2 Methods

The methods are fully described in Appendix 1. In summary, the program is a continuous national study of general practice activity in Australia. It uses details of about 100,000 encounters between GPs and patients (about a 0.1% sample of all general practice encounters) from an ever-changing random sample of approximately 1,000 recognised practising GPs per year.

A random sample of GPs who claimed at least 375 general practice Medicare items of service in the previous 3 months is regularly drawn from Medicare Australia data by the Primary and Ambulatory Care Division of the Australian Government Department of Health and Ageing (DoHA). GPs are approached by letter and followed up by telephone recruitment. Each participating GP completes details for 100 consecutive GP–patient encounters on structured paper encounter forms (Appendix 3). Each also provides information about themselves and their major practice (Appendix 4).

Post-stratification weighting of encounter data adjusts for any variance in the characteristics of the participating GPs from those of the sample frame from which they were drawn, and for the varying 'business' of each GP (measured by the number of claims each has made in the previous 12 months from Medicare Australia). The final sample of encounters shows excellent precision when the age–sex distribution of the patients is compared with the distribution in all Medicare-claimed services of this type.[7]

2.1 Data elements

BEACH includes three interrelated data collections: encounter data, GP characteristics and patient health status. An example of the form used to collect the encounter data and the data on patient health status is included in Appendix 3. The GP characteristics questionnaire is provided in Appendix 4. The data collected include the following:

- **Encounter data:** date of consultation, type of consultation (direct/indirect), up to three Medicare/Department of Veterans' Affairs (DVA) item numbers (where applicable) and other payment source (where applicable) (tick box).

- **Patient data:** date of birth, sex and postcode of residence. Tick boxes are provided for Commonwealth concession cardholder, holder of a Repatriation health card (from DVA), non-English-speaking background (patient self-report—a language other than English is the primary language at home), Aboriginal person (self-identification) and Torres Strait Islander person (self-identification). Space is provided for up to three patient reasons for encounter (RFEs).

- **The problems managed** at encounter (at least one and up to four). Tick boxes are provided to denote the status of each problem as new or continuing for the patient (if applicable).

- **Management of** each problem, including:
  - medications prescribed, supplied by the GP and advised for over-the-counter purchase including brand name, form (where required), strength, regimen, status (if new or continuing medication for this problem for this patient) and number of repeats

- other treatments provided for each problem including counselling, advice and education, and procedures undertaken; and if other treatment was provided by practice nurse (tick box)
  - new referrals to medical specialists, allied health professionals and hospital
  - investigations including pathology tests, imaging and other investigations ordered at the encounter.
- **GP characteristics:** age and sex, years in general practice, number of GP sessions worked per week, number of GPs working in the practice, postcode of major practice address, country of graduation, postgraduate general practice training and Fellow of the Royal Australian College of General Practitioners status, after-hours care arrangements, use of computers in the practice, whether the practice is accredited, whether it is a teaching practice, work undertaken in other clinical settings and hours worked in direct patient care.

2.2 Statistical methods

The analysis of all BEACH data was conducted with Statistical Analysis System (SAS) version 9.1.3.[8] When originally published, data from 1999–00 to 2004–05 were analysed using SAS version 6.12[9] (with additional programming to adjust for the cluster sample study design). In this report (and others published since 2007) these data have been re-analysed using SAS version 9.1.3 (which adjusts for the cluster design without the need for additional programming). This has resulted in slightly tighter confidence intervals and minor variations in point estimates (of up to 0.1) when compared with data published in earlier annual reports for the 1998–2004 data years.

BEACH is a single stage cluster sample study design, each 100 encounters forming a cluster around each GP participant. In cluster samples, variance needs to be adjusted to account for the correlation between observations within clusters. Procedures in SAS version 9.1.3 are used to calculate the intracluster correlation and adjust the confidence intervals accordingly.[8]

The encounter is the primary unit of inference. Proportions (%) are used when describing the distribution of an event that can arise only once at a consultation (for example, age, sex), or to describe the distribution of events within a class of events (for example, problem A as a percentage of total problems). Rates per 100 encounters are used when an event can occur more than once at the consultation (for example RFEs, problems managed or medications).

Rates per 100 problems are used when a management event can occur more than once per problem managed.

The statistical significance of changes in characteristics of the GPs is tested using the chi-square test statistic. However, in general, the results for events occurring at GP–patient encounters present the rate per 100 encounters and the 95% confidence interval.

- Changes over time, in the frequency of these events are judged significant (that is, a real change has occurred) if the two sets of confidence intervals do not overlap. For example, Result A: 11.5 per 100 encounters (95% CI: 11.3–11.7) is significantly less than Result B: 11.9 per 100 encounters (95% CI: 11.8–12.0).
- If the two sets of confidence intervals butt together the difference is regarded as marginal. For example, Result A: 11.5 per 100 encounters (95% CI: 11.3–11.7) is marginally lower than Result B: 11.9 (95% CI: 11.7–12.1).
- If they overlap, then no change has been measured.

2.3   Changes over time

While in this report SAS version 9.1.3[8] was used for all analyses, changes in method or approach have occurred on occasion over the 10 years of the BEACH study. Data presented in this report are comparable for each result across all data years. Where methodological changes have occurred, the data have either:

- been recalculated using the new method (for example, body mass index was recalculated due to a change in the World Health Organization body mass index groupings)
- been regrouped for comparability (where this occurs, it is has been noted in the footnotes of the table)
- been omitted from this report (if recalculation or grouping was not possible). Where data are omitted, this is noted in the tables as not applicable (N/A) or not available (NAv), as appropriate.

Readers should be aware that there may be discrepancies between data in this report and data published in earlier BEACH reports.

In measuring changes over time, the 2007–08 results are compared with those from 1998–99 wherever possible. However, as in any long-term research program, changes occur over the years. For example, in response to requests from DoHA (then the Department of Health and Aged Care), more detailed coding systems for pharmaceuticals, pathology and imaging test orders were developed, and these were applied from year 3 (2000–01) onwards. In these cases, change is measured from 2000–01 because earlier years are not comparable. Practice nurse activity data were not collected until 2005–06, so the changes are only considered between 2005–06 and 2007–08.

Each table includes the most frequent events occurring in 2007–08 and the comparative results for each of the earlier years have been provided. In addition, each table includes data for events that were more frequent in past year(s) that are no longer as frequent in 2007–08. All results are presented in decreasing order of frequency by the 2007–08 data.

The direction and type of change between 1998–99 (or 2000–01 where appropriate) and 2007–08 is indicated for each result in the far right column of the tables:

- ↑/↓ indicates a statistically significant linear change
- ↑/↓ indicates a marginally significant linear change
- § indicates a non-linear significant or marginal change
- — indicates there was no change.

2.4   Extrapolated national estimates

Where the results demonstrate a significant change over time, the estimated national change across total GP Medicare services from 1998–99 (or where appropriate 2000–01) to 2007–08 can be calculated using the method detailed below. An example of an extrapolated national change is given in the description of each table in the report from Chapter 5 onward.

- The national estimates are calculated by dividing the rate per 100 encounters of the selected event for 1998–99 (or 2000–01 where appropriate) by 100, and then multiplying by the total number of general practitioner services claimed through Medicare in that year (rounded to the nearest 100,000, see Table 1.1) to give the estimated annual number of events in 1998–99 (or 2000–01). The process is then repeated for 2007–08. The

difference between the two estimates (to the nearest 10,000) gives the estimated national change in the rate of encounters for that event over the period of interest.

- This is expressed as the estimated increase or decrease over the study period (between 1998–99 or 2000–01 and 2007–08), in the number of general practice contacts for that event. For example, an increase or decrease in the number of GP management contacts with problem X occurring in Australia in 2007–08 when compared with 1998–99 (or 2000–01).

Table 1.1 provides the total number of general practice professional service items claimed from Medicare in each financial year from 1998–99 to 2007–08. In this report extrapolations are calculated using the number of GP Medicare items claimed rounded to the nearest 100,000. The rounded number is also provided in Table 1.1. Readers can use the method described above to calculate the national effect of any significant change in a single result over any two time points.

Example of extrapolation

A significant increase in the number of problems managed at encounter (Chapter 7), from 145.3 per 100 encounters in 1998–99 to 151.3 in 2007–08:

- (145.3/100) x 102.6 million = 149.1 million problems managed in general practice nationally in 1998–99, and (151.3/100) x 107.0 million = 161.9 million problems managed in 2007–08.

This suggests there were 12.8 million (161.9 million minus 149.1 million) more problems managed at GP encounters in Australia in 2007–08 than in 1998–99.

Table 1.1: Number of general practice professional services claimed from Medicare Australia each financial year, 1998–99 to 2007–08 ('000)

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08[a]
Number of GP MBS items	102,552	101,517	100,645	99,921	96,919	96,330	98,180	101,095	103,433	107,041
Rounded no. of GP MBS items	102,600	101,500	100,600	99,900	96,900	96,300	98,200	101,100	103,400	107,000

(a)   Medicare data for the 2007–08 year included data from the March 2007 to April 2008 quarters because the 2007–08 financial year data were not available at the time of preparation of this report.

Source: Medicare statistics, Table B1 - Medicare: Number of services ('000) by quarter and financial year of processing by broad type of service. Available from <www6.health.gov.au/internet/main/publishing.nsf/Content/41322B5BFABA25FFCA25744B000334C4/$File/tableb1.xls>.

Limitations of extrapolations

The extrapolations to the total encounters occurring nationally in any one year is only an estimate. It is likely to provide:

- an underestimate of the true 'GP workload' of a condition/treatment because the extrapolations are made to GP Medicare items claimed, not to the total number of GP encounters per year (which include indirect encounters and those paid by sources other than Medicare, such as DVA, state governments, work cover, employers)

- an overestimate of the management rate of a group of conditions (for example cardiovascular disease) because there is a chance that more than one problem of this type will be managed at a single encounter. In the extrapolations, two cardiovascular problems managed at one encounter will be counted as two encounters.

Further, the base numbers used in the extrapolations are rounded to the nearest 100,000 and the extrapolations are rounded to the nearest 10,000. However, the rounding has been applied to all years, so the effect on measures of change will be very small. The extrapolation therefore still provides an indication of the size of the effect of measured change nationally.

2.5 Classification of data

Reasons for encounter, problems managed and the process of care

The following data elements are classified according to the International Classification of Primary Care—Version 2 (ICPC-2), a product of the World Organization of Family Doctors (Wonca)[10], and the recommended Australian standard for classification of data from general practice or patient self-report[11]:

- patient reasons for encounter (RFEs)
- problems managed
- clinical treatments (for example, counselling, advice)
- procedural treatments
- referrals
- investigations ordered (including pathology, imaging and other investigations).

Coding of data

The above data elements are coded in more detail using ICPC-2 PLUS[12], an interface terminology developed by the FMRC from all the terms used by GPs in studies such as the Australian Morbidity and Treatment Survey 1990–91[13], the Morbidity and Therapeutic Index 1992–1998 (a clinical audit tool that was available to GPs) and BEACH 1998–2008, that together have included about 2 million encounter records. These terms are classified according to ICPC-2 to ensure international standards for reporting.

When the free-text data are received from the GPs, trained secondary coders (who are undergraduate students studying health information management or medical science) code the data in more specific terms using ICPC-2 PLUS. This ensures high coder reliability, and automatic classification of the concept, and gives the ability to 'ungroup' such ICPC-2 rubrics as 'other diseases of the circulatory system' and select a specific disease from the terms within it.

Presentation of data classified in ICPC-2

Statistical reporting is almost always at the level of the ICPC-2 classification (for example, acute otitis media/myringitis—ICPC-2 code H71). However, there are some exceptions where data are grouped either above the ICPC-2 level or across the ICPC-2 level. These grouped morbidity, pathology and imaging codes are defined in Appendix 5, and chronic morbidity groups are provided in Appendix 6.

Reporting morbidity with groups of ICPC-2 codes

When recording problems managed, the GP is not always very specific. For example, in recording the management of diabetes, they may simply record the problem as 'diabetes'. In

ICPC-2, 'diabetes unspecified' is classified as non-insulin-dependent diabetes (code T90). There is another code for insulin-dependent diabetes (T89). In some cases the GP may simply have failed to specify that the patient had insulin-dependent diabetes. The research team therefore feels that for national data reporting, it is more reliable to group the two codes T90 and T89 and label this 'Diabetes—all*'—the asterisk indicating that multiple ICPC-2 codes (as in this example) or ICPC-2 PLUS codes (see below) are included. A list of codes included in these groups are provided in Appendix 5.

Reporting morbidity across ICPC-2 PLUS codes

In other cases a concept can be classified within (but be only part of) multiple ICPC-2 codes. For example, osteoarthritis is classified in ICPC-2 in multiple broader codes according to site, for example L92—shoulder syndrome (includes bursitis, frozen shoulder, osteoarthritis of shoulder, rotator cuff syndrome). When reporting osteoarthritis in this publication, all the more specific osteoarthritis ICPC-2 PLUS terms are taken from all the appropriate ICPC-2 codes and grouped. This group is labelled 'Osteoarthritis*'—the asterisk again indicating multiple codes, but in this case they are PLUS codes rather than ICPC-2 codes. A list of codes included in these groups are provided in Appendix 5.

Reporting chronic morbidity

To identify chronic conditions, a chronic condition list[14] classified according to ICPC-2 was applied to the BEACH data set. In general reporting, both chronic and non-chronic conditions (for example, diabetes and gestational diabetes) may have been grouped together when reporting (for example, diabetes—all*). When reporting chronic morbidity, only problems regarded as chronic have been included in the analysis. Where the group used for the chronic analysis differs from that used in other analyses in this report, they are marked with a double asterisk. Codes included in the chronic groups are provided in Appendix 6.

Reporting pathology and imaging test orders

All the pathology and imaging tests ordered by the GPs are coded very specifically in ICPC-2 PLUS, but the ICPC-2 classifies pathology and imaging tests very broadly (for example, a test of cardiac enzymes is classified in K34—Blood test associated with the cardiovascular system; a CT scan of the lumbar spine is classified as L41—Diagnostic radiology/imaging of the musculoskeletal system). In Australia, the Medicare Benefits Schedule (MBS) classifies pathology and imaging tests in groups that are relatively well recognised. The team therefore re-grouped all pathology and imaging ICPC-2 PLUS codes into MBS standard groups. This allows comparison of data between data sources. These groups are marked with an asterisk and included in Appendix 5.

Classification of pharmaceuticals

Pharmaceuticals that are prescribed, provided by the GP or advised for over-the-counter purchase are coded and classified according to an in-house classification, the Coding Atlas for Pharmaceutical Substances (CAPS).

This is a hierarchical structure that facilitates analysis of data at a variety of levels, such as medication class, medication group, generic composition and brand name.

Strength and regimen are independent fields that, when combined with the CAPS code, give an opportunity to derive the prescribed daily dose for any prescribed medication or group of medications.

CAPS is mapped to the Anatomical Therapeutic Chemical (ATC)[15] classification, which is the Australian standard for classifying medications at the generic level.

The ATC has a hierarchical structure with five levels. For example:

- Level 1: C—Cardiovascular system
- Level 2: C10—Serum lipid reducing agents
- Level 3: C10A—Cholesterol and triglyceride reducers
- Level 4:C10AA—HMG CoA reductase inhibitors
- Level 5: C10AA01—Simvastatin (the generic drug).

Reporting pharmaceutical data

For pharmaceutical data, there is the choice of reporting in terms of the CAPS coding scheme or the ATC. They each have advantages in different circumstances.

In the CAPS system, a new drug enters at the product and generic level, and is immediately allocated a generic code. Therefore, the CAPS classification uses a bottom–up approach.

In the ATC, a new generic may initially enter the classification at any level (1 to 5), not necessarily always at the generic level. Reclassification to lower ATC levels may occur later. Therefore, the ATC uses a top–down approach.

When analysing medications across time, a generic medication that is initially classified to a higher ATC level will not be identifiable in that data period and may result in under-enumeration of that drug during earlier data collection periods.

In measuring changes in medications over time, the team chose to report at Level 2 of the ATC (which is more stable over time than Level 3), and in CAPS for the generic-level drugs.

2.6　Changes to data elements and reporting methods

Changes in data elements and reporting methods have occurred on occasion over the 10 years of the BEACH study:

- More detailed coding systems for pharmaceuticals, pathology and imaging test orders were developed, and these were applied from year 3 (2000–01) onwards. In these cases, change is measured from 2000–01 because earlier years are not comparable.
- Two changes were made to the BEACH form from 2005–06 onwards to capture practice nurse activity associated with the GP–patient consultations. From 2005–06 onwards:
  - GPs could record multiple (up to three) Medicare item numbers
  - in the 'other treatments' section, for each problem managed, the GP was asked to tick the practice nurse box if the treatment recorded was provided by the practice nurse rather than by the GP. If the box was not ticked, the research team assumed that the GP gave the treatment.

  These two changes have implications for the reporting of Medicare/DVA-claimable encounters (Chapter 5), practice nurse activity (Chapter 13) and other treatments (Chapter 10).

Medicare/DVA-claimable encounters

For the first 7 years of the BEACH program (1998–99 to 2004–05), where a Medicare item number was claimable for the encounter, the GP was instructed to record only one item number. Where multiple item numbers (for example, an A1 item such as 'standard surgery consultation' and a procedural item number) were claimable for an encounter, the GP was instructed to record the lower of these (usually an A1 item number). For reporting purposes Medicare-claimable encounters were broken down according to the item number recorded by the GP as claimable (either through Medicare or through DVA) for the encounter.

In this report the Medicare/DVA claimable encounters count only one item number per Medicare/DVA-claimable encounter for comparability with previous years (see Chapter 5). Practice nurse Medicare-claimable encounters are not reported in Chapter 5.

The selection of one item number was undertaken on a priority basis: consultation item numbers override incentive item numbers, which override procedural item numbers, which override other Medicare item numbers.

Practice nurse activity

The research team began to capture practice nurse activity (in 2005–06) due to the introduction of four new MBS item numbers in November 2004 which covered some selected activities conducted by a practice nurse on behalf of a medical practitioner.[16]

The primary aim of BEACH is to describe general practice activity. Before 2005–06, 'general practice activity' has been described in terms of GP–patient encounters and this was considered close to equivalent to 'general practitioner activity'. However, the introduction of the practice nurse item numbers meant that, if practice nurse activity associated with the GP–patient encounter was not included, the content of the consultation was not fully described.

Chapter 13 provides a breakdown of the practice nurse Medicare items claimed, the morbidity managed with the assistance of the practice nurse, and the other treatments given by the practice nurse as recorded by the GP participants from 2005–06 to 2007–08.

When viewing these results, it must be remembered that these practice nurse data do not include activities undertaken by the practice nurse during the GP's BEACH recording period that were performed outside the recorded encounter. These could include Medicare-claimable activities (for example immunisations/vaccinations) provided under instruction from the GP but not provided at the time of the encounter recorded in BEACH, or provision of other activities not currently claimable from Medicare (for example dietary advice on a one-to-one basis, or in a group situation).

Other treatments

In the chapter on other treatments (Chapter 10), all recorded clinical and procedural treatments are included, irrespective of whether they were provided by the GP or by the practice nurse.