HOSPITAL ADMISSIONS FOR AMBULATORY CARE SENSITIVE CONDITIONS
NORTH COAST AREA HEALTH SERVICE
2001 TO 2006

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Table of Abbreviations

ABS	Australian Bureau of Statistics
ACS	Ambulatory care sensitive
AHS	Area Health Service
CHeReL	Centre for Health Record Linkage
CI	Confidence intervals
COPD	Chronic obstructive pulmonary disease
DLB	Data Linkage Branch
ED	Emergency Department
ERP	Estimated resident population
HOIST	Health Outcomes Information Statistical Toolkit
IEO	Index of Education and Occupation
IER	Index of Economic Resources
IRCST	Institute for Rural Clinical Services and Teaching
IRSAD	Index of Relative Socio-economic Advantage and Disadvantage
IRSD	Index of Relative Socio-economic Disadvantage
ISC	Inpatient Statistics Collection
ISR	Indirect age standardised rate
ISRR	Indirect age standardised rate ratio
LGA	Local government area
LL	Lower limit
LOS	Length of Stay
NCAHS	North Coast Area Health Service
NSW	New South Wales
Q1	25th percentile
Q3	75th percentile
SEIFA	Socio-Economic Indexes for Areas
SLA	Statistical local area
UL	Upper limit
WADLS	Western Australia Data Linkage System

INTRODUCTION

The continued increase in hospital admissions, beyond population growth, is one of the major issues facing health services throughout NSW. Reducing any hospital admissions that might be avoidable through early intervention and prevention will lead to improved health outcomes and enable better management of hospital resources.

Around 7% of hospitalisations in NSW during the financial year 2004/05 were considered to be potentially avoidable through preventive care and early disease management (usually delivered by general practitioners or other primary health care). These potentially available admissions are also known as Ambulatory Care Sensitive (ACS) conditions [1]. People who lived in remote or very remote areas of NSW are more than twice as likely compared to those living in metropolitan areas to be hospitalised for these ACS conditions. The most important causes of these avoidable hospitalisations over the period 2002-03 to 2004-05 were chronic obstructive pulmonary disease (COPD), diabetes with complications, angina, asthma, dehydration and gastroenteritis, dental conditions and congestive heart failure [2]

The NSW Government [3] aims to reduce by 15% over five years, hospital admissions for people who should not need to come to hospital. This core aim is also reflected in various State, Area Health Service (AHS) and rural health service plans.

Another core aim of the NSW Government, identified in the *NSW Clinical Services Redesign Program* [4] and the North Coast Area Health Service (NCAHS) *Clinical Services Redesign Program* [5] is to prioritise identification of hospital admissions that could be avoided if alternative models of care were available. The *NCAHS Healthcare Services Plan 2005-2010* [6] outlines the NCAHS's need to manage the current and projected increase in demand for acute services through the development of strategies that offer alternatives to acute bed stays whilst ensuring equitable and improved care outcomes.

In NCAHS in 2007-08 the rate of hospitalisation for all ACS conditions was 2,988.5 per 100,000 population, which is significantly higher than NSW (2473.9 per 100,000 population) [2]. Further analysis over the two-year period of 2006-07 and 2007-08 reports that nine of 12 NCAHS local government areas (LGAs) had smoothed rates per 100,000 population significantly higher than the state average. These LGAs ranged from 79% higher in Kempsey LGA, to 6% higher in Ballina LGA. The exceptions were Tweed, Hastings and Byron LGAs which were 7%, 9% and 21% respectively, significantly lower than the NSW average [2]. Multiple hospital admissions are costly to health services [7]. A recent analysis of multiple hospital admissions in NSW during 2004/05 found that 12% of patients have multiple admissions accounting for 27% of all admissions and 36% of all bed days [8].

This research project extends previous NSW health state wide and AHS wide investigations of multiple admissions, and avoidable hospitalisations by investigating multiple admissions *for* potentially avoidable hospitalisations. This project also provides valuable experience for NCAHS staff to work with linked (hospital admissions linked for individuals) data, an important new and developing health services research resource.

The analysis describes multiple hospital admissions for selected ACS conditions that may have been avoidable with more effective primary care, and includes analysis at the Statistical Local Area unit. This spatial unit is similar to the Local Government Area and is substantially smaller than the Area Health Service geographic area. The analysis describes associations between multiple ACS conditions and individual level characteristics (eg: sex, age, co-morbidities) as well as area level characteristics (eg: regional socio-economic status).

This research project will assist the NCAHS to identify specific groups that predominate in avoidable readmission and possible difference between areas. This information will inform the development of alternative and effective models of care, including out of hospital care. The methods developed for this project will also be useful in evaluating future ACS admissions reduction strategies within the NCAHS.

The overall objectives of the study were to:

1. Identify the priority ACS conditions responsible for the majority of multiple admissions in NCAHS;
2. Describe the characteristics of persons admitted to hospital on more than one occasion for priority ACS conditions in NCAHS, and;
3. Describe the bed days associated with multiple admissions for priority ACS conditions in NCAHS.

The specific research questions addressed in this paper include:

1. Which ACS hospital admissions have the highest rates of multiple admissions in the NCAHS?
2. Which potentially avoidable ACS admissions use the highest proportion of bed days in the NCAHS?
3. Are there age/sex differences in people with ACS multiple admissions in NCAHS?
4. Are there differences in the presence of comorbidities in people with ACS multiple admissions in NCAHS?
5. Are there differences between selected Statistical Local Areas (SLAs) within the NCAHS in multiple ACS admissions?

Literature Review

A search of medical literature was conducted using MEDLINE, EMBASE and CINAHL. The search terms used included; multiple admission; avoidable admission, preventable admission, readmission; cost; ambulatory care sensitive; Australia; data linkage; comorbidity; and access to services. These terms were used in isolation and in combinations with each other. Health and other government agencies have conducted and commissioned much of the research into multiple hospitalisation and this "grey literature" was also searched using web based search engines including, Google Scholar, and NSW Health and NCAHS websites. The Data Linkage Branch (DLB) in Western Australia has worked with data linkage since 1995 and a search was conducted to see if any documented work on ACS conditions and/or multiple admissions have been conducted using to WA Data Linkage System (WADLS) and only one journal article was found [9].

Multiple admissions are costly to health services [7] and do not necessarily improve health outcomes for patients [10]. Identification of patients with multiple admissions for potentially avoidable conditions is one way to assess the adequacy, efficiency and quality of primary health care. Older people (65 years and over) with complex and chronic conditions represent 35% of all hospital separations [11].

Chronic diseases occur mostly later in life [11] and are therefore increasing in prevalence as our population ages. These diseases have complex and often multiple causes, are persistent and debilitating, and people with these conditions can be severely unwell. The quality of life of those affected is significantly impaired due to the accompanying physical limitations and disability. Chronic diseases account for about 70% of the total burden of ill health in Australia [12] ; they are currently Australia's primary health concern and will continue to be into the future[13].

Chronic diseases also present significant problems for the Australian health system [14] (Commonwealth of Australia 2009), accounting for around 70% of the total health expenditure in Australia [15]. Much of this health expenditure reflects the use of hospital and GP services (http://www.aihw.gov.au/cdarf/data_pages/health_care_costs/index.cfm.

There is a considerable body of literature on hospitalisation for ACS conditions. Avoidable hospital admission rates of up to 10% of total hospital admissions have been reported [16], and in Australia the number of avoidable admissions a year is estimated to be approximately half a million admissions [1].

In the only systematic review available of avoidable hospitalisation in chronic disease [17] a range of predictors of avoidable admissions were identified. These operate at the individual level (age, gender, socioeconomic status, race, social support, living arrangements, specific biomarkers, medication use, health status and comorbidity), the health service level (prior hospitalisation, availability of hospital and primary health services, self management support and integrated and coordinated care and physician characteristics) and environmental factors (air quality, air pollutants, and geographical factors such as remoteness and rurality).

For this review, avoidable admissions were defined quite broadly as 'preventable', 'unnecessary' or by the ACS definitions. Study designs were mostly lower level on the hierarchy of research evidence(eg level 3 or 4) (eg observational studies such as retrospective or cross sectional designs), or audit and database reviews.

Definitions of Avoidable Hospitalisation

Currently there are no agreed definitions of avoidable hospital admissions. Research in this area has largely focussed on hospital activity using admissions of people with ACS conditions as an indirect measure of "avoidability". ACS conditions are those conditions for which hospitalisation is considered potentially avoidable through preventive care and early disease management, usually delivered in the primary care setting[1] . Chronic diseases such as diabetes, chronic obstructive pulmonary disease, hypertension, congestive heart failure and angina are known as ACS conditions and studies of hospital admission patterns of people with these conditions[18, 19,1] is thought to be a useful indicator of sub optimal health system performance [20].

There are a wide range of factors, both clinical and non-clinical, influencing admission decisions, and this suggests that efforts to describe an 'avoidable' admission, particularly for research purposes, is complex and multi-dimensional. Not only should it encompass a concept of 'appropriateness' and account for the fact that some admissions are unavoidable, it also requires a careful examination of the continuum of an individual patient's care, before, during and after an earlier hospital admission. The factors include access to and availability of primary health care services, the nature of care and circumstances of the previous admission and the adequacy of care coordination following discharge from an index admission [17, 21].

Different dimensions of avoidability have been explored in recognition of the need for more precise definitions of how avoidability is characterised (ie beyond 'yes' and 'no'). One study [22] examined readmissions using routinely collected data and medical records, classifying these admissions into foreseen, unforeseen for a new condition or unforeseen for a previously known condition. Avoidable admissions were more specifically defined as unforeseen for a previously known condition occurring within an appropriate time interval. Based on this definition, potentially avoidable readmission, adjusted for case mix, was associated with previous hospitalisations, high comorbidity index and long length of stay. In a similar fashion Billings et al [23] analysed computerised Emergency Department (ED) records and with the help of an ED panel of physicians, developed an algorithm classifying admissions into emergent and non emergent. For those that were deemed 'emergent', admissions were further classified into 'primary care treatable', 'ED care needed, but preventable /avoidable', and 'ED care needed, but not preventable/avoidable'.

Predictors of avoidable hospitalisation

Some studies have attempted to describe and quantify predictors of avoidable admissions, using a variety of different methods, study designs and descriptions of avoidability. For the most part, this has been achieved by analysing rates of avoidable admissions using ACS criteria, and examining the relative contribution of a number of other factors readily available in routine health or population data bases, such as: health system use [24 ,25], social disadvantage[1, 24] and rurality [1] ethnicity, neighbourhood, and General Practices types [26], physician supply [25] ,and prescription patterns and primary care services [27].

Avoidable hospitalisation and rurality

Within Australia, the burden of hospitalisation for ACS conditions is higher in rural areas[,1, 2, 11, 28 ,29, 30]. Rural-specific factors have been identified as contributing to avoidable admission. Ansari [28] for example, identifies distance from services as explaining 40% of the variation in ACS hospitalisation rates in Victoria. Muenchberger and Kendall [17] in a systematic review identifying risk factors for ACS chronic admissions identified distance from home to hospital, topographic barriers to access and "rurality". Poorer health outcomes, higher levels of some health risk factors, socioeconomic disadvantage and mental health problems [31] in people living in rural settings have been well documented. Numerous complex and interacting factors are reported in the literature as contributing to hospitalisation rates for ACS conditions [17, 2, 30] but little work has been done on detailed assessments of these factors at the local level, particularly for rural areas.

An analysis of health care expenditure for 2006-7 reveals significant discrepancies between rural and urban areas in the funding of primary health care and suggests that total health expenditure (which includes medical and admitted patient services and PBS) declines with increasing remoteness, while overall spending specifically on patient admissions, increases with remoteness [32]. These discrepancies probably account for the geographical variation in avoidable hospital admission patterns described above, which are in turn driven by relatively poorer access to primary care health professionals compared to urban dwellers [33 ,34]. Hospital services are most likely providing rural people with primary and aged care lacking in their home environment [34]. Some of these acute hospitalisations are therefore likely to be preventable with improved community based care.

There is surprisingly little, if any, hypothesis-driven research on the factors that predispose people to frequent and avoidable hospitalisation in rural settings and specifically, how these differ to urban dwellers. There is ongoing uncertainty about the way in which access influences health service use, health outcomes and quality of life. A number of different dimensions of access have been defined in relation to primary health care, including such factors such as availability, geographical accessibility, affordability and acceptability, and accommodation [28].

A greater understanding of how these factors affect admission patterns for rural patients is needed. Moreover, given the challenges involved with delivery of rural and remote primary health care delivery, there is a critical need for information about the types of interventions that would best reduce frequent and avoidable admissions and maximise quality of life, in rural areas.

Funding

Funding for this project was provided by the then NSW Institute for Rural Clinical Services and Teaching (IRCST) Rural Research Capacity Building Program, now called the Clinical Education and Training Institute (CETI)

Ethics

This project uses de-identifed, routinely collected administrative hospitalisation The research was submitted for "Registering for Negligible Risk or QA" to the NCAHS Human Research Ethics Committee, and granted approval. Permission was also granted from the Centre for Epidemiology and Research, NSW Health, for use of linked hospitalisation data available on Health Outcomes Information Statistical Toolkit (HOIST).

METHODS

Advisory Group

To guide this study, a Project Advisory Group was established and included: a clinician (Dr Paul Laird); senior allied health advisor (Rosie Kew); clinical service planner (Lynn Hopkinson); health service planner (Ms Maureen Lane); project supervisors (Vahid Saberi and Dr Geoff Morgan); public health advisor (Paul Corben); and epidemiologist (Dr Geoff Morgan). This group of specialists were chosen with the view to ensuring that the results of the research would be translated into policy and practice.

Ambulatory Care Sensitive Conditions

Ambulatory Care Sensitive (ACS) conditions are those for which hospitalisation is considered potentially avoidable through preventive care and early disease management, usually delivered through primary health care (for example, by general practitioners or in community health centres). Hospital admissions were categorised into ACS as defined by NSW Health[2]. These ACS condition categories were originally developed by the Victorian Government Department of Human Services[35.] The ACS categories have been reviewed by the Public Health Information Development Unit and approved for use within NSW Health services.

Hospitalisation rates for ACS conditions are used as an indicator of access to, and quality of, primary care[28]. Other factors that influence rates of ACS admissions include disease prevalence in the community, hospital admission and coding practices, and personal choices about seeking health care. ACS conditions were aggregated into three main categories: Vaccine-preventable conditions; Acute conditions; and Chronic conditions. Appendix 1 includes the definition of each of the ACS conditions, and their broader ACS category.

Geographical Area

Hospital admissions for all NCAHS residents were investigated. Due to time and resource constraints, it was not possible to look at hospital admissions for all 12 SLAs within NCAHS. The Project Advisory Group identified five SLAs, which were representative of the socio-economic and age structure of SLAs within the NCAHS. The selected SLAs were Ballina, Bellingen, Richmond Valley – Casino (Casino), Kempsey and Kyogle. None of these SLAs has a referral hospital, and all had a rate of hospitalisation for ACS conditions greater than the NSW average.

Socio-economic Status

Economic status is closely associated with health and wellbeing [36]. People who are economically disadvantaged experience poorer health than economically advantaged people [37].

The socio-economic status of an SLA was assessed using an indicator developed by the Australian Bureau of Statistics (ABS) using data collected in the Australian Census. The indicator, known as Socio-Economic Indexes for Areas (SEIFA), provides a standardised method of determining the level of social and economic well-being of communities within Australia. The SEIFA indices include: Index of Relative Socio-economic Disadvantage (IRSD), Index of Education and Occupation (IEO), Index of Relative Socio-economic Advantage and Disadvantage (IRSAD), Index of Economic Resources (IER) [38-40].

Each SEIFA index ranks different geographic areas of Australia according to a 'score' that is created for the area based on characteristics of people, families and dwellings within that area. We will focus on the IRSD, a measure of socio-economic disadvantage often used in health studies. The reference score for the whole of Australia set to a mean score of 1,000. Lower scores indicate relatively greater disadvantage and lower socioeconomic status. Along with the index score, we have reported each deciles value as ranked within NSW, for each of the SLAs. It should be noted that the indices measure the socio-economic well-being of regions, and not the individual.

Data sources

All data used in this research was accessed through HOIST. The Centre for Epidemiology and Research, NSW Department of Health, operates this SAS-based 'data warehouse' which provides a common data analysis environment across the public health network in NSW. HOIST brings together the majority of data collections often used in population health surveillance in NSW, and contains all the available historical data for each collection. Each of these data collections are stored as SAS datasets.

Record Linkage

Routinely collected data on NSW hospital separations inclusive of the period July 2001 to June 2006 were examined. The Centre for Health Record Linkage (CHeReL) has carried out internal linkage of the Admitted Patient Data Collection (APDC), formerly known as the Inpatient Statistics Collection (ISC), episodes of care datasets. These ISC2ISC (CHeReL) datasets, are split by financial year of separation and are available via the HOIST server.

The data are linked using probabilistic record linkage techniques to link personal information from a defined set of health-related datasets to create a Master Linkage key. Project Person Numbers are attached to the datasets, and used to link records referring to the same person. In this report data linked within individual years 2001/02 to 2005/06 has been used.

Due to the relatively small number of admissions for the priority ACS conditions in the selected SLAs, we decided not to further stratify the generally small number of counts in each ACS condition by age. Apart from asthma, the selected conditions predominately affect the elderly and we assumed the majority of all ACS admissions will be in the ≥65 age groups. This is supported by the information in *Table 11* where the median age of males and females is 65 years or older for all the selected conditions except for cellulitis males (51 years), and asthma males (8 years), asthma females (31 years). The younger median age for asthma and the differences between sexes is consistent with current understanding of the epidemiology of asthma.

Population Data

The population data is derived from Australian Bureau of Statistics (ABS) estimated resident populations and NSW Health Population Projection Series 1, 2009 - ASGC 2006 and available on HOIST. Age- and sex-specific estimated resident populations (ERPs) for NSW AHSs and NSW Statistical Local Areas (SLAs) at 30 June 2004 were used.

Data Analysis

SAS for Windows Version 9.1 (SAS, 2002-2003) was used for all data analysis and Microsoft Office Excel 2003 (1985-2003) for the production of data tables and charts.

Exclusions

The initial data extraction was for all hospitalisation for NCAHS residents and residents of the five selected SLAs. We used a similar approach to a multiple admissions study conducted by the NSW Health Demand and Performance Evaluation Branch in 2007 and excluded a range of admissions for conditions that were considered to be unavoidable, or outside the scope of this analysis. These conditions included: obstetrics and neonates; dialysis; chemotherapy and radiotherapy; admission/discharge from Emergency Department (ED); Drug & Alcohol and psychiatric patients.

Selection of priority conditions

After consideration of the ranking of NCAHS ACS data for admissions and bed days (see Table 6), and consultation with the Project Advisory Group we decided to focus on the following *priority* ACS conditions:

- Angina
- COPD
- Diabetes
- Heart Failure
- Pyelonephritis
- Cellulitis
- Asthma

Comorbidity Index

Comorbidities were assigned to each admission using the Charlson index [41]. The Charlson index assigns weights by severity to the primary and up to 50 secondary diagnoses to give an overall comorbidity score. We also calculated condition specific comorbidity indexes for the selected conditions where the ACS condition was not included in the comorbidity index.

Comorbidity was assessed by looking at all the ACS admissions for the selected condition for a person in the study period and identifying if any admissions indicated the presence / absence of comorbidities (excluding the ACS of interest). Those with no history of comorbidities for all ACS admissions were categorised as “No” (0). Those with a history of comorbidities in one or more admissions were categorised as “Yes” (1,2).

Crude rates

The crude rates of persons, admissions and bed days were calculated by dividing the total number of events (ie persons, admissions or bed days) during the study period by the total number of individuals in the population (ie those who are at risk for these events) and multiplying by 100,000. Crude rates were calculated for all hospitalisations and all ACS admissions for NCAHS residents and residents of the five selected SLAs.

Crude rates were used as a summary measure, as it does not adjust for other factors such as age or gender. A crude rate is a real number and it provides an absolute measurement as well as a useful statistical tool for comparison and trend analysis.

Age- Standardisation of Rates and Ratios

Indirect age standardised rates (ISR) and indirect age standardised rate ratio (ISRR) of persons, admissions and bed days were calculated for all hospitalisations and all ACS admissions for residents of the five selected SLAs, using the NCAHS as the standard population. The NCAHS indirect age standardised rate ratio equals 100. The ISRs were multiplied by 100,000. Indirect standardisation was chosen as it is highly robust when dealing with small numbers[42].

Age at index admission

The age at index admission was defined as the age at the first-ever hospitalisation of a person within the study period.

Length of Stay (LOS)

LOS is defined as the number of days between hospital admission and hospital separation. This value is stored as an integer within each record, and is used to calculate bed days. LOS is generally accepted as a major determinant of and proxy measure for a patient's resource consumption [43].

Frequency of admission

The first-ever hospitalisation (index admission) of a person within the study period was given an admission count value of '1', and for every subsequent admission, their admission count was increased by one. As decided by the Project Advisory Committee, a multiple admission is defined as two or more admissions for the same person anytime within the study period. Frequency of admissions count was calculated for all admissions, and separately for ACS admissions only.

RESULTS

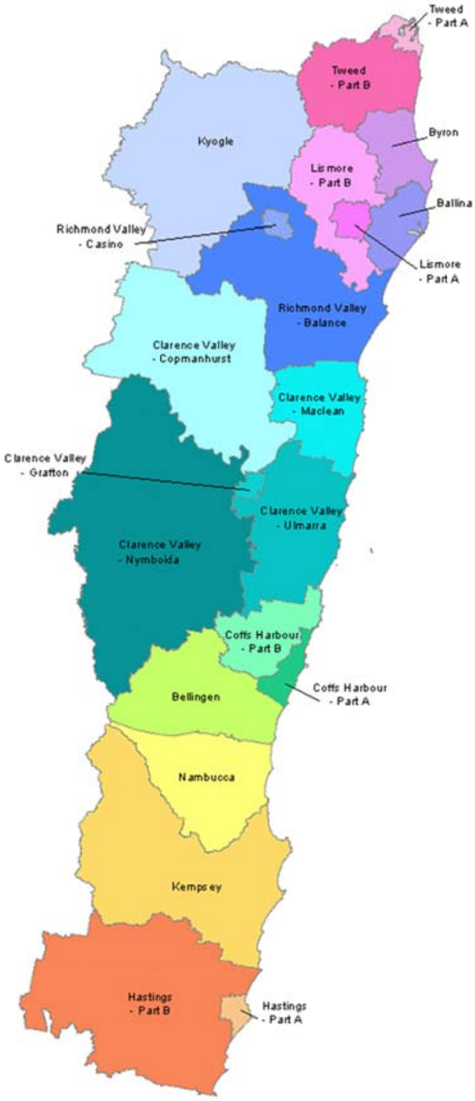
Study Region

NCAHS covers an area of 35,570 square kilometres extending from Port Macquarie in the south, Queensland border in the north and westward to the Great Dividing Range. The western and southern borders of NCAHS join the Hunter/New England Area Health Service.

Settlement patterns of residents in the NCAHS show higher concentrations on the coastal strip, with large coastal settlements at Port Macquarie, Coffs Harbour, Ballina and Tweed Heads. Inland there is a high concentration of people along the rail transit system and state highway. The remaining population is scattered over larger areas, making delivery of health services to isolated areas more difficult.

The NCAHS is made up of 21 statistical local areas (ASGC 2001), as shown in Figure 1.

Figure 1: Map of the Statistical Local Areas within the North Coast Area Health Service



The five selected SLAs are representative of the demographic and social profile of all SLAs within NCAHS. The populations for the NCAHS and the selected SLAs are summarised in

Table 1. In 2004, the total population of the NCAHS was 468,810 persons. The selected SLAs represent 21% of the total NCAHS population with Ballina having the largest total pop (39,567 persons), and Kyogle (9,622 persons) the smallest.

Table 1 : Distribution of estimated resident populations (ERP) by specific age groups and geographical area, 2004
Source: ABS estimated resident populations and NSW Health Population Projection Series 1, 2009 - ASGC 2006 (HOIST)

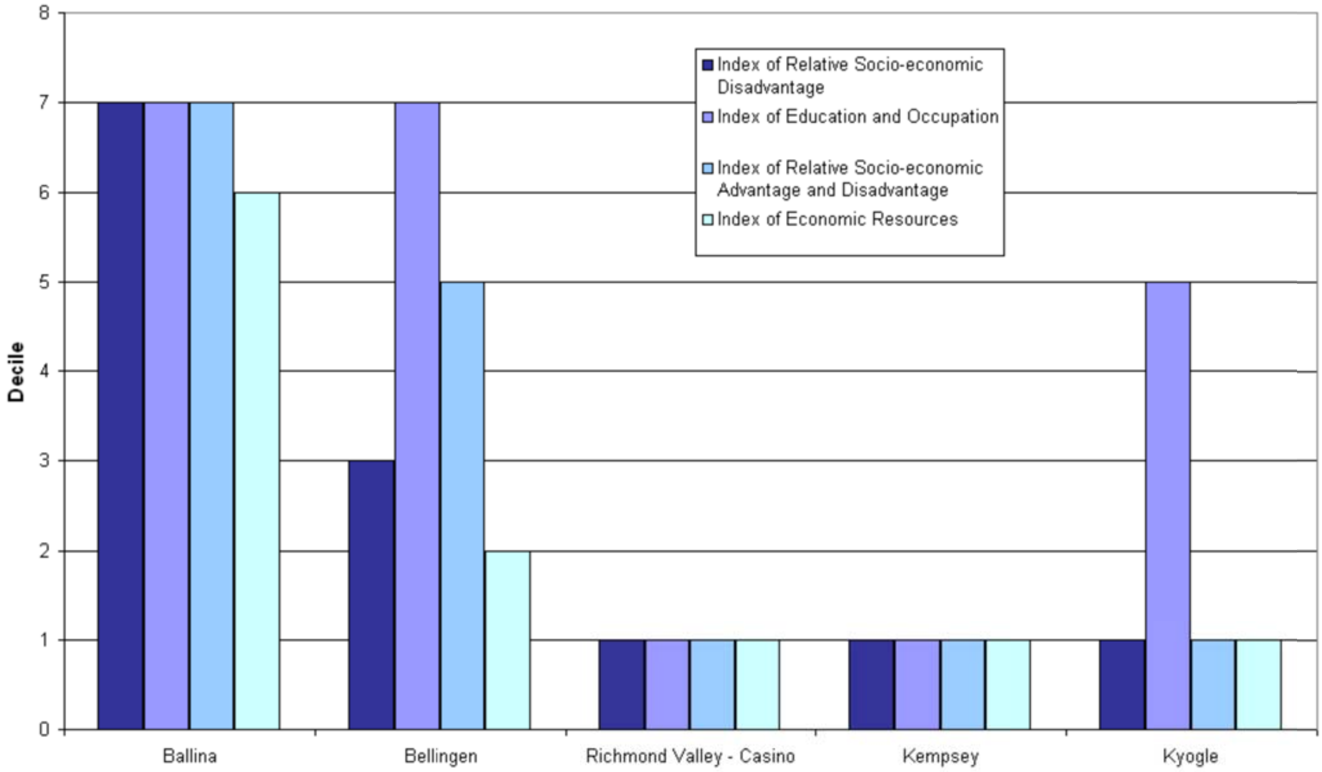
	Age group								
	0 - 14		15 - 44		45 - 64		65+		All ages
Geographical Area	**ERP**	**% of total ERP**	**ERP**	**% of total ERP**	**ERP**	**% of total ERP**	**ERP**	**% of total ERP**	**ERP**
Ballina	7,562	19.1%	13,787	34.8%	10,693	27.0%	7,525	19.0%	39,567
Bellingen	2,656	20.7%	4,105	32.1%	3,783	29.6%	2,232	17.4%	12,776
Casino	2,274	21.4%	3,838	36.1%	2,501	23.5%	1,991	18.7%	10,604
Kempsey	5,949	21.3%	9,455	33.8%	7,820	28.0%	4,701	16.8%	27,925
Kyogle	2,192	22.7%	3,254	33.8%	2,841	29.5%	1,335	13.8%	9,622
North Coast Area	**93,506**	**19.9%**	**163,767**	**34.9%**	**126,588**	**27.0%**	**84,949**	**18.1%**	**468,810**

Table 2 summarises the SEIFA index scores and deciles values (within NSW) by selected SLA. A lower score indicates that an area is relatively disadvantaged compared to an area with a higher score. Ballina SLA is the least socio-economically disadvantaged (IRSD 992; IEO 980; IRSAD 986; IER 985) of the selected SLAs with the largest population, including the largest proportion of older persons (19% of the population 65+ years). Kyogle is amongst the most socio-economically disadvantaged (IRSD 919; IEO 945; IRSAD 898; IER 931) SLAs in the NCAHS, and it has the smallest population, including the lowest proportion of older persons (14% of the population 65+ years). Figure 2 presents the SEIFA indices for the five selected SLAs as bar charts to better illustrate the variation in indices within each SLA, and between SLA's. While there is some variation in the deciles of the four indices for the selected SLAs, Kempsey, Kyogle and Casino have a similar lower socio-economic profile, Bellingen is in the mid range of socio-economic status, and Ballina is the least socio-economically disadvantaged of the selected SLAs.

Table 2: Socio-economic Indexes for Areas (SEIFA) by geographical area, 2006

	Index of Relative Socio-economic Disadvantage (IRSD)		Index of Education and Occupation (IEO)		Index of Relative Socio-economic Advantage and Disadvantage (IRSAD)		Index of Economic Resources (IER)	
Geographical Area	**Score**	**NSW Decile**	**Score**	**NSW Decile**	**Score**	**NSW Decile**	**Score**	**NSW Decile**
Ballina	992	7	980	7	986	7	985	6
Bellingen	955	3	971	7	946	5	944	2
Richmond Valley - Casino	884	1	853	1	866	1	905	1
Kempsey	901	1	891	1	890	1	916	1
Kyogle	919	1	945	5	898	1	931	1

Figure 2 : SEIFA deciles by geographical area, 2006



Exclusions

Initially we extracted hospital admissions for all NCAHS residents from 1 July 2001 to 30 June 2006. Hospital admission data was linked for each person so that it enabled investigation of all admissions during the study period for each person. Admissions that were considered to be non-avoidable, or outside the scope of the analysis were excluded. These exclusions are summarised in Table 3, and are similar to the exclusions that occur when investigating only ACS conditions. After exclusions, there were a total of 269,831 persons with 633,956 admissions resulting in a total of 2,335,157 bed days within NCAHS hospitalisations from July 2001 to June 2006.

Table 3 : Total Admissions and exclusions of persons, admission and bed days, NCAHS (July 2001 - June 2006)

Category	**Persons**	**Admissions**	**Beddays**
Total Admissions	287,580	748,545	2,649,406
Exclusions			
Newborns	25,957	26,745	102,853
Obstetrics	15,802	25,049	83,955
Dialysis	901	63,385	63,460
Drug & Alcohol	5,365	7,416	20,199
Psychiatric	6,535	13,546	127,328
Chemotherapy	74	287	290
Radiotherapy	30	81	81
Admissions(after Exclusions)	269,831	633,956	2,335,157

Table 4 summarises the annualised Indirectly Standardised Rate Ratio (ISRR) and Indirectly Standardised Rate (ISR) of all hospitalisations for persons, admissions and bed days in the selected SLAs within the study period to enable comparisons between the selected SLAs and NCAHS. The results indicate substantial variability in the annualised rates of persons, admission and bed days within the SLAs compared to the NCAHS. Ballina has consistently lower ISRs for persons, admissions and bed days compared to the other SLAs. Compared to NCAHS, the annualised ISR of persons for residents of Ballina

(11,929.3 per 100,000 persons) was not significantly different. Statistically significant increases of 11% existed for Kyogle (13,582.4 per 100,000 persons), 13% for Kempsey (14,632.7 per 100,000 persons), 17% for Bellingen (15,600.9 per 100,000 persons), and 20% higher for Casino (16,526.2 per 100,000 persons) compared with NCAHS residents.

The annualised ISR for admissions ranged from similar to NCAHS for Ballina residents (27,966.3 per 100,000 persons), to a statistically significant increase of 10% for Kyogle (30,046.9 per 100,000 persons), 23% for Casino (41,126.3 per 100,000 persons), 26% for Kempsey (41,766.8 per 100,000 persons), and 29% for Bellingen SLA residents (44,625.9 per 100,000 persons), compared with the NCAHS residents.

The annualised ISR for bed days showed the most variability, ranging from a significant 7% lower rate in Ballina (90,513.6 per 100,000 persons) compared to the NCAHS, to significantly higher increases of 19% in Casino (146,988.5 per 100,000 persons), 24% in Kempsey (144,658.7 per 100,000 persons), 37% in Bellingen (181,736.7 per 100,000 persons) and an even greater increase of 87% higher in Kyogle SLA residents (295,434.0 per 100,000 persons) compared with NCAHS residents.

Table 4 : All hospitalisation annualised indirectly age standardised rates and ratios with 95% CIs for persons, admissions and bed days, July 2001 to June 2006

Local Government Area		Annualised Indirectly Std Rate Ratio (ISRR)	ISRR LL 95% CI	ISRR UL 95% CI	Annualised Indirectly Std Rate per 100,000 (ISR)	ISR LL 95% CI	ISR UL 95% CI
Ballina	Persons	101	98	104	11,929.3	11,589.2	12,276.8
Bellingen		117	112	123	15,600.9	14,868.2	16,360.3
Casino		120	114	126	16,526.2	15,690.9	17,394.5
Kempsey		113	110	117	14,632.7	14,159.3	15,117.9
Kyogle		111	105	118	13,582.4	12,816.7	14,381.9
Ballina	Admissions	100	99	102	27,966.3	27,446.5	28,493.4
Bellingen		129	125	133	44,625.9	43,318.4	45,962.7
Casino		123	119	127	41,126.3	39,784.9	42,501.3
Kempsey		126	123	128	41,766.8	40,921.1	42,625.7
Kyogle		110	106	115	30,046.9	28,906.8	31,220.4
Ballina	Bed days	93	92	94	90,513.6	89,612.3	91,421.8
Bellingen		137	135	139	181,736.7	179,015.1	184,489.2
Casino		119	117	121	146,988.5	144,482.5	149,527.0
Kempsey		124	122	125	144,658.7	143,093.8	146,236.4
Kyogle		187	184	190	295,434.0	290,760.1	300,164.1

Ambulatory Care Sensitive Conditions in NCAHS

Table 5 summarises the number of ACS conditions by persons, admissions and bed days within the NCAHS during the study period, as well as the ranking of the selected ACS conditions compared to all ACS conditions. Angina, COPD, diabetes complications, and congestive heart failure were responsible for 43% of all ACS admissions and 55% of all ACS bed days. COPD, alone, contributed to 20% of all ACS bed days. The highest number of persons admitted for ACS conditions were for angina, followed by dental conditions, diabetes, dehydration and gastroenteritis, pyelonephritis (urinary tract infection), cellulitis, COPD, heart failure, ear nose and throat infections, and asthma. The highest number of admissions for ACS conditions were for angina, followed by COPD, diabetes, heart failure, dental conditions, pyelonephritis, dehydration and gastroenteritis, cellulitis, and asthma. COPD had the highest number of bed days for ACS conditions, followed by heart failure, diabetes, angina, cellulitis, pyelonephritis, dehydration and gastroenteritis, and asthma.

*Table 5 : ACS conditions by ranked persons, admissions and bed days, NCAHS (July 2001 to June 2006)**

ACS Condition	ACS Category	Persons (n, rank, %)			Admissions (n, rank,%)			Beddays (n, rank,%)		
Influenza and pneumonia	Vaccine	1,506		2.9	1,610		2.3	10,359		3.6
Other vaccine preventable	Vaccine	182		0.4	206		0.3	1,046		0.4
Asthma	Chronic	3,186	(10)	6.2	4,564	(9)	6.5	11,440	(8)	3.9
Congestive heart failure	Chronic	3,738	(8)	7.3	5,691	(4)	8.1	42,477	(2)	14.6
Diabetes complications	Chronic	4,752	(3)	9.2	7,904	(3)	11.2	35,300	(3)	12.1
COPD	Chronic	3,836	(7)	7.5	8,299	(2)	11.8	57,747	(1)	19.9
Angina	Chronic	6,038	(1)	11.7	8,604	(1)	12.2	24,765	(4)	8.5
Iron deficiency anaemia	Chronic	1,696		3.3	2,267		3.2	4,397		1.5
Hypertension	Chronic	944		1.8	1,109		1.6	4,513		1.6
Nutritional deficiencies	Chronic	14		0.0	23		0.0	305		0.1
Dehdration and gastroenteritis	Acute	4,631		9.0	5,043		7.2	13,512		4.6
Pyelonephritis	Acute	4,273	(5)	8.3	5,082	(6)	7.2	24,457	(6)	8.4
Perforated/bleeding ulcer	Acute	603		1.2	656		0.9	3,927		1.4
Cellulitis	Acute	3,855	(6)	7.5	4,579	(8)	6.5	24,631	(5)	8.5
Pelvic inflamatory disease	Acute	677		1.3	735		1.0	1,714		0.6
Ear nose and throat infections	Acute	3,544		6.9	3,820		5.4	7,906		2.7
Dental conditions	Acute	4,935		9.6	5,373		7.6	6,379		2.2
Ruptured appendix	Acute	281		0.5	289		0.4	1,716		0.6
Convulsons and epilepsy	Acute	2,490		4.8	4,240		6.0	10,167		3.5
Gangrene	Acute	278		0.5	323		0.5	3,973		1.4
Total		**51,459**			**70,417**			**290,731**		

*Rankings presented for selected ASC conditions compared to all ASC conditions

Table 6 summarises the proportion of persons, admissions and bed days related to ACS conditions in the NCAHS and the selected SLAs, compared to all hospitalisations. In NCAHS, 16.3% (n=44,017) of all persons admitted to hospital during the study period were admitted on at least one occasion for an ACS condition. During the study period, 11% (n=70,175) of all admissions in the NCAHS were ACS admissions, and these ACS admissions accounted for 12.3% (n=288,259) of the total number of bed days. Ballina had a lower percentage of ACS persons, ACS admission and ACS bed days compared to the NCAHS (13.7%, 9.3% and 11.1% respectively). Except for Ballina, the percentage of ACS persons, ACS admissions and ACS bed days was higher in all other selected SLAs compared to NCAHS.

Table 6 : All hospitalisation and ACS totals, and proportions of persons, admissions and total bed days, (July 2001 to June 2006)

Geographical Area	Persons	ACS Persons	ACS Persons %	Admissions	ACS Admissions	ACS Admissions %	Beddays	ACS Beddays	ACS Beddays %
Ballina	23,303	3,195	13.7%	55,085	5,096	9.3%	192,721	21,431	11.1%
Bellingen	8,505	1,609	18.9%	22,051	2,627	11.9%	85,013	10,427	12.3%
Casino	7,329	1,466	20.0%	17,763	2,383	13.4%	65,524	9,703	14.8%
Kempsey	18,054	3,291	18.2%	46,373	5,665	12.2%	163,250	21,064	12.9%
Kyogle	5,874	966	16.4%	13,090	1,551	11.8%	76,143	6,391	8.4%
NCAHS	**269,831**	**44,017**	**16.3%**	**633,956**	**70,175**	**11.1%**	**2,335,157**	**288,259**	**12.3%**

Of the total 70,175 ACS admissions in the study period a small number of ACS admissions (n=242, 0.3%) were classified into two ACS categories, because they were diagnosed with two ACS conditions within the one admission. Table 5 stratifies by specific ACS conditions and it is possible for a person to be counted in each appropriate ACS condition, and therefore the total persons count in Table 6 (44,017) is substantially different to the total persons count in Table 5. In Table 6, the 242 admissions with two ACS conditions diagnosed were counted as 242 ACS admissions and their bed days were counted once. However, in Table 5, again the stratification by specific ACS conditions allows the dual diagnosis from a single ACS admission to be counted in each appropriate ACS condition and their associated bed days. Therefore, the total ACS admissions (70,175) and ACS bed days (288,259) in Table 6 is marginally different to the total ACS admissions (70,417) and ACS bed days (290,731) in Table 5.

For the remainder of this paper we ignore the fact that 242 admissions were classified into two ACS categories, and they are treated as separate admissions.

Table 7 summarises the annualised Indirectly Standardised Rate Ratio (ISRR) and Indirectly Standardised Rate (ISR) of all persons admitted to hospital in the NCAHS within the study period for ACS conditions, along with the associated ACS admissions and ACS bed days. The results indicate substantial variability in the annualised rates of ACS persons, ACS admission and ACS bed days between the selected SLAs compared to NCAHS. As with all hospitalisations, Ballina SLA residents had consistently lower ISRs for ACS persons, ACS admissions and ACS bed days compared to NCAHS and the other SLAs. The annualised ACS persons, ACS admissions and ACS bed days ISR were significantly lower by around 16% in Ballina SLA residents (1,352.7 per 100,000 persons, 2,143.2 per 100,000 admissions, 8,987.4 per 100,000 bed days respectively) compared to NCAHS residents. The ISR of ACS persons, ACS admissions and ACS bed days in all the other selected SLAs were significantly higher compared to the NCAHS, ranging from 18-45% higher compared with NCAHS residents, with Casino SLA residents having consistently the largest increase in ACS persons (43%), ACS admissions (45%) and ACS bed days (41%). These results suggest that the ISRRs of ACS persons, ACS admissions and ACS bed days for Ballina are different to the other selected SLAs. The ISRR suggest that there is little difference in the rates of ACS persons, ACS admissions and ACS bed days between Bellingen, Casino, Kempsey and Kyogle.

Table 7 : All ACS hospitalisation annualised indirectly age standardised rates and ratios with 95% CIs for ACS persons, ACS admissions and ACS bed days by selected SLAs, (July 2001 to June 2006)

Local Government Area		**Annualised Indirectly Std Rate Ratio (ISRR)**	**ISRR LL 95% CI**	**ISRR UL 95% CI**	**Annualised Indirectly Std Rate per 100,000 (ISR)**	**ISR LL 95% CI**	**ISR UL 95% CI**
Ballina	**ACS Persons**	84	77	91	1,352.7	1,249.9	1,461.8
Bellingen		137	122	152	3,441.4	3,075.6	3,838.7
Casino		143	127	160	3,951.0	3,511.6	4,430.1
Kempsey		129	119	139	3,030.3	2,803.2	3,270.9
Kyogle		118	102	135	2,361.0	2,039.8	2,718.4
Ballina	**ACS Admissions**	83	78	88	2,143.2	2,013.6	2,278.9
Bellingen		140	128	152	5,752.4	5,271.0	6,266.0
Casino		145	133	159	6,534.4	5,960.9	7,148.3
Kempsey		140	132	148	5,678.0	5,352.1	6,018.5
Kyogle		121	108	135	3,907.9	3,485.0	4,367.8
Ballina	**ACS Beddays**	83	80	85	8,987.4	8,720.3	9,260.6
Bellingen		136	130	142	22,134.7	21,194.7	23,105.5
Casino		141	135	148	25,848.8	24,711.4	27,025.1
Kempsey		131	127	135	19,747.6	19,155.7	20,353.1
Kyogle		131	124	138	17,384.5	16,444.4	18,364.3

Table 8 summarises the ACS admissions by ACS category for NCAHS and the selected SLAs for the study period. Of the admissions for ACS conditions in the NCAHS, 3% were for vaccine preventable conditions, 55% were for chronic conditions and 43% were for acute conditions. During the study period, ACS vaccine preventable conditions accounted for 4% of ACS persons, 3% of ACS admissions and 4% of ACS bed days for NCAHS residents. Casino SLA residents had double the NCAHS average of ACS persons (8%), ACS admissions (6%) and ACS bed days (9%) admitted for ACS vaccine preventable conditions. ACS Acute conditions accounted for 51% of ACS persons, 43% of ACS admissions and 34% of ACS bed days in NCAHS residents. Bellingen SLA residents had the highest percentage of ACS persons (55%), ACS admissions (47%) and ACS bed days (39%) for ACS Acute conditions compared to the other selected SLAs and NCAHS. In NCAHS residents, ACS Chronic conditions accounted for 45% of ACS persons, 55% of ACS admissions and 62% of ACS bed days of all ACS conditions. Kyogle SLA residents had the highest percentage of ACS persons (46%), ACS admissions (57%) and ACS bed days (68%) for ACS Chronic conditions compared to the other selected SLAs and NCAHS.

Table 8: ACS categories by proportions of ACS persons, ACS admissions and ACS bed days and geographical area, July 2001 to June 2006

Geographical Area	ACS category	ACS Persons		ACS Admissions		ACS Beddays	
Ballina	Vaccine Preventable	111	3%	120	2%	698	3%
Bellingen		47	3%	59	2%	343	3%
Casino		132	8%	143	6%	837	9%
Kempsey		150	4%	174	3%	910	4%
Kyogle		51	5%	58	4%	308	5%
NCAHS		**1,685**	**4%**	**1,816**	**3%**	**11,405**	**4%**
Ballina	Chronic Conditions	1,630	48%	2,860	56%	13,306	62%
Bellingen		733	42%	1,333	51%	6,045	58%
Casino		721	45%	1,294	54%	5,561	57%
Kempsey		1,530	43%	3,094	54%	13,447	63%
Kyogle		481	46%	878	57%	4,347	68%
NCAHS		**21,405**	**45%**	**38,461**	**55%**	**180,944**	**62%**
Ballina	Acute Conditions	1,680	49%	2,130	42%	7,612	35%
Bellingen		957	55%	1,242	47%	4,072	39%
Casino		745	47%	952	40%	3,335	34%
Kempsey		1,861	53%	2,415	42%	6,871	32%
Kyogle		504	49%	615	40%	1,736	27%
NCAHS		**24,202**	**51%**	**30,132**	**43%**	**98,335**	**34%**

Length of Stay (LOS) for ASC hospitalisations

Table 9 presents summary statistics for length of stay (LOS) for ACS and non-ACS admissions. The median LOS for NCAHS ACS hospital admissions is two days, compared to one day for a non-ACS admission, with 25% of ACS admissions staying for five or more days, compared to 25% of non-ACS admissions staying for three or more days. The median LOS for the selected SLAs is similar to NCAHS for both ACS and non-ACS admissions.

Table 9 : Summary statistics for length of stay for ACS and non-ACS admissions by geographical area, July 2001 to June 2006

Geographical Area	ACS					Non-ACS				
	Q1	Median	Q3	Total Beddays	%	Q1	Median	Q3	Total Beddays	%
Ballina	1	2	5	21,431	11.1%	1	1	3	171,290	88.9%
Bellingen	1	2	4	10,427	12.3%	1	1	4	74,586	87.7%
Casino	1	2	5	9,703	14.8%	1	1	3	55,821	85.2%
Kempsey	1	2	4	21,064	12.9%	1	1	3	142,186	87.1%
Kyogle	1	2	4	6,391	8.4%	1	1	3	69,752	91.6%
NCAHS	**1**	**2**	**5**	**288,259**	**12.3%**	**1**	**1**	**3**	**2,046,898**	**87.7%**

Comorbidities in ASC hospitalisation

Table 10 summarises the presence of comorbidities for ACS and non-ACS admissions during the study period. While more than three quarters (79%) of non-ACS admissions of NCAHS residents had no comorbidities, only around half of ACS admissions (51%) had no comorbidities. The proportion of ACS admissions with no comorbidities in the selected SLAs ranged from 47% in Kyogle to 59% in Bellingen SLA residents.

Table 10 : ACS and non-ACS admissions by comorbidity status and geographical area, July 2001 to June 2006

Geographical Area	ACS admissions		non-ACS admissions	
	No. of comorbities	No. of comorbities	No. of comorbities	No. of comorbities
	0	1+	0	1+
Ballina	53	47	82	18
Bellingen	59	41	80	20
Casino	51	49	80	20
Kempsey	51	49	75	26
Kyogle	47	53	82	18
NCAHS	**51**	**49**	**79**	**21**

Age at Index Admission in ASC hospitalisations

Table 11 summarises the age at index admission for persons by sex and priority ACS condition. A similar table also stratified by the selected SLAs is included in Appendix 2. Females are three to four years older than males at index admission for ACS Angina (males 67.8yrs, females 71.7yrs), ACS Diabetes (males 71.3yrs, females 73.8yrs), and ACS Heart Failure (males 78.3yrs, females 82.6yrs). Females are a couple of years younger at index admission for ACS COPD (males 74.8yrs, females 72.6yrs), and eight years younger for Pyelonephritis (males 73.4yrs, females 65.7yrs).

The median age of the index admission for ACS Asthma in the NCAHS is substantially different for males (8 yrs) and females (31 yrs). This large difference in the median age of index admission for male and female ACS asthma is consistent across the selected SLAs. One quarter of males admitted for Asthma are less than three years at index admission, while one quarter of females are less than 6.8 years. There was substantial variability in the median age of first ACS asthma admission for females across the selected SLAs ranging from 27 years in Casino to 41 years in Kempsey.

The median age of the index admission for ACS Cellulitis in the NCAHS is substantially different for males (51 yrs) and females (65 yrs). This large difference in the median age of index admission for ACS Cellulitis is relatively consistent across the selected SLA's. The greatest age difference was in Kyogle SLA, with males (48 yrs) and females (71 yrs). One quarter of males admitted for ACS Cellulitis are less than 31 years at index admission, while one quarter of females are less than 40 years. One quarter of males admitted for ACS Pyelonephritis are less than 53, while one quarter of females are less than 30 years of age at index ACS admission. Of those admitted for ACS COPD, ACS Heart Failure, and ACS Pyelonephritis, one quarter of males and females are over 80 years of age at index ACS admission.

Table 11 : Priority ACS condition by age at index admission and sex, NCAHS (July 2001 to June 2006)

ACS Condition	Sex	Age at index admission			
		N	Q1	Median	Q3
Angina	Male	3,338	57.4	67.8	76.2
	Female	2,700	60.3	71.7	80.7
Asthma	Male	1,512	3	7.8	30.7
	Female	1,674	6.8	31.4	57.4
COPD	Male	2,060	66.8	74.8	80.8
	Female	1,776	63	72.6	80.4
Cellulitis	Male	2,210	30.6	50.8	71.6
	Female	1,645	39.6	64.5	80.2
Diabetes	Male	2,502	60.5	71.3	78.1
	Female	2,250	64.5	73.8	79.5
Heart Failure	Male	1,830	71.4	78.3	84.3
	Female	1,908	75.7	82.6	87.9
Pyelonephritis	Male	1,289	53.3	73.4	81.4
	Female	2,984	29.1	65.7	82.2

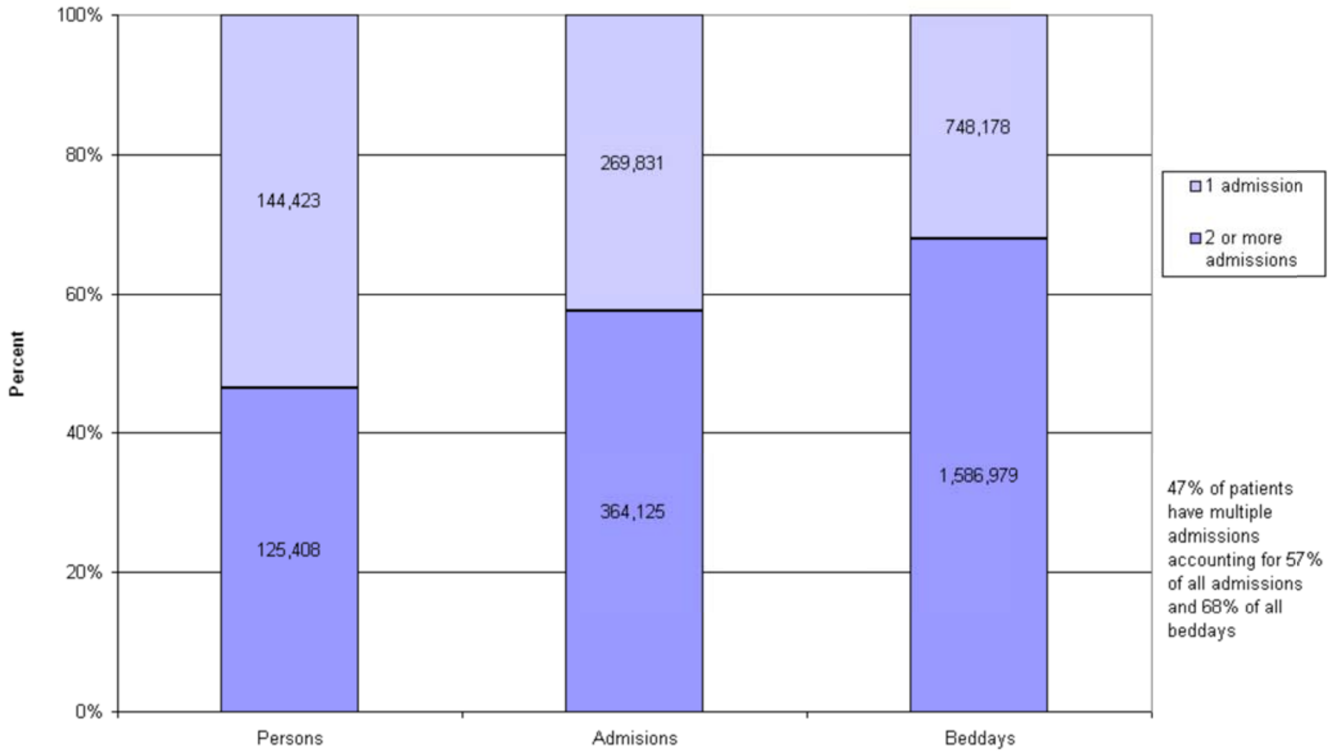
Multiple Admissions

Multiple Admissions in All NCAHS Resident Hospitalisations

Hospital admission data was linked for each person from July 2001 to June 2006 to enabled investigation of all admissions within each person during the study period.

Figure 3 summarises the percentage of persons, admissions and bed days that are related to multiple admissions (two or more) in NCAHS hospitalisations. During the five year period from 2001 to 2006, 47% of patients had multiple admissions accounting for 57% of all admissions and 68% of all bed days.

Figure 3 : Persons, admissions and bed days for patients with multiple admissions (all hospitalisations), NCAHS, July 2001 to June 2006



Multiple Admissions in All NCAHS resident ACS Hospitalisations

Figure 4 summarises the percentage of persons, admissions and bed days that are related to multiple ACS admissions in the NCAHS. During the five year period from 2001 to 2006, 28% of ACS patients had multiple admissions accounting for 55% of all ACS admissions and 64% of all ACS bed days. Compared to all hospitalisations, a much smaller percentage of persons have multiple ACS admissions (28% c.f. 47%), but this group have a similar proportion of multiple ACS admission (55% c.f. 57%) and a similar proportion of ACS bed days (64% c.f. 68%) compared to all hospitalisations.

Figure 4: Multiple admission pattern for All ACS hospitalisations, NCAHS (July 2001 to June 2006)

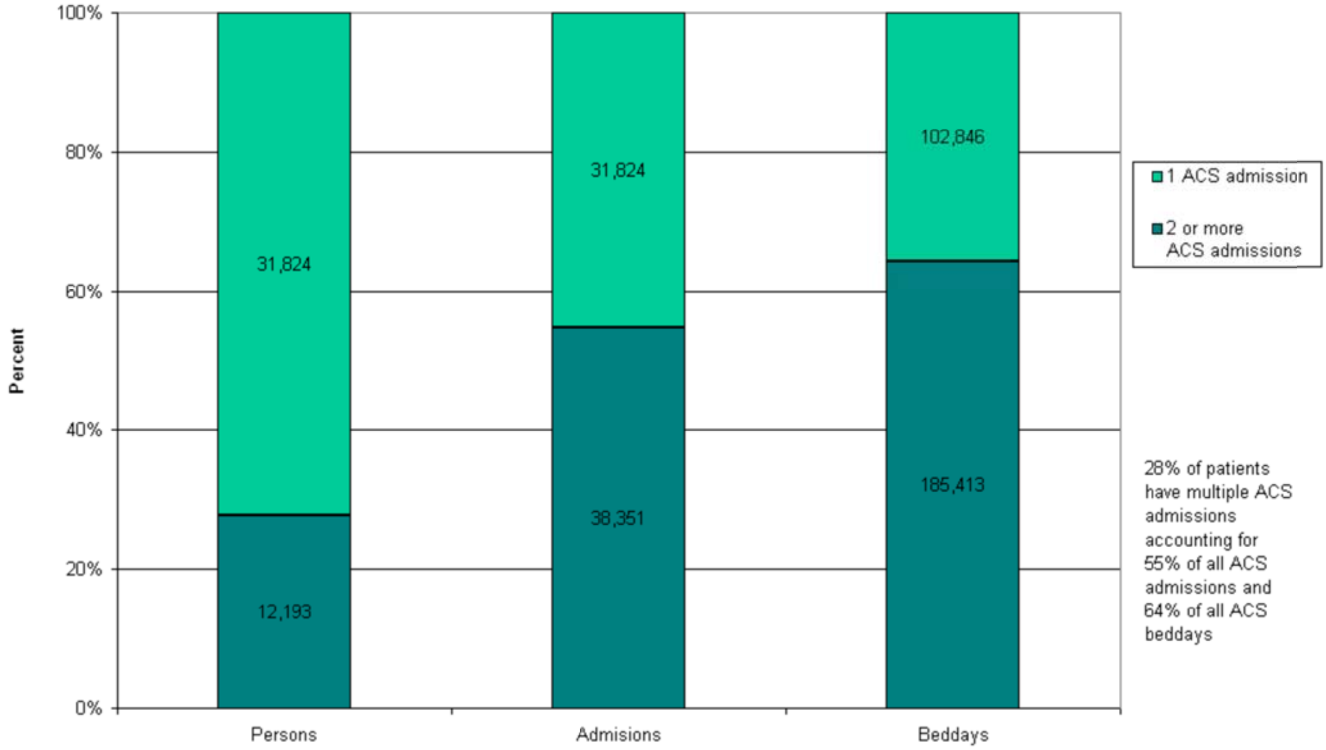


Table *12* summarises the total number of admissions per person by priority ACS condition, and includes the percent (%) of person with no other ACS admissions, and no other hospital admissions. A similar table also stratified by the selected SLAs is included in Appendix 1. 39% of those admitted for ACS COPD and ACS diabetes have multiple ACS admissions for that condition, while only 13% of those admitted for ACS Cellulitus and ACS Pyelonephritis have multiple admissions for that condition. Of those admitted with ACS Heart failure and ACS COPD, 44% and 38% respectively and have other ACS admissions. While for those admitted with ACS Cellulitus and ACS Asthma, 23% and 22% respectively have other ACs admissions.

Table 12: ACS admission trends for persons by ACS condition, NCAHS July 2001 to June 2006

ACS Condition	Persons	One ACS admission (%)	At least one other ACS admission (%)	No other admission (%)
Angina	6,038	77.3	26.1	15.9
Heart Failure	3,738	72.0	43.8	11.1
Diabetes	4,752	60.6	28.2	25.0
COPD	3,836	60.9	38.4	15.8
Cellulitis	3,855	86.9	23.8	27.6
Asthma	3,186	76.7	22.1	39.6
Pyelonephritis	4,273	86.6	27.6	20.7

Source : P:\Shared\Research\IRCSTadmit\data\out\AllTables\Table9-AllSLAs&NCAHS.xls (Worksheet Table9)

Table *13* summarises the frequency of all hospital admissions and ACS admissions for persons in the selected SLAs and NCAHS from July 2001 to June 2006. During the study period, 47% (n= 125,408) of persons admitted to hospital in the NCAHS had two or more admission, 26% (n=69,788) had three or more admissions, and 4% (n=10,648) had eight or more admissions. Of people admitted to the NCAHS with ACS conditions**,** 28% (n= 12,193) had two or more ACS admissions, 12% (n= 5,169) had three or more ACS admissions, and 1% (n=517) had eight or more admissions. Kempsey has the greatest proportion of persons admitted two or more times for both all admissions (49.7%) and ACS admissions (29.8%), while Kyogle had the lowest proportion of persons admitted two or more times for all admissions (43.4%) and ACS admissions (26.4%). Bellingen has the highest proportion of persons admitted eight or more times for both all admissions (5.3%) and ACS admissions (1.4%).

Table 13 : Frequency of all hospital admissions and all ACS admissions for persons by geographical area, July 2001 to June 2006

Geographical Area	Admission frequency	All Admissions		ACS Admissions	
		Persons	Persons %	ACS Persons	ACS Persons %
Ballina	1	12,170	52.2	2,284	71.5
Bellingen		4,278	50.3	1,150	71.5
Casino		3,701	50.5	1,050	71.6
Kempsey		9,083	50.3	2,311	70.2
Kyogle		3,325	56.6	711	73.6
NCAHS		**144,423**	**53.5**	**31,824**	**72.3**
Ballina	≥2	11,133	47.8	911	28.5
Bellingen		4,227	49.7	459	28.5
Casino		3,628	49.5	416	28.4
Kempsey		8,971	49.7	980	29.8
Kyogle		2,549	43.4	255	26.4
NCAHS		**125,408**	**46.5**	**12,193**	**27.7**
Ballina	≥3	6,189	26.6	376	11.8
Bellingen		2,479	29.1	205	12.7
Casino		2,061	28.1	197	13.4
Kempsey		5,208	28.8	441	13.4
Kyogle		1,383	23.5	111	11.5
NCAHS		**69,788**	**25.9**	**5,169**	**11.7**
Ballina	≥8	884	3.8	39	1.2
Bellingen		453	5.3	22	1.4
Casino		277	3.8	20	1.4
Kempsey		802	4.4	43	1.3
Kyogle		207	3.5	12	1.2
NCAHS		**10,648**	**3.9**	**517**	**1.2**

Source : P:\Shared\Research\IRCSTadmit\data\out\AllTables\Table3-AllSLAs&NCAHS.xls (Worksheet Table3a)

Frequency of admission for priority ACS conditions

Table 14 summarises the total number of ACS admissions per person by priority ACS condition. In the NCAHS, around 13% of people admitted for ACS Pyelonephritis and ACS Cellulitis have multiple admissions, 23%-28% of people admitted for ACS Angina, ACS Asthma and ACS Heart Failure have multiple admissions, and 39% of people admitted for ACS COPD and ACS Diabetes have multiple admissions. Over 20% of persons admitted for ACS COPD have three or more admissions, which is nearly double the proportion for any of the other priority ACS condition. Also, 4% have eight or more ACS COPD admissions, which is more than 4 times any of the other priority ACS conditions, which are all less than 1%. This is reflected in the COPD data in Table 5 where COPD is ranked 7 for ACS persons admitted but it is ranked 2 for ACS admissions, and ranked 1 for ACS bed days.

Appendix 4 summarises the total number of ACS admissions per person for the priority ACS conditions by selected SLAs. There was substantial variability in the number of persons with multiple admissions for ACS Angina, ranging from 28% of persons in Bellingen to 14% in Kyogle. There was substantial variability in the number of persons with multiple admissions for ACS Heart Failure, ranging from 35% of persons in Kempsey to 19% in Bellingen. The percentage of persons with three or more ACS Heart Failure admissions ranged from 18% in Kempsey to 5% in Bellingen.

Table 14 : Number of ACS admissions per person by priority ACS condition, NCAHS (July 2001 to June 2006

ACS Condition	Persons	Admission frequency							
		1		≥2		≥3		≥8	
		n	%	n	%	n	%	n	%
Angina	6,038	4,670	77.3	1,368	22.7	531	8.8	33	0.6
Heart Failure	3,738	2,693	72.0	1,045	28.0	440	11.8	20	0.5
Diabetes	4,752	2,881	60.6	1,871	39.4	490	10.3	30	0.6
COPD	3,836	2,335	60.9	1,501	39.1	861	22.5	141	3.7
Cellulitis	3,855	3,350	86.9	505	13.1	124	3.2	4	0.1
Asthma	3,186	2,442	76.7	744	23.4	278	8.7	19	0.6
Pyelonephritis	4,273	3,699	86.6	574	13.4	145	3.4	3	0.1

Source : P:\Shared\Research\IRCSTadmit\data\out\AllTables\Table8-AllSLAs&NCAHS.xls (Worksheet Table8)

Table 15 summarises the average LOS by the number of ACS admissions and ACS condition for NCAHS persons during the study period. Multiple admissions were responsible for around 70% of the total bed days for ACS COPD and ACS Diabetes. Multiple admissions were responsible for around 50% of the total bed days for ACS Angina, ACS Asthma and ACS Heart failure. Multiple admissions were responsible for around 30% of total bed days for ACS Pyelonephritis and ACS Cellulitis.

For persons admitted for the majority of priority ACS conditions, the median LOS per admission generally increased by 1 day for those with multiple admissions compared to those with one admission , except for ACS Asthma and ACS Diabetes. The median LOS for persons with ACS Asthma was similar at around two days for those people admitted once, or two or more, or three or more times during the study period. It then increased to 2.6 days for NCAHS persons with eight or more ACS Asthma admissions. The median LOS for persons with ACS Diabetes was 1 day for those persons admitted once and for those with multiple admissions. The median LOS increased substantially to 4.5 days for the 10% of ACS diabetes patients who have three or more admissions, and these 10% of ACS diabetes patients account for 43% of the total number of ACS Diabetes bed days.

For ACS COPD and ACS Heart Failure the median LOS for those with one admission was 5 days, around 6 days for multiple and three or more admissions, and around 7 days for eight or more admissions. A similar pattern was seen for ACS Cellulitis where the median LOS for those with one admission was 4 days, this increased to 5 days for multiple admissions, and 6 days for three or more admissions. This indicates that the more admissions for ACS COPD, ACS Heart Failure and ACS Cellulitis a person has the longer the LOS required for treatment.

The 39% of ACS COPD patients with multiple admissions account for 74% of the total number of ACS COPD bed days (median=6 days, n=42,491 bed days). The 22% of ACS COPD patients with three or more admissions account for 58% of the total number of ACS COPD bed days (median=6.3 days, n=33,530 bed days).

Table 15 : Priority ACS condition by frequency of admission and LOS summary statistics, NCAHS persons (July 2001 to June 2006)

ACS Condition	Admission frequency	Length of Stay					Total beddays	% of beddays
		Persons (n)	% of persons	Q1	Median	Q3		
Angina	1	4,670	77.3	1	2	3	12,666	51.1
	≥2	1,368	22.7	1.6	2.5	3.8	12,099	48.9
	≥3	531	8.8	2	2.7	4	7,008	28.3
	≥8	33	0.5	2.1	2.9	4	1,182	4.8
Asthma	1	2,442	76.6	1	2	3	5,891	51.5
	≥2	744	23.4	1.3	2	3	5,549	48.5
	≥3	278	8.7	1.3	1.9	3	3,084	27.0
	≥8	19	0.6	1.9	2.6	3.9	756	6.6
Cellulitis	1	3,350	86.9	2	4	6	16,979	68.9
	≥2	505	13.1	3	5	7.5	7,652	31.1
	≥3	124	3.2	3.8	6	7.7	3,341	13.6
	≥8	4	0.1	5.5	6.5	6.8	240	1.0
COPD	1	2,335	60.9	3	5	8	15,256	26.4
	≥2	1,501	39.1	4	6	9	42,491	73.6
	≥3	861	22.4	4.3	6.3	9	33,530	58.1
	≥8	141	3.7	4.7	6.9	8.8	11,705	20.3
Diabetes	1	2,881	60.6	1	1	4	11,715	33.2
	≥2	1,871	39.4	1	1	4.5	23,585	66.8
	≥3	490	10.3	2.7	4.5	9.5	15,186	43.0
	≥8	30	0.6	2.9	4.8	8	2,318	6.6
Heart Failure	1	2,693	72.0	2	5	9	20,273	47.7
	≥2	1,045	28.0	3.5	5.7	9.2	22,204	52.3
	≥3	440	11.8	3.8	6	9.2	12,877	30.3
	≥8	20	0.5	5.3	6.8	8.6	1,357	3.2
Pyelo-nephritis	1	3,699	86.6	1	3	5	16,987	69.5
	≥2	574	13.4	2.5	4	6.5	7,470	30.5
	≥3	145	3.4	3	4.3	6.3	2,755	11.3
	≥8	3	0.1	3.1	4.1	5	114	0.5

Source : P:\Shared\Research\IRCSTadmit\data\out\AllTables\Table13-AllSLAs&NCAHS.xls (Worksheet Table13)

Table 16 summarises the total persons and total LOS by the frequency of ACS admissions for NCAHS persons in the study period. For NCAHS persons with only one ACS admission, ACS Heart Failure was responsible for the greatest number of bed days (20%, n=20,273) and 9% of all priority ACS condition bed days. ACS Pyelonephritis (17%, n=16,987) was the next biggest cause of one ACS admission bed days, followed by ACS Cellulitis (17%, n=16,979), and ACS COPD (15%, n=15,256). These ACS conditions were responsible for 8%, 8%, and 7% of all priority ACS condition bed days respectively. ACS Asthma (6%, n=5,891) was responsible for the least number of one ACS admission bed days and 3% of all priority ACS condition bed days.

Of NCAHS persons with multiple ACS admissions, 20% (1,501) were admitted for ACS COPD, which was responsible for the greatest number of bed days (35%, n=42,491) within multiple admissions, and 19% of all priority ACS condition bed days.

ACS Diabetes (20%, n=23,585) was the next biggest cause of multiple ACS admission bed days, followed by ACS Heart Failure (18%, n=22,204), and ACS Angina (10%, n=12,099). These ACS conditions were responsible for 11%, 10%, and 6% of all priority ACS condition bed days respectively. ACS Asthma (5%, n=5,549) was responsible for the least number of multiple ACS admission bed days and 3% of all priority ACS condition bed days.

For NCAHS persons with three or more ACS admissions, 30% (816) were admitted for ACS COPD, which was responsible for the greatest number of bed days (43%, n=33,530) and 15% of all priority ACS condition bed days.

ACS Diabetes (20%, n=15,186) was the next biggest cause of three or more ACS admission bed days, followed by ACS Heart Failure (17%, n=12,877), and ACS Angina (9%, n=7,008). These ACS conditions were responsible for 7%, 6%, and 3% of all priority ACS condition bed days respectively. ACS Pyelonephritis (4%, n=2,755) was responsible for the least number of three or more ACS admission bed days and 1% of all priority ACS condition bed days.

For NCAHS persons with eight or more ACS admissions, 56% (141) were admitted for ACS COPD, which was responsible for the greatest number of bed days (66%, n=11,705) and 5% of all priority ACS condition bed days.

ACS Diabetes (13%, n=2,318) was the next biggest cause of eight or more ACS admission bed days, followed by ACS Heart Failure (8%, n=1,357), and ACS Angina (7%, n=1,182). These ACS conditions were each responsible for 1% of all priority ACS condition bed days. ACS Pyelonephritis (1%, n=114) was responsible for the least number of eight or more ACS admission bed days and 0.1% of all priority ACS condition bed days.

Table 16 : Number of ACS admissions per person by priority ACS condition, NCAHS (July 2001 to June 2006)

Admission frequency	ASCS Condition	ACS Persons	Percent of admission frequency ACS Persons (%)	Percent of total ACS Persons (%)	ACS Beddays	Percent of admission frequency ACS Beddays (%)	Percent of total ACS Beddays (%)
1 admission	Angina	4,670	21.2	15.7	12,666	12.7	5.7
	Asthma	2,442	11.1	8.2	5,891	5.9	2.7
	Cellulitis	3,350	15.2	11.3	16,979	17.0	7.7
	COPD	2,335	10.6	7.9	15,256	15.3	6.9
	Diabetes	2,881	13.1	9.7	11,715	11.7	5.3
	Heart Failure	2,693	12.2	9.1	20,273	20.3	9.2
	Pyelonephritis	3,699	16.8	12.5	16,987	17.0	7.7
2 or more admissions	Angina	1,368	18.0	4.6	12,099	10.0	5.5
	Asthma	744	9.8	2.5	5,549	4.6	2.5
	Cellulitis	505	6.6	1.7	7,652	6.3	3.5
	COPD	1,501	19.7	5.1	42,491	35.1	19.2
	Diabetes	1,871	24.6	6.3	23,585	19.5	10.7
	Heart Failure	1,045	13.7	3.5	22,204	18.3	10.1
	Pyelonephritis	574	7.5	1.9	7,470	6.2	3.4
3 or more admissions	Angina	531	18.5	1.8	7,008	9.0	3.2
	Asthma	278	9.7	0.9	3,084	4.0	1.4
	Cellulitis	124	4.3	0.4	3,341	4.3	1.5
	COPD	861	30.0	2.9	33,530	43.1	15.2
	Diabetes	490	17.1	1.7	15,186	19.5	6.9
	Heart Failure	440	15.3	1.5	12,877	16.6	5.8
	Pyelonephritis	145	5.1	0.5	2,755	3.5	1.2
8 or more admissions	Angina	33	13.2	0.1	1,182	6.7	0.5
	Asthma	19	7.6	0.1	756	4.3	0.3
	Cellulitis	4	1.6	0.0	240	1.4	0.1
	COPD	141	56.4	0.5	11,705	66.2	5.3
	Diabetes	30	12.0	0.1	2,318	13.1	1.0
	Heart Failure	20	8.0	0.1	1,357	7.7	0.6
	Pyelonephritis	3	1.2	0.0	114	0.6	0.1

Source: Table14-AllSLAs&NCAHS.xls - Worksheet : Table 14

Table *17* summarises the comorbidity history for NCAHS persons by the number of admissions for the priority ACS conditions in the study period. A similar table stratified by the selected SLAs is available in Appendix 5. As the number of ACS admissions increases, the proportion of those people with comorbidities also increases for all priority ACS conditions.

The percentage of persons with one or more comorbidities that have three or more admissions during the study period is around 50% for ACS COPD, ACS Cellulitis and ACS Diabetes, ACS Pyelonephritis and increases to 64% for ACS Angina and 79% for ACS Heart Failure.

Of the people who have one ACS Heart Failure admission, 50% have one or more comorbidity, which is substantially higher than any of the other priority ACS conditions.

The majority of ACS Asthma single admissions, and multiple admissions, have no other comorbidities that may have contributed to the need for admission and these results are similar for the selected SLAs.

Only 16% of those persons with one ACS Diabetes admission had comorbidities and this proportion increased substantially to more than 50% for three or more admissions.

Of the priority conditions, ACS COPD had the largest number of persons with eight or more admissions (n=96 persons), however more than 30% of these persons had no comorbidities.

Of the NCAHS persons with eight or more admissions for ACS Angina and ACS Heart Failure, approximately 90% had one or more comorbidity.

Table 17 : Priority ACS condition by frequency of admission and comorbidity proportion, NCAHS (persons) July 2001 to June 2006

ACS Condition	Admission frequency	1 or more Comorbidities	
		N	%
Angina	1	1,428	30.6
	≥2	713	52.1
	≥3	349	65.7
	≥8	29	87.9
Asthma	1	133	5.4
	≥2	68	9.1
	≥3	33	11.9
	≥8	3	15.8
COPD	1	663	28.4
	≥2	751	50
	≥3	489	56.8
	≥8	96	68.1
Cellulitis	1	675	20.1
	≥2	203	40.2
	≥3	63	50.8
	≥8	4	100
Diabetes	1	451	15.7
	≥2	478	25.5
	≥3	263	53.7
	≥8	17	56.6
Heart Failure	1	1,341	49.8
	≥2	775	74.2
	≥3	351	79.8
	≥8	18	90
Pyelo-nephritis	1	850	23
	≥2	256	44.6
	≥3	78	53.8
	≥8	1	33.3

Source : P:\Shared\Research\IRCSTadmit\data\out\AllTables\Table12-AllSLAs&NCAHS.xls (Worksheet Table12)

Table 18 summarises the age at index admission for persons by the frequency of ACS admissions in the study period. The median age of the index admission for ACS Angina in the NCAHS increases from 69 years for persons with one ACS Angina admission, to 73 years for persons with three or more admissions, and 74 years for persons with eight or more admissions. The median age of the index admission for ACS Angina multiple admissions is 72 years. The median age of index admission for ACS Cellulitis in the NCAHS increases from 55 years for one ACS admission, to 69 years for three or more admissions, it then decreases to 56 years for eight or more admissions. The median age of the index admission for ACS Cellulitis multiple admissions is 66 years. While this trend was not consistently repeated in the selected SLAs it suggests that the risk of multiple ACS Angina and ACS Cellulitis admissions may increase with increasing age at index admission.

The median age of index admission for ACS Heart Failure in the NCAHS was similar (80 years) for those persons with one, multiple, and three or more admissions during the study period.

The median age of index admission for ACS COPD in the NCAHS was similar (around 74 years) for those persons with one, multiple, and three or more admissions during the study period.

The median age at index admission for ACS Asthma in the NCAHS decreases from 17 yrs for one ACS Asthma admission, to 9 years for multiple admissions, and 8 years for three or more admissions, it then increases substantially to 29 years for eight or more admissions. This trend was not consistently repeated in the selected SLAs and suggests that the risk of multiple ACS Asthma admissions increases with decreasing age at index admission.

The median age of the index admission for ACS Diabetes in the NCAHS is younger for eight or more admissions (51 years) compared to one (72 years), multiple (73 years), three or more admissions (68 years) admissions. This trend is generally consistently repeated in the selected SLAs. This suggests that the risk of multiple ACS diabetes admissions increases with decreasing age at index admission. More than one quarter of all persons admitted three or more times for ACS Diabetes are less then 48 years of age.

Table 18 : Priority ACS condition by frequency of admission and age at index admission, NCAHS persons (July 2001 to June 2006)

ACS Condition	Admission frequency	Age at index admission			
		N	Q1	Median	Q3
Angina	1	4,670	57.7	68.6	77.8
	≥2	1,368	62.1	71.5	79.6
	≥3	531	64.1	72.9	80.7
	≥8	33	64.8	73.6	78.4
Asthma	1	2,442	4.5	16.9	50.8
	≥2	744	3.1	9.3	43.5
	≥3	278	2.5	8	39.5
	≥8	19	2.9	28.7	40.4
Cellulitis	1	3,350	32.2	54.7	75.2
	≥2	505	43.4	66.3	79.7
	≥3	124	52	68.7	79.8
	≥8	4	51.5	55.7	70
COPD	1	2,335	64.6	74.2	81.2
	≥2	1,501	65.7	73.5	79.7
	≥3	861	65.1	73.2	78.9
	≥8	141	62.3	67.8	75.7
Diabetes	1	2,881	62	72.2	78.9
	≥2	1,871	63.1	72.9	78.7
	≥3	490	48.3	68	77.2
	≥8	30	35.9	51.4	64.3
Heart Failure	1	2,693	73.3	80.5	86.6
	≥2	1,045	72.9	80.4	86.1
	≥3	440	72.5	79.9	85.5
	≥8	20	66.1	71.8	78.3
Pyelonephritis	1	3,699	32.9	68	81.3
	≥2	574	50.4	75.2	83.9
	≥3	145	51	73.2	82.2
	≥8	3	20.1	60.9	93.9

Source : P:\Shared\Research\IRCSTadmit\data\out\AllTables\Table11-AllSLAs&NCAHS.xls (Worksheet Table11)

DISCUSSION

This project extends previous NSW health state wide and AHS wide investigations of avoidable hospital admissions by looking in detail within the NCAHS.

The study population covered nearly 500,000 persons across NCAHS and we conducted more detailed investigations of five smaller sub-regions covering one fifth of the NCAHS population. The populations in the selected SLAs ranged from around 10,000 in both Kyogle and Casino to nearly 40,000 in Ballina. 19% of Ballina's population was 65 years and over years compared to 14% for Kyogle. While Ballina (46%) and Bellingen (47%) had similar proportions of persons 45 years and over, with Kyogle (43%) and Casino (42%) having smaller 45 years and over populations.

On average 15% of the NCAHS population were admitted to hospital at least once per year during the five-year study period. Eleven percent of all admissions in the NCAHS during the study period were ACS admissions, accounting for around 12% of all bed days. Given that multiple ACS admissions make up a substantial proportion of multiple admissions and bed days for all conditions, it is conceivable that the implementation of strategies to reduce the number of ACS multiple admissions may substantially lighten the load on hospital resources.

The ACS conditions with the highest proportions of admissions and bed days included the chronic conditions of Angina, COPD, Diabetes, Heart Failure and Asthma, and the acute conditions of Pyelonephritis and Cellulitis.

Multiple admissions account for 57% of all admissions and 68% of all bed days and this is similar for multiple ACS admissions. While nearly half (47%) of all people admitted have multiple admissions, just over a quarter (28%) of all people admitted for ACS conditions have multiple ACS admissions. ACS conditions are considered avoidable with improved primary health care. Compared to all multiple admissions, a much smaller proportion of persons is responsible for ACS multiple admissions and any hospital based programs to reduce multiple ACS admissions would need to identify and target the subset of patients who are more likely to have multiple ACS admissions.

Our analyses identified COPD admissions as an area worthy of targeting for improved chronic disease management. Of all the bed days due to admissions for the twenty ACS conditions, one in five bed days was due to ACS COPD. Over the NCAHS for the five year study period around 40% of people admitted for ACS COPD have multiple admissions. Over 20% of persons admitted for ACS COPD have three or more admissions and this is more than double the proportion for the other selected conditions. Nearly 4% of people admitted for ACS COPD have eight or more admissions, more than 4 times the other selected conditions (which are all less than 1%). More than 30% of persons with eight or more ACS COPD admissions had no comorbidities, reflecting that, on its own, hospitalisation for this condition consumes substantial health care resources. However it also suggests that there may be scope to manage outside of hospital at least some persons with frequent COPD admissions. The median age of the index admission for ACS COPD was similar for those persons with single and multiple admissions, suggesting that age at index admissions may not directly influence the frequency of multiple admissions.

Multiple admissions for ACS COPD consume substantial hospital resources. Over the five year period those people with multiple ACS COPD admissions consume more than 42,000 bed days, with more than one-half of those multiple admissions having a LOS of 6 days or longer. The number of patients admitted with three or more ACS COPD admissions (n=861) was more than 50% higher than the next highest ACS category, and they consumed 33,530 bed days, more than double the next highest ACS category. The number of bed days for patients admitted with eight or more ACS COPD admissions (n=11705) was more than five times the next highest ACS category. This suggests that even small reductions in the number of persons admitted for ACS COPD may produce substantial reductions in the number of bed days used by this ACS disease category.

More than three quarters of all multiple ACS admissions were in persons 45 years and over and more than one half were 65years and over. The exceptions were ACS Cellulitis, which had a slightly younger age profile, and ACS Asthma which was more frequent in children. As the selected conditions affect primarily the older age groups, and the relatively small numbers of ACS admissions (even after aggregating over 5 years) we decided not to further stratify these small numbers by age.

More than one-half of the female ACS Cellulitis admissions are younger than 65 years of age at their first ACS Cellulitis admission, while the median age of men is 50 year old. This difference between men and women is relatively consistent across the selected SLAs. One quarter of males admitted for Cellulitis are less than 31 years old at index admission, while one quarter of females are less than 40 years. The median age of the index admission for ACS Cellulitis increases as the frequency of admissions increases, suggesting that the risk of multiple ACS Cellulitis admissions increases with increasing age at index admission.

One quarter of males admitted for Pyelonephritis are less than 53 years of age at the index admission, while one quarter of females are less than 30. The reasons for this large age difference between men and women may relate to differing clinical issues between the sexes, and requires further investigation.

Of those persons with multiple ACS admissions 60% are readmitted on separate occasions for different ACS conditions, while the remainder are readmitted at least once for the same ACS condition. Intervention on the first admission may reduce the number of ACS readmissions for the same ACS condition responsible for the current admission, and may also reduce future ACS admissions for other conditions.

While ACS conditions are potentially avoidable they have a longer median length of stay than the non ACS conditions, with one quarter of all ACS admissions requiring a stay of 5 or more days. As the number of ACS admissions for persons increases, the proportion of those people with comorbidities also generally increases for the selected ACS conditions. While 80% of people admitted for non-ACS conditions have no comorbidities, only 50% admitted for ACS conditions had no comorbidities. While the ACS condition may be avoidable with enhanced primary health care, the condition responsible for the ACS admission may be severe enough to require hospitalisation. Also, the increased frequency of comorbidities in persons with ACS admissions compared to non-ACS admissions may influence the decision to admit these ACS conditions, and contribute to the longer LOS for ACS admissions compared to non-ACS admissions.

Around 75% of persons admitted with ACS Heart Failure had only one ACS admission, while only around 15% had no other admissions during the five-year study period. This suggests that people admitted with ACS Heart Failure have other non-ACS health condition/s requiring hospitalisation. The majority of person with ACS Heart Failure admissions (including multiple admissions), have a range of comorbidities that may have contributed to their admission. This suggests that strategies to reduce ACS Heart Failure admissions would need to address a range of other comorbidities. The median age of the index admission for ACS heart Failure was similar for those persons with single and multiple admissions, suggesting that age at index admissions may not directly influence the frequency of multiple admissions.

Persons admitted for ACS asthma have only one ACS admission (77%) and 40% have no other unplanned admissions. The majority of persons admitted for ACS asthma have no comorbidities. This is likely related to the younger age distribution of ACS Asthma admissions and suggests that programs to reduce ACS Asthma admissions may be effective without assessing other health conditions. We found a large difference in the age at index admission for ACS Asthma between males and females, that was relatively consistent across the selected SLAs. While more than one-half of females admitted for ACS Asthma are older than 30 years of age, the median age for males was 8 years of age. The importance of management of childhood asthma for both males and females is well recognised and it appears that additional strategies targeting post adolescent females may be required. The median age at index admission for ACS Asthma decreases as the frequency of admissions increases. Although this trend was not consistently repeated in the selected SLAs it suggests that children may be more likely to have multiple ACS Asthma than adults. In general, the LOS of persons admitted with ACS Asthma is similar irrespective of the number of admissions they have, suggesting that the LOS required to stabilise asthma exacerbations does not vary substantially by the frequency of readmission.

The percentage of persons admitted for ACS Diabetes with comorbidities increases substantially for those with three or more admissions compared to persons with one or two admissions. More than one quarter of persons admitted three or more time for ACS Diabetes are less then 50 years of age. While more than one half of persons admitted two or more times for ACS Diabetes stay only one day the LOS increases substantially to more than four days for those persons who have three or more admissions, and this group of people with three or more ACS Diabetes admissions account for 43% of the total number of ACS Diabetes bed days. This indicates substantial differences in the age and comorbidities profile for persons with three or moe ACS Diabetes admissions compared to one and two admissions. While there may be scope to manage older ACS Diabetes patients without comorbidities outside the hospital, those younger patients with comorbidities may require hospitalisation.

There is substantial variability in the rate of hospitalised persons, admission and bed days between SLAs within the NCAHS, with Ballina having consistently lower ISR's for hospitalised persons, admissions and bed days compared to the other SLAs. The annualised hospital bed days rate compared to the NCAHS ranged from 7% lower in Ballina to 37% higher in Bellingen and 87% higher in Kyogle. There was also substantial variability in the rate of hospitalised persons, admission and bed days associated with ACS conditions between the selected SLAs. Compared to the NCAHS average the annualised rates of hospitalised persons, admission and bed days for ACS conditions ranged from around 15% lower in Ballina to 20-40% higher for the other selected SLAs. The variation among SLAs suggests that reductions in ACS admissions in some NCAHS SLA may be possible. At least some of the factors associated with this wide variation between SLAs variation may be modifiable, including access to primary health care, admission practices including availability of resources (ie: hospital beds), and population related factors such as underlying health status[45].

Casino residents had around double the NCAHS average of persons, admissions and bed days admitted for ACS vaccine preventable conditions. This indicates that a target vaccination program in this community may be warranted.

Strengths and weaknesses

The strengths of this study include the use of hospital admissions data linked for persons over a 5 year period. These data enabled the description and identification of the extent of multiple admissions by persons over time and the use of hospital service by the high frequency admission patients. While this person based data is useful it is also complex and it can be difficult to summarise for large populations with a wide range of conditions. This is why the analysis was limited to selected high volume ACS conditions and a selection of SLA's within the NCAHS. It was possible to produce indirectly standardised rates for some of the analysis and this enabled statistically robust comparisons for some indicators between regions within the NCAHS.

Admissions were classified into ACS conditions, and this is a relatively crude measure of potential avoidability of admissions. While this study was able to describe patients with multiple admissions and to classify these admissions into potentially avoidable admissions (ACS admissions) it was not able to accurately assess the appropriateness of the admissions. While limited information was available on the presence of comorbidities for each admission it was not possible to determine if any admission was actually avoidable with improved primary health care, either in the short, medium or long term prior to the admission.

The study had no information on the availability of hospital beds and any influence this may have had on the rate of multiple admission for ACS conditions.

CONCLUSION

The results of this study will inform the development of targeted primary health care strategies to reduce potentially avoidable hospital admissions. The analytical methods implemented by the project can be used to evaluate strategies and interventions at both the local (eg: hospital) and regional (eg: AHS) level to reduce hospital admissions for potentially avoidable conditions. This is particularly relevant for chronic health conditions amenable to effective primary health care such as Angina, COPD, Diabetes, Heart Failure and Asthma. Improved home health care in the US appears to have reversed a national trend of increased hospitalisations and similar improvements in home health care may also be effective in Australia. However, a summary of research on interventions aimed at reducing avoidable hospitalisations shows an important lack of evidence about interventions that are effective [44]

This analysis demonstrated substantial variability in the rate of ACS hospitalisation between SLAs within the NCAHS. We were unable to link measures of the number of hospital beds in a community to the data analysed here. Further research is required to define standard methods for quantifying bed availability for hospitals within NCAHS. It would then be possible to compare bed availability and ACS admissions in selected NCAHS hospitals and/or catchment areas to investigate the influence of bed availability on ACS admission rates and associated bed days. Additional data on patients would need to be collected to address the questions about whether more health care improves health status. Further studies are also required to understand the relative contributions such factors as failures in discharge planning, insufficient outpatient and community care, and severe progressive illness make.

Improved understanding is required on a number of fronts: how to care for people with ambulatory care sensitive conditions both inside and outside hospital; how this might reduce rehospitalisation and further, what the magnitude of any potential reduction may be. Ensuring a safe transition for people with such conditions from a hospital to the community or a nursing home requires patient centred care that transcends health system organisational boundaries. Continued investigation of hospitalisation using the linked hospitalisation data will strengthen the foundation for designing and providing improved patient centred care.

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Appendices

Appendix 1 : Codes for disease groups used to calculate ambulatory care sensitive (ACS) hospitalisations

Group	ICD-9-CM codes (NSW Health)	ICD-10-AM codes (NSW Health)	Further selection information
Vaccine-preventable			
Influenza and pneumonia	481, 482.2, 482.3, 482.9, 483, 487.0, 487.1, 487.8	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18.1, J18.8	In any diagnosis field (1-5); exclude people under 2 months; ICD-9-CM: exclude cases with secondary diagnosis of 282.6; ICD-10-AM: exclude cases with secondary diagnosis of D57
Other vaccine preventable	032, 033.0, 033.1, 033.8, 033.9, 037, 045, 055, 056, 070.3, 072, 320.0	A35, A36, A37, A80, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0, M01.4	In any diagnosis field (1-5)
Chronic			
Diabetes complications	250.1-250.9	E10.0-E10.8, E11.0-E11.8, E12.0- E12.8, E13.0-E13.8, E14.0-E14.8	Principal diagnosis only
Nutritional deficiencies	260, 261, 262, 268.0, 268.1	E40-E43, E55.0, E64.3	Principal diagnosis only
Iron deficiency anaemia	280.1, 280.8, 280.9	D50.1-D50.9	Principal diagnosis only
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90	I10, I11.9	Principal diagnosis only; ICD-9-CM: exclude cases with procedure code of 35, 36, 37.5, 37.6, 37.7, 37.8; ICD-10-AM: exclude cases with procedures in blocks 600-693, 705-707, 717 and procedure codes 38721-00, 38721-01, 90226-00
Congestive heart failure	402.01, 402.11, 402.91, 428, 518.4	I11.0, I50, J81	Principal diagnosis only; ICD-9-CM: exclude cases with procedure code of 35, 36, 37.5, 37.6, 37.7, 37.8; ICD-10-AM: exclude cases with procedures in blocks 600-693, 705-707, 717 and procedure codes 38721-00, 38721-01, 90226-00
Angina	411.1, 411.8, 413	I20, I24.0, I24.8, I24.9	Principal diagnosis only; ICD-9-CM: exclude cases with procedure codes 01 to 86.99; ICD-10-AM: exclude cases with procedure codes in blocks 1-1779
Chronic obstructive pulmonary disease	491, 492, 494, 496, (466.0)	J41-J44, J47, (J20)	Principal diagnosis only; ICD-9-CM: 466.0 only with secondary diagnosis of 491, 492, 494, 496; ICD-10-AM: J20 only with secondary diagnosis of J41, J42, J43, J44, J47
Asthma	493	J45, J46	Principal diagnosis only

(continued)

Group	ICD-9-CM codes (NSW Health)	ICD-10-AM codes (NSW Health)	Further selection information
Acute			
Dehydration and gastroenteritis	276.5, 558.9	E86, K52.2, K52.8, K52.9	Principal diagnosis only
Convulsions and epilepsy	345, 642.6, 780.3	G40, G41, O15, R56	Principal diagnosis only
Ear, nose and throat infections	382, 462, 463, 465, 472.1	H66, H67, J02, J03, J06, J31.2	Principal diagnosis only
Dental conditions	521, 522, 523, 525, 528	A69.0, K02-K06, K08, K09.8, K09.9, K12, K13	Principal diagnosis only
Perforated/bleeding ulcer	531.0-531.2, 531.4-531.6, 532.0-532.2, 532.4-532.6, 533.0-533.2, 533.4-533.6, 534.0-534.2, 534.4-534.6	K25.0- K25.2, K25.4-K25.6, K26.0-K26.2, K26.4-K26.6, K27.0-K27.2, K27.4-K27.6, K28.0-K28.2, K28.4-K28.6	Principal diagnosis only
Ruptured appendix	540	K35.0	In any diagnosis field (1-5)
Urinary tract infections including pyelonephritis	590.0, 590.1, 590.8	N10, N11, N12, N13.6	Principal diagnosis only
Pelvic inflammatory disease	614	N70.0, N70.1, N70.9, N73, N74.0-N74.1, N74.2-N74.8	Principal diagnosis only
Cellulitis	681, 682, 683, 686	L03, L04, L08.0, L08.8, L08.9, L88, L98.0, L98.3	Principal diagnosis only; ICD-9-CM: exclude cases with procedure codes 01 to 86.99 except 86.0 where it is the only listed procedure; ICD-10-AM: exclude cases when any procedure performed from blocks 1-1779 except when the following procedures done as the only ones: blocks: 1604-1606, 1608 and procedures: 90660-00, 30207-00, 30676-00, 30679-00, 34530-01 and 47912-00.
Gangrene	785.4	R02	In any diagnosis field (1-5)

Note 1: Where selection is described as "in any diagnosis field" or as "secondary diagnosis", diagnosis fields 1 - 5 are used

Note 2: The procedure codes are based on the Commonwealth Medicare Benefits Scheme (MBS) and are relevant to Australian data only

Source: Population Health Division. *The health of the people of New South Wales - Report of the Chief Health Officer*. Sydney: NSW Department of Health. Available at: www.health.nsw.gov.au/publichealth/chorep/. Accessed (April 2009)

Appendix 2 : ACS condition by age at index admission, sex, and geographical area, July 2001 to June 2006

Angina					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	272	62.4	73	79.8
	Female	233	63.5	74.3	80.6
Bellingen	Male	111	59.2	69.1	75.9
	Female	85	59.4	70.5	75.8
Casino	Male	113	55.1	70	76.8
	Female	115	64.3	77	83
Kempsey	Male	280	52.8	62.1	70.7
	Female	212	56.4	66.8	79
Kyogle	Male	55	58.5	67.3	73.7
	Female	31	48.4	66.3	77.5
NCAHS	Male	3,338	57.4	67.8	76.2
	Female	2,700	60.3	71.7	80.7

Asthma					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	70	3.6	6.5	37.8
	Female	94	8.2	35.8	65.1
Bellingen	Male	54	2.9	11.5	43.3
	Female	62	10.7	34.9	49.3
Casino	Male	68	2.4	5.2	16.1
	Female	69	5.6	27.2	61.8
Kempsey	Male	89	3.2	9.1	22.5
	Female	92	5.2	40.9	53.5
Kyogle	Male	58	3.6	10.9	42.7
	Female	86	15.7	38.2	60.5
NCAHS	Male	1,512	3	7.8	30.7
	Female	1,674	6.8	31.4	57.4

COPD					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	125	68.2	76	81.1
	Female	90	63.7	72.7	79.8
Bellingen	Male	72	66.4	73.6	79.3
	Female	49	62.8	71.9	79.9
Casino	Male	42	69.4	74.8	81.7
	Female	39	62.4	71	80
Kempsey	Male	156	62.3	70.3	77.7
	Female	124	53.1	63.8	76.5
Kyogle	Male	41	59.1	72.5	77.9
	Female	34	58.2	72.7	79.2
NCAHS	Male	2,060	66.8	74.8	80.8
	Female	1,776	63	72.6	80.4

Cellulitis					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	179	36.3	56.8	77.6
	Female	133	43.7	70.2	81
Bellingen	Male	92	42.1	56	75.8
	Female	70	36.5	61.9	76.2
Casino	Male	78	25.9	48.8	71.2
	Female	57	50.6	68.6	79.8
Kempsey	Male	201	20.5	46.5	65.8
	Female	142	27.3	53.6	76.1
Kyogle	Male	68	32.7	48.2	64.1
	Female	31	44.3	71.2	80.4
NCAHS	Male	2,210	30.6	50.8	71.6
	Female	1,645	39.6	64.5	80.2

Diabetes					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	206	61	70.4	79.3
	Female	183	66.4	74.5	79.2
Bellingen	Male	77	58	73.3	77.3
	Female	77	64.4	70.6	75.5
Casino	Male	77	58.1	68.7	76.8
	Female	69	62.4	74	80
Kempsey	Male	197	52.1	66.5	75
	Female	141	58.2	70	76.7
Kyogle	Male	41	54.7	69.1	77.4
	Female	26	54.9	67.7	75.7
NCAHS	Male	2,502	60.5	71.3	78.1
	Female	2,250	64.5	73.8	79.5

Heart Failure					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	140	71.2	78.7	84.4
	Female	160	76.6	82.7	87.5
Bellingen	Male	69	74.8	79.7	84.7
	Female	62	76.3	85.3	88.6
Casino	Male	71	68.1	76.8	84.4
	Female	56	74.7	80.4	87
Kempsey	Male	174	65.1	76.9	83.2
	Female	144	72.6	78.9	84.9
Kyogle	Male	48	70.6	76.7	84.3
	Female	49	77.8	85.4	88.4
NCAHS	Male	1,830	71.4	78.3	84.3
	Female	1,908	75.7	82.6	87.9

Pyelonephritis					
Geographical area	Sex	Age at index admission			
		N	Q1	Median	Q3
Ballina	Male	85	55.6	75.2	84.3
	Female	232	35.3	74.6	83.4
Bellingen	Male	52	40.7	70.1	80.1
	Female	106	36.8	57.8	82.2
Casino	Male	29	63	73.4	83.1
	Female	75	22.6	73.5	83.7
Kempsey	Male	86	48.2	70.2	78.5
	Female	198	28.3	58.2	78.6
Kyogle	Male	26	39.3	68.1	81.5
	Female	44	26.1	51.5	76.4
NCAHS	Male	1,289	53.3	73.4	81.4
	Female	2,984	29.1	65.7	82.2

Appendix 3: ACS admission trends for persons by ACS condition and geographical area, July 2001 to June 2006

ACS Condition	Geographical area	Persons	One ACS admission (%)	No other ACS admission (%)	No other admission (%)
Angina	Ballina	505	76.0	76.8	14.3
	Bellingen	196	72.5	64.3	11.2
	Casino	228	81.1	72.8	14.0
	Kempsey	492	74.6	73.8	13.4
	Kyogle	86	86.1	76.7	26.7
	NCAHS	**6,038**	**77.3**	**73.9**	**15.9**
Heart Failure	Ballina	300	78.3	66.0	11.0
	Bellingen	131	80.9	54.2	1.5
	Casino	127	73.2	49.6	16.5
	Kempsey	318	65.4	56.3	12.3
	Kyogle	97	72.2	61.9	10.3
	NCAHS	**3,738**	**72.0**	**56.2**	**11.1**
Diabetes	Ballina	389	56.6	73.5	20.6
	Bellingen	154	65.6	68.2	27.9
	Casino	146	54.8	68.5	20.6
	Kempsey	338	66.9	67.5	18.6
	Kyogle	67	58.2	70.2	25.4
	NCAHS	**4,752**	**60.6**	**71.8**	**25.0**
COPD	Ballina	215	60.0	67.0	17.7
	Bellingen	121	62.8	52.1	8.3
	Casino	81	65.4	55.6	18.5
	Kempsey	280	60.4	62.9	17.5
	Kyogle	75	61.3	54.7	21.3
	NCAHS	**3,836**	**60.9**	**61.6**	**15.8**
Cellulitis	Ballina	312	83.3	78.5	19.9
	Bellingen	162	85.2	77.2	24.7
	Casino	135	84.4	76.3	26.7
	Kempsey	343	85.4	75.5	29.7
	Kyogle	99	88.9	79.8	37.4
	NCAHS	**3,855**	**86.9**	**76.2**	**27.6**
Asthma	Ballina	164	74.4	79.9	42.1
	Bellingen	116	75.0	70.7	30.2
	Casino	137	75.9	73.7	31.4
	Kempsey	181	69.6	73.5	39.2
	Kyogle	144	79.2	75.0	46.5
	NCAHS	**3,186**	**76.7**	**77.9**	**39.6**
Pyelonephritis	Ballina	317	87.4	72.9	18.6
	Bellingen	158	90.0	71.5	22.2
	Casino	104	87.5	65.4	15.4
	Kempsey	284	87.7	69.4	18.7
	Kyogle	70	87.1	70.0	18.6
	NCAHS	**4,273**	**86.6**	**72.4**	**20.7**

Appendix 4 : Number of ACS admissions per person by priority ACS condition and geographical area, July 2001 to June 2006

	Geographical Area	Persons	Admission frequency 1 %	≥2 %	≥3 %	≥8 %
Angina	Ballina	505	76.0	24.0	10.5	0.6
	Bellingen	196	72.5	27.6	9.2	0.0
	Casino	228	81.1	18.9	11.0	0.4
	Kempsey	492	74.6	25.4	9.4	0.8
	Kyogle	86	86.1	14.0	3.5	0.0
	NCAHS	**6,038**	**77.3**	**22.7**	**8.8**	**0.6**
Heart Failure	Ballina	300	78.3	21.7	7.3	0.0
	Bellingen	131	80.9	19.1	5.3	0.0
	Casino	127	73.2	26.8	13.4	0.8
	Kempsey	318	65.4	34.6	17.6	0.9
	Kyogle	97	72.2	27.8	14.4	1.0
	NCAHS	**3,738**	**72.0**	**28.0**	**11.8**	**0.5**
Diabetes	Ballina	389	56.6	43.4	11.1	1.5
	Bellingen	154	65.6	34.4	10.4	2.0
	Casino	146	54.8	45.2	15.8	1.4
	Kempsey	338	66.9	33.1	11.8	0.9
	Kyogle	67	58.2	41.8	16.4	0.0
	NCAHS	**4,752**	**60.6**	**39.4**	**10.3**	**0.6**
COPD	Ballina	215	60.0	40.0	19.1	1.4
	Bellingen	121	62.8	37.2	24.0	7.4
	Casino	81	65.4	34.6	16.1	1.2
	Kempsey	280	60.4	39.6	25.0	5.7
	Kyogle	75	61.3	38.7	25.3	8.0
	NCAHS	**3,836**	**60.9**	**39.1**	**22.5**	**3.7**
Cellulitis	Ballina	312	83.3	16.7	4.2	0.0
	Bellingen	162	85.2	14.8	4.3	0.6
	Casino	135	84.4	15.6	7.4	0.7
	Kempsey	343	85.4	14.6	2.6	0.3
	Kyogle	99	88.9	11.1	2.0	0.0
	NCAHS	**3,855**	**86.9**	**13.1**	**3.2**	**0.1**
Asthma	Ballina	164	74.4	25.6	10.4	1.8
	Bellingen	116	75.0	25.0	8.6	0.9
	Casino	137	75.9	24.1	10.2	0.7
	Kempsey	181	69.6	30.4	10.5	0.6
	Kyogle	144	79.2	20.8	9.0	0.7
	NCAHS	**3,186**	**76.7**	**23.4**	**8.7**	**0.6**
Pyelonephritis	Ballina	317	87.4	12.6	3.2	0.0
	Bellingen	158	88.0	12.0	3.8	0.0
	Casino	104	87.5	12.5	2.9	0.0
	Kempsey	284	87.7	12.3	3.5	0.0
	Kyogle	70	87.1	12.9	5.7	0.0
	NCAHS	**4,273**	**86.6**	**13.4**	**3.4**	**0.1**

Appendix 5 : Priority ACS condition by frequency of admission and comorbidity proportion and geographical area (persons), July 2001 to June 2006

Angina					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	285	74.2	99	25.8
Bellingen		108	76.1	34	23.9
Casino		122	65.9	63	34.1
Kempsey		257	70	110	30
Kyogle		61	82.4	13	17.6
NCAHS		3,242	69.4	1,428	30.6
Ballina	>=2	69	57	52	43
Bellingen		31	57.4	23	42.6
Casino		16	37.2	27	62.8
Kempsey		58	46.4	67	53.6
Kyogle		4	33.3	8	66.7
NCAHS		655	47.9	713	52.1
Ballina	>=3	24	45.3	29	54.7
Bellingen		9	50	9	50
Casino		7	28	18	72
Kempsey		17	37	29	63
Kyogle		1	33.3	2	66.7
NCAHS		182	34.3	349	65.7
Ballina	>=8	1	33.3	2	66.7
Bellingen		0	0	0	0
Casino		0	0	1	100
Kempsey		0	0	4	100
Kyogle		0	0	0	0
NCAHS		4	12.1	29	87.9

Asthma					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	116	95.1	6	4.9
Bellingen		81	93.1	6	6.9
Casino		96	92.3	8	7.7
Kempsey		119	94.4	7	5.6
Kyogle		107	93.9	7	6.1
NCAHS		2,309	94.6	133	5.4
Ballina	>=2	35	83.3	7	16.7
Bellingen		28	96.6	1	3.4
Casino		29	87.9	4	12.1
Kempsey		52	94.5	3	5.5
Kyogle		29	96.7	1	3.3
NCAHS		676	90.9	68	9.1
Ballina	>=3	14	82.4	3	17.6
Bellingen		10	100	0	0
Casino		12	85.7	2	14.3
Kempsey		17	89.5	2	10.5
Kyogle		13	100	0	0
NCAHS		245	88.1	33	11.9
Ballina	>=8	1	33.3	2	66.7
Bellingen		1	100	0	0
Casino		1	100	0	0
Kempsey		1	100	0	0
Kyogle		1	100	0	0
NCAHS		16	84.2	3	15.8

COPD					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	90	69.8	39	30.2
Bellingen		61	80.3	15	19.7
Casino		36	67.9	17	32.1
Kempsey		126	74.6	43	25.4
Kyogle		39	84.8	7	15.2
NCAHS		1,672	71.6	663	28.4
Ballina	>=2	50	58.1	36	41.9
Bellingen		26	57.8	19	42.2
Casino		16	57.1	12	42.9
Kempsey		55	49.5	56	50.5
Kyogle		18	62.1	11	37.9
NCAHS		750	50	751	50
Ballina	>=3	22	53.7	19	46.3
Bellingen		16	55.2	13	44.8
Casino		6	46.2	7	53.8
Kempsey		31	44.3	39	55.7
Kyogle		12	63.2	7	36.8
NCAHS		372	43.2	489	56.8
Ballina	>=8	2	66.7	1	33.3
Bellingen		4	44.4	5	55.6
Casino		1	100	0	0
Kempsey		3	18.8	13	81.3
Kyogle		4	66.7	2	33.3
NCAHS		45	31.9	96	68.1

Cellulitis					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	209	80.4	51	19.6
Bellingen		122	88.4	16	11.6
Casino		92	80.7	22	19.3
Kempsey		228	77.8	65	22.2
Kyogle		75	85.2	13	14.8
NCAHS		2,675	79.9	675	20.1
Ballina	>=2	29	55.8	23	44.2
Bellingen		18	75	6	25
Casino		6	28.6	15	71.4
Kempsey		33	66	17	34
Kyogle		7	63.6	4	36.4
NCAHS		302	59.8	203	40.2
Ballina	>=3	7	53.8	6	46.2
Bellingen		5	71.4	2	28.6
Casino		2	20	8	80
Kempsey		3	33.3	6	66.7
Kyogle		1	50	1	50
NCAHS		61	49.2	63	50.8
Ballina	>=8	0	0	0	0
Bellingen		0	0	1	100
Casino		0	0	1	100
Kempsey		0	0	1	100
Kyogle		0	0	0	0
NCAHS		0	0	4	100

Diabetes					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	190	86.4	30	13.6
Bellingen		91	90.1	10	9.9
Casino		70	87.5	10	12.5
Kempsey		187	82.7	39	17.3
Kyogle		29	74.4	10	25.6
NCAHS		2,430	84.3	451	15.7
Ballina	>=2	128	75.7	41	24.3
Bellingen		39	73.6	14	26.4
Casino		45	68.2	21	31.8
Kempsey		77	68.8	35	31.3
Kyogle		22	78.6	6	21.4
NCAHS		1,393	74.5	478	25.5
Ballina	>=3	19	44.2	24	55.8
Bellingen		8	50	8	50
Casino		10	43.5	13	56.5
Kempsey		19	47.5	21	52.5
Kyogle		8	72.7	3	27.3
NCAHS		227	46.3	263	53.7
Ballina	>=8	2	33.3	4	66.7
Bellingen		1	33.3	2	66.7
Casino		0	0	2	100
Kempsey		3	100	0	0
Kyogle		0	0	0	0
NCAHS		13	43.3	17	56.6

Heart Failure					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	151	64.3	84	35.7
Bellingen		65	61.3	41	38.7
Casino		50	53.8	43	46.2
Kempsey		97	46.6	111	53.4
Kyogle		48	68.6	22	31.4
NCAHS		1,352	50.2	1,341	49.8
Ballina	>=2	15	23.1	50	76.9
Bellingen		7	28	18	72
Casino		7	20.6	27	79.4
Kempsey		28	25.5	82	74.5
Kyogle		9	33.3	18	66.7
NCAHS		270	25.8	775	74.2
Ballina	>=3	3	13.6	19	86.4
Bellingen		1	14.3	6	85.7
Casino		2	11.8	15	88.2
Kempsey		12	21.4	44	78.6
Kyogle		3	21.4	11	78.6
NCAHS		89	20.2	351	79.8
Ballina	>=8	0	0	0	0
Bellingen		0	0	0	0
Casino		0	0	1	100
Kempsey		0	0	3	100
Kyogle		0	0	1	100
NCAHS		2	10	18	90

Pyelonephritis					
Geographical area	Admission frequency	Comorbidity status			
		No		Yes	
		n	%	n	%
Ballina	1	222	80.1	55	19.9
Bellingen		117	84.2	22	15.8
Casino		71	78	20	22
Kempsey		196	78.7	53	21.3
Kyogle		50	82	11	18
NCAHS		2,849	77	850	23
Ballina	>=2	24	60	16	40
Bellingen		10	52.6	9	47.4
Casino		6	46.2	7	53.8
Kempsey		23	65.7	12	34.3
Kyogle		4	44.4	5	55.6
NCAHS		318	55.4	256	44.6
Ballina	>=3	5	50	5	50
Bellingen		4	66.7	2	33.3
Casino		3	100	0	0
Kempsey		4	40	6	60
Kyogle		2	50	2	50
NCAHS		67	46.2	78	53.8
Ballina	>=8	0	0	0	0
Bellingen		0	0	0	0
Casino		0	0	0	0
Kempsey		0	0	0	0
Kyogle		0	0	0	0
NCAHS		2	66.7	1	33.3