Hospital procedures for diseases of the digestive tract in Aboriginal and Torres Strait Islander peoples and other Australians

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Dr Anthony Moore, Department of Health and Ageing (seconded to the Australian Institute of Health and Welfare)
Dr Hien Vu, Australian Institute of Health and Welfare
Dr Ana Herceg, Winnunga Nimmityjah Aboriginal Health Service (formerly Office for Aboriginal and Torres Strait Islander Health, Department of Health and Ageing)
Dr Fadwa Al-Yaman, Australian Institute of Health and Welfare

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Any enquiries about or comments on this publication should be directed to:

Fadwa Al-Yaman

Social and Indigenous Group

Australian Institute of Health and Welfare

GPO Box 570

Canberra ACT 2601

Phone: (02) 6244 1146

Email: fadwa.al-yaman@aihw.gov.au

Front cover artwork (Lyndy Delian)

This screen print was inspired by sorrows of the Stolen Generations. Water is common to us all and the ripples on the surface of water reach far away. Stealing children over generations has had far reaching effects on the Aboriginal Nations. Using a contemporary design of circle, which is a common traditional symbol for water, the circles represent community and the half circles represent those who were taken from their families and don't make it back to their communities. Stealing just one child means their children and their children's children unto the last generation will bear the effects. Water is also used to represent tears and tears are common to us all.

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Contents

Acknowledgments

This report was written by the following people:

- Dr Anthony Moore, Public Health Medicine Registrar, Department of Health and Ageing (seconded to the Australian Institute of Health and Welfare)
- Dr Hien Vu, Senior Research Officer, Aboriginal and Torres Strait Islander Health and Welfare Unit, Australian Institute of Health and Welfare
- Dr Ana Herceg, Public Health Physician, Winnunga Nimmityjah Aboriginal Health Service (formerly Medical Advisor, Office for Aboriginal and Torres Strait Islander Health, Department of Health and Ageing)
- Dr Fadwa Al-Yaman, Social and Indigenous Group, Australian Institute of Health and Welfare

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- Dr Robyn Lucas, Fellow, National Centre for Epidemiology and Population Health, Australian National University
- Dr Bernie Towler, Senior Medical Advisor, Acute Care Division, Department of Health and Ageing
- Dr Andrew Black, Public Health Medicine Registrar, Office for Aboriginal and Torres Strait Islander Health, Department of Health and Ageing
- Dr Nick Melhuish, Anaesthetist, The Canberra Hospital
- Ms Kirrily Harrison, Data Analysis Branch, Office for Aboriginal and Torres Strait Islander Health, Department of Health and Ageing
- George Bodilsen and Christine Barry, Hospitals Unit, Australian Institute of Health and Welfare

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of health and Welfare
NHMD	National Hospital Morbidity Database
CI	Confidence interval
DF	Degree of freedom
MSE	Mean square error
P	Probability
OR	Odds ratio

Summary

Hospitalisation rates for diseases of the digestive system are lower among Indigenous peoples compared with other Australians. However, of those who are hospitalised with a disease of the digestive system, Indigenous people are less likely to have a procedure recorded than other Australians (ABS/AIHW 2008).

The aim of this study was to examine patterns of undergoing a procedure for diseases of the digestive tract once in hospital for Indigenous Australians compared with other Australians, after adjustment for a number of explanatory variables. Summary analyses were undertaken via generalised linear modelling to determine which variables were most important in terms of affecting the outcome of whether a hospitalised person underwent a procedure.

The key findings of this analysis are outlined below:

- Results from the multivariate analyses showed that Indigenous people were significantly less likely than other Australians to receive the relevant procedure for complicated and uncomplicated hernias (adjusted odds ratio (OR) 0.71) and selected diseases of the extrahepatic biliary tree (adjusted OR 0.88), after adjusting for age, sex, sector, urgency of admission, remoteness of usual residence and additional diagnoses.
- The relative odds of receiving the relevant procedure for Indigenous people compared with other Australians were not significant for appendicitis (adjusted OR 1.27) and selected non-neoplastic anorectal disease (adjusted OR 0.88). The odds for malignant neoplasms of the large intestine and rectum were only of borderline significance (adjusted OR 0.85).
- Remoteness of hospital, gender, hospital sector (public versus private), urgency of admission and most of the comorbidities were all variables that were significantly associated with whether a procedure was recorded during hospital separations involving one of the principal diagnoses chosen for analysis. In most cases, these variables had a stronger association than Indigenous status in terms of their overall influence on whether a hospital separation had a corresponding procedure recorded. Variables not controlled for in our analysis (such as disease severity, socioeconomic status, patient preferences and compliance, smoking status, level of alcohol use and cultural appropriateness of hospital services) are also likely to influence the likelihood of a hospital procedure being recorded.
- It is important that Indigenous-specific health programs, such as those aiming to improve access to hospital procedures for Indigenous patients, are implemented with understanding of the significance of broader factors, such as remoteness of hospital and hospital sector in mind. This also applies to broader health programs that are not necessarily Indigenous-specific.

1 Background

1.1 Hospitalisations with a procedure recorded for Aboriginal and Torres Strait Islander people

In 2003–2004 there were a total of 5.5 million hospitalisations with a procedure recorded, across all categories of hospital (both public and private), of which 2.7% (149,874) were for Indigenous patients. While Aboriginal and Torres Strait Islander people were more likely to be hospitalised than other Australians, they were less likely to undergo a procedure while in hospital. In 2003–04, 72% of hospitalisation episodes involving Indigenous patients included a procedure, compared with 81% of other hospitalisation episodes (ABS/AIHW 2005). When care that involved dialysis was excluded, 54% of hospitalisation episodes involving Indigenous patients included a procedure, compared with 79% of other hospitalisation episodes. Patients who lived in remote areas were less likely to undergo a procedure (43% and 55% for Indigenous and other Australians respectively) than those living in Major cities (68% and 72% for Indigenous and other Australians respectively) (ABS/AIHW 2005).

It has also been suggested in previous studies that Indigenous people are less likely to receive a procedure regardless of whether or not they have additional comorbidities. A study looking at coronary artery procedures suggested that Indigenous people were more likely to present later in the disease process, thereby affecting whether they receive a procedure (Coory & Walsh 2005).

1.2 Procedures of the digestive system

In 2005–06, hospitalisation rates for diseases of the digestive system were lower among Indigenous peoples compared with other Australians. However, of those Indigenous people who were hospitalised with a disease of the digestive system, only 62.4% had a procedure recorded compared with 88.3% for other Australians (ABS/AIHW 2005).

Cunningham (2002) found that the relative odds of having a procedure recorded for patients identified as Indigenous compared with other Australians was 0.52 for diseases of the digestive tract in the financial year 1997–98 ($p < 0.05$, confidence interval 0.49-0.54). [3] The Cunningham analysis adjusted for a number of variables including age, gender, remoteness of usual residence, hospital category and same-day admission.

2 Objectives of study

The main objectives of our study were to:

- examine patterns of receiving a procedure once in hospital for Indigenous and other Australians for selected diseases of the digestive system
- determine the relative likelihood of receiving a corresponding procedure once in hospital for Indigenous Australians, taking into account a number of possible contributing factors
- determine the relative importance of Indigenous status compared to these other factors in terms of influencing whether a procedure is performed
- identify and discuss possible contributing factors which are not available for analysis but which may potentially impact on the results of our analysis.

2.1 Methods

This paper consists of five sets of analyses:

- whether a person hospitalised for appendicitis underwent an appendectomy
- whether a person hospitalised for complicated or uncomplicated hernias underwent a procedure among selected hernia procedures
- whether a person hospitalised for selected diseases of the extrahepatic biliary tree underwent a procedure among selected procedures on the extrahepatic biliary tree
- whether a person hospitalised for selected non-neoplastic anorectal diseases underwent a procedure among selected procedures on the rectum/anus
- whether a person hospitalised for selected malignant neoplasms of the large intestine and rectum underwent a resection procedure of the large intestine and rectum.

A description of the methods used in this paper is given below.

Data sources

Data were obtained from the National Hospital Morbidity Database (NHMD) located at the Australian Institute of Health and Welfare for hospital separations recorded between 1 July 2003 and 30 June 2006. Three years of data were combined to ensure that a sufficiently large number of Indigenous separations were used for the analysis (2003–04, 2004–05 and 2005–06).

The NHMD records are based on separations (episodes of care) rather than individual patients. Separations is the term used to refer to the episode of admitted patient care, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of care type. In this analysis the terms 'patient' and 'separation' are sometimes used interchangeably but it is important to point out the distinction between the two because the clinical circumstances of an individual patient may not always be aligned with what is recorded in the NHMD. Information that corresponds to each hospital separation is formally recorded at the end of each hospital admission.

At present, there is considerable variation across the states and territories in the completeness of hospital separation data for Indigenous people. Analysis of Indigenous

separations data for the years 2004–05 onwards is usually presented for only the six jurisdictions with adequate identification of Indigenous persons in their hospital records, as assessed by the AIHW (New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory). However, analyses in this paper are presented for all eight jurisdictions in Australia because the proportions receiving a procedure are not substantially affected by under-identification as both the numerator and denominator come from the same data set.

The main limitation when using separation data is that the data are usually recorded at the end of a hospital admission, making to it difficult to draw inferences about the chronological sequence of events that occurred during a hospital admission for individual patients. There are issues related to data completeness, as well as the level of clinical correlation between the principal diagnosis and procedure that has been recorded for each separation.

Principal explanatory and outcome variables

Table 2.1 lists the principal diagnoses and procedures of the digestive system analysed in this study**.** The *International Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification* (ICD-10-AM) was used to classify the diagnoses and procedures recorded during the designated time period. The principal diagnoses listed in Table 2.1 were chosen because they are the diagnoses of the digestive system which have one of the listed procedures as a likely component of their management. Given that different procedures performed in the same anatomical vicinity are likely to have overlapping diagnoses for their cause of hospitalisation, it was decided to aggregate individual hospital separations into 'blocks' of procedures and analyse them against blocks of principal diagnoses. The exception here was for a diagnosis of appendicitis which was analysed individually against appendectomy.

Other possible explanatory variables

We also extracted from the NHMD the explanatory variables that may possibly impact on patients receiving a procedure during the same hospital separation as the principal diagnoses under evaluation. These explanatory variables include urgency of admission, hospital sector (public or private except for private hospitals in the Northern Territory) and various patient characteristics. Patient characteristics (besides principal diagnosis) that were included in the analysis were Indigenous status, age group, gender, remoteness of hospital, remoteness of usual residence and specific comorbidities recorded as additional diagnoses by the hospital.

Additional diagnoses include comorbidities (co-existing conditions) and/or complications which may contribute to longer lengths of stay, more intensive treatment or the use of greater resources (AIHW 2007). In this report the term comorbidity was used to describe a selected list of conditions recorded as *additional diagnoses* during the same separation as principal diagnoses under evaluation. Each additional diagnosis was identified by the AIHW using the ICD-10-AM code of disease classification. The *presence* or *absence* of a particular comorbidity was used as a crude indicator of case complexity; however, it must be noted that the disease severity of both the principal diagnoses in question as well as comorbidities can also contribute to case complexity. Disease severity was not considered in this analysis because it was not measurable using ICD codes. The presence or absence of individual risk

factors such as smoking status, level of alcohol consumption and so on was also not analysed because the NHMD does not reliably capture information on risk factors.

Table 2.2 lists 11 selected comorbidities (additional diagnoses) included in this report together with their relevant ICD-10-AM codes. These conditions were included in the analysis because they may be a possible reason why a procedure may not have been performed and they may be disproportionately represented within the Indigenous population compared with other Australians. It is important to point out that the *additional diagnoses* variable in the NHMD does not distinguish between a comorbidity that is a pre-existing condition and onset of a condition during the episode of care.

In this study, we analysed only separations that had values recorded for age, gender, urgency of admission, hospital sector, remoteness of hospital, remoteness of usual residence and principal diagnosis. If a record (separation) had values missing for procedure block or for additional diagnosis we assumed that the record had no procedure or no additional diagnosis. In addition, we excluded records with the care type of newborn, with no qualified days only, and records for posthumous organ procurement, records for patients transferred to another acute hospital, records for patients admitted in a public psychiatric hospital, and gender which was either indeterminate, not stated, or inadequately described.

Table 2.1: Disease codes and corresponding procedures codes of interest

Description of disease (Principal diagnosis)	**Disease code (ICD-10-AM)**	**Description of procedure**	**Procedure block or specific code within block (ICD-10-AM)**
Appendicitis	K35, K36, K37	**Appendicectomy (appendectomy)**	Block 926
Complicated and uncomplicated hernias (all types – inguinal, femoral, umbilical and diaphragmatic)		Selected hernia procedures	Block 990, Block 991, Block 992
NB – a complicated hernia by definition is one which is either incarcerated, obstructed or strangulated	K40 ,K41, K42, K43	*a) Repair of incarcerated, obstructed or strangulated hernia*	Block 993, Block 996, Block 997
		b) Repair of uncomplicated hernia	Block 998
NB – Uncomplicated hernias have been included in the analysis because if left untreated they may develop into a complicated hernia	K44, K45, K46		
Selected diseases of the extrahepatic biliary tree		**Selected procedures on the extrahepatic biliary tree**	
a) Unspecified Jaundice	R17	*a) Examination of Biliary Tract and pancreatic duct via endoscopic retrograde cholangiography/pancreatography)*	Block 957, Block 958, Block 959
b) Cholangitis		*b) Stenting of biliary tract or pancreatic duct*	
c) Obstruction of bile duct without calculus	K80, K81, K82, K83	*c) Biopsy and/or Incision of biliary tract and Sphincter of Oddi*	Block 962, Block 963,
d) Cholelithiasis or calculus of the bile duct with or without cholangitis or cholecystitis		*d) Endoscopic removal of biliary tract calculus*	
e) Spasm of the Sphincter of Oddi		*e) Extracorporeal shockwave lithotripsy of biliary duct*	Block 965
f) Cholelithiasis in which there is calculus of the gall bladder with or without cholecystitis		*f) Incision of biliary tract or sphincter of Oddi*	
g) Cholecystitis		*g) Cholecystectomy (open and laparoscopic)*	
h) Primary malignancy of biliary tract or head of the pancreas	C24, C25.0	*h) Extracorporeal shockwave lithotripsy of gall bladder*	
NB – not all primary malignancies of the head of the pancreas necessarily involve the lower biliary tract. In this analysis it is assumed that all head of the pancreas neoplasms involve the lower biliary tract in some way.			

(continued)

Table 2.1 (continued): Disease codes and corresponding procedures codes of interest

Description of disease **(Principal diagnosis)**	**Disease code** **(ICD-10-AM)**	**Description of procedure**	**Procedure block or specific code within block (ICD-10-AM)**
Selected non-neoplastic anorectal disease		**Selected procedures on the rectum/anus (other than for neoplastic disease)**	Block 930, Block 931, Block 932
a) Haemorrhoids, *b) Rectal prolapse*	I84	*a) Procedures for haemorrhoids*	Block 933, Block 937, Block 940
c) Anal fistula *d) Anal fissure* *e) Rectal fistula* *f) Rectal fissure* *g) Anal abscess* *h) Rectal abscess*	K60, K61, K62	*b) Repair/excision/incision procedures on the rectum/anus*	Block 941, Block 942
Malignant neoplasm of the large intestine and rectum		**Resection procedures of the large intestine and rectum**	
a) Primary malignant neoplasm of the caecum/ascending colon/hepatic flexure/transverse colon/splenic flexure/descending colon/sigmoid colon	C18	*a) Colectomy* *b) Rectosigmoidectomy or proctectomy*	Block 913, Block 915, Block 934
b) Primary malignant neoplasm of the rectosigmoid junction and rectum	C19, C20	*c) Anterior resection of the rectum* *d) Total proctocolectomy*	Block 935, Block 936
NB – non-neoplastic disease of the large intestine and rectum such as diverticular disease, ulcerative colitis and Chrone's disease of the large intestine not included in the analysis		**NB** – includes subcategory of procedures with ileostomy or colostomy formation as well as ileostomy and colostomy procedures recorded in isolation **NB** – above procedures also have non-neoplastic indications	

Table 2.2: Comorbidities (additional diagnoses) of interest

Disease Code	ICD-10-AM codes
Acute upper and lower respiratory tract infections including influenza	J00–J06, J10–J16, J20–J22
Diabetes mellitus or elevated blood glucose levels	E10–E14, R73
Chronic rheumatic heart disease	I05–I09
Ischemic heart disease	I20–I25
Chronic valve disorders other than rheumatic heart disease	I34–I39
Heart failure	I50
Cerebro-vascular disease	I60–I69
Chronic obstructive pulmonary disease	J41–J44
Asthma	J 45
Diseases of the liver	K70–K74
Chronic or unspecified renal failure	N18–N19

Multivariate analysis

Multivariate analyses using the SAS statistical package were undertaken to examine the outcome of whether a hospital separation had a corresponding procedure recorded for each set of principal diagnoses listed in Table 2.1. These analyses adjusted for Indigenous status, age, sex, sector, urgency of admission, remoteness of hospital, remoteness of usual residence of the patient, and 11 additional diagnoses. Note that each record can have more than one additional diagnosis.

For the multivariate analysis, a backward selection procedure was applied to a logistic regression model (an example of a broad class of statistical models known as generalised linear models) to examine the relative importance of selected variables. The variables age group, sex, and Indigenous status were kept in all models regardless of whether they were significant. Firstly a model was fitted which included all variables of interest. Then all variables other than age group, sex and Indigenous status with a p value > 0.05 were considered, and the model was refitted in which the variable with the least significant p value was deleted. This process was repeated until all variables other than age group, sex, and Indigenous status were all statistically significant (p value < 0.05).

The category with the largest percentage of hospital records was chosen as the baseline group for each categorical variable. This was age 75 years and over for the age variable, males for the sex variable, other Australians for the Indigenous status variable, elective admission for the urgency of admission variable, public hospitals for the sector variable, Major cities of Australia for the remoteness of usual residence variable, and Major cities of Australia for the remoteness of hospital variable, and 'not having a corresponding additional diagnosis' for the additional diagnosis variable.

The results of each of the multivariate analyses are presented as a measure of association (odds ratio). Used here, the odds ratio is the ratio of the odds of receiving a procedure (event) for patients (separations) in one group to the odds of that event for patients (separations) in the baseline group. The odds of an event is the ratio of the probability of the event occurring to the probability of the event not occurring. An odds ratio of 1 indicates that the event under study is equally likely in both groups. An odds ratio greater than 1 indicates

that the event is more likely in the considered group in comparison with the baseline group, and an odds ratio less than 1 indicates that the event is less likely in the considered group compared to the baseline group.

In order to ascertain which variables were the most influential in terms of determining the outcome (having a procedure recorded), the mean square error (MSE) which is the chi-squared statistics/degree of freedom (DF) was considered, where the chi-squared statistic is –2 times the difference between the log-likelihoods for the models with and without that particular variable, and the degree of freedom is the number of parameters associated with that variable minus 1. The larger the MSE the more significant that variable is in affecting the outcome. The ranking of variables from most to least significant are presented.

Table 2.3 presents the number of hospital records included in the analysis and the number of records having a corresponding procedure for each of the five sets of analyses.

Table 2.3: Total number of hospitalisations involving a principal diagnosis selected for analysis and number and percentage of these hospitalisations that had a corresponding procedure block(s) recorded in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Principal diagnosis (ICD-10-AM diagnosis code)	Total number of hospitalisations involving principal diagnosis	Corresponding Procedure (ICD-10-AM block code)	Number of hospitalisations involving principal diagnosis that had a corresponding procedure recorded	Percentage
Appendicitis (K35–K37)	26,920	Appendectomy (926)	25,348	94.2
Complicated or uncomplicated hernias (K40–K46)	82,372	Selected hernia procedures (990-993, 996-998)	71,286	86.5
Selected diseases of the extrahepatic biliary tree (R17, C24, C25.0, K80–K83)	73,405	Selected procedures on the extrahepatic biliary tree (957–959, 962, 963, 965)	54,325	74.0
Selected non-neoplastic anorectal disease (I84, K60–K62)	79,655	Selected procedures on the rectum/anus (930–933, 937, 940–942)	39,537	49.6
Malignant neoplasms of the large intestine and rectum (C18–C20)	26,950	Resection procedures of the large intestine and rectum (913, 915, 934–936)	10,455	38.8

Source: AIHW National Hospital Morbidity Database

3 Results

3.1 Appendicitis

Clinical context

The clinical suspicion of acute appendicitis (acutely inflamed appendix) is usually the most common indication for an appendectomy to be performed. Clinical suspicion of acute appendicitis is usually based on a patient history of fever, anorexia (sudden loss of appetite) and localised or diffuse tenderness elicited on abdominal examination that suggests underlying peritonism (irritation of the peritoneum or lining of the abdominal cavity) (Fauci et al. 1998). It must be noted that there is also a wide variety of additional clinical symptoms and signs, some atypical, which can be associated with appendicitis. For the purpose of this analysis, the relative odds of receiving an appendectomy will only be analysed against a principal diagnosis of appendicitis, although there was a good chance of another diagnosis having been retrospectively documented during an admission as the principal reason why an appendectomy occurred. This is more likely to be the case for appendectomies in which acute appendicitis was not found.

Results

Of all hospital separations with appendicitis as the principal diagnosis, 4.3% (n= 26,920) involved patients identified as Indigenous (Table A1). Results from the multivariate analyses (Table 3.1.1) showed that the odds of having an appendectomy recorded for Indigenous people were not significantly different from other Australians in hospital separations involving a principal diagnosis of appendicitis, after adjustment for the other possible explanatory variables.

Results from the multivariate analyses showed that the odds of having an appendectomy in association with a principal diagnosis of appendicitis, after adjustment for other significant variables in the model were (Table 3.1.1):

- thirty five per cent higher in patients in private hospitals compared to those in public hospitals
- approximately 10% lower in females than males
- less common with more remote hospitals or usual place of residence
- increasing across the ages 0–9 years, relatively constant across the ages 5–44 years and decreasing thereafter.

Table 3.1.1: Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with appendicitis as the principal diagnosis and appendectomy as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Age group			
0–4	2.54	(1.43, 4.50)	0.0014
5–9	6.74	(4.69, 9.69)	<.0001
10–14	6.76	(4.98, 9.19)	<.0001
15–19	5.78	(4.28, 7.81)	<.0001
20–24	5.29	(3.90, 7.17)	<.0001
25–29	5.11	(3.72, 7.02)	<.0001
30–34	4.28	(3.13, 5.86)	<.0001
35–39	4.09	(2.96, 5.65)	<.0001
40–44	5.24	(3.71, 7.40)	<.0001
45–49	3.82	(2.70, 5.40)	<.0001
50–54	3.04	(2.15, 4.28)	<.0001
55–59	2.61	(1.84, 3.72)	<.0001
60–64	2.36	(1.60, 3.46)	<.0001
65–70	2.02	(1.34, 3.06)	0.0009
70–74	1.30	(0.86, 1.97)	0.2108
75+	**1.00**		
Sex			
Female	0.91	(0.82, 1.01)	0.0685
Male	**1.00**		
Indigenous status			
Indigenous	1.27	(0.98, 1.65)	0.068
Other	**1.00**		
Remoteness of usual residence			
Inner regional Australia	0.70	(0.58, 0.85)	0.0003
Outer regional Australia	0.85	(0.64, 1.12)	0.2453
Remote Australia	0.91	(0.62, 1.32)	0.6116
Very remote Australia	0.95	(0.62, 1.46)	0.8196
Major cities of Australia	**1.00**		
Remoteness of hospital			
Inner regional Australia	1.12	(0.92, 1.36)	0.2785
Outer regional Australia	0.76	(0.57, 1.01)	0.0550
Remote Australia	0.39	(0.27, 0.58)	<.0001
Very remote Australia	0.13	(0.08, 0.21)	<.0001
Major cities of Australia	**1.00**		

(continued)

Table 3.1.1 (continued): Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with appendicitis as the principal diagnosis and appendectomy as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Sector			
Private hospitals	1.35	(1.19, 1.53)	<.0001
Public hospitals	**1.00**		

Source: AIHW National Hospital Morbidity Database.

Table 3.1.2 summarises the most to least important explanatory variables in the best multivariate model obtained by the backward selection method. Hospital sector, age group and remoteness of hospital were the most important explanatory variables influencing whether an appendectomy was recorded during the same hospital separation as the principal diagnosis of appendicitis followed by remoteness of usual residence. Indigenous status and sex were not a statistically significant variable in this analysis.

Table 3.1.2: Variables associated with having an appendectomy with appendicitis as principal diagnosis, 2003–04 to 2005–06, ranked by importance.

Variable	DF[(a)]	Chi-squared[(b)]	MSE[(c)]	p value
Sector	1	22	22	<.0001
Age group	15	310	21	<.0001
Remoteness of hospital	4	80	20	<.0001
Remoteness of usual residence	4	13	3	0.0095
Indigenous status	1	3	3	0.0680
Sex	1	3	3	0.0685

(a) Degrees of Freedom: number of parameters associated with that variable.

(b) Chi-squared: –2 times the difference between the log-likelihoods for the models with and without that particular variable.

(c) Mean square error: chi-squared statistics/DF.

Source: AIHW National Hospital Morbidity Database.

3.2 Complicated or uncomplicated hernias

Clinical context

Hernia is a general term referring to a protrusion of tissue through the wall of a cavity in which it is normally contained. For the purpose of this analysis, a hernia refers to an opening or weakness in the muscular wall of the abdominal cavity. This defect causes a bulging of the abdominal wall. Examples of activities that can worsen a hernia are lifting, coughing, or even straining to have a bowel motion. Sometimes hernias are congenital. Symptoms of a hernia may include pain or discomfort and sometimes a noticeable localised swelling in the area where the hernia is situated.

Serious complications from a hernia can result from the trapping of organs or tissue in the hernia, a process called incarceration. Incarcerated tissue can potentially have its blood

supply cut off (called strangulation), leading to damage or death of the tissue. If a segment of bowel is incarcerated within a hernia then there is a possibility that segment of bowel can become obstructed. Such incarceration requires immediate surgery.

Results

Of all hospital separations with either a complicated or uncomplicated hernia as the principal diagnosis, 1.5% (n = 82,372) involved patients identified as Indigenous (Table A2). Results from the multivariate analyses (Table 3.2.1) showed the odds of having a hernia repair recorded for Indigenous people were 29% lower compared with other Australians in hospital separations involving hernia as the principal diagnosis, after adjustment for other possible explanatory variables. Results from the multivariate analyses showed that the odds of having a hernia repair in association with a principal diagnosis of complicated or uncomplicated hernia were (see Table 3.2.1):

- more than fourfold higher in male patients compared with female patients
- fifty seven per cent lower in patients hospitalised through emergency admission compared to elective admission
- less common with more remote hospitals
- eighty one per cent lower in patients with an additional diagnosis of acute lower respiratory tract infection (including influenza) and 35% lower in patients with an additional diagnosis of asthma compared with those without an additional diagnosis
- sixty three per cent lower in patients with an additional diagnosis that involved disease of the liver compared with those without an additional diagnosis
- Twenty nine per cent lower in patients with ischemic heart disease as an additional diagnosis compared with those without an additional diagnosis
- forty four per cent higher in patients with an additional diagnosis of diabetes mellitus/elevated blood glucose levels compared with those without an additional diagnosis.

Table 3.2.1: Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with complicated or uncomplicated hernias as the principal diagnosis and selected hernia procedures as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Age group			
0–4	5.67	(4.79, 6.72)	<.0001
5–9	12.30	(8.51, 17.77)	<.0001
10–14	6.11	(3.72, 10.02)	<.0001
15–19	2.79	(2.11, 3.69)	<.0001
20–24	2.03	(1.69, 2.45)	<.0001
25–29	1.81	(1.56, 2.11)	<.0001
30–34	1.95	(1.72, 2.21)	<.0001
35–39	2.00	(1.79, 2.24)	<.0001
40–44	1.63	(1.48, 1.80)	<.0001
45–49	1.54	(1.40, 1.69)	<.0001
50–54	1.29	(1.19, 1.41)	<.0001
55–59	1.16	(1.07, 1.25)	0.0004
60–64	1.01	(0.94, 1.10)	0.7358
65–70	1.01	(0.93, 1.10)	0.8212
70–74	1.00	(0.92, 1.09)	0.9842
75+	**1.00**		
Sex			
Female	0.23	(0.22, 0.24)	<.0001
Male	**1.00**		
Indigenous status			
Indigenous	0.71	(0.59, 0.84)	<.0001
Other	**1.00**		
Remoteness of usual residence			
Inner regional Australia	0.99	(0.92, 1.07)	0.8605
Outer regional Australia	1.15	(1.03, 1.29)	0.0172
Remote Australia	1.19	(0.96, 1.47)	0.1075
Very remote Australia	0.93	(0.72, 1.20)	0.5776
Major cities of Australia	**1.00**		
Remoteness of hospital			
Inner regional Australia	0.62	(0.58, 0.67)	<.0001
Outer regional Australia	0.91	(0.80, 1.03)	0.1248
Remote Australia	0.82	(0.63, 1.06)	0.1307
Very remote Australia	0.51	(0.37, 0.71)	<.0001
Major cities of Australia	**1.00**		

(continued)

Table 3.2.1 (continued): Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with complicated or uncomplicated hernias as the principal diagnosis and selected hernia procedures as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Urgency of admission			
Emergency admission	0.43	(0.40, 0.46)	<.0001
Elective admission	**1.00**		
Sector			
Private	0.95	(0.91, 0.99)	0.0234
Public	**1.00**		
Additional diagnosis			
Acute upper and lower respiratory tract infections including influenza	0.19	(0.14, 0.25)	<.0001
Diseases of the liver	0.37	(0.24, 0.56)	<.0001
Asthma	0.65	(0.50, 0.84)	0.0010
Ischemic heart disease	0.71	(0.59, 0.85)	0.0002
Diabetes mellitus or elevated blood glucose levels	1.44	(1.30, 1.59)	<.0001
No corresponding additional diagnosis	**1.00**		

Source: AIHW National Hospital Morbidity Database

Table 3.2.2 summarises the most to least important explanatory variables in the best multivariate model obtained by the backward selection method. Gender was the most important explanatory variable influencing whether or not a hernia repair was recorded during the same hospital separation as the principal diagnosis of either a complicated or uncomplicated hernia. This was followed by urgency of admission, whether an individual had an acute respiratory tract infection, age group, whether an individual had diabetes mellitus/elevated blood glucose levels and remoteness of hospital. Indigenous status ranked eighth in terms of the most important explanatory variable in this analysis.

Table 3.2.2: Variables associated with having selected hernia procedures with complicated or uncomplicated hernias as the principal diagnosis, 2003–04 to 2005–06, ranked by importance

Variable	DF[(a)]	Chi-squared[(b)]	MSE[(c)]	p value
Sex	1	4,627	4,627	<.0001
Urgency of admission	1	633	633	<.0001
Acute upper and lower respiratory tract infections including influenza	1	131	131	<.0001
Age group	15	1,000	67	<.0001
Diabetes mellitus or elevated blood glucose levels	1	52	52	<.0001
Remoteness of hospital	4	177	44	<.0001
Diseases of the liver	1	21	21	<.0001
Indigenous status	1	16	16	<.0001
Ischemic heart disease	1	14	14	0.0002
Asthma	1	11	11	0.0010
Sector	1	5	5	0.0234
Remoteness of usual residence	4	10	3	0.0365

(a) Degrees of Freedom: number of parameters associated with that variable.

(b) Chi-squared: –2 times the difference between the log-likelihoods for the models with and without that particular variable.

(c) Mean square error: chi-squared statistics/DF.

Source: AIHW National Hospital Morbidity Database

3.3 Selected diseases of the extrahepatic biliary tree

Clinical context

Bile, which is required for the digestion of food, is excreted by the liver into passages that eventually carry bile to the small intestine. This system of channels is called the biliary tree with the part external to the liver called the *extrahepatic* biliary tree. The gallbladder which sits to the side of the main biliary tract, acts as a reservoir for excess bile on its way to the small intestine. It should be noted that only 74.0% of hospitalisations in our sample involving a principal diagnosis of a disease of the extrahepatic biliary tree involved one of the corresponding procedures during the same hospital separation (Table 2.3). This is partly explained by the fact that not all of these diseases require a procedure during the same hospital admission in which the principal diagnosis was first identified. For example, most patients with cholecystitis are re-admitted for a cholecystectomy at a later date once the cholecystitis is resolved. On the other hand, acute ascending cholangitis (inflammation of common bile duct due to obstruction) almost always requires an immediate procedure as this disease is more likely to rapidly lead to septic shock if left untreated.

Results

Of all hospital separations with a disease of the extrahepatic tree as the principal diagnosis, 3.7 % (n = 73,405) involved patients identified as Indigenous (Table A3). Results from the multivariate analyses (Table 3.3.1) showed the odds of having an extrahepatic biliary tree procedure recorded for Indigenous people were 12% lower compared with other Australians in separations involving disease of extrahepatic biliary tree as the principal diagnosis, after adjustment for other possible explanatory variables. Results also from the multivariate analyses showed that the odds of having an extrahepatic biliary tree procedure in association with a principal diagnosis of extrahepatic biliary tree disease were (Table 3.3.1):

- about 70% higher for patients in public hospitals compared with patients in private hospitals
- twenty three per cent higher in females than males
- ninety three per cent lower in patients hospitalised through emergency admission compared with those with an elective admission
- less common with more remote hospital
- twenty four per cent and thirty six per cent lower for patients with a disease of the liver and lower respiratory tract infection respectively as an additional diagnosis compared with those without an additional diagnosis.

Table 3.3.1: Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with selected diseases of the extrahepatic biliary tree as the principal diagnosis and selected procedures on the extrahepatic biliary tree as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Age group			
0–4	0.03	(0.02, 0.06)	<.0001
5–9	0.17	(0.09, 0.32)	<.0001
10–14	0.65	(0.45, 0.94)	0.0237
15–19	1.21	(1.04, 1.41)	0.0157
20–24	1.47	(1.32, 1.65)	<.0001
25–29	1.52	(1.38, 1.68)	<.0001
30–34	1.56	(1.42, 1.71)	<.0001
35–39	1.43	(1.31, 1.57)	<.0001
40–44	1.54	(1.40, 1.68)	<.0001
45–49	1.50	(1.37, 1.63)	<.0001
50–54	1.47	(1.35, 1.60)	<.0001
55–59	1.38	(1.27, 1.50)	<.0001
60–64	1.27	(1.16, 1.39)	<.0001
65–70	1.29	(1.18, 1.42)	<.0001
70–74	1.20	(1.10, 1.32)	<.0001
75+	**1.00**		

(continued)

Table 3.3.1 (continued): Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with selected diseases of the extrahepatic biliary tree as the principal diagnosis and selected procedures on the extrahepatic biliary tree as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Sex			
Female	1.23	(1.17, 1.28)	<.0001
Male	**1.00**		
Indigenous status			
Indigenous	0.88	(0.79, 0.99)	0.0285
Other	**1.00**		
Remoteness of usual residence			
Inner regional Australia	1.01	(0.93, 1.08)	0.8748
Outer regional Australia	1.37	(1.23, 1.52)	<.0001
Remote Australia	2.16	(1.81, 2.58)	<.0001
Very remote Australia	3.08	(2.49, 3.81)	<.0001
Major cities of Australia	**1.00**		
Remoteness of hospital			
Inner regional Australia	0.47	(0.43, 0.50)	<.0001
Outer regional Australia	0.34	(0.30, 0.38)	<.0001
Remote Australia	0.16	(0.13, 0.19)	<.0001
Very remote Australia	0.05	(0.04, 0.07)	<.0001
Major cities of Australia	**1.00**		
Urgency of admission			
Emergency admission	0.07	(0.06, 0.07)	<.0001
Elective admission	**1.00**		
Sector			
Private hospitals	1.72	(1.64, 1.80)	<.0001
Public hospitals	**1.00**		
Additional diagnosis			
Acute upper and lower respiratory tract infections including influenza	0.64	(0.48, 0.86)	0.0026
Diseases of the liver	0.76	(0.62, 0.94)	0.0111
No corresponding additional diagnosis	**1.00**		

Source: AIHW National Hospital Morbidity Database

Table 3.3.2 summarises the most to least important explanatory variables in the best multivariate model obtained by backward selection method. Urgency of admission was the most important explanatory variable influencing whether or not a procedure on the extrahepatic biliary tree was recorded during the same hospital separation as the principal diagnosis of a disease of the extrahepatic biliary tree, followed by hospital sector and remoteness of hospital. Indigenous status ranked ninth in terms of the most important explanatory variable.

Table 3.3.2: Variables associated with having a selected procedure on the extrahepatic biliary tree with selected diseases of the extrahepatic biliary tree as the principal diagnosis, 2003–04 to 2005–06, ranked by importance

Variable	DF[(a)]	Chi-squared[(b)]	MSE[(c)]	p value
Urgency of admission	1	14,950	14,950	<.0001
Sector	1	519	519	<.0001
Remoteness of hospital	4	856	214	<.0001
Sex	1	82	82	<.0001
Remoteness of usual residence	4	134	34	<.0001
Age group	15	361	24	<.0001
Acute upper and lower respiratory tract infections including influenza	1	9	9	0.0026
Diseases of the liver	1	6	6	0.0111
Indigenous status	1	5	5	0.0285

(a) Degrees of Freedom: number of parameters associated with that variable.

(b) Chi-squared: –2 times the difference between the log-likelihoods for the models with and without that particular variable.

(c) Mean square error: chi-squared statistics/DF.

Source: AIHW National Hospital Morbidity Database

3.4 Selected non-neoplastic anorectal disease

Clinical context

For the purpose of this analysis, 'non-neoplastic diseases of the rectum or anus' will be defined as those collective diagnoses listed in Table 2.1. The diagnoses listed were selected because, if left untreated, they can potentially cause considerable discomfort in those affected. For example, haemorrhoids which are both painful and which have not responded to non-surgical measures are likely to require surgical correction to alleviate the associated symptoms. Likewise for the other conditions listed; without proper management these conditions can impair one's quality of life.

It should be noted that only 49.6% of hospitalisations with non-neoplastic anorectal disease recorded as the principal diagnosis involved one of the corresponding procedures during the same hospital separation (Table 2.3). This is partly explained by the fact that not all of these diseases require a procedure during the same hospital admission in which the principal diagnosis was first identified.

Results

Of all hospital separations with a non-neoplastic anorectal disease as the principal diagnosis, 1.2% (n = 79,655) involved patients identified as Indigenous (Table A4). Results from the multivariate analyses (Table 3.4.1) showed the odds of having a corresponding procedure recorded for Indigenous people were 12% lower compared with other Australians in separations involving non-neoplastic anorectal disease as the principal diagnosis, after adjustment for other possible explanatory variables. Results from the multivariate analyses

also showed that the odds of having a corresponding procedure in association with a principal diagnosis of non-neoplastic anorectal disease were (Table 3.4.1):

- thirty four per cent lower for patients hospitalised in private hospitals compared with patients in public hospitals
- seven per cent lower in females than males
- seventy one per cent higher in patients hospitalised through emergency admission compared to patients hospitalised through elective admission
- fourteen percent lower for patients with remoteness of hospital recorded as Very Remote Australia compared with patients residing in Major Cities of Australia
- more than twofold higher in patients with chronic valve disorders (other than rheumatic heart disease) as an additional diagnosis compared with patients without an additional diagnosis.

Table 3.4.1: Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with selected non-neoplastic anorectal disease as the principal diagnosis and selected procedures on the rectum/anus as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Age group			
0–4	2.31	(1.91, 2.80)	<.0001
5–9	0.96	(0.70, 1.30)	0.7708
10–14	1.52	(1.12, 2.06)	0.0075
15–19	1.94	(1.66, 2.27)	<.0001
20–24	2.29	(2.07, 2.54)	<.0001
25–29	2.23	(2.04, 2.44)	<.0001
30–34	2.33	(2.16, 2.52)	<.0001
35–39	2.28	(2.12, 2.44)	<.0001
40–44	2.08	(1.95, 2.22)	<.0001
45–49	1.79	(1.67, 1.91)	<.0001
50–54	1.54	(1.44, 1.64)	<.0001
55–59	1.40	(1.32, 1.50)	<.0001
60–64	1.20	(1.12, 1.29)	<.0001
65–70	1.00	(0.93, 1.08)	0.9127
70–74	0.90	(0.83, 0.98)	0.0105
75+	**1.00**		

(continued)

Table 3.4.1 (continued): Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with selected non-neoplastic anorectal disease as the principal diagnosis and selected procedures on the rectum/anus as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Sex			
Female	0.93	(0.90, 0.95)	<.0001
Male	**1.00**		
Indigenous status			
Indigenous	0.88	(0.76, 1.01)	0.0720
Other	**1.00**		
Remoteness of usual residence			
Inner regional Australia	1.01	(0.96, 1.06)	0.7933
Outer regional Australia	1.11	(1.02, 1.21)	0.0116
Remote Australia	1.01	(0.88, 1.16)	0.8464
Very remote Australia	0.88	(0.72, 1.08)	0.2300
Major cities of Australia	**1.00**		
Remoteness of hospital			
Inner regional Australia	1.29	(1.22, 1.36)	<.0001
Outer regional Australia	1.09	(1.00, 1.19)	0.0576
Remote Australia	1.38	(1.15, 1.66)	0.0005
Very remote Australia	0.86	(0.65, 1.13)	0.2776
Major cities of Australia	**1.00**		
Urgency of admission			
Emergency admission	1.71	(1.62, 1.80)	<.0001
Elective admission	**1.00**		
Sector			
Private hospitals	0.66	(0.64, 0.68)	<.0001
Public hospitals	1.00		
Additional diagnosis			
Diseases of the liver	0.31	(0.21, 0.48)	<.0001
Ischemic heart disease	1.26	(1.01, 1.57)	0.0430
Diabetes mellitus or elevated blood glucose levels	1.33	(1.23, 1.43)	<.0001
Chronic valve disorders other than rheumatic heart disease	2.07	(1.08, 3.99)	0.0295
No corresponding additional diagnosis	**1.00**		

Source: AIHW National Hospital Morbidity Database

Table 3.4.2 summarises the most to least important explanatory variables in the best multivariate model obtained by the backward selection method. Hospital sector was the most important explanatory variable influencing whether or not an anorectal procedure was recorded during the same hospital separation in which non-neoplastic anorectal disease was recorded as the principal diagnosis followed by urgency of admission and age group. Indigenous status was not statistically significant ($p > 0.05$) and ranked tenth in terms of the most important explanatory variable.

Table 3.4.2: Variables associated with having selected procedures on the rectum/anus with non-neoplastic anorectal disease as the principal diagnosis, 2003–04 to 2005–06, ranked by importance

Variable	DF[(a)]	Chi-squared[(b)]	MSE[(c)]	p value
Sector	1	666	666	<.0001
Urgency of admission	1	414	414	<.0001
Age group	15	1,791	119	<.0001
Diabetes mellitus or elevated blood glucose levels	1	52	52	<.0001
Diseases of the liver	1	28	28	<.0001
Sex	1	28	28	<.0001
Remoteness of hospital	4	98	25	<.0001
Chronic valve disorders other than rheumatic heart disease	1	5	5	0.0295
Ischemic heart disease	1	4	4	0.0430
Indigenous status	1	3	3	0.0720
Remoteness of usual residence	4	10	3	0.0396

(a) Degrees of Freedom: number of parameters associated with that variable.

(b) Chi-squared: –2 times the difference between the log-likelihoods for the models with and without that particular variable.

(c) Mean square error: chi-squared statistics/DF.

Source: AIHW National Hospital Morbidity Database

3.5 Malignant neoplasms of the large intestine and rectum

Clinical context

Colorectal cancer is a malignant tumour that begins in the mucosa or inner lining of the colon or rectum. It often develops from a small benign growth called an adenoma (polyp). Polyps are usually benign but some can become malignant (cancerous). Depending on the staging of the malignancy, patients are offered either curative or palliative treatment. This may or may not involve surgical resection of the segment of large bowel that is affected by the carcinoma. Depending on the location of the carcinoma, and in addition to resection, the bowel may or may not have to be rerouted through an artificially created hole in the abdomen so that bowel contents can still leave the body. This hole is called a stoma. A colostomy is an operation that connects the colon to the abdominal wall, while an ileostomy connects the last part of the small intestine (ileum) to the abdominal wall. The stoma may be permanent or it can be a temporary measure. Stoma formation usually occurs when it is deemed not viable at the time of resection to rejoin (or anastomose) the two ends of bowel where a segment of bowel has been resected.

It should be noted that only 38.8% of hospitalisations in our sample with a malignant neoplasm of either the large intestine or rectum recorded as the principal diagnosis involved one of the corresponding procedures during the same hospital separation (Table 2.3). This is partly explained by the fact that not all of these diseases require an immediate procedure during the same hospital admission in which the principal diagnosis was first identified.

Results

Only 0.6% of all hospital separations (n = 26,950) with a malignant neoplasm of the large intestine or rectum recorded as the principal diagnosis involved patients identified as Indigenous (Table A5). Results from the multivariate analyses (Table 3.5.1) showed that the odds of having a resection of the large bowel or rectum recorded for Indigenous people was 15% lower compared with other Australians in separations involving malignant neoplasm of either the large intestine or rectum as the principal diagnosis, after adjustment for other possible explanatory variables. It should be noted that this was not statistically significant (p value = 0.34).

Results also from the multivariate analyses showed that the odds of having resection of the large bowel or rectum in association with a principal diagnosis of malignant neoplasm of large intestine and rectum were (Table 3.5.1):

- forty per cent lower in patients hospitalised in private hospitals compared with patients hospitalised in public hospitals
- fifteen per cent higher in females than males
- thirty two per cent lower in patients hospitalised through emergency admission compared with those with an elective admission
- less common with more remote hospital and more common with more remote usual place of residence
- more than three times as high as in patients with acute upper and lower respiratory tract infection (including influenza) as an additional diagnosis compared with those without an additional diagnosis
- more than five times as high as patients with chronic rheumatic heart disease as an additional diagnosis compared with those without an additional diagnosis
- approximately two times as high as in patients with chronic obstructive pulmonary disease or chronic valve disorders other than rheumatic heart disease as an additional diagnosis compared with patients without an additional diagnosis.

Table 3.5.1: Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with malignant neoplasms of the large intestine and rectum as the principal diagnosis and resection procedures of the large intestine and rectum as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Age group			
0–19	0.45	(0.18, 1.12)	0.0854
20–24	1.08	(0.64, 1.82)	0.7670
25–29	0.93	(0.54, 1.60)	0.8021
30–34	0.79	(0.56, 1.12)	0.1896
35–39	0.81	(0.62, 1.05)	0.1106
40–44	0.98	(0.82, 1.18)	0.8408
45–49	0.92	(0.80, 1.05)	0.2108
50–54	0.92	(0.83, 1.03)	0.1418
55–59	0.93	(0.85, 1.01)	0.0992
60–64	0.98	(0.90, 1.07)	0.6593
65–70	0.95	(0.88, 1.03)	0.2072
70–74	1.07	(0.99, 1.15)	0.1017
75+	**1.00**		
Sex			
Female	1.15	(1.09, 1.21)	<.0001
Male	**1.00**		
Indigenous status			
Indigenous	0.85	(0.61, 1.19)	0.3444
Other	**1.00**		
Remoteness of usual residence			
Inner regional Australia	1.21	(1.11, 1.32)	<.0001
Outer regional Australia	1.25	(1.11, 1.41)	0.0002
Remote Australia	1.16	(0.95, 1.42)	0.1430
Very remote Australia	1.53	(1.10, 2.13)	0.0125
Major cities of Australia	**1.00**		
Remoteness of hospital			
Inner regional Australia	0.75	(0.69, 0.83)	<.0001
Outer regional Australia	0.66	(0.58, 0.76)	<.0001
Remote Australia	0.38	(0.27, 0.53)	<.0001
Very remote Australia	0.10	(0.04, 0.26)	<.0001
Major cities of Australia	**1.00**		
Urgency of admission			
Emergency admission	0.68	(0.63, 0.73)	<.0001
Elective admission	**1.00**		

(continued)

Table 3.5.1 (continued): Odds ratios (95% CI) of the variables in the multivariate model obtained by the backward selection method for records with malignant neoplasms of the large intestine and rectum as the principal diagnosis and resection procedures of the large intestine and rectum as the outcome, 2003–04 to 2005–06

	Odds ratio	95% CI	p value
Sector			
Private hospitals	0.60	(0.57, 0.63)	<.0001
Public hospitals	**1.00**		
Additional diagnosis			
Diabetes mellitus or elevated blood glucose levels	1.29	(1.19, 1.40)	<.0001
Cerebro-vascular disease	1.63	(1.17, 2.28)	0.0039
Chronic obstructive pulmonary disease	2.07	(1.07, 4.01)	0.0303
Chronic valve disorders other than rheumatic heart disease	2.10	(1.43, 3.10)	0.0002
Asthma	2.52	(1.60, 3.96)	<.0001
Ischemic heart disease	2.56	(2.18, 2.99)	<.0001
Heart failure	2.72	(2.20, 3.37)	<.0001
Acute upper and lower respiratory tract infections including influenza	3.41	(2.55, 4.57)	<.0001
Chronic rheumatic heart disease	5.30	(2.61, 10.75)	<.0001
No corresponding additional diagnosis	**1.00**		

Source: AIHW National Hospital Morbidity Database.

Table 3.5.2 summarises the most to least important explanatory variables in the best multivariate model obtained by the backward selection method. Hospital sector was the most important explanatory variable influencing whether or not a resection of either the large intestine or rectum was recorded during the same hospital separation in which a malignant neoplasm of the large intestine or rectum was recorded. This was followed by whether an individual had ischemic heart disease, urgency of admission, heart failure, acute upper and lower respiratory tract infections including influenza, then diabetes mellitus. Indigenous status was not statistically significant and ranked last (16th) in terms of the most important explanatory variables.

Table 3.5.2: Variables associated with resection procedures of the large intestine and rectum with malignant neoplasm of the large intestine or rectum as the principal diagnosis, 2003–04 to 2005–06, ranked by importance.

Variable	DF[(a)]	Chi-squared[(b)]	MSE[(c)]	p value
Sector	1	357	357	<.0001
Ischemic heart disease	1	137	137	<.0001
Urgency of admission	1	120	120	<.0001
Heart failure	1	85	85	<.0001
Acute upper and lower respiratory tract infections including influenza	1	68	68	<.0001
Diabetes mellitus or elevated blood glucose levels	1	40	40	<.0001
Sex	1	29	29	<.0001
Remoteness of hospital	4	96	24	<.0001
Chronic rheumatic heart disease	1	21	21	<.0001
Asthma	1	16	16	<.0001
Chronic valve disorders other than rheumatic heart disease	1	14	14	0.0002
Cerebro-vascular disease	1	8	8	0.0039
Remoteness of usual residence	4	29	7	<.0001
Chronic obstructive pulmonary disease	1	5	5	0.0303
Age group	12	19	2	0.0804
Indigenous status	1	1	1	0.3444

(a) Degrees of Freedom: number of parameters associated with that variable.

(b) Chi-squared: –2 times the difference between the log-likelihoods for the models with and without that particular variable.

(c) Mean square error: chi-squared statistics/DF.

Source: AIHW National Hospital Morbidity Database

4 Discussion

4.1 Possible explanation of specific results

The results of our study suggest that being Indigenous, after statistically controlling for other contributing factors, is significantly associated with fewer hospital procedures for most of the diseases chosen for analysis with the exception of appendicitis, selected non-neoplastic anorectal disease and malignant neoplasm of large intestine/rectum, where being Indigenous was found to be non-significant. However in terms of overall influence, remoteness of hospital, gender, urgency of admission, hospital sector and most of the comorbidities were all variables that featured prominently in whether or not a procedure was recorded. In most cases, these variables were statistically more influential than Indigenous status in determining whether a procedure was recorded. The reasons for this are unclear. There may be factors related to being Indigenous or non-Indigenous not considered in our analysis which may also be influencing whether one gets a procedure or not. Some of these factors are expanded upon in section 4.3 of the discussion**.**

From the diseases selected, it was not too surprising that there were no significant differences between Indigenous and other Australians in terms of their likelihood of receiving an appendectomy if appendicitis was recorded as the principal diagnosis. Appendectomy is usually considered upfront to manage appendicitis, and it would be surprising that an appendectomy were not performed when there is a clinical suspicion of appendicitis. However caution must be taken when interpreting these results-a definitive diagnosis of appendicitis (or not) is usually made retrospectively after surgery and entered into the official record at the end of a hospital admission. Indigenous patients may in fact be differentially accessing surgery to achieve such a diagnosis, that is Indigenous patients may be either having too many appendectomies or too few to achieve such a diagnosis but this cannot be detected using an analysis based on hospital separations. The shortcomings of using hospital separation data are expanded upon in section 4.2 of the discussion.

A possible explanation for why patients hospitalised through an emergency admission of appendicitis were less likely to receive an appendectomy than patients hospitalised through an elective admission of appendicitis is that some patients with clinical appendicitis are initially presenting to hospitals where appendectomy cannot be performed (such as in a remote hospital). Consequently they have to be relocated to a larger hospital offering surgical facilities to perform an appendectomy. The patient who was initially coded as an emergency admission at the peripheral hospital may sometimes be recoded as an elective admission at the referral hospital, increasing the likelihood of a principal diagnosis of appendicitis being recorded during an elective admission.

With the exception of non-neoplastic anorectal disease, we found that it was significantly less likely that people hospitalised in more remote areas would receive a corresponding procedure for the disease groups chosen for our analysis. Again the possible explanation for this is that the surgical facilities needed to perform hernia repairs, procedures on the extrahepatic biliary tree and intestinal resections are simply not available in more remote areas of Australia or there may be insufficient volume of these particular procedures to warrant expertise being made available in remote hospitals. It is also quite possible that patients hospitalised in more remote areas are more likely to have one or more elective

admissions for medical management of these diseases before the hospital admission in which a procedure eventuates, thus inflating the number of separations without a procedure. Given that the 'Remoteness of hospital' variable ranks highly in terms of influencing whether a procedure was recorded, health systems need to ensure that Australians living in remote areas can obtain timely access to hospital procedures, including being transferred to another acute hospital when needed.

In terms of hospital sector, patients who had one of the principal diagnoses chosen for this analysis were more likely to receive an appendectomy, hernia repair or a procedure on the extrahepatic biliary tree in the private sector, while they were more likely to receive a anorectal procedure and a resection of the large intestine/rectum in the public sector. The reason why the private sector is over and under-represented for some of these procedures is unclear.

Having a comorbidity also played a significant role in influencing whether or not a procedure was recorded during the same hospital separation involving one of the principal diagnoses chosen for this study. Having respiratory disease decreased the likelihood of having a procedure recorded in most of the diagnoses of hernias and diseases on the extrahepatic biliary tree, while it increased the likelihood of having a procedure recorded for those separations in which malignant neoplasm of the large intestine or rectum was recorded as the principal diagnosis. Having a disease of the liver also decreased the likelihood of having a procedure recorded if a principal diagnosis of hernia, a disease of the extrahepatic biliary tree or non-neoplastic anorectal disease was recorded. On the other hand, our study demonstrated that having cardiovascular disease as an additional diagnosis, particularly chronic rheumatic heart disease, increased rather than decreased the likelihood of having a procedure recorded during a hospital separation for most of the diseases selected for this analysis.

Finally, having a procedure is not always better than not having one. Sometimes a procedure is delayed because of high anaesthetic risk. More often, an individual is discharged with a plan to be re-admitted at a later date for a procedure; this is particularly the case when the procedure is deemed semi-urgent rather than urgent. In some cases medical management is trialled first (particularly in patients with complex comorbidities) before a decision is made to perform a procedure, while in other cases, medical and surgical management occurs concurrently. These scenarios partly explain why the hospital separations chosen for these analyses (particularly for diseases of the extrahepatic biliary tree and malignant neoplasms of the large intestine and rectum) did not always have a corresponding procedure recorded (Table 2.3).

Attempting to clinically explain these results can be difficult because separation data does not distinguish between whether an additional diagnosis was either a pre-existing condition prior to admission or onset of a condition during admission. One possible explanation could lie in how information on comorbidities is recorded. If a patient is going to surgery it is quite possible that their comorbidities have a higher chance of being recorded as part of a stringent pre-surgical assessment of their anaesthetic risk. As such, patients with additional diagnoses may be over-represented in separation data in which procedures are recorded. Another possible explanation of these results could lie in the severity of the comorbidity. Depending on the severity of the comorbidity in question, it is sometimes decided to delay surgery because of a high mortality risk posed by surgery, while in other cases, despite a higher mortality risk it is decided to proceed with surgery because the overseeing clinician feels the benefits of the surgery outweigh any mortality or morbidity risk arising from comorbidities

during anaesthesia. In addition, a comorbidity may be coded because the patient may require additional care following a procedure.

Finally, the differences across age groups in the likelihood of having a procedure recorded is possibly partly related to how the burden of disease is distributed across age groups in both Indigenous and other Australians.

4.2 Limitations when interpreting data extracted from the National Hospital Morbidity Database

While hospital data collections provide valuable information on various health measures, they have some limitations. Firstly, there is likely to be incomplete identification of Indigenous people in these data, leading to an underestimation of Indigenous hospital separation rates. Even when data are recorded, it is not known how consistently Indigenous status of individual patients has been applied across different hospitals and disease groups. A recent evaluation of the completeness of coverage of Indigenous identification in hospital morbidity collections in each state and territory estimated that the level of completeness was 89% nationally, and varied greatly between states and territories and between remoteness classifications (AIHW forthcoming). Hospital separations where Indigenous status is not stated/missing/unknown were included in the 'other Australians' category. This is because the demographic profile of patients recorded as 'non-Indigenous' has been shown to be similar to that for patients for whom Indigenous status was 'not stated'. For example in 2005–06, there were approximately 128,900 hospitalisations (of all separations that financial year, not our sample) for which Indigenous status of the patient was not reported in New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory combined, compared to approximately 243,100 hospitalisations recorded for Indigenous people. We do know that the proportion of all records where Indigenous status was not reported in these six jurisdictions has declined from approximately 12% of hospitalisations in 1997–98 to 1.8% of hospitalisations in 2005–06 (ABS/AIHW 2008).

Secondly, the NHMD is based on separations (episodes of care) rather than individual patients. While it is still possible to identify many aspects of treatment in hospitals from episode of care records, it is not possible to track individual patients in the data. For example, a patient may have multiple separations for the same disease within the same year and hence multiple episodes for that patient will be counted. This can potentially result in numerator/denominator mismatch.

Thirdly, there are limitations in establishing clear links between a diagnosis code and procedure code using hospital separation data. The principal diagnosis is often recorded at discharge and, by definition, is the diagnosis established to be chiefly responsible for occasioning the patient's episode of admitted hospital care. In some cases the principal diagnosis is known at the beginning of a hospital admission or before a procedure is performed while in other cases there is a provisional diagnosis that is revised over time during an episode of care. In many cases a broad diagnosis (for example, abdominal pain) is made initially and that becomes more specific following subsequent investigation and management. Sometimes a procedure is performed because of an additional diagnosis related to the principal diagnosis, while on other occasions more than one procedure is performed during one hospital admission to manage one diagnosis. Currently the NHMD is not designed to capture the sequencing of diagnoses or the inter-relations between clinical

information. Current classifications, coding practices and medical records design also do not support capturing this information at present.

In addition, procedures are reported in a separate string of codes to diagnoses, and it is not possible to determine if the coding standard that sets out a hierarchy for ordering procedure codes is used in a particular record. Thus it is not known with certainty which procedures relate to which diagnoses, especially in a complex record. However, the analyses that are not included in this report showed that the odds ratios of receiving a particular procedure for those having the related principal diagnosis were very large in comparison with the odds of those not having this principal diagnosis for all of six groups of procedures considered as outcomes in this report (Table 2.3). This confirms the strong association between each group of selected principal diagnoses and the corresponding group of procedures (Table 2.3).

In our study, the preferred option would have been to analyse single diagnoses against single procedures for all the analysis (and not just for appendicitis against appendectomy) but given the fact that procedures performed anatomically close to each other share a degree of overlap in terms of their clinical indications, we decided to analyse aggregated blocks of anatomically related diagnoses against aggregated blocks of corresponding procedures.

4.3 Variables not controlled for in the analysis

There are several other variables that may influence the likelihood of a procedure occurring during a hospital separation. These include *patient-level factors*, such as socioeconomic status, smoking status, level of alcohol consumption, patient preferences for intervention and how well they are anticipated to comply with instructions to care for themselves after procedures and *clinician factors*, such as the supply of expertise to perform procedures and health infrastructure (Fisher & Weeramanthri 2002, Ford & Cooper 1995, Gruen et al. 2002, Mathur et al. 2005). Retrieval services, operating in many parts of the country including remote areas, go some way to addressing the gaps in health service provision for Australians living in more remote areas (both Indigenous and non-Indigenous). It should also be pointed out that while distance between place of usual residence and the nearest health service can provide a crude measure of service access, lack of transport can often mean that even comparatively short distances can be an impediment to service use (ABS/AIHW 2005). One must therefore be careful in interpreting the significance of hospital location in relation to usual place of residence.

Previous studies have also suggested that Indigenous people are hospitalised more per person than other Australians where they could otherwise have had their condition treated in the community (ABS/AIHW 2005). The cultural appropriateness of a health service is also a factor that has been recognised as fundamental to improving use of health services by Indigenous people. Previous studies have suggested that inadequate communication (due to patient–doctor differences in language, culture, priorities and so on) may lead to potentially useful procedures not being performed and that better communication and treatment options may improve compliance (Fisher & Weeramanthri 2002, Mathur et al. 2005). Some of these factors may or may not have been partially accounted for when our study statistically adjusted for Indigenous status.

As discussed earlier, disease severity (for both the principal diagnosis as well as for comorbidities) plays an important role in influencing our results but disease severity cannot be examined or controlled for using the data available from the NHMD.

4.4 Issues related to backward elimination and multivariate analysis

In this study a stepwise, backward elimination method was used to determine the best set of significant explanatory variables to use in the statistical model (also called 'best fit'). Backward elimination begins with an examination of the combined effect of all of the explanatory variables on the dependent variable (the outcome). One by one, the least significant explanatory variables are removed, and a new analysis is performed until all variables left are statistically significant. Backward elimination has the advantage of having all the explanatory variables present in the model at the beginning so their joint predictive capability will be seen.

The backward elimination method produces far more robust results than simply calculating crude odds ratios that are not statistically adjusted for confounding variables. Furthermore, we can divide the variables into two groups. The variables in the first group are always included in the final selected model. For example, Indigenous status was still included in the final selected model for appendectomy (Table 3.1.1) although it was not statistically significant (p value = 0.1677). The variables in the second group are included in the final selected model only if they were statistically significant (p value < 0.05). This approach helps us to decide whether the variables in the second group should be included in the final selected model. Also note that a non-significant variable may be masked by significant variables. For appendectomy, Indigenous status was not significant but people with appendicitis living in more remote areas were less likely to have appendectomy (Table 3.1.1). It is well known that this is more likely to affect Indigenous Australians. Thus this approach allows us to have a say in how the data should be analysed and examine the relationship between the interested variables (Indigenous status) and other significant variables (remoteness of usual residence).

Finally, we used only a logistic regression model as our generalised linear model. There are several other non-logistic statistical models that could also have been used for our analysis.

5 Conclusion

Care must be taken not to overly generalise our results because of the difficulty of disaggregating hospital separation data down to a level that correlates with the clinical subtleties of individual patients. Despite the issues that come with analysing hospital separation data, our multivariate analysis still provides new insights into not only the differential recording of hospital procedures between Indigenous and other patients for specific group diagnoses related to the digestive system, but also into the relative importance of Indigenous status in terms of its influence on the recording of hospital procedures.

In our study, being Indigenous was significantly associated with fewer hospital procedures for most of the diseases chosen for analysis with the exception of appendicitis, selected non-neoplastic anorectal disease and malignant neoplasm of large intestine/rectum, where being Indigenous was found to be non-significant. More importantly we found that there are several other factors, more influential than Indigenous status, that determine whether a hospital procedure is recorded, despite Indigenous status being a significant factor in its own right in most cases. Indigenous-specific health programs, such as those aiming to improve access to hospital procedures, need to be implemented with these broader factors in mind. Such factors include remoteness of hospital, remoteness of usual residence, urgency of admission, admission to a public or private hospital and comorbidities.

Further analysis using similar statistical methods as our study would be useful to ascertain whether the findings of this study are replicated across other diseases categories. Diseases of the digestive tract that would be useful to analyse in any follow-up study include oesophageal carcinoma, end-stage liver disease such as cirrhosis, upper gastrointestinal haemorrhage, diverticular disease of the large bowel and inflammatory bowel disease. Investigative procedures of the upper and lower gastrointestinal tract (that is, gastroscopy and colonoscopy) would also be of value to analyse, but in isolation from the principal diagnosis as these procedures are widely performed for a range of digestive system problems and often before a definitive diagnosis is known.

Appendix

Table A.1: Patient characteristics of hospitalisations with appendicitis as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent
Appendectomy	**25,348**	**94.2**
Age group		
0–4	166	0.6
5–9	1,590	5.9
10–14	4,111	15.3
15–19	4,222	15.7
20–24	3,568	13.3
25–29	2,568	9.5
30–34	2,366	8.8
35–39	1,905	7.1
40–44	1,629	6.1
45–49	1,263	4.7
50–54	1,093	4.1
55–59	877	3.3
60–64	547	2.0
65–70	376	1.4
70–74	283	1.1
75+	356	1.3
Total	**26,920**	**100.0**
Indigenous status		
Indigenous	1,162	4.3
Other	25,758	95.7
Total	**26,920**	**100.0**
Sex		
Female	12,414	46.1
Male	14,506	53.9
Total	**26,920**	**100.0**
Urgency of admission		
Emergency admission	23,280	86.5
Elective admission	3,640	13.5
Total	**26,920**	**100.0**

(continued)

Table A.1 (continued): Patient characteristics of hospitalisations with appendicitis as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent
Sector		
Private hospitals	7,722	28.7
Public hospitals	19,198	71.3
Total	**26,920**	**100.0**
Remoteness of usual residence		
Inner regional Australia	5,160	19.2
Outer regional Australia	4,352	16.2
Remote Australia	1,069	4.0
Very remote Australia	589	2.2
Major cities of Australia	15,750	58.5
Total	**26,920**	**100.0**
Remoteness of hospital		
Inner regional Australia	3,909	14.5
Outer regional Australia	920	3.4
Remote Australia	231	0.9
Very remote Australia	16,786	62.4
Major cities of Australia	5,074	18.9
Total	**26,920**	**100.0**
Additional diagnosis		
Acute upper and lower respiratory tract infections including influenza	115	0.4
Diabetes mellitus or elevated blood glucose levels	506	1.9
Chronic rheumatic heart disease	11	0.0
Ischemic heart disease	119	0.4
Chronic valve disorders other than rheumatic heart disease	13	0.1
Heart failure	77	0.3
Cerebro-vascular disease	16	0.1
Chronic obstructive pulmonary disease	4	0.0
Asthma	158	0.6
Diseases of the liver	9	0.0
Chronic or unspecified renal failure	65	0.2

Source: AIHW National Hospital Morbidity Database

Table A.2: Patient characteristics of hospitalisations with complicated or uncomplicated hernias as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent
Selected hernia procedures	**71,286**	**86.5**
Age group		
0–4	3,946	4.8
5–9	1,581	1.9
10–14	536	0.7
15–19	942	1.1
20–24	1,823	2.2
25–29	2,325	2.8
30–34	3,532	4.3
35–39	4,657	5.7
40–44	5,910	7.2
45–49	6,895	8.4
50–54	8,098	9.8
55–59	9,263	11.3
60–64	8,191	9.9
65–70	7,175	8.7
70–74	6,582	8.0
75+	10,916	13.3
Total	**82,372**	**100.0**
Indigenous status		
Indigenous	1,202	1.5
Other	81,170	98.5
Total	**82,372**	**100.0**
Gender		
Female	20,795	25.3
Male	61,577	74.8
Total	**82,372**	**100.0**
Urgency of admission		
Emergency admission	6,464	7.9
Elective admission	75,908	92.2
Total	**82,372**	**100.0**

(continued)

Table A.2 (continued): Patient characteristics of hospitalisations with complicated or uncomplicated hernias as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003—04 to 2005–06

Variables	Number of hospitalisations	Per cent (%)
Sector		
Private hospitals	44,932	54.6
Public hospitals	37,440	45.5
Total	**82,372**	**100.0**
Remoteness of usual residence		
Inner regional Australia	18,848	22.9
Outer regional Australia	12,767	15.5
Remote Australia	2,070	2.5
Very remote Australia	903	1.1
Major cities of Australia	47,784	58.0
Total	**82,372**	**100.0**
Remoteness of hospital		
Inner regional Australia	17,489	21.2
Outer regional Australia	10,539	12.8
Remote Australia	1,230	1.5
Very remote Australia	431	0.5
Major cities of Australia	52,683	64.0
Total	**82,372**	**100.0**
Additional diagnosis		
Acute upper and lower respiratory tract infections including influenza	245	0.3
Diabetes mellitus or elevated blood glucose levels	3,884	4.7
Chronic rheumatic heart disease	48	0.1
Ischemic heart disease	784	1.0
Chronic valve disorders other than rheumatic heart disease	98	0.1
Heart failure	265	0.3
Cerebro-vascular disease	97	0.1
Chronic obstructive pulmonary disease	70	0.1
Asthma	367	0.5
Diseases of the liver	111	0.1
Chronic or unspecified renal failure	323	0.4

Source: AIHW National Hospital Morbidity Database

Table A.3: Patient characteristics of hospitalisations with selected diseases of the extrahepatic biliary tree as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent (%)
Selected procedures on the extrahepatic biliary tree	**54,325**	**74.0**
Age group		
0–4	88	0.1
5–9	59	0.1
10–14	188	0.3
15–19	1,271	1.7
20–24	2,949	4.0
25–29	4,091	5.6
30–34	5,433	7.4
35–39	5,590	7.6
40–44	5,999	8.2
45–49	6,447	8.8
50–54	6,578	9.0
55–59	7,144	9.7
60–64	6,160	8.4
65–70	5,387	7.3
70–74	5,177	7.1
75+	10,844	14.8
Total	**73,405**	**100.0**
Indigenous status		
Indigenous	2,728	3.7
Other	70,677	96.3
Total	**73,405**	**100.0**
Gender		
Female	49,819	67.9
Male	23,586	32.1
Total	**73,405**	**100.0**
Urgency of admission		
Emergency admission	26,077	35.5
Elective admission	47,328	64.5
Total	**73,405**	**100.0**

(continued)

Table A.3 (continued): Patient characteristics of hospitalisations with selected diseases of the extrahepatic biliary tree as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent
Sector		
Private hospitals	28,954	39.4
Public hospitals	44,451	60.6
Total	**73,405**	**100.0**
Remoteness of usual residence		
Inner regional Australia	16,158	22.0
Outer regional Australia	11,857	16.2
Remote Australia	2,234	3.0
Very remote Australia	1,339	1.8
Major cities of Australia	41,817	57.0
Total	**73,405**	**100.0**
Remoteness of hospital		
Inner regional Australia	14,431	19.7
Outer regional Australia	10,079	13.7
Remote Australia	1,367	1.9
Very remote Australia	622	0.9
Major cities of Australia	46,906	63.9
Total	**73,405**	**100.0**
Additional diagnosis		
Acute upper and lower respiratory tract infections including influenza	301	0.4
Diabetes mellitus or elevated blood glucose levels	5,972	8.1
Chronic rheumatic heart disease	97	0.1
Ischemic heart disease	1,315	1.8
Chronic valve disorders other than rheumatic heart disease	153	0.2
Heart failure	640	0.9
Cerebro-vascular disease	252	0.3
Chronic obstructive pulmonary disease	53	0.1
Asthma	339	0.5
Diseases of the liver	590	0.8
Chronic or unspecified renal failure	659	0.9

Source: AIHW National Hospital Morbidity Database

Table A.4: Patient characteristics of hospitalisations with selected non-neoplastic anorectal disease as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent
Selected procedures on the rectum/anus	**39,537**	**49.6**
Age group		
0–4	517	0.7
5–9	176	0.2
10–14	177	0.2
15–19	768	1.0
20–24	2,136	2.7
25–29	3,044	3.8
30–34	5,014	6.3
35–39	6,707	8.4
40–44	8,274	10.4
45–49	8,751	11.0
50–54	9,489	11.9
55–59	9,614	12.1
60–64	7,506	9.4
65–70	6,142	7.7
70–74	4,564	5.7
75+	6,776	8.5
Total	**79,655**	**100.0**
Indigenous status		
Indigenous	925	1.2
Other	78,730	98.8
Total	**79,655**	**100.0**
Gender		
Female	35,144	44.1
Male	44,511	55.9
Total	**79,655**	**100.0**
Urgency of admission		
Emergency admission	8,310	10.4
Elective admission	71,345	89.6
Total	**79,655**	**100.0**

(continued)

Table A.4 (continued): Patient characteristics of hospitalisations with selected non-neoplastic anorectal disease as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent (%)
Sector		
Private hospitals	49,518	62.2
Public hospitals	30,137	37.8
Total	**79,655**	**100.0**
Remoteness of usual residence		
Inner regional Australia	15,567	19.5
Outer regional Australia	11,355	14.3
Remote Australia	1,756	2.2
Very remote Australia	637	0.8
Major cities of Australia	50,340	63.2
Total	**79,655**	**100.0**
Remoteness of hospital		
Inner regional Australia	13,795	17.3
Outer regional Australia	9,669	12.1
Remote Australia	1,002	1.3
Very remote Australia	314	0.4
Major cities of Australia	54,875	68.9
Total	**79,655**	**100.0**
Additional diagnosis		
Acute upper and lower respiratory tract infections including influenza	62	0.1
Diabetes mellitus or elevated blood glucose levels	2,959	3.7
Chronic rheumatic heart disease	20	0.0
Ischemic heart disease	333	0.4
Chronic valve disorders other than rheumatic heart disease	42	0.1
Heart failure	79	0.1
Cerebro-vascular disease	72	0.1
Chronic obstructive pulmonary disease	13	0.0
Asthma	181	0.2
Diseases of the liver	100	0.1
Chronic or unspecified renal failure	171	0.2

Source: AIHW National Hospital Morbidity Database

Table A.5: Patient characteristics of hospitalisations with malignant neoplasms of the large intestine and rectum as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent
Resection procedures of the large intestine and rectum	**10,455**	**38.8**
Age group		
0–4	1	0.0
5–9	0	0.0
10–14	2	0.0
15–19	25	0.1
20–24	61	0.2
25–29	59	0.2
30–34	150	0.6
35–39	263	1.0
40–44	553	2.1
45–49	1,042	3.9
50–54	1,914	7.1
55–59	2,794	10.4
60–64	3,364	12.5
65–70	4,075	15.1
70–74	4,051	15.0
75+	8,596	31.9
Total	**26,950**	**100.0**
Indigenous status		
Indigenous	172	0.6
Other	26,778	99.4
Total	**26,950**	**100.0**
Gender		
Female	11,623	43.1
Male	15,327	56.9
Total	**26,950**	**100.0**
Urgency of admission		
Emergency admission	4,880	18.1
Elective admission	22,070	81.9
Total	**26,950**	**100.0**

(continued)

Table A.5 (continued): Patient characteristics of hospitalisations with malignant neoplasms of the large intestine and rectum as the principal diagnosis in the AIHW National Hospital Morbidity Database, 2003–04 to 2005–06

Variables	Number of hospitalisations	Per cent (%)
Sector		
Private hospitals	15,285	56.7
Public hospitals	11,665	43.3
Total	**26,950**	**100.0**
Remoteness of usual residence		
Inner regional Australia	6,019	22.3
Outer regional Australia	3,828	14.2
Remote Australia	670	2.5
Very remote Australia	199	0.7
Major cities of Australia	16,234	60.2
Total	**26,950**	**100.0**
Remoteness of hospital		
Inner regional Australia	4,795	17.8
Outer regional Australia	2,746	10.2
Remote Australia	264	1.0
Very remote Australia	57	0.2
Major cities of Australia	19,088	70.8
Total	**26,950**	**100.0**
Additional diagnosis		
Acute upper and lower respiratory tract infections including influenza	240	0.9
Diabetes mellitus or elevated blood glucose levels	2,943	10.9
Chronic rheumatic heart disease	56	0.2
Ischemic heart disease	813	3.0
Chronic valve disorders other than rheumatic heart disease	130	0.5
Heart failure	487	1.8
Cerebro-vascular disease	162	0.6
Chronic obstructive pulmonary disease	40	0.2
Asthma	89	0.3
Diseases of the liver	157	0.6
Chronic or unspecified renal failure	426	1.6

Source: AIHW National Hospital Morbidity Database

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List of tables