marwick 1993).
- AN-DRG-2 cost weights (KPMG Peat Marwick 1994).
- AIHW National Hospital Morbidity Database 1993-94 (for factor  $\bar{p}$ ).

### 2.3.2 Costing outlier days for inpatient episodes

Outliers are patient episodes with atypically long lengths of stay. Such outliers are usually excluded from analysis of casemix lengths of stay and costs using DRGs. To model the costs of patients with abnormally long lengths of stay, it is assumed that all excess days of patients in DRG  $i$  are nursing home type days and costed at a separate rate, representing the lower cost of nursing home type care in hospitals. The excess days are defined in terms of DRG-specific high trim points as defined in the Australian Casemix Reports (Commonwealth Department of Human Services and Health 1994).

The trim point for DRG  $i$  is defined as:

$$T_i = 1.5(Q_{3i} - Q_{1i}) + Q_{1i} = 2.5Q_{3i} - 1.5Q_{1i} \quad (2.2)$$

where:  $Q_{1i}$  = Lower quartile of length of stay for DRG  $i$

$Q_{3i}$  = Upper quartile of length of stay for DRG  $i$

These quartiles are calculated for all relevant States and Territories combined for AN-DRG Versions 1 and 2 separately.

For episode  $e$  in DRG  $i$ , the number of outlier days is calculated as:

$$outlos_e = \begin{cases} los_e - int(T_i) & \text{if } los_e > T_i \\ 0 & \text{otherwise} \end{cases} \quad (2.3)$$

where:  $los_e$  = Length of stay (days) for episode  $e$  ( $los_e = 1$  for same-day patients)

and the cost of these outlier days is:

$$C_e = AVNHT \times outlos_e \quad (2.4)$$

where:  $AVNHT$  = Average cost per day of nursing home type patients

Outlier days are costed at the average cost for nursing home type patient bed days. Based on the Victorian casemix funding formula, the days are costed at \$110 per bed day (Rainbow Hospital Indicators 1996). The 1989-90 methodology used the national average cost per bed day for small type 3 non-metropolitan hospitals as estimated by the AIHW Hospital Utilisation and Costs Study. This figure for 1993-94 is \$287 per bed day, somewhat more than double the figure used in the Victorian casemix funding formula.

#### Assumptions

- Outlier days of hospital inpatient stays are low cost 'nursing care' days.
- The average cost per outlier bed day is \$110, based on the figure used in the Victorian casemix funding formula.

#### Data sources

- AIHW National Hospital Morbidity Database 1993–94. (Number of outlier days and DRG trim points.)
- Victorian Hospital Comparative Data 1994–95 (Rainbow Hospital Indicators 1996).

### 2.3.3 Costing total inlier days for inpatient episodes

Total recurrent expenditure for acute public hospitals and private hospitals by State and Territory is obtained from the AIHW Health Expenditure Database.

$HOS_{gt}$  = Total recurrent expenditure for hospital sector  $t$  in State  $g$  in 1993–94

where:  $g$  = 1...6 denotes State or Territory. The Australian Capital Territory and Northern Territory are grouped with New South Wales ( $g = 1$ ) and South Australia ( $g = 5$ ) respectively because of the small number of separations and the very small number of private hospitals in the two Territories.

$t$  = Hospital sector (1 = public hospitals, 2 = private hospitals)

Public hospitals treat inpatients (admitted patients) and non-inpatients (who present at casualty or accident and emergency departments or attend outpatient clinics). The proportion of total recurrent expenditure that relates to inpatients has been estimated for 1993–94 by the National Health Ministers' Benchmarking Working Group (1996). These proportions are available at the State and Territory level (Table 2.3) and are used to estimate the total expenditure on hospital inpatients:

$$INHOS_{gt} = IFRAC_{gt} \times HOS_{gt} \quad (2.5)$$

where:  $IFRAC_{gt}$  = Inpatient fraction for State  $g$  and sector  $t$

**Table 2.3: Inpatient fractions (IFRAC) for 1993–94**

Sector	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Public hospitals	0.717	0.793	0.770	0.748	0.798	0.774	0.774	0.769
Private hospitals	1.000	1.000	1.000	1.000	1.000	1.000	1.000	—

Source: National Health Ministers' Benchmarking Working Group 1996.

The total cost for all inlier days in State  $g$  and sector  $t$  is then:

$$IC_{gt} = INHOS_{gt} - \sum_{e \in gt} OC_{eg} \quad (2.6)$$

where the second term is the total outlier cost for all outlier bed days (Equation 2.4).

This total inlier cost is attributed to individual episodes  $e$  in proportion to the DRG cost weight for that episode:

$$IC_{egt} = IC_{gt} \times \frac{W_{ipt}}{\sum_{e \in gt} W_{ipt}} \quad (2.7)$$

where episode  $e$  has DRG  $i$ , patient type  $p$  and is in sector  $t$ , State  $g$ . Because of the small number of separations and the very small number of private hospitals in the two Territories, inlier costs are calculated for New South Wales and Australian Capital Territory combined and South Australia and Northern Territory combined.

#### Assumptions

- The proportion of total public acute hospital expenditure that relates to inpatients is given by the inpatient fractions estimated for each State and Territory by the National Health Ministers' Benchmarking Working Group (1996).
- The cost of inlier days for a hospital episode is proportional to the DRG weight for that episode, using AN-DRG-1 or AN-DRG-2 national cost weights for public hospitals and private hospitals.

#### Data sources

- National Health Ministers' Benchmarking Working Group (1996). (Inpatient fractions.)
- AIHW Health Expenditure Database.

## 2.3.4 In-hospital private medical costs

### Total in-hospital medical costs for private patients

Medical costs of treating eligible private patients in public and private hospitals are paid by Medicare (75%), the patients, and health insurance funds. The Health Insurance Commission has provided data on total medical charges for private patients in hospital for which a Medicare benefit was paid. This expenditure is broken down into a number of medical service categories (Table 2.4). Unfortunately, Health Insurance Commission data do not enable these charges to be broken down by hospital sector (public hospital, private hospital).

**Table 2.4: Components of in-hospital medical expenditure for private patients**

Component $c$	Medical service category
1	Obstetrics
2	Operations
3	Anaesthetics and Assisting in Operations
4	Pathology
5	Imaging
6	Other (GP, Specialist, Other)



In order to attribute these private medical expenditures to private patient episodes in hospitals, it is assumed that the medical cost relativities for DRGs for private patients are given by relevant DRG cost weight components that relate to medical services. It is therefore assumed that relative medical costs, but not total costs, are the same across DRG categories in the public and private sectors. The DRG cost components for public patients derived in Section 2.3.1 include the following components for medical costs:

<i>Medical'</i> <sub><i>i</i></sub>	Adjusted medical costs for DRG <i>i</i>
<i>Pathology'</i> <sub><i>i</i></sub>	Adjusted pathology costs for DRG <i>i</i>
<i>Imaging'</i> <sub><i>i</i></sub>	Adjusted imaging costs for DRG <i>i</i>

These DRG weight components are used to derive relative weights for the components of medical costs for private patients (Table 2.5).

Table 2.5: Relative weights for component private medical costs

Medical service category <i>c</i>	DRG cost component used to estimate relative weight ( <i>RW<sub>ic</sub></i> )	Comment
1 Obstetrics	Medical'	For obstetric DRGs only (670–686)
2 Operations	Medical'	For surgical DRGs only (excluding obstetric DRGs)*
3 Anaesthetics & Assisting in operations	Theatre	All DRGs
4 Pathology	0.5* Pathology' Pathology'	Public hospitals Private hospitals
5 Imaging	0.5* Imaging' Imaging'	Public hospitals Private hospitals
6 Other	Medical'	All DRGs excluding obstetric DRGs

\* Medical charges for operations are assumed to vary with the medical weight for surgical DRGs since the Medicare benefit for most surgical procedures includes all medical aftercare.

The private medical cost weights are scaled to add to the total in-hospital medical component expenditure for each State (Australian Capital Territory and Northern Territory included with New South Wales and South Australia respectively). Thus the private medical cost weight component *c* for DRG *i* in hospital sector *t* for State *g* is given by:

$$MCW_{igct} = \frac{IHEME_{gc} \times RW_{ict}}{2 \sum_{t=1} \sum_{e \in gct} RW_{ict}} \tag{2.8}$$

where: *IHEME<sub>gc</sub>* = Total in-hospital eligible medical expenditure for State *g* and service category *c* (Health Insurance Commission data)

*RW<sub>ict</sub>* = Relative medical weight for service category *c* for DRG *i* in hospital sector *t*

The total in-hospital private medical expenditure for an episode  $e$  with DRG  $i$  is thus:

$$PME_{igt} = \sum_{c=1}^6 MCW_{igct} \quad (2.9)$$

Adding the component medical costs across all private patient episodes in State  $g$  gives the total in-hospital private patient medical expenditure for each service category:

$$\begin{aligned} \sum_{t=1}^2 \sum_{e \in gct} MCW_{egct} &= \frac{IHEME_{gc} \times \sum_{t=1}^2 \sum_{e \in gct} RW_e}{\sum_{t=1}^2 \sum_{e \in gct} RW_e} \\ &= IHEME_{gc} \end{aligned} \quad (2.10)$$

#### Assumptions

- In-hospital eligible medical expenditures for various medical service categories are assumed to be distributed among private patient episodes in accordance with the DRG cost weight components shown in Table 2.5.

#### Data sources

- Refer to Section 2.3.1 for derivation of DRG cost weight components.
- Commonwealth Department of Human Services and Health. Tabulations of total in-hospital eligible medical charges by service category and State/Territory.
- AIHW National Hospital Morbidity Database.

### Estimation of medical costs for other patients

Like private patients, compensable and ineligible hospital inpatients are charged privately for medical (and some pathology and imaging) services. These charges are included in the medical expenditure category in the AIHW Health Expenditure Database, but information on the proportion that relates to in-hospital patients is not available.

Medical costs for these 'other' patient episodes are assumed to be the same as those for private patients estimated according to DRG as described in the previous section. For 'other patient' episode  $e$  with DRG  $i$  in State  $g$  and hospital sector  $t$ , the medical cost is:

$$OME_{igt} = PME_{igt} \quad (2.11)$$

where:  $PME_{igt}$  is given by Equation 2.9

The total estimated medical costs for all 'other' patient episodes is:

$$HOME = \sum_{g=1}^6 \sum_{t=1}^2 \sum_{e \in other} OME_{igt} \quad (2.12)$$

The total in-hospital eligible and ineligible medical charges are given by adding this estimate to the total eligible in-hospital medical expenditure (see Equation 2.8):

$$IHME = \sum_{g=1}^6 \sum_{c=1}^6 IHEME_{gc} + IHOME \quad (2.13)$$

This total is subtracted from total medical expenditure to estimate total expenditure on out-of-hospital medical services (see Section 5.3.4).

#### Assumptions

- Medical charges for compensable and ineligible hospital inpatients are assumed to be the same as those for a private patient in the same DRG and type of hospital.

#### Data sources

- AIHW National Hospital Morbidity Database.

### 2.3.5 Total hospital inpatient treatment costs for disease $d$

The DRG cost weights reflect the average cost of all episodes included in the DRG. Some components of the cost of an individual episode will vary with the length of stay (for example, ward nursing costs), whereas others will be essentially independent of the length of stay (for example, theatre costs). Since a number of disease groups  $d$  with different average lengths of stay may fall into the same DRG, it is important to adjust the individual episode costs to reflect the dependence of cost on length of stay.

For an individual episode, the total hospital cost for inlier days is adjusted to reflect the proportion of the overall cost that is dependent on length of stay, as follows:

$$HIC_{egt} = IC_{egt} \times \left( 1 - x_i + x_i \frac{inlos_e}{alos_{ig}} \right) \quad (2.14)$$

- where:
- |            |   |  |
|------------|---|--|
| $IC_{egt}$ | = | Unadjusted cost of inlier days for episode $e$ in State $g$ and sector $t$ (from Equation 2.7)             |
| $x_i$      | = | Proportion of the cost weight that varies with the length of stay for DRG $i$ (in which episode $e$ falls) |
| $inlos_e$  | = | Inlier length of stay  |
|            | = | $los_e - outlos_e$   |

$alos_{ig}$  = Average inlier length of stay for all episodes in DRG  $i$  in State  $g$

The factor  $x_i$  is calculated assuming that the various cost components of the total DRG weight vary with length of stay (Table 2.6) for private patients. Thus:

$$x_i = \frac{\text{Other (Medical)} + \text{Nursing} + \text{Drugs} + \text{Catering} + \text{Depreciation} + \text{Other}}{\text{Total} - \text{Allied} - \text{Medsurg} - \text{Overhead}} \quad (2.15)$$

**Table 2.6: Assumed variation of DRG cost components with length of stay for private patients**

Assumption	Component
Independent of length of stay	Theatre Critical care Obstetrics Operation Anaesthetics and Assisting in operation Pathology Imaging
Proportional to length of stay	Nursing Drugs Catering Depreciation Other Other (medical)
Proportion $x_i$ varies with length of stay	Allied Medical and surgical supplies Overhead

Because the medical costs for public patients include all medical costs except pathology and imaging, it is not possible to calculate the comparable factor  $x_i$  for public patients. It is assumed to be the same as the factor  $x_i$  for private patients for a given DRG  $i$ .

Private medical charges are assumed to be independent of length of stay for all episodes falling in a given DRG. The total hospital and medical inpatient costs for disease  $d$ , age group  $a$  and sex  $s$  are calculated by sector by summing inlier, medical and outlier costs for all episodes whose principal diagnosis falls in disease group  $d$ :

$$\begin{aligned}
INHC_{dsat} &= \sum_{g=1}^6 \sum_{e \in dsagt} [HIC_{egt} + PME_{egt} + AVNHT \times outlos_e] \\
&= \sum_{g=1}^6 \sum_{e \in dsagt} \left[ IC_{gt} \times \frac{W_{ipt}}{\sum_{e \in gt} W_{ipt}} \times \left( 1 - x_i + x_i \frac{inlos_e}{alos_{ig}} \right) + PME_{egt} + AVNHT \times outlos_e \right]
\end{aligned} \quad (2.16)$$

This methodology ensures that the sum of the costs across all disease, age and sex groups within State  $g$  and sector  $t$  adds to the correct total hospital inpatient expenditure (hospital and medical), apart from estimated 'other' patient medical expenditure. The latter is subtracted from the total medical expenditure prior to its attribution, ensuring that the total hospital and medical expenditure sums to that recorded in the AIHW Health Expenditure Database.

### Assumptions

- The components of the DRG hospital cost weight that are assumed to be independent of length of stay are theatre, critical care, pathology, imaging and those components of medical cost relating to obstetrics, surgery, anaesthetics and assisting at operations. The components assumed proportional to length of stay are nursing, drugs, catering, depreciation (private hospitals), other medical costs and other costs.

## 2.4 Public psychiatric hospital methodology in detail

The AIHW National Hospital Morbidity Database for 1993–94 includes public psychiatric hospital data for New South Wales and Victoria only. These data are used to allocate public psychiatric hospital inpatient costs to disease, age and sex, assuming that all bed days in psychiatric hospitals are of the same cost. At this stage, mental disorders are not disaggregated below chapter level in the Disease Costs and Impact Study (DCIS), and the methodology distributes this among age–sex categories in accordance with the casemix data. The proportion of total public psychiatric hospital inpatient expenditure attributable to chapter ‘Mental disorders’, sex  $s$  and age  $a$  is given by:

$$\alpha_{sa} = \frac{obd_{sa}}{\sum_s \sum_a obd_{sa}} \quad (2.17)$$

where:  $obd_{sa}$  = Total bed days for public psychiatric hospital inpatients (in New South Wales and Victoria) with age  $a$  and sex  $s$

### Assumptions

- Inpatient casemix for public psychiatric hospitals in New South Wales and Victoria is representative of the national casemix.
- All inpatient bed days in public psychiatric hospitals have the same average cost.

### Data sources

- AIHW National Hospital Morbidity Database.

## 2.5 Data issues

The AIHW Hospital Morbidity Database records are screened to exclude:

- (a) any records with unknown length of stay;
- (b) records with invalid DRG codes for which cost weights are not available;
- (c) trimming of extremely long lengths of stay; and
- (d) inappropriate diagnosis for sex (for example, pregnancy-related condition in a male).

## 2.6 Differences from 1989–90 methodology

- The 1989–90 methodology used a United States-derived DRG grouper and cost weights based on United States Medicare cost weights, adjusted for Australian average lengths of stay. The current version uses the AN-DRG Versions 1 and 2 and AN-DRG cost weights.
- The 1989–90 methodology assumed that the entire DRG cost weight varied in proportion to the length of stay of the individual episode. The current version assumes that some components of the DRG cost weight are independent of length of stay.
- The 1989–90 methodology assumed that private medical costs per bed day were constant across DRGs. The current methodology derives and uses private medical cost weights for distributing private medical costs.
- The 1989–90 methodology was a bottom-up approach that started with average inpatient costs per episode and average private medical costs per episode estimated from the AIHW Hospital Utilisation and Costs Study. It did not produce disease costs that added to the total inpatient expenditure estimated from the AIHW Health Expenditure Database. The current methodology is a top-down approach which ensures that all disease costs add to the total inpatient expenditure estimated from the AIHW Health Expenditure Database.
- Expenditure for public psychiatric hospitals and repatriation (Department of Veterans' Affairs) hospitals was not included in the 1989–90 methodology.

Figure 2.2 compares the 1989–90 methodology and the revised methodology for acute hospitals in 1993–94. The ICD-9 chapters with the most substantial changes in relative costings are mental disorders, nervous system and sense organs, digestive system disorders and complications of pregnancy.

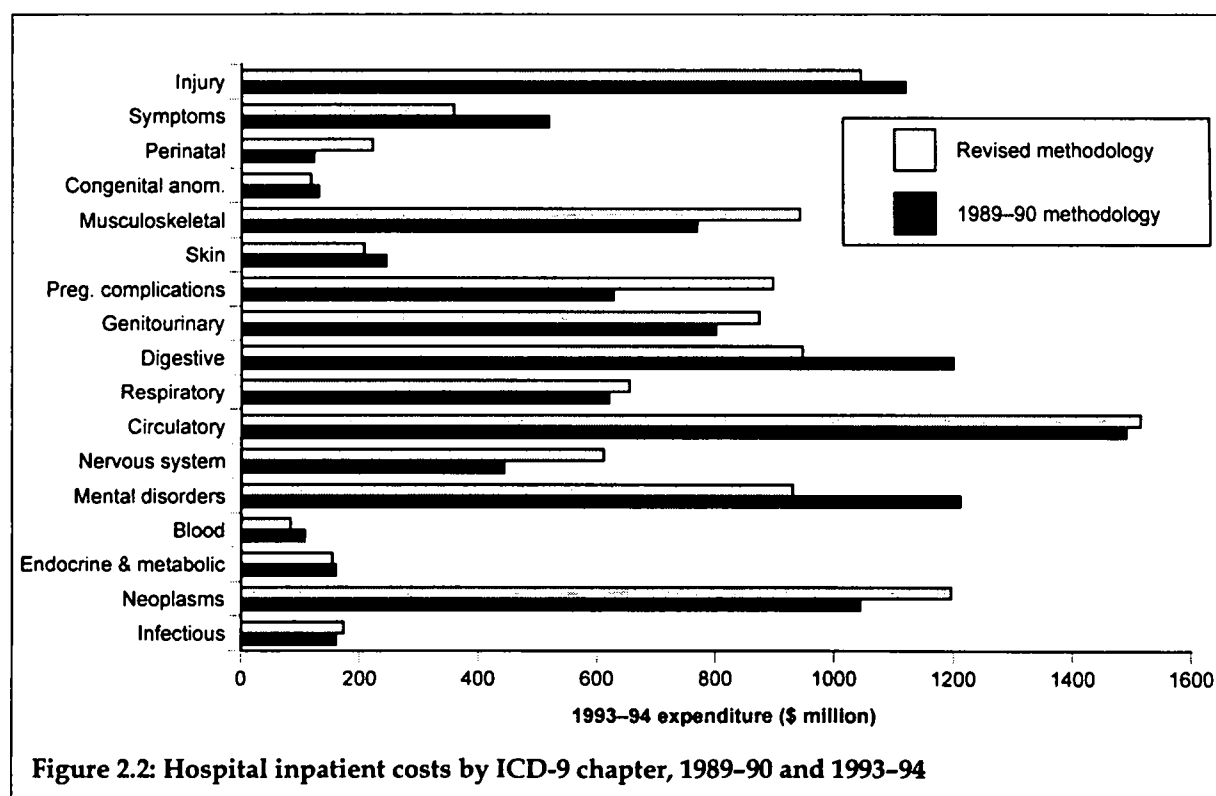


Table 2.7 shows the same data as Figure 2.2 in tabular form. Note that the 1989–90 cost estimates have been inflated to add to the same total as the 1993–94 estimates for the comparison in Figure 2.2 and the comparison as a percentage increase in the final column of Table 2.7.

**Table 2.7: Hospital inpatient costs by ICD-9 chapter, 1989–90 and 1993–94**

ICD-9 chapter		1989–90 actual costs (\$ million)	1989–90 inflated costs (\$ million)	1993–94 estimated costs (\$ million)	Per cent increase from 1989–90 to 1993–94
1	Infectious	123	161	173	8
2	Neoplasms	798	1,044	1,196	15
3	Endocrine & metabolic	122	160	154	–4
4	Blood	82	107	83	–23
5	Mental disorders	926	1,212	930	–23
6	Nervous system	339	443	611	38
7	Circulatory	1,140	1,492	1,514	2
8	Respiratory	474	621	655	6
9	Digestive	918	1,201	947	–21
10	Genitourinary	612	801	874	9
11	Pregnancy complications	480	628	897	43
12	Skin	186	244	207	–15
13	Musculoskeletal	588	769	942	23
14	Congenital anomalies	100	131	117	–11
15	Perinatal	93	122	221	81
16	Symptoms	397	519	358	–31
17	Injury	858	1,122	1,046	–7
18	V codes	673	881	731	83
<b>Total</b>		<b>8,910</b>	<b>11,654</b>	<b>11,654</b>	

## References

Commonwealth Department of Human Services and Health 1994. Australian casemix report on hospital activity 1991–92. Canberra: AGPS.

KPMG Peat Marwick 1993. National costing study: production of cost weights for AN-DRGs version 1.0. Summary Report to the Commonwealth Department of Health, Housing, Local Government and Community Services. Adelaide: KPMG Peat Marwick.

KPMG Peat Marwick 1994. National costing study: production of cost weights for AN-DRGs version 2. Report to the Commonwealth Department of Human Services and Health. Adelaide: KPMG Peat Marwick.

National Health Ministers' Benchmarking Working Group 1996. First national report on health sector performance indicators: public hospitals – the state of play. Canberra: AIHW.

Rainbow Hospital Indicators 1996. Victorian Hospital Comparative Data 1994–95. Melbourne: Victorian Hospitals Association.

# 3 Non-inpatient hospital services

## 3.1 Summary

This methodology uses attribution factors based on the 1989–90 Australian Bureau of Statistics (ABS) National Health Survey to allocate total expenditure on non-inpatient services for 1993–94 to age–sex–disease categories. Total visits to outpatient clinics (including casualty or accident and emergency departments) for each age–sex–disease group are estimated from the National Health Survey data on numbers of outpatient visits in the two weeks prior to interview. Expenditure is allocated assuming that all visits have the same cost.

The methodology covers non-inpatient services in public acute hospitals, but not those in public psychiatric hospitals.

### Box 3.1: Key assumptions

- *The utilisation pattern of non-inpatient services in the 1989–90 ABS National Health Survey is representative of the use of non-inpatient services in 1993–94.*
- *All non-inpatient services have the same average cost across age–sex–disease groups.*
- *Non-inpatient services for cancers and for heart disease are allocated to DCIS disease groups at sub-chapter level, assuming that they are distributed in proportion to inpatient expenditure for each age–sex group.*

### Box 3.2: Data sources

- *National Health Ministers' Benchmarking Working Group 1996.*
- *1989–90 ABS National Health Survey.*
- *AIHW Health Expenditure Database.*

## 3.2 Overview of non-inpatient methodology

Public acute hospitals accounted for 28% of total health expenditure in 1993–94. These hospitals treat inpatients (admitted patients) and non-inpatients (outpatients and casualty or accident and emergency patients). The proportions of total public acute hospital expenditure which relate to inpatients are given by the inpatient fractions (Table 3.1) estimated for each State and Territory by the National Health Ministers' Benchmarking Working Group (1996). Non-inpatient expenditure by public acute hospitals totalled an estimated \$2,421 million in 1993–94, representing 7% of total recurrent health expenditure.

Recurrent expenditure for public psychiatric hospitals included in the AIHW Health Expenditure Database relates entirely to inpatients. Outpatient expenditures by public psychiatric hospitals are included with other non-inpatient psychiatric services in the 'Community and public health' sector, which is not yet included in the Disease Costs and Impact Study (DCIS) model.



Allocation of total expenditure on non-inpatient services to age-sex-disease groups is done in two steps. The first is the allocation to treatment and prevention or screening groups within each ICD-9 chapter, using attribution factors based on the National Health Survey data on number of outpatient visits in the two weeks prior to interview. Of the total sample of 57,000 people interviewed for the National Health Survey, 1,295 reported visiting an outpatient clinic or emergency department in the last two weeks, with a total of 1,736 visits reported during this two-week period.

Total visits to outpatient clinics (including casualty or accident and emergency departments) for each age-sex-disease group are estimated from the National Health Survey sample, weighted to represent the Australian population, and expenditure is allocated assuming that all visits have the same cost. Although some information is available from ambulatory care casemix studies on the relative costs of different types of non-inpatient services, the total lack of information on types of services in the National Health Survey precludes the use of such information at this stage.

Expenditure at the chapter level is apportioned to specific disease groups at the sub-chapter level, to the extent possible, using the specific codes used to record health conditions in the National Health Survey and, where these do not provide sufficient detail, on the corresponding attribution fractions based on the DCIS inpatient expenditure fractions for acute hospitals.

### 3.3 Non-inpatient methodology in detail

#### 3.3.1 Total utilisation and costs of non-inpatient services

Inpatient fractions for 1993–94 are shown in Table 3.1, together with total occasions of service and estimated total expenditure on non-inpatient services. This table includes an estimated \$49 million for repatriation hospital non-inpatient services. This latter figure was calculated using an inpatient fraction of 0.825, calculated from 1991–92 data on outpatient services and total bed days for repatriation hospitals, assuming a HASAC ratio of 6.11 outpatient services per bed day (Cooper-Stanbury, Solon & Cook 1994; National Health Ministers’ Benchmarking Working Group 1996).

**Table 3.1: Total utilisation and costs of non-inpatient services, 1993–94**

State/ Territory	Total non-inpatient services ('000s)	IFRAC	Non-inpatient expenditure (\$ million)
NSW	12,346	71.7	1,039
Vic	6,559	79.3	462
Qld	6,115	77.0	341
WA	2,643	74.8	226
SA	2,119	79.8	165
Tas	664	77.4	57
ACT	404	77.4	43
NT	322	76.9	27
DVA	459	86.2	49
<b>Total</b>	<b>31,602</b>	<b>76.0</b>	<b>2,408</b>

Source: Cooper-Stanbury, Solon & Cook 1994; National Health Ministers’ Benchmarking Working Group 1996.

### 3.3.2 Attribution fractions for disease at ICD-9 chapter level

Allocation of non-inpatient treatment costs to age–sex–disease groups was based on the reported number of outpatient visits in the two weeks prior to interview in the National Health Survey. The reasons given for these visits were grouped into ICD-9 chapters (see Table 1.4) and attribution fractions calculated assuming that all visits reported by a respondent were equally attributable to all the reasons reported by that respondent.

The total number of outpatient visits in the last two weeks is given by:

$$T = \sum_{i=1}^N v_i \times wn_i \quad (3.1)$$

where:  $N$  = Total number of survey respondents in National Health Survey  
 $wn_i$  = National Health Survey weight for respondent  $i$   
 $v_i$  = Number of times respondent  $i$  reported visiting outpatient or casualty services

The attribution fraction for visits and expenditure for age group  $a$ , sex  $s$  and ICD-9 Chapter  $c$  is given by:

$$\alpha_{asc} = \frac{\sum_{i=1}^{N_{csa}} \left( \frac{n_{ci} \times v_i \times wn_i}{n_i} \right)}{T} \quad (3.2)$$

where:  $N_{csa}$  = Total number of survey respondents of age  $a$  and sex  $s$  who reported visiting an outpatient or casualty service for a reason in category  $c$   
 $wn_i$  = National Health Survey weight for respondent  $i$   
 $v_i$  = Number of times respondent  $i$  reported visiting outpatient or casualty services  
 $n_{ic}$  = Number of reasons in disease category  $c$  for visiting outpatient or casualty services reported by respondent  $i$   
 $n_i$  = Total number of reasons for visiting outpatient or casualty services reported by respondent  $i$

#### Assumptions

- The utilisation pattern of non-inpatient services in the National Health Survey is representative of the use of non-inpatient services in 1993–94.
- All non-inpatient services have the same average cost across age–sex–disease groups.

#### Data sources

- 1989–90 ABS National Health Survey.

### 3.3.3 Attribution fractions for disease at sub-chapter level

The expenditure allocated to non-inpatient services at the chapter level is apportioned to specific disease groups at the sub-chapter level, to the extent possible, using the specific codes used to record health conditions in the National Health Survey. The level of detail of these codes varies with chapter and, where it is necessary to apportion costs at a finer level of detail than available in the National Health Survey, costs are allocated in proportion to total estimated costs for inpatient services.

Neoplasms are coded to a single category in the National Health Survey. For neoplasms, the attribution fraction for age, sex and disease at sub-chapter level of Chapter  $c$  is given by:

$$\gamma_{cdsa} = \frac{(\text{Outpatient visits for disease group } d, \text{ sex } s, \text{ age } a)}{(\text{Total outpatient visits for Chapter } c, \text{ sex } s, \text{ age } a)}$$

Cardiovascular disease codes in the National Health Survey are shown in Table 3.2, together with their mapping to DCIS disease sub-groups. Code 16 'Fluid problems' could potentially relate either to renal or cardiovascular problems. Examination of National Health Survey data found that less than 1% of respondents mentioned fluid problems with no other conditions. For those who mentioned other conditions, 57% mentioned heart disease or hypertension also. Only 2% mentioned kidney disease, and most of these also mentioned hypertension or heart disease. For the purposes of the DCIS, all fluid problems are assumed to relate to cardiovascular disease. For the within-chapter allocation, this code and Code 19 'Other cardiovascular disease' were excluded from analysis, so that effectively, costs for these conditions were distributed pro rata across all the cardiovascular sub-groups in proportion to the costs at sub-group level.

**Table 3.2: Mapping of National Health Survey cardiovascular disease codes to DCIS sub-groups**

National Health Survey code	Allocation to DCIS disease sub-group
15 Atherosclerosis	7.7 Diseases of arteries etc.
17 Varicose veins	7.8 Diseases of veins etc.
18 Haemorrhoids	7.8 Diseases of veins etc.
72 Hypertension	7.2 Hypertensive disease
82 Heart disease	Distribute to 7.1 (Rheumatic heart disease), 7.3 (Ischaemic heart disease), 7.4 (Diseases of pulmonary circulation) and 7.5 (Other forms of heart disease) in proportion to total inpatient costs
182 Signs and symptoms of heart problems	
119 Stroke after-effects	7.6 Cerebrovascular disease
219 Cerebrovascular disease	

#### Assumptions

- Non-inpatient services for cancers and for heart disease are allocated to DCIS disease groups at sub-chapter level assuming that they are distributed in proportion to inpatient expenditure for each age-sex group.

#### Data sources

- 1989-90 ABS National Health Survey.

### 3.3.4 Total non-inpatient expenditure by disease

The total non-inpatient expenditure for disease  $d$ , sex  $s$  and age  $a$ ,  $OPEX_{dsa}$ , is estimated by applying the relevant attribution fractions for ICD-9 chapter and, where applicable, for sub-chapter disease groups, to the total estimated non-inpatient expenditure  $OPEX = \$2,421$  million shown at the bottom of Table 3.1:

$$OPEX_{dsa} = \alpha_{csa} \times \gamma_{cdsa} \times OPEX \quad (3.3)$$

where:  $OPEX$  = Total expenditure on non-inpatient services (Table 3.1)

$\alpha_{csa}$  = Attribution fraction to Chapter  $c$  from Equation 3.1

$\gamma_{cdsa}$  = Attribution fraction to the disease grouping  $d$  at sub-chapter level of Chapter  $c$

## 3.4 Differences from 1989–90 methodology

- Non-inpatient service costs were not included in the 1989–90 methodology.

## References

Cooper-Stanbury M, Solon R & Cook M 1994. Hospital Utilisation and Costs Study 1991–92. Volume 1: A survey of public hospitals and related data. Canberra: AGPS.

National Health Ministers' Benchmarking Working Group 1996. First national report on health sector performance indicators: public hospitals—the state of play. Canberra: AIHW.

# 4 Nursing homes

## 4.1 Summary

This methodology uses attribution factors based on the distribution of the main disabling health condition of nursing home residents in the 1993 Australian Bureau of Statistics (ABS) Survey of Disability, Ageing and Carers to allocate total nursing home expenditure for 1993–94 to age–sex–disease categories at ICD-9 chapter level. This expenditure is apportioned to specific disease groups at the sub-chapter level according to the distribution of diagnoses for patients in that age–sex group who transfer from acute hospitals.

### Box 4.1: Key assumptions

- *Nursing home expenditure is attributable to the main health condition resulting in disability.*
- *Nursing home bed days for disease groups within ICD-9 chapters are distributed in the same way as the principal diagnoses of patients transferring from acute hospitals.*
- *Nursing home bed days have the same average cost for all age–sex–disease categories.*

### Box 4.2: Data sources

- 1993 ABS Survey of Disability, Ageing and Carers.
- AIHW National Hospital Morbidity Database 1993–94.
- AIHW Health Expenditure Database.

## 4.2 Overview of nursing homes methodology

Nursing home expenditure accounted for nearly 8% of total health expenditure in 1993–94. The 1989–90 methodology based its attribution of nursing home costs to disease on the diagnosis, age and sex patterns of patients who transfer from hospitals to nursing homes. Around 65% of patients in nursing homes are patients who transferred from hospitals (Gillett 1991). It was recognised that this was probably not a satisfactory basis for attributing nursing home costs to disease since the 35% of nursing home patients who transfer from the community are likely to have a different pattern of disease. Also, the principal diagnosis for an acute hospital episode may not necessarily be the same as the principal reason for admission to a nursing home following the acute episode.

The 1993 Survey of Disability, Ageing and Carers (ABS 1993) contains a sample of nursing homes and provides information on the main health condition causing disability for nursing home residents (of whom approximately 5,000 were sampled in the survey). This information has been used to attribute nursing home costs to age–sex–disease groups at the ICD-9 chapter level on the assumption that the distribution of principal disabling conditions in the survey reflects the distribution of nursing home bed days by disease, age and sex, and that all bed days are of equal average cost.

For a given age–sex group, nursing home expenditure at the ICD-9 chapter level is apportioned to specific disease groups at the sub-chapter level according to the distribution of diagnoses for patients in that age–sex group who transfer from acute hospitals.

This methodology does not include an adjustment for the resource intensity of treatment in nursing homes. While such an adjustment is clearly desirable, data are not yet available on the distribution of dependency levels of nursing home residents by disease category. These dependency levels form the basis of Commonwealth payments to nursing homes. If and when such data become available, it would be worthwhile to further revise the methodology for nursing home costs.

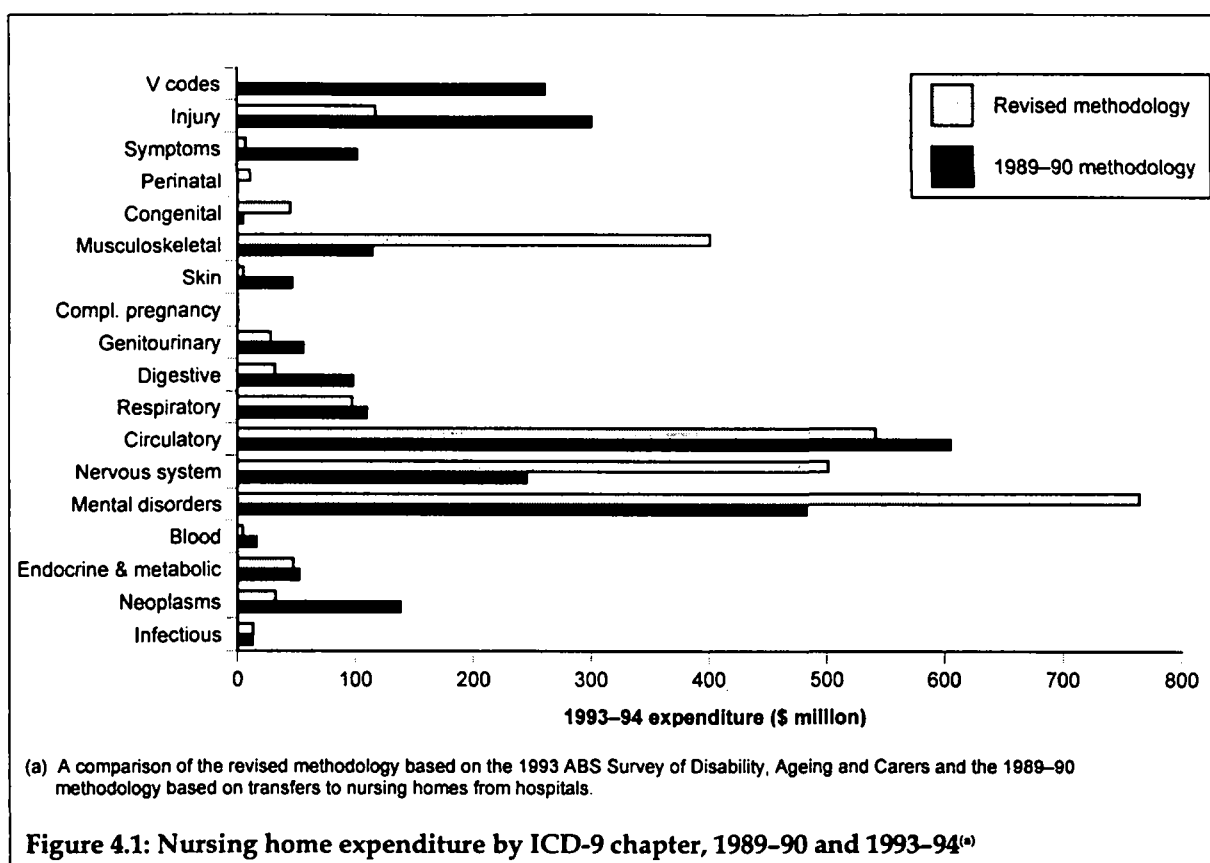
The current methodology does not take account of co-morbidity and assumes that all the cost of nursing home care is attributable to the main disabling condition. The method also assumes that disability is the principal reason for nursing home care. Depending on the uses to which disease costing data is put, it may not be appropriate to treat all nursing home expenditure as health service costs or to attribute all nursing home patients to disease categories. Co-morbidities may be too extensive in the older age groups and, for some applications, it may be sensible to exclude nursing home expenditure for the 'oldest old'. However, as total nursing home expenditure is included in the national accounts and AIHW health expenditure estimates as 'health expenditure', it is fully included in the Disease Costs and Impact Study (DCIS) estimates of disease costs.

There are quite substantial differences between the distribution of principal disabling conditions for nursing home residents and the distribution of principal diagnoses for patients transferring from hospitals to nursing homes. This is illustrated in Figure 4.1, which compares the 1993-94 estimates with the 1989-90 estimates. The latter have been inflated to add to the same total as the 1993-94 estimates to facilitate comparison of the relative changes. The revised methodology results in substantially higher expenditure attributed to:

- mental disorders;
- nervous system and sense organ conditions; and
- musculoskeletal conditions;

and substantially lower expenditure attributed to:

- neoplasms;
- injury and poisoning;
- symptoms, signs and ill-defined conditions; and
- V codes (other reasons for contact with health services).



## 4.3 Nursing home methodology in detail

### 4.3.1 Attribution to disease at ICD-9 chapter level

The 1993 ABS Survey of Disability, Ageing and Carers contained two questions which were used to map disability to disease. These related to (a) the main disabling condition and (b) the cause of the main disabling condition. The main disabling condition was defined as the health condition (disease or impairment) that caused the most problems (in terms of activity restriction). If only one condition was reported by the respondent, it was considered the main disabling condition. The responses to this question were coded to categories based on a condensed ICD-9 three-digit classification of disease, but codes were also included for a range of impairments such as brain injury, blindness, amputated leg, joint problem and speech problem.

Respondents were also asked the cause of the main disabling condition, and could specify a range of responses including:

- accident/injury
- working conditions
- disease/illness/hereditary (around 30 disease categories coded)
- war
- old age
- present at birth
- other
- don't know.

Preliminary analysis of the survey data indicated that where a person gave a disease as their main disabling condition (for example, arthritis, angina) they tended to give a 'determinant of disease' answer to the cause of condition question (for example, stress, old age). Where a person gave an impairment as an answer (for example, brain injury, blindness, amputation), they tended to give a disease or injury as the answer to the cause of condition (for example, AIDS, diabetes). Injury and perinatal conditions were only coded as responses to the cause question, and were not available as categories for the principal condition question.

It was clear from the survey data that some of the people who specified a disease (such as cancer or heart disease) in response to the principal condition question also specified a disease or injury in response to the cause question, and that some of these latter responses were inappropriate. For example, some respondents specifying cancer as the principal condition reported that it was caused by heart disease or motor vehicle accidents.

For each major disease category, experts were consulted to determine which main disabling conditions could be reasonably causally associated with diseases or injuries in that group. This advice was used to assist in assigning disabled people to 'Main health problem' categories as follows:

- (a) 'Main health problem' was initially specified as the main disabling condition.
- (b) People whose main disabling condition was a catch-all category (disability not elsewhere classified, not stated, or unknown), and who did not specify a disease or injury as the cause of the main disabling condition, were assumed to have underlying causes distributed in the same proportions as people who did specify a disease or injury as the underlying cause.
- (c) Where a 'reasonable' disease or injury category was specified as the cause of the main disabling condition, this was defined as the 'main health problem'.
- (d) People whose main disabling condition was an impairment and who did not specify a 'reasonable' disease or injury category were assumed to have 'main health problems' distributed in the same proportions as other people with that main disabling condition.

Attribution fractions for nursing home costs were calculated assuming that the Survey of Disability, Ageing and Carers provided a snapshot of the distribution of bed days by ICD-9 chapter, age and sex. The proportion of total expenditure attributable to Chapter  $c$ , sex  $s$  and age  $a$  is given by:

$$\alpha_{csa} = \frac{n_{csa}}{\sum_c \sum_s \sum_a n_{csa}} \quad (4.1)$$

where:  $n_{csa}$  = Estimated number of nursing home residents in Australia with age  $a$ , sex  $s$  and main health condition in ICD-9 Chapter  $c$

#### Assumptions

- Nursing home expenditure is attributable to the main health condition resulting in disability.
- Nursing home bed days have the same average cost for all age-sex-disease categories.

#### Data sources

- 1993 ABS Survey of Disability, Ageing and Carers.



### 4.3.2 Attribution to disease at sub-chapter level

Expenditure allocated to the chapter level is apportioned to specific disease groups at the sub-chapter level according to the distribution of diagnosis for patients in that age-sex group who transfer from acute hospitals. Total separations for patients transferring from public and private hospitals in Australia in 1993–94 are compiled by age, sex and DCIS disease group for each Chapter  $c$ . The attribution fraction for age  $a$ , sex  $s$  and disease  $d$  at sub-chapter level of Chapter  $c$ , is given by:

$$\gamma_{cda} = \frac{(\text{Total separations to nursing homes for disease group } d, \text{ sex } s, \text{ age } a)}{(\text{Total separations to nursing homes for Chapter } c, \text{ sex } s, \text{ age } a)}$$

The total nursing home expenditure for disease  $d$ , sex  $s$  and age  $a$ ,  $NHEX_{dsa}$ , is estimated by applying the relevant attribution fractions for ICD-9 chapter and, where applicable, for sub-chapter disease groups:

$$NHEX_{dsa} = \alpha_{csa} \times \gamma_{cda} \times NHEX \quad (4.2)$$

where:  $NHEX$  = Total nursing home expenditure for Australia  
 $\alpha_{csa}$  = Attribution fraction to Chapter  $c$  from Equation 4.1  
 $\gamma_{cda}$  = Attribution fraction to the disease grouping  $d$  at sub-chapter level of Chapter  $c$

#### Assumptions

1. Nursing home bed days for disease groups within ICD-9 chapters are distributed in the same way as the principal diagnoses of patients transferring from acute hospitals.

#### Data sources

1. AIHW National Hospital Morbidity Database 1993–94.

## 4.4 Differences from 1989–90 methodology

- The 1989–90 methodology attributed costs to disease on the basis of the principal diagnosis pattern for patients transferring to nursing homes from acute hospitals. The revised methodology uses the distribution of main disabling health conditions in nursing home residents in 1993 to attribute costs at ICD-9 chapter level. This distribution is substantially different (see Figure 4.1)
- The revised methodology uses the distribution of separations from acute hospitals to attribute costs at sub-chapter level. The 1989–90 methodology used the distribution of acute hospital bed days by principal diagnosis for patients transferred to nursing homes.

## References

- Australian Bureau of Statistics (ABS) 1993. Disability, ageing and carers: summary of findings Australia 1993. ABS Cat. No. 4430.0. Canberra: ABS.
- Gillett S 1991. Interaction of acute care and long term care of the aged in Australia. AIHW, Internal Report.

# 5 Medical services

## 5.1 Summary

This methodology uses attribution factors based on the 1990–91 Survey of Morbidity and Treatment in General Practice in Australia (the GP survey) to allocate the age–sex-specific out-of-hospital expenditure on medical services to disease diagnoses. This allocation is done separately for general practitioners (GPs) (based on encounters surveyed in the GP survey) and for 17 categories of specialists (based on the pattern of referrals to each category of specialist in the GP survey).

Age–sex-specific out-of-hospital expenditure on medical services is derived from Medicare and Department of Veterans' Affairs (DVA) data. This expenditure covers all charges for which a Medicare or DVA claim has been made. It is adjusted to include expenditure for which claims have not been made, using an inflation factor derived from the AIHW Health Expenditure Database on total expenditure on medical services.

### Box 5.1: Key assumptions

- *The pattern of GP services by diagnosis in 1993–94 is the same as that in 1990–91.*
- *The total cost of a visit to a GP (an encounter) is divided equally among the diagnoses addressed in the encounter.*
- *Each GP encounter is assumed to have a cost proportional to its Medicare schedule fee or, where no valid Medicare item number has been recorded for an encounter, the schedule fee for a level B surgery consultation (Item 23).*
- *The pattern of diseases managed by each type of specialist in 1993–94 reflects the pattern of referrals to that specialist type from GPs in 1990–91.*
- *Each referral to a specialist of a given type generates services with equal cost.*
- *A referral to a particular type of specialist is equally attributable to all the diseases appropriate to that specialist type managed in the encounter where the referral was made.*
- *The age, sex and disease distribution of services is the same for encounters where a Medicare or DVA claim was made and those where no claim was made.*

### Box 5.2: Data sources

- *1990–91 Survey of Morbidity and Treatment in General Practice in Australia.*
- *Health Insurance Commission. Medicare Benefits Schedule 1994.*
- *Department of Health and Family Services Medicare data and DVA data.*
- *AIHW Health Expenditure Database.*
- *In-hospital medical services costs estimated from the Disease Costs and Impact Study.*

## 5.2 Overview of medical services methodology

The total public and private expenditure on medical services (in and out of hospital) is known from the AIHW Health Expenditure Database. We can estimate the total public and private expenditure on out-of-hospital medical services by subtracting the model's estimate of in-hospital medical expenditure from the total AIHW figure. The purpose of the methodology described here is:

1. to estimate the proportion of this out-of-hospital expenditure spent on GP and specialist services; and
2. to allocate these estimates to a disease group for each age and sex group, where 'disease' is interpreted broadly to include a specific disease or injury diagnosis or a 'healthy' reason for service use such as disease prevention or health promotion.

This methodology uses data from the Survey of Morbidity and Treatment in General Practice in Australia, undertaken by Professor Bridges-Webb and his colleagues at the Family Medicine Research Unit of the University of Sydney in 1990-91 (Bridges-Webb et al. 1992). The survey covered a representative sample of general practitioner (GP) visits (encounters) and collected:

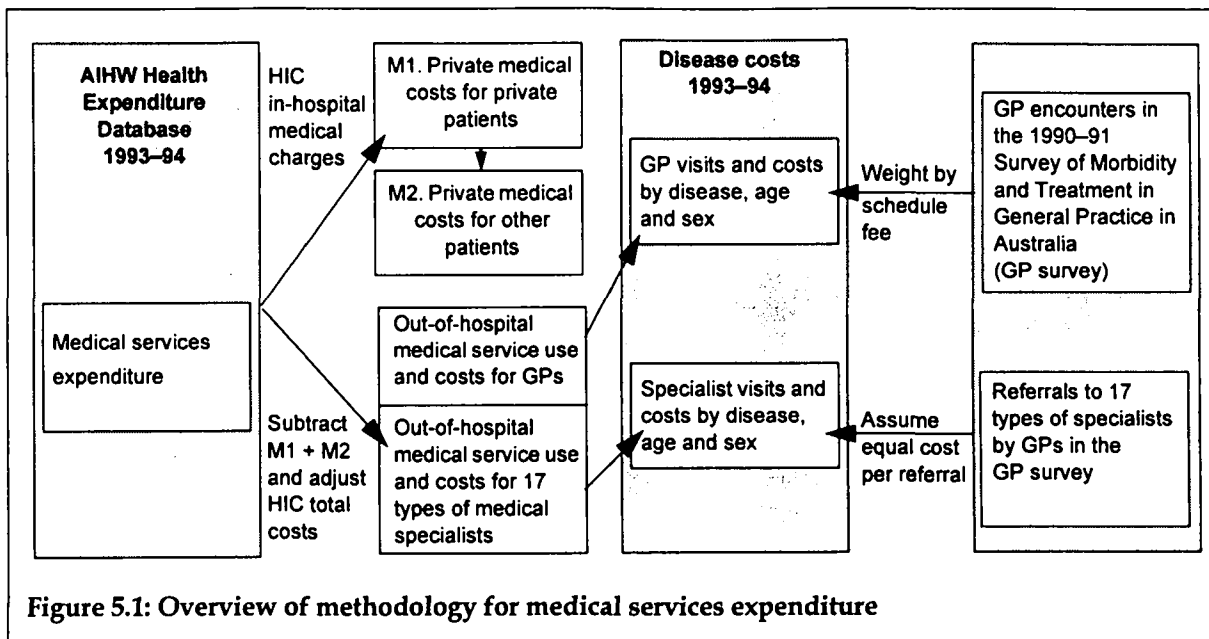
- age and sex of patient;
- reasons for encounter and diagnoses made;
- referrals to specialists and allied professional services;
- treatments and pharmaceutical scripts; and
- orders for tests and investigations.

The first step in the methodology is to use these data to construct attribution factors to allow the distribution of total expenditure on out-of-hospital services by disease category.

For GPs, the attribution factor is calculated so that the total costs are divided between the encounters in proportion to the size of the Medicare schedule fee for that encounter, and then divided equally between each of the problems managed in that encounter. For specialists, the factor is calculated so that the total costs for each type of specialist are divided equally between referrals to that type of specialist, and then divided equally between the relevant problems managed in the encounter where the referral was made. Diagnostic imaging and pathology tests are included as types of specialists.

The total charges for out-of-hospital GP and specialist services for which a claim has been made is known from the Department of Health and Family Services Medicare data and the DVA data, by age and sex. In this discussion these will be referred to as 'eligible' services. These data do not cover services paid for by health insurance funds, individuals, workers' compensation and motor vehicle third-party insurance policies for which a claim is not made. These will be referred to as 'ineligible' services.

The second step in the methodology is to apply the attribution factors calculated from the GP survey to the Medicare and DVA data to calculate a matrix of expenditure on eligible out-of-hospital GP and specialist services by age, sex and diagnosis.



Data from the AIHW Health Expenditure Database cover both eligible and ineligible expenditure, but have the limitations that:

1. they are not categorised by age and sex; and
2. they cover all medical services but are not categorised into services provided by specialists and GPs.

The final step involves inflating the figures for eligible services to cover the ineligible services by adjusting them to match the data from the AIHW Health Expenditure Database. This involves assuming that for out-of hospital medical services, the age, sex and disease distribution of services is the same for both eligible and ineligible services.

An inflation factor is calculated by dividing the estimated AIHW data on total medical expenditure on out-of-hospital medical services by the total charges for out-of-hospital medical services derived from the Medicare and DVA data. This factor is then applied to the age-sex-diagnosis-specific matrix of Medicare and DVA data on eligible out-of-hospital services.

## 5.3 Medical services methodology in detail

### 5.3.1 Attribution fraction for general practitioners

Without further information, there is no easy way to attribute the cost of an encounter among the diseases managed in that encounter. The simplest assumption is to assume that each disease costs an equal proportion of the total cost of the encounter. Thus in an encounter  $e$  where  $n_e$  diseases are managed,  $1/n_e$  of the total cost of the encounter is attributed to each disease. The attribution fraction for disease group  $d$ , sex  $s$  and age  $a$  is then:

$$\alpha_{dsa} = \frac{\sum_{e=1}^{N_{sa}} \left( \frac{w_e \times wb_e \times n_{ed}}{n_e} \right)}{\sum_{e=1}^{N_{sa}} (w_e \times wb_e)} \quad (5.1)$$

- where:
- $N_{sa}$  = Total encounters for sex  $s$  and age  $a$
  - $wb_e$  = GP survey weight for encounter  $e$
  - $w_e$  = Medicare schedule fee for encounter  $e$  if a Medicare item number has been recorded for the encounter; or the schedule fee for a level B surgery consultation (Item 23) if no valid item number has been recorded for the encounter
  - $n_{ed}$  = Number of diagnoses in disease group  $d$  which are managed in encounter  $e$  (which may be 0)
  - $n_e$  = Number of diseases managed in encounter  $e$
  - $\alpha_{dsa}$  = Attribution factor for age  $a$ , sex  $s$  and disease group  $d$

This definition of  $\alpha_{dsa}$  ensures that the sum of the attribution fractions for any specific sex  $s$  and age  $a$  across all disease groups is unity.

The GP encounter data set contains item numbers which do not appear in the Medicare Benefits Schedule. These are listed in Table 5.1, along with the number of encounters recorded for each item. These are assumed to have the same cost as a level B surgery consultation (Item 23). This means that they comprise 3.4% of all GP encounters and contributed 3.2% of the total cost for GP encounters.

Item 23 was the item recorded for the largest number of encounters (49.6%).

**Table 5.1: Item numbers from GP encounter data which do not appear on the Medicare Benefits Schedule**

Item number	Number of encounters	Per cent of total number of encounters
0	2,459	2.2
1000	33	0.0
8995	649	0.6
8996	268	0.2
8997	262	0.2
8998	174	0.2
9800	2	0.0
9803	1	0.0
9901	1	0.0

### Assumptions

- The pattern of GP services by diagnosis in 1993–94 is the same as that collected in 1990–91.
- For all the diagnoses addressed in a visit to a GP (an encounter), each diagnosis costs an equal proportion of the total cost of the encounter in which it is managed.
- Each encounter is assumed to have a cost proportional to its Medicare schedule fee or, where no valid Medicare item number has been recorded for an encounter, the schedule fee for a level B surgery consultation (Item 23).

### 5.3.2 Attribution fraction for specialists

The attribution fraction for specialists is calculated in an analogous way to that for GPs, except that it is based on referrals to a particular type of specialist rather than all GP encounters. The underlying assumption is that a referral to a particular type of specialist is equally attributable to all the diseases managed in that encounter which are appropriate to that specialist type.

Thus in an encounter  $e$  where  $n_{et}$  diseases appropriate to specialist type  $t$  are managed,  $1/n_{et}$  of the referral is attributed to each disease. The attribution fraction for disease group  $d$ , specialist type  $t$ , sex  $s$  and age  $a$  is then:

$$\beta_{dtsa} = \frac{\sum_{e=1}^{E_{tsa}} \left( \frac{s_{et} \times wb_e \times n_{etd}}{n_{et}} \right)}{\sum_{e=1}^{E_{tsa}} (s_{et} \times wb_e)} \quad (5.2)$$

where:	$E_{tsa}$	=	Total encounters with at least one referral to a specialist of type $t$ for age $a$ and sex $s$
	$wb_e$	=	GP survey weight for encounter $e$
	$s_{et}$	=	Number of referrals to a specialist of type $t$ in encounter $e$
	$n_{etd}$	=	Number of diagnoses in disease group $d$ which are appropriate to a specialist of type $t$ and which are managed in encounter $e$
	$n_{et}$	=	Number of diseases managed in encounter $e$ which are appropriate to a specialist of type $t$

This definition of  $\beta_{dtsa}$  ensures that the sum of the attribution fractions for any specific specialist group  $t$ , sex  $s$  and age  $a$  across all disease groups is unity.

Table 5.2 lists the specialist types and the corresponding appropriate diseases.

**Table 5.2: Specialist type and corresponding ICPC codes<sup>(a)</sup>**

Specialist type	ICPC codes
Physician	Not specified
Surgeon	Not specified
Ophthalmologist	F01–F99 (all eye complaints)
ENT	H01–H99 (all ear complaints) R06–R29 (nose and throat complaints and unspec. respiratory) R63–R69 (referrals and other reasons for encounter) R72–R77 (relevant diagnoses) R85–R86 (neoplasms unspec.) R87–R88 (injuries unspec.) R89 (congenital anomalies) R90 (tonsils and adenoids)
Psychiatrist	P01–P99 (psychological) N02 (tension headache) T06 (anorexia)
Dermatologist	S01–S99 (skin diseases) B70 (acute lymphadenitis) D05 (perianal itching) X16 (sympt./complt./vulva)
O & G	X01–X16 X23–X25 X27–X29 X30–X75 X77–X78 X80–X87 X89–X99 (genital system excl. breast) W01–W99 (pregnancy, childbearing, family planning)
Orthopedic	L01–L99 (musculoskeletal)
Pediatrician	Not specified
Urologist	U01–U99 (urology conditions)
Neurologist	N01–N99 (neurological conditions)
Allergist	A12, A85, F29, R08, S88 (listed under allergy in ICPC manual) –32 (sensitivity test) F71 (allergic conjunctivitis) R75 (sinusitis—acute/chronic) R96, R97 (asthma, hay fever, allergic rhinitis) S02, S06, S08 (itchy skin/rash/changes in colour)
Geriatrics incl. GAU	Not specified
Other specialist	Not specified
Diagnostic imaging	Not specified
Pathology tests excluding Pap smears	Not specified
Pap smears <sup>(b)</sup>	X25 (fear of genital cancer)

(a) The International Classification of Primary Care (ICPC) is described in Section 1.7.

(b) Pap smears are assumed to have a diagnosis of X25 irrespective of the diagnoses recorded for the encounter. This enables them to be coded correctly to the cancer prevention and screening category.

### Assumptions

- The pattern of diseases managed by each type of specialist in 1993–94 reflects the pattern of referrals to that specialist type from GPs in 1990–91.
- Each referral to a specialist of a given type generates services with equal cost.



- A referral to a particular type of specialist is equally attributable to all the diseases appropriate to that specialist type managed in the encounter where the referral was made:
  - If at least one disease appropriate to that specialist type is managed in the encounter, then diseases managed in the encounter which are not appropriate to that specialist type are excluded from the attribution.
  - Where no disease appropriate to that specialist type is managed in the encounter, then the referral is attributed equally to all diseases managed in the encounter.
  - Where the grouping of specialists into type is too broad to allow the identification of appropriate diseases, all diseases are considered appropriate.

#### Data sources

- 1990–91 Survey of Morbidity and Treatment in General Practice in Australia.
- Health Insurance Commission. Medicare Benefits Schedule 1994.

### 5.3.3 Eligible expenditure by disease

The attribution fractions calculated in Equation 5.1 and Equation 5.2 are applied to the known expenditure on GP and specialist services from Medicare and DVA data (the ‘eligible’ expenditure) to produce a matrix of age–sex-specific eligible expenditures for out-of-hospital medical services by diagnosis.

$$MELIG_{dsa} = (\alpha_{dsa} \times GP_{sa}) + \sum_{t=1}^{16} (\beta_{dtsa} \times SP_{tsa}) \quad (5.3)$$

- where:
- $GP_{sa}$  = Total charges for out-of-hospital GP services (Medicare and DVA) for sex  $s$  and age  $a$
  - $SP_{tsa}$  = Total charges for out-of-hospital specialist services (Medicare and DVA) for specialist type  $t$ , sex  $s$  and age  $a$
  - $\alpha_{dsa}$  = Attribution factor for sex  $s$ , age  $a$  and disease group  $d$  from Equation 5.1
  - $\beta_{dtsa}$  = Attribution factor for specialist type  $t$ , sex  $s$ , age  $a$  and disease group  $d$  from Equation 5.2

### 5.3.4 Total expenditure by disease, sex and age

The expenditure on medical services from Medicare and DVA (the ‘eligible’ expenditure) is inflated to cover expenditure for which Medicare or DVA claims have not been made (the ‘ineligible’ expenditure) by adjusting it to match the estimated total expenditure on out-of-hospital medical services. This is derived from the AIHW Health Expenditure Database by subtracting estimated in-hospital medical expenditure (see Chapter 2) from total medical expenditure.

$$MS_{dsa} = (ME - IHME) \times \frac{MELIG_{dsa}}{MC} \quad (5.4)$$

where: $ME$	=	Total eligible and ineligible expenditure on in- and out-of-hospital medical services (both specialists and GPs) from the AIHW Health Expenditure Database
$IHME$	=	Total in-hospital eligible and ineligible expenditure on medical services (both specialists and GPs), estimated from the hospital costs section of the model (Equation 2.12) in Section 2.3.4
$MC$	=	Total charges for out-of-hospital medical services (for both GPs and specialists) from Medicare and DVA data
$MELIG_{dsa}$	=	Charges for eligible out-of-hospital medical services for disease $d$ , sex $s$ and age $a$ calculated from Equation 5.3
$MS_{dsa}$	=	Total expenditure on out-of-hospital medical services for disease $d$ , sex $s$ and age $a$

#### *Assumptions*

- The age, sex and disease distribution of services is the same for encounters where a Medicare or DVA claim was made and those where no claim was made.

#### *Data sources*

- Department of Health and Family Services Medicare data and DVA data.
- AIHW Health Expenditure Database.
- In-hospital medical services costs estimated from the Disease Costs and Impact Study.

## 5.4 Data issues

The following issues were raised in estimating the attribution fractions and applying them to the Medicare and DVA data.

### 5.4.1 Rounding error

The estimated attribution fractions for specialists all added exactly to 1. However, some attribution fractions for GPs added to slightly more than 1 due to rounding error. These were forced to add to 1 by distributing the excess pro rata between the diseases within the age-sex groups.

The fractions were passed from the statistical analysis package to spreadsheets with an accuracy of eight decimal places. This was enough to ensure that any rounding error discrepancy was kept to less than \$10.00 for GPs and each specialty group.

### 5.4.2 Anomalies in the Medicare data

The Medicare charges data have some anomalies due to the fact that some practitioners have more than one registered specialty, but all their services are recorded for only one specialty group. These anomalies were as follows.

- Services were recorded for men in the obstetrics and gynaecology category. Advice from the Department of Health and Family Service's Medicare statistics section is that these refer mainly to circumcisions and other procedures relating to male genitals. Hence they have been recoded to urologists.

- Services were recorded for adult patients in the paediatrics category. Less than 5% of the paediatric referrals in the GP survey data are for patients aged over 10 and these are all adult patients – and hence probably the parents of the real patient. So all charges for patients aged 10 years and over were recoded to the specialist physician category.
- Services were recorded for young patients in the geriatrics category. The youngest patients in the GP survey data with a referral to a geriatrics specialist were in the 55 to 60 category, so all charges for patients aged under 55 were recoded to the specialist physician category.

### 5.4.3 Sample size problems

Small sample sizes led to some of the age–sex–specialty groups having Medicare charges but no attribution fraction. In these cases, the attribution fraction was applied to a grouping of the age ranges (Table 5.3).

**Table 5.3: New age groupings for application of attribution fractions**

Speciality group	Sex of patient	New age groupings
Psychiatrist	Female	0 to under 15
Allergist	Males	0 to under 15
		45 and over
	Females	0 to under 15
Geriatrics	Males	65 and over
		55 and over

## 5.5 Differences from 1989–90 methodology

### Attribution factor—GPs

The previous methodology used an attribution factor based on the average number of problems managed per GP encounter. This was calculated in such a way that the sum of the attribution factors across all diseases was less than 1. This sum must equal 1 for the whole expenditure to be attributed to diseases. This methodology calculates the attribution factor in such a way that it will add to 1.

### Attribution factor—specialists

The previous methodology used an attribution factor based on the average number of referrals per encounter. This was also calculated in such a way that the sum of the attribution factors across all diseases was less than 1. Again, this methodology calculates the attribution factor in such a way that it will add to 1.

### Adjustment to total expenditure

The estimated expenditure when summed across diseases must agree with the total figure from the AIHW Health Expenditure Database, less the estimated in-hospital medical services expenditure. The way the previous methodology estimated the private component of out-of-hospital expenditure meant that the total across disease groups for GPs and specialists would not be equal to the total AIHW figure unless the total Medicare and DVA expenditure is exactly equal to the AIHW public out-of-hospital expenditure estimate. This is corrected in this methodology.

## Reference

Bridges-Webb C, Britt H, Miles DA, Neary S, Charles J & Traynor V 1992. Morbidity and treatment in general practice in Australia 1990-1991. *Med J Aust* 157(suppl):S1-S57.

# 6 Dental services

## 6.1 Summary

All dental services were allocated to ICD-9 chapter 9, 'Digestive system diseases'. Expenditure and utilisation of these services were further allocated to treatment or prevention and screening using attribution factors calculated from the 1989–90 Australian Bureau of Statistics (ABS) National Health Survey. Total expenditure was taken from the AIHW Health Expenditure Database. Cost weights for allocating costs to occasions of service were taken from the 1993 Dental Fees Survey and total numbers of services were estimated from the 1994 National Dental Telephone Interview Survey.

### Box 6.1: Key assumptions

- *The pattern of dental visits and services reported in the National Health Survey is the same as that for 1993–94 by age, sex and treatment or prevention category.*
- *The actual expenditure on each type of dental service is proportional to the average fee charged for that service.*
- *For each National Health Survey respondent, the total cost of the dental consultations reported is the sum of the costs for the services reported.*

### Box 6.2: Data sources

- 1989–90 ABS National Health Survey.
- 1993 Dental Fees Survey.
- 1994 National Dental Telephone Interview Survey.
- AIHW Health Expenditure Database.

## 6.2 Overview of dental services methodology

Total expenditure on dental services is known from the AIHW Health Expenditure Database. Total services utilisation can be estimated from the 1994 National Dental Telephone Interview Survey. The purpose of this methodology is to allocate this expenditure and utilisation to age–sex groups classified by treatment or prevention and screening.

The allocation is based on the pattern of visits to the dentist reported in the National Health Survey. Each survey respondent reported on the number of dental consultations in the two weeks prior to the survey and the dental services received. The services were classified as either treatment or prevention and screening, and the consultations for each survey respondent were apportioned to each of these groups in the same proportions as the reported services.

Attribution fractions for utilisation were calculated so that utilisation was apportioned proportional to the number of consultations with services in each category. These fractions were applied to total utilisation of dentists reported in the National Dental Telephone

Interview Survey. Fees were calculated for each service from the results of the Dental Fees Survey and attribution fractions were calculated to attribute expenditure proportional to the fees charged for services for consultations in each category.

Tables 6.1 and 6.2 below list the average fee charged for each service and the allocation of services to the categories 'treatment' or 'prevention and screening'.

**Table 6.1: Fee charged for dental procedure**

Procedure	Fee \$
Dental extraction	57.60
Dental X-ray	36.40
Teeth cleaned/polished	37.15
Dental fluoride treatment	35.80
Dental filling	61.20
Denture fitting	598.50
Denture maintenance/repair	58.20
Dental braces/bands fitted	1,168.00
Dental checkup	26.00
Other dental treatment	64.00

Note: Where two or more procedures in the survey corresponded to a single procedure in Table 6.1, the median fee from the survey was used.

Source: 1993 Dental Fees Survey.

**Table 6.2: Classification of dental services**

Prevention/screening	Treatment
Dental X-ray	Dental extraction
Teeth cleaned/polished	Dental filling
Dental fluoride treatment	Denture fitting
Dental checkup	Denture maintenance/repair
	Dental braces/bands fitted
	Other dental treatment

## 6.3 Dental services methodology in detail

### 6.3.1 Utilisation by age, sex and service category $U_{asd}$

The attribution fraction for attributing total utilisation of dental services to age group  $a$ , sex  $s$  and service category  $d$  is given by:

$$\alpha_{asd} = \frac{\sum_{i=1}^{N_{dsa}} \sum_{j=1}^{n_i} \left( \frac{v_i \times wn_i \times \delta_{jd}}{n_i} \right)}{\sum_{d=1}^2 \sum_{s=1}^2 \sum_{a=1}^{N_{dsa}} \sum_{i=1}^{n_i} \left( \frac{v_i \times wn_i \times \delta_{jd}}{n} \right)} \quad (6.1)$$

where:  $N_{dsa}$  = Total number of survey respondents of age  $a$  and sex  $s$  who reported a dental service in category  $d$

$wn_i$  = National Health Survey weight for respondent  $i$

$v_i$  = Number of times respondent  $i$  reported visiting a dentist

$n_i$  = Total number of dental services reported by respondent  $i$

$\delta_{jd}$  = 1 if service  $j$  is in category  $d$ ; or  
0 otherwise

The utilisation of dental services by age, sex and service category is then given by:

$$DU_{asd} = DU \times \alpha_{asd} \quad (6.2)$$

where:  $DU$  = Total utilisation of dental services (from the National Dental Telephone Interview Survey)

$\alpha_{asd}$  = Fraction for attributing total utilisation of dental services to age group  $a$ , sex  $s$  and service category  $d$ —calculated in Equation 6.1 above

#### Assumptions

- The pattern of dental visits and services reported in the National Health Survey is the same as that for 1993–94 by age, sex and treatment or prevention and screening category.

#### Data sources

- 1989–90 ABS National Health Survey.
- 1994 National Dental Telephone Interview Survey.

### 6.3.2 Expenditure by age, sex and service category $DE_{asd}$

The attribution fraction for attributing total costs of dental services to age group  $a$ , sex  $s$  and service category  $d$  is given by:

$$\beta_{asd} = \frac{\sum_{i=1}^{N_{dsa}} \sum_{j=1}^{n_i} \left( \frac{v_i \times w_j \times wn_i \times \delta_{jd}}{n_i} \right)}{\sum_{d=1}^2 \sum_s \sum_a \sum_{i=1}^{N_{dsa}} \sum_{j=1}^{n_i} \left( \frac{v_i \times w_j \times wn_i \times \delta_{jd}}{n} \right)} \quad (6.3)$$

where:	$N_{dsa}$	=	Total number of survey respondents of age $a$ and sex $s$ who reported a dental service in category $d$
	$wn_i$	=	National Health Survey weight for respondent $i$
	$v_i$	=	Number of times respondent $i$ reported visiting a dentist
	$w_j$	=	Average fee charged for service $j$
	$n_i$	=	Total number of dental services reported by respondent $i$
	$\delta_{jd}$	=	1 if service $j$ is in category $d$ ; or 0 otherwise

Expenditure on dental services by age, sex and service category is then given by:

$$DE_{asd} = DE \times \beta_{asd} \quad (6.4)$$

where:	$DE$	=	Total expenditure on dental services from AIHW Health Expenditure Database
	$DE_{asd}$	=	Expenditure on dental services for age $a$ , sex $s$ and dental service category $d$

#### *Assumptions*

- The pattern of dental visits and services reported in the National Health Survey is the same as that for 1993–94 by age, sex and treatment or prevention and screening category.
- The actual expenditure on each type of dental service is proportional to the average fee charged for that service.
- For each National Health Survey respondent, the total cost of the dental consultations reported is the sum of the costs for the services reported.

#### *Data sources*

- 1989–90 ABS National Health Survey.
- 1993 Dental Fees Survey.

## **6.4 Differences from 1989–90 methodology**

Dental service costs were not included in the 1989–90 methodology. Total dental service costs from the AIHW Health Expenditure Database were added to the 'Diseases of the digestive system' category under 'Allied health professional' in some summary tabulations.



# 7 Allied health services

## 7.1 Summary

This methodology uses attribution factors based on the 1990–91 Survey of Morbidity and Treatment in General Practice in Australia undertaken by Professor Bridges-Webb and colleagues (the GP survey) and the 1989–90 Australian Bureau of Statistics (ABS) National Health Survey to allocate total Australian expenditure on allied health practitioners to age–sex–disease groups. Total visits to allied health practitioners in 1993–94 for each age–sex–disease group are estimated from the National Health Survey data on visits to 14 types of allied health practitioners in the two weeks prior to interview. Annual visits to other types of allied health practitioners are estimated from referrals by general practitioners in the GP survey. Expenditure is allocated assuming that all visits have the same cost. The methodology covers all allied health professionals excluding dental services, which are addressed in Chapter 6 of this paper, and pharmacists, who are addressed in Chapter 8 on prescription and over-the-counter drugs.

### Box 7.1: Key assumptions

- *All visits to practitioners generate services with equal costs.*
- *The pattern of visits to practitioners estimated from the National Health Survey is the same as that in 1993–94.*
- *For practitioner visits reported in the National Health Survey, the cost of the visit is equally attributable to all of the reasons for that visit.*
- *For other types of practitioners, the distribution of visits by disease, age and sex is the same as the distributions of referrals by general practitioners.*
- *A referral to an allied health practitioner in the GP survey is equally attributable to all the diseases appropriate to that practitioner type managed in the encounter.*

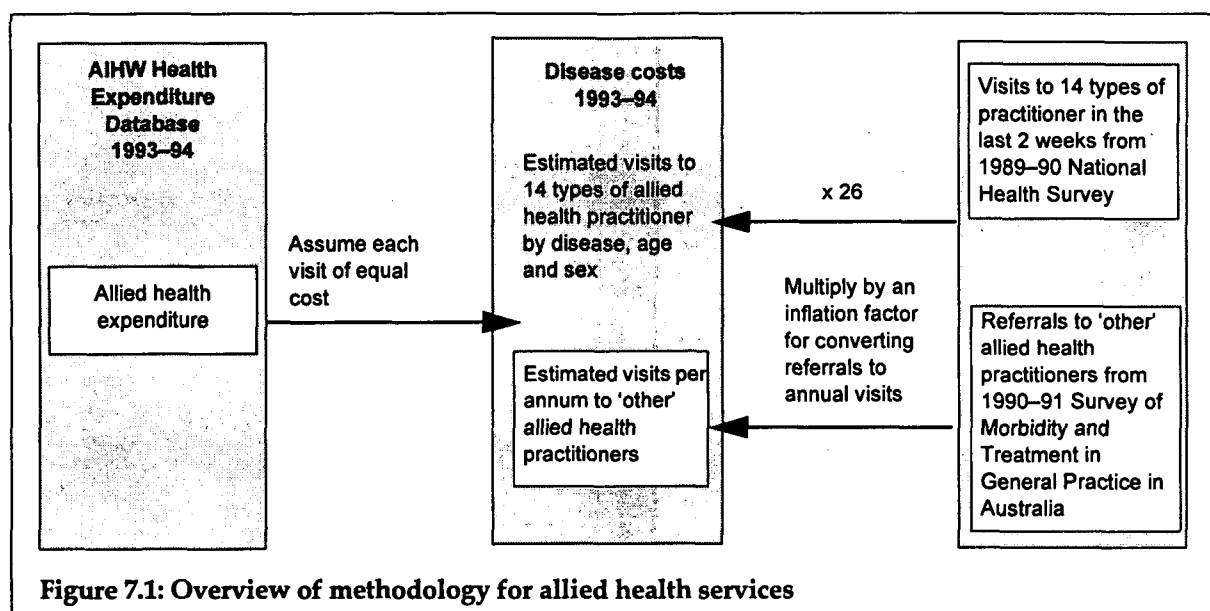
### Box 7.2: Data sources

- *1990–91 Survey of Morbidity and Treatment in General Practice in Australia.*
- *1989–90 ABS National Health Survey.*
- *AIHW Health Expenditure Database.*

## 7.2 Overview of allied health methodology

Allocation of total expenditure on allied health practitioner services (from the AIHW Health Expenditure Database) to age–sex–disease groups is done in two steps. The first is the allocation to treatment or prevention and screening groups within each ICD-9 chapter. The second is the allocation of the cancer and cardiovascular treatment groups to specific cancers and cardiovascular disease groups.

The methodology is based on the data sources shown in Box 7.2. Chapter 5 (Medical costs) contains a further description of the GP survey data. This methodology covers all allied health professionals, excluding dental services, which are addressed in Chapter 6 of this paper, and pharmacists, which are addressed in Chapter 8 on prescription and over-the-counter drugs.



## 7.2.1 Allocation of expenditure to ICD-9 chapters

The first step is to estimate the number of visits to each type of practitioner. The National Health Survey provides estimates of the total visits to selected practitioner types during a two-week period. However, not all types of practitioners are covered by the National Health Survey, so the visits to the remaining practitioner types must be estimated from the GP survey data. This is done by assuming that the ratio between total referrals for each type in the GP survey data and total visits estimated for that type from the National Health Survey data is constant across practitioner types. There are a group of practitioner types which are common to both the GP survey and the National Health Survey. This provides the basis for estimating an inflation factor to apply to referrals in the GP survey data to give an estimate of visits for an 'other practitioners' category, which is consistent with the National Health Survey data.

The attribution factors are then calculated so that costs are divided equally between each visit to a practitioner and then divided equally between each of the reasons for that visit. For the practitioners covered by the National Health Survey, this can be done directly from the survey data. For the other practitioners, this involves dividing the costs equally between the relevant problems managed in each encounter where there was a referral to a practitioner.

## 7.2.2 Allocating expenditure for sub-chapter disease groups

This step takes the expenditure allocated to treatment at the chapter level and apportions it to specific disease groups at the sub-chapter level. This allocation is based purely on the GP survey data.

Disease attribution factors are calculated so that the chapter-level treatment expenditure is divided equally between those encounters where (a) there is a referral to a practitioner and (b) at least one diagnosis for the disease of interest is among the problems managed in the encounter. The expenditure is further divided equally between all diagnoses in the disease group of interest managed in the encounter which are appropriate to the referred practitioner.

Table 7.1: Classification system for allied health practitioners

DCIS code	National Health Survey practitioner type	GP survey practitioner type
1	Chiropractor	Chiropractor
2	Osteopath	n.a.
3	Naturopath	n.a.
4	Herbalist	n.a.
5	Acupuncturist	Acupuncturist
6	Dietician	Dietician <sup>(a)</sup>
7	Optician	n.a.
8	Physiotherapist	Physiotherapist <sup>(a)</sup>
9	Psychologist	Psychologist, counsellor, marriage guidance <sup>(a)</sup>
10	Social worker	n.a.
11	Podiatrist	Podiatrist <sup>(a)</sup>
12	School nurse	n.a.
13	Baby nurse	n.a.
14	Other nurse	Includes home nursing
0	n.a.	Rehabilitation, relaxation/hypnotherapist, speech therapist, other health professional, drug and alcohol, other services nec

(a) These categories form the common set used in Equation 7.3 to estimate the inflation factor. The categories 'chiropractor' and 'acupuncturist' showed marked differences between the two data sets and so were excluded from the common set.

## 7.3 Allied health methodology in detail

### 7.3.1 Utilisation by age, sex and type of practitioner

Information is collected in the National Health Survey on visits to 14 types of allied health professionals (Table 7.1). The total number of visits to these practitioners ( $t = 1,2,...14$ ) is calculated as follows:

$$T_{tsa} = 26 \times \sum_{i = 1}^{N_{tsa}} v_{it} \times wn_i \tag{7.1}$$

- where:

$N_{tsa}$ 
=
Total number of survey respondents of age  $a$  and sex  $s$  who reported visiting a practitioner of type  $t$

$wn_i$ 
=
National Health Survey weight for respondent  $i$

$v_{it}$ 
=
Number of times respondent  $i$  reported visiting practitioner type  $t$  during last two weeks

The type  $t = 0$  covers the remaining types of allied health practitioners identified in the GP survey data (Table 7.1). The total number of referrals for patients of age  $a$  and sex  $s$  to practitioners of type  $t = 0$ , based on the GP survey data, is calculated as:

$$R_{0sa} = \sum_{e=1}^{E_{0sa}} s_{e0} \times wb_e \quad (7.2)$$

where:

- $E_{0sa}$  = Total encounters with patients of age  $a$  and sex  $s$  with at least one referral to a practitioner of type 0
- $wb_e$  = GP survey weight for encounter  $e$
- $s_{e0}$  = Number of referrals to a practitioner of type 0 in encounter  $e$

In order to give an estimate of visits for an 'Other practitioners' category which is consistent with the National Health Survey data, it is necessary to apply an inflation factor to adjust the total referrals to practitioners of type 0 to match the total estimated visits to practitioners of types 1,2,...,14,  $f_{sa}$ .

Some types of health practitioners appear in both the GP survey data and the National Health Survey data. These are denoted the 'common set' of practitioners (Table 7.1). The adjustment factor is the ratio between the total reported visits for each age and sex for this common set from the National Health Survey and the total referrals for each age and sex for this common set from the GP survey data.

$$f_{sa} = \frac{26 \times \sum_{i \in CN_{sa}} wn_i \times v_{ic}}{\sum_{e \in CB_{sa}} wb_e \times s_{ec}} \quad (7.3)$$

where:

- $CN_{sa}$  = The set of National Health Survey respondents of age  $a$  and sex  $s$  who reported visiting a practitioner in the common set
- $CB_{sa}$  = The set of encounters with patients of age  $a$  and sex  $s$  in the GP survey where a referral was made to a practitioner in the common set
- $s_{ec}$  = Number of referrals in encounter  $e$  to a practitioner in the common set
- $v_{ic}$  = Number of times respondent  $i$  reported visiting a practitioner in the common set
- $wn_i$  = National Health Survey weight for respondent  $i$
- $wb_e$  = GP survey weight for encounter  $e$

The estimated number of visits to practitioners of type 0 is then given by:

$$T_{0sa} = f_{sa} \times R_{0sa} \quad (7.4)$$

#### Assumptions

- The ratio between the number of referrals to a practitioner of a given type in the GP survey and the estimated number of visits to that practitioner type from the National Health Survey is constant across types of practitioner.

#### Data sources

- 1990–91 Survey of Morbidity and Treatment in General Practice in Australia.
- 1989–90 ABS National Health Survey.

### 7.3.2 Attribution fraction for allied health practitioners

The first term in the numerator of Equation 7.5 represents the estimated apportionment to diseases in group  $d$  of visits to a practitioner of type 0 based on the GP survey data. The second term represents the same apportionment for practitioners of type 1 to 14 based on National Health Survey data. The mapping of National Health Survey health condition codes to the treatment and prevention categories at chapter level of ICD-9 is shown in Table 1.4.

$$\alpha_{dsa} = \frac{\left\{ \sum_{e=1}^{E_{0sa}} \left( \frac{f_{sa} \times s_{e0} \times n_{de0} \times wb_e}{n_{e0}} \right) + \sum_{t=1}^{14} \sum_{i=1}^{N_{tsa}} \left( \frac{n_{dit} \times v_{it} \times wn_i}{n_{it}} \right) \right\}}{\sum_s \sum_a \sum_{t=0}^{14} T_{tsa}} \quad (7.5)$$

where:	$E_{0sa}$	=	Total encounters with a patient of age $a$ and sex $s$ with at least one referral to a practitioner of type 0
	$wb_e$	=	GP survey weight for encounter $e$
	$s_{e0}$	=	Number of referrals to a practitioner of type 0 in encounter $e$
	$n_{de0}$	=	Number of diagnoses in disease group $d$ which are appropriate to a practitioner of type 0 and which are managed in encounter $e$
	$n_{e0}$	=	Total number of diagnoses which are appropriate to a practitioner of type 0 and which are managed in encounter $e$
	$f_{sa}$	=	Inflation factor for age $a$ and sex $s$ calculated in Equation 7.3
	$N_{tsa}$	=	Total number of survey respondents of age $a$ and sex $s$ who reported visiting a practitioner of type $t$
	$wn_i$	=	National Health Survey weight for respondent $i$
	$v_{it}$	=	Number of times respondent $i$ reported visiting practitioner type $t$

$n_{dit}$	=	Number of reasons in disease group $d$ reported by respondent $i$ for visiting practitioner type $t$
$n_{it}$	=	Total number of reasons reported by respondent $i$ for visiting practitioner type $t$
$T_{tsa}$	=	Total visits by people of age $a$ and sex $s$ to a practitioner of type $t$ calculated in Equations 7.1 and 7.4

This ensures that the attribution fraction  $\alpha_{dsa}$  sums across age, sex and disease groups to unity.

#### *Assumptions*

- All visits to practitioners generate services with equal costs.
- The pattern of visits to practitioners estimated from the National Health Survey for 1989–90 is the same as that in 1993–94.
- Where practitioner visits are reported in the National Health Survey for a practitioner of a given type, the cost of services for each respondent is equally attributable to all of the reasons for visits to that practitioner type.
- Where practitioner visits are not reported in the National Health Survey, the pattern of diseases giving rise to referrals by general practitioners to practitioners is the same as the pattern of diseases for all practitioner visits.
- A referral to a particular type of practitioner in the GP survey is equally attributable to all the diseases appropriate to that practitioner type managed in the encounter where the referral was made.
  - Where no disease appropriate to that practitioner type is managed in the encounter, then the referral is attributed equally to all diseases managed in the encounter.
  - Where the grouping of practitioners into type is too broad to allow the identification of appropriate diseases, all diseases are considered appropriate.

#### *Data sources*

- 1990–91 Survey of Morbidity and Treatment in General Practice in Australia.
- 1989–90 ABS National Health Survey.

### 7.3.3 Expenditure by ICD-9 chapter

The mapping of National Health Survey health condition codes to ICD-9 chapters is shown in Table 1.4.

Total expenditure on allied health services by the treatment and prevention categories  $d$  at chapter level of ICD-9 and age  $a$  and sex  $s$  is given by:

$$AHP_{dsa} = AHPEX \times \alpha_{dsa} \quad (7.7)$$

where:  $AHPEX$  = Total expenditure on allied health practitioners from the AIHW Health Expenditure Database  
 $\alpha_{dsa}$  = Attribution fraction to disease type  $d$ , for age  $a$  and sex  $s$ , from Equation 7.5

Data sources

- AIHW Health Expenditure Database.

### 7.3.4 Expenditure by disease at sub-chapter level

The expenditure allocated to treatment at the chapter level is apportioned to specific disease groups at the sub-chapter level purely on the basis of the GP survey data. In this section,  $d$  refers to a disease diagnosis at sub-chapter level of Chapter  $c$ . The attribution fraction for age, sex and disease at sub-chapter level of Chapter  $c$ ,  $\beta_{dsa}$ , is given by:

$$\beta_{dsa} = \frac{\sum_t \left\{ \sum_{e=1}^{E_{tsac}} \left( \frac{s_{et} \times n_{det} \times wb_e}{n_{et}} \right) \right\}}{\sum_t \left( \sum_{e=1}^{E_{tsac}} s_{et} \times wb_e \right)} \quad (7.8)$$

where:  $E_{tsac}$  = Total encounters with a patient of age  $a$  and sex  $s$  with at least one referral to a practitioner of type  $t$  and at least one diagnosis in Chapter  $c$   
 $wb_e$  = GP survey weight for encounter  $e$   
 $s_{et}$  = Number of referrals to a practitioner of type  $t$  in encounter  $e$   
 $n_{det}$  = Number of diagnoses in disease group  $d$  which are appropriate to a practitioner of type  $t$  and which are managed in encounter  $e$   
 $n_{et}$  = Total number of Chapter  $c$  diagnoses which are appropriate to a practitioner of type  $t$  and which are managed in encounter  $e$

The disease attribution factors are calculated so that the chapter-level treatment expenditure is divided equally between those encounters where (a) there is a referral to a practitioner and (b) at least one diagnosis for the disease of interest is among the problems managed in the encounter. The expenditure is further divided equally between all diagnoses in the disease group of interest managed in the encounter which are appropriate to the referred practitioner. The matrix of expenditure on allied health practitioners by disease at sub-chapter level is given by:

$$AHP_{cda} = AHPEX \times \alpha_{csa} \times \beta_{dsa} \quad (7.9)$$

where:	$AHPEX$	=	Total expenditure on allied health practitioners from the AIHW Health Expenditure Database
	$\alpha_{csa}$	=	Attribution fraction to the treatment classification for Chapter $c$ for age $a$ and sex $s$ , from Equation 7.5
	$\beta_{dsa}$	=	Attribution fraction to the disease grouping at sub-chapter level from Equation 7.8
	$AHP_{cda}$	=	Total expenditure on allied health practitioners for Chapter $c$ , disease group $d$ , for age $a$ and sex $s$

#### Assumptions

- The assumptions relating to the use of GP survey data listed in Section 7.3.2 also apply here. The method assumes that within chapters of ICD-9, the pattern of use of allied health services by disease is similar to the pattern of referrals observed in the GP survey.

#### Data sources

- 1990–91 Survey of Morbidity and Treatment in General Practice in Australia.

## 7.4 Differences from 1989–90 methodology

- The 1989–90 methodology used the National Health Survey to create an overall expenditure matrix for all practitioner types classified by age and sex and the GP survey data for attribution to disease group at an age–sex level. The revised methodology uses the National Health Survey data for the attribution to disease groups as well, where possible.
- The 1989–90 methodology did not address the issue of the National Health Survey not covering all practitioner types. The revised methodology supplements estimates from the National Health Survey with estimates from the GP survey to cover all practitioner types.
- The 1989–90 methodology used an attribution factor for the GP survey data based on the average number of problems managed per general practitioner encounter. This was calculated in such a way that the sum of the attribution factors across all diseases was less than 1. This sum must equal 1 for the whole expenditure to be attributed to diseases. The revised methodology ensures that the attribution factor adds to 1 across diseases for each age and sex.



# 8 Pharmaceutical drugs

## 8.1 Summary

Total private pharmaceutical expenditure is decomposed into two components: expenditures on prescription and on non-prescription drugs. Attribution factors based on the 1990–91 Survey of Morbidity and Treatment in General Practice in Australia undertaken by Professor Bridges-Webb and colleagues (the GP survey), together with 1993–94 estimates of total costs and numbers of prescriptions for 40 categories of drug, are used to allocate total Australian expenditure on prescription pharmaceuticals to age–sex–disease groups. Expenditure on non-prescription (over-the-counter) pharmaceuticals is attributed to age–sex–disease groups using information from the 1989–90 Australian Bureau of Statistics (ABS) National Health Survey. The methodology addresses all pharmaceutical costs apart from the cost of pharmaceuticals dispensed in hospitals (covered in Chapters 2 and 3).

### Box 8.1: Key assumptions

- *For each DCIS therapeutic drug group, the relative distribution of prescriptions by disease, age and sex for all community prescriptions in 1993–94 is the same as that for prescriptions by general practitioners in 1990–91. For diseases where a significant proportion of prescriptions are made by medical specialists, this assumption may have limited validity.*
- *Within each DCIS therapeutic drug group, each prescription is assumed to have equal cost.*
- *The utilisation pattern of drugs 'not prescribed or advised' in the National Health Survey is representative of the total use of over-the-counter medicines in 1993–94.*
- *Purchases of over-the-counter medications have the same average cost per purchase for each age–sex–disease group.*
- *Over-the-counter pharmaceutical expenditure for cancers and for heart disease are allocated to DCIS disease groups at sub-chapter level, assuming that they are distributed across diseases in proportion to numbers of medical visits for each age–sex group.*

### Box 8.2: Data sources

- 1993–94 Household Expenditure Survey (ABS 1996).
- Prescription drug use and costs (1993 Australian Statistics on Medicines).
- 1990–91 Survey of Morbidity and Treatment in General Practice in Australia.
- 1989–90 ABS National Health Survey.
- AIHW Health Expenditure Database.

## 8.2 Overview of pharmaceutical costs methodology

Pharmaceuticals represent the third largest sector of health expenditure after acute hospitals and medical services, accounting for almost 12% of total recurrent health expenditure in 1993–94. Pharmaceutical expenditure includes expenditure on drugs prescribed by private medical practitioners and non-prescription (over-the-counter) drugs purchased by

individuals. Hospital pharmaceuticals dispensed to inpatients and non-inpatients (including those prescribed for private patients and supplied by the hospital) are included in hospital costs and dealt with as part of the attribution of hospital expenditures (see Chapters 2 and 3).

Around 70% of non-hospital prescriptions are dispensed under one of two subsidisation schemes – the Pharmaceutical Benefits Scheme (PBS) and the Repatriation Pharmaceutical Benefits Scheme (RPBS). Under the PBS, general patients paid the full cost of a prescription up to a maximum of \$16.20 (as at August 1994) unless their family expenditure had reached a safety net limit. The other 30% of prescriptions include these unsubsidised prescriptions as well as private prescriptions for drugs not listed on the PBS or RPBS, where the patient pays the full cost of the drug.

Total expenditure on pharmaceutical drugs is known from the AIHW Health Expenditure Database. Estimates of over-the-counter drug expenditure from the 1993–94 ABS Household Expenditure Survey and of total expenditure on private prescriptions are used to split total pharmaceutical expenditure into two components for prescription and non-prescription drugs (see Section 8.3.1).

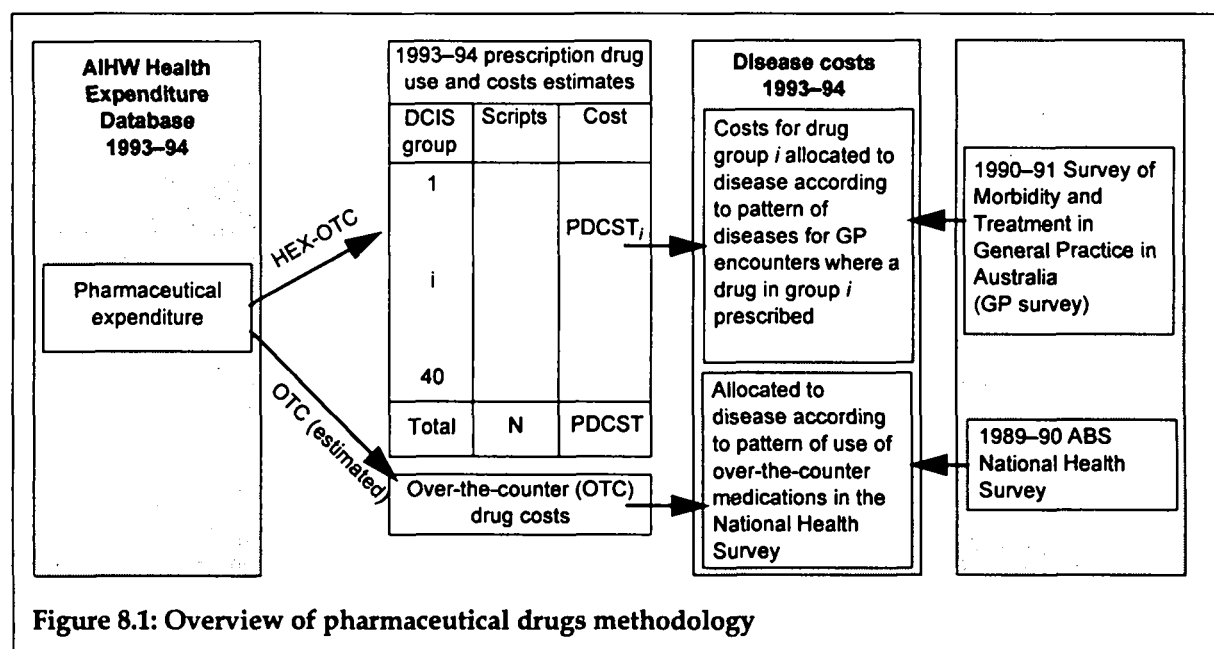
Detailed estimates of 1993–94 utilisation and expenditure for 40 drug categories are used as a starting point for attribution to age–sex–disease groups. This takes into account differences in average drug costs across therapeutic categories, average numbers of repeats, and relative changes in utilisation and costs across drug categories between 1989–90 and 1993–94.

Total prescriptions and costs for each Disease Costs and Impact Study (DCIS) drug category are attributed to disease in accordance with the pattern of diseases for which that category of drug was prescribed in the GP survey encounters. This method takes into account differences between disease groups in the average cost per prescription and in the average number of repeats, changes in relative prescription volume of different classes of drugs, and also substitution of specific drugs used for a disease in 1990 by new or alternate drugs within the same therapeutic category in 1993–94. However, the method assumes that the relative distribution of prescriptions by disease, age and sex for all community prescriptions in 1993–94 is the same as that for prescriptions by general practitioners in 1990–91. For diseases where a significant proportion of prescriptions are made by medical specialists, this assumption may have limited validity, and care should be taken in the interpretation of prescription drug costs at disease sub-group level for such diseases.

Allocation of over-the-counter drug costs to disease, age and sex groups was based on the reported use of medications in the two weeks prior to interview in the National Health Survey. Expenditure at the chapter level is apportioned to specific disease groups at the sub-chapter level, to the extent possible, using the specific codes used to record health conditions in the National Health Survey.

The level of detail of these codes varies with chapter and, where it is necessary to apportion costs at a finer level of detail than available in the National Health Survey, costs are allocated in proportion to total estimated doctor visits.

The key assumptions and data sources used for the allocation of pharmaceutical costs to disease are summarised in Boxes 8.1 and 8.2. Figure 8.1 gives an overview of the pharmaceutical drugs methodology.



## 8.3 Pharmaceuticals methodology in detail

### 8.3.1 Total expenditure on over-the-counter drugs

The AIHW has estimated total expenditure on unsubsidised prescription drugs from 1989-90 to 1992-93 (AIHW 1994:143), with expenditure in 1992-93 estimated at \$691 million. Total expenditure on unsubsidised pharmaceuticals in 1992-93 was \$1,472 million (AIHW 1994), so that an estimated \$781 million was spent on non-prescription drugs. This represents 22.8% of total pharmaceutical expenditure in 1992-93. If the same proportion is applied to 1993-94 pharmaceutical expenditure of \$4,042 million, the total estimated expenditure on over-the-counter drugs is \$920 million.

An alternative source of data for estimating over-the-counter drug expenditure is provided by the 1993-94 ABS Household Expenditure Survey (ABS 1996). According to this survey, an average of \$3.55 per household per week was spent on non-prescription medicines and pharmaceutical products in 1993-94 (estimated by adding expenditure categories 460-463 and 467). This corresponds to total national expenditure of \$1,221 million for over-the-counter medicines, with an estimated 95% confidence interval of \$1,100 to \$1,340 million. The lower bound of this interval is almost 20% higher than the estimate based on estimated expenditure for unsubsidised prescription drugs.

For allocation of over-the-counter drug expenditure in the DCIS, total expenditure for 1993-94 for over-the-counter drugs is estimated as the average of the two estimates described above, that is, \$1,070 million. The estimated total expenditure on prescription drugs is thus \$2,972 million.

#### Data sources

- AIHW estimates of expenditure on private prescriptions.
- 1993-94 ABS Household Expenditure Survey (ABS 1996).

### 8.3.2 Expenditure on prescription drugs

The 1989–90 methodology attributed total pharmaceutical expenditure (prescription and non-prescription) to diseases using the pattern of drugs prescribed or advised in the GP survey data (see Chapter 5 for details of this data set). Each prescription (or advice) was given equal cost weight. This methodology did not allow for differences in average cost per prescription or in the average number of repeat prescriptions for different diseases. Additionally, it did not allow for changes in relative prescription volume of different classes of drugs since 1990.

To address these problems, it was decided to use detailed estimates for 1993–94 of total prescriptions and total costs of drugs, disaggregated into a reasonably large set of therapeutic categories, as the starting point for attribution of prescription drug costs. Within each of these therapeutic categories, total prescriptions and costs are attributed to disease in accordance with the pattern of diseases for which that category of drug was prescribed in the GP survey encounters. This method takes into account differences between disease groups in the average cost per prescription and in the average number of repeats, changes in relative prescription volume of different classes of drugs, and also substitution of specific drugs used for a disease in 1990 by new or alternate drugs within the same therapeutic category in 1993–94.

The therapeutic categories used for the DCIS (Table 8.1) are based on an aggregation of the therapeutic groups used by the Pharmaceutical Benefits Pricing Authority (1994). Table 8.1 also shows the corresponding Anatomical Therapeutic Chemical (ATC) codes for these categories. The ATC classification is used by the Drug Utilisation Sub-Committee of the Pharmaceutical Benefits Advisory Committee to report annual estimates of the total numbers of community prescriptions filled in Australia (Commonwealth Department of Human Services and Health 1995).

The estimates are based on data from the PBS/RPBS for prescriptions submitted for payment of a subsidy, together with data on non-subsidised prescriptions derived from an ongoing survey of a representative sample of community pharmacies. For those drugs which are listed on the PBS, total costs (government and patient) are estimated assuming that, under co-payment, prescriptions for a particular drug cost the same as prescriptions for that drug which attract a subsidy. Costs for private prescriptions are not estimated.

**Table 8.1: Drug groups used in the DCIS**

DCIS group	Review group (minor codes)	Type of drug	ATC group
1	10	Penicillins	J01C
2	11	Tetracyclines	J01A
3	12	Macrolides	J01FA
4	14	Cephalosporins	J01D
5	13, 15–19, 82	Other antibiotics and antiparasitics	D01B, G04AA–AC, J01B, J01E, J01FF, J01G, J01M, J01XA–XB, J01XD, J05, P01B, P02, P03
6	20	Anti-malarials	P01B
7	21	Antituberculars and antileprotics	J04
8	22	Anthelmintics	P02
9	23	Vaccines	J07
10	25	Narcotics analgesics	N02A, N02BA51, N02BE51
11	28	Anti-depressants	N06A, N06C
12	26, 27, 29	Benzodiazepines, sedatives, hypnotics, tranquilisers and anti-migraine	N02C, N05
13	30	Anti-epileptics	N03A
14	31	Anti-Parkinsonism drugs	N04A–N04B
15	32	Central nervous system stimulants	N06B, G02C
16	33	Smooth muscle stimulants	N07A
17	34	Muscle relaxants	M03
18	36	Non-narcotic analgesics	M02, N02BE excl. BA51, BE51
19	37	Non-steroidal anti-inflammatory drugs	M01, N02BA
20	38	Uricosurics	M04
21	40	Diuretics	C03
22	41–42	Anti-hypertensives and beta-blockers	C02, C07, C08
23	43–44	Anti-anginals and anti-arrhythmics	C01B–C01D
24	45	Anti-hyperlipidaemics	B04
25	46	Cardiac stimulants	C01A
26	47	Coagulants and anti-coagulants	B01–B02
27	55	Antihæmorrhoidal drugs	C05
28	49–54, 56, 57, 65	Alimentary system drugs	A02, A03A–B, A03F, A04, A06, A07–A09, A10B, H01AA–BA
29	60	Oral contraceptives	G03A
30	39, 58, 59, 61, 62, 63	Other hormones	A14, G03B–X, H02, H03, H05
31	64	Insulins	A10A
32	66, 71, 77	Nasal preparations, coughs and colds	R01, R02, R05
33	69,70	Anti-asthmatics, anti-bronchitics, anti-histamines	D04AA, R03, R06
34	72	Anti-neoplastics and immunosuppressants	L
35	73–75	Vitamins, dietary, electrolytes	A11, A12, B03, G04B
36	76	Intravenous infusion	B05
37	78–80	Topical anti-infectives	D01, D06, G01
38	81,83	Other dermatologicals	D02, D03, D04AB–AX, D05,
39	84–88	Eye and ear drugs	S
40	48, 67, 68, 90, 95	Various other drugs	C04, G02A, H01BB, V01, V03

The total prescriptions, numbers of private prescriptions and total costs for PBS-listed drugs were estimated for the 40 DCIS drug groups by adding estimates for the corresponding ATC groups (Table 8.2) (Commonwealth Department of Human Services and Health 1995). Private prescriptions represented just over 4% of total prescriptions overall. Costs for these drugs were estimated at the ATC sub-group level using the average cost per prescription of PBS-listed drugs in that sub-group. Assuming that the cost per private prescription is twice the average cost per prescription for PBS-listed drugs at the ATC sub-group level results in a total estimated expenditure on private prescriptions of \$274 million (or 9.2% of total expenditure on prescription drugs). This is very close to total expenditure on private prescriptions for 1993–94, estimated by extrapolating data for 1991–92 and 1992–93 (AIHW 1994:143).

Total expenditure,  $PDCST_i$ , for each DCIS drug group  $i$  was inflated by approximately 10% to ensure that the sum across all drug groups equalled the total estimated in Section 8.3.1 of \$2,972 million for prescription drugs. The final estimates for the DCIS drug groups are shown in Table 8.2.

#### *Assumptions*

- Under co-payment, prescriptions for a specific drug preparation cost the same as prescriptions for that drug preparation which attract a subsidy.
- Private prescriptions are assumed to cost twice the average cost of prescriptions for PBS-listed drugs in the same therapeutic group.

#### *Data sources*

- Prescription drug use and costs (1993 Australian Statistics on Medicines).

**Table 8.2: Total prescriptions and expenditure for DCIS drug groups, 1993-94**

DCIS group <i>i</i>	Type of drug	Total scripts ('000s)	Private scripts ('000s)	Total cost ('\$000) PDCST <sub><i>i</i></sub>	Average cost per script (\$)
1	Penicillins	11,913	8	153,273	13
2	Tetracyclines	4,025	31	39,882	10
3	Macrolides	3,621	19	39,306	11
4	Cephalosporins	3,242	1	43,549	13
5	Other antibiotics and antiparasitics	4,242	59	82,918	20
6	Anti-malarials	811	88	14,559	18
7	Antituberculars and antileprotics	9	3	213	23
8	Anthelmintics	26	0	284	11
9	Vaccines	2,155	436	56,622	26
10	Narcotics analgesics	5,249	1,454	71,183	14
11	Anti-depressants	5,221	10	77,892	15
12	Benzodiazepines, sedatives, hypnotics, tranquillisers and anti-migraine	11,527	478	92,848	8
13	Anti-epileptics	1,177	4	37,129	32
14	Anti-Parkinsonism drugs	668	2	24,737	37
15	Central nervous system stimulants	109	31	2,139	20
16	Smooth muscle stimulants	41	1	869	21
17	Muscle relaxants	78	19	5,732	74
18	Non-narcotic analgesics	3,982	108	31,452	8
19	Non-steroidal anti-inflammatory drugs	8,818	131	110,893	13
20	Uricosurics	1,244	1	13,515	11
21	Diuretics	3,911	1	44,208	11
22	Anti-hypertensives and beta-blockers	15,923	12	403,670	25
23	Anti-anginals and anti-arrhythmics	5,615	2	134,648	24
24	Anti-hyperlipidaemics	2,560	6	144,725	57
25	Cardiac stimulants	876	0	7,075	8
26	Coagulants and anti-coagulants	960	262	13,184	14
27	Antihæmorrhoidal drugs	413	44	6,500	16
28	Alimentary system drugs	10,483	522	395,030	38
29	Oral contraceptives	3,851	100	58,471	15
30	Other hormones	8,349	207	142,509	17
31	Insulins	331	1	46,755	141
32	Nasal preparations, coughs and colds	1,680	330	30,226	18
33	Anti-asthmatics, anti-bronchitics, anti-histamines	13,993	1,333	313,744	22
34	Anti-neoplastics and immunosuppressants	431	0	51,748	120
35	Vitamins, dietary, electrolytes	3,228	62	36,434	11
36	Intravenous infusion	133	1	2,508	19
37	Topical anti-infectives	3,193	289	30,565	10
38	Other dermatologicals	5,531	487	103,342	19
39	Eye and ear drugs	7,658	21	84,325	11
40	Various other	583	14	23,341	40
<b>Total</b>	<b>Total drugs</b>	<b>157,856</b>	<b>6,578</b>	<b>2,972,000</b>	<b>19</b>

### 8.3.3 Allocation of prescription drug costs to disease

Total prescriptions and costs for each DCIS drug category are attributed to disease in accordance with the pattern of diseases for which that category of drug was prescribed in the GP survey encounters. Drugs coded in the GP survey included prescription drugs (PBS and private) as well as non-prescription medicines advised by general practitioners. GP survey drug codes were classified as either prescription or non-prescription through comparison with prescription drugs listed in the 1993 Australian Statistics on Medicine and with advice from the Pharmaceutical Benefits Branch of the Department of Human Services and Health.

The attribution fractions for use and costs of prescription drugs in DCIS group  $i$  ( $i = 1, \dots, 40$ ) are calculated based on the set of prescriptions for drugs in that group in the GP survey. Unlike referrals to specialists and allied health practitioners, the reason or reasons for each prescription are recorded in the encounter record. If more than one reason for a given prescription is recorded, the prescription is assumed to be equally attributable to all the reasons given. The attribution fraction for disease group  $d$ , DCIS drug group  $i$ , sex  $s$  and age  $a$  is then:

$$\alpha_{disa} = \frac{\sum_{p=1}^{P_{isa}} \left( \frac{wb_p \times n_{pd}}{n_p} \right)}{\sum_s \sum_a \sum_{p=1}^{P_{isa}} wb_p} \quad (8.1)$$

- where:
- $P_{isa}$  = Total prescriptions for drugs in DCIS group  $i$  for age  $a$  and sex  $s$
  - $wb_p$  = GP survey weight for encounter in which prescription  $p$  is made
  - $n_{pd}$  = Number of diseases in disease group  $d$  specified as reasons for prescription  $p$
  - $n_p$  = Number of diseases specified as reasons for prescription  $p$

This definition of  $\alpha_{disa}$  ensures that the sum of the attribution fractions for any specific drug group  $i$ , sex  $s$  and age  $a$  across all disease, age and sex groups is unity.

#### Assumptions

- For each DCIS drug group, the relative distribution of prescriptions by disease, age and sex for all community prescriptions in 1993–94 is the same as that for prescriptions by general practitioners in 1990–91. For diseases where a significant proportion of prescriptions are made by medical specialists, this assumption may have limited validity.
- Within each DCIS drug group, each prescription is assumed to generate equal utilisation and costs.

#### Data sources

- 1990–91 National Survey of Morbidity and Treatment in General Practice in Australia.



### 8.3.4 Allocation of over-the-counter drug costs to disease

Allocation of over-the-counter drug costs to disease, age and sex groups was based on the reported use of medications in the two weeks prior to interview in the National Health Survey. The attribution was based on the sum of the use of 10 medication types: vitamins, cough medicines, allergy medications, skin preparations, laxatives, heart medications, tranquillisers, pain-killers, sleeping medications and other medications. For each medication used, up to three reasons for use (in terms of health conditions) were coded.

For each instance  $m$  of use of a class of medication  $k$ , the respondent was asked whether the medication was 'prescribed or advised by a doctor'. If the response was 'No/none' or 'Yes/some', then  $n_{mk}$  uses of an over-the-counter medication were assumed to have occurred

- where:  $n_{mk}$  = 1 for cough medicines, allergy medications, skin preparations, laxatives and heart medications
- =  $t$  for sleeping medications, pain-killers and tranquillisers, where  $t$  is the number of types of medications listed and doctor prescribed 'No/none'
- =  $t/2$  for sleeping medications, pain-killers and tranquillisers, where  $t$  is the number of types of medications listed and doctor prescribed 'Yes/some';  $t$  is rounded down to nearest integer
- = 1 if one type of vitamin or other medication taken and doctor prescribed 'No/none' or if more than one type of vitamin or other medication taken and doctor prescribed 'Yes/some'
- = 2 if more than one type of vitamin or other medication taken and doctor prescribed 'No/none'

The reported number of uses of over-the-counter medications during the two weeks prior to interview will be substantially higher than the actual number of over-the-counter purchases of medications, since a given over-the-counter medication is often likely to be used for periods substantially longer than two weeks. Analysis of the National Health Survey data by Schofield (1997) found that the reported number of uses of prescribed or advised medications in two weeks amounted to 15% of total prescriptions for 1989-90. This represents an inflation factor of 6.67 rather than 26 to convert 'use of medications in 2 weeks' to an estimate of medications prescribed (and purchased) in 12 months. The inflation factor for over-the-counter medications is likely to be even lower than that for prescription drugs, but in the absence of any additional information, the factor 6.67 is used in the Disease Costs and Impact Study to convert 'use of medications' to annual purchases of medications. To the extent that this factor is an overestimate, the DCIS will underestimate the annual purchases of over-the-counter medications and overestimate the average unit cost per purchase. The total estimated expenditure on over-the-counter medications for a specific age-sex-disease group will not be biased by this assumption.

Using this assumption, there are estimated to be a total of approximately 140 million purchases of over-the-counter medications per annum in Australia at an average unit cost of \$7.60. In comparison, there were a total of 161 million prescriptions filled in 1993.

These estimates exclude non-prescription medications 'advised' by a doctor. Based on the GP survey data, there are approximately 400,000 'advices' per year by general practitioners for patients to use non-prescription medications. The actual number of advised purchases is probably lower, as not all patients will follow such advice and some will already have the

advised medication. Since the 'advised' medications are likely to represent less than 5% of total over-the-counter purchases, the model does not attempt to separately estimate use patterns of these, but assumes that the utilisation pattern of drugs 'not prescribed or advised' in the National Health Survey is representative of the use of over-the-counter medicines.

### Attribution fractions by ICD-9 chapter

Numbers of uses of over-the-counter medications were calculated from the National Health Survey data as described above. The reasons given were grouped into ICD-9 chapters as specified in Table 1.4, and attribution fractions to age-sex group and Chapter  $c$  calculated assuming that all over-the-counter drug purchases were of equal average cost:

$$\beta_{csa} = \frac{\sum_{k=1}^{10} \sum_{m=1}^{m_{ksa}} \frac{(n_{mk} \times wn_m \times r_{md})}{r_m}}{\sum_s \sum_a \sum_{k=1}^{10} \sum_{m=1}^{m_{ksa}} n_{mk} \times wn_m} \quad (8.2)$$

- where:
- $m_{ksa}$  = Total number of instances of use of over-the-counter medication in class  $k$  for respondents of age  $a$  and sex  $s$
  - $wn_m$  = National Health Survey weight for instance  $m$  of medication use
  - $n_{mk}$  = Number of uses of medication in class  $k$  and instance  $m$  (as defined above)
  - $r_{md}$  = Number of diseases in disease group  $d$  specified as reasons for use of medication in instance  $m$
  - $r_m$  = Total number of diseases specified as reasons for use of medication in instance  $m$

### Attribution fractions for disease at sub-chapter level

The expenditure allocated to over-the-counter drugs at the chapter level is apportioned to specific disease groups at the sub-chapter level, to the extent possible, using the specific codes used to record health conditions in the National Health Survey. The level of detail of these codes varies with chapter and, where it is necessary to apportion costs at a finer level of detail than available in the National Health Survey, costs are allocated in proportion to total estimated doctor visits.

Neoplasms are coded to a single category in the National Health Survey. For neoplasms, the attribution fraction for age, sex and disease at sub-chapter level of Chapter  $c$  is given by:

$$\gamma_{cdsa} = \frac{(\text{Doctor visits for disease group } d, \text{ sex } s, \text{ age } a)}{(\text{Total doctor visits for Chapter } c, \text{ sex } s, \text{ age } a)}$$

Cardiovascular disease codes in the National Health Survey are mapped to DCIS disease sub-groups as shown in Table 8.3.

**Table 8.3. Allocation of over-the-counter expenditures for cardiovascular disease to DCIS sub-groups at sub-chapter level**

National Health Survey code	Allocation to DCIS disease sub-group
15 Atherosclerosis	7.7 Diseases of arteries etc.
17 Varicose veins	7.8 Diseases of veins etc.
18 Haemorrhoids	7.8 Diseases of veins etc.
72 Hypertension	7.2 Hypertensive disease
82 Heart disease	Distribute to 7.1 (Rheumatic heart disease), 7.3 (Ischaemic heart disease), 7.4 (Diseases of pulmonary circulation) and 7.5 (Other forms of heart disease) in proportion to total medical visits
182 Signs and symptoms of heart problems	
119 Stroke after-effects	7.6 Cerebrovascular disease
219 Cerebrovascular disease	

#### Assumptions

- The utilisation pattern of drugs 'not prescribed or advised' in the National Health Survey is representative of the use of over-the-counter medicines in 1993–94.
- Purchases of over-the-counter medications have the same average cost for each age–sex–disease group.
- Each reported use of a medication in the last two weeks corresponds to 6.67 annual purchases (this assumption used only for estimating utilisation rates).
- Over-the-counter pharmaceutical expenditures for cancers and for heart disease are allocated to DCIS disease groups at sub-chapter level assuming that they are distributed across diseases in proportion to numbers of medical visits for each age–sex group.

#### Data sources

- 1989–90 ABS National Health Survey.

### 8.3.5 Total pharmaceutical expenditure by disease

The total pharmaceutical expenditure for disease  $d$ , sex  $s$  and age  $a$ ,  $PEX_{dsa}$ , is estimated by summing the relevant costs for prescription drugs across the 40 DCIS groups and adding the expenditure for over-the-counter drugs:

$$PEX_{dsa} = \sum_{i=1}^{40} \alpha_{disa} \times PDCST_i \times \beta_{csa} \times \gamma_{cdsa} \times OTC \quad (8.3)$$

where:  $PEX_{dsa}$  = Total expenditure on pharmaceuticals for disease  $d$ , sex  $s$ , age  $a$

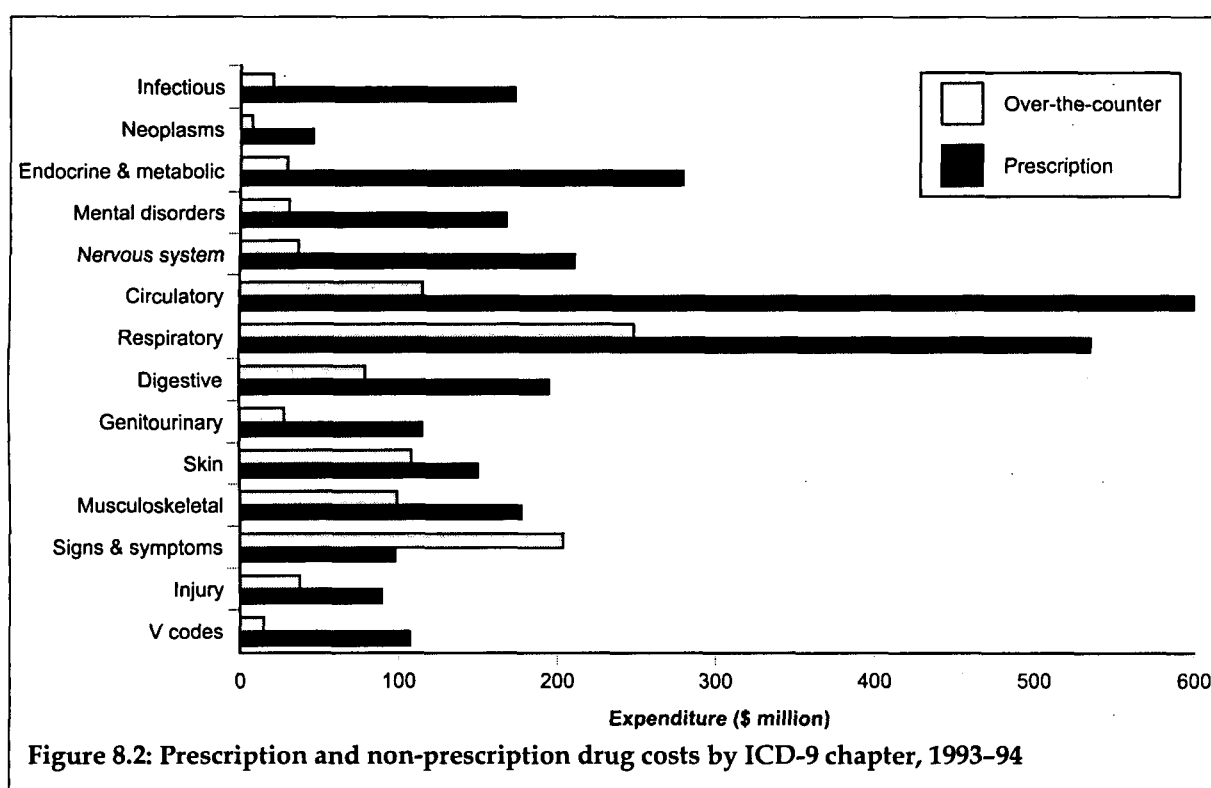
$\alpha_{disa}$  = Attribution fraction to the treatment classification for disease group  $d$  for age  $a$  and sex  $s$ , from Equation 8.1

$\beta_{csa}$  = Attribution fraction to Chapter  $c$  from Equation 8.2

$\gamma_{cdsa}$  = Attribution fraction to the disease grouping  $d$  at sub-chapter level of Chapter  $c$

$PDCST_i$  = Total expenditure for DCIS drug group

Figure 8.2 shows the estimated total expenditures for prescription and non-prescription drugs for 1993–94 by ICD-9 chapter. It can be seen that the distribution of these expenditures across chapters is quite different.



## 8.4 Data issues

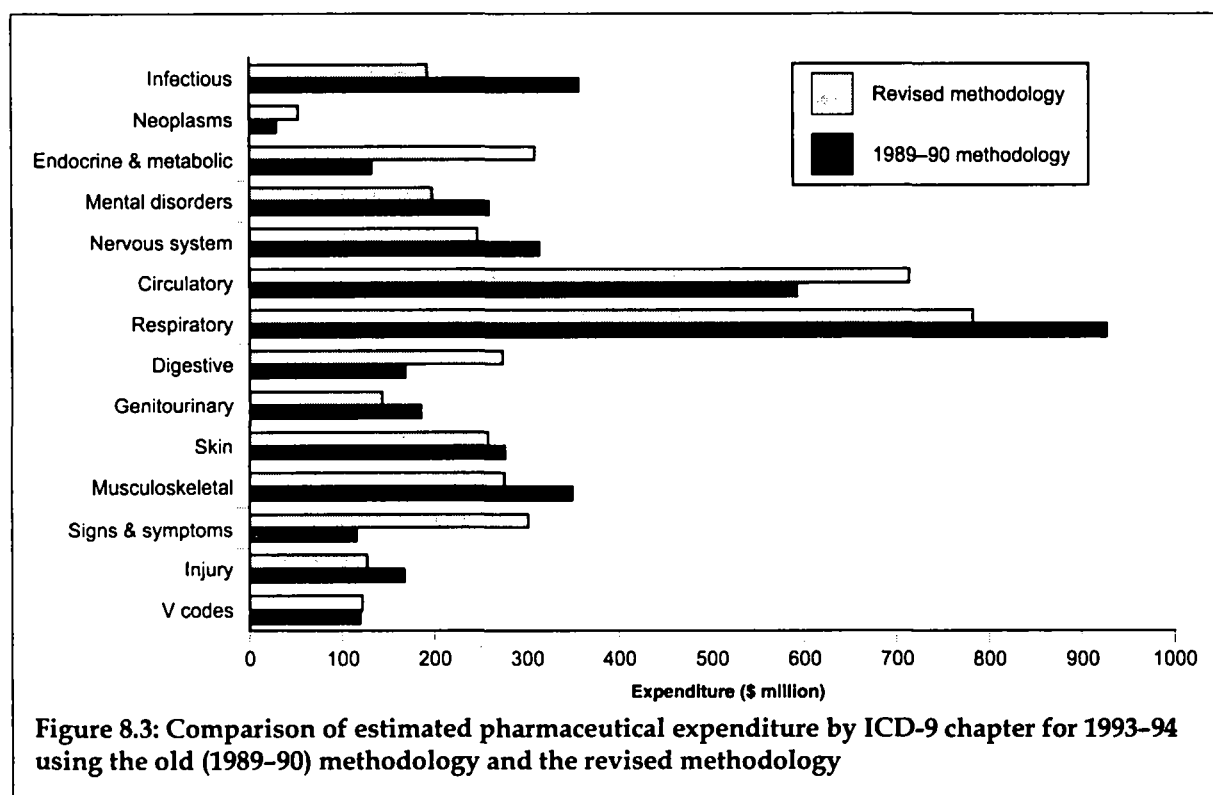
The estimation of total utilisation and costs for prescription drugs by DCIS drug group for 1993–94 was complicated by the fact that two different classifications of drugs are used for reporting statistics on prescription drug use. Mapping of these classifications to a consistent set of drug groups was not always straightforward, and some inaccuracies may have occurred. This problem should be reduced for future years, when the ATC groups are used consistently for all drug statistics.

It was not possible to accurately and consistently estimate the number of over-the-counter drug uses in the last two weeks in the National Health Survey across the 10 categories of medicines as different sets of questions were used for some of these categories. The 1995 National Health Survey contains more detailed and consistent information on the use of medicines and it should be possible to improve these estimates for future years.

## 8.5 Differences from 1989–90 methodology

- The 1989–90 methodology used the GP survey data on all drugs (prescribed or advised) for attribution of total pharmaceutical expenditure to disease group at an age–sex level. The revised methodology uses the GP survey data for prescribed drugs and National Health Survey data for over-the-counter medicines.
- The 1989–90 methodology assumed that each prescription in a GP survey encounter generated equal utilisation and costs. This took no account of differences in average prescription drug cost for different diseases or for systematic variations in the average number of repeats authorised on prescriptions. The revised methodology uses detailed estimates of 1993–94 utilisation and expenditure for 40 drug categories as a starting point for attribution to age–sex–disease groups. This takes into account differences in average drug costs across therapeutic categories, average numbers of repeats, and relative changes in utilisation and costs across drug categories between 1989–90 and 1993–94.

Figure 8.3 compares estimates of total pharmaceutical expenditure by ICD-9 chapter for 1993–94 using the old methodology and the revised methodology. It can be seen that the revised methodology has resulted in substantial changes in these estimates at chapter level for many of the chapters.



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