

2 Methods

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The BEACH program is a continuous national study of general practice activity in Australia. The methods used are described in detail below. In summary it collects details for 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 about 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. 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 1). Each also provides information about themselves and their major practice (Appendix 2).

Post-stratification weighting of each individual year's encounter sample 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 'busyness' 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.¹

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 1. The GP characteristics questionnaire is provided in Appendix 2. The data collected include the following:

- **Encounter data:** date of consultation, type of consultation (direct/indirect), up to three Medicare/Department of Veterans' Affairs item numbers (where applicable) and other payment source (where applicable) (tick box and free text).
- **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 the Department of Veterans' Affairs), 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). At least one (and up to three) patient reasons for encounter (RFEs) must be recorded and space is provided for up to three.
- The **problems managed** at encounter (at least one and up to four). Tick boxes are provided to denote the status of each problem as a new or continuing problem for the patient (see Glossary).

- **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, number of repeats, and status (new/continuing medication for this problem for this patient)
 - other treatments provided for each problem including counselling, advice and education, and procedures undertaken, and whether the 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, size of 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 done in other clinical settings and hours worked in direct patient care.

2.2 Statistical methods

The analysis of all BEACH data were done with Statistical Analysis System (SAS) version 9.1.3.²

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 intraclass correlation and adjust the confidence intervals accordingly.²

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). Rate per 100 encounters is used when an event can occur more than once at the consultation (for example reasons for encounter, problems managed or medications).

Results for events occurring at GP-patient encounters present the rate per 100 encounters and the 95% confidence interval. Rates per 100 selected problems managed are used when a management event can occur more than once per problem.

Changes over time, and comparisons of result for different groups of patients (e.g. males and females) in the frequency of these events are judged to be:

- 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).
- marginally significant 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 the confidence intervals from the two results overlap, no change has occurred, or there is no difference between the groups being compared.

2.3 Changes over time

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 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 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 the Department of Health and Ageing (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.

The direction and type of change between 1998–99 (or later years, where appropriate) and 2007–08 is indicated for each result in the far right column of some 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 effect of this change has sometimes been extrapolated to the total GP Medicare services from 1998–99 (or other years as appropriate) to 2007–08. The method of extrapolation is described below.

- The national estimates are calculated by dividing the rate per 100 encounters of the selected event for 1998–99 by 100, and then multiplying by the total number of GP services claimed through Medicare in that year (rounded to the nearest 100,000, see Table 2.1) to give the estimated annual number of events in 1998–99. 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 and 2007–08), in the number of GP 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 compared with 1998–99 (or 2000–01).

- Throughout this report data from different time points have been used, and sometimes data years have been combined. Where data years have been combined, the average, rounded number of GP MBS item number claims have been used for extrapolations.

Table 2.1 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 2.1. Readers can use the method described above to calculate the national effect of any reported significant change in a single result over any two time points.

Example of extrapolation

In Chapter 4, the number of problems managed at encounters with GPs steadily increased over the decade, from 145.3 (95% CI: 143.5–147.2) in 1998–99 to 151.3 (95% CI: 149.2–153.4) per 100 encounters in 2007–08.

$$[(151.4/100) \times 109.5 \text{ million}] \text{ minus } [(145.3/100) \times 102.6 \text{ million}] = 165.8 \text{ million minus } 149.1 \text{ million} = 16.7 \text{ million.}$$

This suggests that nationally, in 1998–99 the GP workforce dealt with 149.1 million problems at encounters with their patients, whereas in 2007–08 they dealt with, 165.8 million problems, an increase of 16.7 million, or 11.2%.

Table 2.1: General practice professional services claimed from Medicare Australia ('000) by financial year, 1998–99 to 2007–08

	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
No. of GP MBS items ('000)	102,552	101,517	100,645	99,921	96,919	96,330	98,180	101,095	103,433	109,518
Rounded no. of GP MBS items ('000)	102,600	101,500	100,600	99,900	96,900	96,300	98,200	101,100	103,400	109,500

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](http://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 are only estimates. It is likely to provide:

- an underestimate of the true GP workload of a condition/treatment because the extrapolations are made to the number of 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 the Australian Government Department of Veterans' Affairs, 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 and coding of data

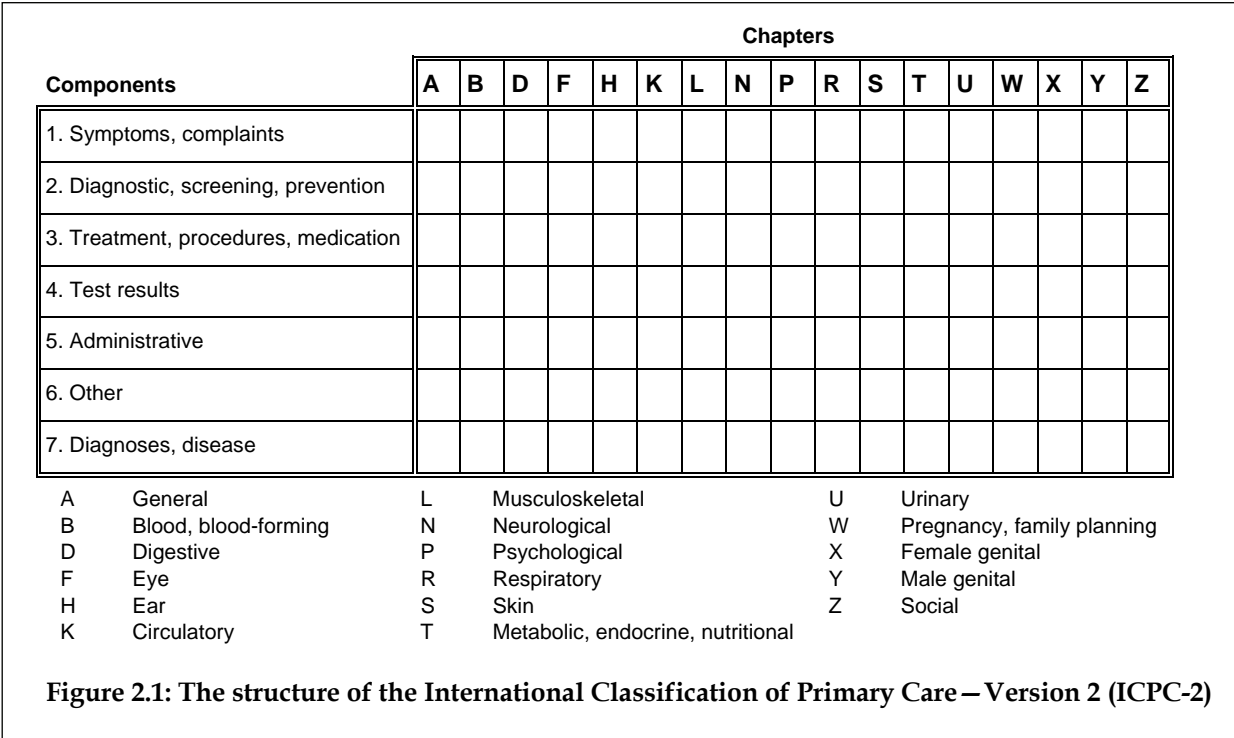
Reasons for encounter, problems managed and the process of care

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)³, and the recommended Australian standard for classification of data from general practice or patient self-report⁴:

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

The ICPC-2 is used in more than 45 countries as the standard for data classification in primary care. It is accepted by the World Health Organization (WHO) in the WHO Family of International Classifications⁵, and is the declared national standard in Australia for reporting of health data from general practice and patient self-reported health information.⁴

The ICPC-2 has a biaxial structure, with 17 chapters on one axis (each with an alphabetic code) and seven components on the other (numeric codes) (Figure 2.1).



Chapters are based on body systems, with additional chapters for psychological and social problems. Component 1 includes symptoms and complaints. Component 7 covers diagnoses. These are independent in each chapter and both can be used for patient reasons for encounter or problems managed.

Components 2 to 6 cover the process of care, and are common throughout all chapters. The processes of care, including referrals, other (non-pharmacological) treatments and orders for pathology and imaging, are classified in these process components of ICPC-2. Component 2 (diagnostic, screening and prevention) is also often applied in describing the problem managed (for example, check-up, immunisation).

The ICPC-2 is an excellent epidemiological tool. The diagnostic and symptomatic rubrics have been selected for inclusion on the basis of their relative frequency in primary care settings, or because of their relative importance in describing the health of the community. It has approximately 1,370 rubrics and these are sufficient for meaningful analyses. However, reliability of data entry, using ICPC-2 alone, requires a thorough knowledge of the classification to ensure correct classification of a concept.

Coding of data

The above data elements are coded in more detail using ICPC-2 PLUS⁶, an interface terminology developed by the Family Medicine Research Centre from all the terms used by GPs in studies such as the Australian Morbidity and Treatment Survey 1990–91⁷, the Morbidity and Therapeutic Index 1992–1998 (a clinical audit tool that was available to GPs) and BEACH 1998–2008, which together have included about 2 million encounter records. These terms are classified according to ICPC-2 to ensure international reporting standards.

When the free-text data are received, 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 respiratory 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). The ICPC-2 code for these individually reported rubrics can be found at: <http://www.globalfamilydoctor.com/wicc/pagers.html>.⁸

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 3.

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 hypertension, they may simply record the problem as ‘hypertension’. In ICPC-2, ‘hypertension unspecified’ is classified as ‘hypertension, uncomplicated’ (code T86). There is another code for ‘hypertension, complicated’ (T87). In some cases the GP may simply have failed to specify that the patient had complicated hypertension. The research team therefore feels that for national data reporting, it is more reliable to group the two codes K86 and K87 and label this ‘Hypertension’. A list of codes included in each of the groups is provided in Appendix 3.

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’ but in this case they are PLUS codes rather than ICPC-2 codes. For a list of codes in these groups see Appendix 3.

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 computerised tomography (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 pathology and imaging ICPC-2 PLUS codes into MBS standard groups. This allows comparison of data between data sources. Groupings are listed in Appendix 3.

Chapter specific code groupings

Within each chapter of this report, the data coded using ICPC-2 PLUS may have been analysed using different groupings. These groups include:

- standard ICPC-2 classification – ICPC-2 chapter level and ICPC-2 rubric code groups. These standard classification groups are defined elsewhere and are not listed in this appendix. Further information about the ICPC-2 chapter structure and rubrics can be found at <http://www.fmrc.org.au/classifi-i.htm>
- standard BEACH grouped codes used in the BEACH annual reports. These groups are listed in Table A3.1 and include ICPC-2 and/or ICPC-2 PLUS codes
- non-standard grouped codes used in chapter-based analysis. Each chapter using non-standard code groups has a table (tables A3.2–A3.12) listing the codes used in these groups. Groups include ICPC-2 and/or ICPC-2 PLUS codes.

Note: if a concept is listed in both Table A3.1 and a chapter-based table (tables A3.2–A3.12) the reader should regard the chapter-based table as correct for that chapter only.

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) classification⁹, which is the Australian standard for classifying medications at the generic level.

2.6 Changes to data elements

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

More detailed coding systems for pathology and imaging test orders were developed from the responses recorded for these data elements by GPs participating in the first 2 years of BEACH. The new codes were applied from year 3 (2000–01) onwards. Changes were also made to the coding of referrals to allied health professionals, and the new codes were used for the first time in 2000–01.

This means that data from earlier years, 1998–99 and 1999–00, can be used when counting the proportion of encounters at which at least one pathology test, or imaging tests was ordered, or in the proportion where at least one referral to any health service was made. However, when looking at changes over time in ordering rates of a specific test type, and in comparing referrals to specialists and to allied health services, this report uses measured change from 2000–01 because earlier years data are not comparable.

2.7 Understanding BEACH encounter data

Many readers of this report will be familiar with other data produced from MBS and the PBS and it is important that readers are aware of how the BEACH data differ from those drawn from such sources.

- In BEACH, each prescription recorded reflects the GP's intent that the patient receives the prescribed medication and the specified number of repeats; the prescription, irrespective of the number of repeats ordered, is counted only once. In contrast, the PBS counts the prescription each time it crosses the pharmacist's counter, so that one prescription with five repeats recorded in BEACH would be counted by the PBS six times if the patient filled all repeats.
- In BEACH, total medications include those prescribed (whether covered by the PBS for all or some patients), those supplied to the patient directly by the GP, and those advised for over-the-counter purchase. The PBS counts only those prescribed medications subsidised by the PBS and costing more than the minimum subsidy (and therefore covered by the PBS for all patients), or medications prescribed for those holding a Commonwealth concession card or for those who have reached the safety net threshold.
- BEACH includes all consultations, irrespective of who pays for them (if anyone), while the MBS data include those GP services that have been billed to Medicare.

Pathology tests done by pathologists that are charged to Medicare are recorded by Medicare Australia. However, these Medicare data are not comparable with BEACH data.¹

This report refers to estimates of prevalence of some diseases, drawn from The National Health Survey (NHS) done by the Australian Bureau of Statistics. The NHS provides estimates of population prevalence of specific diseases, and a measure of the problems taken to the GP by people in the 2 weeks before the survey. Prevalence estimates are based on self-reported morbidity from a representative sample of the Australian population, using a structured interview to elicit health-related information from participants.¹⁰ It also refers to population prevalence estimates from a BEACH substudy which relies on input from both the GP and the attending patient. The methods used in this study are reported elsewhere.¹¹

Much of this report relies on management rates of health problems in general practice. Disease management rates reflect GP workload for a health problem, and they depend on the prevalence of the problem in the community, the chronicity of the problem (as chronic problems require long-term care), and the visit frequency required for health maintenance in the individual patient having the morbidity. Those who are older and/or have more chronic disease are likely to visit more often, and have a greater chance of being sampled in the encounter data. Disease management rates therefore reflect GP workload for a health problem rather than prevalence or incidence of disease.

The BEACH program has generated many papers on a wide range of topics in journals and professional magazines. A complete list of publications is also available from the Family Medicine Research Centre's website <www.fmrc.org.au/publications/>.

2.8 Supplementary Analysis of Nominated Data

In some chapters of this report references are made to the results of Supplementary Analysis of Nominated Data (SAND) studies. This section describes the methods used in the SAND substudies.

A section at the bottom of each recording form investigates aspects of patient health or health care delivery in general practice not covered by the consultation-based data. These additional substudies are referred to as SAND.

- The year-long data period is divided into 10 blocks, each of 5 weeks with three substudies per block. The aim is to include data from about 100 GPs in each block.
- Each GP's pack of 100 forms is made up of 40 forms that ask for the start and finish times of the encounter, and include questions about patient risk factors: patient height and weight (used to calculate body mass index), alcohol intake and smoking status (patient self-report). The start and finish times collected on these encounters are used to calculate the length of consultation (finish time minus start time in minutes).
- The remaining 60 forms in each pack are divided into two blocks of 30. Different questions are asked of the patient in each block and these vary throughout the year.
- The order of SAND sections is rotated in the GP recording pack, so that 40 patient risk factor forms may appear first, second or third in the pack. Rotation of ordering ensures there was no order effect on the quality of the information collected.

Abstracts for all SAND substudies from April 1999 to July 2006 inclusive were published in *Patient-based substudies from BEACH: abstracts and research tools 1999–2006*.¹² Abstracts of results and the research tools used in SAND substudies conducted after August 2006 have been published in the BEACH annual reports in 2007¹³ and 2008.¹ Abstracts of results for all SAND substudies are also available on the Family Medicine Research Centre's website <www.fmrc.org.au/publications/SAND_abstracts.htm>.

Patient risk factor SAND studies

Several chapters of this report refer to the risk behaviours of the patients. These data are drawn from the patient risk factor SAND substudy, which has been consistently applied through the BEACH program since April 2001. The methods used to measure these risk behaviours are summarised below.

The patient risk factors measured include self-reported height and weight (for calculation of body mass index, BMI), alcohol consumption and smoking status. Patient risk factors are investigated for a subsample of 40 of the 100 patient encounters recorded by each GP. For an example of the encounter form with the patient risk factor SAND questions see Appendix 1.

Body mass index

Patient BMI was investigated for a subsample of 40 of the 100 patient encounters. Each GP was instructed to ask the patient (or their carer in the case of children):

- *What is your height in centimetres (without shoes)?*
- *What is your weight in kilograms (unclothed)?*

Metric conversion tables (feet and inches, stones and pounds) were provided to the GP.

Calculations of BMI in adults

The BMI for an adult was calculated by dividing weight (kilograms) by height (metres) squared. The recent WHO recommendations¹⁴ for BMI groups were used, which specify that an adult (18 years and over) with a BMI:

- less than 18.5 is underweight
- greater than or equal to 18.5 and less than 25 is normal
- greater than or equal to 25 and less than 30 is overweight
- of 30 or more is obese.

The reported height for adult patients was checked against sex-appropriate upper and lower height limits from the Australian Bureau of Statistics (ABS).¹⁵ Encounters with adults whose reported heights were outside the sex-appropriate limits were excluded from the analysis.

Calculations of BMI in children

The standard BMI cut-offs described above are not appropriate in the case of children. Cole et al. developed a method that calculates the age–sex-specific BMI cut-off levels for overweight and obesity specific to children aged 2–17 years.¹⁶ There are three categories defined for childhood BMI: underweight/normal, overweight and obese. This method, based on international data from developed Western cultures, is applicable in the Australian setting. The reported height of children was checked against age–sex-appropriate upper and lower height limits from the ABS.¹⁵ Encounters with children whose reported heights were outside the age–sex-appropriate limits were excluded from the analysis.

The BEACH data on BMI are presented separately for adults (aged 18 years and over) and children (aged 2–17 years). The standard BMI cut-offs have been applied for the adult sample, and the method described by Cole et al. has been used for defining overweight and obesity in children (aged 2–17 years).¹⁷

Smoking status

GPs were instructed to ask adult patients (18 years and over):

- *What best describes your smoking status?*

Options: smoke daily; smoke occasionally; previous smoker; never smoked

Respondents were limited to adults aged 18 years and over because there are ethical concerns about approaching the younger patient group to ask for information on smoking for survey purposes. In addition, the reliability of this information from patients aged less than 18 years may be compromised if a parent is present at the consultation.

Alcohol consumption

To measure alcohol consumption, BEACH uses three items from the WHO Alcohol Use Disorders Identification Test (AUDIT)¹⁸, with scoring for an Australian setting.¹⁹ Together, these three questions assess at-risk alcohol consumption. The scores for each question range from zero to four. A total (sum of all three questions) score of five or more for males or four or more for females suggests that the person's drinking level is placing him or her at risk.¹⁹

GPs were instructed to ask adult patients (18 years and over):

- *How often do you have a drink containing alcohol?*

Options: never; monthly or less; once a week/fortnight; 2-3 times a week;
4+ times a week

- *How many standard drinks do you have on a typical day when you are drinking?*
- *How often do you have six or more standard drinks on one occasion?*

Options: never; less than monthly; monthly; weekly; daily or almost daily.

A standard drinks chart was provided to each GP to help the patient identify the number of standard drinks consumed.

Respondents were limited to adults aged 18 years and over because there are ethical concerns about asking younger patients for information on alcohol consumption for survey purposes. In addition, the reliability of this information from patients aged less than 18 years may be compromised if a parent is present at the consultation.

Suggested chapter citation

Britt H 2009. Methods. In: Britt H & Miller GC (eds). General practice in Australia, health priorities and policies 1998 to 2008. General practice series no. 24. Cat. no. GEP 24. Canberra: Australian Institute of Health and Welfare.

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