The University of Sydney
School of Public Health

Family Medicine Research Centre

Evidence-practice gap in GP pathology test ordering

A comparison of BEACH pathology data and recommended testing

A project funded by the Quality Use of Pathology Program (QUPP), Department of Health and Ageing

BEACH

Bettering the Evaluation And Care of Health

Final report to the Quality Use of Pathology Program

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Authorship

Clare Bayram asserts her moral right to be recognised as the author of this report

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Contents

Abbreviations

AACE	American Association of Clinical Endocrinologists
ACE	Angiotensin converting enzyme
ADA	American Diabetes Association
AIHW	Australian Institute of Health and Welfare
Diab Aust	Diabetes Australia
ANA	Antinuclear antibodies
BEACH	Bettering the Evaluation And Care of Health
BMI	body mass index
CDA	Canadian Diabetes Association
CHEP	Canadian Hypertension Education Program
CI	confidence interval (in this report 95% CI is used)
CK	Creatine kinase
CRP	C reactive protein
CSANZ	Cardiac Society of Australia and New Zealand
CTFPHC	Canadian Task Force on Preventive Health Care
CVD	cardiovascular disease
CV	cardiovascular
eGFR	estimated glomerular filtration rate
encs	encounters
E&LFT	Electrolytes and liver function test
ESC	European Society of Cardiology
ESH	European Society of Hypertension
ESR	erythrocyte sedimentation rate
EUC	electrolytes, urea and creatinine
FBC	full blood count
FMRC	Family Medicine Research Centre
GP	general practitioner
Hb	haemoglobin
HbA1c	haemoglobin, type A1c
HDL	high-density lipoprotein
HT	hypertension
HIV	human immunodeficiency virus
ICPC-2	International Classification of Primary Care (Version 2)
ICPC-2 PLUS	a terminology classified according to ICPC-2

JNC 7	Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood pressure (US Department of Health and Human Services)
LDL	Low-density lipoprotein
LFT	Liver function test
MBA	Multibiochemical analysis
MBS	Medicare Benefits Scheme
M,C&S	microscopy, culture and sensitivity
MoH	Ministry of Health (Singapore)
NCEP ATP III	Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)
NEC	Not elsewhere classified
NHF	National Heart Foundation (Australia)
NHLBI	National Heart, Lung, and Blood Institute (US)
NHMRC	National Health and Medical Research Council
NICE	National Institute for Health and Clinical Excellence (United Kingdom)
NOF	National obesity forum (UK)
NOS	Not otherwise specified
Ov/ob	Overweight/obesity
PBS	Pharmaceutical Benefits Scheme
probs	problems
PSA	Prostate specific antigen
RACGP	Royal Australian College of General Practitioners
RCPA	Royal College of Pathologists of Australasia
SAND	Supplementary Analysis of Nominated Data
SAS	Statistical Analysis System
SIGN	Scottish Intercollegiate Guidelines Network
STIs	sexually transmitted infections
T2D	Type 2 diabetes mellitus
TFT	Thyroid function test
TSH	Thyroid stimulating hormone
USPSTF	US Preventive Services Task Force
WHO	World Health Organization

Executive summary

Introduction

Pathology plays a critical role in more than 70% of clinical diagnoses and in many of the decisions made about the optimal treatment for patients.

Pathology tests requested by general practitioners (GPs) are primarily funded by the Medicare Benefits Scheme (MBS). In 2007–08, pathology tests requested by GPs accounted for 70% of MBS pathology services and generated 67% of the pathology costs to Medicare.

Over the 8-year period investigated in this report, 2000 to 2008, the cost and number of MBS pathology items claimed in Australia increased significantly. However, there are a number of MBS claiming and payment rules that mean the MBS data are not a good reflection of pathology requested by GPs. In particular, episode coning restricts the number of MBS pathology item numbers that can be claimed per episode of care for pathology tests requested by GPs, to a maximum of three items.

In general practice, total pathology ordering can be influenced by:

- a change in the number of GP encounters nationally (increased or decreased volume of encounters without a change in the distribution of the GPs' workload)
- a change in the management rate of a problem
- a change in the GPs' pathology ordering behaviour in the management of the problem.

Aim

The aim of this study is to investigate the extent to which GPs' pathology-ordering behaviour for selected problems aligns with recommendations made in national and international guidelines for the management of these problems.

Method

The data used in this report were collected in the BEACH (Bettering the Evaluation of Care And Health) study over 8 years from April 2000 to March 2008.

BEACH is a cross-sectional study of general practice activity in Australia. BEACH uses ever-changing random samples of approximately 1,000 GPs per year. About 20 GPs participate each week, 50 weeks a year. Each GP records details for 100 doctor–patient encounters of all types on structured paper encounter forms. Each GP participant also completes a questionnaire about themselves and their practice.

On each BEACH encounter form there is space for up to 5 pathology test orders to be recorded. The GP may record individual tests (e.g. HbA1c) or batteries of tests (e.g. full blood count). Each pathology test is linked by the GP to the problem or problems for which it was ordered.

Selection of morbidities for investigation

Problems managed in general practice were considered for investigation in this study if:

- the problem was a National Health Priority Area
- pathology ordering was common in the management of the condition

- the pathology ordering behaviour of GPs had changed for the management of the problem between 2000–02 and 2006–08 (the duration of this study)

On this basis, Type 2 diabetes, hypertension, lipid disorders, weakness/tiredness, 'health checks' and overweight/obesity were selected for investigation.

Note: 'Health check' problems include check-ups recorded by GPs at encounters with patients aged 15 years and over, and overweight/obesity includes problems managed that were labelled by the GP as 'obesity' or 'overweight' for patients aged 18 years and over.

Evaluation of pathology tests ordered by GPs for the selected problems

For each morbidity, pathology tests/batteries of tests ordered by GPs in the management of the problem are compared with testing recommendations from national and international guidelines (and other sources of guidance). The level of support is determined for individual pathology tests/batteries of tests (each accounting for >1% of tests for the selected problem). Tests are classified as: supported by the guidelines and guidance documents, having conditional support (or support was unclear) or not supported by the guidelines/guidance documents.

Changes in pathology ordering between 2000–02 and 2006–08 are investigated for each problem. This highlights whether GPs are changing pathology ordering to be more or less in line with recommendations in the guidelines or guidance. Changes in the management rate of each problem (per 100 encounters) between 2000–02 and 2006–08 are also investigated. Any change in the management rate affects pathology ordering numbers even if there is no change in the GPs' pathology ordering rate.

Extrapolations are used in this study to estimate the number of encounters in Australia involving the management of selected problems and the number involving pathology ordering. Extrapolations are also used to estimate the total national effect of changes in GPs' pathology-ordering behaviour and changes in the management rate of a condition.

Results

The six problems investigated in this study were: Type 2 diabetes, hypertension, lipid disorders, weakness/tiredness, 'health checks', and overweight/obesity. These problems accounted for 12.1% of all problems managed in 2000–08 and for more than one-quarter (25.7%) of the total pathology tests/batteries recorded by GPs.

In this summary, data from the most recent data period (2006–08) are reported to demonstrate current GP pathology ordering. This is considered appropriate because there was a significant increase in the rate of pathology tests ordered during this study period (from April 2000 to March 2008), due to increases in both: the proportion of problems with at least one test ordered (likelihood of testing), and the number of tests ordered per tested problem.

Over the period of this study (2000–02 compared with 2006–08) the rate of pathology test orders increased significantly for all six selected problems. These increases were independent of changes in the management rate of the problem. For Type 2 diabetes and hypertension the increase in pathology order rates was due to both: an increase in the likelihood of at least one test being ordered and an increase in the number of tests ordered per tested contact. For weakness/tiredness and overweight/obesity only the likelihood of testing increased, and for lipid disorders and 'health checks' the number of tests ordered per tested contact increased. When these increases are extrapolated we estimate that the increases in these six morbidities

accounted for almost a third (31.1%) of the national increase in pathology tests ordered for all problems from 2000–02 to 2006–08.

In 2006–08, the pathology tests/batteries ordered for the six selected morbidities accounted for more than one-quarter (26.7%) of all pathology tests/batteries recorded. Tests ordered for Type 2 diabetes accounted for 6.2% of the total, hypertension (6.6%), lipid disorder (5.0%), 'health checks' (5.0%), weakness/tiredness (3.7%), and overweight/obesity (1.0%).

The level of support for pathology tests ordered for each of the selected problems is summarised in Table S1.1. This table also provides the national estimate of the number of tests/batteries ordered by GPs (per year in 2006–08) for each of the selected problems.

The problems for which GP ordering behaviour aligned well with guideline recommendations were lipid disorders (75.5% of pathology tests/batteries supported), weakness/tiredness (71.7%), Type 2 diabetes (72.0%) and hypertension (65.0%). However, the level of support for lipid disorders and hypertension is likely to be over-estimated as tests were primarily recommended for the initial assessment of newly diagnosed cases whereas the majority of pathology ordered for these problems was for ongoing management (92% of tests for lipid disorders and 84% for hypertension).

Pathology tests/batteries ordered by GPs for 'health checks' and overweight/obesity problems did not align well with recommended testing. Only 24.3% of pathology tests/batteries recorded for 'health checks' and 50.9% of tests/batteries for overweight/obesity were recommended in the guidelines.

GPs current pathology ordering (2006–08 data) for each of the six selected morbidities is shown in Table S1.2. The proportion of the total pathology tests ordered in 2006–08 (MBS groups and individual pathology tests) accounted for by each selected morbidity is shown. Shading is used to indicate the level of support (as determined by review of the guidance) for each individual pathology test for each problem. Dark green tests are specifically supported, light green tests have condition support or support cannot be determined, and red tests are advised against. Only pathology tests accounting for >1% of total pathology tests are shaded.

Changes in order rates of pathology tests/batteries are also depicted in this table. The type and direction of change from 2000–02 to 2006–08 is indicated for each MBS group and individual test: ↑/↓ indicates a statistically significant change, ↑/↓ indicates a marginal change, and '—' indicates no change.

Discussion

Locating relevant Australian guidelines is not straightforward. There is no central listing of the available evidence-based guidelines, and the organisation creating the guideline/guidance document varies depending on the morbidity. The National Institute of Clinical Studies, part of the National Health and Medical Research Council, is currently developing a national clinical practice guidelines portal which may make locating guidelines easier in the future.

Overall quality of the guidelines from a general practice perspective

Guidelines are often not designed for GPs. Some guidelines are lengthy (frequently 200+ pages) in order to include all the evidence. It is unrealistic to expect GPs to read this amount for all the morbidity types they manage. For example, the NHMRC Type 2 diabetes guideline developed by the Diabetes Australia Guideline Development Consortium has 935 pages. Other sources of GP guidance were included in the study because it was not appropriate to review guideline recommendations in isolation. It is well acknowledged that

simply producing and distributing guidelines do not alone change behaviour. Other documents/resources are often published to provide GPs with information regarding pathology testing, such as, GP guides and fact sheets (usually based on guidelines), and reference material (e.g. RCPA manual). Resources for medication use (e.g. Therapeutic guidelines) were also reviewed as pathology testing is often indicated in the monitoring of long term medication use (e.g. for side effects of medication).

Locating recommendations for pathology testing

Information regarding recommended pathology testing was often not easy to locate in guidelines. The structure of the guidelines meant there was often no specific section that addressed investigations to be done. In addition there was mixed terminology used within the guidelines to refer to testing e.g. 'diagnostic testing', 'laboratory investigations', 'diagnostic investigations', 'assessment', and in the specific test name or the disease to be tested for.

Testing in long term management

Recommendations regarding pathology testing in long term management of conditions were often not provided. In BEACH, the majority (70-90%) of pathology tests ordered for the chronic conditions: Type 2 diabetes, hypertension, lipid disorders and overweight/obesity; were ordered as part of ongoing management. Recommendations to measure the key indicator(s) in the disease (e.g. lipid levels for lipid disorders) were provided. However, guidance regarding the monitoring of other factors was often omitted. For example, the recommendation to monitor liver function in the use of statin medications was made in most guidelines however advice on the frequency and duration of monitoring was not provided.

Tests that were only recommended as part of the initial assessment of new cases of disease (e.g. those recommended to identify possible underlying causes of the disease) may have led to an over-estimate in our assessment of the level of support of some tests for some diseases. Particularly in the assessment of support for pathology tests ordered for hypertension, lipid disorders and overweight/obesity. The ordering rate of tests that are recommended to identify secondary causes of disease (in particular thyroid function) suggests GPs are continuing to order these in the ongoing management of the problem. Further the order rates of some of these tests have increased over the duration of this study. No guidance was provided on whether there is a need to periodically reassess these secondary causes of disease in the future. Information on whether these conditions are likely to occur in the future (e.g. increasing prevalence with age) and whether subsequent diagnosis of the condition is likely to affect management of the disease would inform GPs as to whether repeated testing is needed.

Intra-individual variation

The variation of test results was often not discussed in guidelines or other sources of GP guidance. For example, the coefficient of variation of lipid levels has been reported as between 7 and 11%; for HbA1c total coefficient of variation is about 6%, and for microalbuminuria it is approximately 40%. These estimates of the coefficient of variation were not provided in the guidelines or guidance.

For any test that is used for long term monitoring, GPs should have knowledge of the expected level of intra-individual variation (coefficient of variation) of results so they understand the level at which clinical intervention (e.g. increase medication dose) is required to maintain 'control' and avoid progression of disease. Most guidelines provided a 'target

level' without providing further detail. For example, a recent study reported that regular monitoring (6 or 12 monthly) of lipid levels was more likely to detect false positive results (due to biological and analytic variability) than true positive results (real change), and recommended testing every 3-5 years in patients at or near lipid targets. Current guidelines recommend testing every 6-12 months in these patients. This study used trial data, which may not be directly applicable in the general practice setting (for example, more frequent lipid monitoring may influence patient adherence). However, informing GPs of the degree of intra-individual variation would alert them to the likelihood of measurement error when monitoring patients and may prevent unneeded therapy changes.

False positive results

The number of tests ordered by GPs per tested problem increased over the period of this study and potentially further compounds the issue of deciphering true positive results (real change) from false positive results. The probability that any abnormal result will be incorrectly detected by chance increases for each additional independent test (referred to as an analyte) that is performed. For example, if 10 analytes are tested using the 95% reference range the chance of at least one false positive result occurring by chance is 40%, if 15 analytes are tested the chance is 54%. Guidelines and guidance did not discuss the implications of high volumes of pathology tests.

This issue is highlighted in the increasing order rate of full blood counts (FBCs) in the management of the six selected morbidities. FBC was one of the most frequently ordered tests. However, it was only recommended in the management of weakness/tiredness and in the initial investigation of hypertension. Our results suggest that GPs may opportunistically/ routinely order FBCs when ordering blood tests. Each FBC includes approximately five analytes and as discussed above an increased number of analytes will increase the likelihood of abnormal results purely by chance.

Multiple morbidity

The guidelines reviewed are morbidity based and hence cannot provide guidance that is applicable for all patients. The clinical profile of each patient, including presence or absence of other diseases, informs the GPs decision to order pathology tests. This is one of the limitations of comparing 'recommended testing' with actual clinical practice.

Due to advances in preventive therapy (primary, secondary and tertiary), medical treatments and medications, the Australian population is living longer, often with multiple chronic conditions. For example, a BEACH substudy of 5,900 patients, estimated that of the 27.2% of patients at encounters who had hypertension; 22% also had Type 2 diabetes, 45% also had hyperlipidaemia, 17% were obese, 4% had thyroid disease and 5% had chronic renal failure.

The above example highlights that GPs often manage patients with multiple chronic problems. As the Australian population ages the proportion of people with multiple chronic morbidities is likely to increase. The majority of GP contacts for chronic conditions are for ongoing management, and monitoring tests are usually required for each chronic condition. Providing guidance on the variance of results in long term monitoring (coefficient of variance) and likelihood of abnormal test results when multiple tests are ordered may improve the interpretation and appropriate ordering of pathology tests in primary care.

Conclusion

GP pathology ordering behaviour aligned well with guideline recommendations in the management of lipid disorders, weakness/tiredness, Type 2 diabetes and hypertension. However, due to the lack of guidance on pathology tests recommended for ongoing

management the level of support for some tests may be over-estimated, particularly for hypertension and lipid disorders. Pathology tests/batteries ordered by GPs for 'health checks' and overweight/obesity problems did not align well with recommended testing.

The limitations of this study meant that the level of support could not be determined for 10–24% of pathology tests ordered for each morbidity. Either tests were recommended for a specific clinical situation that could not be evaluated with BEACH data or GPs ordered batteries of tests (e.g. multibiochemical analysis) for which support could not be determined. Further research is needed to determine whether the use of these tests is supported.

Guidelines and guidance regarding pathology test could be improved in multiple ways:

- by providing adequate advice on the pathology tests required in the ongoing management of each condition (e.g. recommendations regarding monitoring long term medication) including detail on the frequency and duration for which testing is required.
- by providing advice on the pretest probability of disease, particularly when recommending investigation of possible causes of secondary disease.
- by informing GPs of the likelihood of intra-individual variation when monitoring long-term conditions. Using medical record software to provide graphical presentation of results of repeated pathology tests with markers to indicate the coefficient of variation may be useful.
- by educating GPs on the likelihood of false positives when ordering multiple pathology tests, particularly in the context of low pretest probability of disease.
- By standardising terminology used to refer to pathology testing to help GPs locate information regarding pathology testing within guidelines.

The clinical indications for ordering full blood counts, thyroid function tests, multibiochemical analysis and liver function tests in the long-term monitoring of chronic conditions need to be clarified. Further research or review of literature to determine the pretest probability of underlying disease may be useful in developing guidance on the use of these tests.

Ensuring GPs can access results of previously ordered pathology tests (regardless of who ordered the test) and that results are easily accessible within the electronic health record may decrease the rate of repeated pathology testing. Pathology test results are currently not incorporated into the electronic health record in many GP clinical systems.

The length of guidelines is perhaps the biggest barrier to their use by GPs, particularly as a quick reference point to locate information about best practice for pathology ordering. Further, by their nature, guidelines' recommendations are not applicable in the clinical context of multiple morbidity within patients. It may be more affective to develop other ways to provide GPs with guidance about pathology ordering. For example, developing and distributing short problem-orientated statements of recommended pathology tests relevant to the stage of management (testing at initial diagnosis and testing for long-term management). Advice on testing in long-term management needs to include information on expected intra-individual variation (biological and analytical), interval to retest and duration for which monitoring is needed. Information on the likelihood of false positive results when ordering multiple pathology tests should also be provided. Where evidence is not available, problem-based consensus statements should be developed with the involvement of practising GPs. These new guidance statements should could also be incorporated into decision support systems within electronic health records, linked at the point of the decision to order pathology tests for that problem and at the point of receipt of results.

Table S1.1: Summary of support for the pathology tests currently (2006–08) ordered by GPs in the management of the selected topics

	Type 2 diabetes			Hypertension			Lipid disorder			Weakness/tiredness			Health check[(a)]			Overweight/obesity[(a)]		
Level of support	**n**	**%**	**National estimate**	**n**	**%**	**National estimate**	**n**	**%**	**National estimate**	**n**	**%**	**National estimate**	**n**	**%**	**National estimate**	**n**	**%**	**National estimate**
Yes	3,929	72.0	2,220,000	3,731	65.0	2,110,000	3,330	75.5	1,880,000	2,294	71.7	1,300,000	1,072	24.3	610,000	464	50.9	260,000
Unclear/conditional	679	12.4	380,000	1,431	24.9	810,000	443	10.0	250,000	412	12.9	230,000	906	20.6	510,000	193	21.2	110,000
No	553	10.1	310,000	300	5.2	170,000	388	8.8	220,000	277	8.7	160,000	2,081	47.2	1,180,000	209	22.9	120,000
Not evaluated	298	5.5	170,000	282	4.9	160,000	249	5.6	140,000	216	6.8	120,000	348	7.9	200,000	46	5.0	30,000
Total	**5,459**	**100.0**	**3,090,000**	**5,744**	**100.0**	**3,250,000**	**4,410**	**100.0**	**2,490,000**	**3,199**	**100.0**	**1,810,000**	**4,407**	**100.0**	**2,490,000**	**912**	**100.0**	**520,000**

(a) Investigation of pathology ordered for overweight/obesity and 'health check' problems was limited by patient age—overweight/obesity was limited to adult patients (aged 18 years and over) and health checks was limited to patients aged 15 years and over.

Notes

1. National estimates are rounded to the nearest 10,000 and therefore may not add to the total.
2. National estimates reflect the estimated number of tests ordered by GPs in Australia for the selected problem each year in 2006–08.

Table S1.2: Proportion of pathology tests accounted for within each selected morbidity, 2006–08

Pathology test ordered	Total (2006–08)	% total for selected problems[a]	Type 2 diabetes			Hypertension			Lipid disorder			Weakness/tiredness			Health check[c]			Overweight/obesity[c]		
			n	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]
MBS pathology groups																				
Chemistry	49,681	39.24	4,828	9.72	↑	4,615	9.29	↑	3,954	7.96	—	2,163	4.35	↑	3,182	6.40	↑	754	1.52	↑
Haematology	15,743	21.72	462	2.93	↑	900	5.72	↑	361	2.29	↑	782	4.97	—	779	4.95	↑	135	0.86	↑
Microbiology	12,186	3.48	41	0.34	—	78	0.64	—	11	0.09	—	131	1.08	—	161	1.32	—	2	0.02	—
Cytopathology	4,534	3.53	0	0.00	—	8	0.18	—	2	0.04	—	1	0.02	—	149	3.29	↓	0	0.00	—
Other NEC	1,741	27.05	123	7.06	—	135	7.75	—	71	4.08	—	47	2.70	—	78	4.48	—	17	0.98	—
Histopathology	1,456	0.07	0	0.00	—	0	0.00	—	1	0.07	—	0	0.00	—	0	0.00	—	0	0.00	—
Immunology	1,369	7.01	3	0.22	—	4	0.29	—	6	0.44	—	69	5.04	↑	11	0.80	—	3	0.22	—
Infertility/pregnancy test	374	1.07	0	0.00	—	0	0.00	—	0	0.00	—	2	0.53	—	1	0.27	—	1	0.27	—
Simple test	360	16.67	2	0.56	—	4	1.11	—	4	1.11	—	4	1.11	—	46	12.78	↑	0	0.00	—
Individual pathology tests/batteries																				
Full blood count	11,696	26.55	433	3.70	↑	811	6.93	↑	333	2.85	↑	689	5.89	↑	716	6.12	↑	123	1.05	↑
Lipids*	8,410	62.09	869	10.33	↑	1,220	14.51	↑	1,957	23.27	↓	91	1.08	—	877	7.50	↑	208	2.47	—
EUC*	6,175	40.42	510	8.26	↑	1,084	17.55	↑	294	4.76	↑	221	3.58	—	324	2.77	↑	63	1.02	—
Liver function*	6,067	36.20	363	5.98	↑	524	8.64	↑	550	9.07	—	282	4.65	↑	399	3.41	↑	78	1.29	—
Glucose/glucose tolerance*	5,170	46.81	550	10.64	↓	616	11.91	↑	417	8.07	—	154	2.98	—	519	4.44	↑	164	3.17	—
Thyroid function*	5,034	26.02	69	1.37	—	254	5.05	↑	112	2.22	↑	498	9.89	↑	255	2.18	↑	122	2.42	↑
Pap smear*	4,449	3.60	0	0.00	—	8	0.18	—	2	0.04	—	1	0.02	—	149	1.27	↓	0	0.00	—
Multibiochemical analysis*	3,615	37.54	258	7.14	↑	407	11.26	↑	211	5.84	↑	167	4.62	—	264	2.26	↑	50	1.38	↑
Urine M,C&S*	3,613	4.73	34	0.94	—	72	1.99	—	7	0.19	—	30	0.83	—	27	0.23	—	1	0.03	—

(continued)

Table S1.2 (continued): Proportion of pathology tests accounted for within each selected morbidity, 2006–08

Pathology test ordered	Total (2006–08)	% total for selected problems[a]	Type 2 diabetes			Hypertension			Lipid disorder			Weakness/tiredness			Health check[c]			Overweight/obesity[c]		
			n	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]	*n*	% of total	↑↓[b]
Individual pathology tests/batteries (continued)																				
Chemistry; other*	2,594	33.54	492	18.97	↑	174	6.71	↑	33	1.27	—	76	2.93	—	74	0.63	↑	21	0.81	↑
Ferritin*	2,540	21.97	31	1.22	—	48	1.89	—	20	0.79	—	365	14.37	↑	82	0.70	—	12	0.47	—
HbA1c*	1,959	85.66	1,566	79.94	↑	55	2.81	—	27	1.38	—	11	0.56	—	14	0.12	—	5	0.26	—
ESR	1,908	13.21	19	1.00	—	71	3.72	—	24	1.26	—	85	4.45	—	42	0.36	—	11	0.58	—
Hormone assay*	1,739	5.29	4	0.23	—	3	0.17	—	4	0.23	—	46	2.65	—	21	0.18	—	14	0.81	—
Prostate specific antigen*	1,514	32.30	39	2.58	—	110	7.27	↑	55	3.63	↑	13	0.86	—	263	2.25	↑	9	0.59	—
C reactive protein	1,288	8.15	6	0.47	—	20	1.55	—	10	0.78	—	58	4.50	↑	10	0.09	—	1	0.08	—
Hepatitis serology*	1,116	5.02	1	0.09	—	0	0.00	—	1	0.09	—	5	0.45	—	49	0.42	—	0	0.00	—
Vitamin B12*	847	20.31	15	1.77	—	12	1.42	—	8	0.94	—	110	12.99	↑	27	0.23	—	0	0.00	—
Other test NEC*	718	26.32	51	7.10	—	52	7.24	—	33	4.60	—	14	1.95	—	27	0.23	—	12	1.67	—
Blood Test	677	31.76	46	6.79	—	64	9.45	—	34	5.02	—	29	4.28	—	38	0.32	—	4	0.59	—
Immunology, other*	649	7.09	1	0.15	—	1	0.15	—	3	0.46	—	38	5.86	↑	0	0.00	—	3	0.46	—
Creatine kinase	554	53.79	29	5.23	—	30	5.42	—	232	41.88	↑	3	0.54	—	3	0.03	—	1	0.18	—
Monospot*	291	15.12	0	0.00	—	0	0.00	—	0	0.00	—	44	15.12	—	0	0.00	—	0	0.00	—
Occult blood test	310	19.35	2	0.65	—	4	1.29	—	4	1.29	—	4	1.29	—	46	0.39	↑	0	0.00	—
Subtotal of individual pathology tests	*72,933*	*32.3*	*5,388*			*5,640*			*4,371*			*3,034*			*4,226*			*902*		
Total pathology tests	**87,444**	**27.60**	**5,459**	**6.24**	↑	**5,744**	**6.57**	↑	**4,410**	**5.04**	↑	**3,199**	**3.66**	↑	**4,407**	**5.04**	↑	**912**	**1.04**	↑

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) The proportion of total tests/batteries ordered in each category in 2006–08 accounted for by the six selected morbidities.

(b) Indicates a statistically significant change in the rate of the specific test for the management of the specific problem between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, ↑/↓ indicates a marginal change, and — indicates no change.

(c) Investigation of pathology ordered for overweight/obesity and 'health check' problems was limited by patient age—overweight/obesity was limited to adult patients (aged 18 years and over) and health checks was limited to patients aged 15 years and over.

Note: Shading is used to indicate the level of support (as determined by review of the guidance) for each individual pathology test for each problem. Dark green tests are specifically supported, light green tests have condition support or support cannot be determined, and red tests are advised against. Only pathology tests accounting for >1% of total pathology tests are shaded.

1 Introduction

1.1 Background

Pathology plays a critical role in more than 70% of clinical diagnoses and in many of the decisions made about the optimal treatment for patients.[1]

Pathology tests requested by general practitioners (GPs) are primarily funded by the Medicare Benefits Scheme (MBS). MBS services and expenditure statistics reflect both specialist and GP requests. In 2007–08, pathology tests requested by GPs accounted for 70% of MBS pathology services and generated 67% of the pathology costs to Medicare.[2]

There are a number of MBS claiming and payment rules that mean the MBS data are not an exact reflection of pathology requested by GPs. In particular:

- episode coning restricts the number of MBS pathology item numbers that can be claimed per episode of care for pathology tests requested by GPs in non-hospitalised patients, to a maximum of three items. Some MBS pathology item numbers are exempt from the coning rule (for example, Pap smear items).[3]
- each MBS pathology item number can represent multiple pathology tests (a group of tests) or a single analyte.[3]

These rules have not changed significantly over the period of this study.

Over the 8-year period investigated in this report, 2000 to 2008, the cost and number of MBS pathology items claimed in Australia increased significantly.

- In the 2000–01 financial year, the cost of pathology services to the MBS was $1.2 billion (15.8% of total MBS benefits paid) and in 2007–08, the cost was $1.9 billion, (14.4% of MBS benefits paid). From 2000–01 to 2007–08, the total cost increased by 62.2%, and the per capita cost increased by 47.5%.[4]
- In 2000–01, there were 62 million pathology services claimed (3.2 per capita) and in 2007–08, there were 96 million (4.5 per capita). Representing a 54.1% increase in the number of claimed services and a 40.6% increase in the number of services per capita.[4]

From 2000 to 2008, the number of GP encounters paid through the MBS in Australia increased. In the 2000–01 financial year, there were 100.6 million GP encounters, and in 2007–08, there were 109.5 million encounters.[5]

In general practice, total pathology ordering can be influenced by:

- a change in the number of GP encounters nationally (increased or decreased volume of encounters without a change in the distribution of the GPs' workload)
- a change in the management rate of a problem
- a change in the GPs' pathology ordering behaviour in the management of the problem. This is measurable as a change in the rate of pathology orders; caused by:
  - a change in the likelihood of pathology ordering for the problem (more or fewer episodes of testing) and/or
  - a change in the number of pathology tests ordered per tested problem (more or fewer tests per episode).

The drivers of change in these factors are a complex combination of GP characteristics (e.g. years of experience, size and location of practice), patient characteristics (e.g. age, morbidity), and environment factors (e.g. ageing population, increased survival time and long term monitoring, new technologies and new tests, change in disease incidence or prevalence).

1.2 Objectives

The aim of this study is to investigate the extent to which GPs' pathology-ordering behaviour for selected problems aligns with recommendations made in national and international guidelines for the management of these problems, and:

- to identify whether changes have occurred in the pathology ordered for the selected problems over the last eight years, and whether any measured change reflects a change to be 'more' or 'less' in line with guideline recommendations.
- to identify the extent to which measured changes have been the result of changes in:
  - the management rate of the problem and/or
  - the likelihood of pathology being ordered in the management of the problem and/or
  - the number of pathology tests/batteries of tests being ordered is also explored.

The problems investigated were: Type 2 diabetes, hypertension, lipid disorders, weakness/tiredness, 'health checks' and overweight/obesity. Pathology ordered for these six problems accounted for more than a quarter of total pathology tests ordered by GPs.

References

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2 Method

This chapter provides a summary of the BEACH (Bettering the Evaluation and Care of Health) method, and details the methods used specifically in this study. The complete BEACH method has been reported in detail elsewhere,[1] see *General practice activity in Australia 2007–08*, available from www.aihw.gov.au.

2.1 BEACH method

In summary:

- BEACH involves an ever-changing random sample of approximately 1,000 GPs per year
- each GP records details for 100 doctor–patient encounters of all types
- the GP sample is a rolling (ever-changing) sample
- approximately 20 GPs participate each week, 50 weeks a year
- the encounter information is recorded by the GPs on structured paper encounter forms
- each GP participant also completes a questionnaire about themselves and their practice.

Data elements used in this study

In this report the BEACH encounter data elements were used.

- **Encounter details:** date of consultation, type of consultation (direct/indirect), Medicare item numbers (where applicable) (up to three) and other payment source (where applicable) (tick boxes).
- **The patient:** date of birth, sex and postcode of residence. Tick boxes are provided for Commonwealth concession card holder, 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 (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.

Pathology data elements

In summary:

- there is space for up to 5 pathology test orders to be recorded on each encounter form. The GP may record individual tests (e.g. HbA1c) or batteries of tests (e.g. full blood count)
- each pathology test is linked to the problem or problems it was ordered for
- GPs record pathology test orders in free text on the form
- each test is coded using the primary care terminology ICPC-2 PLUS. The tests are coded as specifically as possible to reflect what the GP has written
- these ICPC-2 PLUS codes are mapped to the appropriate Medicare Benefits Schedule (MBS) pathology groups.

Pathology tests ordered at the GP encounter are recorded in free text on the BEACH form. Each test or battery of tests is linked by the GP to the related problem or problems managed at the encounter for which the test is ordered (see Appendix 1, the BEACH encounter form). Each pathology test can be linked to up to four problems managed (the maximum number of problems recorded per encounter).

Pathology tests can be recorded as either a single test (e.g. fasting glucose test) or as a battery of tests (such as FBC) and each of these counts as one order. All BEACH data are secondarily coded. The pathology tests are coded using the terminology ICPC-2 PLUS (see coding and classification of data below).

BEACH data report the pathology test(s) requested by the GP (to a maximum of five tests/batteries of tests per encounter). In contrast:

- data from pathology laboratories list the organisation's interpretation of the GP's order
- the MBS data report the number of MBS pathology items claimed by pathologists. As noted above, for GP-requested tests, pathologists can only claim the three most expensive MBS items due to episode coning.

2.2 Statistical methods

The analysis of all BEACH data was conducted 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 intracluster correlation and adjust the confidence intervals accordingly.[2]

The encounter or the problem is the primary unit of inference in this report. 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.

In this report, pathology tests/batteries ordered by GPs are primarily presented as the rate per 100 problems with the 95% confidence interval.

Changes over time

Changes in the frequency of events over time 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 problems (95% CI: 11.3–11.7) is significantly less than Result B: 11.9 per 100 problems (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 problems (95% CI: 11.3–11.7) is marginally lower than Result B: 11.9 per 100 (95% CI: 11.7–12.1).

If they overlap, then no change has been measured.

In measuring changes in pathology ordering over time, the 2006–08 results are compared with those from 2000–02. While BEACH began in April 1998, pathology data from the first two years are not comparable because the pathology codes were expanded to provide more specificity from April 2000 onward.

The direction and type of change between 2000–02 and 2006–08 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 there was no change.

Extrapolated national estimates

Extrapolations are used in this study to estimate the number of encounters in Australia involving the management of selected problems and the number involving pathology ordering. Extrapolations are also used to estimate the total national effect of changes in GPs' pathology-ordering behaviour and changes in the management rate of a condition.

Extrapolations are calculated using the method detailed below. The following example gives the method for calculating the estimated national change across total GP Medicare services from 2000–02 to 2006–08.

- The national estimates are calculated by dividing the rate per 100 encounters of the selected event for 2000–02 by 100, and then multiplying by the total number of GP services claimed through Medicare per year in that time period (rounded to the nearest 100,000, see below) to give the estimated annual number of events per year in 2000–02. The process is then repeated for 2006–08. The difference between the two estimates gives the estimated national change in the number of encounters for that event over the period of interest.
- This is expressed as the estimated increase or decrease over the study period (between 2000–02 and 2006–08), 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 2006–08 when compared with 2000–02.

Extrapolations are calculated using the number of GP Medicare encounter items claimed in each financial year rounded to the nearest 100,000.[3] The average of multiple years are used in this report to provide the estimated annual number of events per year in each time period.

- In 2000–02 the number of GP encounters used is 100.3 million
- In 2006–08 the number of GP encounters used is 106.5 million
- In 2000–08 the number of GP encounters used is 100.8 million

Extrapolations are based on the problem-pathology links for the selected problem(s) rather than the number of pathology tests/batteries of tests. The extrapolated numbers for each data point are average annual estimates. For example, the number of encounters at which hypertension is managed by GPs is estimated to be 10.1 million encounters per annum in 2006–08. Extrapolation estimates are rounded to the nearest 100,000 if more than a million, to the nearest 10,000 if between 100,000 and a million, and to the nearest 5,000 if less than 100,000. Limitations of extrapolations are discussed in Section 2.5.

The extrapolated changes reported throughout this report are calculated as the difference between the average annual estimates in each 2-year time point. An example is provided below.

If the pathology ordering behaviour for all encounters in BEACH in 2000–02 and 2006–08 (see Chapter 3) are extrapolated to the GP encounters claimed through Medicare in Australia (100.3 million per annum in 2000–02 and 106.5 million per annum in 2006–08) the results suggest that in 2006–08 there were:

- 6.4 million additional problems for which the GP ordered at least one pathology test/battery of tests (23.2 million per annum in 2006–08 compared with 16.8 million per annum in 2000–02)
- 17.7 million additional tests/batteries of tests ordered by GPs (51.3 million per annum in 2006–08 compared with 33.6 million per annum in 2000–02).

Note: The 17.7 million additional tests reflect the number of problem-pathology links, i.e. the number of tests ordered for all problems in general practice. This is likely to over-estimate the number of individual pathology tests/batteries ordered by GPs by approximately 3–4% because each test can be linked to more than one problem (see limitations of BEACH pathology data in Section 2.5).

2.3 Coding and classification of data

Most data elements collected in BEACH are classified according to the International Classification of Primary Care—Version 2 (ICPC-2), a product of the World Organization of Family Doctors (Wonca)[4], and the recommended Australian standard for classification of data from general practice or patient self-report.[5]

Patient reasons for encounter (RFEs), **problems managed,** clinical treatments (for example, counselling, advice), procedural treatments, referrals, investigations ordered (including **pathology**, imaging and other investigations) are all classified to ICPC-2.

The above data elements are coded in more detail using ICPC-2 PLUS[6], an interface terminology developed by the Family Medicine Research Centre, University of Sydney.

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 code the data in more specific terms using ICPC-2 PLUS. This ensures high coder reliability, and automatic classification of the concept.

The primary data elements used in this report are problems managed and pathology tests ordered.

Grouping of problems managed

In this report, morbidity data are either grouped:

- by ICPC-2 rubric, i.e. at the classification level using a single ICPC-2 rubric, *or*
- by multiple ICPC-2 rubrics, i.e. grouping multiple ICPC-2 rubrics, *or*
- by multiple ICPC-2 PLUS code i.e. the terminology level.

Morbidity groups are defined at the beginning of each relevant chapter and listed in Appendix 2.

Coding and grouping of pathology data

Pathology data are grouped at the ICPC-2 PLUS terminology level. The ICPC-2 classifies pathology tests too broadly for meaningful analysis (for example, a test of cardiac enzymes is classified in K34—Blood test associated with the cardiovascular system).

In Australia, the MBS classifies pathology tests in groups that are well recognised. All pathology ICPC-2 PLUS codes have therefore been grouped into MBS standard pathology groups. Each MBS pathology group with the associated ICPC-2 PLUS pathology codes is listed in Appendix 3.

Individual pathology tests and batteries of tests have also been grouped together to form logical reporting entities (for example, the 'Glucose/glucose tolerance' test group includes all types of serum glucose tests). All pathology tests/batteries of tests that include multiple ICPC-2 PLUS codes are marked with an asterisk in the tables and listed in Appendix 3 with the associated PLUS codes.

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). CAPS is mapped to the Anatomical Therapeutic Chemical (ATC)[7] 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).

2.4 Methods specific to this study

The data in this report were collected in the BEACH (Bettering the Evaluation of Care And Health) study over 8 years from April 2000 to March 2008. The BEACH method is described in Section 2.1.

The aim of this study is to investigate the extent to which GPs' pathology-ordering behaviour for selected problems aligns with recommendations made in inter/national guidelines for the management of these problems.

Problems managed in general practice were considered for investigation in this report if:

- the problem is a National Health Priority Area
- pathology ordering was common in the management of the condition
- the pathology ordering behaviour of GPs had changed for the management of the problem between 2000–02 and 2006–08 (the duration of this study)

An investigation of GP pathology ordering informed which individual problems would benefit most from investigation of 'quality' of tests ordered against recommended test ordering (guidelines and other sources of guidance) in this study. The problems identified are listed below in priority order.

1. Diabetes
2. Hypertension
3. Lipid disorders
4. Weakness/tiredness
5. General check-up
6. Overweight/obesity
7. Depression
8. Ischaemic heart disease (IHD)
9. Urinary tract infection (UTI)
10. Abdominal pain
11. Menopause
12. Viral disease
13. Thyroid disease.

Due to the timeline of the study only the first six problems are included in this report.

The six selected problems account for 12.1% of all problems managed in 2000–08 and for more than one-quarter (25.7%) of the total pathology tests/batteries ordered by GPs. The selected problems and corresponding chapter numbers are:

- Type 2 diabetes (Chapter 4)
- Hypertension (Chapter 5)
- Lipid disorder (Chapter 6)
- Weakness/tiredness (Chapter 7)
- 'Health checks' (Chapter 8)—pathology tests ordered in the management of 'health check' problems at encounters with patients aged 15 years and over.
- Overweight/obesity (Chapter 9)—pathology tests ordered in the management of overweight/obesity problems at adult encounters (patients aged 18 years and over).

Note: Chapter 3 of this report provides an overview of the pathology data set used in this study, including the number of total pathology tests for each data period.

Three data periods are consistently used within this report:

- the total 8 years of data, April 2000 to March 2008, referred to as 2000–08
- the first 2 years of data, April 2000 to March 2002, referred to as 2000–02

- the last 2 years of data, April 2006 to March 2008, referred to as 2006–08.

Changes in pathology ordering behaviour are examined using two data points, 2000–02 and 2006–08.

Pathology ordering investigation for each morbidity

Evaluation of pathology tests ordered for the selected problems.

For each morbidity pathology tests/batteries of tests ordered by GPs in the management of the problem are compared with testing recommendations from guidelines (and other sources of guidance).

- Pathology data from the entire study period (2000–08) is used in this comparison.
- National and international guidelines and Australian GP guidance documents for the management of each selected problem are identified. Other sources of GP guidance are included in the study because it was not appropriate to review guideline recommendations in isolation.
  - Guidelines are often not designed for GPs. The guidelines are lengthy (often 200+ pages) in order to include all the evidence. It is unrealistic to expect GPs to read this amount for all the morbidity types they manage. Given time pressures in general practice (compounded by workforce shortage) GPs are even less likely to read these.
  - GP guides and fact sheets (which are often based on a guideline) have therefore also been included. These guides are reviewed in comparison to the matching guidelines to identify mismatches (e.g. differing levels of recommendations and omissions) between summarised and complete guidelines
  - Other published sources also provide information regarding pathology testing. For example, 'Murtagh's general practice', RCPA manual, testing recommendations for medications (such as, statins). Where identified these are included in the review of material advising GP pathology ordering as 'sources of guidance'.
- Guidelines and guidance documents are reviewed to identify recommendations regarding pathology tests in the management of the problem.
- Level of support is determined for individual pathology tests/batteries of tests (each accounting for >1% of pathology tests for the selected problem). Tests are classified as:
  - supported by the guidelines and guidance documents
  - conditional support or support was unclear
  - not supported by the guidelines/guidance documents.

Changes in pathology ordering between 2000–02 and 2006–08

Changes in pathology ordering between 2000–02 and 2006–08 are investigated for each problem. This highlights whether GPs are changing pathology ordering to be more or less in line with recommendations in the guidelines or guidance. Changes investigated include comparison of:

- likelihood of at least one pathology tests being ordered in the management of the problem
- number of pathology tests ordered per tested contact (number of tests ordered once the decision to order pathology had been made)

- rates of individual pathology tests/batteries ordered per 100 selected problems managed.

Investigation of change is required because there have been significant changes in the pathology ordering behaviour of GPs over the study period (see Chapter 3).

Note: in this report changes in GP pathology ordering behaviour are measured using a problem basis and therefore reflect changes in the way GPs manage the specific problem, independent of any change in management rate of the problem.

Change in management rate of the problem 2000–02 and 2006–08

Changes in the management rate of each problem (per 100 encounters) between 2000–02 and 2006–08 are also investigated. This is included because a change in management rate affects pathology ordering numbers even with no change in the GPs' pathology ordering rate.

Extrapolations

Extrapolations are used in this report to estimate the total national effect of:

- changes in GPs' pathology-ordering behaviour
- changes in the management rate of a condition.

Extrapolations are also used to highlight the volume of tests ordered nationally that are supported by guidelines for the selected problems.

Extrapolations incorporate the effect of the four factors that influence the total volume of pathology tests ordered in Australia by GPs for each problem. These four factors are:

- the total number of GP encounters provided in Australia
- the management rate of the problem (measured using an encounter base)
- the likelihood of at least one pathology test being ordered per problem (problem base)
- the number of tests ordered per tested problem (problem base).

A change in any of these factors affects the national estimate of the number of tests ordered for each problem.

2.5 Limitations

Limitations of BEACH pathology data

When a GP places an order for pathology at the encounter, each test may relate to more than one problem being managed. Therefore, it is possible for a single pathology order to be linked to more than one problem. This report uses a problem base and consequently it looks at the linkages of pathology tests to the problem. A pathology test order will be counted more than once if it is linked to more than one problem.

- In 2000–02, there were 2.7% more links than tests (66,429 pathology-problem links and 64,643 pathology tests/batteries of tests)
- In 2006–08, there were 3.8% more links than tests (90,753 pathology-problem links and 87,444 pathology tests/batteries of tests).

A single pathology test/battery of tests could be counted more than once in the large morbidity groups (e.g. cardiovascular disease, psychological disease and musculoskeletal

problems). Therefore, the number of tests/batteries for the large morbidity groups and total problems is likely to be a small over-estimation of the true number of tests/batteries ordered. However, it is very unlikely that a single pathology test would be counted twice within an individual morbidity group (e.g. hypertension, Type 2 diabetes).

There is space for up to five individual tests or batteries of tests to be recorded per encounter. If more than five tests/batteries of tests are recorded, the five tests that represent the breadth of testing ordered by the GP are coded, with priority given to batteries of tests over single tests. We code the pathology data at the same level of specificity that the GP records whenever possible. However, on occasions where GPs specify all the analytes from a battery of tests these have been coded as the battery of tests to allow space for any other tests recorded by the GP to be coded. This coding decision would also contribute to an under-estimation of the number of tests ordered by GPs. However, this under-estimation applies to all data years investigated.

Over time there was a significant increase in the number of encounters where five pathology tests have been recorded. In 2000–02, 11.5% of encounters (95% CI: 10.9–12.1) that involved at least one pathology test had five pathology tests recorded by the GP and in 2006–08 this had increased significantly to 19.0% (95% CI: 18.2–19.8). This increase suggests that BEACH data are likely to under-estimate the number of pathology tests/batteries ordered by GPs, and more so in 2006–08 than in 2000–02.

Limitations of extrapolations

Extrapolations to the total encounters occurring nationally are only an estimate. They are likely to provide:

- an under-estimate 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, for example, Department of Veterans' Affairs, state governments, work cover, employers)
- an over-estimate 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. Extrapolation estimates are also rounded: to the nearest 100,000 if more than a million, to the nearest 10,000 if between 100,000 and a million, and to the nearest 5,000 if less than 100,000. 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.

Considerations and limitations of this study design

Pathology testing recommendations made for each problem by guidelines/guidance documents are often made in the context of a specific clinical situation. As BEACH data are cross-sectional it is not always possible to evaluate the entire clinical situation.

- Patient age and sex, presence (or absence) of risk factors, clinical signs, and presence of other diseases are factors that are often mentioned in the context of testing guidance.

BEACH collects data on patient sex and age and has information about other problems managed at the same encounter as the problem of interest. However, the other listed factors are not routinely collected in the BEACH encounter data. Therefore, in the evaluation of GP pathology ordering against guidelines the affected tests are listed as having 'conditional support'.

- Testing is often recommended as part of the initial assessment of the newly diagnosed condition (e.g. to identify possible causes or sequelae of the disease). BEACH includes information on whether the problem is 'new' at the encounter (see glossary for definition of 'new problem'). Pathology tests for new cases of the selected problem are used to reflect whether GPs are ordering tests recommended as part of the initial assessment. However, testing (for initial assessment) may not be ordered at the same encounter at which the problem is first diagnosed.

It is not possible to assess the frequency of testing (i.e. interval to retest) using the BEACH data because the data are cross-sectional. The recommended interval for repeated testing is influenced by many variables including the presence or absence of risk factors (e.g. comorbidities). As discussed above data on these factors are not usually available in BEACH.

It is not always possible to determine whether the use of a 'grouped test' is supported by guidelines/guidance. Multibiochemical analysis (MBA) and 'Chemistry, other' were the two grouped tests most commonly ordered by GPs in the management of the selected problems. In the evaluation of GP pathology ordering against guidelines these tests are listed as 'unable to determine guidance'.

- The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported.
- 'Chemistry, other' refers to a group of multiple individual chemistry tests. The tests in this group were analysed to determine whether any individual tests within the group were recommended in the guidance. Where this occurs it is noted in the chapter.

The most recently available international and national guidelines for each selected problem and other Australian sources of GP guidance were reviewed in this study.

- BEACH data do sometimes precede the guideline date (i.e. data were collected before the guideline was released). The most recent pathology data (2006–08) are reported separately for each problem so that the reader can determine whether there have been changes in pathology ordering.
- International guidelines are reviewed which may not be appropriate in the Australian setting. However the guidelines reviewed were published in developed countries. Also the trial data on which recommendations are based are utilised in the Australian guidelines reviewed.

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3 Overview of data set

The tables in this chapter provide an overview of the BEACH data analysed in this study. Three time periods are described in these tables: all data years (2000–08); 2000–02 and 2006–08—the latter two are used to measure changes in GP pathology ordering over time. Main findings are summarised in the dot points below each table description.

Table 3.1 describes the number of encounters, problems and pathology orders in each of the data periods. It also describes the pathology ordering behaviour of GPs for all problems.

- In 2000–08, 7,843 GPs provided data about 784,300 encounters and the management of more than one million problems. At these encounters GPs ordered 307,013 pathology tests or batteries of tests. At least one pathology test was ordered at 16.8% of encounters and for 12.8% of problems managed.
- In 2000–02, there were 198,200 encounters recorded by 1,982 GPs, and in 2006–08 there were 188,300 encounters recorded by 1,883 GPs. During this time there was a significant increase in the number of problems managed per GP encounter, from 147.3 per 100 encounters (95% CI: 146.1–148.4) to 153.3 per 100 (95% CI: 151.9–154.7).
- The rate of pathology tests/batteries ordered per 100 encounters increased significantly from 32.6 per 100 encounters in 2000–02 to 46.4 per 100 in 2006–08. This was due to significant increases in:
  - the likelihood of at least one pathology test/battery being ordered at encounters (14.9% of encounters in 2000–02 and 18.7% in 2006–08)
  - the number of pathology tests ordered per encounter once the decision to order was made (217.8 per 100 tested encounters in 2000–02 and 247.8 in 2006–08) (Table 3.1).
- The rate of pathology tests/batteries ordered per 100 problems managed increased from 22.2 per 100 in 2000–02 to 30.3 in 2006–08. This was due to a significant increases in:
  - the likelihood of at least one pathology test/battery being ordered in the management of problems (11.4% of problems in 2000–02 and 14.2% in 2006–08)
  - the number of pathology tests ordered per problem once the decision to order was made (200.1 per 100 tested problems in 2000–02 and 221.3 in 2006–08) (Table 3.1).

Table 3.2 describes the pathology orders made for all problems by MBS pathology groups and the most common individual pathology tests.

- At the MBS pathology group level—there were significantly more chemistry, haematology, microbiology and cytopathology (tissue) pathology test orders (per 100 total problems) in 2006–08 than in 2000–02. There were also marginally significant increases in histopathology and immunology test order rates tests from 2000–02 to 2006–08.
- At the individual test/battery of tests level— from 2000–02 to 2006–08, there were significant increases in the ordering rate (per 100 total problems) of full blood counts, lipid tests, EUC tests, liver function tests, glucose tests, thyroid function tests, ferritin, 'other chemistry' tests, HbA1c, 'other microbiology tests', prostate specific antigen, histology skin tests, C reactive protein and vitamin B12 tests. There were also marginal increases in the rates of Pap smears, urine M,C&S and coagulation tests.

Table 3.1: Overview of data set and summary of pathology ordering, 2000–08 (all years), 2000–02 and 2006–08

	2000–08				2000–02				2006–08				
	Number	Rate/ per cent	95% LCL	95% UCL	Number	Rate/ per cent	95% LCL	95% UCL	Number	Rate/ per cent	95% LCL	95% UCL	Change
General practitioners	7,843	—	—	—	1,982	—	—	—	1,883	—	—	—	
Number of encounters	784,300	—	—	—	198,200	—	—	—	188,300	—	—	—	
Number of problems	1,174,893	—	—	—	291,890	—	—	—	288,610	—	—	—	
Pathology order rate per 100 encounters[(a)]	307,013	39.1	38.6	39.7	64,389	32.6	31.7	33.5	87,444	46.4	45.2	47.7	↑
At least one pathology order per encounter (% of all encounters)	131,586	16.8	16.6	17.0	29,559	14.9	14.6	15.3	35,284	18.7	18.3	19.2	↑
Number of tests ordered per 100 tested encounters (rate)	131,586	233.1	231.6	234.7	29,559	217.8	214.9	220.6	35,284	247.8	244.6	251.1	↑
Pathology test rate per 100 problems managed[(b)]	307,013	26.1	25.8	26.5	64,389	22.2	21.6	22.7	87,444	30.3	29.6	31.0	↑
At least one pathology order per problem (% of total problems managed)	150,187	12.8	12.6	12.9	33,196	11.4	11.1	11.6	41,019	14.2	13.9	14.5	↑
Number of tests ordered per 100 tested problems (rate)	150,187	210.8	209.5	212.1	33,196	200.1	197.6	202.6	41,019	221.3	218.5	224.0	↑

(a) This is a rate of pathology test/batteries ordered per 100 encounters based on the number of pathology tests/batteries over the number of encounters rather than the number of problem–pathology links.

(b) This is a rate of pathology test/batteries ordered per 100 problems managed based on the number of pathology tests/batteries over the number of problems rather than the number of problem–pathology links. There are more links than tests because each test can be linked to more than one problem under management (see Section 2.5).

Notes

1. LCL—lower confidence limit; UCL—upper confidence limit.
2. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, ↑/↓ indicates a marginal change, and — indicates no change

Table 3.2: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders for all problems, 2000–08 (all years), 2000–02 and 2006–08

	All years (2000–08)				2000–02				2006–08				
Pathology test ordered	Number	Rate per 100 problems[(a)]	95% LCL	95% UCL	Number	Rate per 100 problems[(a)]	95% LCL	95% UCL	Number	Rate per 100 problems[(a)]	95% LCL	95% UCL	Change
MBS pathology groups													
Chemistry	167,676	14.3	14.0	14.5	33,843	11.6	11.2	12.0	49,681	17.2	16.7	17.7	↑
Haematology	57,594	4.9	4.8	5.0	12,636	4.33	4.2	4.5	15,743	5.5	5.3	5.6	↑
Microbiology	45,604	3.9	3.8	4.0	10,098	3.5	3.3	3.6	12,186	4.2	4.0	4.4	↑
Cytopathology	17,152	1.5	1.5	1.5	3,931	1.4	1.3	1.4	4,534	1.6	1.5	1.7	↑
Other NEC	6,285	0.5	0.5	0.6	1,492	0.5	0.5	0.6	1,741	0.6	0.5	0.7	—
Histopathology	5,218	0.4	0.4	0.5	978	0.3	0.3	0.4	1,456	0.5	0.4	0.6	↑
Immunology	4,540	0.4	0.4	0.4	970	0.3	0.3	0.4	1,369	0.5	0.4	0.5	↑
Infertility/pregnancy test	1,841	0.7	0.2	0.2	502	0.2	0.1	0.2	374	0.1	0.1	0.1	—
Simple test	1,103	0.1	0.1	0.1	193	0.1	0.1	0.1	360	0.1	0.1	0.1	—
Individual pathology tests/batteries													
Full blood count	40,882	3.5	3.4	3.5	8,629	3.0	2.8	3.1	11,696	4.1	3.9	4.2	↑
Lipids*	29,578	1.8	1.7	1.8	6,627	1.5	1.4	1.5	8,410	2.1	2.0	2.3	↑
EUC*	21,037	2.5	2.5	2.6	4,234	2.3	2.3	2.4	6,175	2.9	2.8	3.0	↑
Liver function*	20,183	1.7	1.7	1.8	4,201	1.4	1.4	1.5	6,067	2.1	2.0	2.2	↑
Glucose/glucose tolerance*	18,615	1.6	1.5	1.6	4,215	1.4	1.4	1.5	5,170	1.8	1.7	1.9	↑
Thyroid function*	17,225	1.5	1.4	1.5	3,335	1.1	1.1	1.2	5,034	1.7	1.7	1.8	↑
Pap smear*	16,818	1.4	1.4	1.5	3,844	1.3	1.2	1.4	4,449	1.5	1.4	1.6	↑
Urine M,C&S*	14,243	1.2	1.2	1.2	3,371	1.2	1.1	1.2	3,613	1.3	1.2	1.3	↑
Multibiochemical analysis*	12,094	1.0	1.0	1.1	2,181	0.8	0.7	0.8	3,615	1.3	1.1	1.4	↑
ESR	8,018	0.7	0.7	0.7	1,974	0.7	0.7	0.7	1,908	1.7	0.6	0.7	—

(continued)

Table 3.2 (continued): Distribution of pathology orders across MBS pathology groups and most frequent individual test orders for all problems, 2000–08 (all years), 2000–02 and 2006–08

	All years (2000–08)				2000–02				2006–08				
Pathology test ordered	**Number**	**Rate per 100 problems[(a)]**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 problems[(a)]**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 problems[(a)]**	**95% LCL**	**95% UCL**	**Change**
Individual pathology tests/batteries (continued)													
Ferritin*	7,780	0.7	0.6	0.7	1,463	0.5	0.5	0.5	2,540	0.9	0.8	0.9	↑
Chemistry; other*	7,467	0.6	0.6	0.7	1,035	0.4	0.4	0.4	2,594	0.9	0.8	1.0	↑
Hormone assay*	7,118	0.6	0.6	0.6	1,663	0.6	0.5	0.6	1,739	0.6	0.5	0.7	—
HbA1c*	6,901	0.6	0.6	0.6	1,330	0.5	0.5	0.5	1,959	0.7	0.6	0.7	↑
Coagulation*	6,201	0.5	0.5	0.5	1,447	0.5	0.5	0.5	1,539	0.5	0.5	0.6	↗
Microbiology; other*	5,872	0.5	0.5	0.5	1,089	0.4	0.4	0.4	1,702	0.6	0.5	0.6	↑
Hepatitis serology*	4,697	0.4	0.4	0.4	1,191	0.4	0.4	0.4	1,116	0.4	0.3	0.4	—
Prostate specific antigen*	4,656	0.4	0.4	0.4	893	0.3	0.3	0.3	1,514	0.5	0.5	0.6	↑
Histology; skin	4,603	0.4	0.4	0.4	790	0.3	0.3	0.3	1,328	0.5	0.4	0.5	↑
C reactive protein	3,522	0.3	0.3	0.3	472	0.2	0.1	0.2	1,288	0.5	0.4	0.5	↑
Vaginal swab M,C&S	3,091	0.3	0.2	0.3	741	0.3	0.2	0.3	830	0.3	0.3	0.3	↗
Vitamin B12*	2,482	0.2	0.2	0.2	400	0.1	0.1	0.2	847	0.3	0.3	0.3	↑
Total pathology tests	**307,013**	**26.1**	**25.8**	**26.5**	**64,643**	**22.2**	**21.6**	**22.7**	**87,444**	**30.3**	**29.6**	**31.0**	↑

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Notes:

1. Only the pathology accounting for >1% of all tests/batteries in any of the three data periods are included.
2. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, ↗/↘ indicates a marginal change, and — indicates no change.

4 Type 2 diabetes

Summary: Type 2 diabetes

Background

- Diabetes was made a National Health Priority Area in 1996.
- The National Health Survey 2007–08 estimated the prevalence of diabetes (Type 1 and 2) to be 4% of the Australian population using self-reported data. A 2005 BEACH study estimated the prevalence of diagnosed Type 2 diabetes in the Australian population to be 5%.
- Diabetes was responsible for 5.5% of the burden of disease and injury in Australia (2003).

GP management of Type 2 diabetes (BEACH data) April 2000 to March 2008

Type 2 diabetes was managed at a rate of 2.9 per 100 GP encounters, equating to approximately 3.2 million GP encounters nationally per year for Type 2 diabetes.

There was a significant increase in the management rate of Type 2 diabetes over the duration of this study (27% increase), from 2.6 per 100 encounters in 2000–02 to 3.3 per 100 in 2006–08.

Pathology ordering (BEACH data)

Pathology ordered for Type 2 diabetes problems accounted for 5.6% of all pathology tests recorded in 2000–08.

Pathology was ordered at a rate of 77.2 tests/batteries per 100 Type 2 diabetes contacts in 2000–08. Almost one-third of Type 2 diabetes contacts (29.7%) resulted in at least one pathology order, and on average 2.59 pathology tests/batteries were ordered per tested Type 2 diabetes contact.

The pathology ordering rate increased significantly, from 63.6 tests/batteries per 100 Type 2 diabetes contacts (in 2000–02) to 88.4 per 100 (in 2006–08). This was due to significant increases in both: the likelihood of pathology testing being ordered for Type 2 diabetes, and the number of tests ordered per tested contact.

Of the total national increase in pathology test orders between 2000–02 and 2006–08, 8.0% was attributable to pathology ordering in the management of Type 2 diabetes.

Evaluation of current GP pathology ordering (2006–08) against guidelines

Based on the 2006–08 pathology ordering data for Type 2 diabetes problems we estimate that 3.1 million tests were ordered for Type 2 diabetes problems per year in Australia. Review of the guidelines/guidance suggests:

- 2.2 million (72.0%) tests were supported by the guidelines and guidance documents
- 380,000 (12.4%) may or may not be supported due to unclear guidance
- 310,000 (10.1%) were not supported by the guidelines/guidance documents.

The remaining 5.5% of tests ordered each accounted for <1% of total pathology tests ordered for Type 2 diabetes, and were not checked against guidelines/guidance.

Comments on guidelines/guidance documents

Australian guideline—Testing of glycaemic control and renal function were not mentioned in the NHMRC guideline developed by the Diabetes Australia Guideline Development Consortium. The guideline was divided into seven sections with a total length of 935 pages. There were no sections for glycaemic control and renal problems in the management Type 2 diabetes. DoHA has recently accepted submissions (April 2009) for an update of this guideline (using the existing structure), which would exclude guidance on glycaemic control and renal problems.

Monitoring of Type 2 diabetes—The majority (94%)of Type 2 diabetes contacts are for ongoing management, as are the majority of the pathology tests ordered for this problem (93%). There is clear guidance on the role of HbA1c, lipids, EUC and albumin testing in the ongoing management of Type 2 diabetes. However the role of other tests in the ongoing monitoring of the patient is unclear—especially full blood count, liver function tests, multibiochemical tests and thyroid function tests.

Pathology testing is also needed for medication management (medication selection and side effects)—Medications commonly prescribed for Type 2 diabetes include hypoglycaemic agents, antihypertensives and statins. Renal impairment and liver function were the two main considerations in selecting and monitoring side effects of medications. Monitoring of liver function was recommended for glitazones, and statins, and monitoring of electrolytes and creatinine for selected antihypertensives. However the frequency and duration of monitoring was not specified.

Future growth in pathology ordering?

If the management rate of Type 2 diabetes increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering. It is likely that the management rate of Type 2 diabetes at GP encounters will increase:

- due to the increasing prevalence of overweight/obesity in the Australian population
- if there is an increase in detection of diabetes. The AusDiab study reported that in 1999–2000 for every diagnosed case of diabetes there was one undiagnosed case.
- The 45–49 Health Check Medicare item introduced in 2006 has the potential to increase the detection rate.

Extrapolated example of the effect of a future increase in the management rate

The extrapolations made in this example are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of GP encounters occur in Australia in the future. Increases or decreases in total attendance rates, and/or in the GP test ordering rate would affect the estimates in this example.

Example: If there was a further 27% increase in the management rate of Type 2 diabetes:

Scenario 1: No change in the current (2006–08) pathology ordering behaviour of GPs:

- there would be 3.9 million tests ordered by GPs for the management of Type 2 diabetes problems.

Scenario 2: If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.8 million tests ordered by GPs (72.0% of the 3.9 million tests)

Scenario 3: If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 3.3 million tests ordered by GPs (84.4% of the 3.9 million tests)

Ten per cent of the 3.9 million tests would not be supported by the guidelines/guidance documents and the remaining 5.5% of tests ordered were not evaluated.

4.1 Definition

The analysis of Type 2 diabetes includes all problems recorded by GPs that were classified as 'non-insulin dependent diabetes' in the International Classification of Primary Care (Version 2) (ICPC-2 code T90). Diabetes mellitus that was unspecified by the GP (as Type 1 or Type 2) is classified by ICPC-2 as Type 2 diabetes mellitus, as it is far more prevalent that Type 1 diabetes.

The analysis was limited to Type 2 diabetes as this accounts for the majority of diabetes (85% of all diabetes in Australia.[1] Type 2 diabetes accounted for 91.5% of all diabetes encounters managed in general practice in BEACH 2000–08, and 93.5% of pathology testing for all diabetes encounters. In addition, the majority of guidelines are specific to the type of diabetes.

4.2 Background

- According to the AusDiab survey, conducted in 1999–2000, 7.5% of Australians aged 25 years or over have Type 2 diabetes. This prevalence estimate includes diagnosed and undiagnosed diabetes. The AusDiab study reported that for every case of diabetes there was another that was undiagnosed.[2]
- The National Health Survey 2007–08 estimated the prevalence of diabetes (both Type 1 and 2) to be 4% of the Australian population. However, this is likely to be an under-estimation as it only includes self-reported diagnosed diabetes.[3]
- In 2003, diabetes was responsible for 5.5% of the total burden of disease and injury in Australia—85% of the diabetes burden was due to the disease itself and the remaining 15% caused by the complications of diabetes.[4]

Specific policies and initiatives

- The Australian Government recognised diabetes as a National Health Priority Area in 1996.[5]
- In 1999 the Australian Government introduced the Enhanced Primary Care package (EPC), which included remuneration for participation in the multidisciplinary care of patients with chronic or complex conditions such as diabetes.[6]
- In June, 2000 the WHO lowered the diagnostic value for fasting plasma/blood glucose concentrations, which had the effect of raising the potential number of patients diagnosed with diabetes.[7]
- An initiative by the Queensland government, 'Diabetes mellitus 2000–04', was followed by similar initiatives in other states. During this period, all other states and territories initiated their own diabetes strategic plans.

- In 2001 the Australian government introduced its $76 million program that included incentives to GPs and GP Divisions for programs aiming to improve diabetes care in general practice.[8] The National Integrated Diabetes Program included a Medicare item number for Diabetes Annual Cycle of Care, which also attracted Practice Incentive Program (PIP) funding points.
- In 2004, the EPC multidisciplinary care plan for chronic disease management was superseded by the Allied Health and Dental Care Initiative, allowing patients with a care plan to access Medicare rebates for five allied health or dental services a year.[9] This led to a doubling in the number of claims for care plan items from the MBS.[10] At the same time the government launched its Action Plan on diabetes.[11]
- In 2005 GP Management Plans and team care arrangements replaced EPC care plans.[9]
- The Australian Primary Care Collaboratives (previously the National Primary Care Collaboratives), initially a $14.6 million, 3-year program to help GPs improve patient clinical outcomes, was also launched in 2004 and a second phase was funded in 2007. One of the major topics of the Collaboratives quality improvement program was diabetes.[12]

Prevalence of Type 2 diabetes in general practice patients

The prevalence of Type 2 diabetes in patients attending general practice was studied in a number of BEACH SAND substudies. There was a significant increase in the prevalence of diagnosed Type 2 diabetes patients seen at encounters in general practice between 2000–01 and 2007–08. From 6.0% of patients attending general practice in 2000–01 (SAND abstract 21,25) to 8.5% in 2007–08 (SAND abstract 119).[13]

Using BEACH SAND data from 2005, Knox et al estimated the prevalence of Type 2 diabetes in a BEACH sample of over 9000 patients encountered in general practice to be 7.2% (95%, CI: 6.5–7.9); 5.7% (95%, CI: 5.1–6.3) in the GP attending population and 5.0% (95%, CI: 4.5–5.5) in the general population.[14]

Multimorbidity occurring with diabetes

Britt et al investigated the prevalence of multimorbidity in patients with diabetes (all types) using data from BEACH SAND substudy 89.[15] The Cumulative Illness Rating Scale was used to group chronic illnesses into domains according to the method described by Fortin at al.[16] For patients with diabetes the most common associated morbidity was vascular disease, and this combination was present in 4.4% of the national population. Of these patients 26.5% had a morbidity in a third domain and 53.2% have 2 or more additional morbidities.

Diabetes patients with one or more additional morbidities constituted 6.1% of the population (estimated to be 1.3 million patients), 4.5% had 3 or more morbidities (estimated as 945,000 patients) and 2.8% had 4 or more additional morbidities (estimated 588,000 patients).

The frequent occurrence of multimorbidity with diabetes has significant implications for the management of diabetes and the development of guidelines for best practice care in complex patient situations.

4.3 Management rate in Australian general practice

In BEACH, Type 2 diabetes was managed at 22,935 patient encounters by 6,451 GPs between April 2000 and March 2008 (Table 4.1). That is equivalent to one management of Type 2 diabetes per 35 encounters with patients in 2000–08.

Type 2 diabetes was managed at a rate of 2.9 per 100 general practice encounters (Table 4.1). This equates to approximately 3.2 million encounters nationally per year where Type 2 diabetes is managed by GPs.

New cases of Type 2 diabetes accounted for 6.2% of Type 2 diabetes problems (Table 4.3). The problem is considered new if, it is a new problem to the patient or a new episode of a recurrent problem, and the patient has not been treated for that problem by any medical practitioner before.

Table 4.1: Summary of Type 2 diabetes data set, 2000–08

Variable	Number	Rate per 100 total encs (*n*=784,300)	95% LCL	95% UCL	Per cent of total problems (*n*=1,174,893)	Management: encounter ratio
General practitioners	6,451	—	—	—	—	—
Type 2 diabetes encounters	22,935	—	—	—	—	—
Type 2 diabetes problems managed	22,938	2.9	2.9	3.0	2.0	1:35
New Type 2 diabetes problems	1,421	0.2	0.2	0.2	—	—

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Change in management over time

Previously published data from the BEACH study show that there was a significant increase in the management of diabetes (including type 1 and 2) over the last decade, from 2.6 per 100 encounters (95% CI: 2.4–2.7) in 1998–99 to 3.9 per 100 (95% CI: 3.6–4.1) in 2007–08.[17]

Similarly in this study, there was a significant increase in the management rate of Type 2 diabetes, from 2.6 per 100 encounters in 2000–02 to 3.3 per 100 in 2006–08 (Table 4.4). In 2006–08 this is equivalent to one management of Type 2 diabetes per 30 encounters with patients.

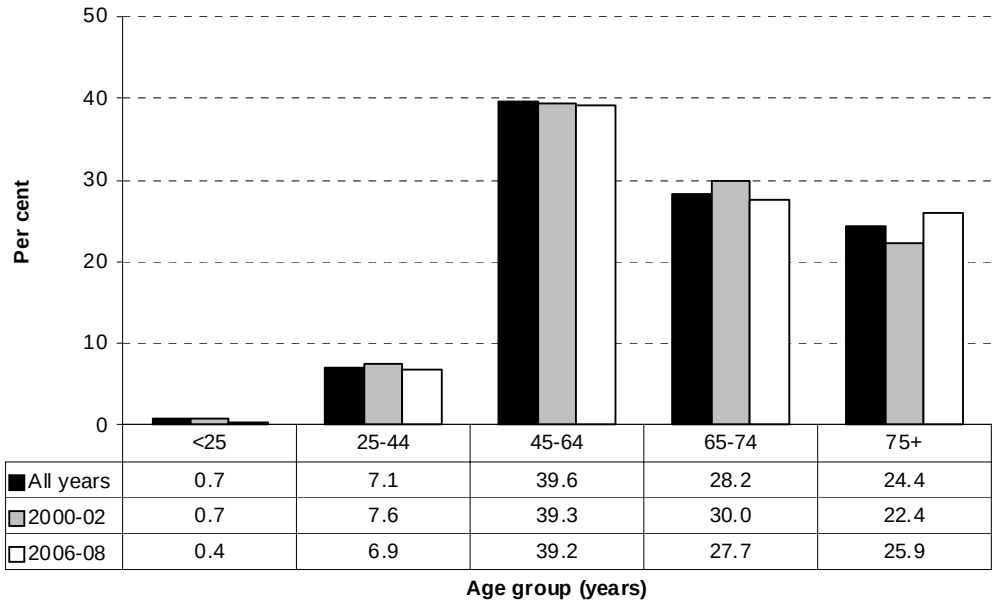
There was no change in the diagnosis or detection rate of new cases of Type 2 diabetes from 2000–02 to 2006–08. This indicates that the increase in the management rate largely reflects an increase in monitoring encounters for Type 2 diabetes.

Age distribution

The age distribution of adult patients with Type 2 diabetes managed at general practice encounters 2000–08 is presented in Figure 4.1.

Patients being managed for Type 2 diabetes were most often aged 45–64 years (39.6%), followed by patients aged 65–74 years (28.2%), 75+ years (24.4%), 25–44 years (7.1%), and <25 years (0.7%).

From 2000–02 to 2006–08, the only significant change in age distribution of patients managed for Type 2 diabetes was a significant increase in the proportion of patients aged 75+ years—increasing from 22.4% (95% CI: 21.1–23.7) to 25.9% (95% CI: 24.5–27.2) (Figure 4.1).

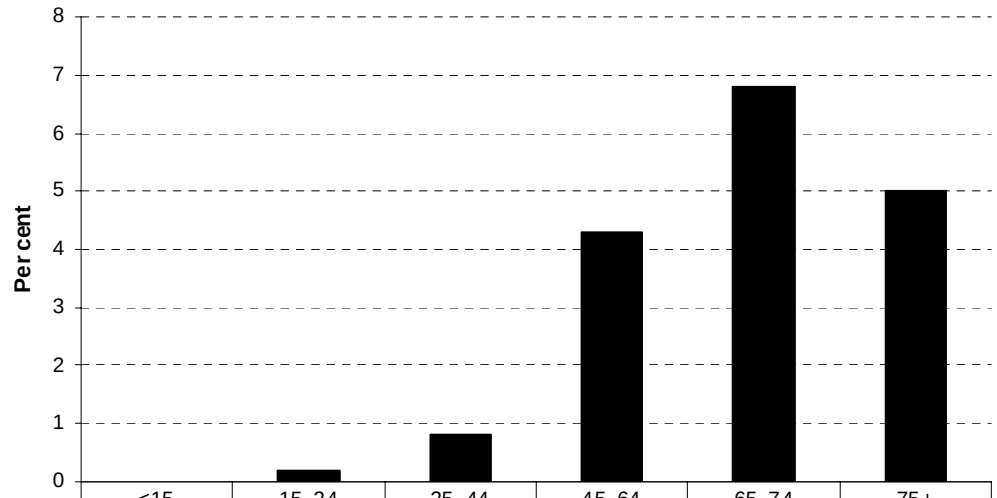


	<25	25-44	45-64	65-74	75+
All years	0.7	7.1	39.6	28.2	24.4
2000-02	0.7	7.6	39.3	30.0	22.4
2006-08	0.4	6.9	39.2	27.7	25.9

Age group (years)

Figure 4.1: Age distribution of adult patients with Type 2 diabetes managed at general practice encounters, 2000–08 (all years), 2000–02, and 2006–08

Figure 4.2 shows the age-specific rates of management of Type 2 diabetes among patients attending general practice. Patients aged 65–74 were most likely to be managed for diabetes, (6.8% of encounters with patients in this aged group), followed by patients aged 75+ (5.0%) and those aged 45–64 years (4.3%).



	<15	15–24	25–44	45–64	65–74	75+
Rate	0.0	0.2	0.8	4.3	6.8	5.0

Age group (years)

Figure 4.2: Age-specific rate of management of Type 2 diabetes 2000–08

Table 4.2 shows the number of problems managed per encounter where Type 2 diabetes was managed and the number managed at all BEACH encounters in 2000–08. A maximum of 4 problems can be recorded per encounter in BEACH.

Encounters involving the management of Type 2 diabetes were more complex, being more likely to have multiple (2, 3 or 4) problems managed per encounter than average general practice encounters.

Table 4.2: Number of problems managed at Type 2 diabetes and total encounters

	Type 2 diabetes encs (2000–08)				All BEACH encs (2000–08)			
Number of problems managed	Number	Per cent of problems	95% LCL	95% UCL	Number	Per cent of problems	95% LCL	95% UCL
One problem	5,242	22.9	22.1	23.6	502,522	64.1	63.7	64.4
Two problems	8,613	37.6	36.9	38.3	193,452	24.7	25.5	24.9
Three problems	5,978	26.1	25.4	26.7	67,837	8.7	8.5	8.8
Four problems	3,102	13.5	12.9	14.1	20,489	2.6	2.5	2.7

Note: LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08.

4.4 Pathology ordering behaviour

Pathology was ordered at a rate of 77.2 per 100 Type 2 diabetes problems in 2000–08. Almost one-third of Type 2 diabetes problems (29.7%) resulted in at least one pathology order (Table 4.3).

Once the decision to order a pathology test/battery of tests was made the GP ordered on average 2.59 pathology tests/batteries per tested Type 2 diabetes problem (Table 4.3). Pathology ordered for Type 2 diabetes problems accounted for 5.6% of all pathology tests recorded from April 2000 to March 2008.

Table 4.3: Summary of pathology ordering for Type 2 diabetes, 2000–08

Variable	Number	Per cent / Rate of Type 2 diabetes problems	95% LCL	95% UCL
Type 2 diabetes problems managed	22,938	100.0	—	—
New problems (% of Type 2 diabetes problems)	1,421	6.2	5.9	6.5
Pathology (Rate per 100 Type 2 diabetes problems)	17,710	77.2	75.0	79.5
At least one pathology order (% of Type 2 diabetes problems)	6,818	29.7	29.0	30.5
Number of tests/batteries per 100 tested Type 2 diabetes problems	—	259.8	255.7	263.8

Note: LCL—lower confidence limit; UCL—upper confidence limit.

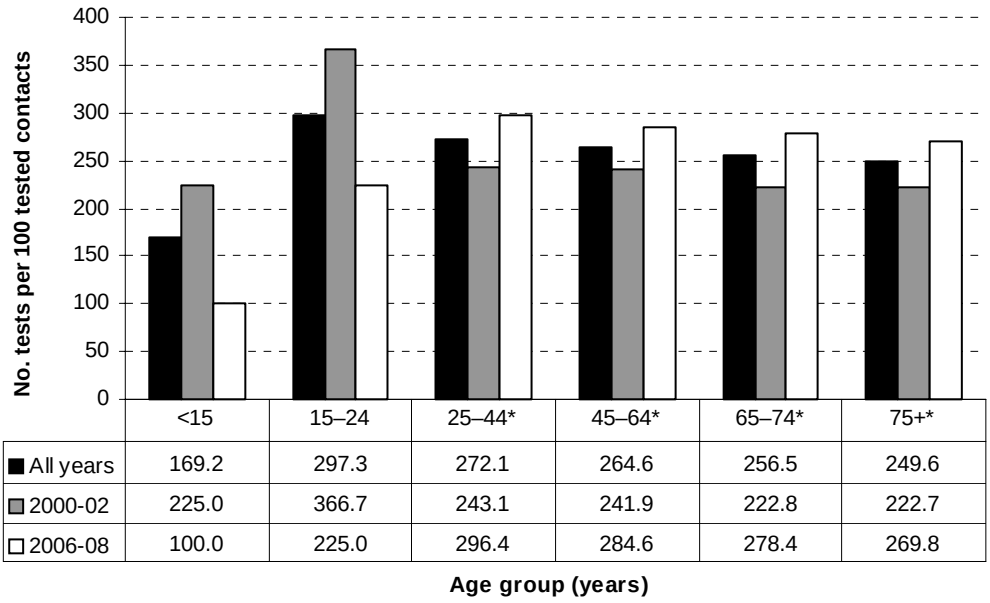
Changes over time, 2000–02 to 2006–08

The proportion of total pathology tests/batteries accounted for by Type 2 diabetes problems was 5.0% in 2000–02 and 6.0% in 2006–08.

The rate of pathology ordering increased significantly from 63.6 tests/batteries of tests ordered per 100 Type 2 diabetes contacts (in 2000–02) to 88.4 per 100 (in 2006–08). This was due to significant increases in both:

- the likelihood of pathology testing being ordered for Type 2 diabetes (27.3% in 2000–02 to 31.6% in 2006–08 of diabetes problems)
- the number of tests ordered once the decision to order tests was made (232.9 per 100 tested Type 2 diabetes contacts in 2000–02 and 280.2 in 2006–08) (Table 4.4).

Figure 4.3 shows the average number of tests ordered per 100 tested contacts by patient age. All patient groups aged 25 years and over had significantly more tests ordered per tested diabetes contact in 2006–08 than in 2000–02.



	<15	15–24	25–44*	45–64*	65–74*	75+*
All years	169.2	297.3	272.1	264.6	256.5	249.6
2000-02	225.0	366.7	243.1	241.9	222.8	222.7
2006-08	100.0	225.0	296.4	284.6	278.4	269.8

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 4.3: Age-specific mean number of pathology tests per 100 tested Type 2 diabetes contacts, 2000–08 (all years), 2000–02, and 2006–08

Extrapolation of pathology ordering behaviour

When these data were extrapolated to the number of GP encounters claimed through Medicare nationally the results suggest there were approximately:

- 850,000 more encounters involving the management of Type 2 diabetes in 2006–08 (3.5 million per annum) than in 2000–02 (2.6 million per annum).
- 380,000 additional Type 2 diabetes contacts that involved the ordering of at least one pathology test/battery of tests (tested contacts) in 2006–08 (1.1 million per annum) than in 2000–02 (720,000 per annum).

- 1.4 million additional pathology tests/batteries of tests ordered for Type 2 diabetes in 2006–08 (3.1 million per annum) than in 2000–02 (1.7 million per annum) (results not shown).

Of the estimated 17.7 million additional tests/batteries ordered by GPs in 2006–08 (51.3 million tests/batteries ordered by GPs per annum), compared with 2000–01 (33.6 million per annum), 8.0% was attributable to pathology ordering in the management of Type 2 diabetes.

There was a 50% increase in the volume of GP requests for pathology tests/batteries attributable to Type 2 diabetes, due to a combination of factors:

- the increase in the total number of GP encounters in Australia
- the increased management rate of Type 2 diabetes
- to changes in GP pathology ordering behaviour for Type 2 diabetes, that is:
  - increased likelihood of pathology being ordered for Type 2 diabetes
  - increased number of tests ordered once the decision to order was made.

Table 4.4: Changes in the management of Type 2 diabetes over time, 2000–02 to 2006–08

	2000–02							2006–08							
Variable	**Number**	**Rate per 100 total encs (*n*=198,200)**	**95% LCL**	**95% UCL**	**Per cent / Rate of T2D probs (*n*=5,211)**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 total encs (*n*=188,300)**	**95% LCL**	**95% UCL**	**Per cent / Rate of T2D probs (*n*=6,172)**	**95% LCL**	**95% UCL**	**Change**
General practitioners	1,573	—	—	—	—	—	—	864	—	—	—	—	—	—	—
Type 2 diabetes encounters	5,211	—	—	—	—	—	—	6,171	—	—	—	—	—	—	—
Type 2 diabetes problems managed	5,211	2.6	2.5	2.8	—	—	—	6,172	3.3	3.1	3.4	—	—	—	↑
New problems	325	0.2	0.1	0.2	6.2	5.5	7.0	369	0.2	0.2	0.2	6.0	5.4	6.6	—
Pathology (Rate per 100 Type 2 diabetes problems)	3,314	—	—	—	63.6	59.6	67.6	5,459	—	—	—	88.4	83.7	93.2	↑
At least one pathology order (% of Type 2 diabetes problems)	1,423	—	—	—	27.3	25.8	28.8	1,948	—	—	—	31.6	30.1	33.0	↑
Number of tests/batteries per 100 tested Type 2 diabetes problems	—	—	—	—	232.9	224.8	241.0	—	—	—	—	280.2	272.4	288.1	↑

Note: T2D—Type 2 diabetes; LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change and — indicates no change.

4.5 Types of pathology tests ordered

Table 4.5 shows the distribution of pathology tests/batteries ordered for Type 2 diabetes in 2000–08 by MBS groups and the most common individual types of pathology tests ordered.

- Chemistry tests were the group of tests most often ordered, at a rate of 68.5 per 100 contacts with Type 2 diabetes. The most common chemistry tests ordered were:
  - HbA1c tests (23.0 per 100 Type 2 diabetes contacts)
  - lipid tests (11.7 per 100 Type 2 diabetes contacts)
  - glucose/glucose tolerance tests (10.0 per 100 contacts)
  - electrolyte, urea and creatinine tests (7.2)
  - other chemistry tests (6.2)—90% of this group were urine albumin tests
  - liver function tests (4.5) (Table 4.5).
- Haematology tests (6.1 per 100 contacts), in particular full blood counts (5.5 per 100), were also commonly ordered in the management of Type 2 diabetes (Table 4.5).

Only 7% of pathology tests were ordered in the management of 'new' cases of Type 2 diabetes. The vast majority of pathology tests/batteries ordered in the management of Type 2 diabetes were for ongoing management (Table 4.5).

Changes in types of pathology tests ordered 2000–02 to 2006–08

Table 4.6 compares the pathology ordering for Type 2 diabetes problems in 2000–02 with 2006–08, shaded results highlight significant differences. There was a significant increase in the rate of pathology tests ordered from 56.6 per 100 Type 2 diabetes contacts in 2000–02 to 78.2 per 100 in 2006–08—an increase of 38%.

There were significant increases in the order rate of:

- HbA1c tests—33% increase
- lipid tests—53% increase
- electrolyte, urea and creatinine tests—48% increase
- other chemistry tests—135% increase (due to the 125% rise in urine albumin tests)
- liver function tests—79% increase
- multibiochemical analysis—83% increase
- full blood counts—89% increase

There was also a significant decrease in the order rate of glucose/glucose tolerance tests—28% decrease (Table 4.6).

4.6 Prescribed medications

Table 4.7 lists the most common prescribed medications for Type 2 diabetes. From 2000–02 to 2006–08, there were significant increases in prescribing of the hypoglycaemic agents: thiazolinediones (glitazones), combination oral blood glucose lowering drugs, and long-acting insulin. There were simultaneous decreases in the prescribing rates of sulfonamides and fast acting insulins. There were also significant increases in the prescribing rates of statins, ACE inhibitors, Angiotensin II receptor antagonists and aspirin.

Table 4.5: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for Type 2 diabetes, 2000–08

	Pathology for all Type 2 diabetes problems						Pathology for new Type 2 diabetes problems				
Pathology test ordered	**Number**	**Per cent of all pathology for t2D**	**Per cent of group**	**Rate per 100 T2D probs (*n*=22,938)**	**95% LCL**	**95% UCL**	**Number**	**% test for new cases**	**Rate per 100 new T2D probs (n=1,421)**	**95% LCL**	**95% UCL**
Chemistry	**15,719**	**88.8**	**100.0**	**68.5**	**66.5**	**70.6**	**1,051**	**6.7**	**74.0**	**67.6**	**80.3**
HbA1c*	5,272	29.8	33.5	23.0	22.3	23.7	257	4.9	18.1	16.0	20.1
Lipids*	2,681	15.1	17.1	11.7	11.2	12.2	124	4.6	8.7	7.2	10.2
Glucose/glucose tolerance*	2,299	13.0	14.6	10.0	9.5	10.5	287	12.5	20.2	18.1	22.3
EUC*	1,657	9.4	10.5	7.2	6.8	7.6	89	5.4	6.3	4.9	7.6
Chemistry; other*	1,418	8.0	9.0	6.2	5.8	6.6	110	7.8	7.7	6.3	9.2
Liver function*	1,040	5.9	6.6	4.5	4.2	4.9	60	5.8	4.2	3.2	5.3
Multibiochemical analysis*	803	4.5	5.1	3.5	3.2	3.8	46	5.7	3.2	2.3	4.2
Thyroid function*	235	1.3	1.5	1.0	0.9	1.2	47	20.0	3.3	2.3	4.3
Haematology	**1,402**	**7.9**	**100.0**	**6.1**	**5.7**	**6.5**	**116**	**8.3**	**8.2**	**6.6**	**9.7**
Full blood count	1,266	7.2	90.3	5.5	5.2	5.9	106	8.4	7.5	6.1	8.9
Other NEC	**401**	**2.3**	**100.0**	**1.8**	**1.5**	**2.0**	**31**	**7.7**	**2.2**	**1.4**	**3.0**
Microbiology	**164**	**0.9**	**100.0**	**0.7**	**0.6**	**0.8**	**23**	**14.0**	**1.6**	**0.9**	**2.3**
Other pathology groups	**24**	**0.1**	**100.0**	**—**	**—**	**—**	**3**	**12.5**	**—**	**—**	**—**
Total pathology tests	**17,710**	**100.0**	—	**77.2**	**75.0**	**79.5**	**1,224**	**6.9**	**86.1**	**78.7**	**93.6**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations.

Table 4.6: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for Type 2 diabetes, 2000–02 compared with 2006–08

	2000–02						2006–08						
Pathology test ordered	Number	Per cent of all pathology for Type 2 diabetes	Per cent of group	Rate per 100 Type 2 diabetes probs[(a)]	95% LCL	95% UCL	Number	Per cent of all pathology for Type 2 diabetes	Per cent of group	Rate per 100 Type 2 diabetes probs[(a)]	95% LCL	95% UCL	Change
Chemistry	**2,951**	**89.1**	**100.0**	**56.6**	**53.0**	**60.2**	**4,828**	**88.4**	**100.0**	**78.2**	**73.9**	**82.5**	↑
HbA1c*	994	30.0	33.7	19.1	17.7	20.4	1,566	28.7	32.4	25.4	23.9	26.8	↑
Glucose/glucose tolerance*	641	19.3	21.7	12.3	11.1	13.5	550	10.1	11.4	8.9	7.9	9.9	↓
Lipids*	478	14.4	16.2	9.2	8.2	10.1	869	15.9	18.0	14.1	13.0	15.2	↑
EUC*	289	8.7	9.8	5.6	4.8	6.3	510	9.3	10.6	8.3	7.4	9.1	↑
Chemistry; other*	176	5.3	6.0	3.4	2.8	4.0	492	9.0	10.2	8.0	7.1	8.8	↑
Liver function*	170	5.1	5.8	3.3	2.7	3.8	363	6.7	7.5	5.9	5.1	6.6	↑
Multibiochemical analysis*	121	3.7	4.1	2.3	1.8	2.9	258	4.7	5.3	4.2	3.5	4.9	↑
Thyroid function*	43	1.3	1.5	0.8	0.6	1.1	69	1.3	1.4	1.1	0.8	1.4	—
Haematology	**226**	**6.8**	**100.0**	**4.3**	**3.7**	**5.0**	**462**	**8.5**	**100.0**	**7.5**	**6.6**	**8.4**	↑
Full blood count	190	5.7	84.1	3.7	3.1	4.2	433	7.9	93.7	7.0	6.2	7.8	↑
Other NEC	**94**	**2.8**	**100.0**	**1.8**	**1.3**	**2.3**	**123**	**2.3**	**100.0**	**2.0**	**1.5**	**2.5**	**—**
Other test NEC*	34	1.0	36.2	0.7	0.4	0.9	51	0.9	41.5	0.8	0.5	1.1	—
Microbiology	**35**	**1.1**	**100.0**	**0.7**	**0.4**	**0.9**	**41**	**0.8**	**100.0**	**0.7**	**0.5**	**0.9**	**—**
Other pathology groups	**8**	**0.2**	**100.0**	**—**	**—**	**—**	**5**	**0.1**	**100.0**	**—**	**—**	**—**	**—**
Total pathology tests	**3,314**	**100.0**	**—**	**63.6**	**59.6**	**67.6**	**5,459**	**100.0**	**—**	**88.4**	**83.7**	**93.2**	↑

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) The total number of Type 2 diabetes problems in 2000–02 was 5,211 and in 2006–08 was 6,172.

Note: Probs—problems; LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

Table 4.7: Prescribed medications for Type 2 diabetes by ATC levels 3 and 4, 2000–08, 2000–02 and 2006–08

	All years (2000–08)				2000–02				2006–08				
ATC Level 3	**Number**	**Rate per 100 T2D probs[(a)]**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 T2D probs[(a)]**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 T2D probs[(a)]**	**95% LCL**	**95% UCL**	**Change**
Blood glucose lowering drugs, excl. insulins	12,262	53.5	52.1	54.8	3,058	56.7	55.7	61.6	3,207	52.0	49.4	54.5	↓
Biguanides (e.g. metformin)	6570	28.6	27.8	29.4	1528	29.3	27.6	31.0	1779	28.8	27.3	30.3	—
Sulfonamides, urea derivatives	5029	21.9	21.2	22.7	1480	28.4	26.6	30.2	1088	17.6	16.4	18.9	↓
Thiazolidinediones (glitazones)	436	1.9	1.7	2.1	8	0.2	0.0	0.3	245	4.0	3.4	4.5	↑
Combo oral blood glucose lowering drugs	92	0.4	0.3	0.5	‡	0.0	—	—	75	1.2	0.8	1.6	↑
Insulins and analogues	1,275	5.6	5.2	6.0	297	5.7	4.7	6.7	395	6.4	5.6	7.2	—
Intermediate combined with fast-acting	893	3.9	3.6	4.2	186	3.6	2.9	4.2	269	4.4	3.8	5.0	—
Long-acting	103	0.5	0.4	0.5	19	0.4	0.2	0.5	71	1.2	0.8	1.5	↑
Fast-acting	279	1.2	1.1	1.4	92	1.8	1.3	2.2	55	0.9	0.6	1.1	↓
Lipid modifying agents, plain	605	2.6	2.4	2.9	59	1.1	0.8	1.5	260	4.2	3.6	4.8	↑
HMG CoA reductase inhibitors (statins)	568	2.5	2.2	2.7	54	1.0	0.7	1.3	242	3.9	3.4	4.5	↑
ACE inhibitors, plain	311	1.4	1.2	1.5	51	1.0	0.7	1.3	110	1.8	1.4	2.1	↑
Other analgesics and antipyretics (e.g. Acetylsalicylic acid, Paracetamol)	266	1.2	1.0	1.3	27	0.5	0.3	0.7	111	1.8	1.3	2.3	↑
Angiotensin II antagonists, plain	103	0.5	0.4	0.5	7	0.1	0.0	0.2	41	0.7	0.5	0.9	↑
Viral vaccines (e.g. influenza vaccine)	61	0.3	0.2	0.4	28	0.5	0.2	0.8	17	0.3	0.1	0.4	—
Selective calcium channel blockers with mainly vascular effects (e.g. Amlodipine)	47	0.2	0.1	0.3	4	0.1	0.0	0.2	21	0.3	0.2	0.5	—
Angiotensin II antagonists, combinations	47	0.2	0.1	0.3	3	0.1	0.0	0.1	21	0.3	0.2	0.5	↑
Total prescribed medications	**15,926**	**69.4**	**67.8**	**71.0**	**3,749**	**71.9**	**68.7**	**75.2**	**4,440**	**71.9**	**68.7**	**75.2**	**—**

(a) The total number of Type 2 diabetes problems in 2000–08 was 22,938, in 2000–02 was 5,211 and in 2006–08 was 6,172.

‡ Medication was not available in 2000–02.

Note: Only the most frequent drugs are included. ATC—Anatomical Therapeutic Chemical classification; scripts—prescriptions; encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit; excl—excluding; ACE—angiotensin converting enzyme. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

4.7 Guidelines for the management of Type 2 diabetes

Guidance documents for the management of Type 2 diabetes were considered in this study. The majority of guidelines consider pathology testing for (i) the diagnosis of diabetes, (ii) glycaemic control, and (iii) microvascular and macrovascular complications.

Guidelines reviewed were:

- 'Diabetes management in general practice: guidelines for type 2 Diabetes 2008–09' [Diabetes Australia & RACGP, 2008].[18]
- 'National evidence based guidelines for the management of Type 2 diabetes mellitus' [Diabetes Australia Guideline Development Consortium, NHMRC, 2005].[19]
- 'Canadian Diabetes Association 2008 clinical practice guidelines for the prevention and management of diabetes in Canada' [CDA, 2008].[20]
- 'Type 2 diabetes: national clinical guideline for management in primary and secondary care' [UK, NICE guideline, National Collaborating Centre for Chronic Conditions, Royal College of Physicians, 2008—update of 2002 guideline].[21]
- 'Medical guidelines for clinical practice for the management of diabetes mellitus' [American Association of Clinical Endocrinologists, AACE, America 2007].[22]
- 'Clinical practice guidelines: Diabetes mellitus' [Ministry of Health, MoH, Singapore, 2006].[23]
- 'Standards of Medical Care in Diabetes—2008' [American Diabetes Association, ADA, 2008].[24]
- 'Management of Diabetes: a national clinical guideline' [Scottish Intercollegiate Guidelines Network, SIGN, 2001].[25]
- 'Global guideline for Type 2 diabetes' [International Diabetes Federation, IDF, 2005].[26]

Other Australian sources of guidance reviewed were:

- Murtagh's general practice, diabetes mellitus management section [Murtagh 2007].[27]
- 'Patient presentations in general practice', section on patients presenting for diabetes check-up [Steven 1999].[28]
- 'RCPA manual', diabetes mellitus section—Manual of use and interpretation of pathology tests [The Royal College of Pathologists of Australasia (RCPA), 2004].[29]

Other guidelines and sources of guidance that were reviewed but not included in tables 4.7 and 4.8 were:

- 'Management of Type 2 diabetes' [New Zealand Guidelines Group 2003], was not included because it is based on the SIGN, NHMRC (Diabetes Australia Guideline Development Consortium) and NICE guidelines—these are reviewed above.
- Lipid control in the management of Type 2 diabetes mellitus: A clinical practice guidelines from the American College of Physicians [2004][30]— discussed in the context of tests related to medication use.
- Therapeutic guidelines[31]—discussed in the context of tests related to medication use.
- Product information for medications in MIMS[32]—discussed in the context of medication use.

4.8 Application of the guidance

Evaluation of GP pathology ordering against guidelines/guidance

Table 4.8 provides a summary of the individual tests and the level of support provided in the guidelines/guidance for each: yes—supported; unclear guidance or conditional support; no—not supported:

- 74.4% of the tests ordered for the management of Type 2 diabetes were supported by the guidelines and guidance documents
- For 11.2% of tests ordered guidance was conditional or unable to be determined
- 8.5% of tests ordered were not supported by the guidelines/guidance documents.

The individual tests/batteries listed in Table 4.8 account for 94.1% of pathology tests/batteries ordered for Type 2 diabetes because only the most common individual pathology tests ordered are included (each accounted for >1% of tests for Type 2 diabetes).

Table 4.8: Summary of support for GP pathology ordering for the most frequent individual test orders for Type 2 diabetes, 2000–08

Pathology test ordered	Number	Per cent of all pathology for Type 2 diabetes
YES	**13,185**	**74.4**
HbA1c*	5,272	29.8
Lipids*	2,681	15.1
Glucose/glucose tolerance*	2,299	13
EUC*	1,657	9.4
Urine albumin/albumin:creatinine ratio	1,276	7.2
UNCLEAR/CONDITIONAL SUPPORT	**1,985**	**11.2**
Liver function*	1,040	5.9
Multibiochemical analysis*	803	4.5
Chemistry; other* (excluding urine albumin/albumin:creatinine ratio)	142	0.8
NO	**1,501**	**8.5**
Full blood count	1,266	7.2
Thyroid function*	235	1.3
Subtotal (n, % of total tests included in the table)	*16,671*	*94.1*
Total pathology tests	**17,710**	**100.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 4.9 compares the commonly ordered pathology tests/batteries for Type 2 diabetes with the guidelines and guidance documents' recommended tests for Type 2 diabetes. The key explaining the colours used in the table is before Table 4.9. Briefly, dark green tests are specifically supported, light green have partial support, red tests are advised against, orange tests are those for which support cannot be determined, and pink tests were not mentioned in the guideline/guidance.

HbA1c

There was strong agreement between guidelines for the monitoring of glycaemic control using the HbA1c test. Frequency of recommended testing was specified in the majority of guidance documents.

There were three guidelines that did not explicitly recommend testing of HbA1c—NHMRC (Diabetes Australia Guideline Development Consortium), SIGN and AACE guidelines (discussed in more detail below, see 'incomplete guidance').

In BEACH, HbA1c tests accounted for almost 30% of pathology tests for Type 2 diabetes in 2006–08 and over the period of the study (2000–02 to 2006–08) the rate of ordering increased by 33%.

Glucose and glucose tolerance

The use of fasting glucose and oral glucose tolerance tests (OGTT) were often recommended only for the diagnosis of diabetes. There were three guidelines (CDA, NICE, IDF) that recommended an annual fasting plasma glucose test to check the accuracy of the patient's self-monitoring blood glucose machine.

In BEACH, glucose and glucose tolerance tests accounted for 10% of pathology tests for Type 2 diabetes in 2006–08, over the period of the study (2000–02 to 2006–08) the rate of ordering decreased by 28%.

Lipids

There was strong agreement between guidelines for assessment of lipid levels. Frequency of testing was recommended in the majority of guidance documents.

There were two guidelines (SIGN and AACE), which did not provide clear guidance on lipid levels (this is discussed in more detail below, see 'incomplete guidance')

In BEACH, lipid tests accounted for 16% of pathology tests for Type 2 diabetes in 2006–08 and over the period of the study (2000–02 to 2006–08) the rate of ordering increased by 53%.

Electrolytes, urea & creatinine (EUC) and urine albumin (Chemistry, other)

The 'Chemistry, other' test group includes multiple analytes. The vast majority of tests ordered in this group (90%) were urine albumin and albumin:creatinine ratio tests.

Annual assessment of kidney function was recommended in all guidelines with the exception of the NHMRC guideline. Serum creatinine (for calculation of eGFR) and urine albumin (albumin:creatinine ratio) were the recommended tests. Urea was also recommended by two of the guidance documents (Steven and RCPA). Annual testing was recommended for patients with Type 2 diabetes without established albuminuria.

Renal function was also often discussed in the context of medications. The NHMRC guideline only discussed renal function in the context of medications and BP target, it did not did not discuss monitoring of creatinine or urine albumin to detect diabetic nephropathy.

In BEACH, EUC tests accounted for 9% of pathology tests for Type 2 diabetes in 2006–08 and, over the period of the study (2000–02 to 2006–08) the rate of ordering increased by 48%.

Other chemistry tests accounted for 9% of orders in 2006–08 (urine albumin and albumin:creatinine ratio tests accounted for 8% of orders in 2006–08). Over the period of this study the rate of ordering more than doubled, increasing by 135%, largely due to the 125% increase in urine albumin and albumin:creatinine ratio tests.

Full blood count

Full blood count (FBC) was mentioned in only two guidelines.

The AACE and IDF guidelines recommended monitoring to check for anaemia when chronic kidney disease was present.

In BEACH, FBCs accounted for 8% of pathology tests for Type 2 diabetes in 2006–08 and over the period of the study (2000–02 to 2006–08) the rate of ordering increased by 89%.

Liver function

Liver function tests (LFTs) were often not recommended, either as part of the initial investigation of newly diagnosed cases or for monitoring of Type 2 diabetes. However, guidance documents often mentioned LFTs in relation to medications, monitoring during use of glitazones, and prior to commencement of metformin.

In BEACH, LFTs accounted for 7% of pathology tests for Type 2 diabetes in 2006–08 and over the period of the study (2000–02 to 2006–08) the rate of ordering increased by 79%.

Multibiochemical analysis

In this analysis the multibiochemical analysis (MBA) includes the MBA test and the E&LFT (electrolytes and liver function test). E&LFT tests account for 72% of this group.

The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported. However, indiscriminate testing does not meet evidence-based principles.

The LFT component of the MBA would have support in certain circumstances as discussed above.

In BEACH, MBA accounted for 5% of pathology tests for Type 2 diabetes in 2006–08 and over the period of the study (2000–02 to 2006–08) the rate of ordering increased by 83%.

Thyroid function tests

In the majority of guidance documents thyroid function tests (TFT) were not mentioned. There were two guidelines that mentioned circumstances where TFT may be needed although the circumstances were different:

- the Diabetes Australia/RACGP guideline recommended TFT as part of the initial assessment if there is a family history or clinical suspicion
- the ADA guideline recommended TFT as part of the initial assessment if dyslipidaemia was present or the patient was female and aged >50 years.

In BEACH, TFT accounted for 1% of pathology tests for Type 2 diabetes in 2006–08 and over the period of the study (2000–02 to 2006–08) the rate of ordering did not change.

Other tests mentioned in the guidance documents

Other tests mentioned in the guidance documents included:

- urinalysis as part of the initial investigations (the RCPA listed this as part of monitoring of kidney function). These were not included in the BEACH pathology data as GPs participating in BEACH are specifically instructed not to record dipstick tests.
- the use of blood keytones was not recommended in the Singapore MoH guideline
- urine microscopy, culture and sensitivity testing (urine M,C&S) was recommended in the Diabetes Australia/RACGP guideline if risk of urine infection is high and was recommended for monitoring of kidney function in the RCPA manual.

When statins were used routine monitoring of creatine kinase (CK) was not recommended. The Australian Therapeutic guidelines also stated that CK monitoring is not needed in the absence of muscle pain.

These other tests accounted for a small proportion of pathology tests for Type 2 diabetes (<1% of individual tests for Type 2 diabetes).

Key to Table 4.9

Colour	Description
	The document specifically recommended this test. Any notes within the cell indicate further detail. For example, a specific disease to test for within subset of patients; a specific test within a battery of tests.
	The document stated that this test should be considered. Any notes within the cell indicate further detail (e.g. a specific test to consider)
	Unable to determine guidance—MBA tests include mixed content for which it is not possible to determine guideline agreement (see footnote (a) above).
	Guideline specifically stated not to do this test. Additional information is supplied if the guideline stated not to do the test unless clinically indicated.
	Guideline did not mention this test

Table 4.9: Summary of guideline/guidance recommendations by most frequent individual test orders for Type 2 diabetes, 2000–08

Pathology test ordered	Diab Aust/ RACGP 2008/9	NHMRC 2001 (2005)	CDA 2008	NICE 2008	SIGN 2001	ADA 2008	Singapore MoH 2006	AACE 2007	IDF 2005	Murtagh 2007	Steven 1999	RCPA 2004	Pathology for T2D (n=17,710)
HbA1c*		Implied			Implied			Implied					5,272 (29.8%)
Lipids*					Implied			Implied				Implied	2,681 (15.1%)
Glucose/glucose tolerance*													2,299 (13.0%)
Glucose fasting	Diag	Diag	Diagnosis & annual	Annual	Diag	Diag	Diag	Diag	Diag & annual	Diag	NA	Diag	2,143 (12.1%)
OGTT	Diag	Diag	Diag	NA	Diag	Diag	Diag	Diag	Diag	Diag	NA	Diag	156 (0.9%)
EUC*		Implied											1,657 (9.4%)
Chemistry; other*													1,418 (8.0%)
Urine albumin/ albumin:creatinine ratio		Implied											1,276 (7.2%)
Full blood count								Kidney disease	Kidney disease				1,266 (7.2%)
Liver function*	Meds	Meds	Meds	Statins Meds		Diag	Meds	Meds					1,040 (5.9%)
Multibiochemical analysis*[(a)]													803 (4.5%)
Thyroid function*	Diagnosis (Family Hx or sympt)					Diagnosis (dyslipid or F >50)							235 (1.3%)
Other tests in the guideline	Urinalysis (Diag)						Blood keytones	Parathyroid in kidney disease			Nitrates (Diag)	Urinalysis	
	Urine M,C&S (infection)											Urine M,C&S	

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) Multibiochemical analysis (MBA) potentially includes a combination of a broad group of tests. The MBS chemical analysis group includes a wide variety of biochemical tests (such as those in MBS item 66500).

Note: T2D—Type 2 diabetes mellitus; Diag—test at diagnosis; NA—not applicable; Meds—medications; also see Abbreviations.

Evaluation of the guidelines and guidance documents

Incomplete guidance

There were some guidance documents that did not make clear recommendations for testing in crucial aspects of Type 2 diabetes management.

- HbA1c testing was implied in the NHMRC, SIGN and AACE guidelines.
  - The NHMRC guideline did not explicitly recommend HbA1c testing; glycaemic control was only discussed in regard to lipid control.
  - The SIGN guideline did not explicitly recommend HbA1c testing, but did discuss the HBA1c target in relation to prevention of cardiovascular disease, nephropathy and visual disturbances but not in the monitoring of hyperglycaemia.
  - The AACE guideline provided the target for HbA1c however frequency of testing was only discussed in the response to therapy.
- Lipid testing was implied in the SIGN and AACE guideline and in the RCPA manual
  - The SIGN guideline listed dyslipidaemia as a cardiovascular risk factor but specific targets for lipid levels, components to test and testing interval were not provided. Target lipid levels were provided in the presence of established vascular disease.
  - The AACE guideline provided the target levels for lipids but did not specify testing intervals or the specific lipid components to test
  - The RCPA listed hyperlipidaemia as potential long-term consequence of diabetes mellitus but the test was not mentioned in the relevant section.
- Assessment of renal function (EUC, urine albumin/albumin:creainine ratio) was implied in the NHMRC guideline. Kidney disease in diabetes was not covered in detail in the guideline. Testing of kidney function was implied—it was discussed as a consideration in choice of therapy and monitoring of medication side effects.

Australian NHMRC guideline

The NHMRC guideline was divided into seven sections. Sections 2–7 had an average length of 120 pages and the total length of the seven sections was 935 pages. There were no sections for glycaemic control and renal problems in the management Type 2 diabetes. The length and structure of the guideline meant that it was often difficult to locate recommendations and information regarding pathology testing. The Department of Health and Ageing has recently accepted submissions (closing date 6th April 2009) for an update of this guideline. The tender was for an update of the existing structure and this would exclude sections on glycaemic control and renal problems. Improvements in the structure may assist users of this guideline to identify recommendations regarding pathology testing in the management of Type 2 diabetes.

HbA1c testing

The guidelines are reasonably consistent on the recommendation for at least 6 monthly review of HbA1c and more frequent (2–3 monthly) testing if glycaemic control is poor. With the exception of those discussed above in 'incomplete guidance'.

The 2008 the evidence-practice gaps report from the National Institute of Clinical Studies reviewed the recent estimates of the proportion of Australians with diabetes who had a HbA1c test done in the last 6 months.[33] The proportion varied from 27% to 80%.

The annual cycle of care (service incentive payment, SIP) requires annual testing of HbA1c. This requirement may suggest to GPs that this is sufficient, and may contribute to GPs not monitoring the HbA1c as frequently as recommended in guidelines.

The Australian guidelines could be clearer. The NHMRC guideline did not provide any recommendations on the testing of HbA1c. The Diabetes Australia and RACGP guideline clearly stated that HbA1c should be tested at least 6 monthly in the quarterly review section, however it was omitted in the annual review section of the guideline. A comment regarding the need for assessment if not done within the last 6 months in the annual review section would avoid confusion.

Comorbidities in general practice patients

The recommendations in guidelines reflect the high rate of comorbidities associated with Type 2 diabetes. In a recent (unpublished) BEACH SAND substudy of 5,900 patients at GP encounters, patient comorbidities were investigated. Prevalence of Type 2 diabetes in this sample was 8.4%. Of these patients:

- 84.8% also had at least one cardiovascular disease (including hypertension, ischaemic heart disease, congestive heart failure, peripheral vascular disease and cerebrovascular accident). The most common cardiovascular disease was hypertension (71.8% of patients with Type 2 diabetes)
- 48.9% had hyperlipidaemia
- 28.0% were obese
- 3.3% had thyroid disease (either hyperthyroidism or hypothyroidism)
- 7.5% had chronic renal failure

Note: in the above results patients with multiple other conditions will be counted more than once (e.g. a patient with Type 2 diabetes + hyperlipidaemia + hypertension will be counted twice). Source: unpublished BEACH data.

These data demonstrate that multiple morbidity is common in patients (at general practice encounters) with Type 2 diabetes. Further analysis of these data may provide information on the pretest probability of diseases in patients who have Type 2 diabetes. Analysis may also inform the proportion of patients in whom more frequent monitoring would be recommended on the basis of presence of other diseases.

Monitoring of Type 2 diabetes

Only 6.2% of Type 2 diabetes problems managed were for 'newly diagnosed' cases of Type 2 diabetes. Pathology tests/batteries ordered for new cases of Type 2 diabetes problems accounted for 6.9% of all pathology tests. Therefore, the majority of contacts are for ongoing management of Type 2 diabetes, as are the majority of the pathology tests ordered for this problem.

There is clear guidance on the role of HbA1c, lipids, EUC and albumin testing in the ongoing management of Type 2 diabetes. The order rate of these tests increased significantly over the period of this study (2000–02 to 2006–08). In 2000–08, these tests accounted for 61.5% of pathology tests ordered in the management of Type 2 diabetes.

Blood glucose—the role of the blood glucose test in the ongoing management of Type 2 diabetes was mentioned in three guidelines, as part of a check of the accuracy of the patient's glucose monitor. In BEACH, the order rate of glucose tests (mostly fasting glucose tests) decreased significantly over the period of this study (2000–02 to 2006–08). This may indicate that GPs are relying on HbA1c to monitor glycaemic control (HbA1c order rate has increased significantly) and/or may be the result of an increase in patient self-monitoring of glucose levels.

In BEACH, oral glucose tolerance tests were ordered infrequently (1% of tests) and reflect their recommended role in the diagnosis of diabetes.

FBC—The role of FBC in monitoring Type 2 diabetes was mentioned in two guidelines as a check for anaemia when renal function is limited. In BEACH, the order rate of FBC increased significantly over the period of this study. It accounted for 7.2% of pathology for Type 2 diabetes (in 2000–08) and this is likely to reflect a higher order rate than would be indicated in the monitoring of reduced renal function.

LFT—Assessment of liver function was mentioned in a number of guidelines in the monitoring of potential adverse effects of medications. However, frequency and duration of monitoring were often not specified within the guidance. Sources of product information in Australia (e.g. Therapeutic Guidelines, MIMS) were also often not explicit in regard to the frequency and duration of monitoring required. LFT was also recommended as part of the annual assessment of diabetes by Steven (1999). In BEACH, the order rate of LFTs increased significantly over the duration of this study, as did the prescribing rate for medications for which LFT monitoring was recommended (statins and thiazides).

MBA—The role of MBA testing is harder to determine. The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether it's use is supported. However, certain components of the MBA (e.g. electrolytes, creatinine, LFT) would be supported by the guidance. In BEACH, the order rate of MBAs increased significantly over the duration of this study.

Targets for therapy

The majority of guidance documents provide clear guidance on the role of tests in monitoring the progression of Type 2 diabetes and the response to therapy.

Over the duration of this study the evidence base about diabetes and its associated cardiovascular risk has increased. Two primary themes have emerged from this evidence:

- recognition of the need to monitor and control the diabetes (glycaemic control) due to the progressive nature of the disease and the associated risks of poor control (e.g. eye damage, renal impairment)
- awareness of the level (threshold) at which risk factors contribute to the burden of disease (particularly cardiovascular disease).

This has resulted in lower targets for a number of observable findings, for example, LDL cholesterol, (increased HDL cholesterol), and blood pressure. Lower HbA1c targets have also been recommended in some guidelines.

These targets are potentially harder and take longer to achieve. Pathology testing to measure response is more frequent while actively trying to achieve a target (titrating medications). While the guidance documents acknowledge targets should be adjusted to the individual patient it is likely that a change in targets may result in increased testing rates.

Medication monitoring

This discussion refers to available guidance about pathology tests required as part of medication selection (e.g. presence of impaired renal function) and identification of adverse effects.

The amount of information provided regarding medication selection and potential side effects varies considerably between guidance documents. Some guidelines considered that medication information was outside the scope of the guideline and referred the reader to the relevant product information.[20,21] The AACE guideline provided an excellent summary table for oral hypoglycaemic medications and the monitoring required to determine medication response and presence of side effects, with information on time interval to test.

Most of the guidance documents included some information regarding use of oral hypoglycaemic medications. Only considerations/adverse effects that would require pathology tests are discussed below. Recommendations regarding testing to measure response to therapy are clear in the guidance and are therefore not discussed here.

- For metformin, renal impairment and liver disease were considerations in the appropriateness of the medication.[18,22,23] The need for a recent/current LFT assessment was not discussed. LFTs were not recommended as part of initial or routine testing in most guidelines. Renal function testing was recommended as part of routine care of Type 2 diabetes.
- In the use of glitazones, liver dysfunction/disease is a consideration and monitoring of liver enzymes was recommended.[18,22,23] The frequency of monitoring of liver enzymes was often not specified. The Australian Therapeutic Guidelines recommended LFT prior to initiation of glitazone, followed by 2 monthly monitoring for the first year of therapy and periodically thereafter.[31]

Due to the high prevalence of dyslipidaemia and hypertension with Type 2 diabetes most guidance documents addressed the management of these conditions. Some discussed the considerations and adverse effects associated with use of medications for lipid-lowering and blood pressure control.

- In the use of the hypertension drugs—ACE inhibitors, Angiotensin receptor blockers and diuretics—testing of electrolytes and creatinine was recommended.[18,22-25]
- Statins—the NICE guideline and a paper by the American Physicians Association specifically stated monitoring of liver function in statin use is not necessary.[21,30] However, current lipid guidance recommends testing of liver function (see Chapter 6). The Australian Therapeutic Guidelines also recommended monitoring of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma glutamyltransferase (GGT) after 4 weeks of statin use, information on ongoing monitoring was not provided.[31]

In BEACH, over the duration of this study (2000–02 to 2006–08) the prescribing rates of:

- thiazides and statins in the management of Type 2 diabetes increased significantly and this may have contributed to the significant increase in the rate of LFT testing.
- ACE inhibitors and Angiotensin II receptor antagonists in the management of Type 2 diabetes increased significantly and may have contributed to the significant increase in EUC testing rates.

More detailed information regarding the frequency of monitoring and the duration of monitoring for medications could be useful to GPs.

Other comments

Level of evidence included in guideline

The majority of guidelines provided the evidence behind recommendations. The level of evidence for recommendations (i.e. graded recommendations) was not provided in the Diabetes Australia/RACGP and the IDF guidelines.

The other guidance documents did not provide full evidence statements. Murtagh (2007) and Steven (1999) provide some references. The RCPA manual (2004) did not provide the evidence behind guidance.

4.9 National implications

Quality of current pathology ordering

Based on the 2006–08 pathology ordering data for Type 2 diabetes problems we estimate that 3.1 million tests were ordered for Type 2 diabetes problems per year in Australia. Review of the guidelines/guidance suggests:

- 2.2 million (72.0%) tests were supported by the guidelines and guidance documents
- 380,000 (12.4%) may or may not be supported due to unclear guidance
- 310,000 (10.1%) were not supported by the guidelines/guidance documents.

The remaining 5.5% of tests ordered for Type 2 diabetes each accounted for <1% of total pathology tests ordered for Type 2 diabetes.

Future increases in pathology?

Future increase in management rate of Type 2 diabetes

- It is likely that the management rate of Type 2 diabetes at general practice encounters will increase:
  - due to the increasing prevalence of overweight and obesity in the Australian population. Australia's ageing population also contributes as prevalence of overweight/obesity increases with age
  - if there is an increase in detection of diabetes. The AusDiab study reported that among adults aged 25 years and over in 1999–2000 for every diagnosed case of diabetes there was one undiagnosed case. Therefore an increase in detection rate (e.g. due to a public awareness campaign) is likely to increase management rate of Type 2 diabetes
- The 45–49 Health Check Medicare item introduced in 2006 has the potential to increase the detection rate. In addition there are current initiatives to reduce the prevalence of overweight and obesity among Australian adults. If these coincidently increase management rates of overweight and obesity the detection rate and management of diabetes is likely to increase concomitantly.
- If the management rate of Type 2 diabetes increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering.

Future increase in pathology ordering

The pathology ordering rate for Type 2 diabetes increased significantly between 2000–02 and 2006–08. Increases in the pathology ordering behaviour of GPs are likely to continue in the future.

Extrapolated example of increase

The extrapolations made in this section are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of general practice encounters occur in Australia in the future—an increase or decrease would affect the extrapolated estimates.

Increase in future management rate of Type 2 diabetes

There was a 27% increase in the management rate of Type 2 diabetes over the duration of this study, from 2000–02 to 2006–08, in this example this proportion of change has been applied as a future increase.

The example below highlights the consequences of a future increase in management rate, of the same magnitude over the next 8 years. An increase of 27% in the management rate of Type 2 diabetes, with no change in the pathology ordering behaviour of GPs:

- there would be 3.9 million tests ordered by GPs for the management of Type 2 diabetes problems.

If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.8 million tests ordered by GPs (72.0% of the 3.9 million tests)

If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 3.3 million tests ordered by GPs (84.4% of the 3.9 million tests)

Ten per cent of the 3.9 million tests would not be supported by the guidelines/guidance documents and the remaining 5.5% of tests ordered were not evaluated (each accounting for <1% of total pathology tests ordered for Type 2 diabetes).

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5 Hypertension

Summary: Hypertension

Background

- BEACH data show that hypertension is the most commonly managed individual problem in general practice in Australia, managed at 10% of encounters.
- Cardiovascular disease was added as a National Health Priority Area in 1996. Hypertension is the most common cardiovascular condition.
- 'High blood pressure' was responsible for 7.6% of the total burden of disease and injury in Australia in 2003.
- The 2007–08 National Health Survey reported that 9% of the population (self-reported data) had hypertension (high blood pressure). A 2005 BEACH study estimated the prevalence of diagnosed hypertension in the Australian population to be 15.5%.

GP management of hypertension (BEACH data) April 2000 to March 2008

Hypertension was managed at a rate of 9.2 per 100 GP encounters in 2000–08, equating to approximately 9.3 million GPs encounters nationally per year for hypertension.

There was no change in the management rate of hypertension between 2000–02 and 2006–08, managed at a rate of 9.1 per 100 encounters in 2000–02 and 9.5 per 100 in 2006–08.

Pathology ordering (BEACH data)

Pathology ordered for hypertension problems accounted for 6.0% of all pathology tests recorded (2000–08).

Pathology was ordered at a rate of 26.2 tests/batteries per 100 hypertension contacts in 2000–08. One in ten hypertension contacts (10.2%) resulted in at least one pathology order, and on average 2.56 pathology tests/batteries were ordered per tested hypertension contact.

The rate of pathology ordering per 100 hypertension contacts increased significantly, from 21.6 per 100 contracts in 2000–02 to 32.3 per 100 in 2006–08. This increase was due to significant increases in both: the likelihood of pathology being ordered, and the number of tests ordered per tested hypertension contact.

Of the total national increase in pathology test orders between 2000–02 and 2006–08, 7.2% was attributable to pathology ordering in the management of hypertension.

Evaluation of current GP pathology ordering (2006–08) against guidelines

Based on the 2006–08 pathology ordering data for hypertension problems we estimated that 3.2 million tests were ordered for hypertension problems in Australia in 2006–08. Review of the guidelines/guidance suggests:

- 2.1 million (65.0%) tests were supported by the guidelines and guidance documents
- 810,000 (24.9%) may or may not be supported due to conditional support or unclear guidance
- 170,000 (5.2%) were not supported by the guidelines/guidance documents.

The remaining 4.9% of tests each accounted for <1% of total pathology tests ordered for hypertension, and were not checked against guidelines/guidance.

Comments on guidelines/guidance documents

The majority (84%) of pathology tests ordered in the management of hypertension were for ongoing management. However the role of pathology tests in the long term monitoring of hypertension was often not discussed, therefore the proportion of tests estimated as supported by the guidance may be an over-estimate.

Pathology tests were commonly recommended in the initial investigation of newly diagnosed hypertension, aiming to: assess cardiovascular risk, end/target organ damage and identify possible secondary hypertension. The rationale for some of the recommended tests (e.g. full blood count, liver function tests) was not provided.

There has been increased GP ordering of most of the tests recommended for initial assessment. While some of the increase is logical (e.g. reassessment of cardiovascular risk), the increase in the tests recommended to identify causes of secondary hypertension (e.g. thyroid tests) is not. Further information on whether there is a need to reassess the patients when initial results are clinically insignificant is needed.

When guidelines did recommend monitoring tests they did so in regard to end/target organ damage, and monitoring medication use (side effects).

Future growth in pathology ordering?

If the management rate of hypertension increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering.

- It is likely that the management rate of hypertension will increase as the Australian population ages because the prevalence of hypertension increases with age.
- The management rate of hypertension did not increase significantly over the duration of this study (from 2000–02 to 2006–08); however, BEACH data demonstrates that the management rate increased significantly (by 20%) over the decade 1998–99 to 2007–08.

Extrapolated example of the effect of a future increase in the management rate

The extrapolations made in this example are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of GP encounters occur in Australia in the future. Increases or decreases in total attendance rates, and/or in the GP test ordering rate would affect the estimates in this example.

Example: If there was a further 20% increase in the management rate of hypertension:

Scenario 1: No change in the current (2006–08) pathology ordering behaviour of GPs:

- there would be 3.9 million tests ordered by GPs for the management of hypertension problems.

Scenario 2: If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.53 million tests ordered by GPs (65.0% of the 3.9 million tests)

Scenario 3: If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 3.50 million tests ordered by GPs (89.9% of the 3.9 million tests)

Of the remaining 10.1% of tests, 5.2% would not be supported by the guidelines/guidance and 4.9% of tests were not evaluated (each accounting for <1% of total pathology tests ordered for hypertension).

5.1 Definition

In this study, hypertension includes uncomplicated and complicated hypertension. It does not include hypertension in pregnancy (pre-eclampsia) because this condition is not managed in the same way as essential hypertension and is not a risk factor for developing hypertension in the future.

5.2 Background

- BEACH data show that hypertension is the most commonly managed individual problem in general practice in Australia, managed at one-tenth of encounters.[1] It has remained the most commonly managed problem since 1998.[1]
- Cardiovascular disease was added as a National Health Priority Area (NHPA) in 1996.[2] Hypertension is the most common cardiovascular condition.[3]
- 'High blood pressure' was responsible for 7.6% of the total burden of disease and injury in Australia in 2003.[4]
- The 2007–08 National Health Survey reported that 9% of the population (self-reported data) had hypertension (high blood pressure).[3]
- AusDiab study reported the prevalence of hypertension among the population aged 25 years and over was 28.8%: 30.6% for males and 27.1% for females[5]
- The prevalence of hypertension increases with age—every year 3% of the adult population develop hypertensive disease with the risk increasing from 1% for those aged between 25 and 34 years to 8% for those aged between 65 and 74 years.[5]
- The Framingham heart study reported the lifetime risk of hypertension, for patients who are normotensive at age 55 or 65 years was approximately 90% (assuming survival to 80–85 years).[6]
- BEACH SAND (data from a subsample of 9,156 patient encounters) estimated the prevalence of hypertension in 2005 to be:
  - 23.3% of patients at encounters in general practice
  - 17.6% of the general practice patient population (patients who attend general practice at least once)
  - 15.5% of the Australian population.[7]
- In a 2008 BEACH SAND substudy of 5,900 patients at GP encounters, the prevalence of diagnosed hypertension was 27.2% (unpublished BEACH data).

5.3 Management rate in Australian general practice

In BEACH, hypertension was managed at 72,169 encounters by 7,489 GPs between April 2000 and March 2008 (Table 5.1). That is equivalent to one management of hypertension per 11 encounters with patients in 2000–08.

Hypertension was managed at a rate of 9.2 per 100 general practice encounters (Table 5.1). This equates to approximately 9.3 million encounters nationally per year where hypertension is managed by GPs. The vast majority of hypertension managed in general practice (99.9%) in 2000–08 was uncomplicated hypertension.

New cases accounted for 5.9% of hypertension problems (Table 5.3). The problem is considered new if, it is a new problem to the patient or a new episode of a recurrent problem, and the patient has not been treated for that problem by any medical practitioner before.

Table 5.1: Summary of hypertension data set, 2000–08

Variable	Number	Rate per 100 total encs (*n*=784,300)	95% LCL	95% UCL	Per cent of total problems (*n*=1,174,893)	Management: encounter ratio
General practitioners	7,489	—	—	—	—	—
Hypertension encounters	72,169	—	—	—	—	—
Hypertension problems managed	72,171	9.2	9.0	9.4	6.1	1:11
Hypertension uncomplicated	72,101	9.2	9.0	9.4	6.1	—
Hypertension complicated	70	0.0	0.0	0.0	0.0	—
New hypertension problems	4,237	0.54	0.52	0.56	—	—

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Change in management over time

Previously published data from the BEACH study show that there was a significant increase in the management of hypertension (including gestational hypertension) over the decade, from 8.3 per 100 encounters (95% CI: 7.8–8.7) in 1998–99 to 9.9 per 100 (95% CI: 9.4–10.5) in 2007–08.[1]

However in the current study, there was no significant change in the management rate of hypertension between 2000–02 and 2006–08, managed at a rate of 9.1 per 100 encounters in 2000–02 and 9.5 per 100 in 2006–08 (Table 5.4). In contrast, the management rate of new hypertension problems increased by 24%, indicating an increase in the diagnosis or detection rate, from 0.48 per 100 encounters (95% CI: 0.44–0.52) in 2000–02 to 0.60 (95% CI: 0.56–0.64) in 2006–08.

Age distribution

The age distribution of adult patients with hypertension managed at general practice encounters 2000–08 is presented in Figure 5.1.

Patients being managed for hypertension were most often aged 45–64 years (37.2%), followed by patients aged 75+ years (29.0%), 65–74 years (26.9%), 25–44 years (6.5%) and <25 years (0.4%) (Figure 5.1).

From 2000–02 to 2006–08 there were two statistically significant changes in the age distribution of patients with hypertension managed. The proportion of patients aged 25–44 years decreased significantly from 7.0% (95% CI: 6.5–7.4) to 5.9% (95% CI: 5.5–6.3). The proportion of patients aged 75+ increased significantly from 27.5% (95% CI: 26.5–28.6) to 30.5% (95% CI: 29.5–31.5) (Figure 5.1).

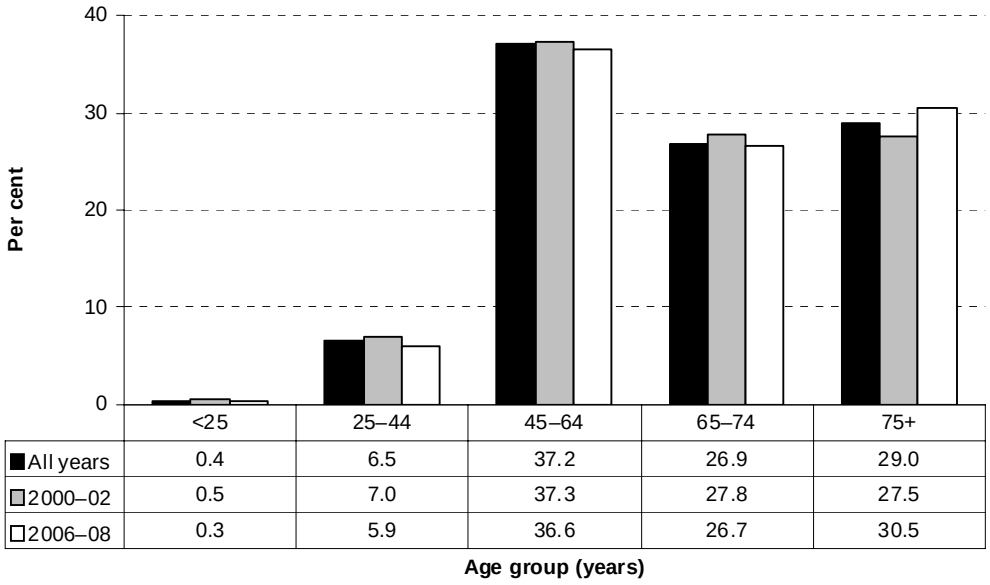


Figure 5.1: Age distribution of patients with hypertension managed at general practice encounters, 2000–08 (all years), 2000–02, and 2006–08

Figure 5.2 presents the age-specific management rates of hypertension among patients attending general practice. The age-specific rate of management was similar for patients aged 25 to 74 years of age, with approximately one in five encounters with patients in these age groups involving the management of hypertension.

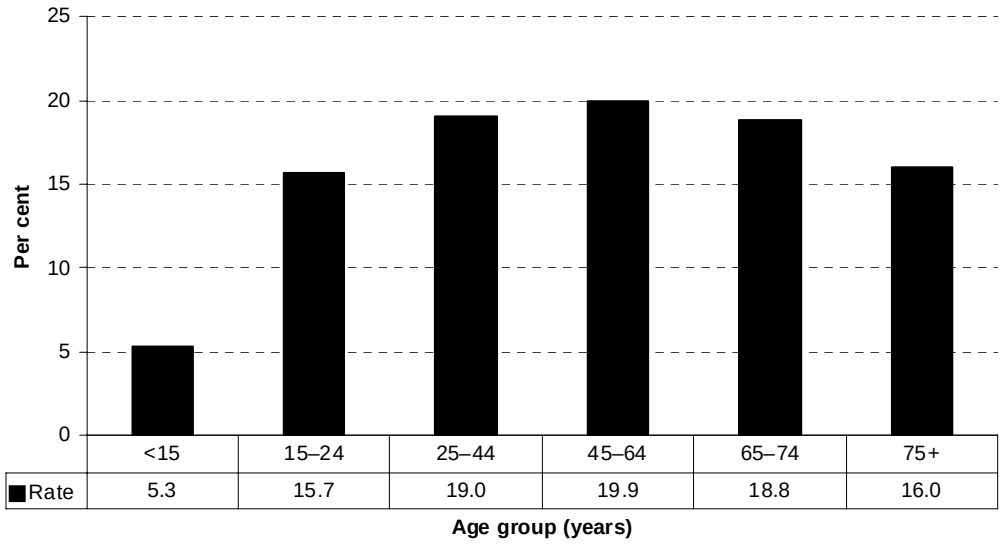


Figure 5.2: Age-specific rate of management of hypertension, 2000–08

Table 5.2 shows the number of problems managed per encounter where hypertension was managed and the number managed at all BEACH encounters in 2000–08. Encounters involving the management of hypertension were more complex, being more likely to have 2, 3 or 4 problems managed per encounter than average general practice encounters.

Table 5.2: Number of problems managed at hypertension and total encounters

	Hypertension encs (2000–08)				All BEACH encs (2000–08)			
Number of problems managed	Number	Per cent of problems	95% LCL	95% UCL	Number	Per cent of problems	95% LCL	95% UCL
One problem	16,416	22.8	22.2	23.3	502,522	64.1	63.7	64.4
Two problems	29,727	41.2	40.7	41.7	193,452	24.7	25.5	24.9
Three problems	17,956	24.9	24.5	25.3	67,837	8.7	8.5	8.8
Four problems	8,070	11.2	10.8	11.6	20,489	2.6	2.5	2.7

Note: LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08.

5.4 Pathology ordering behaviour

Pathology was ordered at a rate of 26.2 per 100 hypertension contacts in 2000–08. One in ten hypertension problems (10.2%) resulted in at least one pathology order (Table 5.3).

Once the decision to order a pathology test for hypertension was made the GP ordered on average 2.56 pathology tests per tested problem (Table 5.3). Pathology ordered for hypertension problems accounted for 6.0% of all pathology tests recorded from April 2000 to March 2008.

Table 5.3: Summary of pathology ordering for hypertension, 2000–08

Variable	Number	Per cent/ Rate of hypertension problems	95% LCL	95% UCL
Hypertension problems managed	72,171	100.0	—	—
New problems (% of hypertension problems)	4,237	5.9	5.7	6.1
Pathology (Rate per 100 hypertension problems)	18,890	26.2	25.3	27.1
At least one pathology order (% of hypertension problems)	7,377	10.2	9.9	10.6
Number of tests/batteries per 100 tested hypertension problems	—	256.1	251.8	260.4

Note: LCL—lower confidence limit; UCL—upper confidence limit.

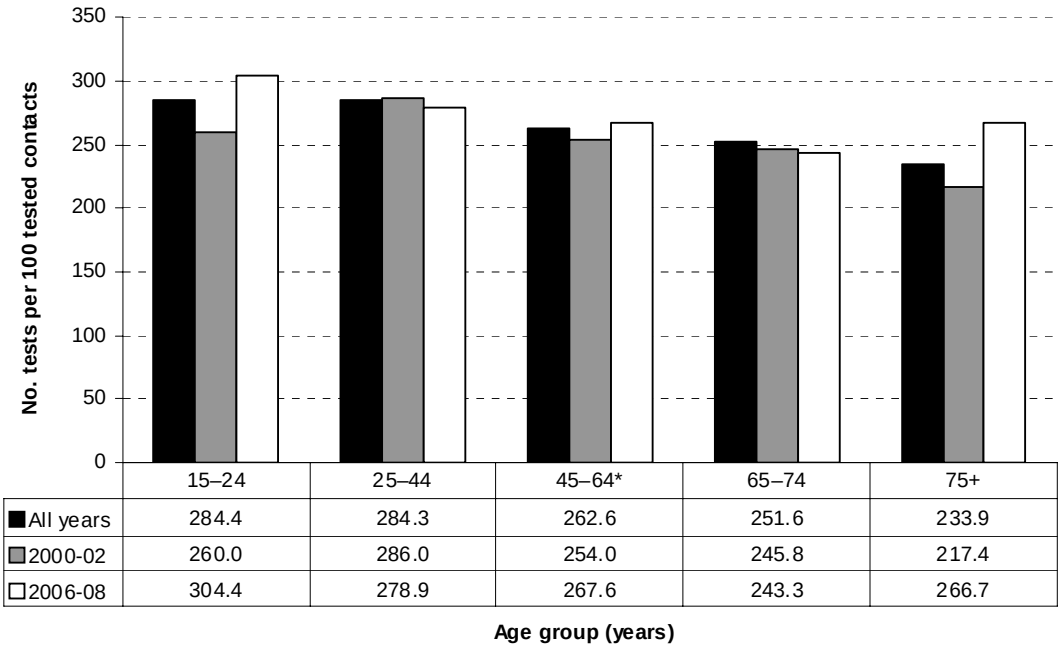
Changes over time, 2000–02 to 2006–08

Pathology ordering for hypertension accounted for 5.9% of the pathology ordered in 2000–02 and 6.3% in 2006–08. The rate of pathology ordering per 100 hypertension contacts increased significantly, from 21.6 per 100 contracts in 2000–02 to 32.3 per 100 in 2006–08. This increase was due to significant increases in:

- the likelihood of pathology being ordered in the management of hypertension (8.7% of hypertension contacts in 2000–02 rising to 11.9% in 2006–08)

- the number of pathology tests ordered per tested hypertension problem (from 248.2 per 100 tested contacts in 2000–02 to 270.4 per 100 in 2006–08) (Table 5.4).

Figure 5.3 shows the average number of tests ordered per 100 tested hypertension contacts by patient age. Patients aged 45–64 years had significantly more tests ordered per tested hypertension contact in 2006–08 than in 2000–02.

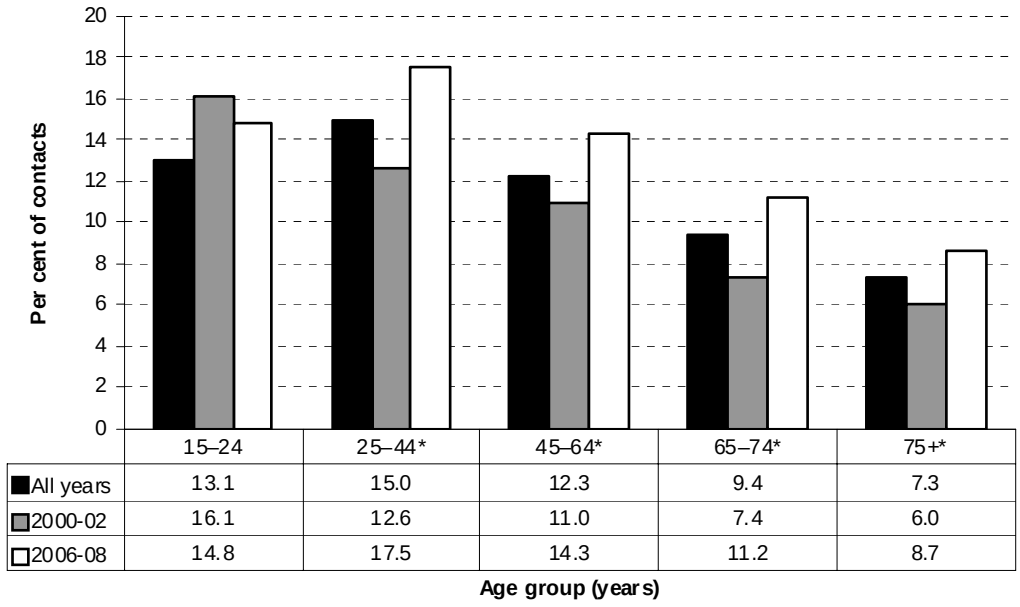


	15–24	25–44	45–64*	65–74	75+
All years	284.4	284.3	262.6	251.6	233.9
2000-02	260.0	286.0	254.0	245.8	217.4
2006-08	304.4	278.9	267.6	243.3	266.7

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 5.3: Age-specific mean number of pathology tests per 100 tested hypertension contacts, 2000–08 (all years), 2000–02, and 2006–08

Figure 5.4 shows the likelihood of pathology testing being ordered for hypertension by patient age. Pathology was significantly more likely to be ordered for hypertension in patients aged 25 years and over in 2006–08 than in 2000–02.



	15–24	25–44*	45–64*	65–74*	75+*
All years	13.1	15.0	12.3	9.4	7.3
2000-02	16.1	12.6	11.0	7.4	6.0
2006-08	14.8	17.5	14.3	11.2	8.7

Age group (years)

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 5.4: Age-specific likelihood of at least one pathology test being ordered for hypertension, 2000–08 (all years), 2000–02, and 2006–08

Extrapolation of pathology ordering behaviour

When these data were extrapolated to the number of GP encounters claimed through Medicare nationally the results suggest there were approximately:

- 950,000 more encounters involving the management of hypertension problems in 2006–08 (10.1 million per annum) than in 2000–02 (9.1 million per annum).
- 410,000 more hypertension contacts involving at least one pathology request (tested contacts) in 2006–08 (1.2 million per annum) compared with 2000–02 (790,000 per annum)
- 1.3 million more tests/batteries of tests ordered for hypertension problems in 2006–08 (3.2 million per annum) than in 2000–02 (2 million per annum) (results not shown).

Of the estimated 17.7 million additional tests/batteries ordered by GPs in 2006–08 (51.3 million tests/batteries ordered by GPs per annum), compared with 2000–02 (33.6 million per annum), 7.2% was attributable to pathology ordering in the management of hypertension. There was a 65% increase in the volume of GP requests for pathology tests/batteries attributable to hypertension, due to a combination of factors:

- the increase in the total number of GP encounters in Australia
- changes in GP pathology ordering behaviour for hypertension, that is:
  - increased likelihood of pathology being ordered for hypertension
  - increased number of tests ordered once the decision to order was made.

Table 5.4: Changes in the management of hypertension over time, 2000–02 to 2006–08

	2000–02							2006–08							
Variable	**Number**	**Rate per 100 total encs (*n*=198,200)**	**95% LCL**	**95% UCL**	**Per cent / Rate of HT probs (*n*=18,007)**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 total encs (*n*=188,300)**	**95% LCL**	**95% UCL**	**Per cent / Rate of HT probs (*n*=17,793)**	**95% LCL**	**95% UCL**	**Change**
General practitioners	1,900	—	—	—	—	—	—	1,810	—	—	—	—	—	—	—
Hypertension encounters	18,007	—	—	—	—	—	—	17,792	—	—	—	—	—	—	—
Hypertension problems managed	18,007	9.1	8.8	9.4	—	—	—	17,793	9.5	9.1	9.8	—	—	—	—
New problems	958	0.48	0.44	0.52	5.3	4.9	5.7	1,131	0.60	0.56	0.64	6.4	5.9	6.8	↑
Pathology (Rate per 100 hypertension problems)	3,885	—	—	—	21.6	20.0	23.2	5,744	—	—	—	32.3	30.3	34.2	↑
At least one pathology order (% of hypertension problems)	1,565	—	—	—	8.7	8.1	9.3	2,124	—	—	—	11.9	11.3	12.6	↑
Number of tests/batteries per 100 tested hypertension problems	—	—	—	—	248.2	239.5	257.0	—	—	—	—	270.4	262.5	278.4	↑

Note: HT—hypertension; probs—problems; encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

5.5 Types of pathology tests ordered

Table 5.5 shows the distribution of pathology tests/batteries ordered for hypertension in 2000–08 by MBS groups and the most common individual types of pathology tests ordered.

- Chemistry tests were the group of tests most often ordered, at a rate of 21.0 per 100 hypertension contacts. The most common chemistry tests ordered were:
  - lipid tests (5.8 per 100 hypertension contacts)
  - electrolyte, urea and creatinine tests (5.3 per 100 contacts)
  - glucose/glucose tolerance tests (2.9 per 100)
  - liver function tests (2.3) (Table 5.5).
- Haematology tests (4.0 per 100 contacts), in particular full blood counts (3.6 per 100), were also commonly ordered in the management of hypertension (Table 5.5).

One-eighth (16.4%) of pathology tests were ordered for 'new' cases of hypertension. New cases accounted for 5.9% of hypertension problems. This suggests that the majority of pathology tests were for the ongoing management or monitoring of hypertension in general practice (Table 5.5)..

Changes in types of pathology tests ordered 2000–02 to 2006–08

Table 5.6 compares the pathology ordering for hypertension problems in 2000–02 with 2006–08, shaded results highlight significant differences. There was a significant increase in the rate of pathology from 21.6 per 100 hypertension contacts in 2000–02 to 32.3 per 100 in 2006–08—an increase of 50%.

There were significant increases in the order rate of:

- lipid tests—28% increase
- electrolyte, urea and creatinine tests—36% increase
- full blood counts—64.3% increase
- glucose/glucose tolerance tests—35% increase
- liver function tests—71% increase
- multibiochemical analysis—109% increase
- thyroid function tests—75% increase
- prostate specific antigen—200% increase
- other chemistry tests—400% increase (mostly due to increases in the rate of albumin/albumin creatinine tests) (Table 5.6).

Table 5.5: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for hypertension, 2000–08

	Pathology for all hypertension problems						Pathology for new hypertension problems				
Pathology test ordered	Number	Per cent of all pathology for HT	Per cent of group	Rate per 100 HT probs (*n*=22,938)	95% LCL	95% UCL	Pathology for new HT	% path for new cases	Rate per 100 new HT probs (n=1,421)	95% LCL	95% UCL
Chemistry	**15,149**	**80.2**	**100.0**	**21.0**	**20.2**	**21.7**	**2,387**	**15.8**	**56.3**	**52.6**	**60.0**
Lipids*	4,203	22.3	27.7	5.8	5.6	6.1	644	15.3	15.2	13.9	16.5
EUC*	3,837	20.3	25.3	5.3	5.1	5.6	528	13.8	12.5	11.4	13.6
Glucose/glucose tolerance*	2,119	11.2	14.0	2.9	2.8	3.1	348	16.4	8.2	7.3	9.1
Liver function*	1,624	8.6	10.7	2.3	2.1	2.4	281	17.3	6.6	5.8	7.4
Multibiochemical analysis*	1,237	6.6	8.2	1.7	1.6	1.9	207	16.7	4.9	4.2	5.6
Thyroid function*	768	4.1	5.1	1.1	1.0	1.1	179	23.3	4.2	3.6	4.8
Chemistry; other*	456	2.4	3.0	0.6	0.5	0.7	78	17.1	1.8	1.4	2.3
Prostate specific antigen*	270	1.4	1.8	0.4	0.3	0.4	45	16.7	1.1	0.8	1.4
HbA1c*	182	1.0	1.2	0.3	0.2	0.3	14	7.7	0.3	0.2	0.5
Haematology	**2,917**	**15.4**	**100.0**	**4.0**	**3.8**	**4.2**	**528**	**18.1**	**12.5**	**11.3**	**13.6**
Full blood count	2,564	13.6	87.9	3.6	3.4	3.7	480	18.7	11.3	10.3	12.3
ESR	261	1.4	8.9	0.4	0.3	0.4	40	15.3	0.9	0.7	1.2
Other NEC	**462**	**2.5**	**100.0**	**0.6**	**0.6**	**0.7**	**74**	**16.0**	**1.8**	**1.3**	**2.2**
Blood test	197	1.0	42.6	0.3	0.2	0.3	30	15.2	0.7	0.4	1.0
Microbiology	**293**	**1.6**	**100.0**	**0.4**	**0.4**	**0.5**	**107**	**36.5**	**2.5**	**2.0**	**3.0**
Urine M,C&S*	274	1.5	93.5	0.4	0.3	0.4	100	36.5	2.4	1.9	2.9
Other pathology groups	**69**	**0.4**	**100.0**	**—**	**—**	**—**	**7**	**10.1**	**—**	**—**	**—**
Total pathology tests	**18,890**	**100.0**	**—**	**26.2**	**25.3**	**27.1**	**3,103**	**16.4**	**73.2**	**68.6**	**77.9**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations.

Table 5.6: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for hypertension, 2000–02 compared with 2006–08

	2000–02						2006–08						
Pathology test ordered	Number	Per cent of all pathology for HT	Per cent of group	Rate per 100 HT probs[(a)]	95% LCL	95% UCL	Number	Per cent of all pathology for HT	Per cent of group	Rate per 100 HT probs[(a)]	95% LCL	95% UCL	Change
Chemistry	**3,106**	**80.0**	**100.0**	**17.3**	**15.9**	**18.6**	**4,615**	**80.3**	**100.0**	**25.9**	**24.3**	**27.6**	↑
Lipids*	970	25.0	31.2	5.4	4.8	6.0	1,220	21.2	26.4	6.9	6.4	7.3	↑
EUC*	817	21.0	26.3	4.5	4.1	5.0	1,084	18.9	23.5	6.1	5.5	6.6	↑
Glucose/glucose tolerance*	462	11.9	14.9	2.6	2.3	2.9	616	10.7	13.3	3.5	3.1	3.8	↑
Liver function*	306	7.9	9.9	1.7	1.5	1.9	524	9.1	11.4	2.9	2.6	3.3	↑
Multibiochemical analysis*	199	5.1	6.4	1.1	0.9	1.3	407	7.1	8.8	2.3	2.0	2.6	↑
Thyroid function*	141	3.6	4.5	0.8	0.6	0.9	254	4.4	5.5	1.4	1.2	1.6	↑
Chemistry; other*	39	1.0	1.3	0.2	0.1	0.3	174	3.0	3.8	1.0	0.8	1.2	↑
Prostate specific antigen*	39	1.0	1.3	0.2	0.1	0.3	110	1.9	2.4	0.6	0.5	0.7	↑
HbA1c*	36	0.9	1.2	0.2	0.1	0.3	55	1.0	1.2	0.3	0.2	0.4	—
Haematology	**588**	**15.1**	**100.0**	**3.3**	**2.9**	**3.6**	**900**	**15.7**	**100.0**	**5.1**	**4.6**	**5.5**	↑
Full blood count	501	12.9	85.2	2.8	2.5	3.1	811	14.1	90.1	4.6	4.2	5.0	↑
ESR	65	1.7	11.1	0.4	0.3	0.5	71	1.2	7.9	0.4	0.3	0.5	—
Other NEC	**97**	**2.5**	**100.0**	**0.5**	**0.4**	**0.7**	**135**	**2.4**	**100.0**	**0.8**	**0.6**	**0.9**	**—**
Blood test	39	1.0	40.2	0.2	0.1	0.3	64	1.1	47.4	0.4	0.2	0.5	—
Microbiology	**74**	**1.9**	**100.0**	**0.4**	**0.3**	**0.5**	**78**	**1.4**	**100.0**	**0.4**	**0.3**	**0.6**	**—**
Urine M,C&S*	67	1.7	90.5	0.4	0.3	0.5	72	1.3	92.3	0.4	0.3	0.5	—
Other pathology groups	**20**	**0.5**	**100.0**	**—**	**—**	**—**	**16**	**0.3**	**100.0**	**—**	**—**	**—**	**—**
Total pathology tests	**3,885**	**100.0**	**—**	**21.6**	**20.0**	**23.2**	**5,744**	**100.0**	**—**	**32.3**	**30.3**	**34.2**	↑

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) The total number of hypertension problems in 2000–02 was 18,007 and in 2006–08 was 17,793.

Note: Probs—problems; LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

5.6 Guidelines for the management of hypertension

The guidance documents (guidelines and other sources of guidance) for the management of hypertension that were considered in this study are outlined below.

Guidelines reviewed were:

- 'Guide to management of hypertension 2008: assessing and managing raised blood pressure in adults' [National Heart Foundation of Australia, 2008].[8]
- 'Hypertension: management of hypertension in adults in primary care' [UK, National Collaborating Centre for Chronic Conditions and the British Hypertension Society, NICE guideline, 2006].[9]
- Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood pressure (JNC 7) [US Department of Health and Human Services, National Institutes of Health, 2004].[10]
- '2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension'.[11]
- '2007 Guidelines for the management of arterial Hypertension' [European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC), 2006][12]
- 'Health care guideline: hypertension diagnosis and treatment' [Institute for Clinical Systems Improvement, ICSI, US, 2006].[13]
- 'Hypertension in older people' [Scottish Intercollegiate Guidelines Network, SIGN guideline, 2001].[14]
- '2008 Canadian Hypertension Education Program (CHEP) recommendations for the management of hypertension' [Canada, 2008][15] and the '2007 CHEP recommendations for the management of hypertension: part 1 and 2'.[16,17]

Other Australian sources of guidance for GPs reviewed were:

- 'RCPA manual'—Manual of use and interpretation of pathology tests [The Royal College of Pathologists of Australasia (RCPA), 2004].[18]
- Murtagh's general practice, hypertension section [Murtagh 2007].[19]
- 'Patient presentations in general practice', section on patients presenting for measurement of blood pressure [Steven 1999].[20]

One other guideline that was reviewed but not included in tables 5.7 and 5.8:

- Medical guidelines for clinical practice for the diagnosis and treatment of hypertension. [American Association of Clinical Endocrinologists Hypertension Task Force, 2006]—not included as they only refer to the management of secondary hypertension (primarily endocrine causes of secondary hypertension).

5.7 Application of the guidelines

Evaluation of GP pathology ordering against guidelines

Table 5.7 provides a summary of the individual tests and the level of support provided in the guidelines/guidance for each: yes—supported; unclear guidance; no—not supported:

- 67.4% of tests ordered for the management of hypertension were supported by the guidelines and guidance documents
- for one-quarter (20.1%) of tests guidance was unclear or support was conditional
- 4.8% of tests were not supported by the guidelines/guidance documents.

The individual tests/batteries listed in Table 5.7 account for 96.3% of pathology tests/batteries ordered for hypertension because only the most common individual pathology tests ordered are included (each accounted for >1% of tests for hypertension).

Supported tests are those that the guidance documents have supported at any phase of management of hypertension. Tests recommended for the initial phase of management (i.e. assessment of newly diagnosed hypertension) are discussed below. If tests are primarily recommended as part of the initial assessment the level of support may be over-estimated.

Table 5.7: Summary of support for GP pathology ordering for the most frequent individual test orders for hypertension, 2000–08

Pathology test supported by guidelines/guidance	Number	% of all pathology for hypertension
YES	**12,723**	**67.4**
Lipids*	4,203	22.3
EUC*	3,837	20.3
Full blood count	2,564	13.6
Glucose/glucose tolerance*	2,119	11.2
UNCLEAR/CONDITIONAL	**4,567**	**24.2**
Liver function*	1,624	8.6
Multibiochemical analysis*	1,237	6.6
Thyroid function*	768	4.1
Chemistry; other*	456	2.4
Urinary albumin/Albumin:creatinine ratio	*208*	*1.1*
Urine M,C&S*	274	1.5
NO	**910**	**4.8**
Prostate specific antigen*	270	1.4
HbA1c*	182	1.0
ESR	261	1.4
Blood test	197	1.0
Subtotal (n, % of total tests included in the table)	*18,200*	*96.3*
Total pathology tests	**18,890**	**100.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 5.8 compares the commonly ordered pathology tests/batteries for hypertension with the guidelines' and guidance documents' recommended tests for hypertension. The key explaining the colours used in the table is below Table 5.8. Briefly, dark green tests are specifically supported, light green have partial support, red tests are advised against, orange tests are those for which support cannot be determined, and pink tests were not mentioned in the guideline/guidance.

Lipids

There was strong agreement between guidelines for assessment of lipid levels to determine the cardiovascular risk profile.

Lipid tests were ordered at a rate of 5.4 per 100 hypertension contacts in 2000–02, and significantly increased to 6.9 per 100 hypertension contacts in 2006–08—an increase of 28%.

Electrolytes, urea & creatinine (EUC)

There was unanimous agreement across guidance documents for the testing of creatinine and electrolytes (predominately potassium and sodium). Some guidelines also specifically recommended the testing of urea.

Guidelines recommended the testing of EUC to assess kidney function (both as end or target organ damage and kidney disease as a cause of secondary hypertension). EUC was also recommended in the monitoring of response to medications, specifically potassium monitoring in the management of diuretics, and sodium and creatinine in the monitoring of ACE inhibitors and angiotensin receptor blockers/angiotensin II receptor antagonists (see comments on medication monitoring below).

In BEACH, EUCs were ordered at a rate of 4.5 per 100 hypertension contacts in 2000–02, and significantly increased to 6.1 per 100 hypertension contacts in 2006–08—an increase of 36%.

Full blood count

Haematocrit and haemoglobulin tests were commonly recommended in the guidance documents. However, rationale for the ordering of these tests was not provided with the exception of the SIGN guideline which stated that mean cell volume may indicate alcohol excess.

The Canadian (CHEP) guideline specifically recommended against the use of haematocrit and haemoglobulin tests in the management of hypertension.

In BEACH, FBCs were ordered at a rate of 2.8 per 100 hypertension contacts in 2000–02, and significantly increased to 4.6 per 100 hypertension contacts in 2006–08—an increase of 64%.

Glucose and glucose tolerance

Testing of fasting glucose was almost unanimously recommended by the guidance documents to detect undiagnosed diabetes.

Glucose and glucose tolerance tests were ordered at a rate of 2.6 per 100 hypertension contacts in 2000–02, and significantly increased to 3.5 per 100 hypertension contacts in 2006–08—an increase of 35%.

Liver function

Liver function tests (LFTs) were specifically recommended in two guidelines:

- the NHF guideline recommended LFT as part of the initial investigations however the reason for this test was not specified
- the SIGN guideline recommended testing of Gamma glutamyl transpeptidase as a possible indicator of alcoholism

In BEACH, LFTs were ordered at a rate of 1.7 per 100 hypertension contacts in 2000–02, and significantly increased to 2.9 per 100 hypertension contacts in 2006–08—an increase of 71%.

Multibiochemical analysis

In this analysis the multibiochemical analysis (MBA) includes the MBA test and the E&LFT (electrolytes and liver function test). E&LFT tests account for 72% of this group.

The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported. However, indiscriminate testing does not meet evidence-based principles.

Some components of the MBA would have support in certain circumstances (e.g. EUC) as discussed above.

In BEACH, MBAs were ordered at a rate of 1.1 per 100 hypertension contacts in 2000–02, and significantly increased to 2.3 per 100 hypertension contacts in 2006–08—an increase of 109%.

Thyroid function tests

In the majority of guidance documents thyroid function tests (TFT) were not mentioned. Thyroid disease was commonly mentioned as a possible cause of secondary hypertension. However, TFT testing was only recommended in the initial assessment if thyroid disease was suspected (e.g. clinical suspicion or abnormal physical examination).

In BEACH, TFTs were ordered at a rate of 0.8 per 100 hypertension contacts in 2000–02, and significantly increased to 1.4 per 100 hypertension contacts in 2006–08—an increase of 75%.

Urine albumin / albumin:creatinine ratio (Chemistry, other)

The 'Chemistry, other' test group includes multiple analytes. Approximately half of the tests ordered in this group were urine albumin and albumin:creatinine ratio tests.

Testing for microalbuminuria using urine albumin test or albumin:creatinine ratio tests was recommended in the majority of guidance documents either as part of the routine initial assessment or following an abnormal urinalysis test.

In BEACH, other chemistry tests were ordered at a rate of 0.2 per 100 hypertension contacts in 2000–02, and significantly increased to 1.0 per 100 hypertension contacts—largely due to an increase in albumin/albumin:creatinine ratio tests.

Urine M,C&S

Some guidance documents recommended urine M,C&S as part of the initial investigations to identify possible urinary tract infection. It was also recommended as a follow-up test if urinalysis was abnormal.

In BEACH, rate of urine M,C&S did not change over the period of this study, remaining at 0.4 per 100 hypertension contacts in 2000–02 and 2006–08.

HbA1c

HbA1c testing was not recommended by any of the guidance documents.

Hypertension and diabetes are common comorbidities. In a recent BEACH SAND substudy of 5,900 patients at GP encounters, 27.2% had diagnosed hypertension. Of these patients one-fifth (22.1%) also had type 2 diabetes (unpublished BEACH data). It is possible that HbA1c tests were ordered for the monitoring of diabetes or for patients who have had abnormal glucose test results.

In BEACH, the rate of HbA1c tests did not change over the period of this study (0.2 per 100 hypertension contacts in 2000–02 and 0.3 per 100 in 2006–08).

PSA

PSA testing was not recommended by any of the guidance documents. It is likely to represent opportunistic testing in male patients.

In BEACH, the order rate increased significantly, from 0.2 per 100 hypertension contacts in 2000–02 to 0.6 per 100 contacts in 2006–08.

ESR

ESR testing was not recommended by any of the guidance documents. The C reactive protein test (CRP), an alternative test to the ESR, was recommended in Murtagh's general practice book. The rationale for ordering this test was not provided.

In BEACH, the rate of ESR tests did not change over the period of this study, remaining at 0.4 per 100 hypertension contacts in 2000–02 and 2006–08.

Blood test

This reflects that GPs have ordered a blood test in the management of hypertension but have not specified the type of blood test.

In BEACH, the order rate of 'blood test' did not change over the period of this study, 0.2 per 100 hypertension contacts in 2000–02 and 0.4 per 100 in 2006–08.

Other tests mentioned in the guidance documents

Other tests mentioned in the guidance documents included:

- urinalysis was commonly recommended as part of the initial investigations for hypertension. These were not included in the BEACH pathology data as GPs participating in BEACH are specifically instructed not to record dipstick tests.
- urate/uric acid was mentioned in a few guidance documents as a measure of kidney function and in regard to thiazide use
- calcium testing was recommended as part of the initial review in a few of the guidance documents as indicator for hyperparathyroidism.

These other tests accounted for a small proportion of pathology tests for hypertension (<1% of individual tests for hypertension).

Table 5.8: Summary of guideline/guidance recommendations by most frequent individual test orders for hypertension, 2000–08

Pathology test ordered	NHF 2008	NICE 2006	JNC 7 2004	SIGN 2001 (60+yrs)	WHO/ISH 2003	ESH & ESC 2007	ISCI 2006	CHEP 2007	Murtagh 2007	Steven 1999	RCPA 2004	Number (n=18,890)	% of all HT path
Lipids*												4,203	22.3
EUC*												3,837	20.3
Full blood count	Hb		Haematocrit			Hb & haematocrit	Haematocrit		Hb & haematocrit			2,564	13.6
Glucose/glucose tolerance*												2,119	11.2
Liver function*				Gamma GT								1,624	8.6
Multibiochemical analysis*[(a)]												1,237	6.6
Thyroid function*												768	4.1
Chemistry; other*[(b)]												456	2.4
Urinary albumin/ albumin:creatinine ratio	If abnormal UA					If abnormal UA	If abnormal UA	In diabetes	In diabetes			*208*	*1.1*
Urine M,C&S*	If abnormal UA											274	1.5
Prostate specific antigen*												270	1.4
HbA1c*												182	1.0
ESR												261	1.4
Blood test												197	1.0
Other tests	UA Uric acid		UA Calcium	UA Calcium Se urate		UA Uric acid	UA Calcium	UA	UA Uric acid CRP	UA	UA		

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) Multibiochemical analysis (MBA) potentially includes a combination of a broad group of tests. The MBS chemical analysis group includes a wide variety of biochemical tests (such as those in MBS item 66500).

(b) 'Chemistry; other' refers to a group of individual chemistry tests (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. HT—hypertension; Hb—haemoglobulin; UA—urinalysis; CRP—C reactive protein; also see Abbreviations.

Key to Table 5.8

Colour	Description
	The document specifically recommended this test. Any notes within the cell indicate further detail. For example, a specific disease to test for within subset of patients; a specific test within a group.
	The document stated that this test should be considered. Any notes within the cell indicate further detail (e.g. a specific test to consider)
	Unable to determine guidance: • MBA tests include mixed content for which it is not possible to determine guideline agreement (see footnote (a) above). • 'Other chemistry' tests include a group of individual chemistry tests (see footnote (b) above).
	Guideline specifically stated not to do this test. Additional information is supplied if the guideline stated not to do the test unless clinically indicated.
	Guideline does not mention this test

Evaluation of the guidelines and guidance documents

Testing for investigation vs ongoing monitoring

All guidance documents discussed pathology testing as part of the management of hypertension, usually as part of the initial investigation of newly diagnosed hypertension for the assessment of cardiovascular risk, end/target organ damage and as a cause of secondary hypertension.

Most guidelines had a clear section on the pathology tests to be ordered as part of the initial investigation. There was strong agreement between guidelines that the initial investigations include: lipid profile, EUC, FBC, glucose. There was also moderate support for testing urinary albumin/albumin:creatinine ratio, urine M,C&S, calcium and uric acid as part of the initial assessment.

However, only minimal guidance was provided regarding investigations for the ongoing management of hypertension. BEACH data show that only 16.4% of the pathology orders made were in the management of new cases of hypertension. New problems accounted for 6% of hypertension problems suggesting the ratio of testing for 'new' problems was higher than for 'old' problems.

The guidelines that did discuss monitoring tests did so in relation to:

- monitoring medications—primarily potassium, sodium and creatinine (see discussion below)
- the monitoring or detection of incident end organ damage (primarily kidney function).

Therefore the use of EUC and albumin/albumin:creatinine ratio were supported in the initial assessment and ongoing management of patients with hypertension. Monitoring of medications is discussed in more detail below.

Hypertension is a chronic condition requiring (in most cases) life long management. Guidance documents often included a section on follow-up, which recommended frequency of visits however the role of pathology tests in the long term monitoring of hypertension was often not discussed.

Lipids and glucose/glucose tolerance—While ongoing testing was explicitly recommended in two guidance documents (Steven, JNC 7) and referred to in another (NHF) (as a footnote in a table), the periodic assessment of cardiovascular risk (lipid testing) and testing for

diabetes (glucose/glucose tolerance) is logical given the higher risk of cardiovascular events associated with these risk factors. Other guidelines referred to the relevant guideline if other conditions were identified in the assessment of hypertension (e.g. diabetes) however testing beyond the initial assessment if the result was not clinically significant was not mentioned.

Full blood counts (FBCs) were commonly recommended as part of the initial assessment of patients with hypertension. Most commonly haematocrit and haemoglobulin were recommended. Only one guideline provided the rationale for ordering a full blood count, it stated that the mean cell volume is an indicator of excess alcohol consumption.[14]

The Canadian CHEP guideline was the only guideline to specifically recommend against ordering a FBC as it did not aid in the investigation or monitoring of hypertension.[16] This was a change between the 2006 and 2007 version of the guideline.

When recommended, FBC was recommended as an initial investigation. However, only 11.3% of FBCs were ordered in the management of new cases of hypertension suggesting that it is ordered more frequently than as just an initial investigation. The rate of FBC testing has also increased significantly between 2000–02 and 2006–08—from 2.8 to 4.6 per 100 contacts with hypertension.

Liver function tests (LFTs) were recommended as part of the initial investigations in two guidelines. [8,14] Only one stated the rationale behind the recommendation, that is, as an indicator of excess alcohol consumption.[14] Alcoholism/excess alcohol consumption was mentioned as a potential cause of secondary hypertension in some of the guidance documents however specific testing for the condition was not recommended.[9,10,13,15]

It is conceivable that GPs could be ordering LFTs to detect excess alcohol consumption. However, the order rate suggests that it is ordered more frequently than as an initial investigation. The rate of LFT testing has also increased significantly between 2000–02 and 2006–08—from 1.7 to 2.9 per 100 contacts with hypertension.

As discussed in the lipid chapter (Chapter 6) of this report liver function monitoring among patients taking statins was commonly recommended. In BEACH, prescribing of statins in the management of hypertension did not change over the period of this study. However, increased assessment of CV risk may identify dyslipidaemia and GPs will commonly manage this as a separate clinical entity. LFT testing may be increasing if it is measured opportunistically in these patients.

Causes of secondary hypertension

Investigation of causes of secondary hypertension was recommended if initial testing was abnormal or other clinical indicators suggested cause of secondary hypertension was likely. This suggests that investigation of secondary causes were unlikely to be associated with 'new' cases because the status of 'new' reflects the initial encounter where hypertension was diagnosed not encounters where it has been previously diagnosed.

The causes of secondary hypertension that involve pathology ordering in their diagnosis are listed below with the relevant suggested test(s).

- Kidney disease—EUC, albumin, albumin:creatinine ratio
- Aldosteronism—aldosterone and renin
- Cushings disease—cortisol
- Phaeochromocytoma—catecholamines and methylated amines
- Parathyroid disease—parathyroid hormone

- Thyroid disease—TSH and T4 (thyroid function tests)

The tests for the rare causes that cause secondary hypertension (aldosteronism, cushings disease, phaeochromocytoma) were ordered very infrequently, less than 1% of pathology tests.

Thyroid function tests (TFTs) appear to be ordered more frequently than as a test to investigate potential secondary hypertension. The rate of TFT testing has also increased significantly between 2000–02 and 2006–08—from 0.8 to 1.4 per 100 contacts with hypertension.

Medication monitoring

Pathology tests related to medication use were often discussed in the guidance documents, however specific recommendations about testing and frequency of tests were often not provided.

- Some guidance documents listed the common side effects of medications (including hypo/hyperkalaemia, hyponatraemia, hyperglycaemia, worsening renal function) without recommending testing to identify side effects[12,13,15,21]
- Specific recommendations were made in some circumstances involving medication combinations:
  - electrolytes, especially potassium in combination medication use involving diuretic use
  - ACE inhibitor and angiotensin II receptor antagonists or ACE inhibitor and angiotensin receptor blocker in combination therapy (monitor potassium, & renal function)
- ACE inhibitor or angiotensin receptor blocker monitor se creatinine and potassium levels particularly within the first two weeks of therapy
- Potassium levels in thiazide use

It is possible that many of the guidance documents may have considered recommendations regarding monitoring of response to medication outside the scope of the guidance as the relevant product information was referred to for specific details about medication use.

The Australian electronic Therapeutic Guidelines (eTG) recommends testing of electrolytes and creatinine prior to ACE inhibitors/Angiotensin II receptor blockers being started and one to two weeks after initiation or dose adjustments. For thiazide diuretics the common adverse effects are listed (hypokalaemia, hyponatraemia and elevated plasma glucose, urate and calcium) however testing intervals are not mentioned. Similarly for loop diuretics the adverse effects were listed but specific testing intervals were not mentioned.[22]

Rationale for selection of tests

The majority of tests recommended either for initial investigation or monitoring provided the rational or reason for ordering the tests. However there are some tests where the rationale for the recommendation is not clear.

- FBC—as discussed above the haematocrit and haemoglobulin analytes of the FBC were commonly recommended as part of the initial investigations for patients with newly diagnosed hypertension. However the rationale was only provided in one guideline (i.e. indication of excess alcohol consumption). The Canadian CHEP guideline specifically

recommended against the use of the FBC in the initial investigations or monitoring of hypertension.

- LFT—was only recommended in two guidelines as part of the initial assessment. One provided the rationale as being an indicator for excess alcohol consumption. The second guideline did not provide the rationale for the recommendation. LFT is not a recommended test to identify excess alcohol consumption.
- TFT—thyroid dysfunction was mentioned as a potential cause of secondary hypertension. However, testing was only recommended in the circumstance of clinical suspicion of thyroid disease. It appears that thyroid function was being tested more frequently than as an initial investigation for secondary hypertension.

These three tests are only recommended for a single aspect of the management of hypertension (i.e. initial investigation of cause of secondary hypertension). However, the order rate in BEACH suggests these tests are ordered in the ongoing management of hypertension. In addition the order rate for these three tests has increased significantly between 2000–02 and 2006–08.

If the results of the initial testing of FBC, LFT and TFT are normal there appears to be no recommendations or rationale for their role in the ongoing monitoring of patients with hypertension.

Recommendations for the role of pathology tests in the monitoring of hypertension

The majority of contacts with hypertension in Australian general practice were associated with the ongoing management of the condition (94% of hypertension problems relate to ongoing management and 83.6% of pathology testing). However, the majority of guideline recommendations involving pathology testing related to the initial investigations in patients with newly diagnosed hypertension.

Of the tests listed in Table 5.5 the following tests have a clear role in the initial investigation and ongoing management of hypertension

- EUC tests—assess and monitor kidney function in regard to end organ damage and medication use
- Urinary albumin/albumin creatinine ratio—assessment of kidney function often recommended in the guidelines for use once kidney function was reduced
- Lipids—often recommended in guidance documents only in the initial assessment of cardiovascular risk. However, periodic reassessment of cardiovascular risk if normal results is recommended elsewhere, every 1–2 years depending on risk profile.[23] Monitoring of lipids in diagnosed dyslipidaemia is also justified.
- Glucose/glucose tolerance— often recommended in guidance documents only in the initial assessment of cardiovascular risk. However, periodic reassessment of diabetes is justified given the cardiovascular risks associated with the condition. The RACGP guideline for preventive activities recommends annual testing for type 2 diabetes in the presence of hypertension in patients aged 45 years and over.[23] Incident diabetes has also been linked to thiazide use.

These four tests account for approximately half (54.9%) of the pathology tests ordered in the management of hypertension. However, the interval between testing could be clearer.

- The guidance provided for monitoring of adverse effects of medications is not clear in the guidance documents. The timing of tests, whether monitoring is required throughout the entire duration of medication use and the specific tests that are required are often not provided.
- The interval to reassess cardiovascular risk and presence of diabetes was often not provided in the hypertension guidelines.

The role of FBC, LFT and TFT tests in the ongoing monitoring of patients with hypertension is not provided in the guidance. GPs appear to continue to use these tests in the long-term management of hypertension.

Further information on whether there is a need to reassess the patients when initial results are clinically insignificant is needed. For example, does incidence of causes of secondary hypertension increase with age and require testing in the future. GP awareness of pretest probability of associated conditions or underlying causes of hypertension among patients and whether this changes with increasing age would inform the decision to order pathology tests.

If there is no need for further reassessment or it is unlikely to be required this should be included in the guidance. Where evidence is not available consensus statements may be useful to provide some guidance on the role of pathology testing in the ongoing management of hypertension.

Comorbidities in general practice patients

The recommendations in guidelines reflect the comorbidities and possible causes of hypertension. In a recent (2008) BEACH SAND substudy (unpublished) of 5,900 patients at GP encounters, patient comorbidities were investigated. Prevalence of hypertension in this sample was 27.2%. Of these patients:

- 22.1% also had Type 2 diabetes
- 44.9% had hyperlipidaemia
- 16.6% were obese
- 4.1% had thyroid disease (either hyperthyroidism or hypothyroidism)
- 5.3% had chronic renal failure

Note: in the above results patients with multiple other conditions will be counted more than once (e.g. a patient with hypertension + hyperlipidaemia + obesity will be counted twice). Source: unpublished BEACH data.

These data demonstrate that multiple morbidity is common in patients (at general practice encounters) who have hypertension. Further analysis of these data may provide information on the pretest probability of diseases in patients with hypertension. Analysis may also inform the proportion of patients in whom more frequent monitoring would be recommended on the basis of presence of other diseases.

Other comments

Level of evidence included in guideline

A number of the guidelines reviewed do not present the evidence and/or the level of evidence behind their recommendations.

The guidelines that are evidence-based and provide evidence for recommendations include: JNC 7 (2004), CHEP (2008), NICE guideline (2006), SIGN (2001), ESH&ESC (2007)

Those guidelines that do not provide sufficient evidence for recommendations include: NHF guideline (2008), WHO/ISH (2003). (Note references are provided in these guidelines but not to the same level as the evidence-based guidelines).

The other guidance documents do not provide full evidence statements. Murtagh (2007) and Steven (1999) provide some references. The RCPA manual (2004) did not provide the evidence behind guidance.

5.8 National implications

Quality of current pathology ordering

Based on the 2006–08 pathology ordering data for hypertension problems we estimated that 3.2 million tests were ordered for hypertension problems in Australia in 2006–08. Review of the guidelines/guidance suggests:

- 2.1 million (65.0%) tests were supported by the guidelines and guidance documents
- 810,000 (24.9%) may or may not be supported due to conditional support or unclear guidance
- 170,000 (5.2%) were not supported by the guidelines/guidance documents.

The remaining 5% of tests ordered for hypertension each accounted for <1% of total pathology tests ordered for hypertension.

Note: the proportion of tests that are supported by the guidance may be over-estimated as pathology tests are primarily recommended as part of the initial assessment of hypertension in the guidance documents. BEACH data demonstrate that only 16% of pathology tests are ordered in the management of 'new' hypertension contacts.

Future increases in pathology?

Future increase in management rate of hypertension

It is likely that the management rate of hypertension at general practice encounters will increase as the Australian population ages because the prevalence of hypertension increases with age. The Framingham heart study estimated that the lifetime risk of hypertension, for patients who are normotensive at age 55 or 65 years was approximately 90% (assuming survival to 80–85 years).

The management rate of hypertension did not increase significantly over the duration of this study (from 2000–02 to 2006–08); however, BEACH data demonstrated that the management rate increased significantly over the decade 1998–99 to 2007–08.

Future increase in pathology ordering

The pathology ordering rate for hypertension has increased significantly between 2000–02 and 2006–08. The pathology ordering behaviour of GPs is likely to increase in the future.

Extrapolated example of increase

The extrapolations made in this section are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of general practice encounters occur in Australia in the future—an increase or decrease would affect the extrapolated estimates.

Increase in future management rate of hypertension

There was a 20% in the management rate of hypertension from 1998–99 to 2007–08, in this example this proportion of change has been applied.

The example below highlights the consequences of a future increase in management rate, of the same magnitude over the next 8 years. If there was a further 20% increase in the management rate of hypertension, with no change in the pathology ordering behaviour of GPs:

- there would be 3.9 million tests ordered by GPs for the management of hypertension problems.

If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.53 million tests ordered by GPs (65.0% of the 3.9 million tests)

If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 3.50 million tests ordered by GPs (89.9% of the 3.9 million tests)

Of the remaining 10.3% of the 3.9 million tests, 5.2% tests would not be supported by the guidelines/guidance documents and the 4.9% of tests were not evaluated (each accounting for <1% of total pathology tests ordered for hypertension).

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6 Lipid disorders

Summary: Lipid disorders

Background

- Lipid disorders are one of the National Health Priority Area risk factors. It is a risk factor for cardiovascular disease, particularly in patients with diabetes and obesity.
- 'High blood cholesterol' was responsible for 6.2% of the total burden of disease and injury in Australia in 2003.
- The 1999–00 AusDiab study reported the prevalence in patients aged 25 years or older of elevated total cholesterol (>5.5 mmol/l) was 51.2% (51.1% for males and 51.2% for females). A 2005 BEACH study estimated the prevalence of hyperlipidaemia in the Australian population to be 11.2%.

GP management of lipid disorders (BEACH data) April 2000 to March 2008

Lipid disorder was managed at a rate of 3.2 per 100 GP encounters, equating to about 3.2 million encounters nationally per year where lipid disorder was managed by GPs.

There was a significant increase in the management rate of lipid disorders (20% increase), from 2.9 per 100 encounters in 2000–02 to 3.5 per 100 in 2006–08.

Pathology ordering (BEACH data)

Pathology ordered for lipid problems accounted for 5.0% of all pathology tests recorded in 2000–08.

Pathology was ordered at a rate of 62.5 per 100 lipid disorder problems in 2000–08. Almost one-third of lipid disorder contacts (30.5%) resulted in at least one pathology order, and on average 2.05 pathology tests/batteries were ordered per tested contact.

The rate of pathology ordering increased significantly from 58.2 tests/batteries of tests ordered per 100 lipid disorder contacts (in 2000–02) to 66.5 per 100 (in 2006–08). This was due to a significant increase in the number of tests ordered per tested contact.

Of the total national increase in pathology test orders between 2000–02 and 2006–08, 4.5% was attributable to pathology ordering in the management of lipid disorders.

Evaluation of current GP pathology ordering (2006–08) against guidelines

Based on the 2006–08 pathology ordering data for lipid disorder problems we estimate that 2.5 million tests were ordered for lipid disorder problems per year in Australia. Review of the guidelines/guidance suggests:

- 1.9 million (75.5%) tests were supported by the guidelines and guidance documents
- 250,000 (10.0%) may or may not be supported due to unclear guidance
- 220,000 (8.8%) were not supported by the guidelines/guidance documents.

The remaining 5.6% of tests ordered for lipid disorders each accounted for <1% of total pathology tests ordered for lipid disorders, and were not checked against guidelines/guidance.

Comments on guidelines/guidance documents

Intra-individual variation in lipid levels—the variation in measured lipid levels was rarely discussed in guidelines. Approximately half of the guidelines stated the need to test lipid levels at least twice before commencing lipid-lowering medications. However, the amount of expected variation of lipid results and the likelihood of variation in long term monitoring were often not discussed.

Long term monitoring of lipid levels—the majority (92%) of tests ordered for lipid disorder contacts were for ongoing management. In the guidelines, the recommended interval for testing lipids when the patient is at or near target was not consistent, ranging from no monitoring to 3, 6 or 12 monthly. A recent study reported that regular monitoring of lipid levels was more likely to detect false positive results (due to biological and analytic variability) than true change, and recommended testing every 3-5 years in patients at or near lipid targets. This new evidence may have implications for future guideline development. However, the influence of lipid monitoring on patient adherence is not known. Regardless, further information on the degree of intra-individual variation is needed in guidelines to inform GPs of the likelihood of measurement error when monitoring lipid levels.

Monitoring of statin use—The majority of lipid-lowering medications (91%) prescribed for lipid disorders were plain statins. In the guidelines, liver function tests (LFTs) and creatine kinase (CK) tests were often discussed in regard to statins:

- LFT—guidance varied on the need for ongoing monitoring—most commonly LFT monitoring was recommended but no guidance was provided on frequency or duration of monitoring.
- CK— CK testing was not recommended in routine monitoring of statin use—guidelines recommended testing only in the presence of muscle symptoms. However, in BEACH, the rate of CK testing increased significantly even though the rate of statin prescriptions did not change.

Causes of secondary lipid disorders— Testing for causes of secondary dyslipidaemia was recommended in most guidance documents. The conditions commonly listed as secondary causes that involved pathology tests were hypothyroidism (TSH/TFT), renal disease (EUC), liver disease (LFT) and diabetes (glucose). In BEACH the rate of TFT and EUC testing increased significantly suggesting GPs are ordering these tests as part of the ongoing monitoring of lipid disorders. No guidance was provided on whether there is a need to periodically reassess these secondary conditions in the future. Information on whether these conditions are likely to occur in the future (e.g. increasing prevalence with age) and whether subsequent diagnosis of the condition is likely to affect management of lipid disorders would inform whether repeated testing is needed.

Future growth in pathology ordering?

If the management rate of lipid disorder increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering.

- It is likely that the management rate of lipid disorders at GP encounters will increase as the Australian population ages because the prevalence increases with age. Also if lipid targets are reduced further an increase in the number of contacts may be required to achieve target lipid levels.
- The management rate of lipid disorders increased significantly over the duration of this study (from 2000–02 to 2006–08).

The pathology ordering rate for lipid disorders increased significantly between 2000–02 and 2006–08.

Extrapolated example of the effect of a future increase in the management rate

The extrapolations made in this example are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of GP encounters occur in Australia in the future. Increases or decreases in total attendance rates, and/or in the GP test ordering rate would affect the estimates in this example.

Example: If there was a further 20% increase in the management rate of lipid disorder:

Scenario 1: No change in the current (2006–08) pathology ordering behaviour of GPs:

- there would be 3.0 million tests ordered per year by GPs for the management of lipid disorder problems.

Scenario 2: If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.3 million tests ordered per year by GPs (75.5% of the 3.0 million tests)

Scenario 3: If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 2.6 million tests ordered per year by GPs (85.6% of the 30 million tests)

Of the 3.0 million tests, 8.8% would not be supported by the guidelines/guidance documents and the remaining 5.6% of tests ordered were not evaluated (each accounting for <1% of total pathology tests ordered for lipid disorders).

6.1 Definition

The analysis of lipid disorders includes all problems recorded by GPs that were classified as 'lipid disorder' in the International Classification of Primary Care (Version 2) (ICPC-2 code T93).

6.2 Background

- Lipid disorders are one of the National Health Priority Area risk factors. It is a risk factor for cardiovascular disease, particularly in patients with diabetes and obesity. Cardiovascular disease was made a National Health Priority Area (NHPA) in 1996.[1]
- 'High blood cholesterol' was responsible for 6.2% of the total burden of disease and injury in Australia in 2003.[2]
- The 1999–00 AusDiab study reported the prevalence in patients aged 25 years or older of elevated total cholesterol (>5.5 mmol/l) was 51.2% (51.1% for males and 51.2% for females). Lipid lowering agents were being taken by only 7.3% of the population.[3]

6.3 Management rate in Australian general practice

Lipid disorder was managed at 25,231 patient encounters by 6,480 GPs between April 2000 and March 2008. Lipid disorder was managed at a rate of 3.2 per 100 general practice encounters (Table 6.1). This is equivalent to one management of lipid disorder per 31 encounters with patients in 2000–08, and equates to approximately 3.2 million encounters nationally per year where lipid disorder was managed by GPs.

New cases of lipid disorders accounted for 12.6% of lipid disorder problems managed (Table 6.3). The problem is considered new if, it is a new problem to the patient or a new episode of a recurrent problem, and the patient has not been treated for that problem by any medical practitioner before.

Table 6.1: Summary of lipid disorders data set, 2000–08

Variable	Number	Rate per 100 total encs (*n*=784,300)	95% LCL	95% UCL	Per cent of total problems (*n*=1,174,893)	Management: encounter ratio
General practitioners	6,480	—	—	—	—	—
Lipid disorder encounters	25,231	—	—	—	—	—
Lipid disorder problems managed	25,248	3.2	3.2	3.3	2.2	1:31
New lipid disorder problems	3,169	0.40	0.39	0.42	—	—

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Change in management over time

Previously published data from the BEACH study show there was a significant increase in the management of lipid disorders over the last decade, from 2.5 per 100 encounters (95% CI: 2.3–2.7) in 1998–99 to 3.7 per 100 (95% CI: 3.4–4.0) in 2007–08.[4]

Similarly in this study, there was a significant increase in the management rate of lipid disorders, from 2.9 per 100 encounters in 2000–02 to 3.5 per 100 in 2006–08 (Table 6.4). That is equivalent to one management occasion per 29 encounters with patients in 2006–08.

There was a significant increase in the diagnosis or detection rate of new cases of lipid disorder, from 0.35 new cases of lipid problems per 100 encounters in 2000–02 to 0.48 new cases per 100 in 2006–08.

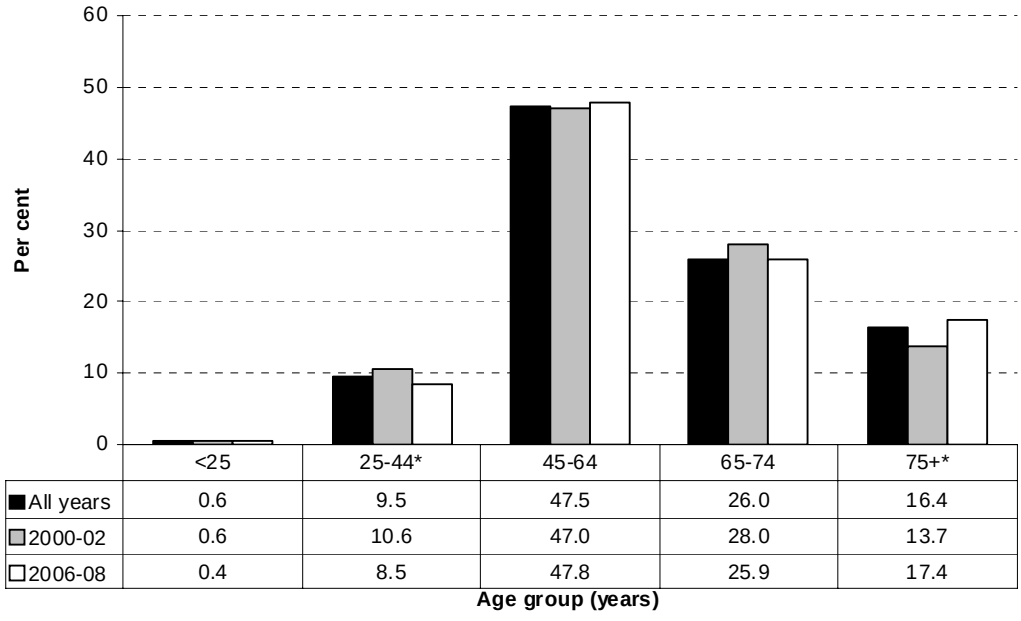
This suggests that the increase the management rate reflects increases in both detection and monitoring encounters for lipid disorders.

Age distribution

The age distribution of adult patients with lipid disorder managed at general practice encounters in 2000–08 is presented in Figure 6.1. Almost half the patients being managed for lipid disorder were aged 45–64 years (47.5%), followed by patients aged 65–74 years (26.0%), 75+ years (16.4%), 25–44 years (9.5%), and <25 years (0.6%).

From 2000–02 to 2006–08 there were two statistically significant changes in the age distribution of patients with lipid disorders managed. The proportion of patients aged 25–44 years decreased significantly from 10.6% (95% CI: 9.7–11.5) to 8.5% (95% CI: 7.8–9.3). The

proportion of patients aged 75+ increased significantly from 13.7% (95% CI: 12.7–14.8) to 17.4% (95% CI: 16.3–18.5) (Figure 6.1).



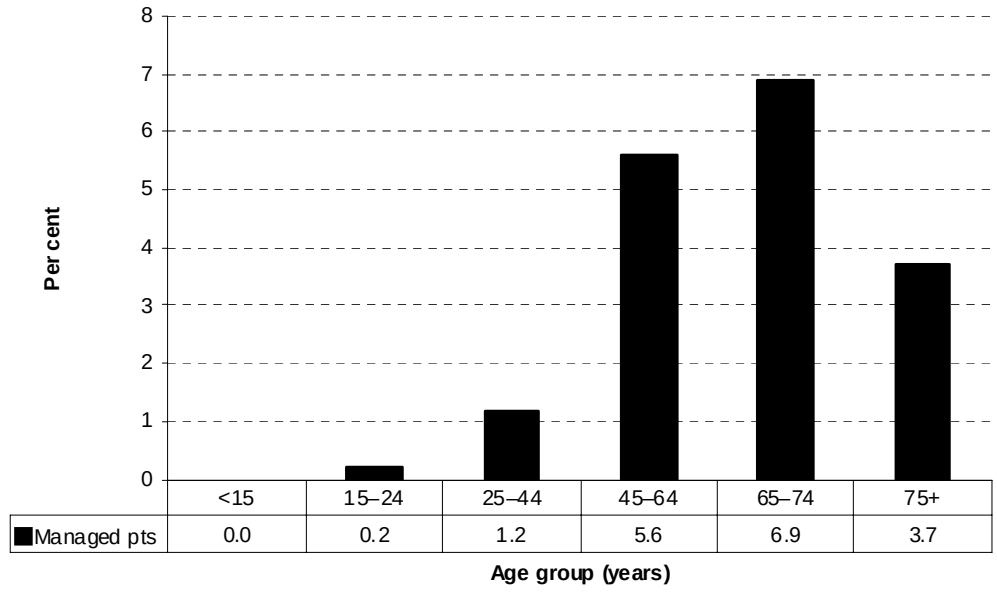
	<25	25-44*	45-64	65-74	75+*
All years	0.6	9.5	47.5	26.0	16.4
2000-02	0.6	10.6	47.0	28.0	13.7
2006-08	0.4	8.5	47.8	25.9	17.4

Age group (years)

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 6.1: Age distribution of patients with lipid disorder managed at general practice encounters, 2000–08 (all years), 2000–02, and 2006–08

Figure 6.2 shows the age-specific management rate of lipid disorders. The age group most likely to have lipid disorder problems managed were 65–74 year olds, 6.9% of encounters with patients in this age group involving the management of lipid disorders.



	<15	15–24	25–44	45–64	65–74	75+
Managed pts	0.0	0.2	1.2	5.6	6.9	3.7

Age group (years)

Figure 6.2: Age-specific rate of management of lipid disorders 2000–08

Table 6.2 shows the number of problems managed per encounter where lipid disorder was managed and the number managed at all BEACH encounters in 2000–08. A maximum of 4 problems can be recorded per encounter in BEACH.

Encounters involving the management of lipid disorders were more complex, being more likely to have multiple problems (2, 3 or 4 problems managed) per encounter than average general practice encounters.

Table 6.2: Number of problems managed at lipid disorder encounters and total encounters

	Lipid disorder encs (2000–08)				All BEACH encs (2000–08)			
Number of problems managed	Number	Per cent of problems	95% LCL	95% UCL	Number	Per cent of problems	95% LCL	95% UCL
One problem	4,433	17.6	17.0	18.2	502,522	64.1	63.7	64.4
Two problems	9,257	36.7	36.0	37.4	193,452	24.7	25.5	24.9
Three problems	7,458	29.6	28.9	30.2	67,837	8.7	8.5	8.8
Four problems	4,083	16.2	15.6	16.8	20,489	2.6	2.5	2.7

Note: LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08.

6.4 Pathology ordering behaviour

Pathology was ordered at a rate of 62.5 per 100 lipid disorder problems in 2000–08. Almost one-third of lipid disorder contacts (30.5%) resulted in at least one pathology order (Table 6.3).

Once the decision to order pathology was made the GP ordered on average 2.05 pathology tests/batteries per tested lipid problem (Table 6.3). Pathology ordered for lipid problems accounted for 5.0% of all pathology tests recorded from April 2000 to March 2008.

Table 6.3: Summary of pathology ordering for lipid disorder, 2000–08

Variable	Number	Per cent / Rate of lipid disorder problems	95% LCL	95% UCL
Lipid disorder problems managed (% of lipid disorder problems)	25,248	100.0	—	—
New problems (% of lipid disorder problems)	3,169	12.6	12.1	13.0
Pathology (Rate per 100 lipid disorder problems)	15,778	62.5	60.6	64.4
At least one pathology order (% of lipid disorder problems)	7,704	30.5	29.8	31.3
Number of tests/batteries per 100 tested lipid disorder problems	—	204.8	201.2	208.4

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Changes over time, 2000–02 to 2006–08

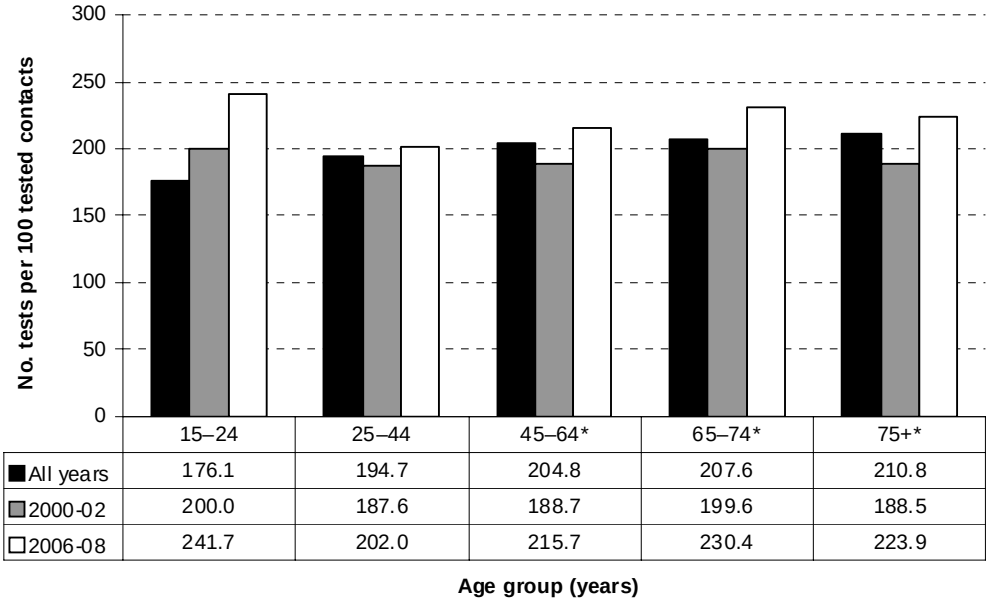
The proportion of pathology orders accounted for by lipid problems was 5.1% in 2000–02 and 4.9% in 2006–08.

The rate of pathology ordering increased significantly from 58.2 tests/batteries of tests ordered per 100 lipid disorder contacts (in 2000–02) to 66.5 per 100 (in 2006–08). This was due to a significant increase in:

- The number of tests ordered once the decision to order pathology was made (191.4 tests/batteries per 100 tested contacts in 2000–02 compared with 219.4 per 100 in 2006–08) (Table 6.4).

There was no change in the likelihood of pathology being ordered in the management of lipid disorders (30.4% of lipid disorder contacts in 2000–02 and 30.3% in 2006–08).

Figure 6.3 shows the average number of tests ordered per 100 tested contacts by patient age. Patients aged 45–64 years, 65–74 years and 75 years and over had a significantly higher number of tests ordered per tested lipid disorder contact in 2006–08 than in 2000–02.



	15–24	25–44	45–64*	65–74*	75+*
All years	176.1	194.7	204.8	207.6	210.8
2000-02	200.0	187.6	188.7	199.6	188.5
2006-08	241.7	202.0	215.7	230.4	223.9

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 6.3: Age-specific mean number of pathology tests per 100 tested lipid disorder contacts, 2000–08 (all years), 2000–02, and 2006–08

Extrapolation of pathology ordering behaviour

When these data were extrapolated to the number of GP encounters claimed through Medicare nationally the results suggest there were approximately:

- 820,000 more encounters involving lipid disorders in 2006–08 (3.7 million per annum) than in 2000–02 (2.9 million per annum).
- 250,000 more lipid disorder contacts that involved the ordering of at least one pathology test/battery of tests (tested contacts) in 2006–08 (1.1 million per annum) than in 2000–02 (890,000 per annum)
- 790,000 more tests/batteries ordered for diagnosed lipid disorders in 2006–08 (2.5 million per annum) than in 2000–02 (1.7 million per annum) (results not shown).

Of the estimated 17.7 million additional tests/batteries ordered by GPs in 2006–08 (51.3 million tests/batteries ordered by GPs per annum), compared with 2000–02 (33.6 million per annum), 4.5% was attributable to pathology ordering in the management of lipid disorders. There was a 46.5% increase in the volume of GP requests for pathology tests/batteries attributable to lipid disorders, due to a combination of factors:

- the increase in the total number of GP encounters in Australia
- the increased management rate of lipid disorders
- one change in GP pathology ordering behaviour for lipid problems—increased number of tests ordered once the decision to order was made.

Table 6.4: Changes in the management of lipid disorder over time, 2000–02 to 2006–08

	2000–02							2006–08							
Variable	Number	Rate per 100 total encs (*n*=198,200)	95% LCL	95% UCL	Per cent/ Rate of lipid probs (*n*=5,782)	95% LCL	95% UCL	Number	Rate per 100 total encs (*n*=188,300)	95% LCL	95% UCL	Per cent/ Rate of lipid probs (*n*=5,782)	95% LCL	95% UCL	Change
GPs who managed lipid disorder	1,629	—	—	—	—	—	—	1,602	—	—	—	—	—	—	—
Lipid disorder encounters	5,780	—	—	—	—	—	—	6,624	—	—	—	—	—	—	—
Lipid disorder problems managed	5,782	2.9	2.8	3.0	—	—	—	6,629	3.5	3.4	3.7	—	—	—	↑
New problems	699	0.35	0.32	0.38	12.1	11.2	13.0	902	0.48	0.44	0.52	13.6	12.6	14.6	↑
Pathology (Rate per 100 lipid disorder problems)	3,364	—	—	—	58.2	54.7	61.7	4,410	—	—	—	66.5	62.5	70.6	↑
At least one pathology order (% of lipid problems)	1,758	—	—	—	30.4	28.9	31.9	2,010	—	—	—	30.3	28.9	31.8	—
Number of tests/batteries per 100 tested lipid disorder problems	—	—	—	—	191.4	184.6	198.2	—	—	—	—	219.4	211.6	227.3	↑

Note: encs—encounters; probs—problems; LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

6.5 Types of pathology tests ordered

Table 6.5 shows the distribution of pathology tests/batteries ordered for lipid disorders in 2000–08 by MBS groups and the most common individual types of pathology tests ordered.

- Chemistry tests were the group of tests most often ordered, at a rate of 57.1 per 100 contacts with lipid disorders. The most common chemistry tests ordered were:
  - lipid tests (31.4 per 100 lipid disorder contacts)
  - liver function tests (7.8 per 100 lipid disorder contacts)
  - glucose/glucose tolerance tests (6.0 per 100 contacts)
  - electrolyte, urea and creatinine tests (3.2)
- Haematology tests (4.3 per 100 contacts), in particular full blood counts (3.8 per 100), were also commonly ordered in the management of lipid disorders (Table 6.5).

Only 7.6% of pathology tests were ordered in the management of 'new' cases of lipid disorders. The vast majority of pathology tests/batteries ordered in the management of lipid disorders were for ongoing management (Table 6.5).

Changes in types of pathology tests ordered 2000–02 to 2006–08

Table 6.6 compares the pathology ordering for lipid problems in 2000–02 with 2006–08, shaded results highlight significant differences. There was a 14% increase in the rate of pathology from 58.2 per 100 lipid disorder contacts in 2000–02 to 66.5 per 100 in 2006–08.

- There was a significant decrease in the order rate of lipid tests—11% decrease.
- There were significant increases in the order rate of:
  - full blood counts—85% increase
  - electrolyte, urea and creatinine tests—109% increase
  - multibiochemical analysis—68% increase
  - creatine kinase—94% increase
  - thyroid function tests—70% increase
- There was also a marginal increase in the rate of prostate specific antigen tests—135% increase (Table 6.6).

6.6 Prescribed medications

Lipid lowering agents (plain and combination) accounted for more than 97% of medications prescribed in the management of lipid disorders, in 2000–08. Most of these were plain statins (91% of all prescribed medications for lipid disorders). There was a marginal increase in the rate of prescribed medications between 2000–02 and 2006–08 from 63.0 per 100 contacts with lipid disorders (95% CI: 61.1–64.8) to 66.5 per 100 (95% CI: 64.8–68.2). This increase was due to the introduction of ezetimbe and statin/ezetimbe combination medications. The prescribing rate of statins, fibrates and other lipid-lowering medications did not change (results not shown).

Table 6.5: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for lipid disorder, 2000–08

	Pathology for all lipid disorder problems						Pathology for new lipid disorder problems				
Pathology test ordered	Number	Per cent of all pathology for lipid disorder	Per cent of group	Rate per 100 lipid disorder probs (*n*=22,938)	95% LCL	95% UCL	Number	% test for new cases	Rate per 100 new lipid disorder probs (n=1,421)	95% LCL	95% UCL
Chemistry	**14,415**	**91.4**	**100.0**	**57.1**	**55.4**	**58.8**	**1,104**	**7.7**	**34.8**	**31.9**	**37.8**
Lipids*	7,919	50.2	54.9	31.4	30.5	32.3	704	**8.9**	22.2	20.4	24.0
Liver function*	1,962	12.4	13.6	7.8	7.3	8.2	106	**5.4**	3.3	2.7	4.0
Glucose/glucose tolerance*	1,520	9.6	10.5	6.0	5.7	6.4	107	**7.0**	3.4	2.7	4.0
EUC*	801	5.1	5.6	3.2	2.9	3.5	42	**5.2**	1.3	0.9	1.7
Multibiochemical analysis*	683	4.3	4.7	2.7	2.4	3.0	37	**5.4**	1.2	0.8	1.6
Creatine kinase	671	4.3	4.7	2.7	2.4	2.9	44	**6.6**	1.4	1.0	1.8
Thyroid function*	318	2.0	2.2	1.3	1.1	1.4	27	**8.5**	0.9	0.5	1.2
Prostate specific antigen*	157	1.0	1.1	0.6	0.5	0.7	4	**2.5**	0.1	0.0	0.2
Haematology	**1,076**	**6.8**	**100.0**	**4.3**	**3.9**	**4.6**	**55**	**5.1**	**1.7**	**1.2**	**2.2**
Full blood count	949	6.0	88.2	3.8	3.5	4.1	48	**5.1**	1.5	1.1	1.9
Other NEC	**210**	**1.3**	**100.0**	**0.8**	**0.7**	**1.0**	**16**	**7.6**	**0.5**	**0.2**	**0.8**
Other pathology groups	**77**	**0.5**	**100.0**	**—**	**—**	**—**	**18**	**23.4**	**—**	**—**	**—**
Total pathology tests	**15,778**	**100.0**	**—**	**62.5**	**60.6**	**64.4**	**1,193**	**7.6**	**37.7**	**34.5**	**40.8**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations.

Table 6.6: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for lipid disorder, 2000–02 compared with 2006–08

	2000–02						2006–08						
Pathology test ordered	Number	Per cent of all pathology for lipid disorder	Per cent of group	Rate per 100 lipid disorder probs[(a)]	95% LCL	95% UCL	Number	Per cent of all pathology for lipid disorder	Per cent of group	Rate per 100 lipid disorder probs[(a)]	95% LCL	95% UCL	Change
Chemistry	**3,125**	**92.9**	**100.0**	**54.1**	**50.8**	**57.3**	**3,954**	**89.7**	**100.0**	**59.7**	**56.1**	**63.2**	—
Lipids*	1,932	57.4	61.8	33.4	31.5	35.4	1,957	44.4	49.5	29.5	27.9	31.1	↓
Liver function*	409	12.2	13.1	7.1	6.2	8.0	550	12.5	13.9	8.3	7.4	9.2	—
Glucose/glucose tolerance*	305	9.1	9.8	5.3	4.6	6.0	417	9.5	10.5	6.3	5.5	7.0	—
EUC*	121	3.6	3.9	2.1	1.6	2.5	294	6.7	7.4	4.4	3.8	5.1	↑
Multibiochemical analysis*	112	3.3	3.6	1.9	1.4	2.4	211	4.8	5.3	3.2	2.6	3.8	↑
Creatine kinase	101	3.0	3.2	1.8	1.2	2.3	232	5.3	5.9	3.5	2.9	4.1	↑
Thyroid function*	56	1.7	1.8	1.0	0.7	1.2	112	2.5	2.8	1.7	1.3	2.1	↑
Prostate specific antigen*	26	0.8	0.8	0.5	0.3	0.6	55	1.3	1.4	0.8	0.6	1.1	↑
Haematology	**185**	**5.5**	**100.0**	**3.2**	**2.6**	**3.8**	**361**	**8.2**	**100.0**	**5.5**	**4.7**	**6.2**	↑
Full blood count	156	4.6	84.3	2.7	2.2	3.2	333	7.6	92.2	5.0	4.3	5.8	↑
Other NEC	**35**	**1.0**	**100.0**	**0.6**	**0.4**	**0.8**	**71**	**1.6**	**100.0**	**1.1**	**0.7**	**1.4**	—
Other pathology groups	**19**	**0.6**	**100.0**	—	—	—	**24**	**0.5**	**100.0**	—	—	—	—
Total pathology tests	**3,364**	**100.0**	—	**58.2**	**54.7**	**61.7**	**4,410**	**100.0**	—	**66.5**	**62.5**	**70.6**	↑

(a) The total number of lipid disorder problems in 2000–02 was 5,782 and in 2006–08 was 6,629.

Note: Probs—problems; LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

6.7 Guidelines for the management of lipid disorders

Guidance documents for the management of lipid disorders and the lipid section of cardiovascular disease prevention guidelines were considered in this study.

Guidelines reviewed were:

- Position Statement on Lipid Management—2005 [National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand, NHF & CSANZ, 2005].[5]
- Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) [US, National Institutes of Health, 2002][6] & Implications of Recent Clinical Trials for the NCEP Adult Treatment Panel III Guidelines [2004 update].[7]
- Clinical Guidelines and Evidence Review for Lipid Modification: cardiovascular risk assessment and the primary and secondary prevention of cardiovascular disease. [London, National Collaborating Centre for Primary Care and Royal College of General Practitioners, NICE guideline, 2008].[8]
- Risk estimation and the prevention of cardiovascular disease [Scottish Intercollegiate Guidelines Network, SIGN, 2007].[9]
- Medical Guidelines for Clinical Practice for the Diagnosis and Treatment of Dyslipidemia and Prevention of Atherogenesis, 2002 Amended Version [American Association of Clinical Endocrinologists, AACE, 2002].[10]
- European guidelines on cardiovascular disease prevention in clinical practice: Executive summary [European Society of Cardiology, ESC, 2007].[11]
- Screening and Management of Lipids [University of Michigan, 2009].[12]
- Recommendations for the management of dyslipidemia and the prevention of cardiovascular disease: 2003 update [the Working Group on Hypercholesterolemia and Other Dyslipidemias, Canada, 2003].[13,14]
- Clinical practice guidelines: lipids [Singapore Ministry of Health, MoH, 2006].[15]
- Health Care Guideline: Lipid Management in Adults [Institute for Clinical Systems Improvement, ICSI, 2007].[16]

Other Australian sources of guidance reviewed were:

- Murtagh's general practice, dyslipidaemia section [Murtagh, 2007].[17]
- 'RCPA manual', hyperlipidaemia section—Manual of use and interpretation of pathology tests [The Royal College of Pathologists of Australasia (RCPA), 2004].[18]

Other sources of guidance that were reviewed but not included in tables 6.7 and 6.8 were:

- Testing pitfalls and summary of guidance in lipid management [Smellie, UK, BMJ, 2006].[19]
- 'Best practice in primary care pathology: review 1' section on measurement and monitoring of cholesterol and of liver and muscle enzymes in patients in the context of lipid lowering drugs [Smellie et al., UK, J Clin Path, 2005].[20]
- 'Best practice in primary care pathology: review 3' section on secondary hyperlipidaemia and hypertrigyleridaemia [Smellie et al., UK, J Clin Path, 2006].[21]
- Cholesterol—frequently asked questions [Australia, Phillips, AFP, 2006].[22]

- Lipid lowering: what and when to monitor [Criqui & Golomb, Lancet, 2008].[23]
- Final conclusions and recommendations of the National Lipid Association Statin Safety Assessment Task Force [US, Am J Cardiol, 2006].[24]
- Monitoring cholesterol levels: measurement error or true change? [Glasziou et al., Annals Internal Medicine, 2008].[25]
- Use of randomised trials to decide when to monitor response to new treatment [Bell et al., BMJ, 2008].[26]

These papers are included in the discussion of guidance.

6.8 Application of the guidance

Evaluation of GP pathology ordering against guidelines/guidance

Table 6.7 provides a summary of the individual tests and the level of support provided in the guidelines/guidance for each: yes—supported; unclear guidance or conditional support; no—not supported:

- 79.4% of tests ordered for management of lipid disorders were supported by the guidelines and guidance documents
- for 8.6% of tests guidance was conditional or unable to be determined
- 7.0% of tests were not supported by the guidelines/guidance documents.

The individual tests/batteries listed in Table 6.7 account for 94.9% of pathology tests/batteries ordered for lipid disorders because only the most common individual pathology tests ordered are included (each accounted for >1% of tests for lipid disorders).

Table 6.7: Summary of support for GP pathology ordering for the most frequent individual test orders for lipid disorder, 2000–08

Pathology test ordered	Number	Per cent of all pathology for lipid disorders
YES	**12,520**	**79.4**
Lipids*	7,919	50.2
Liver function*	1,962	12.4
Glucose/glucose tolerance*	1,520	9.6
EUC*	801	5.1
Thyroid function*	318	2.0
UNCLEAR/CONDITIONAL SUPPORT	**1,354**	**8.6**
Multibiochemical analysis*	683	4.3
Creatine kinase	671	4.3
NO	**1,106**	**7.0**
Full blood count	949	6.0
Prostate specific antigen*	157	1.0
Subtotal (n, % of total tests included in the table)	*14,980*	*94.9*
Total pathology tests	**15,778**	**100.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 6.8 compares the commonly ordered pathology tests/batteries for lipid disorders with the tests recommended by guidelines and guidance documents for lipid disorders. The key explaining the colours used in the table is below Table 6.8. Briefly, dark green tests are specifically supported, light green have partial support, red tests are advised against, orange tests are those for which support cannot be determined, and pink tests were not mentioned in the guideline/guidance.

Lipids

Lipids tests were recommended in all guidance documents and include the testing of total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides.

In BEACH, during this study (2000–02 to 2006–08), there was a significant decrease in the rate of lipid test orders. However, this represents a change in how GPs record the lipid test on the BEACH encounter forms rather than a change in lipid ordering behaviour. GPs were more likely to record the specific lipid subfractions in 2000–02 (multiple tests) whereas in 2006–08 they were more likely to record the lipid profile test (a single test). This is discussed further below in 'monitoring lipid levels'.

Liver function

Liver function testing was recommended in all guidance documents. Either to determine presence of liver dysfunction as a cause of secondary lipid disorders or in the monitoring of statin medications and selected other medications (e.g. combination therapy).

In BEACH, during this study (2000–02 to 2006–08), the rate of liver function tests ordered in the management of lipid disorders did not change.

Glucose/glucose tolerance

Glucose testing was recommended in most guidelines to determine the presence of diabetes as a cause of secondary lipid disorder. It was also discussed in regard to cardiovascular risk as this affects which lipid target is appropriate for the patient. Guidelines often included a section on the management of lipid disorders in diabetes.

In BEACH, during this study (2000–02 to 2006–08), the rate of glucose tests ordered in the management of lipid disorders did not change.

EUC

Assessment of renal function was recommended in most guidelines to determine the presence of renal impairment as a cause of secondary lipid disorder. It was also discussed in regard to cardiovascular risk as this affects which lipid target is appropriate for the patient and as a consideration in medication selection.

In BEACH, during this study (2000–02 to 2006–08), the rate of EUC tests ordered in the management of lipid disorders doubled, from 2.1 per 100 lipid disorder contacts in 2000–02 to 4.4 per 100 in 2006–08.

Thyroid function

Assessment of thyroid function was recommended in most guidelines to determine the presence of hypothyroidism as a cause of secondary lipid disorder.

In BEACH, during this study (2000–02 to 2006–08), the rate of thyroid function tests ordered in the management of lipid disorders increased significantly, from 1.0 per 100 lipid disorder contacts in 2000–02 to 1.7 per 100 in 2006–08.

Creatine kinase

Creatine kinase (CK) was discussed in regard to medication use (primarily statin use) to detect myopathy and most guidance stated that routine monitoring of CK was not necessary. CK testing was indicated in patients with muscle symptoms and some guidance documents recommended taking a baseline measure prior to starting statins for future comparison.

A few guidelines recommended routine monitoring in certain high risk patient (e.g. renal disease, high dose statins, statin combination therapy). In the guidelines where guidance about CK testing was not given, the potential for myopathy as an adverse effect of statin use was discussed.

In BEACH, during this study (2000–02 to 2006–08), the rate of CK tests ordered in the management of lipid disorders increased significantly, almost doubling from 1.8 per 100 lipid disorder contacts in 2000–02 to 3.5 per 100 in 2006–08.

Multibiochemical analysis

The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported by the guidance. Indiscriminate testing does not meet evidence-based principles.

However, the LFT and EUC components of the MBA would have support in certain circumstances as discussed above.

In BEACH, during this study (2000–02 to 2006–08), the rate of MBA tests ordered in the management of lipid disorders increased significantly, from 1.9 per 100 lipid disorder contacts in 2000–02 to 3.2 per 100 in 2006–08.

Full blood count

Full blood counts were not recommended by any of the guidance documents in the management of lipid disorders. Systemic lupus erythematosus was listed as a possible cause of secondary lipid disorders in two guidelines and it is possible that GPs may order the FBC to assess the presence of this condition.[27]

In BEACH, during this study (2000–02 to 2006–08), the rate of FBC tests ordered in the management of lipid disorders increased significantly, almost doubling from 2.7 per 100 lipid disorder contacts in 2000–02 to 5.0 per 100 in 2006–08.

Prostate specific antigen

Prostate specific antigen (PSA) testing was not recommended by any of the guidance documents in the management of lipid disorders.

In BEACH, during this study (2000–02 to 2006–08), the rate of PSA tests ordered in the management of lipid disorders increased marginally, from 0.5 per 100 lipid disorder contacts in 2000–02 to 0.8 per 100 in 2006–08.

It is probable that the PSA tests ordered by GPs represent opportunistic testing for prostate cancer. However, PSA testing is not recommended as a screening test for prostate cancer in asymptomatic men.[28] PSA testing is discussed in regard to check-ups in Chapter 8.

Table 6.8: Summary of guideline/guidance recommendations by most frequent individual test orders for lipid disorder, 2000–08

Pathology test ordered	NHF & CSANZ 2005	NCEP ATP III (2002 & 2004 update)	NICE 2008	SIGN 2007	AACE 2002	ESC 2007	Singapore MoH 2006	Uni Michigan 2009	Canada 2003	ICSI 2007	RCPA 2004	Murtagh 2007	Number (*n*=15,778)	% of all path for HT
Lipids*													7,919	50.2
Liver function*	Med safety discussed					Med safety discussed			Meds			Meds	1,962	12.4
Glucose/glucose tolerance*	CV risk			CV risk					CV risk				1,520	9.6
Full blood count						SLE				SLE			949	6.0
EUC*	CV risk and meds								Implied renal function				801	5.1
Multibiochemical analysis*[(a)]													683	4.3
Creatine kinase	Baseline & muscle sx	Baseline & muscle sx	Muscle sx	Muscle sx + high risk pts	Implied	Med safety discussed	High risk meds	Muscle sx	High risk meds	Baseline & muscle sx		Monitor in statin use	671	4.3
Thyroid function*													318	2.0
Prostate specific antigen*													157	1.0

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) Multibiochemical analysis (MBA) potentially includes a combination of a broad group of tests. The MBS chemical analysis group includes a wide variety of biochemical tests (such as those in MBS item 66500).

Note: Meds—medications; CV risk—cardiovascular risk; SLE—systemic lupus erythematosus; sx—symptom; also see Abbreviations.

Key to Table 6.8

Colour	Description
	The document specifically recommended this test. Any notes within the cell indicate further detail. For example, a specific disease to test for within subset of patients; a specific test within a battery of tests.
	The document states that this test should be considered. Any notes within the cell indicate further detail (e.g. a specific test to consider)
	Unable to determine guidance—MBA tests include mixed content for which it is not possible to determine guideline agreement (see footnote (a) above).
	Guideline specifically states not to do this test. Additional information is supplied if the guideline states not to do the test unless clinically indicated.
	Guideline does not mention this test

Evaluation of the guidelines and guidance documents

Monitoring lipid levels

In the 'active' phase of managing lipid levels (response to diet and exercise and/or medications) the interval for measuring response (i.e. retesting lipid levels) recommended in guidance documents varies from 4 to 12 weeks until the recommended target lipid levels are achieved. The testing intervals recommended in these guidance documents were based on consensus.[6,10,12,14,16,19]

The 2008 NICE guideline recommended a different approach. In the primary prevention of CVD where statin therapy is indicated no target was provided and the guideline recommends against monitoring lipid levels in response to statin use unless clinical judgement or patient preference indicate the need to review the lipid profile. In the secondary prevention section of the NICE guideline lipid targets were provided however the interval to testing response was not provided.[8] Bell et al. (2008) questioned the need to monitor patients where randomised control trial data are available to give an indication of whether target will be achieved based on initial lipid levels.[26] This approach assumes a high level of patient adherence to medication. It is a very different approach to the Australian NHF & CSANZ guidance whose current recommendation is to measure lipid levels every 6–12 months to assess patient adherence and manage cardiovascular risk.[5]

The recommended interval for testing in the monitoring phase (once at target) varies between the guidance documents: from 3–6 monthly to 12 monthly testing, or not at all in the case of primary prevention in the NICE guideline. Glasziou et al. (2008) recently recommended that in patients for whom lipid levels are stable (within 0.5 mmol/L of target) the interval for monitoring should be every 3–5 years because more frequent testing is more likely to reflect measurement error than true change.[25]

Most of the guidance documents in Table 6.8 did not discuss intra-individual variation of cholesterol testing. The NICE, SIGN and University of Michigan guidelines discussed variance and the need for at least two tests before starting therapy. The AACE and NCEP guidelines recommended at least two tests before starting therapy but the reason for this was not provided.

The NICE guideline was the only guideline in Table 6.8 that provided detailed information on the amount of intra-individual variation in lipid levels. NICE recommended multiple testing to reduce this variation prior to starting medications and in monitoring response. However, it was acknowledged that multiple testing might not be practical in monitoring. The intra-individual variation in monitoring lipid levels has also been discussed by other authors.[19,20,22,23,25]

The recommended interval for testing lipids when the patient is at or near target was not consistent within the guidance documents. Recent evidence suggests that testing too frequently may reflect measurement error and this may have implications for future guideline development. However, the influence of lipid monitoring on patient adherence is not known. Regardless, further information on the degree of intra-individual variation is needed in guidelines to inform GPs of the likelihood of measurement error when monitoring lipid levels.

The discussion regarding interval for monitoring of lipid disorders is recent and does not appear to have had an impact on the lipid test order rate observed in this study.

In BEACH there was a significant decrease in the order rate of lipid tests. This represents a change in how GPs record the lipid test on the BEACH encounter forms, not a change in the interval for monitoring lipids. GPs were more likely to record the specific lipid subfractions in 2000–02 (multiple tests) whereas in 2006–08 they were more likely to record the lipid profile test (a single test). This may reflect the change in approach to management of lipid disorders with increasing evidence of the role of managing specific lipid subfractions. It may also reflect a limitation of the BEACH form as only 5 tests can be recorded per encounter, and as more tests are recorded per encounter GPs may abbreviate the way they record the lipid test on the encounter form.

Lipid targets

Lipid targets have become lower over time and differ between guidelines. The majority of guidance documents recommended LDL-C targets, often determined by level of cardiovascular risk. Lower targets are potentially harder and may take longer to achieve. More frequent pathology testing to measure response is recommended while actively trying to achieve a target (titrating medications). While the guidance documents acknowledged that targets may not be achievable in all patients and should be adjusted to the individual patient it is likely that the change in recommended targets may result in increased testing rates.

Monitoring statin use

The majority of lipid-lowering medications prescribed in the management of lipid disorders were plain statins (91% of medications for lipid disorders were plain statins). The guidelines primarily refer to monitoring in statin therapy.

Liver function testing (LFT)

There was reasonable agreement between guidance documents on the need to test LFT before initiating statins, after commencing and after increasing dose (approx 12 weeks). However, guidance varied on the need for ongoing monitoring.

The US National Lipid Association Statin Safety Assessment (NLASSA) task force recommended ongoing monitoring but noted there was little evidence to support it.[24] Recognition of the lack of evidence for long term monitoring was echoed by other authors.[8,19,20]

The NICE guideline provided a consensus recommendation that LFT testing was needed pre-treatment, within 3 months of starting medication, and a year after that. Further monitoring was not recommended unless clinically indicated.

The majority of guidance documents recommended monitoring of LFT but offered no comment on frequency or duration of monitoring.[10,16,17] This was also the case for the Australian medication guidelines (Australian therapeutic guidelines)[29] and the NHF & CSANZ lipid management position statement.[5]

The order rate of LFT did not change over the period of this study—GPs have not changed their behaviour in regard to monitoring LFTs in the management of lipid disorders.

Creatine kinase

Creatine kinase (CK) testing was not recommended in routine monitoring of statin use in most guidelines. Murtagh recommended ongoing monitoring of CK in statin use. Smellie et al recommended a baseline CK test prior to initiating a statin for two reasons: if baseline CK

is elevated statin should not be started, and if CK testing is indicated in the future (e.g. muscle symptoms develop) results can be compared with baseline.[19,20] The NLASSA task force stated that baseline testing in patients at high risk for muscle toxicity may be considered but routine baseline testing for all patients commencing a statin was not recommended.[24]

CK testing was commonly recommended in patients who develop muscle symptoms. The NLASSA task force stated that muscle symptoms or increased CK were likely to be caused by other aetiologies and should be investigated by health professionals.[24] If rhabdomyolysis is suspected serum creatinine should also be measured.

CK testing increased significantly over the period of this study (2000–02 to 2006–08), even though the vast majority of guidance recommended against routine monitoring of CK.

Causes of secondary dyslipidaemia

Testing for causes of secondary dyslipidaemia was recommended in most guidance documents, usually prior to starting lipid-lowering therapy. The exceptions were:

- the Australian NHF & CSANZ guideline—both the 2005 position statement and the 2001 guideline did not discuss causes of secondary dyslipidaemia
- the cardiovascular prevention guidelines from ESC and SIGN did not address causes of secondary dyslipidaemia. This is possibly because these guidelines were not solely providing guidance on the management of lipid disorder. They included all aspects of cardiovascular prevention (e.g. blood pressure, antiplatelet therapy).

The conditions commonly listed as secondary causes that involved pathology tests were hypothyroidism (TSH/TFT), renal disease (EUC), liver disease (LFT) and diabetes (glucose). In BEACH the rate of TFT and EUC testing increased significantly (see 'increases in pathology tests' discussion below). Testing to identify causes of secondary dyslipidaemia were mentioned as part of the initial evaluation of the patient. No guidance was provided on whether there is a need to periodically reassess these secondary conditions in the future. Information on whether these conditions are likely to occur in the future (e.g. increasing prevalence with age) and whether subsequent diagnosis of the condition is likely to affect management of lipid disorders would inform whether repeated testing is needed.

Comorbidities in general practice patients

The recommendations in guidelines reflect the comorbidities and possible causes of hyperlipidaemia. In a recent (2008) BEACH SAND substudy (unpublished) of 5,900 patients at GP encounters, patient comorbidities were investigated. Prevalence of hyperlipidaemia in this sample was 18.6%. Of these patients:

- 65.7% also had hypertension
- 22.1% had Type 2 diabetes
- 16.1% were obese
- 4.4% had thyroid disease (either hyperthyroidism or hypothyroidism)
- 4.9% had chronic renal failure

Note: in the above results patients with multiple other conditions will be counted more than once (e.g. a patient with hyperlipidaemia + hypertension + obesity will be counted twice). Source: unpublished BEACH data.

These data demonstrate that multiple morbidity is common in patients (at general practice encounters) who have hyperlipidaemia. Further analysis of these data may provide information on the pretest probability of diseases in patients with hyperlipidaemia. Analysis may also inform the proportion of patients in whom more frequent monitoring would be recommended on the basis of presence of other diseases.

Increase in pathology tests

This study has demonstrated that between 2000–02 and 2006–08 the significant increase in pathology testing for lipid disorders was due to an increase in the number of tests ordered per tested contact. The likelihood of pathology being ordered in the management of lipid disorders did not change.

The data suggest that GPs have not changed the rate at which they monitor lipids in response to therapy. GPs have also not changed the rate of glucose testing (e.g. assessing presence of diabetes/impaired glucose tolerance) or liver function testing (i.e. presence of liver disorder/monitoring side effect of statin) when managing lipid disorder.

The increases were in the order rates of FBC, EUC, MBA, CK, TFT and PSA testing. Of these tests, EUC (kidney function), CK and TFTs were referred to in the guidance documents.

The proportion of lipid problems that were newly diagnosed increased between 2000–02 and 2006–08 and this may have contributed to some of the increased rates of EUC, TFT and CK testing as these were recommended as part of the initial investigations (discussed below). However, this is unlikely to account for the entire increase in these tests in the management of lipid disorders.

Over the last decade the awareness of total cardiovascular risk as being multifactorial has increased and this was reflected in guidelines. For example, screening for conditions that increase cardiovascular risk (such as diabetes) and initiation of lipid-lowering therapy based on level of cardiovascular risk. Locally the PBS criteria for subsidy of lipid-lowering medications changed in late 2006. This provided access to subsidised lipid-lowering medications based on the patient's cardiovascular risk.[30] This is likely to have contributed to the increased management rate of lipid disorders demonstrated in BEACH from 2000–02 to 2006–08. However, the increased focus on total CV risk does not appear to have altered pathology ordering behaviour in the management of lipid disorders. The individual tests that increased (FBC, EUC, MBA, CK, TFT and PSA) for lipid disorder problems did not appear to relate to the evaluation or management of total cardiovascular risk.

Kidney function

Kidney function testing was mentioned as part of the initial assessment of the patients with lipid disorders due to the implications for cardiovascular risk if limited kidney function is present and as a possible cause of secondary lipid disorders. However, its role in ongoing management was not discussed in most guidance documents. Creatinine levels were mentioned in regard to diagnosis of rhabdomyolysis as an adverse effect of statin therapy.

The (NLASSA) task force states that it is not necessary to monitor serum creatinine or proteinuria routinely during statin therapy. If either is found to be elevated unexpectedly (without rhabdomyolysis) the statin does not generally need to be withdrawn but if indicated the dose may be adjusted. The SIGN guideline refers to the task force's recommendations.

Creatine Kinase (CK)

CK testing in the monitoring of statins is discussed above (see 'Monitoring statin use'). In BEACH the rate of CK testing increased significantly over the period of this study.

Thyroid function test

Hypothyroidism is a cause of secondary hyperlipidaemia. Testing for secondary causes is recommended in most guidance documents, usually prior to starting lipid-lowering therapy. Smellie et al recommend that TSH testing is only required if initial total cholesterol level >8.0 mmol/L. Other guidance documents recommend testing regardless of initial lipid levels. The need for ongoing testing is not discussed by any of the guidance documents.

Other tests (FBC, MBA and PSA)

The significant increases in FBC and MBA testing and marginal increase in PSA testing are not directly related to guidance provided in the management of lipid disorders. It is unclear why the rates of these tests increased over the period of this study.

- FBC testing was not recommended in any of the guidance documents.
- It is not possible to determine whether MBA testing is supported as it includes multiple components however it is possible that some components are supported in certain circumstances (e.g. EUC).
- PSA testing was not recommended in any of the guidance documents.

6.9 National implications

Quality of current pathology ordering

Based on the 2006–08 pathology ordering data for lipid disorder problems we estimate that 2.5 million tests were ordered for lipid disorder problems per year in Australia. Review of the guidelines/guidance suggests:

- 1.9 million (75.5%) tests were supported by the guidelines and guidance documents
- 250,000 (10.0%) may or may not be supported due to unclear guidance
- 220,000 (8.8%) were not supported by the guidelines/guidance documents.

The remaining 5.6% of tests ordered for lipid disorders each accounted for <1% of total pathology tests ordered for lipid disorders.

Future increases in pathology?

Future increase in management rate of lipid disorders

- It is likely that the management rate of lipid disorders at general practice encounters will increase:
  - due to the increasing prevalence of lipid disorders associated with Australia's ageing population and potentially dyslipidaemia associated with overweight and obesity
  - if lipid targets are reduced further and increased contacts are required to achieve target lipid levels.

- The 45–49 health check introduced in 2006 has the potential to increase detection rate, as lipid disorders are more prevalent as age increases. In addition there are current initiatives to reduce the prevalence of overweight and obesity among Australian adults. If these coincidently increase management rates of overweight and obesity the detection rate and management of lipid disorders is likely to increase concomitantly.
- If the management rate of lipid disorders increases there will be a corresponding increase in pathology tests ordered based on the current pattern of pathology test ordering.

Future increase in pathology ordering

The pathology ordering rate for lipid disorders increased significantly between 2000–02 and 2006–08. In particular the number of tests ordered once the decision to order had been made increased. The increase in the pathology ordering by GPs is likely to continue in the future.

Extrapolated example of increase

The extrapolations made in this section are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of general practice encounters will occur in Australia in the future—an increase or decrease would affect the extrapolated estimates.

Increase in future management rate of lipid disorders

There was a 20% increase in the management rate of lipid disorders over the duration of this study, from 2000–02 to 2006–08. In this example this proportion of change has been applied as a future increase.

If there was another 20% increase in the management rate of lipid disorders in the future (over the next 8 years), with no change in the pathology ordering behaviour of GPs:

- there would be 3.0 million tests ordered per year by GPs for the management of lipid disorder problems.

If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.3 million tests ordered per year by GPs (75.5% of the 3.0 million tests)

If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 2.6 million tests ordered per year by GPs (85.6% of the 30 million tests)

Of the 3.0 million tests, 8.8% would not be supported by the guidelines/guidance documents and the remaining 5.6% of tests ordered were not evaluated (each accounting for <1% of total pathology tests ordered for lipid disorders).

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7 Weakness / tiredness

Summary: Weakness/tiredness

Background

Tiredness is a common presentation in general practice. It is a symptom of a large variety of diseases including psychological disorders, sleep problems, chronic disorders and other serious disease (e.g. cancer).

In BEACH data patients present with weakness/tiredness as a reason for encounter approximately twice as often as it is managed (as a separate clinical problem). In 2006–08 it was given as a reason for encounter at a rate of 1.4 per 100 encounters and managed at a rate of 0.7 per 100 encounters.

GP management of weakness/tiredness (BEACH data) April 2000 to March 2008

Weakness/tiredness was managed at a rate of 0.7 per 100 GP encounters, equating to about 710,000 encounters nationally per year where weakness/tiredness was managed.

Over the period of this study there was no change in the management rate of weakness/tiredness, being 0.8 per 100 encounters in 2000–02 and 0.7 per 100 in 2006–08.

Pathology ordering (BEACH data)

Pathology ordered for weakness/tiredness problems accounted for 3.7% of all pathology tests recorded in 2000–08.

Pathology was ordered at a rate of 205.4 tests/batteries per 100 weakness/tiredness contacts in 2000–08. More than half of contacts (56.6%) resulted in at least one pathology order, and on average 3.63 pathology tests/batteries were ordered per tested contact.

Almost 60% of the pathology tests (59.6%) were ordered in the management of 'new' cases of weakness/tiredness. New cases accounted for 43.7% of weakness/tiredness problems. 'New' weakness/tiredness problems have a higher test rate than contacts for ongoing management.

The rate of pathology ordering increased significantly from 177.9 tests/batteries of tests ordered per 100 weakness/tiredness contacts (in 2000–02) to 233.0 per 100 (in 2006–08). This was due to a significant increase (24% increase)in the likelihood of pathology being ordered in the management of weakness/tiredness.

Of the total national increase in pathology test orders between 2000–02 and 2006–08, 4.4% was attributable to pathology ordering in the management of weakness/tiredness.

Evaluation of current GP pathology ordering (2006–08) against guidelines

Based on the 2006–08 pathology ordering data for weakness/tiredness problems we estimate that 1.8 million tests were ordered for weakness/tiredness per year in Australia in 2006–08. Review of the guidelines/guidance suggests:

- 1.3 million (71.7%) tests were supported by the guidelines and guidance documents
- 230,000 (12.9%) may or may not be supported due to unclear guidance
- 160,000 (8.7%) were not supported by the guidelines/guidance documents.

The remaining 6.8% of tests ordered for weakness/tiredness each accounted for <1% of total pathology tests ordered for weakness/tiredness, and were not checked against guidelines/guidance.

Comments on guidelines/guidance documents

There is very little evidence and guidance available for the investigation and management of weakness/tiredness. The guidance reviewed was primarily consensus-based rather than evidence-based.

In BEACH, the majority of tests ordered for the investigation of weakness/tiredness were ordered at the first GP contact for this problem. GPs were more likely to order at least one pathology test in 2006–08 than in 2000–02. Studies suggest that only 4-9% of GP patients presenting with tiredness had an underlying disease detected using pathology testing. Published studies on fatigue reported the morbidities identified after investigation. These diseases provide some detail on the pretest probability of disease and inform which tests should be ordered as part of the initial investigation. Results of these studies also demonstrate high rates of false positive results due to the volume of pathology tests ordered and low pretest probability of disease.

Future growth in pathology ordering?

If the management rate of weakness/tiredness increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering. However, an increase in the management rate is unlikely. This is because the number of encounters with patients aged 15–44 years (those most likely to have weakness/tiredness managed) is unlikely to increase based on the age distribution of the Australian population. Assuming there is no external contribution to an increase in the prevalence of weakness/tiredness it can be anticipated that the management rate will not change significantly in general practice in the near future.

The likelihood of pathology tests being ordered for weakness/tiredness problems increased significantly during this study between 2000–02 and 2006–08.

Extrapolated example of the effect of a future increase in the likelihood of pathology tests being ordered

The extrapolations made in this section are based on the current BEACH management rate of weakness/tiredness (2006–08) and the same number of tests being ordered per tested contact. Extrapolations are made on the assumption that the same number of GP encounters occur in Australia in the future. Increases or decreases in total attendance rates, and/or in the number of tests/batteries ordered by GPs would affect the estimates in this example.

Example: If there was a further 24% increase in the likelihood of pathology test orders for weakness/tiredness

Scenario 1: No change in the current (2006–08) pathology ordering behaviour of GPs:

- there would be 2.2 million tests ordered per year by GPs for the management of weakness/tiredness problems.

Scenario 2: If GPs ordered only the tests strongly supported in the guidelines:

- there would be 1.6 million tests ordered per year by GPs (71.7% of the 2.2 million tests)

Scenario 3: If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 1.9 million tests ordered per year by GPs (84.6% of the 2.2 million tests)

Of the 2.2 million tests, 8.7% would not be supported and the remaining 7% of tests ordered were not evaluated (each <1% of total pathology tests ordered for weakness/tiredness).

7.1 Definition

The analysis of weakness/tiredness includes all problems recorded by GPs that were classified as 'weakness/tiredness' in the International Classification of Primary Care (Version 2), ICPC-2 code A04.

Note this study refers to the management of problems labelled as weakness/tiredness by the GP. It does not include all patient presentations of weakness/tiredness.

7.2 Background

Tiredness is a common presentation in general practice. It is a symptom of a large variety of diseases including psychological disorders, sleep problems, chronic disorders and serious disease.

In BEACH data patients present with weakness/tiredness as a reason for encounter approximately twice as often as it is managed (as a separate clinical problem). In 2006–08 it was given as a reason for encounter at a rate of 1.4 per 100 encounters[1] and managed at a rate of 0.7 per 100 encounters (Table 7.1). The difference in presentation and management rate indicates that GPs were able to apply a more specific diagnostic label to approximately half of the weakness/tiredness presentations at the encounter.

BEACH data do not provide a measure of prevalence of weakness/tiredness, rather they reflect the presentation rate and subsequent management rate of weakness/tiredness at Australian general practice encounters. Specifically this chapter investigates only the pathology orders provided in the management of problems that are labelled as weakness/tiredness by the GP. This does not include all patient presentations of weakness/tiredness.

7.3 Management rate in Australian general practice

Weakness/tiredness problems were managed at 5,624 patient encounters with 3,279 GPs between April 2000 and March 2008 (Table 7.1). That is equivalent to one weakness/tiredness problem per 143 encounters with patients in 2000–08.

Weakness/tiredness was managed at a rate of 0.7 per 100 general practice encounters (Table 7.1). This equates to approximately 710,000 encounters nationally per year where weakness/tiredness problems are managed by GPs.

New cases accounted for 43.7% of weakness/tiredness problems (Table 7.3). The problem is considered new if, it is a new problem to the patient or a new episode of a recurrent problem, and the patient has not been treated for that problem by any medical practitioner before.

Table 7.1: Summary of weakness/tiredness data set, 2000–08

Variable	Number	Rate per 100 total encs (*n*=784,300)	95% LCL	95% UCL	Per cent of total problems (*n*=1,174,893)	Management: encounter ratio
General practitioners	3,279	—	—	—	—	—
Weakness/tiredness encounters	5,624	—	—	—	—	—
Weakness/tiredness problems managed	5,627	0.7	0.7	0.8	0.5	1:143
New weakness/tiredness problems	2,456	0.31	0.30	0.33	—	—

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Change in management over time

Over the period of this study there was no change in the management rate of weakness/tiredness, being 0.8 per 100 encounters in 2000–02 and 0.7 per 100 in 2006–08 (Table 7.4). There was also no significant change in the rate of new cases per 100 encounters. However, there was a significant increase in the proportion of weakness/tiredness contacts that were new to the patient. This indicates that there were more new contacts and concomitantly fewer follow-up contacts for weakness/tiredness over the study period (Table 7.4).

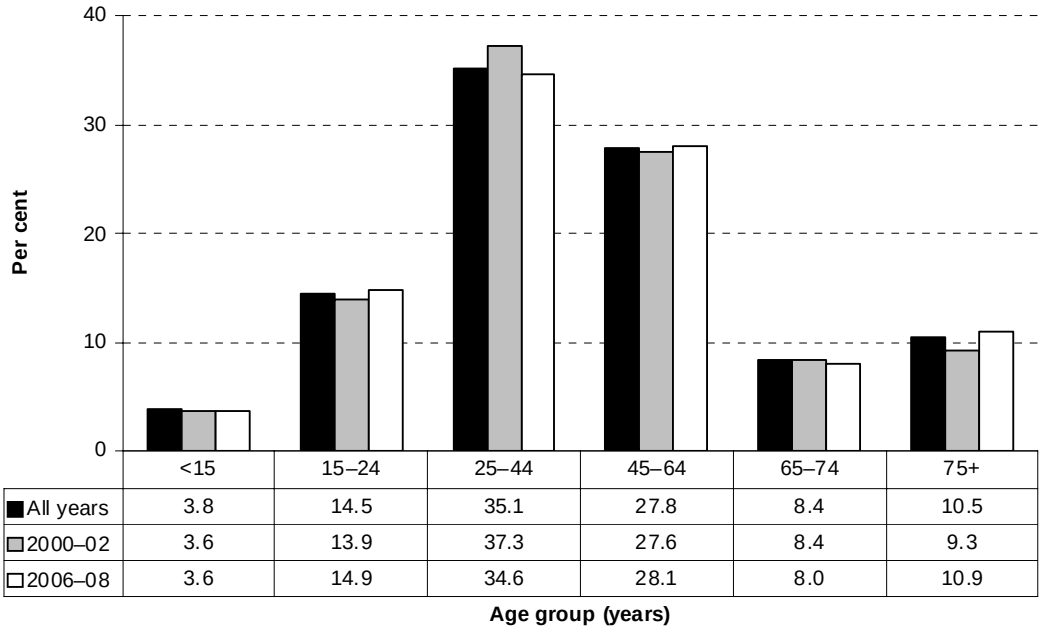
Age distribution

The age distribution of patients with weakness/tiredness managed at general practice encounters in 2000–08 is presented in Figure 7.1.

Patients at weakness/tiredness encounters were most often aged 25–44 years (35.1%), followed by patients aged 45–64 years (27.8%), 15–24 years (14.5%), 75+ years (10.5%), 65–74 years (8.4%), and <15 years (3.8%).

The age distribution of patients at weakness/tiredness encounters did not change significantly over the period of this study (2000–02 compared with 2006–08) (Figure 7.1).

Figure 7.2 presents the age-specific management rate of weakness/tiredness among patients attending general practice. The management rate was highest among patients aged 15–24 (1.1% of encounters with patients in this age group) and those aged 25–44 years (1.0%).

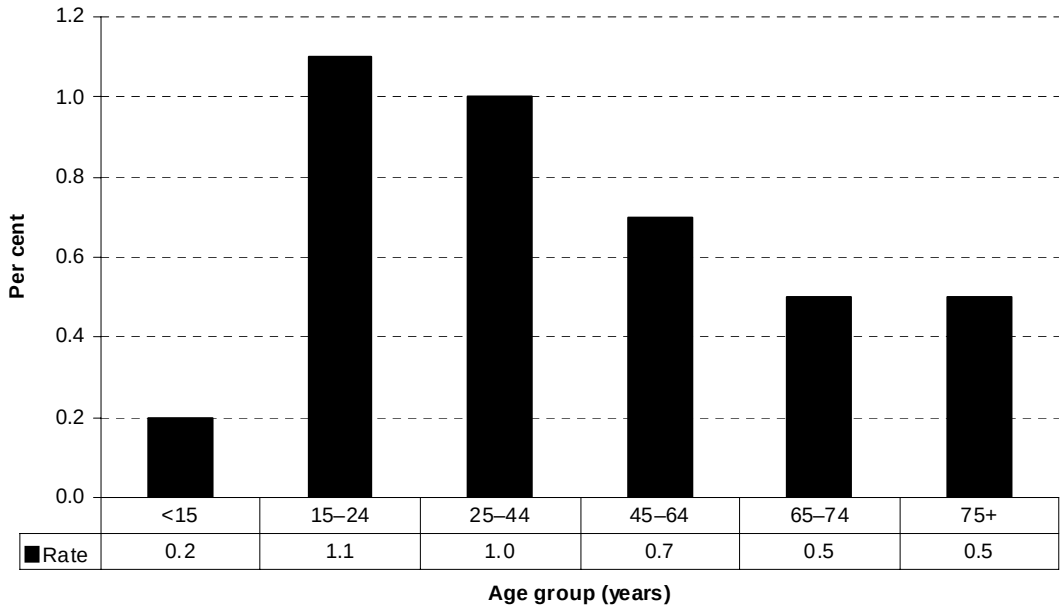


	<15	15–24	25–44	45–64	65–74	75+
All years	3.8	14.5	35.1	27.8	8.4	10.5
2000–02	3.6	13.9	37.3	27.6	8.4	9.3
2006–08	3.6	14.9	34.6	28.1	8.0	10.9

Age group (years)

Note: Patient age was missing for 42 patients in 2000–08, 15 in 2000–02 and 10 in 2006–08

Figure 7.1: Age distribution of patients with weakness/tiredness managed at general practice encounters, 2000–08 (all years), 2000–02, and 2006–08



	<15	15–24	25–44	45–64	65–74	75+
Rate	0.2	1.1	1.0	0.7	0.5	0.5

Age group (years)

Note: Patient age was missing for 42 patients in 2000–08, 15 in 2000–02 and 10 in 2006–08

Figure 7.2: Age-specific rate of management of weakness/tiredness, 2000–08

Table 7.2 shows the number of problems managed per encounter where weakness/tiredness was managed and the number managed at all BEACH encounters in 2000–08. A maximum of 4 problems can be recorded per encounter in BEACH.

Encounters involving weakness/tiredness were more complex, being more likely to have multiple problems (2, 3 or 4 problems managed) per encounter than average general practice encounters.

Table 7.2: Number of problems managed at weakness/tiredness encounters and total encounters

	Weakness/tiredness encs (2000–08)				All BEACH encs (2000–08)			
Number of problems managed	Number	Per cent of problems	95% LCL	95% UCL	Number	Per cent of problems	95% LCL	95% UCL
One problem	2,098	37.3	35.3	39.3	502,522	64.1	63.7	64.4
Two problems	2,035	36.2	34.8	37.6	193,452	24.7	25.5	24.9
Three problems	1,130	20.1	18.8	21.4	67,837	8.7	8.5	8.8
Four problems	361	6.4	5.6	7.2	20,489	2.6	2.5	2.7

Note: LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08.

7.4 Pathology ordering behaviour

Pathology was ordered at a rate of 205.4 tests/batteries per 100 weakness/tiredness contacts in 2000–08, and more than half of contacts (56.6%) resulted in at least one pathology order (Table 7.3).

Once the decision to order a pathology test/battery of tests was made the GP ordered on average 3.63 pathology tests/batteries per tested weakness/tiredness contact (Table 7.3). Pathology ordered for weakness/tiredness problems accounted for 3.7% of all pathology tests recorded from April 2000 to March 2008.

Table 7.3: Summary of pathology ordering for weakness/tiredness, 2000–08

Variable	Number	Per cent / Rate of weakness/tiredness problems (*n*=5,627)	95% LCL	95% UCL
Weakness/tiredness problems managed	5,627	100.0	—	—
New problems (% weakness/tiredness problems)	2,456	43.7	41.8	45.5
Pathology (Rate per 100 weakness/tiredness problems)	11,559	205.4	197.2	213.6
At least one pathology order (% weakness/tiredness problems)	3,187	56.6	54.7	58.6
Number of tests/batteries per 100 tested weakness/tiredness problems	—	362.7	357.0	368.3

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Changes over time, 2000–02 to 2006–08

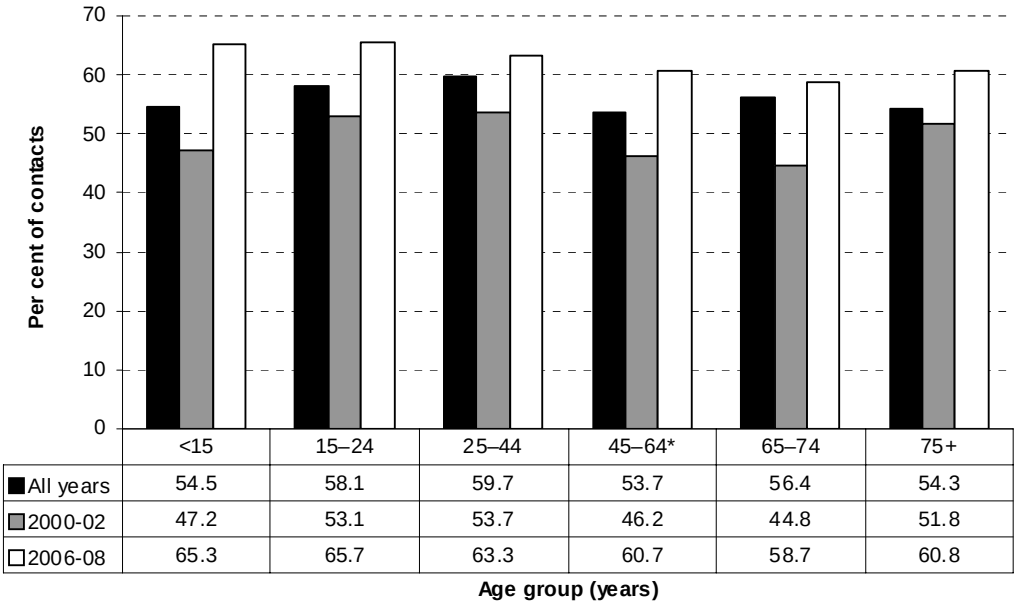
Pathology ordering for weakness/tiredness problems accounted for 4.0% of tests/batteries in 2000–02 and 3.5% in 2006–08.

The rate of pathology ordering increased significantly from 177.9 tests/batteries of tests ordered per 100 weakness/tiredness contacts (in 2000–02) to 233.0 per 100 (in 2006–08). This was due to a significant increase in:

- the likelihood of pathology testing being ordered in the management of weakness/tiredness problems, from 50.3% of contacts in 2000–02 to 62.2% in 2006–08.

There was no statistically significant change in the number of tests ordered once the decision to order tests was made, 353.6 per 100 tested weakness/tiredness contacts in 2000–02 and 374.6 in 2006–08 (Table 7.4).

Figure 7.3 shows the change in likelihood of pathology testing at weakness/tiredness contacts by patient age group. Between 2000–02 and 2006–08 there was a significant increase in the likelihood of testing in patients aged 45–64 years.



	<15	15–24	25–44	45–64*	65–74	75+
All years	54.5	58.1	59.7	53.7	56.4	54.3
2000-02	47.2	53.1	53.7	46.2	44.8	51.8
2006-08	65.3	65.7	63.3	60.7	58.7	60.8

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 7.3: Age-specific likelihood of at least one pathology test being ordered for weakness/tiredness, 2000–08 (all years), 2000–02, and 2006–08

Extrapolation of pathology ordering behaviour

When these data were extrapolated to the number of GP encounters claimed through Medicare nationally the results suggest there were approximately:

- 15,000 more encounters involving the management of weakness/tiredness in 2006–08 (775,000 per annum) than in 2000–02 (760,000 per annum).
- 100,000 additional weakness/tiredness contacts that involved the ordering of at least one pathology test/battery of tests (tested contacts) in 2006–08 (480,000 per annum) than in 2000–02 (380,000 per annum).

- 450,000 additional pathology tests/batteries ordered for weakness/tiredness in 2006–08 (1.8 million per annum) than in 2000–02 (1.4 million per annum) (results not shown).

Of the estimated 17.7 million additional tests/batteries ordered (for all problems) by GPs in 2006–08 (51.3 million tests/batteries ordered by GPs per annum), compared with 2000–02 (33.6 million per annum), 4.4% was attributable to pathology ordering in the management of weakness/tiredness. There was a 33% increase in the volume of GP requests for pathology tests/batteries attributable to weakness/tiredness, due to a combination of factors:

- the increase in the total number of GP encounters in Australia
- to a change in GP pathology ordering behaviour for weakness/tiredness, that is:
  - increased likelihood of pathology being ordered.

Table 7.4: Changes in the management of weakness/tiredness over time, 2000–02 to 2006–08

	2000–02							2006–08							
Variable	**Number**	**Rate per 100 total encs (*n*=198,200)**	**95% LCL**	**95% UCL**	**Per cent / Rate of probs (*n*=1,509)**	**95% LCL**	**95% UCL**	**Number**	**Rate per 100 total encs (*n*=188,300)**	**95% LCL**	**95% UCL**	**Per cent / Rate of probs (*n*=1,373)**	**95% LCL**	**95% UCL**	**Change[(a)]**
General practitioners	853	—	—	—	—	—	—	788	—	—	—	—	—	—	—
Weakness/tiredness encounters	1,507	—	—	—	—	—	—	1,372	—	—	—	—	—	—	—
Weakness/tiredness problems managed	1,509	0.8	0.7	0.8	—	—	—	1,373	0.7	0.7	0.8	—	—	—	—
New problems	597	0.30	0.27	0.33	39.6	36.3	42.8	657	0.35	0.32	0.38	47.9	44.4	51.3	—/↑
Pathology (Rate per 100 weakness/ tiredness problems)	2,684	—	—	—	177.9	164.0	191.8	3,199	—	—	—	233.0	217.3	248.7	↑
At least one pathology order (% or weakness/tiredness problems)	759	—	—	—	50.3	46.7	53.9	854	—	—	—	62.2	58.5	65.9	↑
Number of tests/batteries per 100 tested weakness/ tiredness problems	—	—	—	—	353.6	343.2	364.0	—	—	—	—	374.6	363.5	385.7	—

(a) Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

Note: Encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit; probs—problems.

7.5 Types of pathology tests ordered

Table 7.5 shows the distribution of pathology tests/batteries ordered for weakness/tiredness in 2000–08 by MBS groups and the most common individual types of pathology tests ordered.

- Chemistry tests were the group of tests most often ordered, at a rate of 135.7 per 100 weakness/tiredness contacts. The most common chemistry tests ordered were:
  - thyroid function tests (32.3 per 100 weakness/tiredness contacts)
  - ferritin (21.0 per 100 contacts)
  - liver function tests (17.4 per 100 contacts)
  - electrolyte, urea and creatinine tests (15.5)
  - multibiochemical analysis (11.6)
  - glucose/glucose tolerance tests (11.5) (Table 7.5).
- Haematology tests (53.9 per 100 contacts), in particular full blood counts (45.7 per 100), were commonly ordered in the management of weakness/tiredness.
- Microbiology tests (9.7 per 100 contacts) were also commonly ordered (Table 7.5).

Almost 60% of the pathology tests (59.6%) were ordered in the management of 'new' cases of weakness/tiredness (Table 7.5). New cases accounted for 43.7% of weakness/tiredness problems. 'New' weakness/tiredness problems have a higher test rate than contacts for ongoing management.

Changes in types of pathology tests ordered 2000–02 to 2006–08

Table 7.6 compares the pathology ordering for weakness/tiredness problems in 2000–02 with 2006–08, shaded results highlight significant differences. There was a significant increase in the rate of pathology from 177.9 tests/batteries per 100 weakness/tiredness contacts in 2000–02 to 233.0 per 100 in 2006–08—an increase of 31%.

There were significant increases in the order rate of:

- full blood counts—20.4% increase
- thyroid function tests—35% increase
- ferritin—64% increase
- liver function tests—33% increase
- vitamin B12—105% increase
- C reactive protein—281% increase (there was trend for a corresponding decrease in the order rate of ESR tests but this trend did not reach statistical significance)
- 'other' immunology tests—600% increase, due to an increased number of immunoglobulin and anti-endomysial antibody tests (Table 7.6).

Table 7.5: Distribution of pathology orders across MBS groups and most frequent individual tests within each group for weakness/ tiredness, 2000–08

	Pathology for all weakness/tiredness problems						Pathology for new weakness/tiredness problems				
Pathology test ordered	**Number**	**% pathology**	**Per cent of group**	**Rate per 100 probs (*n*=5,624)**	**95% LCL**	**95% UCL**	**Number**	**% path for new cases**	**Rate per 100 new probs (*n*=2,456)**	**95% LCL**	**95% UCL**
Chemistry	**7,636**	**66.1**	**100.0**	**135.7**	**130.0**	**141.5**	**4,558**	59.7	**185.6**	**178.9**	**192.3**
Thyroid function*	1,819	15.7	23.8	32.3	30.5	34.1	1,113	61.2	45.3	43.1	47.5
Ferritin*	1,183	10.2	15.5	21.0	19.6	22.5	727	61.5	29.6	27.6	31.6
Liver function*	979	8.5	12.8	17.4	16.1	18.7	589	60.2	24.0	22.1	25.8
EUC*	872	7.5	11.4	15.5	14.3	16.7	510	58.5	20.8	18.9	22.6
Multibiochemical analysis*	650	5.6	8.5	11.6	10.5	12.6	405	62.3	16.5	14.8	18.2
Glucose/glucose tolerance*	647	5.6	8.5	11.5	10.5	12.5	391	60.4	15.9	14.3	17.6
Lipids*	329	2.9	4.3	5.9	5.1	6.6	184	55.9	7.5	6.4	8.6
Vitamin B12*	311	2.7	4.1	5.5	4.8	6.2	171	55.0	7.0	5.9	8.1
Chemistry; other*	213	1.8	2.8	3.8	3.0	4.6	99	46.5	4.0	3.0	5.0
Hormone assay*	197	1.7	2.6	3.5	2.7	4.3	117	59.4	4.8	3.4	6.1
C reactive protein	147	1.3	1.9	2.6	2.1	3.1	91	61.9	3.7	2.9	4.5
Haematology	**3,034**	**26.3**	**100.0**	**53.9**	**51.5**	**56.3**	**1,832**	**60.4**	**74.6**	**71.9**	**77.3**
Full blood count	2,572	22.3	84.8	45.7	43.7	47.7	1,561	60.7	63.6	61.5	65.7
ESR	430	3.7	14.2	7.6	6.9	8.4	250	58.1	10.2	8.9	11.4
Microbiology	**543**	**4.7**	**100.0**	**9.7**	**8.6**	**10.7**	**311**	**57.3**	**12.7**	**11.0**	**14.3**
Monospot*	153	1.3	28.2	2.7	2.2	3.2	95	62.1	3.9	3.1	4.7
Urine M,C&S*	127	1.1	23.4	2.3	1.8	2.7	79	62.2	3.2	2.5	3.9
Other NEC	**181**	**1.6**	**100.0**	**3.2**	**2.6**	**3.8**	**100**	**55.2**	**4.1**	**3.1**	**5.1**
Immunology	**147**	**1.3**	**100.0**	**2.6**	**2.1**	**3.1**	**74**	**50.3**	**3.0**	**2.2**	**3.8**
Other pathology groups	**18**	**0.2**	**100.0**	**—**	**—**	**—**	**10**	**55.6**	**—**	**—**	**—**
Total pathology tests	**11,559**	**100.0**	**—**	**205.42**	**197.2**	**213.6**	**6,885**	**59.6**	**280.3**	**271.6**	**289.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations.

Table 7.6: Distribution of pathology orders across MBS groups and most frequent tests within each group for weakness/tiredness, 2000–02 and 2006–08

	2000–02						2006–08						
Pathology test ordered	Number	% path for weak/tired	Per cent of group	Rate per 100 weak/tired probs[(a)]	95% LCL	95% UCL	Number	% path for weak/tired	Per cent of group	Rate per 100 weak/tired probs[(a)]	95% LCL	95% UCL	Change
Chemistry	**1,696**	**63.2**	**100.0**	**112.4**	**102.9**	**121.9**	**2,163**	**67.6**	**100.0**	**157.5**	**146.1**	**168.9**	↑
Thyroid function*	406	15.1	23.9	26.9	24.1	29.7	498	15.6	23.0	36.3	32.9	39.7	↑
Ferritin*	245	9.1	14.4	16.2	13.9	18.5	365	11.4	16.9	26.6	23.6	29.5	↑
Liver function*	232	8.6	13.7	15.4	13.2	17.6	282	8.8	13.0	20.5	17.9	23.2	↑
EUC*	199	7.4	11.7	13.2	10.9	15.5	221	6.9	10.2	16.1	13.8	18.4	—
Multibiochemical analysis*	154	5.7	9.1	10.2	8.3	12.1	167	5.2	7.7	12.2	10.0	14.3	—
Glucose/glucose tolerance*	174	6.5	10.3	11.5	9.6	13.4	154	4.8	7.1	11.2	9.1	13.3	—
Vitamin B12*	59	2.2	3.5	3.9	2.8	5.0	110	3.4	5.1	8.0	6.3	9.7	↑
Lipids*	65	2.4	3.8	4.3	3.2	5.4	91	2.8	4.2	6.6	5.1	8.2	—
Chemistry; other*	47	1.8	2.8	3.1	2.0	4.2	76	2.4	3.5	5.5	3.7	7.4	—
C reactive protein	17	0.6	1.0	1.1	0.6	1.7	58	1.8	2.7	4.2	2.9	5.5	↑
Hormone assay*	45	1.7	2.7	3.0	1.8	4.2	46	1.4	2.1	3.4	2.0	4.7	—
Haematology	**778**	**29.0**	**100.0**	**51.6**	**47.3**	**55.9**	**782**	**24.5**	**100.0**	**57.0**	**52.5**	**61.4**	**—**
Full blood count	629	23.4	80.8	41.7	38.3	45.1	689	21.5	88.1	50.2	46.4	53.9	↑
ESR	138	5.1	17.7	9.2	7.5	10.8	85	2.7	10.9	6.2	4.8	7.6	—
Microbiology	**135**	**5.0**	**100.0**	**9.0**	**6.9**	**11.0**	**131**	**4.1**	**100.0**	**9.5**	**7.5**	**11.6**	**—**
Monospot*	37	1.4	27.4	2.5	1.6	3.4	44	1.4	33.6	3.2	2.2	4.2	—
Urine M,C&S*	33	1.2	24.4	2.2	1.4	3.0	30	0.9	22.9	2.2	1.4	3.0	—
Immunology	**18**	**0.7**	**100.0**	**1.2**	**0.6**	**1.8**	**69**	**2.2**	**100.0**	**5.0**	**3.5**	**6.6**	↑
Immunology, other*	6	0.2	33.3	0.4	0.1	0.7	38	1.2	55.1	2.8	1.6	3.9	↑

(continued)

Table 7.6 (continued): Distribution of pathology orders across MBS groups and most frequent tests within each group for weakness/tiredness, 2000–02 and 2006–08

	2000–02						2006–08						
Pathology test ordered	Number	% path for weak/tired	Per cent of group	Rate per 100 weak/tired probs[(a)]	95% LCL	95% UCL	Number	% path for weak/tired	Per cent of group	Rate per 100 weak/tired probs[(a)]	95% LCL	95% UCL	Change
Other NEC	**56**	**2.1**	**100.0**	**3.7**	**2.4**	**5.0**	**47**	**1.5**	**100.0**	**3.4**	**2.1**	**4.7**	**—**
Blood test	29	1.1	51.8	1.9	1.0	2.8	29	0.9	61.7	2.1	1.1	3.2	—
Other pathology groups	**1**	**0.04**	**100.0**	**—**	**—**	**—**	**7**	**0.2**	**100.0**	**—**	**—**	**—**	
Total pathology tests	**2,684**	**100.0**	**—**	**177.9**	**164.0**	**191.8**	**3,199**	**100.0**	**—**	**233.0**	**217.3**	**248.7**	**↑**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) The total number of weakness/tiredness in 2000–02 was 1,509 and in 2006–08 was 1,373.

Note: LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations. Shading indicates a statistically significant change—the direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change and — indicates no change.

7.7 Guidance for the management of weakness/ tiredness

Guidance documents for the management of tiredness and fatigue were considered in this study. Guidance on acute and chronic fatigue was considered however guidance specifically for chronic fatigue syndrome has not been included in this report.

There were two guidelines reviewed:

- Investigating fatigue of less than 6 months' duration: Guidelines for family physicians [Canada, 1999].[2]
- Dutch College of General Practitioners (DCGP) guideline for blood testing in medically unexplained complaints [The Netherlands, 1994, cited in Koch et al. 2009].[3] Unexplained complaints are defined as 'those complaints for which a GP, after clarifying the reason for the encounter, taking the patient's history, and performing a physical examination, is unable to establish a diagnosis.'

Other sources of guidance reviewed were:

- Fatigue – a general diagnostic approach [Murtagh, 2003, AFP][4]
- Murtagh's general practice, tiredness section [Murtagh 2007][5]
- 'RCPA manual', chronic fatigue section—Manual of use and interpretation of pathology tests [The Royal College of Pathologists of Australasia (RCPA), 2004][6]
- RCPA case scenario, 'There must be something wrong'—primary presentation in the scenario is fatigue of a chronic duration >6 months [RCPA & University of Sydney Department of Medical Education, 2003][7]
- Laboratory investigation of tiredness [New Zealand, bpac, 2006][8]
- ABC of psychological medicine: Fatigue [Sharpe, Wilks, BMJ, 2002][9]

In total eight guidance documents were reviewed however there was some duplication as two were authored by Murtagh and another two by the RCPA.

Other journal articles/reports that were reviewed but not included in tables 7.7 and 7.8 were:

- Investigating tiredness in Australian general practice: Do pathology tests help in diagnosis? (Based on findings from a QUPP-funded study) [Gialamas et al. AFP, 2003][10]
- Pathology testing in the tired patient: A rational approach [Harrison, 2008, AFP][11]
- Ordering blood tests for patients with unexplained fatigue in general practice: what does it yield? Results of the VAMPIRE trial [Koch et al, 2009, British Journal of General Practice][3]
- Patients with fatigue in general practice: a prospective study [Ridsdale et al, Britain, 1993][12]
- Influence of Watchful Waiting on Satisfaction and Anxiety Among Patients Seeking Care for Unexplained Complaints [van Bokhoven et al, 2009, The Netherlands, Annals of Family Medicine][13]

7.8 Application of the guidance

Evaluation of GP pathology ordering against guidelines/guidance

Table 7.7 provides a summary of the individual tests and the level of support provided in the guidelines/guidance for each: yes—supported; unclear guidance or conditional support; no—not supported:

- 73.6% of tests ordered for management of weakness/tiredness were supported by the guidelines and guidance documents
- for 10.1% of tests ordered guidance was conditional or unable to be determined
- 8.3% of tests ordered were not supported by the guidelines/guidance documents.

The individual tests/batteries listed in Table 7.7 account for 92.0% of pathology tests/batteries ordered for weakness/tiredness because only the most common individual pathology tests ordered are included (each accounted for >1% of tests for weakness/tiredness).

Table 7.7: Summary of support for GP pathology ordering for the most frequent individual test orders for weakness/tiredness, 2000–08

Pathology test ordered	Number	Per cent of all pathology for weakness/tiredness
YES	**8,502**	**73.6**
Full blood count	2,572	22.3
Thyroid function*	1,819	15.7
Ferritin*	1,183	10.2
Liver function*	979	8.5
EUC*	872	7.5
Glucose/glucose tolerance*	647	5.6
ESR	430	3.7
UNCLEAR/CONDITIONAL SUPPORT	**1,163**	**10.1**
Multibiochemical analysis*	650	5.6
Chemistry; other*	213	1.8
Monospot*	153	1.3
C reactive protein	147	1.3
NO	**964**	**8.3**
Lipids*	329	2.9
Vitamin B12*	311	2.7
Hormone assay*	197	1.7
Urine M,C&S*	127	1.1
Subtotal (n, % of total tests included in the table)	*10,629*	*92.0*
Total pathology tests	**11,559**	**100.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 7.8 compares the commonly ordered pathology tests/batteries for weakness/tiredness with the tests recommended by guidelines and guidance documents for weakness/tiredness. The key explaining the colours used in the table is before Table 7.8. Briefly, dark green tests are specifically supported, light green have partial support, red tests are advised against, orange tests are those for which support cannot be determined, and pink tests were not mentioned in the guideline/guidance.

Full blood count

Full blood counts were supported (full or conditional support) in all guidance documents. The Canadian and Dutch guidelines only provided conditional support for the use of any pathology tests in the management/investigation of tiredness. The Canadian guideline recommended the FBC test if indicated by the physical examination. The Dutch guideline recommended that in unexplained fatigue FBC testing should be delayed for 4 weeks.

In BEACH, during this study (2000–02 to 2006–08), the rate of FBC tests ordered in the management of weakness/tiredness increased significantly, from 41.7 per 100 contacts in 2000–02 to 50.2 per 100 in 2006–08.

Thyroid function

Thyroid function tests (TFTs) were supported (full or conditional support) in all guidance documents.

The Canadian and Dutch guidelines and the New Zealand 'bpac' guidance provided only conditional support for TFT testing:

- the Canadian guideline recommended TFT if indicated by the physical examination.
- the Dutch guideline recommended that in unexplained fatigue TFT should be delayed for 4 weeks.
- the bpac guidance recommended TFT if the patient had tiredness for longer than 1 month, was aged 50 years and over or if aged <50 years was at increased risk of thyroid problems.

In BEACH, during this study (2000–02 to 2006–08), the rate of TFT ordered in the management of weakness/tiredness increased significantly, from 26.9 per 100 contacts in 2000–02 to 36.3 per 100 in 2006–08.

Ferritin

Ferritin testing was supported by four of the guidance documents and not mentioned in the other four documents. Of the four guidance documents that do not mention ferritin, two discuss anaemia as a common cause of tiredness/fatigue of which iron-deficiency is a common cause.

In BEACH, during this study (2000–02 to 2006–08), the rate of ferritin tests ordered in the management of weakness/tiredness increased significantly, from 16.2 per 100 contacts in 2000–02 to 26.6 per 100 in 2006–08.

Liver function

Liver function tests (LFTs) were supported (full or conditional support) in the majority of guidance documents. Two documents did not discuss LFTs and the bpac guidance provided support for TFT testing if the patient had tiredness for longer than 1 month, was aged 50 years and over or if aged <50 years and at increased risk of liver dysfunction.

In BEACH, during this study (2000–02 to 2006–08), the rate of LFTs ordered in the management of weakness/tiredness increased significantly, from 15.4 per 100 contacts in 2000–02 to 20.5 per 100 in 2006–08.

Electrolytes, urea and creatinine

Electrolytes, urea and creatinine (EUC) tests were supported (full or conditional support) in the majority of guidance documents. Two documents did not discuss EUCs or renal function and two (Canadian and bpac) provided conditional support. The Canadian guideline recommended EUC if indicated by the physical examination and the bpac guidance provided support for TFT testing if the patient had tiredness for longer than 1 month, was aged 50 years and over or if aged <50 years and at increased risk of renal problems.

In BEACH, during this study (2000–02 to 2006–08), the rate of EUC tests ordered in the management of weakness/tiredness did not change significantly.

Multibiochemical analysis

The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported by the guidance. Indiscriminate testing does not meet evidence-based principles.

However, the LFT and EUC components of the MBA would have support in certain circumstances as discussed above.

In BEACH, during this study (2000–02 to 2006–08), the rate of MBA tests ordered in the management of weakness/tiredness did not change significantly.

Glucose/glucose tolerance

Glucose tests were supported (full or conditional support) in most guidance documents.

The Canadian and Dutch guidelines and the bpac guidance provided only conditional support for glucose testing:

- the Canadian guideline recommended glucose testing if indicated by the physical examination.
- the Dutch guideline recommended that in unexplained fatigue glucose testing should be ordered after a delay of 4 weeks.
- the bpac guidance recommended glucose testing if the patient had tiredness for longer than 1 month, was aged 50 years and over or if aged <50 years and at increased risk of diabetes.

In BEACH, during this study (2000–02 to 2006–08), the rate of glucose tests ordered in the management of weakness/tiredness did not change significantly.

ESR

Erythrocyte sediment rate (ESR) testing was recommended in the majority of guidance documents. In two guidance documents ESR or C-reactive protein was recommended.

The Canadian and Dutch guidelines provided conditional support for the use of the test.

In BEACH, during this study (2000–02 to 2006–08), the rate of ESR tests ordered in the management of weakness/tiredness did not change significantly. However, there was a trend for decreased ESR order rate, which did not reach statistical significance. There was also a corresponding significant increase in the order rate of CRP tests.

Lipids

Lipid tests were not recommended by any of the guidance documents in the management of weakness/tiredness.

In BEACH, during this study (2000–02 to 2006–08), the rate of lipid tests ordered in the management of weakness/tiredness did not change significantly.

Vitamin B12

Vitamin B12 tests were not recommended by any of the guidance documents in the management of weakness/tiredness. However, anaemia was often mentioned as a common cause of tiredness/fatigue of which vitamin B12 deficiency one possible cause.

In BEACH, during this study (2000–02 to 2006–08), the rate of Vitamin B12 tests ordered in the management of weakness/tiredness more than doubled, from 3.9 per 100 contacts in 2000–02 to 8.0 per 100 in 2006–08.

Chemistry; other

'Other chemistry tests' refers to a group of tests. The tests included are listed in Appendix 3. The 213 tests ordered in this group represent a diverse range of individual tests therefore it is not possible to determine whether this group of tests were supported by the guidance.

In BEACH, during this study (2000–02 to 2006–08), the rate of 'other chemistry tests' ordered in the management of weakness/tiredness did not change significantly.

Hormone assay

Cushing's syndrome was mentioned as a potential cause of tiredness in a few guidance documents. Cortisol testing is indicated if Cushing's syndrome is suspected. However in this study the 'hormone assay' test order represents GP orders for sex hormones in >90% of cases—and this was not mentioned in any of the guidance documents.

In BEACH, during this study (2000–02 to 2006–08), the rate of hormone assays ordered in the management of weakness/tiredness did not change significantly.

Monospot

Epstein Barr Virus was mentioned in most guidelines as a possible cause of tiredness. The limitations of the test in diagnosing the condition were also commonly discussed and one guideline specifically recommended against testing as the result was positive in approximately 90% of the population.

In BEACH, during this study (2000–02 to 2006–08), the rate of monospot tests ordered in the management of weakness/tiredness did not change significantly.

C reactive protein

C reactive protein (CRP) was mentioned in four guidance documents. Two documents recommended use of CRP or ESR. The RCPA manual recommended use of the ESR test in chronic fatigue however the RCPA case scenario on chronic fatigue discussed use of the CRP test. The bpac guidance recommends CRP testing if the patient was aged >50 years or tiredness had lasted longer than a month.

In BEACH, during this study (2000–02 to 2006–08), the rate of CRP tests ordered in the management of weakness/tiredness increased significantly (an almost four-fold increase), from 1.1 per 100 contacts in 2000–02 to 4.2 per 100 in 2006–08.

Urine M,C&S

Urine microscopy, culture and sensitivity test was recommended by the two Murtagh references, however it was not mentioned in any of the other guidance documents.

In BEACH, during this study (2000–02 to 2006–08), the rate of urine M,C&S tests ordered in the management of weakness/tiredness did not change significantly.

Other tests

A wide variety of other conditions with associated diagnostic tests were mentioned in the guidance documents. The associated tests included urinalysis, calcium, magnesium, autoimmune tests (especially ANA), testing for chronic infections (e.g. HIV, hepatitis), muscle enzymes (e.g. creatine kinase) and cancer antigens.

Key to Table 7.8

Colour	Description
	The document specifically recommends this test. Any notes within the cell indicate further detail. For example, a specific disease to test for within subset of patients; mixed guidance within a guideline.
	The document states that this test should be considered. Any notes within the cell indicate further detail (e.g. a specific test to consider)
	Unable to determine guidance—MBA tests include mixed content for which it is not possible to determine guideline agreement (see footnote (a) above).
	Guideline specifically states not to do this test. Additional information is supplied if the guideline states not to do the test unless clinically indicated.
	Guideline does not mention this test

Table 7.8: Summary of guideline/guidance recommendations by most frequent individual test orders for weakness/ tiredness, 2000–08

	Fatigue/tiredness						Chronic fatigue (>6 mths)			
Pathology test ordered	**Murtagh AFP paper 2003**	**Murtagh 2007**	**Canada 1999**	**DCGP 1994**	**bpac 2006**	**Sharpe, Wilks BMJ paper 2002**	**RCPA manual 2004**	**RCPA fatigue case study 2003**	**Number (n =11,559)**	**% path**
Full blood count				Wait 4 wks Hb only					2,572	22.3
Thyroid function*				Wait 4 wks	risk/ >50 yrs/ 1+mth				1,819	15.7
Ferritin*									1,183	10.2
Liver function*					At risk/ >50 yrs / 1+mth				979	8.5
EUC*					At risk/ >50 yrs / 1+mth				872	7.5
Multibiochemical analysis*[(a)]									650	5.6
Glucose/glucose tolerance*				Wait 4 wks	At risk/ >50 yrs / 1+mth				647	5.6
ESR		or CRP		Wait 4 wks		or CRP			430	3.7
Lipids*									329	2.9
Vitamin B12*									311	2.7
Chemistry; other*[(b)]									213	1.8
Hormone assay*	Cortisol	Cortisol						Cortisol	197	1.7
Monospot*	Consider	Consider			Not useful in diagnosis			Recent infection	153	1.3
C reactive protein		or ESR			50+yrs/ 1+mth	or ESR			147	1.3
Urine M,C&S*									127	1.1
Other tests	Urinalysis	Calcium & magnesium	Urinalysis		Urinalysis, ANA, calcium & phosphate 50+yrs/ 1+mth	Urinalysis		Urinalysis, ANA		
	Calcium & magnesium	Autoimmune, chronic infections, muscle enzyme, cancer antigens			HIV & Hep B/C at risk	Creatine kinase		Creatine kinase		

* Includes multiple ICPC-2 PLUS terms (see Appendix 3)

(a) Multibiochemical analysis (MBA) potentially includes a combination of a broad group of tests. The MBS chemical analysis group includes a wide variety of biochemical tests (such as those in MBS item 66500).

(b) 'Chemistry; other' refers to a group of individual chemistry tests (see Appendix 3).

Note: Hb—haemoglobulin; >50 yrs—aged more than 50 years; 1+mth—duration of one month or more; Hep B/C—hepatitis B or C; also see Abbreviations. Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Evaluation of the guidelines and guidance documents

Consensus based guidance

The guidelines and guidance documents listed in Table 7.8 are primarily consensus-based rather than evidence-based. Recommendations are based on the likelihood of underlying morbidities and the conditions that commonly have fatigue/tiredness as a presenting symptom.

While eight guidance documents were reviewed these represented guidance from six sources due to duplication. Murtagh authored two documents and another two were authored by the RCPA. There was some inconsistency within guidance provided by the same author usually due to one document being more detailed than the other.

There are no Australian guidelines for the investigation and management of tiredness and recently calls for the development of evidence-based guidelines have been renewed.[11,14]

Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) testing

These two tests are both non-specific indicators for inflammation. All guidance documents referred to either the CRP or ESR test in their recommended tests. Two referred to the use of either one as preferred by the GP.

Over the duration of this study (2000–02 to 2006–08) the order rate of CRP increased significantly while the ESR rate did not change.

The CRP is a more sensitive early indicator of an acute phase response but is less sensitive than the ESR for some disorders eg, ulcerative colitis, SLE.[6]

Hansson et al concluded that in clinical situations with suspected inflammatory diseases, the CRP test often appears to yield more useful results than the ESR.[15] In contrast, Dinant et al. concluded that diagnostic value of CRP did not justify replacement of ESR.[16]

In the study by Koch et al. ESR testing was responsible for a significant number of false positive results.[3] The CRP test was not evaluated by Koch et al. and the tests responsible for high rates of false positives in the Australian and British studies were not reported. These results may inform which tests may be of limited use in the diagnosis of patients with weakness/tiredness.

Delaying pathology testing

The DCGP guideline for blood testing in medically unexplained symptoms recommends postponing testing for 4 weeks and limiting the number of tests needed to just four tests. [3] The aim of this approach is to reduce false positives and reduce the number of patients being tested. Koch et al tested this approach in the context of unexplained fatigue. Of the 111 patients randomised to wait 4 weeks only 24 patients revisited and only 19 received blood tests. The low rate of follow-up meant that this approach could not be evaluated.[3]

Van Bokhoven et al investigated patient satisfaction and anxiety associated with delaying pathology testing per the DCGP guideline compared with immediate testing and found no difference in satisfaction or anxiety levels.[13]

The BEACH results represent the management of otherwise unexplained weakness/ tiredness problems. Almost half (43.7%) of these problems were new problems to the patient (i.e. not managed by any medical practitioner before) and these new problems accounted for

60% of pathology testing. This suggests that GPs consider pathology testing at the initial encounter to be part of the diagnostic process of weakness/tiredness.

Approximately 60% of all individual tests were ordered as part of the initial investigation, indicating that there were no particular tests which GPs considered to be more appropriate in the initial assessment of the patient.

Other comments on guidance and literature

Underlying pathology

Koch et al. (2009)[3] recently published results from their study on unexplained fatigue in patients presenting to general practice. Of the 173 patients with unexplained fatigue who were tested immediately 8% (n=14) were diagnosed with somatic disease as a result of pathology testing.

The 14 diagnoses found were diabetes (4), anaemia (3) infectious mononucleosis (3) hypothyroidism (1), dust mite allergy (1), Haemoglobulin E thalassaemia (1), and vitamin B12 deficiency (1).

Gialamas et al.[10] found that among 342 Australian general practice patients presenting from April 1994 to March 2001 with a symptom of tiredness 4% (n=12) had a significant clinical diagnosis made as a result of pathology testing (somatic diagnosis). A further 5% of patients (n=16) had a significant clinical diagnosis made without the need for pathology testing.

The diagnoses made with pathology results were anaemia (3), diabetes (2), renal failure (2), glandular fever (1), goitre (1), hepatitis (1), HIV infection (1), hypokalaemia (1), and nephropathy (1). Based on the somatic diseases identified in the study Gialamas et al. concluded that the most useful tests were full blood count, blood glucose test, EUC test.

Ridsdale et al.[12] found that among 210 British general practice patients presenting with fatigue 9% (n=19) had a clinical somatic diagnosis made as a result of pathology testing.

The 19 diagnoses were anaemia (8), hypothyroidism (3), infection(3), glandular fever (3), diabetes (1), and carcinomatosis (1).

The diagnoses identified in these three outcome studies are similar.

False positive results

The results of the three outcome studies discussed above also highlight high rates of false positive results. The British and Dutch studies were prospective, testing protocols were established at the beginning of the studies, whereas the Australian study was retrospective with investigation of the tests ordered by GPs as recorded in their medical records.

In the Australian study, there were 1,046 pathology test orders recorded with results available. Of these tests, 16% had (n=166) abnormal results. However only 12 patients had new clinical diagnoses. In this study 14 new diagnoses were made in 12 patients. It is unclear how many patients had multiple abnormal results across different pathology tests that resulted in new diagnoses, and therefore the number of abnormal results (of the 166) that were represented by the 12 patients.

In the British study 210 patients had the same group of pathology tests ordered at enrolment in the study. These tests were haemoglobulin, white blood cell count, ESR or plasma viscosity, EUC, TSH and glucose test (blood or urine). The selection of the tests reflects the age of this study, which was conducted in the early 1990's (dates are not provided but the

article was accepted for publication in May 1993). Of the 210 patients 33% (n=69) had at least one abnormal result, however only 19 patients had a clinical diagnosis identified.

In the Dutch study two testing sets were used in the 173 patients:

- the four tests recommended by the Dutch College of General Practitioners (DCGP) for unexplained complaints—haemoglobulin, glucose, ESR, TSH (note haemoglobulin is not a part of the FBC in the Netherlands)
- a panel of tests selected by consensus—the four tests above and alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, carbohydrate deficient transferrin, creatinine, differentiated leukocyte count, ferritin, gamma-glutamyl transferase, potassium, lactate dehydrogenase, leukocyte count, monosticon, transferrin saturation.

Both sets of tests were ordered at the initial encounter. Results compare the two testing protocols in regard to diagnostic yield (new diagnoses made as a result of pathology), rate of false negative results and rate of false positive results.

Diagnostic yield—of the 14 somatic diagnoses made the initial investigations identified: 11 of the 14 using the DCGP tests (4 tests), and 13/14 using the panel of tests (17 tests). However if the DCGP recommendation for Hb was expanded to include the full blood count the diagnostic yield would have been the same, 13/14.

False negative rate—there were 3 false negative results in the GGPC tests and 1 false negative result in the panel of tests. However as discussed above if the DGPC expanded the Hb recommendation to FBC the false negative rate would be the same, 1 in both panels.

False positive rate—there were 38 patients with at least one false positive result (28.3% of the 173 patients) using the DCGP tests and there were 96 patients with at least one false positive result from the panel of tests (55.5%).

In the DCGP test set, the tests most likely to result in false positive results were ESR and glucose set and in the full panel, ferritin, gamma-glutamyl transferase and carbohydrate-deficient transferrin were most likely to have false positive results.

7.9 National implications

Quality of current pathology ordering

Based on the 2006–08 pathology ordering data for weakness/tiredness problems we estimate that 1.8 million tests were ordered for weakness/tiredness per year in Australia in 2006–08. Review of the guidelines/guidance suggests:

- 1.3 million (71.7%) tests were supported by the guidelines and guidance documents
- 230,000 (12.9%) may or may not be supported due to unclear guidance
- 160,000 (8.7%) were not supported by the guidelines/guidance documents.

The remaining 6.8% of tests ordered for weakness/tiredness each accounted for <1% of total pathology tests ordered for weakness/tiredness.

Future increases in pathology?

Future increase in management rate of weakness/tiredness?

Patients aged 15–44 years were most likely to have weakness/tiredness managed at general practice encounters (see Figure 7.2). The current age distribution of the Australian population suggests encounters with patients in this age group are unlikely to increase. Assuming there is no external contribution to an increase in the prevalence of weakness/tiredness it can be anticipated that the management rate will not change significantly in general practice in the near future.

Future increase in pathology ordering

The pathology ordering rate for weakness/tiredness increased significantly between 2000–02 and 2006–08. This was due to an increase in the likelihood of pathology tests being ordered in the management of weakness/tiredness. These increases in likelihood of testing were seen in patients aged 25–44 and those aged 65–74 (see Figure 7.3)

The increase in the pathology ordering behaviour of GPs is likely to continue in the future.

Extrapolated example of increase

The extrapolations made in this section are based on the current BEACH management rate of weakness/tiredness (2006–08) and the same number of tests being ordered per tested problem (3.75 per tested weakness/tiredness contact).

Extrapolations are made on the assumption that the same number of general practice encounters occur in Australia in the future—an increase or decrease would affect the extrapolated estimates.

Increase in future likelihood of pathology test orders for weakness/tiredness

There was a 24% increase in the likelihood of pathology tests being ordered in the management rate of weakness/tiredness over the duration of this study, from 2000–02 to 2006–08. In this example this proportion of change has been applied as a future increase.

If there is another 24% increase in the likelihood of pathology testing in the future (e.g. over the next 8 years), 77% of contacts with weakness/tiredness would involve pathology testing. Nationally this would mean that:

- there would be 2.2 million tests ordered per year by GPs for the management of weakness/tiredness problems.

If GPs ordered only the tests strongly supported in the guidelines:

- there would be 1.6 million tests ordered per year by GPs (71.7% of the 2.2 million tests)

If GPs ordered the tests that were strongly supported and those with conditional support:

- there would be 1.9 million tests ordered per year by GPs (84.6% of the 2.2 million tests)

Of the 2.2 million tests, 8.7% would not be supported by the guidelines/guidance documents and the remaining 6.8% of tests ordered for were not evaluated (each accounting for <1% of total pathology tests ordered for weakness/tiredness).

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8 Health checks

Summary: Health check

Background

The analysis of 'health check' problems includes check-ups recorded by GPs at encounters with patients aged 15 years and over.

The main policy initiatives in Australian general practice likely to impact on the provision of health checks were from the Enhanced Primary Care (EPC) program:

- the 45–49 health check MBS item number, introduced in November 2006
- the health assessment in patients aged 75 years and over, introduced in May 1999.

GP management of 'health check' (BEACH data) April 2000 to March 2008

'Health check' was managed at a rate of 1.2 per 100 GP encounters, equating to approximately 1.04 million encounters nationally p.a. where health checks were managed.

There was a significant increase in the management rate of health checks (a 36% increase), from 1.1 per 100 encounters in 2000–02 to 1.5 per 100 in 2006–08.

Pathology ordering (BEACH data)

Pathology ordered for health checks accounted for 3.8% of all pathology tests recorded in 2000–08.

Pathology was ordered at a rate of 147.9 tests/batteries per 100 health check contacts with patients aged 15 years and over in 2000–08. Almost half of the contacts (49.5%) resulted in at least one pathology order, and on average 2.98 tests/batteries were ordered per tested health check contact.

The rate of pathology ordering increased significantly from 121.9 tests/batteries of tests per 100 health check contacts (in 2000–02) to 178.9 per 100 (in 2006–08). This was due to a significant increase in the number of tests ordered per tested health check contact.

Of the total national increase in pathology test orders between 2000–02 and 2006–08, 7.6% was attributable to pathology ordering in the management of health checks.

Evaluation of current GP pathology ordering (2006–08) against guidelines

Based on the 2006–08 pathology ordering data for health check problems we estimate that 2.5 million tests/batteries p.a. were ordered by GPs conducting health checks in Australia. Review of the guidelines/guidance suggests:

- 610,000 (24.3%) tests were supported by the guidelines and guidance documents
- 510,000 (20.6%) may or may not be supported due to unclear guidance
- 1.2 million (47.2%) were not supported by the guidelines/guidance documents.

The remaining 7.9% of tests ordered for health checks each accounted for <1% of total pathology tests ordered for health checks, and were not checked against guidelines/guidance.

Less than a quarter of the pathology tests ordered in the management of health checks were supported by the guidance. This is very low when compared with the disease-specific chapters in this report.

Comments on guidelines/guidance documents

The guidelines reviewed in this chapter were for preventive care. Only two of the guidelines can be considered current comprehensive guidelines—the Australian RACGP guideline and the US Preventive Task Force recommendations.

Three commonly ordered tests that accounted for almost a third of tests ordered (full blood counts, liver function tests and electrolyte, urea and creatinine tests) were not mentioned in the guidelines. Further, the order rate of these three tests in the management of 'health check' increased significantly over the duration of this study.

Future growth in pathology ordering?

If the management rate of 'health check' increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering.

- It is likely that the management rate of 'health checks' at GP encounters will increase due to Australia's ageing population.

Extrapolated example of the effect of a future increase in the management rate

The extrapolations made in this example are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of GP encounters occur in Australia in the future. Increases or decreases in total attendance rates, and/or in the GP test ordering rate would affect the estimates in this example.

Example: If there was a further 36% increase in the management rate of 'health checks':

Scenario 1: No change in the current (2006–08) pathology ordering behaviour of GPs:

- there would be 3.4 million tests ordered per year by GPs for the management of health checks.

Scenario 2: If GPs ordered only the tests strongly supported in the guidelines:

- there would be 820,000 tests ordered per year by GPs (24.3% of the 3.4 million tests)

Scenario 3: If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 1.5 million tests ordered per year by GPs (44.9% of the 3.4 million tests)

Of the 3.4 million tests, 47.2% would not be supported by the guidelines/guidance documents and the remaining 7.9% of tests ordered were not evaluated (each accounting for <1% of total pathology tests ordered for health checks).

8.1 Definition

The analysis of 'health check' problems includes check-ups recorded by GPs at encounters with patients aged 15 years and over. Encounters with children involving check-ups have been excluded because the recommended activities do not involve pathology testing.

The analysis excludes check-ups related to employment, insurance, licence check-ups, pre/post-operative check-ups and those related to specific ongoing problems.

The 'health check' problems managed by GPs may be considered preventive in nature but whether primary, secondary or tertiary prevention is unknown. The health checks cannot all be considered 'well patient checks' (i.e. primary prevention) because BEACH data do not include the presence or absence of all diagnosed disease(s) for these patients. However, the BEACH does collect data about other diseases and problems that were managed at the same encounter with health checks.

The ICPC-2 PLUS terms included in this group are listed in Appendix 2. All 'health check' check-up codes are classified as complete or partial check-ups in the International Classification of Primary Care (Version 2) (ICPC-2 codes A30 and A31).

8.2 Background

The main policy initiatives in Australian general practice likely to impact on the provision of health checks were from the Enhanced Primary Care (EPC) program:

- the 45–49 health check MBS item number, introduced in November 2006[1]
- the health assessment in patients aged 75 years and over, introduced in May 1999.[2]

8.3 Management rate in Australian general practice

'Heath check' was recorded at 8,113 patient encounters with 3,707 GPs between April 2000 and March 2008 (Table 8.1).

'Health check' was managed at a rate of 1.2 per 100 general practice encounters (Table 8.1). This is equivalent to one health check per 83 encounters with patients in 2000–08, and equates to approximately 1.04 million encounters nationally p.a. where health checks were managed by GPs.

Change in management over time

In this study, there was a significant increase in the management rate of health checks, from 1.1 per 100 encounters in 2000–02 to 1.5 per 100 in 2006–08 (Table 8.4).

Table 8.1: Summary of health check data set in patients aged 15+ years, 2000–08

Variable	Number	Rate per 100 total encs (*n*=682,932)	95% LCL	95% UCL	Per cent of total problems (*n*=1,054,872)	Management: encounter ratio
General practitioners	3,707	—	—	—	—	—
Health check encounters	8,113	—	—	—	—	—
Health check problems managed	8,120	1.2	1.1	1.2	0.8	1:83

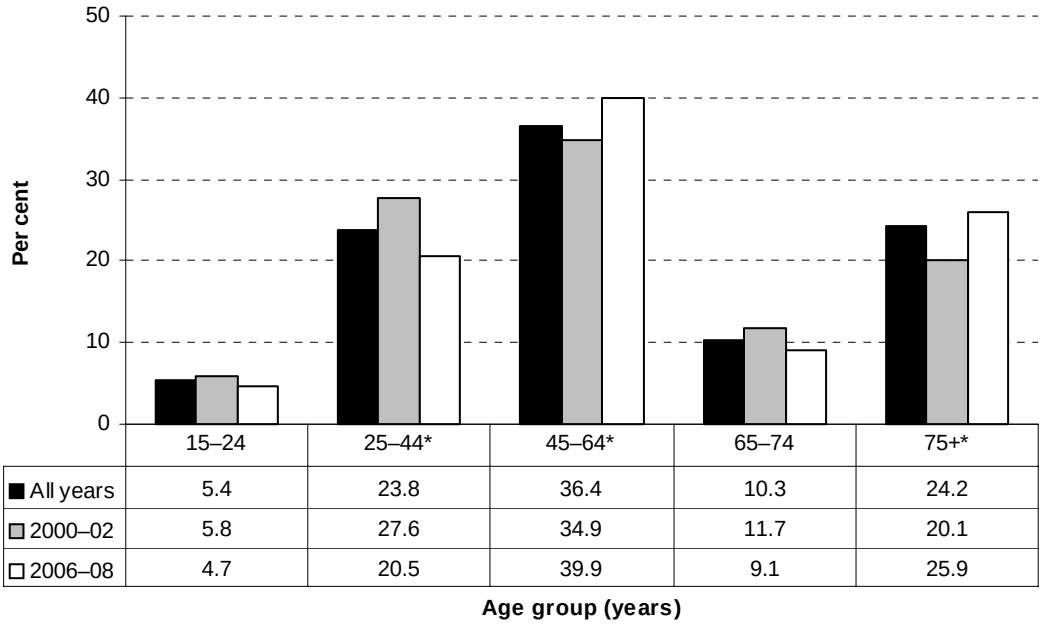
Note: LCL—lower confidence limit; UCL—upper confidence limit.

Age distribution

The age distribution of patients aged 15 years and over at general practice encounters involving health checks in 2000–08 is presented in Figure 8.1.

Patients at 'health check' encounters were most often aged 45–64 years (36.4%), followed by the 75 years and over age group (24.2%), the 25–44 year (23.8%), the 65–74 year (10.3%), and the 15–24 year age group (5.4%).

The age distribution of patients at health check encounters changed significantly over the period of this study (2000–02 compared with 2006–08). The proportion of encounters involving health checks with patients aged 45–64 and 75+ years increased significantly, while those with patients aged 25–44 years decreased (Figure 8.1).



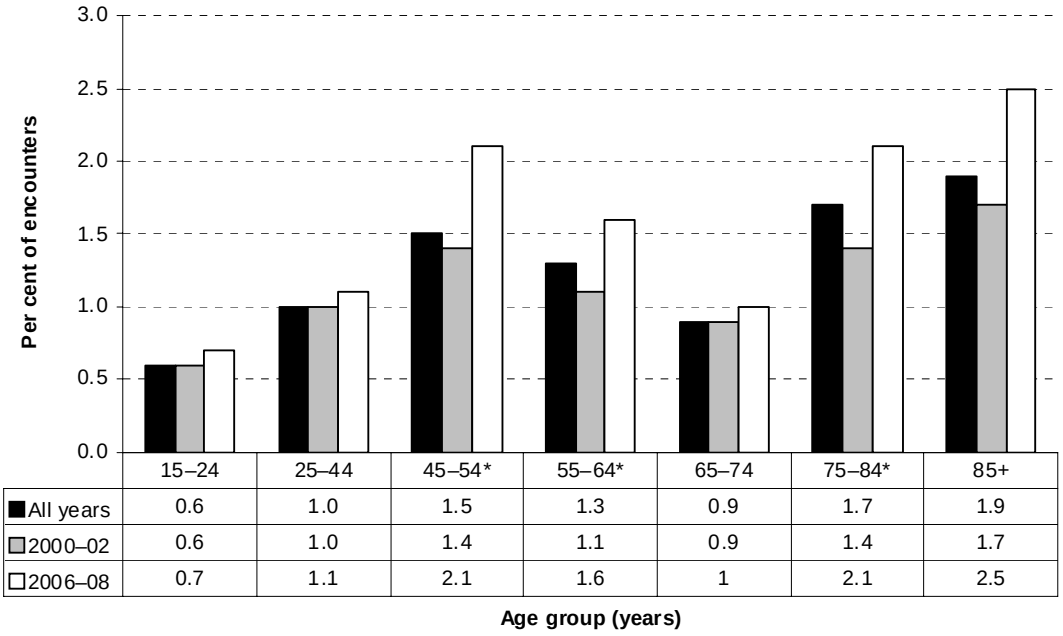
	15–24	25–44*	45–64*	65–74	75+*
All years	5.4	23.8	36.4	10.3	24.2
2000–02	5.8	27.6	34.9	11.7	20.1
2006–08	4.7	20.5	39.9	9.1	25.9

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 8.1: Age distribution of patients aged 15+ years with 'health check' managed at general practice encounters, 2000–08 (all years), 2000–02 and 2006–08

Figure 8.2 shows the age-specific management rate of health checks. Patients aged 85 years and over were the most likely to have health checks, 1.9% of encounters with these patients involving a health check. They were followed by patients aged 75–84 years (1.7% of encounters involving a health check), those aged 45–54 years (1.5%) and 55–64 years (1.3%).

Over the duration of this study (2000–02 to 2006–08) there were significant increases in the age-specific management rates for patients aged 45–54 years, 55–64 years and 75–84 years. Patients aged 65–74 years had the lowest management rate of health checks compared with all other middle and older age groups, and the management rate did not change over the duration of this study.



* Indicates statistically significant change between 2000–02 and 2006–08

Figure 8.2: Age-specific rate management of health checks in patients aged 15+ years, 2000–08 (all years), 2000–02 and 2006–08

Table 8.2 shows the number of problems managed per encounter where health check was managed for patients aged 15 years and over and the number managed at all BEACH encounters in 2000–08 (for patients aged 15+ years). A maximum of 4 problems can be recorded per encounter in BEACH.

Encounters involving health checks were more complex, being more likely to have multiple problems (2, 3 or 4 problems managed) per encounter than average general practice encounters in this patient age group.

Table 8.2: Number of problems managed at health check encounters (15+ years) and total encounters (15+ years)

	Health check encs (2000–08)				All BEACH encs (2000–08)			
Number of problems managed	Number	Per cent of problems	95% LCL	95% UCL	Number	Per cent of problems	95% LCL	95% UCL
One problem	3329	41.0	39.5	42.6	417284	61.1	60.7	61.5
Two problems	2912	35.9	34.7	37.1	179551	26.3	26.1	26.5
Three problems	1410	17.4	16.5	18.3	65902	9.7	9.5	9.8
Four problems	462	5.7	5.1	6.3	20195	3.0	2.9	3.1

Note: Encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08.

8.4 Pathology ordering behaviour

Pathology was ordered at a rate of 147.9 tests/batteries per 100 health check contacts with patients aged 15 years and over in 2000–08. Almost half of the contacts (49.5%) resulted in at least one pathology order (Table 8.3).

Once the decision to order a pathology test/battery of tests was made the GP ordered on average 2.98 pathology tests/batteries per tested health check contact (Table 8.3). Pathology ordered for health checks accounted for 3.8% of all pathology tests recorded from April 2000 to March 2008.

Table 8.3: Summary of pathology ordering for health check (patients 15+ years), 2000–08

Variable	Number	Per cent / Rate of health check problems (*n*=8,120)	95% LCL	95% UCL
Health check problems managed	8,120	100.0	—	—
Pathology (Rate per 100 health check problems)	12,007	147.9	142.1	153.6
At least one pathology order (% of health check problems)	4,023	49.5	48.0	51.1
Number of tests/batteries per 100 tested health check problems	—	298.5	291.6	305.3

Note: LCL—lower confidence limit; UCL—upper confidence limit.

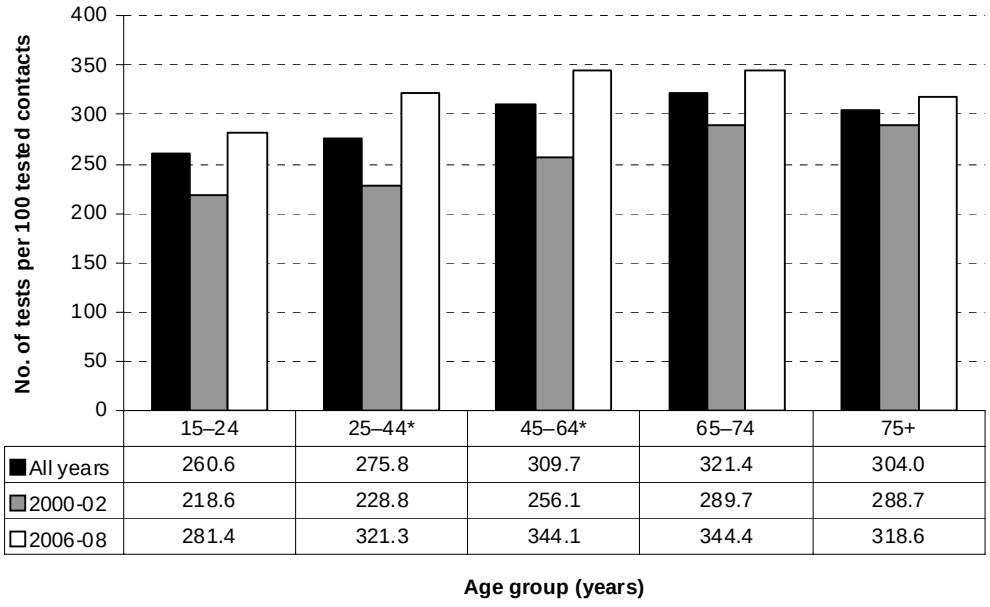
Changes over time, 2000–02 to 2006–08

Pathology ordering for health checks accounted for 3.4% of tests/batteries of tests in 2000–02 and 4.9% in 2006–08.

The rate of pathology ordering increased significantly from 121.9 tests/batteries of tests per 100 health check contacts (in 2000–02) to 178.9 per 100 (in 2006–08). This was due to a significant increase in:

- the number of tests ordered once the decision to order tests was made, from 250.1 per 100 tested check-up contacts in 2000–02 to 334.1 in 2006–08—an increase of 34% (Table 8.4).

Figure 8.3 shows the average number of tests ordered per 100 tested contacts by patient age. Patients aged 25–44, and 45–64 years had a significantly higher number of tests ordered per tested health check contact in 2006–08 than in 2000–02.



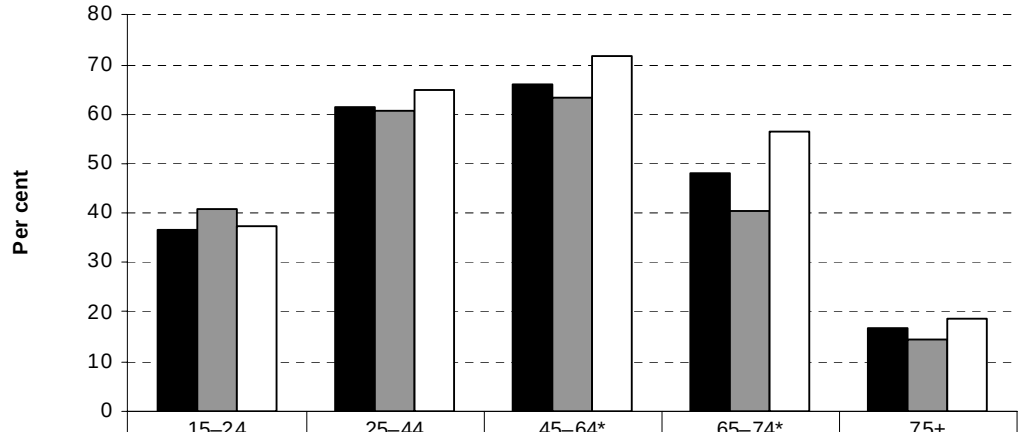
	15–24	25–44*	45–64*	65–74	75+
All years	260.6	275.8	309.7	321.4	304.0
2000-02	218.6	228.8	256.1	289.7	288.7
2006-08	281.4	321.3	344.1	344.4	318.6

Age group (years)

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 8.3: Age-specific mean number of pathology tests per 100 tested health check problems in patients aged 15+ years, 2000–08 (all years), 2000–02, and 2006–08

There was no statistically significant change in the likelihood of pathology testing being ordered for health checks in the total 'health check' sample (48.8% in 2000–02 and 53.5% in 2006–08) (Table 8.4). However, there was a statistically significant increase in the likelihood of pathology being ordered as part of a health check in patients aged 45–64 years and 65–74 years (Figure 8.4).



	15–24	25–44	45–64*	65–74*	75+
All years	36.7	61.4	66.0	48.1	16.6
2000–02	40.6	60.6	63.4	40.5	14.3
2006–08	37.4	65.0	71.5	56.5	18.5

Age group (years)

* Indicates statistically significant change between 2000–02 and 2006–08

Figure 8.4: Age-specific likelihood of pathology being ordered for health check problems in patients aged 15+, 2000–08 (all years), 2000–02, and 2006–08

Extrapolation of pathology ordering behaviour

When these data were extrapolated to the number of GP encounters claimed through Medicare nationally the results suggest there were approximately:

- 460,000 more encounters involving the management of health checks in 2006–08 (1.4 million per annum) than in 2000–02 (930,000 million per annum).
- 290,000 additional health check contacts that involved the ordering of at least one pathology test/battery of tests (tested contacts) in 2006–08 (750,000 per annum) than in 2000–02 (460,000 per annum).
- 1.4 million additional pathology tests/batteries ordered for health checks in 2006–08 (2.5 million per annum) than in 2000–02 (1.1 million per annum) (results not shown).

Of the estimated 17.7 million additional tests/batteries ordered by GPs in 2006–08 (51.3 million tests/batteries ordered by GPs per annum), compared with 2000–02 (33.6 million per annum), 7.6% was attributable to pathology ordering in the management of health checks. There was a 119% increase in the volume of GP requests for pathology tests/batteries attributable to health checks, due to a combination of factors:

- the increase in the total number of GP encounters in Australia
- the increased management rate of health checks
- to a change in GP pathology ordering behaviour for health checks, that is:
  - an increased number of tests ordered once the decision to order was made.

Table 8.4: Changes in the management of health check over time (patients aged 15+), 2000–02 to 2006–08

	2000–02							2006–08							
Variable	Number	Rate per 100 total encs (*n*=171,136)	95% LCL	95% UCL	Per cent / Rate of probs (*n*=1,846)	95% LCL	95% UCL	Number	Rate per 100 total encs (*n*=165,439)	95% LCL	95% UCL	Per cent / Rate of probs (*n*=2,464)	95% LCL	95% UCL	Change[(a)]
General practitioners	872	—	—	—	—	—	—	1,028	—	—	—	—	—	—	—
Health check encounters	1,845	—	—	—	—	—	—	2,463	—	—	—	—	—	—	—
Health check problems managed	1,846	1.1	1.0	1.2	100.0	—	—	2,464	1.5	1.4	1.6	100.0	—	—	↑
Pathology (Rate per 100 health check problems)	2,251	—	—	—	121.9	110.6	133.2	4,407	—	—	—	178.9	167.3	190.4	↑
At least one pathology order (% health check problems)	900	—	—	—	48.8	45.1	52.5	1,319	—	—	—	53.5	50.7	56.3	—
Number of tests/batteries per 100 tested health check problems	—	—	—	—	250.1	236.1	264.2	—	—	—	—	334.1	322.8	345.4	↑

(a) Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, and — indicates no change.

Note: Encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit; probs—problems.

8.5 Types of pathology tests ordered

Table 8.5 shows the distribution of pathology tests/batteries ordered for health check problems in patients aged 15 years and over in 2000–08 by MBS groups and the most common individual types of pathology tests ordered.

- Chemistry tests were the group of tests most often ordered, at a rate of 102.2 per 100 health check contacts. The most common chemistry tests ordered were:
  - lipid tests (29.7 per 100 health check contacts)
  - glucose/glucose tolerance tests (18.5 per 100 health check contacts)
  - liver function tests (11.7 per 100 contacts)
  - electrolyte, urea and creatinine tests (10.3)
  - multibiochemical analysis (8.7) (Table 8.5).
- Haematology tests (25.3 per 100 contacts), in particular full blood counts (22.7 per 100), were commonly ordered as part of the management of health check.
- Cytopathology tests (9.2 per 100 check-up contacts), in particular Pap smears (9.1 per 100) were also commonly ordered (Table 8.5).

Changes in types of pathology tests ordered 2000–02 to 2006–08

Table 8.6 compares the pathology ordering for health check problems in 2000–02 with 2006–08, shaded results highlight significant differences. There was a significant increase in the rate of pathology from 121.9 per 100 health check contacts in 2000–02 to 178.9 per 100 in 2006–08—an increase of 47%.

From 2000–02 to 2006–08, there were significant increases in the order rate of:

- lipid tests—36% increase
- full blood counts—72% increase
- glucose/glucose tolerance—40% increase
- liver function tests—100% increase
- electrolyte, urea and creatinine tests—128% increase
- multibiochemical analysis—60% increase
- thyroid function tests—95% increase
- prostate specific antigen—121% increase
- other chemistry tests—233% increase
- occult blood test—100% increase (Table 8.6).

There was also a significant decrease in the order rate of Pap smears as part of health checks—58% decrease from 2000–02 to 2006–08 (Table 8.6). Note the rate of Pap smears for all problems increased significantly from 2000–02 to 2006–08. This is discussed in more detail later in this chapter.

Table 8.5: Distribution of pathology orders across MBS groups and most frequent individual tests within each group for health check, 2000–08

Pathology test ordered	Number	Per cent of pathology for health check	Per cent of group	Rate per 100 health check problems (n=8,120)	95% LCL	95% UCL
Chemistry	**8,300**	**69.1**	**100.0**	**102.2**	**97.8**	**106.6**
Lipids*	2,412	20.1	29.1	29.7	28.4	31.0
Glucose/glucose tolerance*	1,500	12.5	18.1	18.5	17.3	19.6
Liver function*	952	7.9	11.5	11.7	10.7	12.7
EUC*	839	7.0	10.1	10.3	9.5	11.2
Multibiochemical analysis*	705	5.9	8.5	8.7	7.8	9.6
Prostate specific antigen*	663	5.5	8.0	8.2	7.5	8.9
Thyroid function*	583	4.9	7.0	7.2	6.5	7.9
Ferritin*	203	1.7	2.4	2.5	2.1	2.9
Chemistry; other*	144	1.2	1.7	1.8	1.2	2.3
Haematology	**2,055**	**17.1**	**100.0**	**25.3**	**23.9**	**26.7**
Full blood count	1,839	15.3	89.5	22.7	21.4	23.9
ESR	153	1.3	7.4	1.9	1.5	2.2
Cytopathology	**745**	**6.2**	**100.0**	**9.2**	**8.0**	**10.4**
Pap smear*	740	6.2	99.3	9.1	7.9	10.3
Microbiology	**574**	**4.8**	**100.0**	**7.1**	**5.8**	**8.4**
Hepatitis serology*	161	1.3	28.0	2.0	1.5	2.5
Other NEC	**199**	**1.7**	**100.0**	**2.5**	**2.0**	**2.9**
Other pathology groups	**134**	**1.1**	**100.0**	**—**	**—**	**—**
Total pathology tests	**12,007**	**100.0**	—	**147.9**	**142.1**	**153.6**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations.

Table 8.6: Distribution of pathology orders across MBS groups and most frequent tests within each group for health check, 2000–02 and 2006–08

	2000–02						2006–08						
Pathology test ordered	Number	% path for hlth check	Per cent of group	Rate per 100 hlth check probs[(a)]	95% LCL	95% UCL	Number	% path for hlth check	Per cent of group	Rate per 100 hlth check probs[(a)]	95% LCL	95% UCL	Change
Chemistry	**1422**	**63.2**	**100.0**	**77.0**	**68.8**	**85.2**	**3182**	**72.2**	**100.0**	**129.1**	**120.3**	**138.0**	↑
Lipids*	483	21.5	34.0	26.2	23.3	29.0	877	19.9	27.6	35.6	33.1	38.1	↑
Glucose/glucose tolerance*	278	12.4	19.5	15.1	12.6	17.5	519	11.8	16.3	21.1	18.8	23.3	↑
Liver function*	149	6.6	10.5	8.1	6.1	10.0	399	9.1	12.5	16.2	14.0	18.4	↑
EUC*	107	4.8	7.5	5.8	4.5	7.1	324	7.4	10.2	13.2	11.4	14.9	↑
Multibiochemical analysis*	124	5.5	8.7	6.7	5.0	8.4	264	6.0	8.3	10.7	8.9	12.5	↑
Prostate specific antigen*	101	4.5	7.1	5.5	4.1	6.8	263	6.0	8.3	10.7	9.2	12.1	↑
Thyroid function*	86	3.8	6.0	4.7	3.2	6.1	255	5.8	8.0	10.4	8.8	11.9	↑
Ferritin*	33	1.5	2.3	1.8	1.0	2.5	82	1.9	2.6	3.3	2.4	4.3	—
Chemistry; other*	17	0.8	1.2	0.9	0.4	1.4	74	1.7	2.3	3.0	1.5	4.5	↑
Haematology	**369**	**16.4**	**100.0**	**20.0**	**17.1**	**22.9**	**779**	**17.7**	**100.0**	**31.6**	**28.8**	**34.4**	↑
Full blood count	312	13.9	84.6	16.9	14.4	19.4	716	16.3	91.9	29.1	26.4	31.7	↑
ESR	41	1.8	11.1	2.2	1.5	2.9	42	1.0	5.4	1.7	1.0	2.4	—
Microbiology	**130**	**5.8**	**100.0**	**7.0**	**4.5**	**9.6**	**161**	**3.7**	**100.0**	**6.5**	**4.4**	**8.6**	—
Hepatitis serology*	37	1.6	28.5	2.0	1.1	2.9	49	1.1	30.4	2.0	0.9	3.1	—
Cytopathology	**270**	**12.0**	**100.0**	**14.6**	**11.4**	**17.8**	**149**	**3.4**	**100.0**	**6.1**	**4.3**	**7.8**	↓
Pap smear*	270	12.0	100.0	14.6	11.4	17.8	149	3.4	100.0	6.1	4.3	7.8	↓
Other NEC	**42**	**1.9**	**100.0**	**2.3**	**1.4**	**3.2**	**78**	**1.8**	**100.0**	**3.2**	**2.1**	**4.2**	—
Simple test	**10**	**0.4**	**100.0**	**0.5**	**0.2**	**0.9**	**46**	**1.0**	**100.0**	**1.9**	**1.2**	**2.5**	↑
Occult blood test	10	0.4	100.0	0.5	0.2	0.9	46	1.0	100.0	1.9	1.2	2.5	↑
Other pathology groups	**18**	**0.8**	**100.0**	**—**	**—**	**—**	**58**	**1.3**	**100.0**	**—**	**—**	**—**	—
Total pathology tests	**2251**	**100.0**	**—**	**121.9**	**110.6**	**133.2**	**4407**	**100.0**	**—**	**178.9**	**167.3**	**190.4**	↑

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) The total number of health check problems in 2000–02 was 1,846 and in 2006–08 was 2,464.

Note: Hlth check—health check; LCL—lower confidence limit; UCL—upper confidence limit; also see Abbreviations. Shading indicates a statistically significant change—the direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change and — indicates no change.

8.6 Guidelines for health checks

The guidance documents (guidelines and other sources of guidance) for health checks that were considered in this study are outlined below.

Guidelines reviewed were:

- 'Guidelines for preventive activities in general practice', 7th edition 'red book' [Royal Australian College of General Practitioners, RACGP, 2009][3]
- US Preventive Services Task Force (USPSTF) recommendations [US, 2008][4]
- Canadian Task Force on Preventive Health Care (CTFPHC) recommendations [Canada, recommendations from 1994–2005][5]
- 'Health Care Guidelines: Preventive services for adults' [Institute for Clinical Systems Improvement, US, 2008][6]
- 'Health Screening' [Singapore Ministry of Health, Health Promotion Board, 2004][7]

8.7 Application of the guidelines

Evaluation of GP pathology ordering against guidelines

Table 8.7 provides a summary of the individual tests and the level of support provided in the guidelines/guidance for each: yes—supported; unclear guidance; no—not supported:

- 26.3% of tests ordered in health checks were supported by the guidelines and guidance documents
- 22.5% of tests had conditional support or support was unclear
- 43.6% of tests were not supported by the guidelines/guidance documents.

The individual tests/batteries listed in Table 8.7 account for 93.2% of pathology tests/batteries ordered by GPs for health checks because only the most common individual pathology tests ordered are included (each accounted for >1% of tests for health checks).

Note: supported tests are those that the guidance documents have supported in all patients even if this starts at a specified age. Tests that have conditional support are those that are supported in patients with specific risk factors, for example, screening for STIs in patients with high risk sexual behaviours.

Only a quarter of the pathology tests ordered by GPs conducting health checks were supported by the guidance. This is very low when compared with the disease-specific chapters in this report.

Table 8.7: Summary of support for GP pathology ordering for the most frequent individual test orders for health check (patients aged 15+), 2000–08

Pathology test ordered	Number	Per cent of all pathology for health check
YES	**3,152**	**26.3**
Lipids*	2,412	20.1
Pap smear*	740	6.2
Faecal occult blood	104	0.9
UNCLEAR/CONDITIONAL SUPPORT	**2,707**	**22.5**
Glucose/glucose tolerance*	1,500	12.5
Multibiochemical analysis*	705	5.9
Other STI testing (incl. Chlamydia, HIV, STI screen)	197	1.6
Hepatitis serology*	161	1.3
Chemistry; other*	144	1.2
NO	**5,232**	**43.6**
Full blood count	1,839	15.3
Liver function*	952	7.9
EUC*	839	7.0
Prostate specific antigen*	663	5.5
Thyroid function*	583	4.9
Ferritin*	203	1.7
ESR	153	1.3
Subtotal (n, % of total tests included in the table)	*11,195*	*93.2*
Total pathology tests	**12,007**	**100.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 8.8 compares the commonly ordered pathology tests/batteries for health checks with the guidelines' recommended tests. The key explaining the colours used in the table is before Table 8.8. Briefly, dark green tests are specifically supported, light green have partial support, red tests are advised against, orange tests are those for which support cannot be determined, and pink tests were not mentioned in the guideline/guidance.

Lipids

There is strong agreement between the guidelines listed in Table 8.8 that lipid testing should be measured in selected patients. Recommendations were made on the basis of identifying patients who are at increased risk of cardiovascular disease and are therefore most likely to benefit from testing. Cardiovascular risk guidelines provide further support for the role of lipid testing to evaluate cardiovascular risk in certain patient groups.[8-10]

The Canadian task force recommendation was the only one to conclude that there was insufficient evidence to recommend testing although this guideline was released in 1994 and could be considered out of date.

The evidence for recommending screening in male patients is stronger than for females.[3,4]

The optimal interval for screening is uncertain; most guidelines recommend intervals based on risk, often 5 yearly in the lowest risk groups and 1–2 yearly in the higher risk groups.

In BEACH, during this study (2000–02 to 2006–08), the rate of lipid tests ordered in the management of health checks increased significantly, from 26.2 per 100 check-up contacts in 2000–02 to 35.6 per 100 in 2006–08.

Full blood count

Full blood counts (FBC) were not recommended in any of the guidelines. The ICSI guideline specifically recommended against use of routine laboratory testing (including haemoglobulin and haematocrit screening) without clinical suspicion of disease.

In BEACH, during this study (2000–02 to 2006–08), the rate of FBC tests ordered in the management of health checks almost doubled, from 16.9 per 100 check-up contacts in 2000–02 to 29.1 per 100 in 2006–08.

Glucose / glucose tolerance

Testing for diabetes mellitus was recommended with different indications for testing in most guidelines. The Singapore guideline recommended screening for diabetes in all patients from the age of 40 years and from 30 years with known risk factors. The ICSI stated that routine testing of blood glucose in asymptomatic patients was not recommended. The US, Canadian and RACGP guidelines did not recommend population screening in patients without risk factors but supported testing for selected high risk patient groups.

In BEACH, during this study (2000–02 to 2006–08), the rate of glucose tests ordered in the management of health checks increased significantly, from 15.1 per 100 check-up contacts in 2000–02 to 21.1 per 100 in 2006–08.

Liver function

Liver function tests (LFTs) were not mentioned in any of the guidelines. The ICSI guideline specifically recommended against use of routine laboratory testing for patients in the absence of clinical suspicion of disease.

In BEACH, during this study (2000–02 to 2006–08), the rate of LFT tests ordered in the management of health checks doubled, from 8.1 per 100 check-up contacts in 2000–02 to 16.2 per 100 in 2006–08.

Electrolytes, urea and creatinine

Electrolytes, urea and creatinine (EUC) tests were supported in one guideline. The RACGP red book recommends annual screening using the estimated glomerular filtration rate (eGFR) for high risk patients. High risk patients were defined as those with hypertension, obesity, diabetes, family history of kidney disease, and Indigenous patients aged >35 years.

The 1993 Canadian guidance on screening asymptomatic adults for chronic renal failure concluded that screening was not recommended because efficacious, non harmful treatment was not available early in the disease course. This is still the case for chronic kidney disease. However, testing (using the dipstick urinalysis) for patients with diabetes was recommended.

Other guidelines did not discuss screening for kidney disease.

In BEACH, during this study (2000–02 to 2006–08), the rate of EUC tests ordered in the management of health checks more than doubled, from 5.8 per 100 check-up contacts in 2000–02 to 13.2 per 100 in 2006–08.

Multibiochemical analysis

The multibiochemical analysis (MBA) test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported by the guidance.

Indiscriminate testing does not meet evidence-based principles. The ICSI guideline specifically recommended against use of routine laboratory testing (including blood chemistry panels) without clinical suspicion of disease.

In BEACH, during this study (2000–02 to 2006–08), the rate of MBA tests ordered in the management of health checks increased significantly, from 6.7 per 100 check-up contacts in 2000–02 to 10.7 per 100 in 2006–08.

Prostate specific antigen

The majority of guidelines recommended against routine testing of prostate specific antigen (PSA) to detect prostate cancer. The RACGP red book recommended against the test but then stated that patients should be informed of risks and benefits to make an informed choice. The US guideline stated that there was insufficient evidence to make a recommendation to test or not to test men aged <75 years and testing was not recommended in men aged 75 years and over. The Singapore guideline recommended screening in high risk men aged >50 years who have had close relatives diagnosed with prostate cancer when aged less than 60 years.

In BEACH, during this study (2000–02 to 2006–08), the rate of PSA tests ordered in the management of health checks doubled, from 5.5 per 100 check-up contacts in 2000–02 to 10.7 per 100 in 2006–08.

Thyroid function tests

Thyroid function tests (TFTs) were not supported in most of the guidelines. The RACGP specifically recommended against the use of TFTs as a screening test. The US, Canadian and ICSI guidelines stated that there was insufficient evidence to recommend for or against use of TFTs in asymptomatic adults, and the Singapore guideline did not mention thyroid function.

In BEACH, during this study (2000–02 to 2006–08), the rate of TFTs ordered in the management of health checks more than doubled, from 4.7 per 100 check-up contacts in 2000–02 to 10.4 per 100 in 2006–08.

Pap smears

There is strong agreement between the guidelines that cervical cancer screening should be routinely undertaken in all sexually active females until the age of 65 or 69 years. In certain female patients screening may need to extend past the age of 65 or 69 years.

In BEACH, during this study (2000–02 to 2006–08), the rate of Pap smears ordered in the management of health checks decreased significantly, from 14.6 per 100 check-up contacts in 2000–02 to 6.1 per 100 in 2006–08. Note: the rate of Pap smears ordered for all problems increased significantly over the duration of this study (2000–02 to 2006–08). The reason for the decrease in the rate of Pap smears for health checks is discussed later in this chapter.

Occult blood tests

There is strong agreement between the guidelines that colorectal cancer screening should be routinely undertaken in patients aged 50 years and over and earlier for those at increased risk. The faecal occult blood test is only one of the screening options available.

In BEACH, during this study (2000–02 to 2006–08), the rate of occult blood tests ordered in the management of health checks increased significantly, from 0.5 per 100 check-up contacts in 2000–02 to 1.9 per 100 in 2006–08.

Hepatitis and tests for other sexually transmitted infections

Screening for sexually transmitted infections (STIs), particularly chlamydia, was strongly supported in the majority of guidelines for high risk patients.

In BEACH, testing for STI infections accounted for 2.6% of pathology ordered in health checks. This STI group includes tests for hepatitis, HIV, chlamydia, HIV and 'STI screen'.

In BEACH, during this study (2000–02 to 2006–08), the rate of STI tests ordered in the management of health checks did not change significantly.

Ferritin, erythrocyte sedimentation rate (ESR) and 'other' chemistry tests

Ferritin, ESR and 'other' chemistry tests were not mentioned in any of the guidelines.

Other chemistry tests refers to a group of tests. The tests included are listed in Appendix 3. The 144 tests ordered in this group represent a diverse range of individual tests. It is not possible to determine whether this group of tests were supported by the guidance

In BEACH, during this study (2000–02 to 2006–08), the rate of ferritin and ESR testing did not change significantly. However, the rate of other chemistry tests increased significantly from 0.9 per 100 check-up contacts in 2000–02 to 3.0 per 100 in 2006–08.

Key to Table 8.8

Colour	Description
	The document specifically recommended this test. Any notes within the cell indicate further detail. For example, a specific disease to test for within subset of patients; a specific test within a battery of tests.
	The document stated that this test should be considered. Any notes within the cell indicate further detail (e.g. a specific test to consider)
	Unable to determine guidance—MBA tests include mixed content for which it is not possible to determine guideline agreement (see footnote (a) above).
	Guideline specifically stated not to do this test. Additional information is supplied if the guideline states not to do the test unless clinically indicated.
	Guideline did not mention this test

Table 8.8: Summary of guideline/guidance recommendations by most frequent individual test orders for health check, 2000–08

Pathology test ordered	RACGP 2009	USPSTF 2008	ICSI 2008	CTFPHC 1994–2005	Singapore 2004	Number (n=12,007)	% path for check-up
Lipids*	>45 yrs or high risk	Not in F without CHD risk	M >34 yrs & F >45	Insufficient evidence (1994)	>40 yrs or high risk	2,412	20.1
Full blood count			Not as screening			1,839	15.3
Glucose/glucose tolerance*	Patients at high risk	Yes in HT. Consider for CVD and dyslipidaemia. Not in asymptomatic pts	Not recommended in asymptomatic pts	Yes in HT and dyslipidaemia (2005)	>40 yrs or >30 yrs and risk factors	1,500	12.5
Liver function*						952	7.9
EUC*	High risk pts					839	7.0
Pap smear*	Sexually active – 69yrs	Sexually active – 69yrs	21 to 64 yrs & 65+ if new sexual partner	Sexually active to 65yrs (1994)	F >25 yrs	740	6.2
Multibiochemical analysis*(a)			Not as screening			705	5.9
Prostate specific antigen*	Not recommended. Pt choice (50–75yrs) informed of risk & benefit.	Insufficient evidence in M<75 yrs and NO in M>75yrs	Not recommended	Not recommended (1994)	High risk, FHx onset<60yrs	663	5.5
Thyroid function*	Low prevalence even with FHx	Insufficient evidence to recommend	Insufficient evidence to recommend	Insufficient evidence to recommend (1994)		583	4.9
Ferritin*						203	1.7
Hepatitis serology*	High risk/request STI check	Only in pregnant women	Insufficient evidence in average risk pts			161	1.3
ESR						153	1.3
Chemistry; other*(b)						144	1.2
Occult blood test	>50 to 75yrs or >25 in high risk	>50 to 75 yrs	>50yrs or >45 in high risk pts	>50 yrs and earlier in high risk pts (2001)	>50 yrs	104	0.9
Other tests	Chlamydia in F aged<25yrs and other high risk pts	Chlamydia in F aged<25yrs and other high risk F	Chlamydia in F aged<25yrs and other high risk F	Chlamydia in F aged<25yrs and other high risk F (1996)	Chlamydia in high risk pts	39	0.3
	Other STIs in high risk pts	Other STIs in high risk patients. Not Hep B/C no evidence of improved outcomes	Other STIs insufficient evidence in average risk pts	Other STIs if high risk (1994)	Other STIs if high risk,	158	1.3

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) Multibiochemical analysis (MBA) potentially includes a combination of a broad group of tests. The MBS chemical analysis group includes a wide variety of biochemical tests (such as those in MBS item 66500).

(b) 'Chemistry; other' refers to a group of individual chemistry tests (see Appendix 3).

Note: M—male; F—female; yrs—years; pts—patients; HT—hypertension; CVD—cardiovascular disease; FHx—family history; STI—sexually transmitted infection; Hep B/C—hepatitis B or C; also see Abbreviations.

Evaluation of the guidelines and guidance documents

Out of date guidance

Of the five guidelines reviewed in this chapter two could be considered out of date.

- The Canadian task force recommendations date from 1994, 1996, 2001 and 2005. The year of each recommendation is provided in Table 8.8. The guidance from 1994 to 1996 is likely to be out of date. Regardless the recommendations of the task force are extensively referenced throughout the literature. The Canadian Government (Public Health Agency of Canada) is currently in the process of establishing a new Canadian Task Force on Preventive Health Care.[11]
- The Singapore guideline from June 2004 is now considered out of date because the Singapore guidelines are withdrawn after 5 years if they are not updated. The Health Promotion Board has not released updated guidelines. However, the website provides current information on health screening activities (2009), the majority of recommendations are in line with those from the 2004 guideline.[12]

The guidelines reviewed are compiled from multiple sources and provide the evidence base for preventive care in a central document. There are numerous other guidelines for the management of individual chronic morbidities and these often make screening recommendations regarding the specific morbidity of interest. These have not been reviewed in this chapter; however, they were referenced within the guidelines that are reviewed in this chapter.

Limitations of BEACH data—presence of patient risk factors

Screening in all asymptomatic patients was rarely recommended in guidelines. Patient age, sex and presence of other related risk factors were often included in the context of the recommendation to screen. While patient sex and age data are available, the BEACH data do not routinely include data on the presence/absence of comorbidities and risk factors not managed at the encounter that will impact on the appropriateness of pathology tests for health checks. Therefore it was not possible to evaluate the quality of GP pathology ordering in regard to these tests and this should be considered when reviewing the tests for which there is conditional support (in Table 8.7).

Additionally, it was not possible to assess the frequency of testing (i.e. interval to retest) using the BEACH data because the data are cross-sectional. Further, the recommended interval for repeated testing is influenced by many variables including the presence or absence of risk factors (e.g. comorbidities). As discussed above data on these factors are not usually available in BEACH.

Pathology tests without support in guidelines

Prostate specific antigen (PSA)

PSA testing was not recommended in the majority of guidelines. The Singapore guideline provided support for prostate screening in selected high risk patients. The RACGP recommended against the test but recommended informing patients of the risks and benefits and allowing them to chose whether to be tested.

Results from two clinical trials on prostate cancer screening were recently published (March 2009). The US and European studies provided inconclusive evidence of whether screening for prostate cancer was worthwhile:

- the European study concluded (after an average 9 year follow-up) that 1,410 patients would need to be screened and 48 patients treated to save one life.[13]
- the US study reported after a 7 year follow-up that no difference in mortality from prostate cancer was seen in the screened group compared with control.[14]

A recent discussion of prostate cancer screening in the Medical Observer concluded that the new evidence was unlikely to change current practice.[15]

The BEACH data show that PSA testing in the management of health check-ups increased significantly over the duration of this study (2000–02 to 2006–08). In fact PSA testing for all problems increased significantly over the duration of this study (see Table 3.2). However, during this time there was no change in the guidance provided on PSA testing. It is possible that during this time the number of males aged 50–75 years increased and this contributed to a higher rate of PSA testing. Alternatively it could suggest that patients were asking to be tested.

Thyroid function test (TFT)

The majority of guidelines reviewed in this study stated that there was insufficient evidence to make a recommendation regarding screening of thyroid function in asymptomatic patients. The RACGP guideline recommended against the testing of thyroid function in asymptomatic adults (regardless of family history) due to low prevalence and lack of evidence of benefit.

Other reviews/authors have recommended that opportunistic thyroid function testing is not supported in the healthy population.[16-20] However, as thyroid disease is most prevalent in older women[21] some guidance suggested that screening in menopausal women may be cost-effective.[16,19,20,22] The American Thyroid Association guidelines for detection of thyroid dysfunction was the only guideline to recommend routine screening (every 5 years, using the TSH test) in all adults from the age of 35 years.[23]

Despite this lack of evidence the BEACH data demonstrated a significant increase in the rate of TFTs—from 2000–02 to 2006–08 the order rate increased significantly both in the management of health checks and in total in the management of all problems.

Pathology tests not mentioned in guidelines

The guidelines did not mention the use of FBCs, LFT, EUC, ferritin and ESR tests in the health check. Therefore these tests were listed as having no support in Table 8.7. It was also not possible to determine the level of support for MBA and 'other chemistry' test groups, and therefore these tests were listed as having unclear support in Table 8.7.

The BEACH data show that the order rates increased significantly between 2000–02 and 2006–08 for FBCs, LFTs, EUC, and MBA.

A FBC is often requested as a routine screening blood test in general practice.[24] However, the guidance documents reviewed in this chapter did not recommend FBC testing in the management of health checks.

The ICSI guideline provided a consensus recommendation against ordering routine testing in preventive health care, particularly the use of blood chemistry panels, haemoglobulin/

haematocrit screening and urinalysis without clinical suspicion of an underlying condition. This clearly suggests that routine ordering of MBA and FBCs were not supported by the ICSI.

Changes in order rate of tests that were supported

Pap smear

The reduction in the rate of Pap smears demonstrated in this study for health checks reflects a change in the problem label recorded by GPs (from 'check-up' to 'well woman check-up', the latter was not included in the analysis for this chapter) rather than a reduction in cervical cancer screening. The pathology ordering data for all problems showed that the total rate of Pap smear testing increased significantly over the duration of this study (2000–02 to 2006–08).

Lipids

The increase in the order rate of lipid tests from 2000–02 to 2006–08 is likely to be influenced by multiple factors:

- an increase in the number of patients in the target age group for screening due to Australia's ageing population
- increase in the knowledge base leading to the management of cardiovascular risk and availability of an effective medication to manage lipid levels
- increase in the proportion of patients with known risk factors (e.g. hypertension, diabetes, metabolic syndrome, cardiovascular disease, chronic kidney disease) particularly if the diagnosed prevalence of risk factors increases with increasing age.

Glucose/glucose lowering

The increase in the order rate of glucose tests from 2000–02 to 2006–08 is likely to be influenced by multiple factors:

- an increase in the number of patients in the target age group for screening due to Australia's ageing population
- increase in the knowledge base linking diabetes to micro- and macro-vascular disease risk
- increase in the proportion of patients with known risk factors (e.g. previous cardiovascular event, history of gestational diabetes, obesity) particularly if the prevalence of risk factors increases with increasing age.

Occult blood tests

The increase in the rate of occult blood tests from 2000–02 to 2006–08 shown in this study is likely to be influenced by the introduction of the National Bowel Cancer Screening program.[25] It is also possible that the ageing of the Australian population may have contributed if more patients are now in the target range for screening (i.e. 50–75 years).

8.8 National implications

Quality of current pathology ordering

Based on the 2006–08 pathology ordering data for health check problems we estimate that 2.5 million tests/batteries p.a. were ordered by GPs conducting health checks in Australia. Review of the guidelines/guidance suggests:

- 610,000 (24.3%) tests were supported by the guidelines and guidance documents
- 510,000 (20.6%) may or may not be supported due to unclear guidance
- 1.2 million (47.2%) were not supported by the guidelines/guidance documents.

The remaining 7.9% of tests ordered for health checks each accounted for <1% of total pathology tests ordered for health checks.

Less than a quarter of the pathology tests ordered in the management of health checks were supported by the guidance. This is very low when compared with the disease-specific chapters in this report.

Future increases in pathology?

Future increase in management rate of health checks

- It is likely that the frequency of health checks at general practice encounters will increase due to Australia's ageing population. The RACGP red book recommended that lipid testing and screening for colorectal cancer start from the age of 45–50 years. Therefore, as the proportion of Australians aged 45 years and over increases it is likely to contribute to an increased rate of health checks.
- If the management rate of health check increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering.

Future increase in pathology ordering

The pathology ordering rate for health checks increased significantly between 2000–02 and 2006–08. In particular, there was an increase in the number of tests ordered once the decision to order had been made and this is likely to increase in the future.

Extrapolated example of increase

The extrapolations made in this section are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of general practice encounters occur in Australia in the future—an increase or decrease would affect the extrapolated estimates.

Increase in future management rate of health checks

There was a 36% in the management rate of health checks over the duration of this study, from 2000–02 to 2006–08, in the following example this proportion of change has been applied.

The example below highlights the consequences of a future increase in management rate, of the same magnitude over the next 8 years. An increase from 1.5 per 100 encounters (current)

to 2.0 per 100 encounters (future), if there was a further 36% increase in the management rate of health checks, with no change in the pathology ordering behaviour of GPs:

- there would be 3.4 million tests ordered per year by GPs for the management of health checks.

If GPs ordered only the tests strongly supported in the guidelines:

- there would be 820,000 tests ordered per year by GPs (24.3% of the 3.4 million tests)

If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 1.5 million tests ordered per year by GPs (44.9% of the 3.4 million tests)

Of the 3.4 million tests, 47.2% would not be supported by the guidelines/guidance documents and the remaining 7.9% of tests ordered were not evaluated (each accounting for <1% of total pathology tests ordered for health checks).

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9 Overweight or obesity

Summary: Overweight/ obesity

Background

- Obesity was made a National Health Priority Area in April 2008 and is one of the areas targeted by the National Preventative Taskforce. A National Obesity Strategy is due to be developed by mid 2009.
- Prevalence of overweight/obesity in adult general practice patients is estimated to be 59.3% (2007-08). The 2007–08 National Health Survey reported the prevalence as 62% in the Australian adult population.
- Australian Better Health Initiative national initiative was launched in November 2008—'Measure Up' campaign (which the Government is planning to extend).

GP management of overweight/obesity (BEACH data) April 2000 to March 2008

- Overweight/obesity was managed at a rate of 1.2 per 100 adult GP encounters.
- 49 overweight/obese adult patients seen by GPs per 1 management encounter for overweight/obesity.

Pathology ordering (BEACH data)

Pathology ordered for overweight/obesity problems accounted for 1.0% of all pathology tests recorded in 2000–08.

Pathology was ordered at a rate of 39.3 per 100 overweight/obesity problems. One in ten (13.6%) overweight/obesity problems resulted in at least one pathology order, and 2.75 tests/batteries of tests were ordered per tested overweight/obesity problem.

The pathology ordering rate increased significantly over the duration of this study, from 30.7 per 100 overweight/obesity contacts in 2000–02 to 47.1 per 100 contacts in 2006–08. This was due to a significant increase in the likelihood of pathology being ordered in the management of overweight/obesity.

Of the total national increase in pathology test orders between 2000–02 and 2006–08, 1.2% was attributable to pathology ordering in the management of overweight/obesity.

Evaluation of current GP pathology ordering (2006–08) against guidelines

Based on the 2006–08 pathology ordering data for overweight/obesity problems we estimated that 520,000 tests were ordered for overweight/obesity problems in Australia in 2006–08. Review of the guidelines/guidance suggests:

- 260,000 (50.9%) tests were supported by the guidelines and guidance documents
- 110,000 (21.2%) may or may not be supported due to unclear guidance
- 120,000 (22.9%) were not supported by the guidelines/guidance documents.

The remaining 5.0% of tests ordered for overweight/obesity each accounted for <1% of total pathology tests ordered for overweight/obesity and were not checked against guidelines/guidance.

Comments on guidelines/guidance documents

Most guidelines/guidance recommend testing in the assessment of overweight/obesity only. No recommendations are made for testing in ongoing management.

The majority of overweight/obesity contacts in BEACH are for ongoing management, as are the majority of the pathology tests ordered for this problem (only 15% of problems are for new cases of overweight/obesity, accounting for 26.5% of pathology testing).

Future growth in pathology ordering?

There is a considerable gap between the proportion of patients who are overweight/obese and the management rate of overweight/obesity.

- With increasing public awareness (e.g. Measure Up campaign) it is likely that the management rate of overweight and obesity in general practice will increase.
- A change in policy will influence the management rate (e.g. a new MBS item)
- If the management rate increases there will be a corresponding increase in the number of pathology tests even with no change in pathology test ordering.

Extrapolated example of the effect of a future increase in the management rate

The extrapolations made in this example are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of GP encounters occur in Australia in the future. Increases or decreases in total attendance rates, and/or in the GP test ordering rate would affect the estimates in this example.

Example: If there was a 10 fold increase in the management rate of overweight/obesity in the future:

Scenario 1: No change in the current (2006–08) pathology ordering behaviour of GPs:

- there would be 5.2 million tests ordered by GPs for the management of overweight/obesity problems.

Scenario 2: If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.65 million tests ordered by GPs (50.9% of the 5.2 million tests)

Scenario 3: If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 3.75 million tests ordered by GPs (72.1% of the 5.2 million tests)

One-fifth (22.9%) of the 5.2 million tests would not be supported by the guidelines/guidance documents. The remaining 5.0% of tests ordered for overweight/obesity were not evaluated (each accounting for <1% of total pathology tests ordered for overweight/obesity).

9.1 Definition

The overweight/obesity analysis includes problems managed that were labelled by the GP as 'obesity' or 'overweight' for patients aged 18 years and over. This does not represent all encounters with overweight/obese patients, only those who are being actively managed for overweight or obesity at the encounter. It also does not include GP management of overweight/obesity when it is recorded as part of the management of other morbidity (e.g. weight management advice in the management of hypertension).

In this study the method(s) used by the GP to define the problem as obesity or overweight in the patients is not known. It may be clinical opinion, calculation of body mass index (BMI), waist measurement, weight measurement, or a combination of the above indications. (Note: GPs do not specifically record the problem as a BMI>=30, or BMI 25–29.9)

Overweight and obesity were combined to provide a larger sample with greater statistical power than obesity alone would have provided. In addition, some guidelines provide guidance on the management of both overweight and obesity. If a patient is overweight they are at considerable risk of progressing to obesity. Hence the WHO regards overweight as preobesity.[1]

The analysis of pathology ordering for overweight and obesity was limited to patients aged 18 years and over because:

- different guidance is provided for management of overweight/obesity in children and adolescents compared with adults
- the vast majority of encounters (95.1%) involving the management of overweight/obesity were with adult patients (18+years).

9.2 Background

- Prevalence of overweight/obesity among Australians aged 18 years and over was estimated to be 62% in the 2007–08 National Health Survey (NHS). The prevalence of overweight/obesity was higher among males (68%) than females (55%). The NHS study used measured height and weight to calculate BMI.[2]
- A substudy of adults at general practice encounters is conducted in the BEACH study. It uses self-reported height and weight to calculate BMI for a subsample of approximately 30,000 adult patients per year. This substudy has shown there was a significant increase in the prevalence of overweight and obesity in adult attendees in general practice over the last decade, from 51.1% in 1998–98 to 59.3% in 2007–08. An increase was also apparent in the years of this study, from 54.3% of patients being overweight or obese in 2000–01 to 59.3% in 2007–08.[3]
- The prevalence of overweight/obesity calculated in the BEACH study uses height and weight alone without attempting to identify patients for whom standard BMI cutoffs may not apply (e.g. athletes, certain ethnic backgrounds).[1]
- Obesity was named as a National Health Priority Area in April 2008 at the Australian Health Ministers' Conference due to the burden of chronic disease currently caused by obesity.[4]
- High body mass was responsible for 7.5% of the total burden of disease and injury in Australia in 2003.[5]
- The direct cost of obesity in 2008 was estimated to be $8.3 billion and the total cost, including the cost of lost wellbeing, was estimated to be $58.2 billion.[6]
- The NHMRC invested over $68.9 million in research relating to overweight and obesity between 2000 and 2007.[7]
- Obesity is one of the areas targeted by the National Preventative Taskforce. A National Obesity Strategy is due to be developed by mid 2009. A technical report by the Obesity Working Group of the taskforce, 'Obesity in Australia: a need for urgent action' was published in October 2008.[8] It's recommendations include:

- 'strengthen, upskill and support healthcare workers and the public health workforce to support people in making healthier choices' —this suggests that primary care workers will have an increasing role in the management of obesity in the future.
- 'develop and disseminate evidence-based clinical guidelines and other multidisciplinary training packages for health and community workers.'[8]

- There have been several national and state-based programs that aim to reduce the prevalence of overweight and obesity. A recent example from the Australian Better Health Initiative, is the 'Measure Up' campaign[9] (which the Government is planning to extend[10]).
- With increasing public awareness it is likely that the management rate of overweight and obesity in general practice will increase. The recommendations of the Obesity Working Group suggest that primary care workers will have an increasing role in the management of obesity in the future.[8]
- If the management rate of overweight/obesity increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering for overweight/obesity.

9.3 Management rate in Australian general practice

Obesity or overweight was managed at 7,797 encounters with adult patients (1.2% of adult encounters) by 3,677 GPs between April 2000 and March 2008. The management of obesity accounted for 71.6% of these encounters and overweight for the remaining 28.4% (Table 9.1).

Overweight/obesity was managed at a rate of 1.2 per 100 adult general practice encounters (Table 9.1). This equates to approximately 1 million encounters nationally per year where overweight/obesity is managed by GPs.

New cases of overweight/obesity accounted for 14.6% of overweight/obesity problems. The problem is considered new if, it is a new problem to the patient or a new episode of a recurrent problem, and the patient has not been treated for that problem by any medical practitioner before (Table 9.3).

Table 9.1: Summary of overweight/obesity data set (adult patients), 2000–08

Variable	Number	Rate per 100 total adult encs (*n*=666,135)	95% LCL	95% UCL	Per cent of total adult problems (*n*=1,033,757)	Management: encounter ratio
General practitioners	3,677	—	—	—	—	—
Overweight/obesity encounters	7,797	—	—	—	—	—
Overweight/obesity problems managed	7,797	1.2	1.1	1.2	0.8	1:82
Obesity	5,598	0.8	0.8	0.9	0.5	1:125
Overweight	2,199	0.3	0.3	0.4	0.2	1:333
New overweight/obesity problems managed	1,141	0.17	0.16	0.18	—	—

Note: encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit.

Change in management over time

Previously published data from the BEACH study show that there was a marginal increase in the management of obesity among all patients over the last decade, from 0.5 per 100 encounters (95% CI: 0.4–0.6) in 1998–99 to 0.7 per 100 (95% CI: 0.6–0.8) in 2007–08.[3] While this change occurred over the last decade, during the years of this study (2000–01 to 2007–08) there was no change in the management rate of obesity.[3]

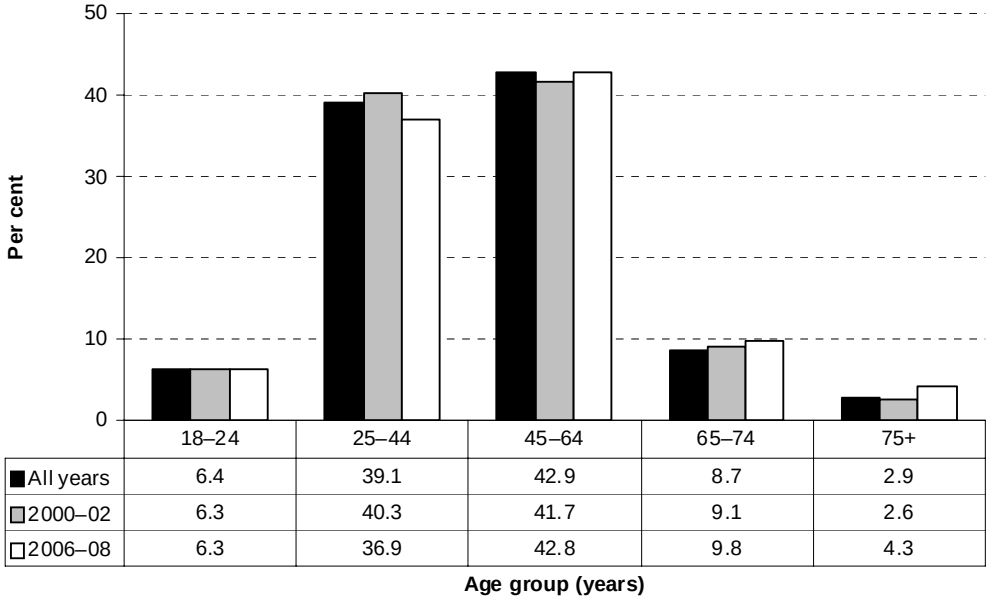
Similarly in this study, there was no significant change in the management rate of overweight/obesity between 2000–02 and 2006–08, managed at a rate of 1.2 per adult 100 encounters at both time points (Table 9.4). That is equivalent to one occurrence management of overweight/obesity per 82 encounters with adult patients.

Age distribution

The age distribution of adult patients with overweight/obesity managed at general practice encounters 2000–08 is presented in Figure 9.1.

Patients being managed for overweight/obesity were most often aged 45–64 years (42.9%), followed by patients aged 25–44 years (39.1%), 65–74 years (8.7%), 18–24 years (6.4%) and 75+ years (2.9%) (Figure 9.1).

The age distribution of adult patients at overweight/obesity encounters did not change significantly over the period of this study (2000–02 compared with 2006–08) (Figure 9.1).



	18–24	25–44	45–64	65–74	75+
All years	6.4	39.1	42.9	8.7	2.9
2000–02	6.3	40.3	41.7	9.1	2.6
2006–08	6.3	36.9	42.8	9.8	4.3

Figure 9.1: Age distribution of adult patients with overweight/obesity managed at general practice encounters, 2000–08 (all years), 2000–02, and 2006–08

Figure 9.2 compares the age-specific rates of management of overweight/obesity among adult patients and the age-specific prevalence of overweight/obesity among patients encountered in general practice. This figure should be interpreted as follows—for patients

aged 45–64 years, 1.6% were managed for obesity or overweight at the encounter, whereas 68.1% of patients attending in this age group were obese or overweight.

There is a considerable gap between the proportion of patients who are overweight/obese and the management rate of overweight/obesity. The combination of prevalence and encounter data suggests there were 49 overweight/obese adult patients seen by GPs per 1 management encounter for overweight/obesity. This illustrates that there is huge scope for increase in the management rate of overweight/obesity. If the management rate of overweight/obesity increases there will be a corresponding increase in pathology ordering based on the current pattern of pathology test ordering for overweight/obesity.

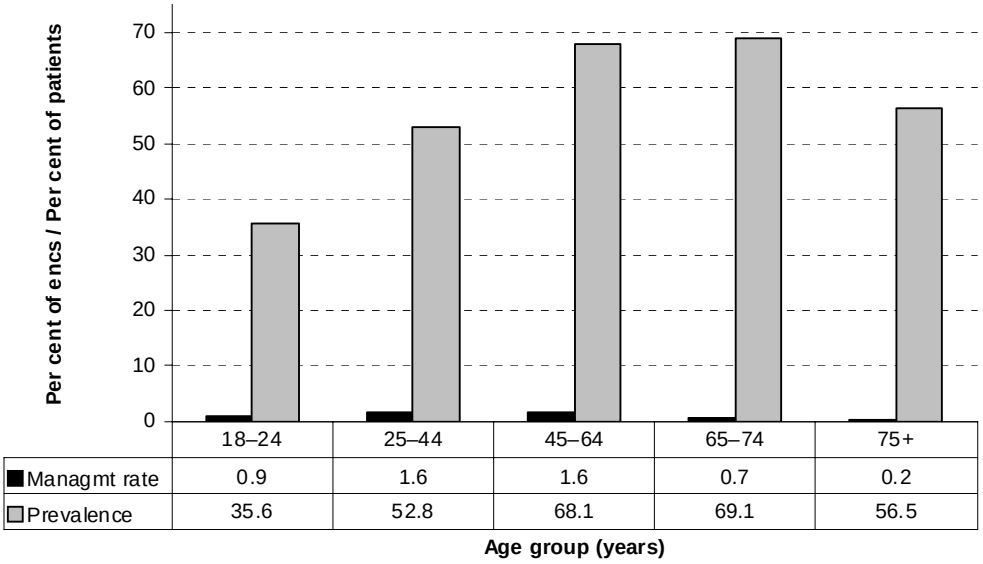


Figure 9.2: Age-specific rate of management of overweight/obesity and age-specific rates of overweight/obesity in adult patients

Table 9.2 shows the number of problems managed per encounter where overweight/obesity was managed and the number managed at all BEACH encounters in 2000–08. A maximum of 4 problems can be recorded per encounter in BEACH. Encounters involving the management of overweight/obesity were more complex, being more likely to have multiple (2, 3 or 4) problems managed per encounter than average general practice encounters.

Table 9.2: Number of problems managed at overweight/obesity encounters and total encounters

	Overweight/obesity encs (2000–08)				All BEACH encs (2000–08)			
Number of problems managed	Number	Per cent of problems	95% LCL	95% UCL	Number	Per cent of problems	95% LCL	95% UCL
One problem	1,704	21.9	20.3	23.5	502,522	64.1	63.7	64.4
Two problems	3,272	42.0	40.7	43.2	193,452	24.7	25.5	24.9
Three problems	1,972	25.3	24.1	26.5	67,837	8.7	8.5	8.8
Four problems	849	10.9	10.0	11.7	20,489	2.6	2.5	2.7

Note: Encs—encounters; LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08.

9.4 Pathology ordering behaviour

Pathology was ordered at a rate of 39.3 per 100 overweight/obesity problems managed in 2000–08 for adult patients. More than one in ten overweight/obesity problems (13.6%) resulted in at least one pathology order (Table 9.3).

Once the decision to order a pathology test for overweight/obesity was made the GP ordered on average 2.75 pathology tests per tested problem (Table 9.3). Pathology ordered for overweight/obesity problems accounted for 1.0% of all pathology tests recorded from April 2000 to March 2008.

Table 9.3: Summary of pathology ordering for overweight/obesity (adult patients), 2000–08

Variable	Number	Per cent / Rate of overweight/obesity problems	95% LCL	95% UCL
Overweight/obesity problems managed	7,797	100.0	—	—
New problems (% of overweight/obesity problems)	1,141	14.6	13.7	15.6
Pathology (Rate per 100 overweight/obesity problems)	2,917	37.4	34.4	40.4
At least one pathology order (% of overweight/obesity problems)	1,062	13.6	12.6	14.6
Number of tests/batteries per 100 tested overweight/obesity problem	—	274.7	265.5	283.8

Note: LCL—lower confidence limit; UCL—upper confidence limit.

Changes over time, 2000–02 to 2006–08

The proportion of total pathology tests/batteries accounted for by management of overweight/obesity problems did not change (0.9% in 2000–02 and 1.0% in 2006–08.)

The pathology ordering rate increased significantly over the duration of this study, from 30.7 per 100 overweight/obesity contacts in 2000–02 to 47.1 per 100 contacts in 2006–08. This increase was due to a significant increase in:

- the likelihood of at least one test/battery of tests being ordered in the management of overweight/obesity problems, from 11.7% of contacts in 2000–02 to 16.5% in 2006–08.

There was no significant change in the number of tests ordered per tested overweight/obesity problem (262.3 per 100 tested contacts in 2000–02 and 285.9 per 100 in 2006–08) (Table 9.4).

Extrapolation of pathology ordering behaviour

When these data were extrapolated to the number of GP encounters claimed for adults through Medicare nationally the results suggest there were approximately:

- 95,000 more encounters involving the management of overweight/obesity in 2006–08 (1.1 million per annum) than in 2000–02 (1 million per annum)
- 65,000 more overweight/obesity contacts involving at least one pathology request (tested contacts) in 2006–08 (180,000 per annum) than in 2000–02 (120,000 per annum)
- 210,000 more tests/batteries of tests ordered for overweight/obesity problems in 2006–08 (520,000 per annum) than in 2000–02 (310,000 per annum) (results not shown).

Of the estimated 17.7 million additional tests/batteries ordered by GPs in 2006–08 (51.3 million tests/batteries ordered by GPs per annum), compared with 2000–02 (33.6 million per annum), 1.2% was attributable to pathology ordering in the management of overweight/obesity. The increase in the volume of pathology ordering for overweight/obesity problems in general practice was due to a combination of factors:

- the increase in the total number of GP encounters in Australia (from 100.3 million per annum in 2000–02 to 106.5 million per annum in 2006–08)
- a change in the GP pathology ordering behaviour for overweight/obesity—an increase in the likelihood of at least one test being ordered.

Table 9.4: Changes in the management of overweight/obesity over time (adult patients), 2000–02 to 2006–08

	2000–02							2006–08							
Variable	Number	Rate per 100 total adult encounters (*n*=166,770)	95% LCL	95% UCL	Per cent / Rate of ov/ob probs (*n*=1,975)	95% LCL	95% UCL	Number	Rate per 100 total adult encounters (*n*=161,571)	95% LCL	95% UCL	Per cent / Rate of ov/ob probs (*n*=1,935)	95% LCL	95% UCL	Change
General practitioners	954	—	—	—	—	—	—	864	—	—	—	—	—	—	—
Overweight/obesity encounters	1,975	—	—	—	—	—	—	1,935	—	—	—	—	—	—	—
Overweight/obesity problems managed	1,975	1.2	1.1	1.3	—	—	—	1,935	1.2	1.1	1.3	—	—	—	—
Obesity	1,458	0.9	0.8	1.0	—	—	—	1,418	0.9	0.8	1.0	—	—	—	—
Overweight	517	0.3	0.3	0.4	—	—	—	517	0.3	0.3	0.4	—	—	—	—
New overweight/obesity problems	292	0.18	0.15	0.20	14.8	12.9	16.7	242	0.15	0.12	0.18	12.5	10.4	14.6	—
Pathology (Rate per 100 overweight/ obesity problems)	606	—	—	—	30.7	24.6	36.8	912	—	—	—	47.1	39.9	54.4	↑
At least one pathology order (% of overweight/obesity problems)	231	—	—	—	11.7	9.7	13.7	319	—	—	—	16.5	14.1	18.9	↑
Number of tests/batteries per 100 tested overweight/ obesity problem	—	—	—	—	262.3	241.4	283.3	—	—	—	—	285.9	268.2	303.6	—

Note: Ov/ob—overweight/obesity; probs—problems; LCL—lower confidence limit; UCL—upper confidence limit. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change and — indicates no change.

9.5 Types of pathology tests ordered

Table 9.5 shows the distribution of pathology tests/batteries ordered for overweight/obesity in 2000–08 by MBS groups and the most common individual types of pathology tests ordered.

- Chemistry tests were the group of tests most often ordered, at a rate of 32.5 per 100 overweight/obesity managed contacts. The most common chemistry tests ordered were:
  - lipid tests (9.2 per 100 overweight/obesity contacts)
  - glucose/glucose tolerance tests (7.7 per 100 contacts)
  - thyroid function tests (5.3) (Table 9.5).
- Haematology tests (5.3 per 100 contacts), in particular full blood counts (4.8 per 100), were also commonly ordered in the management of overweight/obesity (Table 9.5).

One quarter of pathology tests (26.2%) were ordered for 'new' cases of overweight/obesity, new cases accounted for 14.6% of overweight/obesity problems. 'New' overweight/obesity problems have a higher test rate than that for ongoing management. However the majority of pathology tests ordered for overweight/obesity were for ongoing management or monitoring (Table 9.5).

Changes in types of pathology tests ordered 2000–02 to 2006–08

Table 9.6 compares the pathology ordering for overweight/obesity problems in 2000–02 with 2006–08. The shaded results highlight significant differences.

- There were significant increases in the order rate of:
  - thyroid function tests—70% increase
  - full blood counts—68% increase
  - 'other' chemistry tests—450% increase
- There was also a marginal increase in the order rate of multibiochemical analysis (Table 9.6).

Table 9.5: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for overweight/obesity, 2000–08

	Pathology for all overweight/obesity problems						Pathology for new overweight/obesity problems		
Pathology test ordered	Number	Per cent of all pathology for overweight/obesity	Per cent of group	Rate per 100 overweight/obesity probs (*n*=7,797)	95% LCL	95% UCL	Number	% path for new cases	Rate per 100 new overweight/obesity probs (n=1,141)
Chemistry	**2,412**	**82.7**	**100.0**	**30.9**	**28.4**	**33.5**	**643**	**26.7**	**56.4 (48.5–64.2)**
Lipids*	676	23.2	28.0	8.7	7.8	9.5	178	26.3	15.6 (13.1–18.1)
Glucose/glucose tolerance*	550	18.9	22.8	7.1	6.3	7.8	144	26.2	12.6 (10.1–15.1)
Thyroid function*	392	13.4	16.3	5.0	4.5	5.6	119	30.4	10.4 (8.5–12.3)
Liver function*	248	8.5	10.3	3.2	2.7	3.6	70	28.2	6.1 (4.5–7.7)
EUC*	197	6.8	8.2	2.5	2.1	2.9	47	23.9	4.1 (2.9–5.4)
Multibiochemical analysis*	149	5.1	6.2	1.9	1.6	2.3	47	31.5	4.1 (2.9–5.4)
Hormone assay*	53	1.8	2.2	0.7	0.4	0.9	16	30.2	1.4 (0.6–2.2)
Chemistry; other*	46	1.6	1.9	0.6	0.4	0.8	8	17.4	0.7 (0.2–1.2)
Ferritin*	30	1.0	1.2	0.4	0.2	0.6	3	10.0	0.3 (0.0–0.6)
Haematology	**408**	**14.0**	**100.0**	**5.2**	**4.6**	**5.8**	**112**	**27.5**	**9.8 (7.8–11.8)**
Full blood count	369	12.7	90.4	4.7	4.2	5.3	101	27.4	8.9 (7.1–10.6)
ESR	30	1.0	7.4	0.4	0.2	0.5	9	30.0	0.8 (0.3–1.3)
Other NEC	**53**	**1.8**	**100.0**	**0.7**	**0.5**	**0.9**	**10**	**18.9**	**0.9 (0.3–1.4)**
Other pathology groups	**44**	**1.5**	**100.0**	**—**	**—**	**—**	**7**	**15.9**	**—**
Total pathology tests	**2917**	**100.0**	—	**37.4**	**34.4**	**40.4**	**772**	**26.5**	**67.7 (58.6–76.7)**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations. Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 9.6: Distribution of pathology orders across MBS pathology groups and most frequent individual test orders within each group for overweight/obesity, 2000–02 compared with 2006–08

	2000–02						2006–08						
Pathology test ordered	**Number**	**Per cent of all pathology for ov/ob**	**Per cent of group**	**Rate per 100 ov/ob probs[(a)]**	**95% LCL**	**95% UCL**	**Number**	**Per cent of all pathology for ov/ob**	**Per cent of group**	**Rate per 100 ov/ob probs[(a)]**	**95% LCL**	**95% UCL**	**Change**
Chemistry	**499**	**82.3**	**100.0**	**25.3**	**20.2**	**30.3**	**754**	**82.7**	**100.0**	**39.0**	**32.7**	**45.2**	↑
Lipids*	153	25.3	30.7	7.8	6.0	9.5	208	22.8	41.7	10.8	8.8	12.7	—
Glucose/glucose tolerance*	127	21.0	25.4	6.4	4.8	8.0	164	18.0	21.8	8.5	6.7	10.3	—
Thyroid function*	72	11.9	14.4	3.7	2.7	4.6	122	13.4	24.4	6.3	5.0	7.6	↑
Liver function*	45	7.4	9.0	2.3	1.3	3.2	78	8.6	15.6	4.0	2.9	5.1	—
EUC*	39	6.4	7.8	2.0	1.3	2.7	63	6.9	12.6	3.3	2.3	4.2	—
Multibiochemical analysis*	25	4.1	5.0	1.3	0.7	1.8	50	5.5	10.0	2.6	1.8	3.4	↑
Chemistry; other*	4	0.7	0.8	0.2	0.0	0.4	21	2.3	4.2	1.1	0.6	1.6	↑
Hormone assay*	13	2.2	2.6	0.7	0.2	1.1	14	1.5	2.8	0.7	0.3	1.2	—
Ferritin*	8	1.3	1.6	0.4	0.1	0.7	12	1.3	2.4	0.6	0.1	1.1	—
Prostate specific antigen*	6	1.0	1.2	0.3	0.0	0.6	9	1.0	1.8	0.5	0.2	0.8	—
Haematology	**83**	**13.7**	**100.0**	**4.2**	**3.0**	**5.4**	**135**	**14.8**	**100.0**	**7.0**	**5.6**	**8.4**	↑
Full blood count	75	12.4	90.4	3.8	2.7	4.9	123	13.5	91.1	6.4	5.1	7.6	↑
ESR	6	1.0	7.2	0.3	0.1	0.5	11	1.2	8.1	0.6	0.2	0.9	—
Other NEC	**17**	**2.8**	**100.0**	**0.9**	**0.3**	**1.4**	**17**	**1.9**	**100.0**	**0.9**	**0.5**	**1.3**	**—**
Other test NEC*	5	0.8	29.4	0.3	0.0	0.5	12	1.3	70.6	0.6	0.3	1.0	—
Blood test	10	1.7	58.8	0.5	0.1	0.9	4	0.4	23.5	0.2	0.0	0.4	—
Other pathology groups	**7**	**1.2**	**100.0**	**—**	**—**	**—**	**6**	**0.7**	**100.0**	**—**	**—**	**—**	**—**
Total pathology tests	**606**	**100.0**	**—**	**30.7**	**24.6**	**36.7**	**912**	**100.0**	**—**	**47.1**	**39.9**	**54.4**	↑

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) The total number of overweight obesity problems in 2000–02 was 1,975 and in 2006–08 was 1,935.

Note: Ov/ob—overweight/obesity; probs—problems; LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations. Shading indicates a statistically significant change between 2000–02 and 2006–08. The direction and type of change is indicated for each measure between 2000–02 and 2006–08: ↑/↓ indicates a statistically significant change, ↑/↓ indicates a marginal change, and — indicates no change.

9.6 Guidelines for the management of overweight or obesity

Only guidelines for the management of overweight and obesity for adult patients were considered in this study. The majority of guidelines recommended pathology testing in the assessment of obese patients prior to treatment. The assessment and related pathology tests recommended generally fall into two areas: diseases and conditions associated with metabolic consequences; and possible underlying causes of obesity.

Guidelines reviewed were:

- 'Clinical practice guidelines for the management of overweight and obesity in adults' [National Health and Medical Research Council, NHMRC, complete guideline, Australia, 2003].[11]
- 'Overweight and obesity in adults: a guide for general practitioners' [NHMRC, GP guide, Australia, 2003].[12]
- 'Canadian clinical practice guidelines on the management and prevention of obesity in adults and children' [Obesity Canada Clinical Practice Guidelines Expert Panel, 2006].[13]
- Guidelines on management of adult obesity and overweight in primary care [National obesity forum, NOF, UK, 2006][14] and in depth assessment resource for health professionals [UK, 2004].[15]
- 'Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children' [UK, National Collaborating Centre for Primary Care & the Centre for Public Health Excellence at NICE, NICE, 2006][16] and the abbreviated 'Quick reference guide 2 for the National Health Service' [UK NICE 2006].[17]
- 'The practical guide to the identification, evaluation, and treatment of overweight and obesity in adults' [US, NHLBI Obesity Education Initiative Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, National Heart, Lung, and Blood Institute, NHLBI 2000].[18]

Other Australian sources of guidance for GPs reviewed were:

- 'RCPA manual'—Manual of use and interpretation of pathology tests [The Royal College of Pathologists of Australasia (RCPA), 2004].[19]
- Murtagh's general practice, obesity section [Murtagh 2007].[20]
- 'Patient presentations in general practice', section on patients presenting for management of overweight [Steven 1999].[21]

Other guidelines/guidance that were reviewed but not included in tables 3.7 and 3.8 were:

- the draft Scottish SIGN guideline 'Management of obesity: a national clinical guideline' was released as a draft in October 2008.[22] It was not included, as the guideline is not finalised. The recommendations are similar to those in the NICE guideline.
- 'Screening for obesity in adults: recommendations and rationale' [US preventive service task force 2003].[23] Referred only to screening for overweight/obesity.
- Royal Australian College of General Practitioners (RACGP) Overweight and obesity policy (2006)[24] and Guidelines for preventive activities in general practice 'The Redbook' (2004).[25] This document referred to the NHMRC guidelines.

- National heart foundation— General practice fact sheet: Management of overweight and obesity in adults (2007).[26] This document referred to the NHMRC guidelines.
- Management of obesity paper [Proeitto and Baur, MJA 2004].[27] Insufficient testing detail provided in the paper to be included.

9.7 Application of the guidelines

Evaluation of GP pathology ordering against guidelines

Table 9.7 provides a summary of the individual tests ordered for overweight/obesity and the level of support provided in the guidelines/guidance for each: yes—supported; unclear guidance; no—not supported:

- 52.3% of tests ordered for management of overweight/obesity were supported by the guidelines and guidance documents
- for one-fifth (20.1%) of tests guidance was unclear
- 21.5% of tests ordered by the GPs were not supported by the guidelines/guidance documents.

The individual tests/batteries listed in Table 9.7 account for 93.9% of pathology tests/batteries ordered for overweight/obesity because only the most common individual pathology tests ordered for overweight/obesity are included (each accounted for >1% of tests for overweight/obesity).

Table 9.7: Summary of support for GP pathology ordering for the most frequent individual test orders for overweight/obesity, 2000–08

Pathology test supported by guidelines/guidance	Number	Per cent of all pathology tests for overweight/obesity
YES	**1,527**	**52.3**
Lipids*	676	23.2
Glucose/glucose tolerance*	550	18.9
Liver function*	248	8.5
Hormone assay*	53	1.8
UNCLEAR	**587**	**20.1**
Thyroid function*	392	13.4
Multibiochemical analysis*	149	5.1
Chemistry; other*	46	1.6
NO	**626**	**21.5**
Full blood count	369	12.7
EUC*	197	6.8
Ferritin*	30	1.0
ESR	30	1.0
Subtotal (n, % of total tests included in the table)	*2,740*	*93.9*
Total pathology tests	**2,917**	**100.0**

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included.

Table 9.8 compares the commonly ordered pathology tests/batteries for overweight/obesity by GPs with the guidelines' and guidance documents' recommended tests for overweight/obesity. The key explaining the colours used in the table is below Table 9.8. Briefly, dark green tests are specifically supported, light green have partial support, red tests are advised against, orange tests are those for which support cannot be determined, and pink tests were not mentioned in the guideline/guidance.

Lipid and glucose tests

There was strong agreement between guidelines for the ordering of lipid tests and glucose tests in the management of overweight and obesity, to identify diabetes, impaired glucose tolerance and hyperlipidaemia.

In BEACH, lipid tests accounted for 22.8% of pathology tests ordered for overweight/obesity problems and glucose/glucose tolerance tests accounted for 18.0% of tests in 2006–08. Over the period of the study (2000–02 to 2006–08) the order rate of these tests for overweight/obesity problems did not change.

Thyroid function tests

There was mixed support for use of thyroid function tests (TFTs) in the management of overweight/obesity.

- There was contradiction within guidelines regarding testing for thyroid disease (see comments in contradictory statements section below).
- The rate of thyroid function testing for overweight/obesity increased over the period of this study (2000–02 to 2006–08). Guidance in this area needs to be clarified.

In BEACH, TFTs accounted for 13.4% of tests/batteries ordered for overweight/obesity in 2006–08. Over the period of the study (2000–02 to 2006–08) the rate of TFTs almost doubled, from 3.7 per 100 overweight/obesity contacts in 2000–02 to 6.3 per 100 in 2006–08.

Full blood count, ferritin and erythrocyte sedimentation rate

Full blood counts (FBCs), ferritin and erythrocyte sedimentation rate (ESR) tests were not mentioned by the majority of the guidance documents. With the exception of one guideline that stated that ordering the FBC should be considered.

In BEACH, FBCs accounted for 13.5% of tests for overweight/obesity in 2006–08. The rate of FBCs ordered for overweight/obesity almost doubled over the period of this study (2000–02 to 2006–08), from 3.8 per 100 contacts in 2000–02 to 6.4 per 100 in 2006–08.

Ferritin tests accounted for 1.3% and ESR tests accounted for 1.2% of tests for overweight/obesity in 2006–08. Over the period of the study (2000–02 to 2006–08) the order rate of ferritin and ESR tests did not change.

Liver function tests

There was reasonable support for liver function tests (LFT) to identify fatty liver disease among overweight/obesity patients.

In BEACH, LFTs accounted for 8.6% of pathology tests/batteries ordered for overweight/obesity in 2006–08. Over the period of the study (2000–02 to 2006–08) the order rate of LFTs for overweight/obesity problems did not change.

Electrolytes, urea and creatinine

There was little support for use of electrolyte, urea and creatinine (EUC) tests in the management of overweight/obesity. Testing of kidney function is recommended in one source (Murtagh) and listed for consideration in two others (NOF and NHLBI). It was not mentioned in the majority of guidelines/guidance.

In BEACH, EUCs accounted for 6.9% of pathology tests/batteries ordered for overweight/obesity in 2006–08. Over the period of the study (2000–02 to 2006–08) the order rate of EUCs for overweight/obesity problems did not change.

Hormone assay

The hormone assay test group includes all types of hormone tests including sex hormones and cortisol. In the guidelines/guidance reviewed:

- There were strong recommendations for sex hormone testing in two separate guidelines (NHMRC and Canadian). It was also listed for consideration in two other sources (NOF guideline and Murtagh's general practice). The rationale for the test was to identify polycystic ovary syndrome, and infertility problems.
- Cortisol tests were recommended for consideration by four separate sources of guidance if symptoms of Cushing's disease were present.

In BEACH, hormone assay accounted for 1.5% of tests/batteries ordered for overweight/obesity in 2006–08. Over the period of the study (2000–02 to 2006–08) the order rate of hormone assay for overweight/obesity problems did not change.

Multibiochemical analysis

The MBA test includes a large number of analytes and the specific analytes included vary between laboratories therefore it is not possible to determine whether this test is supported. However, indiscriminate testing does not meet evidence-based principles.

Selected components of the MBA would (e.g. LFT) have support in certain circumstances as discussed above.

In BEACH, MBA tests accounted for 5.5% of pathology tests for overweight/obesity in 2006–08. Over the period of the study (2000–02 to 2006–08) there was a marginal increase in the rate of MBA tests ordered for overweight/obesity, from 1.3 per 100 contacts in 2000–02 to 2.6 per 100 in 2006–08.

'Other chemistry' tests

'Other chemistry tests' refers to a group of tests. The tests included are listed in Appendix 3. The 46 tests ordered in this group represent a diverse range of individual tests therefore it is not possible to determine whether this group of tests were supported by the guidance.

In BEACH, 'other chemistry' tests accounted for 2.3% of tests for overweight/obesity in 2006–08. During this study (2000–02 to 2006–08), the rate of 'other chemistry tests' ordered in the management of overweight/obesity more than doubled from 0.2 per 100 contacts in 2000–02 to 1.1 per 100 in 2006–08.

Table 9.8: Summary of guideline/guidance recommendations by most frequent individual test orders for overweight/obesity, 2000–08

Pathology test ordered	NHMRC total guideline 2003	NHMRC GP guide 2003	Canadian guideline 2006	NOF guideline 2006	NOF full assess 2004	NICE NHS guide 2006	NHLBI 2000	Murtagh 2007	Steven 1999	RCPA manual 2004	No. tests (n=2917)	% all ov/ob path
Lipids*							Yes + consider		Yes if primary obesity		676	23.2
Glucose/glucose tolerance*							Yes + consider		Yes if primary obesity		550	18.9
Thyroid function*			Not unless clinically indicated		TSH only				Yes if primary obesity		392	13.4
Full blood count											369	12.7
Liver function*											248	8.5
EUC*											197	6.8
Multibiochemical analysis*[(a)]											149	5.1
Hormone assay*	Polycystic ovary and fertility	Polycystic ovary and fertility	Polycystic ovary syndrome	Cortisol and sex hormones	Cortisol			Cortisol and sex hormones	Cortisol	Cortisol	53	1.8
Chemistry; other*[(b)]											46	1.6
Ferritin*											30	1.0
ESR											30	1.0

* Includes multiple ICPC-2 PLUS codes (see Appendix 3).

(a) Multibiochemical analysis (MBA) potentially includes a combination of a broad group of tests. The MBS chemical analysis group includes a wide variety of biochemical tests (such as those in MBS item 66500).

(b) 'Chemistry; other' refers to a group of individual chemistry tests (see Appendix 3).

Note: Only the groups of tests/individual tests accounting for >=1% of all pathology tests for the selected problem are included. LCL—lower confidence limit; UCL—upper confidence limit; NEC—not elsewhere classified; also see Abbreviations.

Key to Table 9.8

Colour	Description
	The document specifically recommended this test. Any notes within the cell indicate further detail. For example, a specific disease to test for within subset of patients; mixed guidance within a guideline (yes + consider).
	The document stated that this test should be considered. Any notes within the cell indicate further detail (e.g. the clinical situation in which ordering the test is appropriate)
	Unable to determine guidance: • MBA tests include mixed content for which it is not possible to determine guideline agreement (see footnote (a) above). • 'Other chemistry' tests include a group of individual chemistry tests (see footnote (b) above).
	Guideline specifically stated not to do this test. Additional information is supplied if the guideline stated not to do the test unless clinically indicated.
	Guideline did not mention this test

Evaluation of the guidelines and guidance documents

Difficulties with identifying pathology tests recommended within guidelines

There was not a clear section in any of the guidelines that specifically stated the pathology tests to be done in each phase of management. Pathology tests were often included in the text of the assessment section of the overweight/obesity guidelines.

There was mixed terminology used within the guidelines to refer to testing e.g. 'diagnostic testing', 'laboratory investigations', 'diagnostic investigations', 'assessment', the specific test name or the disease to be tested for. This made searching the guideline documents (often 200+ pages) difficult.

The Australian guideline and the related GP guide (NHMRC full guideline and GP guide for adults) did not specifically mention any pathology tests. The guideline lists conditions that should be tested for in the assessment phase of the management of overweight or obese patients. These conditions (associated metabolic consequences) were listed by the relative risk of developing the condition and the guideline stated 'standard procedures are used to test for these'.

Testing for phase of management

Guidelines for the management of overweight/obesity logically followed the 'normal' management pathway from identification, to assessment, to management, to monitoring.

Pathology tests were, in the main, only recommended in the assessment phase (i.e. prior to starting treatment) to identify:

- the presence/absence of other morbidities associated with overweight/obesity
- possible medical causes for overweight/obesity.

The Canadian guideline was the only guideline to make a recommendation about retesting. It made a consensus recommendation to retest glucose and lipid levels 'at regular intervals'.

Multiple guidelines commented that obesity (and overweight) is a chronic condition that requires long-term ongoing management:

> *'regular monitoring and encouragement should be provided over the long term, possibly for life'*[11]

However, no recommendations (evidence-based or consensus), with the exception of the Canadian guideline, were made about the need to assess the absence or presence of associated morbidities in the future.

In the BEACH data, only 15% of overweight/obesity problems were for 'newly diagnosed' cases of overweight/obesity. Pathology tests/batteries ordered for new cases accounted for 26.5% of all pathology tests. Therefore, the majority of overweight/obesity contacts were for ongoing management, as were the majority of the pathology tests ordered for this problem.

Contradictory statements

Conflicting statements were sometimes made within the guidelines, and between the abbreviated guideline and the full guideline.

The information regarding thyroid function tests in the NHMRC guideline and NHMRC GP guide is a good example.

- Thyroid disease was not mentioned as a disease that should be tested for in the assessment of overweight/obese patients in the full guideline
- In the GP guide, a new category 'medical conditions' was included that was not included in the overall guideline section of reasons for energy imbalance. The GP guide stated: *'Medical conditions: Certain medical conditions, for example, hypothyroidism, are known causes of overweight.'*
- This was a contradiction to the statement made in the overall guideline in the alternative treatment section regarding hypothyroidism:
  '*Although obesity can result from hypothyroidism, very few cases of obesity are caused by the condition*.'
- In the full guideline hypothyroidism was also listed as a condition that places patients 'at risk' of obesity, although the guideline noted the monogenetic conditions (e.g. Cushing's syndrome, Prader-Willi syndrome and hypothyroidism) generally show up earlier in life.

The NHLBI guideline listed the lipids and glucose tests as recommendations in one section of the guideline and as tests to be considered in another section.

The National Obesity Forum (NOF) guideline listed many tests for GPs to consider and in the separate 'full assessment' resource made test recommendations for the initial assessment of overweight/obesity but did not mention some of the tests that were listed for consideration in the guideline.

The NHRMC GP guide listed the conditions to test for in the assessment phase using standard testing. The GP guide also included a Weight management tool, which prompts for results of triglycerides, cholesterol, insulin, glucose, LFT, and endocrine tests in the assessment of overweight/obese patients. However, insulin is not a recommended standard pathology test to use for testing any of the listed morbidities (e.g. diabetes, insulin resistance).

Comorbidities in general practice patients

The recommendations in guidelines reflect the comorbidities and possible causes of obesity. In a recent (2008) BEACH SAND substudy (unpublished) of 5,900 patients at GP encounters, patient comorbidities were investigated. Prevalence of obesity (as judged by the GP) in this sample was 8.2%. Of these patients:

- 55.1% also had hypertension
- 28.7% had Type 2 diabetes
- 36.6% had hyperlipidaemia
- 4.4% had thyroid disease (either hyperthyroidism or hypothyroidism)
- 3.1% had chronic renal failure

Note: in the above results patients with multiple other conditions will be counted more than once (e.g. a patient with obesity + hyperlipidaemia + hypertension will be counted twice). Data on prevalence and comorbidities of overweight were not available. Source: unpublished BEACH data.

These data demonstrate that multiple morbidity is common in obese patients (at general practice encounters). Further analysis of these data may provide information on the pretest probability of diseases in obese patients. Analysis may also inform the proportion of patients in whom more frequent monitoring would be recommended on the basis of presence of other diseases.

It is worth noting that the prevalence of obesity reported by GPs in this SAND substudy (8.2%) was only a third of that measured in other BEACH SAND substudies (23.9%). This is due to a difference in how GPs recorded the data. The first prevalence estimate (8.2%) was from a tick a box option, GPs were asked to tick the box if the patient was obese, defined as body mass index, BMI ≥30. The second estimate (23.9%) from 2007–08, used patient-reported height and weight to calculate BMI, obesity was defined as BMI ≥30).[3] The difference in the results may reflect the way the data were collected—as an objective measure (height and weight to calculate BMI) or as a subjective measure (tick box). While the BMI calculation is not appropriate in all patient populations, the difference in the two estimates suggests GPs are not inclined to label patients as obese.

Other comments

Likelihood of underlying cause of overweight/obesity

Murtagh's was the only guidance source that discussed the likelihood that there could be a identifiable cause of secondary obesity (e.g. underlying disease), stating that a cause of secondary obesity would be identifiable in less than 1% of patients.

The assessment section of many guidelines included diseases that could be underlying causes of obesity.

- Many of those that mentioned testing cortisol for Cushings disease did state that the disease was rare.
- The guidelines that included thyroid function testing as a recommendation or consideration did not include a description of the likelihood of the disease being present or absent.

GP awareness of pretest probability of associated conditions or underlying causes of disease among overweight/obese patients would inform the decision to order pathology tests.

Evidence base for overweight

A lot of the available evidence base recommendations were based on is for obesity only. For example, the studies that have identified links to associated morbidities and causative conditions/diseases were in obese patients not in the overweight. Recommendations were made for overweight and obese patients based on this evidence. The causative links may be less clear in overweight patients.

Level of evidence included in guideline

A number of the guidelines reviewed did not present the evidence and/or the level of evidence behind their recommendations.

Those guidelines that were evidence-based include: NHMRC total guideline (2003), Canadian guideline (2006) and the NICE full guideline (2006).

Those guidelines that did not provide sufficient evidence include: NOF guideline (2006), NOF full assessment resource (2004) and the NHLBI guide (2000).

The NICE NHS guide 2006 and the NHMRC GP guide 2003 summarised the associated full evidence guideline and referred to the full guideline for further information.

The other guidance documents did not provide full evidence statements. Murtagh (2007) and Steven (1999) provided some references. The RCPA manual (2004) did not provide the evidence behind guidance.

Pathology tests referred to in guidelines that were not among most frequent tests recorded by GPs

Urinalysis was referred to in two guidelines (Canadian guideline 2006 and NOF guideline 2006) but was not among the most common individual tests. These were not included in the BEACH pathology data as GPs participating in BEACH are specifically instructed not to record dipstick tests.

Two guidelines recommended testing for gout (NHMRC and Canadian). The most common test for gout is urate/uric acid, which was not among the most common individual tests. However, it may have been a part of the MBA testing.

9.8 National implications

Quality of current pathology ordering

Based on the 2006–08 pathology ordering data for overweight/obesity problems we estimate that 520,000 tests were ordered for overweight/obesity problems per year in Australia. Review of the guidelines/guidance suggests:

- 260,000 (50.9%) tests were supported by the guidelines and guidance documents
- 110,000 (21.2%) may or may not be supported due to unclear guidance
- 120,000 (22.9%) were not supported by the guidelines/guidance documents.

The remaining 5.0% of tests ordered for overweight/obesity each accounted for <1% of total pathology tests ordered for overweight/obesity.

Future increases in pathology?

Future increase in management rate of overweight/obesity

There is huge scope for a future increase in the management rate of overweight/obesity at general practice encounters.

- This is illustrated by the enormous gap between the proportion of patients who are overweight/obese and the management rate of overweight/obesity. The combination of prevalence and encounter data suggests that in 2006–08 there were 49 overweight/obese adult patients seen by GPs for every one management occasion of overweight/obesity.
- Currently, considerable attention is being paid to the obesity problem:
  - Obesity is one of the areas targeted by the National Preventative Taskforce. A National Obesity Strategy is due to be developed by mid 2009.[8]
  - One of the recommendations of the Taskforce obesity report (October 2008) was to 'strengthen, upskill and support healthcare workers and the public health workforce to support people in making healthier choices'[8]—this suggests that primary care workers will have an increasing role in the management of obesity in the future.
  - A national initiative was launched in November 2008 'Measure Up' campaign[9] (which the Government is planning to extend[10]).
- With increasing public awareness it is likely that the management rate of overweight and obesity in general practice will increase.
- If the management rate of overweight/obesity increases there will be a corresponding increase in pathology orders for overweight/obesity based on the current pattern of pathology test ordering.

Future increase in pathology ordering

The pathology ordering rate for overweight/obesity increased significantly between 2000–02 and 2006–08. Increases in the pathology ordering behaviour of GPs is likely to continue in the future.

Extrapolated example of increase

The extrapolations made in this section are based on the current BEACH pathology test ordering data (2006–08). Extrapolations are made on the assumption that the same number of general practice encounters occur in Australia in the future—an increase or decrease would affect the extrapolated estimates.

Increase in future management rate of overweight/obesity

For example:

If there was a 10 fold increase in the management rate of overweight and obesity (i.e. the management rate increased from 1 overweight/obesity problem managed per 49 encounters with overweight/obese adults to 10 overweight/obesity problems managed per 49 encounters with overweight/obese adults), with no change in the pathology ordering behaviour of GPs:

- there would be 5.2 million tests ordered yearly by GPs for the management of overweight/obesity problems.

If GPs ordered only the tests strongly supported in the guidelines:

- there would be 2.65 million tests ordered by GPs (50.9% of the 5.2 million tests)

If GPs ordered the tests that were strongly supported and those with mixed support in the guidelines:

- there would be 3.75 million tests ordered by GPs (72.1% of the 5.2 million tests)

One-fifth (22.9%) of the 5.2 million tests would not be supported by the guidelines/guidance documents and the remaining 5% of tests ordered for overweight/obesity were not evaluated (each accounting for <1% of total pathology tests ordered for overweight/obesity).

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Glossary

Chronic problem: see *Diagnosis/problem, Chronic problem.*

Complaint: A symptom or disorder expressed by the patient when seeking care.

Consultation: See *Encounter.*

Diagnosis/problem: A statement of the provider's understanding of a health problem presented by a patient, family or community. GPs are instructed to record at the most specific level possible from the information available at the time. It may be limited to the level of symptoms.

- *New problem:* The first presentation of a problem, including the first presentation of a recurrence of a previously resolved problem, but excluding the presentation of a problem first assessed by another provider.
- *Old problem:* A previously assessed problem that requires ongoing care, including follow-up for a problem or an initial presentation of a problem previously assessed by another provider.
- *Chronic problem:* A medical condition characterised by a combination of the following characteristics: duration that has lasted or is expected to last 6 months or more, a pattern of recurrence or deterioration, a poor prognosis, and consequences or sequelae that impact on an individual's quality of life. (*Source:* O'Halloran J, Miller GC, Britt H 2004. Defining chronic conditions for primary care with ICPC-2. Fam Pract 21(4):381–6).
- *Work-related problem:* Irrespective of the source of payment for the encounter, it is likely in the GP's view that the problem has resulted from work-related activity or workplace exposures or that a pre-existing condition has been significantly exacerbated by work activity or workplace exposure.

General practitioner (GP): A medical practitioner who provides primary comprehensive and continuing care to patients and their families within the community (Royal Australian College of General Practitioners).

Medication: Medication that is prescribed, provided by the GP at the encounter or advised for over-the-counter purchase.

Morbidity: Any departure, subjective or objective, from a state of physiological wellbeing. In this sense, sickness, illness and morbid conditions are synonymous.

Prescribed rates: The rate of use of prescribed medications (that is, does not include medications that were GP-supplied or advised for over-the-counter purchase).

Problem managed: See *Diagnosis/problem.*

Reasons for encounter (RFEs): The subjective reasons given by the patient for seeing or contacting the general practitioner. These can be expressed in terms of symptoms, diagnoses or the need for a service.

Rubric: The title of an individual code in ICPC-2.

Significant: This term is used to refer to a statistically significant results. Statistical significance is measured at the 95% confidence level in this report.

Appendices

Appendix 1: Example of a BEACH 2007–08 recording form

BEACH (Bettering the Evaluation And Care of Health) - Morbidity and Treatment Survey - National DOC ID

Encounter Number

Date of encounter	Date of Birth	Sex	Patient Postcode
___/___/___	___/___/_ _ _ _	M ☐ F ☐	

	Yes	No
New Patient	☐	☐
Health Care/Benefits Card	☐	☐
Veterans Affairs Card	☐	☐
NESB	☐	☐
Aboriginal	☐	☐
Torres Strait Islander	☐	☐

PATIENT SEEN BY GP ☐
PATIENT NOT SEEN BY GP ☐

Medicare Item Nos: (if applicable)
1. _____
2. _____
3. _____

Workers comp paid ☐
State Govt/Other paid ☐
No charge ☐

START Time
:
AM / PM
(please circle)

Patient Reasons for Encounter
1.
2.
3.

Diagnosis/ Problem ① : **Problem Status** New ☐ Old ☐ Work related ☐

Drug Name AND Form for this problem	Strength of product	Dose	Frequency	No. of Rpts	OTC	GP Supply	Drug status New	Drug status Cont.
1.								
2.								
3.								
4.								

Procedures, other treatments, counselling this consult for this problem
1. Prac Nurse? ☐ 2. Prac Nurse? ☐

Diagnosis/ Problem ② : **Problem Status** New ☐ Old ☐ Work related ☐

Drug Name AND Form for this problem	Strength of product	Dose	Frequency	No. of Rpts	OTC	GP Supply	Drug status New	Drug status Cont.
1.								
2.								
3.								
4.								

Procedures, other treatments, counselling this consult for this problem
1. Prac Nurse? ☐ 2. Prac Nurse? ☐

Diagnosis/ Problem ③ : **Problem Status** New ☐ Old ☐ Work related ☐

Drug Name AND Form for this problem	Strength of product	Dose	Frequency	No. of Rpts	OTC	GP Supply	Drug status New	Drug status Cont.
1.								
2.								
3.								
4.								

Procedures, other treatments, counselling this consult for this problem
1. Prac Nurse? ☐ 2. Prac Nurse? ☐

Diagnosis/ Problem ④ : **Problem Status** New ☐ Old ☐ Work related ☐

Drug Name AND Form for this problem	Strength of product	Dose	Frequency	No. of Rpts	OTC	GP Supply	Drug status New	Drug status Cont.
1.								
2.								
3.								
4.								

Procedures, other treatments, counselling this consult for this problem
1. Prac Nurse? ☐ 2. Prac Nurse? ☐

NEW REFERRALS, ADMISSIONS Problem(s)
1. _____ 1 2 3 4
2. _____ 1 2 3 4

IMAGING/Other tests Body site Problem(s)
1. _____ - _____ 1 2 3 4
2. _____ - _____ 1 2 3 4

PATHOLOGY Problem(s)
1. _____ 1 2 3 4
2. _____ 1 2 3 4
3. _____ 1 2 3 4

PATHOLOGY (cont) Problem(s)
4. _____ 1 2 3 4
5. _____ 1 2 3 4

Patient reported
Height: _____ cm
Weight: _____ kg

To the patient if 18+:
Which best describes your smoking status?
Smoke daily ☐
Smoke occasionally ☐
Previous smoker ☐
Never smoked ☐

To the patient if 18+:
How often do you have a drink containing alcohol?
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 6 or more standard drinks on one occasion?
Never ☐
Less than monthly ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

FINISH Time
:
AM / PM
(please circle)

BA10

Appendix 2: Code groups from ICPC-2 and ICPC-2 PLUS

Table A2.1: Code groups from ICPC-2 and ICPC-2 PLUS

Problem managed	ICPC-2 rubric	ICPC-2 PLUS code	ICPC-2/ICPC-2 PLUS label
Health check		A30001	Health evaluation;complete
		A30002	Exam;complete
		A30011	Check up;complete
		A30010	Exam;complete;physical
		A30017	Medical exam;complete
		A30028	Health assessment
		A30029	Check up;adult health;complete
		A31001	Health evaluation;partial
		A31003	Assessment;normal growth
		A31004	Exam;partial;physical
		A31005	Check up;partial
		A31006	Exam;partial
		A31008	Health screening
		A31012	Check up
		A31013	Medical exam
		A31017	Assessment;aged care
		A31025	Check up;adult health;partial
		A31026	Health surveillance;partial
		A31027	Assessment;physical fitness
		A31030	Check up;height/weight
Hypertension (non-gestational)	K86		Hypertension; uncomplicated
	K87		Hypertension; complicated
Lipid disorders	T93		Lipid disorder
Overweight/obesity	T82		Obesity
	T83		Overweight
Type 2 diabetes	T90		Diabetes; non-insulin-dependent
Weakness/tiredness	A04		Weakness/tiredness, general

Note: Codes listed in this appendix are only those that are currently active within ICPC-2 PLUS.

Appendix 3: Pathology code groups from ICPC-2 PLUS

Table A3.1: Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Chemistry		
Amylase	D34004	Test; amylase
C reactive protein	A34005	Test; C reactive protein
Calcium/phosphate	A34006	Test; calcium
	A34013	Test; phosphate
	A34024	Test; calcium phosphate
Cardiac enzymes	D34005	Test; aspartate aminotransferase
	K34003	Test; cardiac enzymes
	K34004	Test; creatine kinase
Chemistry; other	A33023	Test; alpha fetoprotein
	A33026	Test; cancer antigen 125
	A33027	Test; cancer antigen 15.3
	A33028	Test; cancer antigen 19.9
	A33029	Test; carcinoembryonic antigen
	A33041	Test; cancer antigen
	A34015	Test; protein
	A34018	Vitamin assay
	A34019	Test; lead
	A34020	Test; blood gas analysis
	A34022	Test; mineral
	A34023	Test; zinc
	A34025	Test; DHEAS
	A34030	Test; biochemistry
	A34031	Test; blood alcohol
	A34032	Test; prolactin
	A34033	Test; testosterone
	A34037	Test; Glutathione S-transferase
	A34038	Test; magnesium
	A34040	Test; renin
	A35004	Test; urine sodium
	A35007	Test; urine; albumin
	A35008	Test; albumin creatine ratio
	B34023	Test; transferrin

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Chemistry; other (continued)	D34002	Test; alanine aminotransferase
	D35002	Test; 5-HIAA
	K34001	Test; blood; digitalis
	K34006	Test; amino acids
	K34007	Test; troponin
	N34001	Test; blood; phenylhydantoin
	P34003	Test; methadone
	T34018	Test; androgens
	T34019	Test; insulin
	T34021	Test; C peptide
	T34029	Test; aldosterone
	T34030	Test; parathyroid hormone
	T34035	Test; lipase
	T35002	Test; catecholamines
	W34008	Test; PAPPA
	W38002	Amniocentesis
Drug screen	A34002	Drug assay
	A34026	Blood drug screen
	A34027	Blood screen
	A35003	Drug screen
	A35005	Urine drug screen
	K34005	Test; digoxin
	N34003	Test; phenytoin
	N34004	Test; valproate
	N34005	Test; carbamazepine
	P34002	Test; lithium
EUC	A34007	Test; chloride
	A34008	Test; electrolytes
	A34010	Test; EUC
	A34014	Test; potassium
	A34017	Test; sodium
	A34029	Test; U&E
	A34034	Test; E&C
	U34002	Test; creatinine
	U34003	Test; urea
HbA1c	T34010	Test; HbA1c
	T34017	Test; fructosamine
	T34022	Test; HBA1

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Ferritin	B34016	Test; ferritin
	B34019	Test; iron studies
Folic acid	B34017	Test; folic acid
	B34024	Test; folate
Glucose/glucose tolerance	T34005	Test; glucose
	T34009	Test; glucose tolerance
	T34023	Test; glucose (fasting/random)
	T34025	Test; glucose; fasting
	T34026	Test; glucose; random
Hormone assay	A34003	Hormone assay
	D33015	Test; Anti gliadin antibody
	T34007	Test; cortisol
	T34034	Test; ACTH
	W34005	Test; HCG
	W34006	Test; B HCG level (titre/quant)
	X34002	Test; LH
	X34003	Test; progesterone
	X34004	Test; oestradiol
	X34005	Test; FSH
	X34006	Test; SHBG; female
	X34007	Test; free androgen index; female
	Y34004	Test; SHBG; male
	Y34005	Test; free androgen index; male
Lactose intolerance	D38002	Test; lactose intolerance
Lipids	T34001	Check up; cholesterol
	T34004	Test; lipids profile
	T34006	Test; cholesterol
	T34011	Test; cholesterol HDL
	T34013	Test; cholesterol LDL
	T34016	Test; triglycerides
	T34020	Test; free fatty acids
	T34024	Test; chol/trig
Liver function	A34004	Test; albumin
	D34003	Test; alkaline phosphatase
	D34006	Test; bilirubin
	D34007	Test; gGT
	D34008	Test; liver function
	T34012	Test; LDH

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Multi-biochemical analysis	A34012	Test; multi-biochemical analysis
	A34021	Test; E & LFT
Prostate specific antigen	Y34002	Test; acid phosphatase
	Y34003	Test; prostate specific antigen
Thyroid function	T34015	Test; thyroid function
	T34027	Test; thyroxine
	T34028	Test; TSH
Urate/uric acid	U34004	Test; urate/uric acid
Vitamin B12	B34015	Test; B12
	D34009	Test; Schillings
Cytopathology		
Cytology	A37002	Test; cytology
	B37003	Test; cytology; blood
	D37002	Test; cytology; digestive
	F37002	Test; cytology; eye
	H37002	Test; cytology; ear
	K37002	Test; cytology; cardiovascular
	L37002	Test; cytology; musculoskeletal
	N37002	Test; cytology; neurological
	R37002	Test; cytology; respiratory
	R37003	Test; sputum cytology
	S37002	Test; cytology; skin
	T37002	Test; cytology; endocrine/metabolic
	U37002	Test; cytology; urology
	W37002	Test; cytology; reproduction
	Y37002	Test; cytology; genital; male
Pap smear	X37001	Pap smear
	X37003	Test; cytology; genital; female
	X37004	Vault smear
	X37005	Pap smear; thin prep
Haematology		
Blood grouping & typing	B33001	Test; Coombs
	B33002	Test; blood grouping & typing
	B33009	Test; blood group
	B33013	Test; blood; cross match
Blood; other	A33042	Test; lymphocyte type & count
	A34035	Test; blood film
	A34036	Test; blood thick film
	B33003	RH; antibody titer

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Blood; other (continued)	B34005	Test; blood; platelets
	B34007	Test; blood; sickle cell
	B34021	Test; reticulocyte count
	B34031	Test; haemoglobin epg
	B34032	Test; packed cell volume
	B34033	Test; blood; blood
	B37001	Exam; bone marrow
Coagulation	B34003	Test; coagulation time
	B34006	Test; part thromboplastin time
	B34009	Test; prothrombin time
	B34014	Test; APTT
	B34022	Test; thrombin time
	B34025	Test; INR
	B34026	Test; fibrinogen
	B34028	Test; bleeding time
	B34029	Test; coagulation screen
	K34008	Test; D-Dimer
ESR	A34009	Test; ESR
Full blood count	A34011	Test; full blood count
Haemoglobin	B34018	Test; haemoglobin
Tissue pathology (Histopathology)		
Histology; skin	S37001	Test; histopathology; skin
Histology; other	A37001	Test; histopathology
	B37002	Test; histopathology; blood
	D37001	Test; histopathology; digestive
	F37001	Test; histopathology; eye
	H37001	Test; histopathology; ear
	K37001	Test; histopathology; cardiovascular
	L37001	Test; histopathology; musculoskeletal
	N37001	Test; histopathology; neurological
	R37001	Test; histopathology; respiratory
	T37001	Test; histopathology; endocrine/metabolic
	U37001	Test; histopathology; urology
	W37001	Test; histopathology; reproductive
	X37002	Test; histopathology; genital; female
	Y37001	Test; histopathology; genital; male
Immunology		
Anti-nuclear antibodies	L33004	Test; anti-nuclear antibodies

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Immunology; other	A32001	Test; sensitivity
	A33005	Test; immunology
	A33011	Test; HLA
	A33024	Test; bone marrow surface mark
	A33025	Test; serum electrophoresis
	A33051	Test; immune status
	A33052	Test; skin patch
	A38004	Test; DNA
	B33005	Test; immunology; blood
	B33007	Test; immunoglobulins
	B33011	Test; IgE
	B34027	Test; FBC for surface markers
	B34030	Test; intrinsic factor
	D32001	Test; sensitivity; digestive
	D33004	Test; immunology; digestive
	D33014	Test; endomysial antibody
	D33028	Test; mitochondrial antibodies
	D33031	Test; anti-tissue transglutaminase
	D34010	Test; transglutamase
	F33002	Test; immunology; eye
	H33002	Test; immunology; ear
	K33002	Test; immunology; cardiovascular
	K33003	Test; ANCA
	L33003	Test; immunology; musculoskeletal
	L34001	Test; lupus erythematosus; cell prep
	N33002	Test; immunology; neurological
	R32004	Test; sensitivity; respiratory
	R33004	Test; immunology; respiratory
	S32001	Test; sensitivity; skin
	S33002	Test; immunology; skin
	T33002	Test; immunology; endocrine/metabolic
	U33003	Test; immunology; urology
	W33007	Test; immunology; reproductive
	X33002	Test; immunology; genital; female
	Y33002	Test; immunology; genital; male
RAST	A34016	Test; RAST
Rheumatoid factor	L33001	Test; rheumatoid factor
Infertility/pregnancy	W33002	Test; pregnancy
	W34002	Test; blood; pregnancy

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Infertility/pregnancy (continued)	W34003	Test; antenatal
	W34007	Test; pregnancy screen
	Y38002	Test; sperm count
	Y38003	Test; semen examination
Microbiology		
Antibody	A33003	Test; antibody
Cervical swab	X33004	Test; cervical swab M,C&S
Chlamydia	A33006	Test; chlamydia
	A33034	Test; chlamydia direct immunofl
	X33006	Test; viral culture; genital; female
Ear swab and C&S	H33003	Test; ear swab M,C&S
Faeces M,C&S	D33002	Stool(s); culture
	D33008	Test; faeces M,C&S
	D36001	Test; faeces; cyst/ova/parasite
Fungal ID/sensitivity	A33008	Test; fungal ID/sensitivity
	A33030	Test; skin scraping fungal M,C&S
Hepatitis serology	D33005	Test; hepatitis A serology
	D33006	Test; hepatitis B serology
	D33007	Test; hepatitis C serology
	D33013	Test; hepatitis serology
	D33018	Test; hepatitis A antibody
	D33019	Test; hepatitis B antibody
	D33020	Test; hepatitis D antibody
	D33021	Test; hepatitis E antibody
	D33022	Test; hepatitis A antigen
	D33023	Test; hepatitis C antigen
	D33024	Test; hepatitis D antigen
	D33025	Test; hepatitis E antigen
	D33026	Test; hepatitis antibody
	D33027	Test; hepatitis antigen
HIV	A33021	Test; cytomegalovirus serology
	B33006	Test; HIV
	B33008	Test; AIDS screen
	B33012	Test; HIV viral load
H pylori	D33009	Test; H Pylori
Microbiology; other	A33004	Test; microbiology
	A33007	Test; culture and sensitivity
	A33012	Test; mycoplasma serology
	A33013	Test; parvovirus serology

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Microbiology; other (continued)	A33015	Test; Barmah forest virus
	A33016	Test; Antistreptolysin O Titre
	A33017	Test; herpes simplex culture
	A33019	Test; herpes simplex serology
	A33020	Test; toxoplasmosis serology
	A33033	Test; swab M,C&S
	A33035	Test; serology
	A33036	Antibodies screen
	A33038	Test; rapid plasma regain
	A33039	Test; viral swab M,C&S
	A33040	Test; viral serology
	A33043	Test; HPV
	A33044	Test; Brucella
	A33045	Test; fungal M,C&S
	A33046	Test; measles virus antibodies
	A33047	Test; Rickettsial serology
	A33053	Test; Bartonella
	A33054	Test; MC&S
	A34028	Test; blood culture
	A34039	Test; Q fever
	B33004	Test; microbiology; blood
	B33010	Test; serum immunoglobulins
	D33003	Test; microbiology; digestive
	D33010	Test; hepatitis D serology
	D33011	Test; hepatitis E serology
	D33012	Test; rotavirus
	D33016	Test; hepatitis C antibody
	D33017	Test; hepatitis B antigen
	F33001	Test; microbiology; eye
	F33003	Test; eye swab M,C&S
	H33001	Test; microbiology; ear
	K33001	Test; microbiology; cardiovascular
	L33002	Test; microbiology; musculoskeletal
	N33001	Test; microbiology; neurological
	R33001	Culture; tuberculosis
	R33002	Culture; throat
	R33003	Test; microbiology; respiratory
	R33009	Test; influenza serology
	R33010	Test; Legionnaires antibodies

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Microbiology; other (continued)	R33011	Test; RSV
	S33001	Test; microbiology; skin
	S33005	Test; varicella zoster serology
	S33006	Test; varicella zoster culture
	S33007	Test; nail M,C&S
	T33001	Test; microbiology; endocrine/metabolic
	U33002	Test; microbiology; urology
	W34004	Test; antenatal serology
	W33006	Test; microbiology; reproductive
	X33001	Test; microbiology; genital; female
	X33003	Culture; gonococcal; female
	Y33001	Test; microbiology; genital; male
	Y33003	Culture; gonococcal; male
	Y33004	Test; viral culture; genital; male
	Y33005	Test; urethral/penile swab
Monospot	A33002	Test; monospot
	A33014	Test; Paul Bunnell
	A33031	Test; Epstein Barr virus serology
	A33032	Test; Epstein Barr virus
Nose swab C&S	R33008	Test; nose swab M,C&S
Pertussis	R33007	Test; pertussis
Ross River fever	A33009	Test; Ross River Fever
Rubella	A33001	Test; rubella
Skin swab C&S	S33003	Test; skin swab M,C&S
Sputum C&S	R33005	Test; sputum M,C&S
Throat swab C&S	R33006	Test; throat swab M,C&S
Urine MC&S	U33001	Test; culture; urine
	U33004	Test; urine M,C&S
Vaginal swab and M,C&S	X33005	Test; vaginal swab M,C&S
Venereal disease	A33010	Test; venereal disease
	A33022	Test; syphilis serology
	A33057	STI screen
Simple basic tests	B35001	Test; urine; blood
	D36003	Test; occult blood
	R32001	Test; Mantoux
	R32002	Test; tuberculin
	W33001	Test; urine; pregnancy
	W35003	Test; urine; HCG

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Other NEC		
Blood test	A34001	Test; blood
Urine test	A35001	Test; urine
Urinalysis	A35002	Urinalysis
Faeces test	A36001	Test; faeces
Other test NEC	A35006	Test; urine; FWT
	A38001	Test; other lab
	A38002	Pathology
	A38003	Test; genetic
	A38005	Test; disease screen
	B38001	Test; other lab; blood
	D34001	Test; blood; digestive
	D35001	Test; urine; digestive
	D36002	Test; faeces; digestive
	D38001	Test; other lab; digestive
	F34001	Test; blood; eye
	F38001	Test; other lab; eye
	H34001	Test; blood; ear
	H38001	Test; other lab; ear
	K34002	Test; blood; cardiovascular
	K38001	Test; other lab; cardiovascular
	L34003	Test; blood; musculoskeletal
	L38001	Test; other lab; musculoskeletal
	N34002	Test; blood; neurological
	N38001	Test; other lab; neurological
	P34001	Test; blood; psychological
	P35001	Test; urine; psychological
	P38001	Test; other lab; psychological
	R34001	Test; blood; respiratory
	R38001	Test; other lab; respiratory
	S34001	Test; blood; skin
	S38001	Test; other lab; skin
	T34002	Test; blood; endocrine/metabolic
	T35001	Test; urine; endocrine/metabolic
	T38001	Test; other lab; endocrine/metabolic
	U34001	Test; blood; urology
	U35002	Test; urine; urology
	U38001	Test; other lab; urology

(continued)

Table A3.1 (continued): Pathology code groups for MBS groups and individual tests/batteries

Pathology test orders	ICPC-2 PLUS code	ICPC-2 PLUS label
Other pathology test NEC (continued)	W34001	Test; blood; reproductive
	W35001	Test; urine; reproductive
	W38001	Test; other lab; reproductive
	X34001	Test; blood; genital; female
	X35001	Test; urine; genital; female
	X38001	Test; other lab; genital; female
	Y34001	Test; blood; genital; male
	Y35001	Test; urine; genital; male
	Y38001	Test; other lab; genital; male
	Z38001	Test; other lab; social

Note: NOS—not otherwise specified; NEC—not elsewhere classified; MBS—Medicare Benefits Schedule.

List of tables

List of figures