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.
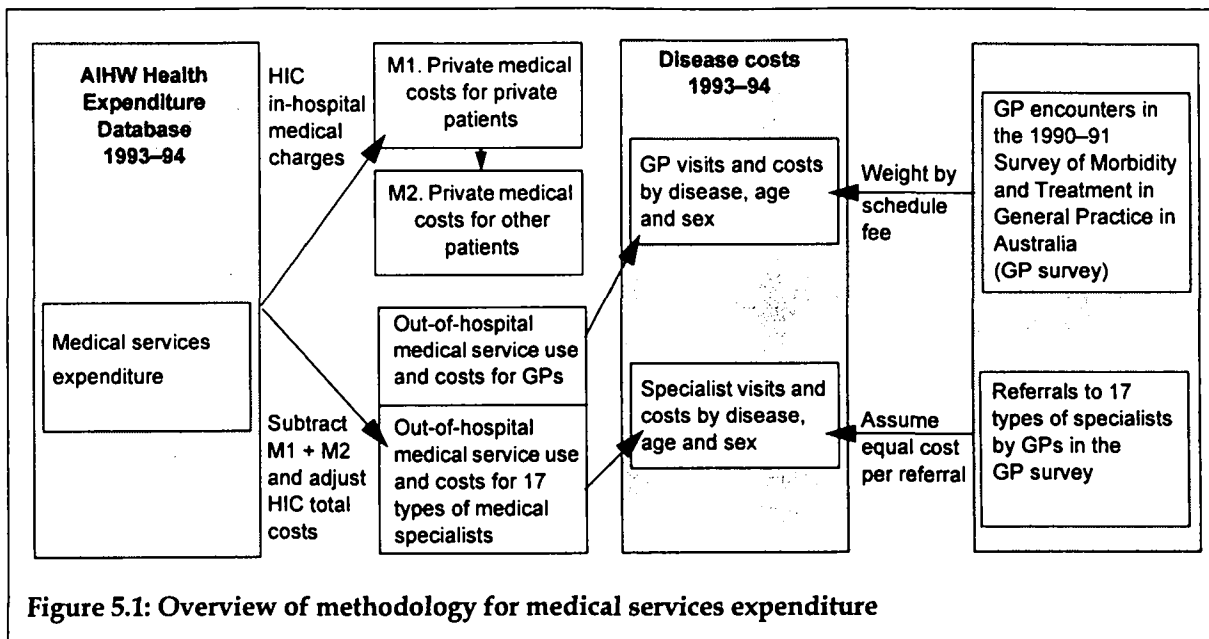
Figure 5.1: Overview of methodology for medical services expenditure

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:

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

α_{dsa} = Attribution factor for age a, sex s and disease group d

This definition of α_{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:

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

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 β_{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[a]

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 rhintis) 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[b]	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.

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

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

α_{dsa} = Attribution factor for sex s, age a and disease group d from Equation 5.1

β_{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.

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

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 65 and over
Geriatrics	Males	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.