Ambulance and Public Hospital Emergency Department Utilisation by Elderly People in Perth Western Australia.

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ABSTRACT

Introduction

A disproportionate number of ambulance requests and ED presentations are made by elderly people who present with acute medical problems complicated by complex co-morbidities, cognitive/functional decline and social issues. Further compounding ambulance and ED utilisation by elderly people is that between 18-47% of elderly patients are treated and discharged home. Given that ambulance demand and ED's are at capacity, it would seem imperative to gain a better understanding of why elderly patients, especially those who are not admitted to hospital, choose to attend the ED.

Aims

This two-staged analytical epidemiological study aimed to understand why elderly people chose to attend the ED.

- To describe the epidemiology of ED utilisation by a cohort of elderly patients who were transported via ambulance to one of seven public metropolitan hospitals within Perth Western Australia during 1990-2002.
- To identify risk factors of ED presentation in a group of randomly selected elderly patients who attended a major tertiary public teaching hospital in Perth Western Australia between November 2007 and March 2008.

Methods

In Stage 1 a retrospective cohort study using a longitudinal health dataset for the period 1990-2002 of all elderly patients transported via ambulance to one of seven public Perth metropolitan Emergency Departments (ED) was undertaken. While in Stage 2, a cross sectional descriptive study of a random selection of elderly patients who attended a major tertiary ED over a four month period was undertaken.

Results: Stage 1

Between 1990 and 2002 a cohort of 179 206 patients used ambulances to attend ED on 309 435 occasions. The majority of elderly patients were observed to attend ED via

ambulance only once (59.2%; n=106 126). Trend analysis showed that the age-standardised rate for all prehospital care episodes by elderly people in 1990 was 2 142 episodes per 100 000 persons (SE 13.1) but had increased significantly to 2 220 episodes per 100 000 persons (SE 10.9) in 2002 (t=4.603; p<=0.001). An increasing trend was also observed for elderly patients who accessed ambulance and ED treatment more than 7 times, with 7.4 episodes per 100 000 (SE 0.9) reported in 1990 with this figure rising dramatically to 249.9 per 100 000 (SE 4.1) by 2002 (t=56.612; p=0.000).

Of the 179 206 elderly patients who attended the ED, 88 756 were admitted to hospital with a slightly higher amount of patients (n=90 450) treated and discharged home. Admitted patients were observed to attend ED on 215 146 (70%) occasions compared to non admitted patients who attended far less (30%; n=94 289).

Cardiac problems were the most frequent ambulance problem cited by those younger than 85 years (n=49 209; 59.2%) while trauma was the most reported problem for those older than 85 years (n=15 639; 18.2%). Age standardised rates for ambulance problem codes were compared between 1990 and 2002 and showed that of the four most frequently reported problems, trauma and respiratory problems in elderly patients were all observed to increase significantly between 1990 and 2002 while cardiac and neurological problems were showed to decrease significantly.

Results: Stage 2

A final sample of 219 patients participated in the telephone interviews. The most frequent form of transport used to attend the ED was by ambulance (n=114; 52%) which was shown to significantly increase with age (X^2=8.99; df=2; p=0.011). The most frequent health problem reported across all age groups was chest pain, which accounted for 17.3% (n=38) of all problems.

The main risk factor associated with GP consultation prior to attending ED was having sustained a fall (OR 2.56). Patients aged 85 years or more were over four times (OR 4.15)

more likely to attend ED via ambulance than younger patients. If there was a perception that their health condition required immediate medical treatment then elderly patients were three times as likely to use an ambulance (OR 3.13) or if the emergent health problem was cardiac (OR 2.86). The strongest risk factor of hospital admission was health professional advice to attend ED (OR 3.75), followed by using an ambulance to attend ED (OR 2.48), being triaged with an ATS category of 'resuscitation or emergency' were (OR 2.49) or being male (OR 1.98).

Conclusion

Emergency medical services and ED utilisation by elderly patients continues to be used at a disproportionately higher rate than by those younger than 65 years however the real disparity is highlighted in the use of these services by those aged 85 years or more. It is therefore imperative that both the EMS and emergency departments within the metropolitan area must ensure that they are equipped educationally, operationally and strategically to meet the burgeoning demands made by this segment of the population.

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DEFINITIONS AND ABBREVIATIONS

Australasian Triage Scale (ATS): The ATS is a rating scale consisting of five categories used for prioritising clinical urgency of patients attending an emergency department: ATS 1 refers to immediate treatment required
ATS 2 refers to treatment within 10 minutes
ATS 3 refers to treatment within 30 minutes
ATS 4 refers to treatment within 60 minutes
ATS 5 refers to treatment within 120 minutes.

* It should be noted that during the data collection period for this study, the National Triage Scale was used. The NTS used the exact same treatment times as the ATS but also assigned descriptors such as ‘resuscitation, emergency, urgent’ etc to each category. To keep this thesis contemporary the term ATS will be used.

Admission: Refers to the formal process that a patient undergoes to be admitted into hospital for an episode of care.

Co-morbidity: The presence of one or more health conditions or illnesses.

DALY: The deterioration in health status is measured by disability-adjusted life years whereby both the incidence of illness, severity and mortality of that illness are calculated to estimate the burden of disease.

Disability: Is a term covering all or any of the following components: “impairment, activity limitation and participation restriction, as influenced by environmental factors.”

Elderly: The term elderly is defined as any person aged 65 years or older.

Emergency Medical Services: (EMS): This refers to prehospital care and transport to an emergency department/clinic.

DEFINITIONS AND ABBREVIATIONS CONT

Episode of care: In this study episode of care refers to the type of care given for ambulance or ED visits. An episode of care is for an initial visit and ends when the problem no longer requires treatment. If a patient re-presents to hospital then this is deemed a new episode of care.

GDP: Gross domestic product.

HDWA: Health Department of Western Australia**.**

HMDS: The Hospital Morbidity Data System is an information system used for patients admitted into all WA hospitals and is maintained by the WA Department of Health. Data are collected on all episodes of presentation and hospitalisation within the State from both acute care public and private hospitals.

MBS: Medicare Benefits Schedule.

OPD: Outpatients Department.

PBS: Pharmaceutical Benefits Schedule.

Prehospital Care: Refers to emergency care given by trained ambulance health care personnel who then transport the patient to an appropriate hospital setting for treatment.

Separation: Refers to admitted patients who have been discharged from a hospital.

TEPEDD: The Elderly Prehospital and Emergency Department Dataset.

TEDEPI: Refers to The Emergency Department Elderly Patient Interview.

STATISTICAL DEFINITIONS AND ABBREVIATIONS

Age Standardisation Rate: A statistically corrected figure which controls for confounding effects of age when comparing populations of different age groups.

Crude Rate: Is the weighted average of a category specific rate, where weights are expressed as a proportion of the population.

Incidence: The number of new cases of a disease/condition that occurs during a given time period from the total population at risk.

Prevalence: The number of existing cases of a disease/condition that occurs during a given time period from the total population.

Odds Ratio: Odds ratio is an estimation of relative risk, measuring the ratio of the odds of exposure among cases and controls.

Rate ratio: Rate ratio is the ratio of two instantaneous incidence rates.

SD: Standard deviation.

SE: Standard error.

Chapter 1
INTRODUCTION

1.0 Introduction

Elderly people, defined as those aged 65 years or older, are the fastest growing segment of the population in many western societies.[1-7] In countries such as the United States of America, Japan and Australia, it is estimated that the elderly population will more than double within the next twenty years.[1] In addition, population studies have also shown that people are living longer, with the proportion of elderly people 80 years and over, expected to become the largest age group in the developed world by 2050. [1]

These changes in demography and longevity have serious implications for the provision and delivery of adequate health care services, given that ageing is usually accompanied by deterioration in health status. Specifically, elderly people often suffer from a number of chronic health conditions (cardiovascular conditions, cancer, arthritis, respiratory problems, diabetes, renal problems) that require regular ongoing medical attention.[2-4]

When the health status of elderly people becomes acutely and severely compromised, access to emergency medical services (EMS) is warranted. The EMS comprises prehospital care and transport to an emergency department (ED) for treatment. Several population based studies have reported that elderly people access EMS at a significantly higher rate than the rest of the population.[5-15] One older study by Strange et al. (1998) reported that of an estimated 15.6 million visits to ED by elderly patients, this group of patients were 4.75 times (CI 4.71-4.79) more likely to arrive by ambulance and 6.59 times (CI 6.54-6.64) more likely to be admitted into hospital compared with a person younger than 65 years.[5]

As stated elderly people are frequent users of the EMS but they also present with complex clinical problems, which are generally resource intensive. For example, in Australia between 1993-1994 patients aged over 65 years constituted 12% of the total population yet health expenditure for this group during that same year was calculated at 35% of the total health budget and amounted to $11 billion.[16] Further compounding the financial costs of health care provision for the elderly are the ED attendances by the elderly people who are treated and released back into the community.[17, 18] Between 18%-47% of elderly people attending ED, are identified as not requiring hospital admission. [17, 18] Since a disproportionate amount of health care expenditure is spent on the elderly, consideration of the extent to which elderly people utilise the EMS in the Australian setting is therefore essential for the future planning of appropriate health care services and infrastructure.[19]

This two-staged analytical epidemiological study aimed to understand why elderly people chose to attend the ED. The first stage describes the epidemiology of ED utilisation by a cohort of elderly patients who were transported via ambulance to one of seven public metropolitan hospitals within Perth Western Australia during 1990-2002. Historically, health information was recorded in many different types of data collection systems that often did not facilitate the easy retrieval of information. The establishment of the Western Australian Prehospital Care Linked Dataset through the use of record linkage techniques has to a certain extent, overcome this problem.[20] This database incorporates prehospital information and subsequent hospital and outcome data for each patient and is one of the distinguishing attributes of this study. Using this data in combination with specific inclusion and exclusion criteria, a dataset known as The Elderly Prehospital and Emergency Department Dataset (TEPEDD) was derived. The unique development of TEPEDD allowed for comprehensive epidemiological analysis to be undertaken on elderly patients who utilised the EMS, within a geographically isolated Australian community of over 1.6 million people, which is overseen by one main public health authority and serviced by one EMS care provider.

The second stage of this study identified risk factors of ED presentation in a group of randomly selected elderly patients who attended a major tertiary public teaching hospital in Perth Western Australia between November 2007 and March 2008. Specifically, this sub study compared the reasons for ED attendance and the barriers to accessing primary care by elderly patients who attended ED but who were treated and sent home with those who were admitted to hospital.

Finally, there is a paucity of literature within the Australian context which identifies the trends and characteristics of elderly people utilising the EMS and ED's. To date much of the research into EMS and ED utilisation has been conducted in the United States of America (USA), a health care system which is vastly different to that used in Australia. Hence the ability to draw comparisons is limited and thus provides further support for the conduct of research studies that address the impact that an aging population will have on the Australian health care system. Additionally, this study provides a benchmark of elderly Australian's health and health care needs and provides insight into to the reasons why elderly Australians access the ED.

1.1 Thesis Structure

This thesis presents findings from two distinct but interrelated studies. Firstly Stage 1 of this thesis is constructed from 309 435 episodes of prehospital care and hospital admission data from elderly patients who used an ambulance to attend seven designated metropolitan ED's between January 1st 1990 and December 31st 2002. Findings from Stage 1 describe the ambulance and ED utilisation by elderly people from a population based perspective. While Stage 2 of the study focused on gaining an in depth understanding of the reasons and decision making processes used by 219 elderly people who presented to a Perth ED in 2008. Additionally, data from Stage 2 was subsequently used to identify risk factors of ED presentation by elderly people.

Chapter two critically analyses the literature on ambulance and ED utilisation by elderly people aged 65 years or more. An overview of the Australian health care system and the St John Ambulance Organisation was undertaken, along with a discussion on the implications of the associated health care costs expended on the elderly population who utilise these services. Building on the background of the EMS and ED structure and function within the Australian context, a critical review of the literature is provided in chapter three. Specifically, this chapter highlights the immense pressure that the EMS and ED's are under, in trying to meet demand while still providing a high standard of care. Examination of factors that impact on service delivery, such as an aging population are reviewed and critically analysed. Both national and international outcome studies were reviewed to highlight and compare the similarities and differences associated with emergency access by elderly people.

Chapter four provides the geography and demography of the Perth metropolitan area with regard to the structure and services provided by St John Ambulance and the public hospital ED system. This chapter also describes the record linkage methods and data sets used to construct TEPEDD and the analysis undertaken for Stage 1. The descriptive survey methods used in Stage 2, along with the development and piloting of TEDEPI and the descriptive analyses and multivariate regression modelling used are also detailed.

The results chapter presents the findings for the elderly cohort of patients in Stage 1 who were transported via ambulance to seven public hospital EDs and details the annual standardised incidence and prevalence estimates of elderly peoples' ambulance and ED utilisation at metropolitan public hospitals over a 13 year period. Characteristics and predictors of ED attendance by elderly people identified in the subsamples in Stage 2 are also discussed. Specifically, the characteristics and risk factors associated with hospital admission, ambulance utilisation and primary care are presented. The final chapter discusses the findings within the context of the current literature and particularly from an Australian perspective. Study limitations are examined and recommendations for future research directions are also stated, followed by the reference chapter.

Chapter 2
BACKGROUND LITERATURE

2.0 Introduction

This chapter reviews the background issues that influence EMS utilisation by elderly people. These key areas include describing the trends of ageing from a national and international perspective, standardising the definition of the term 'elderly' within the context of emergency service literature and also discussing the difference between the subgroups that constitute this segment of the population. Specifically, for the purposes of this study the term 'elderly' refers to people aged 65 years or more.

The provision of care for the elderly, within the Australian and Western Australian health care systems and the associated health care costs are discussed broadly to provide context when compared to international findings. Background information is also given on the structure of the St John Ambulance service and how this service integrates with public health care delivery in Australia. This chapter lays the foundation for the literature review, which discusses the specific issues relating to ambulance and ED utilisation by elderly people.

2.1 A Global Perspective of the Ageing Population

Improved living standards and developments in health care have resulted in declining mortality rates in virtually all countries in the western world and several developing countries, and has facilitated increases in population longevity.[4] This has resulted in an international upsurge in the number of elderly people aged 65 years or more.[1, 4, 5, 12, 21-23]

In 2002, the US Census Bureau estimated that 440 million people worldwide were aged 65 years or more, which approximates to 7 percent of the global population.[23]

Demographers project that by 2020, the global proportion of elderly people will increase to 9% and nearly double to 17% by 2050.[23] The World Health Organization (WHO) estimates that by 2020 countries such as China will have approximately 230 million elderly people, India 142 million; Indonesia 29 million; Brazil 27 million and Pakistan will have 18 million elderly people.[1] According to the US Census Bureau (2005) [22], in 2000, Americans aged over 65 years were the fastest growing segment of the population, accounting for approximately 35 million people (12.4%), with estimates that this number will increase to 72 million (20%) by the year 2030.[22]

The United Kingdom (UK) has a much smaller population (60.2 million people) than the USA with elderly people making up an increasing proportion.[24] Specifically, in 2005 16% (3.8 million) of the UK population were 65 years or older and of those 16%, the proportion of people aged 85 years or more was 32% (1.2 million).[24] Higher population estimates are reported by the WHO which states that by 2020, Europe's elderly population will increase from 20% to 25%, with elderly Europeans accounting for 20% of the world's elderly population.[1]

Similar trends are emerging in Australia with 2005 figures showing that 13.1% (2.6 million) of the total population are over the age of 65 years, with this number expected to increase to 17.8% by 2021.[4, 25] Additionally, it has been reported that after 2010 the proportion of elderly Australians is projected to increase rapidly as the 'baby boomer' generation starts to retire.[26]

Coupled with this growth in the proportion of Australians who are elderly, is the substantial increase in life expectancy. For example, Australian males are now living on average to 83 years and Australian females living on average to 86 years.[4]. Population estimates show that males and females aged 85 years or more are expected to live a further 5.7 and 6.9 years respectively.[4] In addition to increased longevity, is the rise in the proportion of elderly age groups. For example, in 1976 one in six

Australians were aged 80 years or more, in 1996 it was one in five and by 2016 it is estimated that one in four people will be aged 80 years or more. [27]

This trend in ageing is also observed in WA statistics which show that in 1996, 144 460 or 9.1% people living in the Perth metropolitan area were aged 65 years or more with this expected to increase to 208 854 by 2011 and rising even further to 308 108 by 2021.[28] This upward trend will occur at the same time as a decline in those aged younger than 45 years, which will have severe implication for the provision of social support and services.[28] Additionally, three quarters of the WA population resides in the Perth metropolitan area, reinforcing the fact that expansion of public health services and infrastructure is warranted to accommodate these unprecedented demographic changes.[28]

2.2 Defining the Term 'Elderly'

Defining the term 'elderly' is important if research studies focusing on the 'elderly' are to be compared and contrasted. Currently, there is a huge disparity in the EMS and medical literature with regard to the definition of the terms 'elderly', 'older', or 'geriatric'. Review of the literature found 50 studies which defined 'elderly', 'older', or 'geriatric' as people aged 65 years and over.[5, 8, 10, 14, 19, 21, 22, 29-69] While the remaining studies defined older people using age criteria ranging from 50 to 75 years or more.[48, 70-83]

This inconsistency with regard to the definition of older age groups in the current literature is further highlighted in a systematic review undertaken on older adults who utilise the ED. [84] This systematic review used the following key words to gather studies; 'aged, elder, older, geriatrics, senior, ageing and aging', it included relevant literature published between 1985 and 2001.[84] Given that this review compared 'older' people's use of ED services with younger people's, it is interesting that the term 'older' was not quantified except when referring to articles which focussed on adverse health

outcomes among older ED patients. Further exploration of the key articles used by Aminzadeh and Dalziel,[84] revealed a wide variation in how researchers defined the age criteria of the various sample populations. Specifically, the majority of articles in this systematic review defined elderly as those people who were aged 65 years or more, [5, 8, 19, 29, 36, 46, 52, 62, 63, 72, 85, 86] while a few studies used 75 years as their inclusion criteria [75, 76, 87] and two studies used even younger categories of 50 years or more, or 62 years or more.[77, 80] Rather than simply defining elderly people based on chronological age, a comprehensive review was undertaken by staff at the Tokyo Metropolitan Geriatric Hospital and the Tokyo Metropolitan Institute of Gerontology who analysed data taken from several long term epidemiology studies, government health policy reports, clinical and pathology studies as well as public opinion to try and establish an appropriate cut off age for the definition of elderly people based on available evidence. [74]

To do this Orima et al (2006)[74] reviewed several different information sources that examined issues such as societal definitions and attitudes towards ageing, requirements of nursing home care, activities of daily living, physical function, clinical characteristics (blood pressure, haemoglobin levels, cholesterol levels, body mass index), presence of diabetes, cancer, heart disease, cerebrovascular disorders and death within the Japanese population. The authors reported that one government survey of the public (n=3 941), undertaken in 2004, highlighted that public opinion considered that elderly people 'should be characterized by loss of functional independence and the term should be defined as persons aged 70 or 75 years'.[74]

Another source of evidence used in the defining the term 'elderly' was obtained from prevalence data taken from a Japanese policy review committee report, which looked at the funding of nursing homes.[74] Specifically, results showed that 87% of people requiring serious nursing and medical care were aged over 75 years.[74] In addition to the above mentioned sources of evidence, Orima et al.,[74] also included results taken from a 10 year cohort study of 735 people aged over 65 years who lived in a small rural Japanese community. Every two years, between 1992-2002, 100 medical parameters

were examined and participant interviews were undertaken in this population.[74] Findings revealed that over time, walking speed, grip strength and functional independence all decreased with age, with significantly higher decreases observed for those in the oldest age category.[74] Findings were then translated into functional age, with results showing that men and women in the 2002 cohort were functionally much younger than elderly people in the 1992 cohort. Specifically, men in the 2002 cohort were calculated as being functionally younger by 4-11 years while women in the same cohort were reported to be 8-11 years functionally younger than those in the 1992 study.[74] The main conclusion drawn from this review was that Japanese people aged 65 years or more, in the 2002 cohort were physically much fitter and more independent than those who were of a similar age in 1992 and therefore the term 'elderly' should be reassigned to those who are 75 years and older.[74] While classifying 'elderly' by functional age rather than chronological age has merit, it can lead to difficulties if standardised valid and reliable measurements are not utilised.

Until standardised definitions of the term elderly are consistently employed, utilisation of research findings focussing on elderly people who utilise the EMS and ED's will be severely limited. For the purposes of this study, the term 'elderly' is used to refer to those people who are aged 65 years or more.

2.3 Elderly People and Extremely Elderly People

Given that the term 'elderly' encompasses a range of 40 years, the disparity between the general health status of a 65 year old compared to that of an 85 year old could be immense, therefore greater distinction needs to be given to the subgroups within the broader term of elderly. Neugarten[88] suggests that in order to provide more detailed and meaningful data, the elderly population should be divided into three distinct categories: 65-74 years, 75-84 years or 85 years plus. This distinction is important as increasing numbers of elderly people accompanied by increases in life expectancy have major implications for health care delivery, particularly when considering that the oldest

age group (85 yrs +) continues to grow at a rapid rate.[5] For example, Australian population statistics report that in 2007, 1.7% (n=355 300) of the national population was aged 85 years or older with this figure projected to increase to 2.7% (n=683 100) by 2027 and to 5.6% (n=1.6 million) by 2047.[26]

Significant increases in Australians aged 65 years or more has the potential to have enormous implications on our health care system. Specifically, EMS/ED research has shown that those aged 85 years or more use a higher proportion of diagnostic services than their younger 'elderly' counterparts (i.e. 65-84 yrs).[85] For example, in a small but detailed study by Singal et al.,[85] results showed that the number of radiographic requests increased significantly with age (65-74 yrs=73%; 75-84 yrs=79%; 85 yrs+= 93%; $p<0.04$).[85] Similar frequencies were also observed in this subsample when laboratory tests were ordered (65-74 yrs=76%; 75-84 yrs=80%; 85 yrs+=84%), however on this occasion no significant difference was observed between the subgroups.[85]

While the above mentioned results clearly show that elderly patients aged 65 to 74 years have different health care and resource utilisation needs compared to those aged 85 years or more, there is still only minimal published research in this area. The studies that do strata elderly patients into different age groups report on only a handful of variables such as ambulance/ED attendance[5-7, 39, 89] reason for requesting an ambulance,[11, 12] gender[12, 39, 89], hospital admission rate or diagnostic utilisation[85] by those 85 years or more.[39, 90] These findings have implications for health care service delivery and as such warrant further investigation if health services are to meet the future needs of these three distinct elderly subgroups.

2.4 Australia's Government Structure and the Health Care System

To gain a full appreciation of the health care system in Australia it is imperative to outline how Australia is governed and therefore how the Australian health care system is funded. Australia has a federal system of government, which oversees six State and

two Territory parliaments. The Commonwealth parliamentary system operates on the Westminster system of government, which consists of the Monarchy (represented by the Governor General) and two elected houses of parliament – the House of Representatives and the Senate.(94)

The political party with the majority of elected members in the House of Representatives (lower house) forms the government of the day. The Senate (upper house) plays a powerful part in the 'checks and balance' process, and is considered a "chamber of review for the decisions of the government".(94) Currently the Australian Federal Government is led by the Australian Labor Party, with all State and Territories except Western Australia who is governed by the Liberal/National Party Coalition.(95)

State and Territory parliaments have their own constitutions but also are subject to the national constitution with Federal law taking precedent.(94) Whilst these two levels of government may co-operate in areas such as transport, education, health and law enforcement, this power differential between State and Federal governments has serious implications for policy and service delivery, primarily in relation to revenue access and duplication of resources.(94) Specifically, when it comes to health care, the responsibility becomes even more complicated as the State and Federal systems become intertwined, with the State and Federal Governments **both** responsible for funding of public hospitals, community aged care and disability care.(96) This was not always the case as originally, the Federal Government's only duty to health care was restricted to quarantine issues. However the Constitution was changed in 1946, to enable the Federal Government to provide health care services and benefits.(96) One of the Federal Government's responsibilities is to fund most out-of-hospital medical services. Specifically, the Federal Government funds the universal health care program known as Medicare, of which the Medicare Benefits Schedule (MBS) is the core component.(27) The MBS provides payment subsidies for patients accessing an array of health services such as, medical practitioner services, optometry, pathology and diagnostic imaging. In addition, the Australian Government under the Pharmaceutical Benefits Scheme (PBS)

provides access to a wide range of affordable medicines by subsidising pharmaceuticals.[27] Both of these schedules are dynamic with subsidies for new procedures, tests, medicines and services (such as ambulance cover for the elderly) continuously being added to the schedule once government approval has been obtained.[27]

Primary care in Australia is accessed through medical doctors known as general practitioners (GPs), who assess and treat patients within the community. General practitioners also refer patients to specialists or hospital treatment.[97] Usually a co-payment for a GP visit is required, however certain groups in the community, e.g. the unwaged, children or pensioners may be charged at the scheduled medical benefits fee, avoiding the need for an up front payment.[98]

Acute care in Australia is comprised of a mixed system of public government funded hospitals and private hospitals.[98] Seventy-five percent of all hospitals in Australia are public hospitals, and cater for two thirds of all hospital separations.[98] Under the Australian Health Care Agreement, publicly funded hospitals are required to provide free inpatient care to all Australians and eligible residents.[98]

2.4.1 Community Aged Care Provision

In addition to hospital access and to meet growing demand from an ageing population, the Australian Government has injected funds into community care packages and residential aged care for older people. [99] Before access to community or aged care facilities, assessment and approval must be obtained from the Aged Care Assessment Team (ACAT), which is a jointly funded program between the Australian Government and State/Territories. [99]

There are two main programs that provide care to elderly Australians. The first program known as the Community Aged Care Package provides care to frail older people to

maintain their quality of life whilst remaining in their own home.[99] The second program offers two levels of care: residential aged care and hostel care. Residential aged care facilities provide high level care when intense support is required for an individual to carry out basic activities of daily living.[100] Residential hostels are for those people who are less dependent but still require some sort of support.[99]

The Resident Classification System (RCS) measures dependency using an eight level scale, which ranges from low level care (rated RCS 5-8) to high care (RCS 1-4).[99] Specified monetary subsidies are paid to the residential care provider for residents classified as RCS levels 1-7, with no basic payments given for those who are assessed at level 8.[99] At 30 June 2005, nationally there were 161 765 residential care places, of which 12 346 were in WA, the majority of which were permanent places (n=10,709).[99] By 30 June 2007, residential care places had increased to 170 071, with 18 591 places allocated within WA.[99] The average occupancy rate of residential aged care facilities in major cities in WA was 95.6%.[99]

However, throughout Australia the number of 'high care' places for those aged 70 and over has progressively reduced from 67.2 beds per 1,000 persons in 1985 to 44.1 per 1,000 persons in 1996 and has remained static at 44 per 1000 persons as of 2007.[99] During this same period the provision of home-based services was increased but there has been some concern that community care may not be a fully effective alternative to residential care, particularly as dependency increases.[(99)] There has also been a steady increase in the number of residents classed as 'high dependency' (ie RCS 1-4), rising from 53% in 1998 to 56% in 1999 and 58% in 2001.[3] While elderly people are staying at home longer, when they do enter residential care they tend to be frailer, which translates into the requirement of more complex and higher care services.[100]

2.4.2 Costs of Health Care in the Australian Context

The Australian Federal Treasury Department reported that spending in health care by the Australian Government has increased from 1.5% of the gross domestic product (GDP) in the early 1970s to nearly 4% by 2004.[27] To put this in perspective, health is the main area of Government spending followed by income support which consumes just under 3% of Australia's GDP, while less than 2% of GDP is spent on education and defence.[27]

In comparison to other OECD countries in 2004, on a per capita basis Australia spent slightly more on health in 2003 ($2 876 USD) compared with an OECD average of $2 550 USD for that same time period.[101] While these findings are encouraging, health care spending in Australia is still substantially less that what the US spend per capita ($6 100 USD).[101]

Contrary to the literature which stipulates that an ageing population will have huge economic ramifications of health care provision, a current report by the Australian Federal Treasury Department, revealed that rising costs were mainly due to non demographic factors such as the subsidising of new medications and greater use of diagnostic procedures, which increased health spending from 2.91% in 1985 to 3.92% of GDP in 2006.[27] Approximately 75% of fiscal spending projections will be spent on these areas rather than on ageing.[27] These percentages were calculated using the annual average growth from the start and end of the 1985/1986 to 2005/2006 period and then in 1995/1996 to the 2005/2006 period. In comparison, health expenditure resulting from population growth was much less for those respective time periods, (1.27% and 1.19% of GDP) while changes in the age structure of the population accounted for 0.53% and 0.60% of GDP respectively, spent on health.[27] It should be noted that many of the projections presented here are built on certain assumptions which are sensitive to economic, social and environmental changes. As such, these projections should be viewed as an estimation only.[27]

Treasury statistics and projections have highlighted that in 2007, for every person aged 65 years and over there were five people of working age to support them. In forty years time this ratio will drop to 2.4 people of working age per elderly person.[27] These projections indicate the need for the Government to address the financial implications of this type of fiscal down turn by ensuring that strategies such as the availability of a futures fund for provision of unfunded liabilities, self funded superannuation, private health cover etc are in place to ensure adequate provision of services, health included, for future generations. This increase in the proportion of the Australian population who are elderly, combined with the projected decrease in the proportion of people of working age, points to a slowing of the Australian economy over the next 40 years.[27] The greatest fall in economic growth is projected to occur in the 2020s due to the 'baby boomer' generation retiring. This decrease in economic growth will have considerable implications on government finances, with health, aged pensions and aged care continuing to be the main areas of spending.[27] These extrapolations are only set to worsen given the current world wide economic down turn.

The provision of both acute care and long term aged care also requires substantial funding. In 2003-2004 the Australian and State Governments spent $21.3 billion on hospitals (this figure includes children's hospitals).[102] In addition to acute care health service costs, are the costs associated with residential and community care services. The Australian and State Governments spent $3.9 billion on high level residential aged care for the same time period.[102]

In 2006/2007 it was estimated that funding for residential and community care services for the elderly constituted 0.8% of the GDP in addition to funds provided by State and Territory governments and the people themselves.[27] Further compounding future health care spending in the aged care sector, will be the impact from people aged 80 years or more who are the major users of aged care services.[27] As mentioned, this

segment of the Australian population is expected to treble over the next four decades thereby exerting substantial pressure on health and aged care spending.[27]

2.5 Deterioration of Health in an Ageing Population

The effects of population ageing have serious implications for the provision of public health care services. Increases in service demand and associated costs are due to the fact that aging is generally accompanied by deterioration in health status. [49, 84] Further impacting on the issue of compromised health status in the elderly population is the increase in longevity, resulting in a substantial rise in the prevalence of chronic diseases.[20, 103] Results from the National Center of Health Statistics between 2000-2003, reported that Americans aged 65 years or more suffered from chronic diseases/conditions such as hypertension (50.1%; SE 0.39), heart disease (31.1%; SE 0.35), and diabetes (15.9%; SE 0.28).[20]

Similar population based statistics from the US Census Bureau cited arthritis as the leading chronic health condition in the USA, affecting 117.7 per 1000 people aged 65-74 years and 193.7 per 1000 people aged 75 years+. [4] The national prevalence estimates for heart disease and stroke in the elderly US population was calculated at 110.8 per 1000 people aged 65-74 years climbing to 170. 9 per 1000 people older than 75 years. [4]

2.5.1 Disability-Adjusted Life Years

Deterioration in health status can also be measured by disability-adjusted life years (DALY) whereby both the incidence of illness, severity and mortality of that illness are calculated to estimate the burden of disease.[105] DALY rates have been shown to increase with age, with Australian women and men in the 45-54 age group estimated to have 102 and 125 (respectively) DALYs per 1000 people compared with a much higher

rate calculated for those aged 75 years or more (females 615 DALYs per 1000 people and males 736 DALYs per 1000 people).[105]

Analysis of the latest available Australian data which did use DALY measurements, revealed that nationally 16.3% of disease and injury burden in 2003 was experienced by people aged 65-74 years.[106] Cancer accounted for 31% of burden for both males and females in this age group followed by cardiovascular (23%) and neurological disease (15%), with 60% of burden in this age group due to mortality. [106] Variation between gender was observed, with leading causes of DALYs much higher in males than females. For example, males report higher DALYs for ischaemic heart disease (37 860 DALYs), lung cancer (19 258 DALYs), diabetes type 2 (14 203 DALYs), prostate cancer (11 950 DALYs) and hearing loss (11 920 DALYs). In comparison, females had much lower DALYs for conditions such as ischaemic heart disease (21 052 DALYs), lung cancer (9 937 DALYs), diabetes type 2 (11 517 DALYs) and hearing loss (5 834 DALYs). Females also reported slightly different leading disease burdens with breast cancer (10 445 DALYs) and dementia (10 236 DALYs) included in the top four leading causes of burden.[106]

Changes in burden of disease were observed for those aged 75 years or more with cardiovascular disease (34%) replacing cancer (19%) as the leading cause of burden followed by neurological problems (18%).[106] In this age group, despite females comprising the majority of the population, males still recorded higher DALYs for cancer (males 52% vs females 48%) and chronic respiratory disease (males 51% vs females 49%).[106] However for other diseases/conditions, females had much higher DALYs (cardiovascular; females 59% vs males 41%; neurological; females 62% vs males 38%).[106] Ischemic heart disease, stroke, lung cancer and dementia were the four leading causes of burden for both genders[107].

Some of the most common chronic and degenerative diseases/conditions that were observed in the elderly population included dementia, stroke, coronary heart disease,

osteoarthritis, Parkinson's disease, diabetes, hearing and visual loss, chronic obstructive pulmonary disease (COPD), depression, cancer, asthma and osteoarthritis. [9, 105, 107-109] These types of conditions are lifelong requiring ongoing medical intervention to monitor, treat and control. Exacerbation of these chronic health conditions, or the development of severe traumatic injuries or life threatening health care incidents such as compromised cardiovascular, respiratory, neurological, endocrine, renal or infectious problems, result in the need for accessing the EMS.[8-10, 110, 111]

2.6 St John Ambulance Structure: Australia

Finally, integral to ED utilisation is the St John Ambulance Service, which is an international organization dedicated to providing both emergent and non-emergent prehospital care and transport, in addition to first aid education and first aid activities such as primary care, youth programs, relief and disaster work.[112] St John Ambulance is a self funded charitable organization that has been operating throughout Australia for over 114 years.[112] Currently, St John Ambulance are only contracted to provide emergency treatment and transport in WA and the Northern Territory (NT). The remaining States utilise other organizations for the delivery of prehospital care. The demand for St John Ambulance prehospital attendance in WA for 2006, was shown to increase by 4.4% on the previous year, with more than 161 000 ambulance attendances for people of all ages.[112] Increases in ambulance utilisation were also observed in the NT, which saw a 3.3% increase in 2006, with 32 316 cases of prehospital treatment and care delivered.[112]

2.7 Conclusion

The provision and delivery of health in Australia is a complex and complicated process, involving many different organizations, all of whom are required to operate within a competitive State and Federal Government fiscal structure. Therefore, greater understanding the health care utilisation of an ageing population is not only prudent but imperative.

Chapter 3

CRITICAL REVIEW OF THE LITERATURE

3.0 Introduction

While the focus of this study is elderly utilisation of the EMS and ED, consideration must also be given to the critical role provided by Primary Health Care (PHC). Both these entities are integral components in the health care continuum as they have the potential to reduce illness severity, prevent death and maintain health.[17, 89, 113, 114]

Primary health care provides access to medical management in the community, where general practitioners (GPs) treat and manage the health care needs of patients. Additionally, the GP acts as a gatekeeper to secondary care such as accessing of medical specialists or hospital treatment.[97, 98, 114]

The EMS and Emergency medicine are comprised of two equally important groups:

- The ambulance service which provides immediate pre-hospital care and transport for both emergent and non-emergent situations; and
- The emergency departments, which provide treatment for patients who have an acute onset of severe illness or injury that requires urgent treatment.[115] Emergency departments also act as referral sites to evaluate and stabilise patients before admission to hospital.[116]

Given the paucity of literature on ambulance, ED utilisation and PHC by elderly people, an extensive search was undertaken which included the following search engines and databases: BIOMEDICAL, CINAHL, COCHRANE DATABASE, EMBASE, MEDLINE, PROQUEST and PUBMED. The search terms used were: age, aged, ageing, acute care, elder, elderly, geriatric, old, older, senior, 65 years, ambulance, prehospital, emergency, emergency department, emergent, ED, hospital, emergency

medical service, EMS, primary health care, PHC, general practitioner, physician, primary care physician, medical practitioner.

This chapter examines the trends and characteristics of elderly people who utilise both PHC and emergency care. In addition, this chapter explores the ramifications that an ageing population will have on the provision of health services within the Perth metropolitan area. In particular this chapter critically reviews the literature describing EMS, ED and PHC utilisation by elderly people aged 65 years and older, and discusses the differences between the subgroups that constitute this segment of the population. Particular attention is given to reviewing all available Australian studies and a selection of key international studies.

3.1 Primary Health Care and Elderly Patients

General practitioners are the first point of contact at which patients are treated or referred to medical specialists, allied health services or if necessary emergency medical services or outpatient services.[29] This health care service is an integral component within the delivery of health care as it enables health care needs of patients to be screened thereby allowing the appropriate use of emergent and non-emergent health care services.

Recent statistics from the US Census Bureau reported that elderly patients made 229 494 000 visits to physicians offices within one year. These visits accounted for 25.5% of all visits to physicians, with 645.3 visits per 100 persons per year made by elderly patients.[113] Further breakdown highlighted that those aged 75 years or more attended physicians' offices at an even higher rate of 718.6 visits per 100 persons per year.[113] It should be noted that in the USA "physicians" referred to both specialist medical/surgical consultants as well as those seen by a general practitioner. Unfortunately, age related data specifically for those only attending GP services was not presented.

General practitioner attendances by elderly people in Australia reported slightly higher attendances than those reported in the USA. Specifically, in 2007 a random sample of 953 GPs across Australia was accessed and asked to complete details on 100 consecutive patients. Results showed that of the 95 898 visits made, 27.3% (n=25 933) were made by elderly people. [117] The same authors then reviewed 10 years of general practice activity data and reported the frequency of GP visits by elderly people rose considerably from 25% in 1998 to 27.3% in 2008. [117]

3.2 Global Ambulance Service Utilisation

Worldwide ambulance utilisation in general has increased steadily over the last two decades.[1, 16, 110, 115, 118, 119] In 1990 it was estimated that just over 12% (11 million) of all emergency visits in America required ambulance assistance. By 2003, of the 113.9 million visits made to EDs, 16 million (14.2%) were transported by ambulance (either air or ground).[118] By 2006, the number of ambulance transports to EDs had increased to 18.4 million, accounting for 15.4% of all ED presentations.[120]

Higher ambulance utilisation rates, ranging between 15.6% (n=9 225) to 93% (n=108) have been reported in smaller single hospital studies undertaken in Canada, USA and Japan.[19, 39, 60] The majority of Australian ambulance utilisation studies that have been conducted tend to be cross-sectional studies performed at between one and three sites, with sample sizes ranging from 191 to 11 297 people.[31, 33, 70, 89] These Australian studies report much higher rates of ambulance utilisation, ranging from 20.2% (n=2067)[33] to 35.6% (n=67 770)[89] to 51.6% (n=5821)[31] to 65% (n=74).[70]

One reason for high use of prehospital care may be due to higher percentages of Australian patients being insured for ambulance transport. This rationale is supported by findings by Clark.,[33] who reported that 60% of Queensland's population in 1995 had ambulance insurance cover. It should also be noted that many of the above

mentioned studies conducted on EMS utilisation do not specifically focus on elderly people but give a generic overview of EMS utilisation.

3.2.1 Ambulance Service Utilisation by Elderly People

Prevalence estimates of ambulance use have consistently reported higher utilisation by elderly people. A 1995 study of over 2 million ED episodes found that elderly people accounted for 39% of patients arriving by ambulance and when compared to non elderly patients were 4.75 more likely to use an ambulance service to attend hospital.[(1)] A more recent US study from 2006 reported that of the 17.3 million elderly people who attended the ED, 36% (n=6.2 million) were transported by ambulance.[(120)]

To assess changes in the emergency workload of the London Ambulance Service, Peacock et al., (2005) captured data for the same one week period in 1989, 1996 and 1999 from all age groups to provide a snapshot of ambulance utilisation trends.[(119)] Results showed that emergency ambulance responses for one week in 1989 were 6 624, rising to 10 921 in 1996 and by 1999 had increased to 13 178 calls. When reviewing data specifically for patients aged 65 to 74 years, ambulance utilisation in 1989 was calculated at 128.8 calls per 100 000 population increasing to 263.7 calls per 100 000 population by 1999. [(119)] Higher incidence rates were observed for patients aged 75 years or more with 308.7 calls per 100 000 recorded in 1989 climbing to 627.1 calls per 100 000 population by 1999.[(119)]

Results from a smaller US study (n=4 688) using 1990 data of ambulance transports to EDs by patients aged 60 years and older, showed much higher rates of 105 transports per 1000 persons. In particular, transport rates were shown to increase significantly with age (p=<0.001) with those aged 85 years and over utilising ambulance transportation at an even greater rate than people aged 60-65 years (291/1000 vs 51/1000 respectively).[(11)]

There is a paucity of Australian research that focuses on elderly people's utilisation of ambulance services. Of the studies that were available, all utilised data that were between 9-18 years old (1992-1999) with one study also including data for elderly people aged 60 years plus.[31, 33, 70, 89] Results from these studies showed that elderly people were disproportionately high users of the Australian ambulance service, with utilisation rates ranging from 20.2% - 65.0%.[31, 33, 70, 89]

3.2.2 Characteristics of Elderly People who Use the Ambulance Service

As previously mentioned, aging is generally accompanied by deterioration in health status with elderly people more likely to experience chronic conditions such as cardiovascular problems, diabetes, Parkinson's disease, hearing and visual loss, COPD, depression, cancer, asthma and osteoarthritis.[107-109, 121, 122] Elderly people are often transported to hospital with exacerbation of these chronic conditions or after sustaining trauma or injuries, which are also leading causes of morbidity and mortality in this age group. [39, 42, 56, 61, 107, 123, 124]

Several studies have identified that use of an ambulance to attend ED increases exponentially with age.[11, 12, 15, 19, 31, 33, 39] Even after adjusting for gender, triage category, diagnosis, marital status and ethnicity, Clark et al., identified age as a predictor for ambulance usage, with patients older than 65 years three to four times more likely to use EMS compared to younger patients.[33] A few studies have also reported that elderly people 75 yrs or older use ambulance transport at a much greater rate than those aged between 65-74 years.[33, 39, 115, 119] Additionally, elderly people who utilised the EMS were observed to be in more urgent need of clinical treatment than younger patients, as observed by higher acuity scores, [17, 45, 60] admission to hospital [7, 13, 15, 23, 52, 85] and longer lengths of stay. [60, 84]

The impact of gender on ambulance utilisation appears to be contentious with some evidence to support a correlation[17, 19, 89, 119] while other studies have found no

correlation.[11, 12] For example, results from the London Ambulance Service study by Peacock et al., highlighted that the ambulance utilisation rate ratio over three years, was considerably higher for elderly males aged 65-74 years (rate ratio 2.13) and 75 years or older (rate ratio 2.08) than for elderly females in the same age groups (2.01; 1.69 respectively).[119] However, Marinovich et al., in a Canadian study reported the reverse, with a higher proportion of females (59%) compared to males (55%) utilising ambulance transport.[19] Results from two other international population based studies reported no significant difference between males and females who used ambulance transport.[11, 12]

Gender differences were observed in an Australian population based study with preliminary data revealing that females were higher users of ambulance services. However, once data were stratified for age and gender, males had higher ambulance utilisation rates than females across all elderly age groups for both emergent and non-emergent transport.[89] Occasions of emergent ambulance service rates by males in the 65-74 year age group were much higher (117.7 per 1000 people) than for females (82.0 per 1000 people) in the same age group. This trend in utilisation by males peaked at 647.0 per 1000 people for those aged 90 years or more while ambulance utilisation by females in the same age group was much less at 483.6 per 1000 people.[89] In this same study, rates for non-emergent transportation of males in the 65-74 year age group were also higher at 161.2 per 1000 people compared to females (126.6 per 1000 people) in the same age group. This increased utilisation by males peaked at 1248.0 per 1000 people for those aged 90 years or more while the ambulance utilisation rate by females in the same age group was much less at 986.8 per 1000 people.[89]

Presenting medical condition, age and gender are all relevant factors that warrant further investigation within the Australian context if ambulance utilisation by the elderly population is to be accurately analysed and fully understood. Greater understanding will assist not only the future planning of the ambulance service but will also identify modifiable factors that can be used to improve the efficiency of the EMS.

3.3 Global Emergency Department Utilisation

Many of the studies focussing on ED usage have tended to be conducted in the USA. [1, 2, 7, 11, 13, 16, 17, 52, 108, 118, 125, 126] For example, a retrospective review of billing data from 88 emergency departments throughout America showed that visits to the ED increased from 92 million in 1990 to 100 million by 1995.[1] A more recent American study which includes data from all age groups was published in 2008 by the National Hospital Ambulatory Medical Care Survey (NHAMCS). Results from this national sample of 486 hospitals showed that between 1996-2006, ED visits increased by 32% from 90.3 million to 119.2 million.[16, 120] This equates to an average increase of 2.9 million visits per year in a period where hospital ED services were reported to have declined by 5%.[120] It seems incongruous that while demand for ED access increases availability is shown to decrease.

Additionally, during this time period, ED utilisation in the USA increased from 36 to 38.2 visits per 100 persons. This increase in ED utilisation rates may in part be explained by the growing issue of EDs in the USA being used as the primary source of health care because people either lack health insurance or are not sufficiently insured to be able to afford access to primary health care services.[127] This disparity in affordable primary health care in the USA highlights that American population statistics, while providing solid evidence about ambulance and ED utilisation, need to be viewed within context. Specifically, as previously mentioned the Australian care system is vastly different to that employed in the USA. For example, one Australian study into the demand and utilisation of metropolitan public hospital EDs reported that between 2001-2002 and 2004-2005, ED presentations to public adult and children's hospitals in the Perth metropolitan area increased on average by 14 000 presentations per year.[90] This was an increase of 16%, during a time when the metropolitan population increased by only 5%.[90] Further analysis of metropolitan EDs use in WA showed that 83% of presentations to ED were classified as a spontaneous episode, with this figure remaining constant for over two years.[90]

3.3.1 ED Utilisation by Elderly People

The use of the ED specifically by elderly patients has also been documented in a variety of western nations. [1, 2, 7, 11, 13-15, 17, 31, 32, 36, 45, 52, 66, 70, 84, 128] The US National Health Care Survey, undertaken by the Centre For Disease Control (CDC), is a compilation of six national studies, which provide the majority of information on national trends in ambulatory medical care, surgical care, hospital ambulatory medical care and discharge, home and hospice care and nursing home care.[126] Findings revealed that between 1992–2000 there was a 21% increase in ED utilisation by elderly people, with a rate of between 40.9 - 49.6 per 100 population observed.[126] Figures published in 2008 revealed that population estimates had decreased slightly with elderly patients making 48.2 visits per 100 population (SE 2.2) compared to other non-institutionalised civilians. [118, 120] Results from this study also revealed that elderly people made 17.3 million visits (14.5%) to EDs in 2006.[120]

While many of the larger population based studies report population figures using both crude and age adjusted rates, the same cannot be said for the smaller studies which tend to report findings using only descriptive statistics. However, until more population based studies are undertaken in the area of ED utilisation by the elderly, results expressed in either format still provide valuable evidence on this issue.

Even higher ED presentations by elderly people were reported in a retrospective New Zealand study and in a prospective Taiwanese study, where findings revealed that 21% (n=13 655) and 24% (n=6 759) respectively, of ED patients were aged over 65 years. [45, 66] In Australia the prevalence of ED use by elderly patients ranged between 7.5% and 26%, [31, 35, 47, 76] while one in four elderly people in WA attended a public hospital ED in Perth during 2002-2003.[111] An even higher ED prevalence was cited in a WA health and wellbeing survey undertaken in 2007, which revealed a hospital attendance prevalence of 32.4% (CI 29.3%-35.7%) for people aged 65 years and over.[129]

Comparative analyses of patients utilising the ED often divide this population into those equal to or older than 65 years of age or those patients younger than 65 years [1, 30, 123] However, this grouping of the elderly is much too wide and more meaningful data are obtained if results are stratified. For example, elderly people in the 65-74 year age group were reported to have made on average 35.3 visits per 100 persons while much higher utilisation rates were observed for those 75 years or older (63.5 visits per 100 persons).[127]

3.3.2 Clinical Urgency and Diagnosis of Elderly People Utilising the ED

Older people often present to the ED with acute medical problems that are further compounded by complex co-morbidities, cognitive and functional decline and social issues.[30, 85] Studies have also reported that elderly patients are often triaged at a higher urgency level than patients younger than 65 years, have longer ED stays and subsequently have a higher rate of hospital admission. [30, 84, 85]

Specifically, a cross sectional Australian study by Chu et al., (2001),[30] reported that elderly patients presenting to ED comprised 20.4% (n=6070; CI 19.9%-20.8%) of total ED attendances during a six month period. Results revealed that older patients compared with those younger than 65 years, when classified by the Australasian Triage Scale (ATS) were significantly more likely to be triaged at a higher clinical urgency level (p value= 0.001) and had an increased likelihood of being admitted to hospital when categorised with an ATS score of 1-4, than those patients younger than 65 years.[30]

While in the above-mentioned study, clinical urgency was assessed using a standardised tool this cannot be said for all emergency medical studies, with many different classification systems used. For example, in a small prospective study by Iwata et al [93] results showed that 15.6% (n=43) of patients aged 90 years or more who presented at emergency departments during the study period were classified as emergency cases.

Emergency cases were defined as 'death or permanent morbidity will result if there is no treatment within an hour.' Urgent cases were defined as 'threats exist to life or bodily functions if care is delayed more than several hours.[93] This disparity of definitions needs to be considered to ensure that study results are accurately compared and not erroneously grouped together for the benefit of presenting a stronger argument.

Further characteristics of elderly people who attend the ED were taken from the 2006 NHAMCS report, which revealed that of the 15.7 million visits to ED made by elderly people, the five main primary diagnoses for this group were as follows:

- Chest pain accounted for 2.6 visits per 100 persons per year (SE 0.3)
- Heart disease (excluding ischaemic heart disease) accounted for 2.3 visits per 100 persons per year (SE 0.2)
- Abdominal pain accounted for 1.6 visits per 100 persons per year (SE 0.2)
- Contusions accounted for 1.6 visits per 100 persons per year (SE 0.2); and
- Pneumonia accounted for 1.5 visits per 100 persons per year (SE 0.2).[16]

A systematic review of older people's ED patterns of use and outcomes was undertaken by Aminzedeh and Dalziel (2002),[84] which concurred in many aspects with the diagnostic findings from the above mentioned study. Specifically, Aminzedeh and Dalziel, [84] reported that the most common medical and surgical diagnoses for older patients attending ED were: heart disease, cardiac dysrhythmias, cerebrovascular accidents, pneumonia, abdominal disorders and traumatic injuries predominantly as a result of a fall.[36, 84]

Similar results have been reported in Australia by Lamb et al., with 82% (n=9 263) of elderly patients presenting to ED with medical problems such as cardiac and respiratory problems.[31] Furthermore, 6.5% (n=704) of elderly patients were admitted to either the coronary care unit or the intensive care unit compared with a much lower proportion of younger patients admitted into these areas (1.1%; n=121; 0.6%; n=65 respectively).[31] It should be noted that the younger sample also included children, as the authors

deemed it would artificially inflate the admission figures to exclude them.[31] Despite this inclusion, results still clearly highlight that elderly people attending the ED are more likely to require hospital admission to critical care areas. Street et al., also reported that cardiac disease, respiratory disease and neurological conditions were the main diagnoses for elderly patients presenting to three EDs in Australia.[35]

3.3.3 Diagnostic Testing within the ED

Several studies have reported that elderly patients tend to have a higher rate of diagnostic tests performed compared with younger patients presenting with the same complaint.[1, 7, 13, 85] For instance, patients aged 65 years or more who presented with shortness of breath, were frequently ordered more chest X-rays, electrocardiograms, blood gases, respiratory therapy, intravenous access and parenteral therapy than younger patients. [1, 7, 13, 85]

Higher rates of diagnostic tests predominantly occur due to older patients presenting to ED with acute health problems that are further compounded by comorbidities, disabilities and frailties.[7, 13, 35, 85] Additionally, the severity of the presenting problem often resulted in a higher proportion of elderly people being admitted into hospital for acute treatment.[1, 7]

The magnitude of higher resource utilisation by the elderly population is also highlighted by Strange and Chen[1] who conducted a retrospective analysis of 88 EDs in 21 states across America, utilising the Emergency Physicians Billing Service Database. Results obtained in 1990 were compared with those captured in 1995. Extrapolating from the database to the national population, the authors estimated that 15.6 million elderly people made visits to EDs throughout the USA. Diagnostic workup and medical care given to individual patients were classified for billing purposes into one of the following categories; brief, limited, intermediate, extended or comprehensive services.[1]

Results clearly showed that elderly patients were five times more likely than younger patients to require comprehensive levels of service (OR 5.06; CI 5.02-5.10).[1]

3.3.4 Elderly People who Presented to ED but were Not Admitted to Hospital

Studies have revealed that between 18% and 47% of elderly people are treated at ED's are sent home.[21, 22, 130] An epidemiological study undertaken using secondary data analysis of the ED component of the National Hospital Ambulatory Medical Care Survey, revealed that 38% (n=62.2 million) of ED visits were made by patients aged 65 years or more. [21] In addition, 47% (29.2 million) of elderly patients were treated and discharged home.[21] Similar findings are reported in a 2007 Australian report on national public hospital utilisation,[130] with 46% of 65-74 year olds, 36% of 75-84 year olds and 32% of those older than 85 years attending public emergency departments not being admitted.

Given the economic and resource implications of emergency health care utilisation, these findings are of concern and warrant further exploration as to why such a large proportion of elderly patients who do not require hospital admission, present to ED. Yet only a few descriptive studies undertaken overseas have evaluated the issue of ED utilisation for non-urgent conditions. [131-134] Specifically, a cross sectional study design was used on a convenience sample of patients of all ages presenting to a University hospital in the USA. The study was undertaken to determine if non-urgent ED patients had primary care providers (PCP), or if the patients knew of other alternatives in the treatment of their medical complaint. [131] Findings revealed that only 56% (n=157) of participants had a PCP and a further 66% (n= 183) stated that the ED was the only place they knew to treat their presenting condition. [131] Other studies found similar reasons for attending ED which included that patients believed the treatment in the ED was better, patients stated they didn't know where else to go or that other care was not available to them. [131-134] Only aggregate data from these studies were presented, with no differentiation made for age. [131-134] This lack of detailed evidence as to why the

older generation decide to attend an ED for conditions that appear to be non-urgent, requires further examination.

3.3.5 Gender Distribution by Elderly Patients Utilising the ED

As with ambulance utilisation, gender distribution of patients who utilise the ED is also controversial with evidence found to both corroborate and refute a relationship.[7, 20, 45, 60, 78, 81] A health study of nearly 40 000 Americans aged 55 years or more stated that there was no gender differences observed in the rate of ED attendances by elderly people over a 12 month period.[20] However, another study conducted at eight adult hospitals in Taipei did reveal that elderly males present more frequently to ED, with a gender ratio of 1.83 (males) to 1 (female).[45]

In contrast several studies have highlighted that a larger proportion of elderly females attend ED compared to males.[7, 60, 78, 81, 135] In particular, findings from these studies highlighted that between 56% and 77% of ED presentations were made by females aged 50 years or more. [7, 78, 81, 135] A few descriptive studies focussing on ED utilisation by the elderly did not address or report utilisation data based on gender.[126, 128, 136] Given that total life expectancy in many countries is higher for females [10, 137-139] it is therefore perplexing that data on health care utilisation does not automatically include subgroup analysis based on gender.

3.3.6 Repeat Visits to ED by Elderly Patients

A number of studies by McCusker et al., [46, 50, 54] have highlighted that elderly patients are more likely to return to the ED within six months of an initial visit. Specifically, results from these studies revealed that between 24% and 44% of elderly people who were treated in ED and discharged, ended up returning to ED. Between 19.3% to 34.9% of elderly patients returned to the ED within 30 days of the index presentation.[46, 50, 54, 140] McCusker et al.,[46] stated that early re-presentation by elderly patients was more

likely to be for the same medical problem the patient first presented with. Analysis revealed that patients with respiratory (OR 2.07; CI 0.94-4.57) and digestive problems (OR 2.74 CI 1.29-5.84) were more likely to return within 30 days compared to elderly patients presenting with an injury.[46] These results highlight that re-presentation by elderly patients is an issue that requires further investigation.

3.4 Higher Hospital Admissions of Elderly Patients

Separations or patient days in hospital have been used as a measure of the number of patients admitted to hospital for treatment.[8] International and national studies have demonstrated that elderly patients presenting to hospital are more likely to be admitted to hospital as they present with more complex and severe health problems.[1, 7, 18, 30, 31, 35, 45, 47, 52, 70, 84, 86] Results have also shown that standardised hospital admission rates of elderly patients vary greatly from country to country.[18, 45, 84, 126, 141, 142] Much lower hospital admission rates of elderly people have been observed in the USA (350 per 1000 persons),[126] compared to Australia (706 per 1000 persons).[141]

An Australian population based study of 6.4 million hospital separations reported even higher hospital separation rates for elderly patients of 876 per 1000 population compared to those less than 65 years (251 per 1000 population).[18] While elderly patients had higher rates of inpatient care, the ageing population, contrary to popular belief, had no impact on the proportion of hospital beds utilised.[18] Specifically, Gray et al., revealed in this study which spanned a 10 year period and included both public and private hospitals, that hospital bed utilisation by elderly patients had remained stable at 47%.[18] However, it should be noted that within the elderly group, differences were observed with a greater proportion of beds used by those aged 75 years or older compared to those aged 65-74 years.[18]

Similar bed occupancy days by elderly patients were cited in an Australian Federal Government report published in 2007 which stated that 35% (n=2.38 million) of

separations from Australian hospitals (both public and private) were by those aged 65 years or more who occupied 47% of all bed days.[130] This finding is interesting given that elderly Australians comprise only 13.2% of the Australian population, yet occupy nearly half of all hospital beds.[130] Gray et al., also reported that the most common principal diagnoses for hospital admission by elderly patients were: renal dialysis (n=350 513), cardiology (n=144 678), respiratory medicine (n=93 469), orthopaedics (n=78 388), gastroenterology (n=70 951), neurology (57 270), ophthalmology (n=56 581) and chemotherapy (n=51 504).[130]

A retrospective study of ED utilisation by elderly Australians revealed that while elderly patients accounted for 16.8% of ED visits, a much higher proportion of elderly patients (59.2%; n=6 691) were admitted to hospital compared to 19.7% (n=11 007) of patients younger than 65 years.[31] Specifically, elderly patients were 3.79 times (CI=3.64-3.79) more likely to be admitted than younger patients.[31] Similar results have been cited by studies both in Australia and the USA, with hospital admissions by elderly people 3-5 times more likely than for younger patients.[70, 76, 80, 143]

In Western Australia people aged 65 years or more, despite comprising only 11% of the State's population in 2004, accounted for 29% of hospital admissions with even higher utilisation of hospital beddays reported (43%).[111] The three main reasons for admission to hospital in WA were cardiovascular disease, diabetes and falls.[111] Findings revealed that 72% of hospital beddays in public hospitals were used by 22% of the population, with people aged 75 years or more accounting for one third of admissions.[111]

Proximity to death and age have also been shown to be significant correlates of health need and therefore hospital admission.[144, 145] In a population based study from Western Australia, linked data were used to calculate the proportion of elderly people who were admitted to hospital in the year prior to their death.[145] Results showed that over a 10 year period the average number of hospital admissions per person in the last

year of life increased consistently.[145] Specifically, patients aged between 65 and 74 years in their last year of life had an average of 2.9 admissions in 1985 rising to 4.3 admissions in 1994. Those aged 85 years or more also showed an average increase in admissions in the last year of life. The increase was not as dramatic, with 1.9 average number of admissions in 1985 compared to 2.5 in 1994.[145]

Hospital Index (HI) is a scaled product derived to indicate the demands placed on a hospital system. HI is calculated by multiplying the proportion of people utilising a hospital service, the average number of episodes and the average cost per episode for each age group.[97] Results showed that males between 50-90 years have a HI of greater than 0.5 which increases dramatically to peak at a HI score of nearly 4 at 90 years. This indicates that males have greater morbidity than females of the same age, who though following the same trend did so at a consistently lower rate. Unfortunately, these data were displayed graphically and lacked specific statistical detail.[97] The average number of hospital visits per year for Australians aged 65 years and over ranged from 1 to 2.1, with a slightly higher average observed for males compared to females in the same age group.[97]

3.4.1 Length of Hospital Stay by Elderly Patients

Once admitted to hospital, elderly patients more so than other age groups tend to have longer hospital stays (LOS).[84, 142, 146, 147] For example, McMullan et al., in an Irish study reported that elderly medical patients aged 75 years or more were 3.64 times more likely (CI 2.38 to 5.61) to stay in hospital for 8 days or more than medical patients younger than 65 years.[142]

Using the International Classification of Diseases version 10, greater median LOS for UK elderly nursing home patients admitted to hospital with diseases of the respiratory system (10 days; SD 15.1 days), digestive tract (9 days; SD 12.4 days) and for a fractured neck of femur (15 days; SD 28.6 days) were observed compared to those

reported by hospitalised elderly patients from the community.[37] Specifically, elderly patients who were admitted from the community reported lower LOS for respiratory (median days = 9; SD 14.1 days) and digestive complaints (median days = 7; SD 17.5 days) but higher LOS was observed for fractured neck of femur (median days = 20; SD 26.7 days).[37]

An Australian hospital statistics report highlighted that in 2006-2007, that despite constituting only 23.9% of the population elderly patients utilised 15.1 million days inpatient bed days.[148] In a smaller study of hospital admissions for those aged 90-99 years, results showed that mean length of stay differed between medical and surgical admissions.[147] Medical patients had a longer mean hospital LOS of 8.9 days (SD 9.6 days) compared to surgical admissions (5.6 days; SD 6.6 days). [147] Contrary to these findings, Gray et al.,[18] revealed that overall mean LOS decreased from 8.4 days to 7.5 days in the 65-74 year group, while LOS for those aged 75 years or more showed an even greater reduction (12.2 days to 10.1 days) compared to those patients younger than 64 years whose LOS increased from 4.9 to 5.1 days.[18] Unfortunately results from this study were not analysed by diagnostic condition and so comparisons to other studies is limited. While inpatient medical treatment is an important part of a patient's health care trajectory, increased lengths of stay coupled with rising demand impact greatly on the health care system by reducing throughput and ultimately limiting admissions from ED. More research is therefore needed to gain a better understanding of how LOS is affected by age and diagnostic groupings.

3.4.2 Table of International Studies

Table 1 highlights both the commonalities and disparities of selected key studies which focussed on the use of the EMS by elderly people. Several different research methodologies were used in the studies highlighted, which range from a simple prospective descriptive survey to population based studies using national electronic databases. A major inconsistency between studies was the difference in the cut off age

used to define elderly people, which was found to range anywhere between 60 to 75 years.[75-77, 87] Additionally, the absolute dearth of published research on ambulance and ED utilisation by elderly people is evidenced by research studies which span two decades, with research studies citing references that date back even more than 20 years. Data collection periods also differed widely with collection periods as short as 22 days or as long as several years. Some studies only reported aggregate population data, making it impossible to identify results focussing specifically on this elderly cohort of interest. Despite these differences, the studies presented provide evidence of the magnitude of the problem facing the delivery of health care to an ageing population.

Location: Sample Size, Reference	Year *	Topic	Duration of Data Collection	Data Source	Design	Sites Included	Elderly Age Defined as:	% Elderly using an Ambulance to get to ED	Statistics Used	% 65 yrs+ Admitted to Hospital
USA: n= 1 080[13]	1987	Comparison of ED use by those 18 to 64 yrs and those 65 years and older.	4 months Audit, patient audit every 2nd day	Medical records	Retrospective chart audit	1 hospital	65 yrs +	54.6% vs 10% for non-elderly	Non parametric tests, t tests Odds Ratios	51.5% vs 14.4% for non elderly
USA: n=1 620[7]	1987	Comparison of ED use by those 0 to 64 yrs and those 65 years+.	22 days	Medical records	Retrospective chart audit	1 hospital	65 yrs +	35% vs 10% for non-elderly	Chi square, t tests	46% vs 10% for non elderly
Israel: n= 2 936[23]	1990	Comparing ED use by elders categorised by age group (45-64yrs; 65-74 yrs; 75ys+).	12 x 1wk periods over 12 months	ED Admissions Registry	Prospective cross sectional	1 hospital	65 yrs +	n.s	Rates per 1000 population	n.s
Canada n=2 368[32]	1991	Elderly use of hospital based ED services.	4 x 1 wk periods	Medical Records	Retrospective	2 hospitals	n.s	n.s	Logistic regression	n.s
Australia n=210[76]	1992	Elderly patients in the ED.	1 four week period	Medical records	Prospective	1 hospital	75 yrs+	n.s	Logistic regression	55.2%
USA: n=4 688[11]	1995	EMS transport by the elderly.	1 year	Forsyth County EMS database	Observational population based	2 hospitals	60 yrs +	100%	ASR per 1000 population Chi Square Mantel Haenszel	n.s.
USA: n=15.6 million[1]	1998	Comparing ED use by elders in 1995 with data from 1990.	2 yrs	ED Physicians Billing Database	Retrospective	88 hospitals	65 yrs +	39%	Ratio estimation Odds Ratios	43%

Table 1 Selected Studies on Ambulance and ED Utilisation by the Elderly Population

* Year of publication n.s =Not Stated ** Australasian Triage Scale (ATS) n/a =Not Applicable ASR: Age Standardised Rates

Location: Sample Size, Reference	Year *	Topic	Duration of Data Collection	Data Source	Design	Sites Included	Elderly Age Categorised as:	% Elderly using an Ambulance to get to ED	Statistics Used	% 65 yrs + Admitted to Hospital
USA: n=73 874[17]	1998	Demand for prehospital emergency care in an aging population.	1990	Dallas EMS Division City Fire Dept	Retrospective	All Fire Dept sites in Dallas	65 yrs +	17.3%	Chi square, t tests ASR per 1000 population	n.s
Australia: n= 351 005 [89]	1999	Older people's use of ambulances: A population based study.	1 year	Ambulance Information Management Systems	Retrospective	The State of Qld Australia	65 yrs +	35.6%	ASR	n.s
Australia: n=10 229[33]	1999	Predictors of emergency prehospital care.	4 months	ED Admissions Registry	Prospective Cross sectional	1 hospital	65 yrs +	34.7%	Prevalence ratios (crude and adjusted)	n.s
Singapore: n=13 697[149]	2000	Ambulance patterns to an ED.	1 year	ED records	Retrospective	1 hospital	60 yrs +	n.s by age group	Categorical data	n.s by age group
Australia: n= 6 070[30]	2001	Older patients use of ED resources by acuity using the ATS**.	6 months	Hospital's Database	Prospective Cross sectional	1 hospital	65 yrs +	n.s	Descriptive statistics Chi Square	n.s by age group
Israel: n=73[132]	2005	Characteristics of self referrals to ED.	5 days	Hospital Survey	Prospective	1 Hospital	60 yrs+	n.s	Descriptive Statistics	n/a
USA: N=40 253[150]	2006	Ambulance transport and diversions among the US ED's.	1year	National Ambulatory Medical Care Survey	Retrospective	405 EDs	n.s	38.5%	Descriptive Statistics, ASR per 100 pop	n.s by age group

Table 1 Selected Studies on Ambulance and ED Utilisation by the Elderly Population

* Year of publication n.s =Not Stated ** Australasian Triage Scale (ATS) n/a =Not Applicable ASR: Age Standardised Rates

Location: Sample Size, Reference	Year *	Topic	Duration of Data Collection	Data Source	Design	Sites Included	Elderly Age Categorised as:	% Elderly using an Ambulance to get to ED	Statistics Used	% 65 yrs + Admitted to Hospital
France n=2 866[81]	2006	Health network to improve elderly pts flow in the ED.	1 year	ED data base	Retrospective	1 ED	75 yrs	n.s.	Descriptive statistics	42.8%
Japan: n=1 092[74]	2006	Epidemiology of elderly people defined by clinical and functional status.	10 years	Longitudinal Survey	Prospective	1 rural town	65 years+	n/a	Descriptive statistics	n/a
Japan: n=275[93]	2006	ED attendance by elderly people (90 years or more).	1 year	Longitudinal Survey	Prospective	1 ED	90 years+	56%	Descriptive statistics	65.1% of
USA: n=62.2 million[21]	2007	Epidemiology of EMS use by older people.	4 years	National Ambulatory Medical Care Survey	Retrospective	112 EDs	65 yrs +	38%	ASR per 1000 population	53%
USA/Canada: n=40 253[92]	2007	ED utilisation in the USA and Canada.	1 year	NAMCS (US),NACRS (Can)	Prospective cross sectional	406 EDs	65 yrs +	n.s	ASR per 1000 population	n.s by age group
USA: n=88 252[151]	2007	Factors associated with longer ED stays.	3 years	National Ambulatory Medical Care Survey	Prospective	408 EDs	65 yrs +	n.s	ASR per 1000 population	n.s by age group
Canada: n=140 379[91]	2007	ED presentations by older patients and return visits.	1 year	Provincial Databases	Retrospective	80 EDs	66 yrs +	n.s	Descriptive, Cox Regres	n.s by age group
Canada: n=1.6 million[152]	2008	Health care utilisation by the elderly.	1 year	Population based	Retrospective	5 national databases	65 yrs+	n.s	Descriptive statistics	33%

Table 1 Selected Studies on Ambulance and ED Utilisation by the Elderly Population

* Year of publication n.s =Not Stated ** Australasian Triage Scale (ATS) n/a =Not Applicable ASR: Age Standardised Rates

3.4.3 Existing Instruments

An extensive search of the literature was conducted to located existing instruments used to collect data on risk factors associated with ED utilisation by the elderly population. The following search engines and databases were used: BIOMEDICAL, CINAHL, COCHRANE DATABASE, EMBASE, MEDLINE, PROQUEST and PUBMED initially from January 2000 to June 2009. Due to the lack of research in this area the search was expanded to include earlier seminal research dating back to 1974. The search terms used were: age, aged, ageing, acute care, elder, elderly, geriatric, gerontology, old, older, senior, 65 years, emergency, emergency department, emergent, ED, hospital, emergency medical service, EMS, tools, surveys and questionnaires.

Only three survey instruments were located, with the majority of studies using unspecified data collection tools to capture data from patients' electronic or paper medical record information. [153] Several population based studies used data obtained from national surveys data such as the National Hospital Ambulatory Medical Care Survey, or Medicare Databases or Physician Billing Dataset.[1, 16, 21, 64, 93, 108] In such surveys data are extracted from patient's medical notes or electronic files, collated and sent to the governing survey body.

One Japanese study by Iwata et al.,[60] combined record linkage medical data with data from patient interviews. In this study, 199 ED patients aged 90 years or older were interviewed to ascertain data on number of medications, co-morbid conditions and ability to undertake activities of daily living. Patients perceptions on ED utilisation or the decision making process used prior to ED attendance were not elicited.

An older Canadian study which looked at the predictors of hospital use among elderly patients six months after an ED visit, reported using a 27 item self report questionnaire.[63] In this study McCusker et al.,[63] was able to validate a six item self report questionnaire to identify patients who would experience adverse health outcomes and hospital admissions.

One Israeli study described characteristics of self referral to ED by patients aged between 18-82 years with non-urgent conditions.[132] Rassin et al., [132] developed a 30 item instrument which included demographic information, clinical diagnosis, perception of treatment, geographical proximity to the ED, mental state, social support, physician referral and urgency of condition. The internal consistency of the tool was measured using Cronbach's alpha with a score of 0.77 achieved. Requests to obtain the instrument were not successful and therefore it could not be used for this study of elderly patients utilising the ED. Review of the abovementioned studies also clearly highlighted the heterogeneity of the survey tools used and as such it was deemed necessary to develop a tool to specifically address the aims of this study.

3.5 Conclusion

This review of the literature provides substantial evidence to support the argument that ambulance and ED utilisation by elderly people continues to rise at a disproportionate rate to that of the general population. As ageing is usually accompanied by deterioration in health status, future health care planners need to be cognisant of the impact that an ageing population will have on health care access and delivery.

Studies show the persistent over-utilisation of EMS by elderly people is poorly understood. The significance of this study is that it examines four important aspects of health care utilisation: 1. ambulance utilisation, 2. ED utilisation and 3. hospital admissions by a minority of the Australian population and lastly, the risk factors associated with EMS and ED utilisation As mentioned there is a paucity of literature and instruments within the Australian context, which identifies and captures the trends and characteristics of the elderly utilising these services. To date much of the research into emergency department utilisation has been conducted in the United States of America, a health care system which unlike Australia, does not provide for universal free access to health care. As the consumption of emergency medical services is a matter of importance for public health policy, greater understanding of prehospital and ED activity specifically with regard to the elderly, would provide valuable data from a clinical and organisational perspective.

Chapter 4
METHODS

4.0 Introduction

This two-staged analytical epidemiological study aimed to understand why elderly people chose to attend the ED. This chapter reports on data from Stage 1, an analytical epidemiological study that sought to describe factors contributing to the utilisation of metropolitan ambulance and public hospital ED services by elderly people. While Stage 2, describes results from a randomly selected group of elderly people who attended the ED of a tertiary hospital in Perth, Western Australia.

This chapter also provides information on overall emergency department structure and services of the seven public metropolitan hospitals involved in Stage 1 of this study. The databases used for the derivation of TEPEDD are described in detail, as are the probabilistic matching processes used to enable record linkage and the subsequent data analysis used. While the researcher undertook the checking and cleaning of the data, she did not link the data, as this was performed by the Data Linkage Unit and the Emergency Medicine Department at the University of Western Australia.

While in Stage 2, the utilisation of ED services by a randomly selected group of elderly people who attended a tertiary hospital in the Perth, Western Australia was undertaken. This chapter describes how The Emergency Department Elderly Patient Interview (TEDEPI) instrument, which was specifically developed for this study was pilot tested, administered and the statistical analysis that was undertaken are also reported in this chapter. To facilitate comprehension of the different methodologies used in each stage, the information is presented separately.

4.1 Aims and Objectives: Stage 1

The aim of Stage 1 was to describe the epidemiology of ED utilisation by a cohort of elderly patients who were transported via ambulance to one of seven public

metropolitan hospitals within Perth Western Australia during 1990-2002. The specific objectives of Stage 1 were to:

- Describe the epidemiology of the elderly cohort of ambulance patients who attended the emergency departments at public metropolitan hospitals between 1990-2002;
- Determine annual standardised incidence and prevalence estimates for ambulance and ED attendance at metropolitan public hospitals for the period 1990-2002.

4.1.1 Research Design: Stage 1

Stage 1 utilised a retrospective cohort study design, using probabilistic matching to construct a longitudinal health data set for the period 1990-2002. Cohort designs are also referred to as follow up studies, where a sample of the population, based on the presence or absence of a particular condition/disease is tracked over time.[158] Whilst cohort studies can be time consuming and costly, a more economical alternative is a retrospective cohort study where the events of interest have already occurred in the sample.[154] Retrospective cohorts allow for quicker access to the data but a major draw back of this design is the possibility of incomplete or non-comparable data. However, through the use of probabilistic matching this issue has been minimised.[154]

4.1.2 Sample and Setting: Stage 1

The population cohort consisted of patients aged 65 years and over, who during 1990-2002 presented via ambulance to one of seven public hospitals (four tertiary public hospitals and three secondary public hospitals). These public adult teaching hospitals serviced the Perth metropolitan area, which at the time comprised over 1.4 million people.[155]

Perth has three tertiary public teaching hospitals and four non tertiary public teaching hospitals which offer emergency treatment services.[156] Two of the tertiary hospitals are adult only and the third offers limited paediatric facilities. These three main public tertiary hospitals have a bed capacity in excess of 1800.[156] The four secondary

hospitals offer a mixture of adult and limited paediatric treatment.[156] All complex paediatric cases are transferred to a specialist children's hospital located near the centre of Perth. These secondary hospitals with ED facilities, have inpatient capabilities of between 90 and 365 beds.[156]

4.1.3 Probabilistic Matching

Probabilistic matching is a method used in record linkage studies. The whole "objective of probabilistic linkage is to identify and link records from one data set to corresponding records in a second dataset in a statistically justifiable manner".[157] Specifically, certain variables are chosen as the "links" between the datasets of interest and these links are then used to construct a longitudinal dataset. Key fields are chosen, such as name, address and age maybe used as a basis to match records from different databases, with a probability calculated on the likelihood of a match.[158] For each key field, two types of probability are assigned. Matched probability (m) refers to the probability that the key field matches the record pair, while the unmatched probability (u) refers to the probability of a key field matching when it is not a genuine match.[158]

4.1.4 The Hospital Morbidity Data System

The Hospital Morbidity Data System (HMDS) is an information system used for patients admitted into all WA hospitals and is maintained by the Health Department of WA (HDWA). Data are collected on all episodes of hospitalisation within the State from both acute care public and private hospitals (excluding mental health hospital data).[24] HMDS categorises data into four main groups:

1. Identifiers
2. Service and administrative information
3. Demographics
4. Clinical information.[159]

During the data collection period of 1990-2002, data on the diagnosis, procedure and external cause were classified using the International statistical Classification of Diseases and related health problems, version 9 and 10 of the Australian modification (ICD-9-WHO, ICD-10-AM). While there are no Australian national standards for

auditing ICD data, the quality of the coding is assessed by selecting and independently coding the data which is then compared to the originally assigned codes.[26] Coding audits in WA were undertaken by the HDWA, whereby a random selection of admitted patient cases from both teaching and non teaching hospitals were recoded and results compared. WA audit results revealed the quality of coded ICD data were rated as 'good' or 'very good'.[26]

4.1.5 The Western Australian Health Services Linked Database

Six core population based health data information systems were brought together in 1995 to establish the Western Australian Health Services Research Linked Database.[160]. This database consists of, inpatient hospital morbidity data, mental health registrations, birth records, mortality records, cancer registrations, and midwives' notifications for the population of Western Australia. In addition to the above-mentioned databases, the Electoral Roll Commission Database is also utilised. With the exception of the Cancer Registry, which was linked from 1981, the initial construction phase from this linked database commenced with the 1980- 1994 period. With continual updates, this database has since expanded to include health data up until 2009.[160]

The Western Australian Health Services Research Linked Database[160] is a unique to Australia. At the time of data collection the database consisted of 20 862 011 records and comprises 3,949 276 chains.[160] Using Automatch software, key fields are passed over six times to identify linkage. Incongruent data is highlighted and checked manually. The Western Australian Health Services Research Linked Database utilises data on an individual that are chronologically linked regardless of where the dataset originated.[160] Files are linked on seven principal matching fields consisting of unit medical record number, surname, first name, initial, date of birth, gender and address.[160] The Western Australian Health Services Research Linked Database as at 2009 consists of 17 240 986 morbidity records, 730 921 midwives records, 239 800 cancer records, 377 573 mental health records, 386 351 death records and 1 886 380 electoral records.[160]

4.1.6 The Western Australian Prehospital Care Linked Dataset

Emergency requests for prehospital assistance go through to a centralised Ambulance Communications Centre, where trained personal gather information and dispatch ambulances accordingly, using the computer aided dispatch system (CAD). The CAD system automatically captures: the time the call was received; the time the ambulance was dispatched to the scene; the time the ambulance arrived and departed the scene; and the time the ambulance arrived at the hospital. This information along with patient background details, treatment and management information is collected on the Patient Care Record (PCR) form by ambulance officers. The PCR forms are collated for data entry onto the St John Ambulance Patient Care Record Data which is linked with the Western Australian Health Services Research Linked Database.[161]

4.1.7 Derivation and Validation of The Elderly Prehospital and Emergency Department Dataset (TEPEDD)

Data obtained from the Western Australian Prehospital Care Linked Dataset to form TEPEDD, consisted of 13 years of ambulance transfers of elderly patients to all Perth metropolitan public hospitals plus full subsequent hospital admission and outcome data. Individual linked data sets written in text files were obtained from the Data Linkage Unit. This data was then merged by the Emergency Medicine Department at the University of Western Australia. Data for each individual from the different datasets was encrypted with the same unique code referred to as a root number (rtlpno). The rtlpno is the linkage key which allowed for the chronological linkage of a person's health dataset. Using this rtlpno data from the different datasets (ambulance, morbidity and mortality) were then able to be merged into an SPSS data set.

In the initial dataset, a total of 598 880 episodes were identified that matched the seven principal fields mentioned previously. Data were then carefully checked by the researcher based on the inclusion criteria of:

- patients being aged 65 years and over
- presented to ED via ambulance

- attended one of seven public hospitals located in the Perth metropolitan area (four tertiary public hospitals and three secondary public hospitals) between 1990 and 2002.

The result of this was TEPEDD (see Figure 1) which consisted of all ambulance transfers of elderly patients who were transported to any Perth metropolitan public hospital ED between January 1990 and December 2002. In addition to the ambulance data, this dataset also included morbidity data for those patients admitted to hospital as well as outcome data for all patients in the dataset. Specifically, TEPEDD consisted of patient's information records such as: demographic details, arrival time and date, source of referral, triage category, problem codes, treatment outcomes and discharge destination, which was then linked to morbidity and mortality data. The initial TEPEDD consisted of 598 880 episodes and contained 457 variables. Data were cleaned and checked extensively to ensure that only individuals meeting the inclusion criteria were included in TEPEDD. Results from the linked data revealed that 284 304 episodes (47%) did not in fact match the inclusion criteria or contained 100% missing data and were therefore excluded. Duplicate data was also tagged and checked against rtlpno, date and time of episode with 5 141 (0.009%) duplicate episodes identified. A total of 289 445 (48.3%) episodes were excluded resulting in the derivation of TEPEDD, which in the final count included 309 435 episodes and consisted of 251 variables (see Figure 1).

Episode dates from the ambulance data were checked against date data from the HMDS and revealed that 99.9% of records matched. Every variable in the dataset was defined and labelled. String (alphanumeric) variables were recoded into numeric variables to enable inferential statistics to be performed. Data cleaning required that frequencies be run on each variable with response codes checked and where needed corrected. Furthermore variables were also reviewed and where appropriate response codes were collapsed based on clinical or statistical requirements. Collapsing of response codes was warranted due to the huge variation in responses, for example the 'cause of death' variable contained 33 pages of codes making analysis cumbersome and prevented inferential statistics to be undertaken as statistical assumptions were violated.

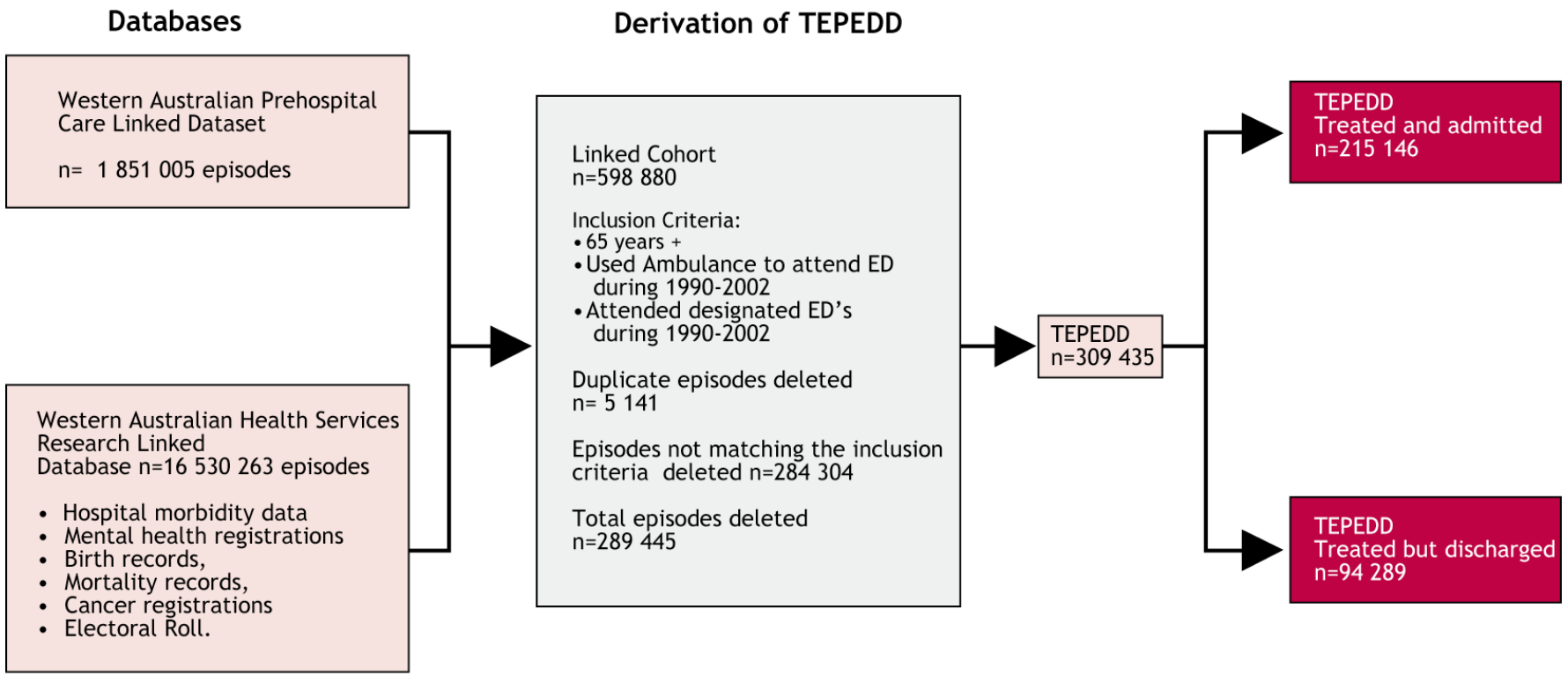


Figure 1 Derivation of The Elderly Prehospital and Emergency Department Dataset (TEPEDD) 1990-2002

4.1.8 Ethical Approval: Stage 1

Under the auspices of a larger study undertaken by the Department of Emergency Medicine, scientific and ethical approval was granted from the University of Western Australia and the HDWA. Confidentiality and anonymity of data was addressed through de-identification of data supplied by the Data Linkage Unit HDWA. Additionally, all data are stored in a secure location within a locked office for a period of 5 years after the completion of the study. Electronic records were also secured on a password protected computer stored within a secure environment, accessed only by the candidate or supervisors. After such time printed material will then be destroyed and computer disks erased.

4.1.9 Stage 1 Data Analysis

This stage of the study undertook secondary data analysis on a cohort of elderly patients during the years 1990-2002. Univariate statistics, incidence, prevalence and age standardisation estimates were compared to Australian Bureau of statistics data. Data were analysed using SPSS for Windows version 15. Statistical significance levels were set at α=0.05 and 95% confidence intervals were reported were appropriate.

Age standardisation rates used in this study were calculated based on the direct methodology, which compared age specific rates with a standard population. The standard population used in this study was taken from the Perth metropolitan area and incorporate population statistics from 1990 to 2002.[41]

Aims and Objectives: Stage 2

The primary aim of this study for Stage 2 was to:

- Identify risk factors associated with ED presentation in a group of randomly selected elderly patients attending a major tertiary hospital ED in Perth Western Australia.

The specific objectives of Stage 2 of this study were to:

- Describe characteristics and outcomes of older adults who presented to the ED of a major teaching hospital during the period: November 2007 – March 2008.
- Estimate the proportion of ED patients who were 65 years or more.
- Identify the reasons why older patients sought care at the ED.
- Describe primary care access utilisation by this group of patients.
- Compare elderly non-admitted patients' characteristics with elderly patients who were admitted to hospital.
- To identify risk factors of ambulance, ED presentation and admission in a group of elderly patients who attended a tertiary public teaching hospital between November 2007 and March 2008

4.2.1 Research Design: Stage 2

A descriptive study design was used to address the aims and objectives of Stage 2 of this study. This type of study design was chosen as the best method to explore the frequency and characteristics of ED attendance by an elderly group of patients. Specifically, a cross sectional survey of elderly patients attending ED over a four month period was undertaken. The information obtained provided prevalence data on; emergent health problems and frequency of ED attendance, current co-morbidities, type of transportation used to attend ED, access and use of primary health care and demographics of this group of elderly patients.

4.2.2 Sample and Setting: Stage 2

Stage 2 was conducted at a single metropolitan teaching hospital in Perth Western Australia. The Hospital has over 500 beds and treats over 400 000 patients from across Western Australia every year. It also provides a comprehensive range of clinical services including trauma, emergency and critical care, orthopaedics, general medicine, general surgery and cardiac care. It is home to WA's only comprehensive cancer centre - the largest cancer treatment centre in the State - and is also WA's principal hospital for neurosurgery and liver transplants.

A random selection of 394 elderly patients who attended the ED during the data collection period were invited to participate in this study. Inclusion criteria required patients to:

- Be aged 65 years or more
- Be able to understand English
- Provide verbal consent
- Have attended the ED of the participating tertiary hospital
- Have attended the ED between November 26th 2007 and March 22nd 2008.

Sample size was based on a power of 0.95 to be able to detect a moderate difference when using a significance level of 0.005. Using a statistical calculator the abovementioned data were inserted and calculations resulted in the need for 208 participants in the final sample. [162] Further sample size calculations required to perform regression analysis are discussed in section 4.2.13.

4.2.3 The Emergency Department Elderly Patient Interview (TEDEPI)

In the absence of a suitable valid and reliable instrument which could identify risk factors associated with ED utilisation by elderly patients, a semi structured telephone interview guide was developed by the candidate, and comprised the following phases:

1. Item selection and instrument development from existing instruments and the literature which identified risk factors associated with ED utilisation by elderly people.
2. Review of the TEDEPI instrument by an expert panel consisting of two expert ED nurses and two professorial nurses.
3. Piloting of the TEDEPI instrument.

4.2.4 Items Selection and Instrument Development

The Emergency Department Elderly Patient Interview instrument was designed specifically for this study and was based on items selected from the literature and existing instruments (see Appendix A). This instrument was developed based on the following domains:

- Emergent health problems, history and perceptions
- Type of transportation used to attend ED
- Access and use of primary health care
- Demographics**.**

The TEDEPI schedule was a semi-structured instrument consisting of 31 multiple choice and open response items. Specifically, 16 questions used a fixed response format and covered all of the abovementioned domains. Ten items were open ended and five items used an ordinal scale to capture responses. Open ended responses were recorded verbatim and then categorised for analysis. Additionally, filter items were used to streamline the interview process for patients who did not use an ambulance to attend ED or who did not use a health practitioner.

Questions also included the use of single precoded items, items that required a yes/no/not sure response and items that used a Likert-type rating scale. The interview took between 10 and 40 minutes to complete, with participants having received a copy of the TEPEDI instrument prior to the telephone interview. This was done to assist elderly patients with choosing the most appropriate response to the multiple choice questions. It should be noted that Human Research Ethics Committee approval also

allowed for additional data to be obtained from the patient's electronic medical record. This was done to reduce to participant burden but also to obtain accurate data for such items as exact date and time of ED presentation.

4.2.5 The Total Patient Administrative System

For this stage of the study patients attending the designated ED were identified using The Total Patient Administrative System (TOPAS). This HDWA management information system captures specified data for all patients utilising WA public hospitals. Data obtained from this study included: the patient's name, contact details, date and time of presentation, LOS, presenting problem, urgency status and admission status. Utilisation of the TOPAS enabled identification of all elderly patients who attended ED regardless of date or time of presentation enabling a random selection of patients to be obtained that were representative of the population and also reduced selection bias. The use of TOPAS data also enhanced the accuracy of the information with data such as date, time of presentation and diagnosis obtained from health staff and relatives rather than elderly people who at the time of their ED presentation were unwell/injured (personal communication S Linton, June 2007).

4.2.6 Readability of the TEDEPI Instrument

As mentioned all participants were sent a copy of the TEDEPI instrument to use as a reference guide whilst being interviewed via the telephone. For this reason it was essential to assess the TEDEPI instrument for readability and comprehension using the: Flesch Reading Ease Score and the Flesch-Kincaid Grade Level Score. The Flesch Reading Ease Score uses a 100-point scale to rate the text in a document/instrument. The higher the score, the easier it is to understand the document or in this case the questions. Specifically, readability scores are based on the average number of polysyllabic words in each sentence. For most standard documents/instruments a score of 60% to 70% is acceptable.[163] The formula for the Flesch Reading Ease score is: 206.835 – (1.015 x ASL which refers to the average sentence length ie the number of words divided by the number of sentences) – (84.6 x ASW which refers to the average number of syllables per word ie the number of syllables divided by the number of

words). [163] The Flesch-Kincaid Grade Level score rates readability of a text and converts it to a corresponding school year/grade level. The formula for the Flesch-Kincaid Grade Level score is: (.39 x ASL) + (11.8 x ASW) – 15.59.

The Flesch Reading Ease Score for the TEDEPI instrument was calculated at 76% indicating comprehension of the instrument items rated well.[163] The Flesch-Kincaid Grade Level score for the TEDEPI Instrument was calculated at a grade/year level of 5.4 indicating that readability and comprehension level of the instruments items were at a level understood by a child of 11 years.

4.2.7 Validity of the TEDEPI Instrument

Content validity was established through the literature and the use of an expert panel of two professorial supervisors and two ED registered triage nurses who had over 40 years of combined nursing experience, of which 28 years was in the ED. The two nurses reviewed the TEDEPI instrument for clarity, content analysis and apparent internal consistency of the interview schedule. Panel members were asked to indicate whether the language used in the instrument was appropriate and whether items:

a) were clearly worded
b) belonged together
c) were relevant
d) were complete.

Results from the expert panel indicated that all items were clearly worded and easily understood with no alterations made.

4.2.8 Piloting of the TEDEPI Instrument

A pilot test was then conducted with five patients who met the inclusion criteria, to test the relevance, comprehensiveness, clarity and acceptability of the instrument. The pilot test resulted in only minor editorial changes being required and therefore the pilot group was included in the final sample. These included editorial changes to:

- The term general practitioner, which was replaced with health practitioner to accommodate patients who utilised other medical treatment.
- Item 17 which asked "From the time the symptoms/injury occurred, how much time elapsed before you presented to ED? A category of "weeks" was included.
- Item 21 which asked, "Did you believe your health problem required….? A category of "medical treatment within 24 hours" was included.

4.2.9 Inter-Rater Reliability

Inter-rater reliability was also conducted with both interviewers who had several years of interview experience. Specifically, three pilot patients were interviewed via speaker phone with a second rater also recording responses according to the interview schedule. For all three interviews results revealed high correlations of 97% achieved between raters. The one item that differed between raters was item 16, "Do you have any other long term health problems", with rater 1 recording an extra co-morbidity compared with rater 2. With such high correlations between raters with regard to capturing patient's responses, and only one difference recorded between raters, inter-rater reliability was deemed to be sufficient.

4.2.10 Procedure

Elderly patients who presented to the participating tertiary teaching hospital ED were randomly selected to be interviewed. As mentioned previously patients were identified using the TOPAS. To capture this data, a database query was set up to automatically highlight and collate information on all patients meeting the inclusion criteria who

attended the ED during November 26th 2007 to March 22nd 2008. A total of 4613 elderly patients attended ED during this period (see Table 2).

Table 2 Frequency of ED Presentations by Elderly People to a Tertiary Hospital

Month and Year of ED Attendance	Total Attendance to ED By Elderly Pts (n)	Randomly Selected to Participate (n)
November 26-31st 2007	168	9
December 2007	1240	26
January 2008	1189	160
February 2008	984	136
March 2008	1032	63
TOTAL	4613	394

The results of the automated query, which captured ED attendance for patients aged 65 years or more was sent directly to the candidate. On receipt of this database, patients were randomly selected using a SPSS computer generated numbers function (SPSS Version 15 Chicago USA).

A total of 394 patients were selected and every patient was sent a detailed letter inviting them to participate in a short semi-structured telephone interview about the issues surrounding their recent hospital attendance. This information also included information about the study's aims and procedures involved plus information on providing informed verbal consent. For those patients still in hospital, the candidate or assistant visited the patient to invite their participation and leave written information about the study. A copy of the interview schedule was also sent to the patient to facilitate the interview process.

Within one week of distributing the letter, telephone contact was made by the candidate or assistant to ascertain interest in participation, to obtain verbal consent and to arrange a suitable time to conduct the telephone interview. At the time of the telephone interview, participants were once again informed of their rights and asked to give consent. Once verbal consent was received a semi-structured interview was undertaken

to gain an account of what led to the patient's presentation to ED. Demographic data were also collected. On completion of the interview patients were asked if there were any questions they needed to be answered and were then thanked for their participation.

4.2.11 Ethics Approval: Stage 2

Prior to the commencement of this study, approval was obtained from the Human Research Ethics committees from both the participating Hospital and University of Western Australia. All participants were given both verbal and written information about the study and time to consider their participation. Verbal consent was obtained prior to the interview commencing. Participants were informed of the voluntary nature of the study and that they could withdraw at any time without affecting their current or future care. All information was coded and de-identified before analysis. Hard copies of the questionnaires are kept in a locked filing cabinet within a secure office environment while all electronic information is password secured with only the candidate able to access the data. All information will be destroyed after five years.

4.2.12 Data Analysis: Stage 2

Data were analysed using SPSS Version 15 (Chicago USA). Descriptive statistics such as frequency distributions were conducted to determine the proportion of demographic and clinical characteristics of those elderly patients who presented to ED. Logistic regression analysis was undertaken to identify risk factors of ED attendance in this sample of elderly patients. Non-parametric tests such as Chi square, Kruskall Wallis tests and Mann Whitney U tests were also performed. Additionally, comparisons between patient groups who had been treated and discharged with those who had been admitted were also undertaken.

4.2.13 Logistic Regression

Logistic regression modelling was undertaken to identify risk factors of hospital admission, ambulance use and GP use in this group of patients. In the first instance, logistic regression analysis was undertaken using the standard 'enter' technique to establish whether each variable was a significant independent predictor of hospital

admission. To test the univariate association between each individual factor and the specific outcome of interest a logistic regression model, adjusted univariate analysis was run with the independent and dependent variables of interest. Associations with p values of ≤ 0.1 were included in the multivariate model. Statistical significance for the multivariate logistic regression modelling was defined as a p value ≤ 0.05. The multivariate logistic regression was undertaken to determine the extent to which each of the variables were predictors of ambulance utilisation to attend the ED, hospital admission and use of GP consultation prior to ED presentation. Risk estimates and 95% confidence intervals were also reported.

For logistic regression to be undertaken each outcome variable was reviewed and where necessary collapsed to obtain two or more categories. Collapsing of risk factors was performed based on findings taken from the literature, with identified risk factors and predictors of hospital admission, primary care and ambulance utilisation used to guide the analysis. For example, studies have highlighted that elderly patients utilise ambulance transport to attend ED at a higher rate than those younger than 65 years. To test this finding within the context of this study, a risk factor "transport to ED" was coded as:

- Used other transport (reference group)
- Used ambulance transport. [13, 164]

Where no previously identified risk factors or predictors of hospital admission, ambulance or primary care utilisation by elderly patients were available, the candidate developed logistic regression categories. Assumptions for logistic regression include:

- Sample size in relation to the number of predictor variables to be included in the model was carefully considered to ensure that the number of cases was sufficient for undertaking a regression analysis. Rules regarding sample size vary from 10 cases to 40 cases.[165, 166] For this study 10 cases were utilised to calculate the sample size needed for each model. The formula used to calculate sample size was N>10+17a (where 'a' refers to the number of predictor variables. The results of this calculation indicated that a minimum of 170 cases were needed, with a final sample of 219 cases obtained.

- Observations were independent.
- Multicollinearity of predictor variables, identification of outliers and goodness of fit were also examined to ensure that it was appropriate to undertake this type of analysis.

4.2.14 Qualitative Comments

All open ended responses were reviewed and analysed to identify common words and phrases. Responses were then grouped to allow for categories to be developed.

Chapter 5

RESULTS

5.0 Introduction

In Stage 1, an analytical epidemiological study was undertaken to describe ambulance and public hospital emergency department utilisation by a cohort of elderly ambulance patients between 1990 and 2002. This first part of the chapter provides background information on the provision of prehospital care and emergency department care within the State of Western Australia and in particular the Perth metropolitan area from which study data were collected.

The second part of this results chapter presents findings from Stage 2, which focussed on identifying characteristics and the associated risk factors of elderly patients who presented to a tertiary hospital ED over a five month period between 2007 and 2008 (see introduction section 5.2).

5.1.1 Demographic Information on Elderly Ambulance Users 1990-2002

This dataset comprised of 179 206 elderly patients who were treated and transported by ambulance to designated ED's in the Perth metropolitan area between January 1st 1990 and December 31st 2002. In total, 309 435 episodes of prehospital care were given to this sample of patients over a 13 year period. The most populous age group was the 75-84 year olds who received 40.5% (n=72 583) of prehospital care and transport (see Table 3).

Table 3 Ambulance Utilisation by Age Group

Ambulance Utilisation	**65-74 Years**		**75-84 Years**		**85+ Years**		**Total**	
	n	%	n	%	n	%	n	%
No. of Patients	61 664	34.4	72 583	40.5	44 959	25.1	179 206	100.0
No. of Episodes	95 394	30.8	128 239	41.4	85 802	27.8	309 435	100.0

For the 179 206 patients in this sample, age was shown to range from 65-111 years, with a mean age of 79 years (SD 7.9 years) recorded. The majority of patients in this sample were female (56.9%; n=101 858) with the highest proportion of females (n=41 915) observed in the 75-84 year age group (see Table 4). A significant association was noted between the groups with regard to gender (X^2 = 97061.042; df 2; p=0.000).

Table 4 Gender of Ambulance Users by Age Group between 1990-2002

Gender	65-74 Years		75-84 Years		85+ Years		Total	
	n	%	n	%	n	%	n	%
Male	32 508	52.8	30 604	42.2	14 053	31.3	77 165	43.1
Female	29 098	47.8	41 915	57.8	30 845	68.7	101 858	56.9
Total	**61 606**	100.0	**72 519**	100.0	**44 898**	**100.0**	**179 023***	100.0

*n=183 missing data

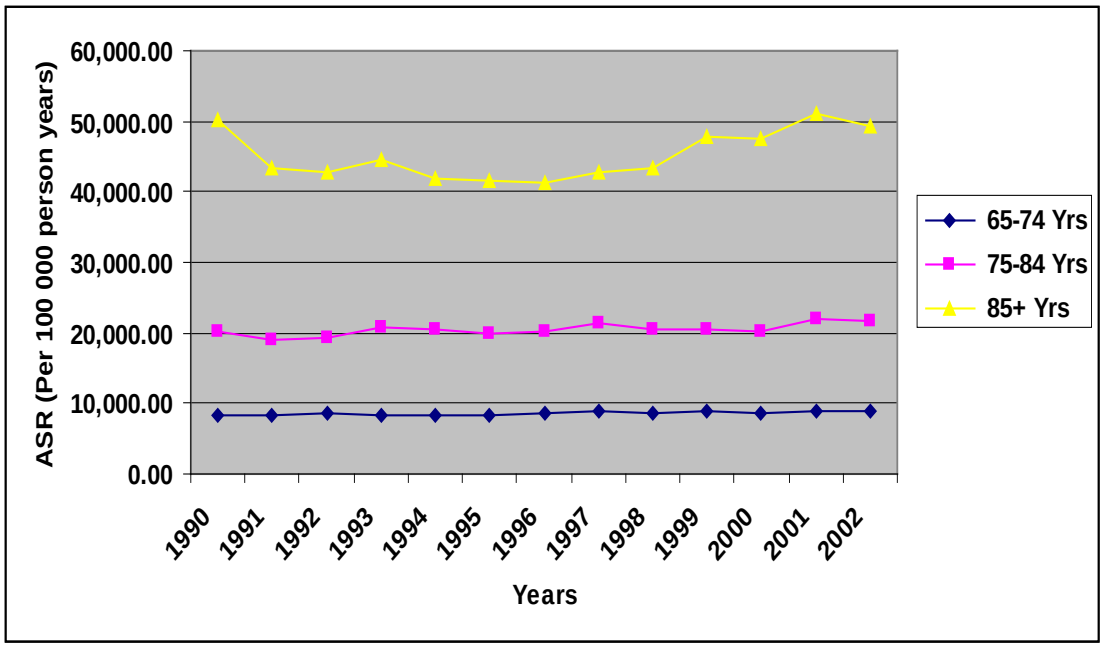
Eighty six percent (n=265 774) of ambulance utilisations resulted in presentations to a public tertiary hospital (see Table 5). While the majority of patients were treated at the original hospital they attended, a small proportion of patients were transferred to another hospital (n=25 065; 8.1%). Of these patients 90% (n=22 550) were transferred to a tertiary hospital with the remainder being transferred to a secondary hospital.

Table 5 Frequency of Presentation by Hospital Type and by Age Group between 1990-2002

Hospitals	65-74 Years		75-84 Years		85+ Years		Total s	
	n	%	n	%	n	%	n	%
Tertiary	82 453	86.4	109 358	85.3	73 963	86.2	265 774	85.9
Secondary	12 941	13.6	18 881	14.7	11 839	13.8	43 661	14.1
Total	**95 394**	100.0	**128 239**	100.0	**85 802**	100.0	**309 435**	100.0

Elderly people received 309 435 episodes of ambulance and ED treatment. Figure 2 highlights the disproportionate use of EMS by elderly people aged 85 years or more. Utilisation rates for the younger age groups remained relatively constant over the data collection period while those in the oldest age group were observed to fluctuate overtime.

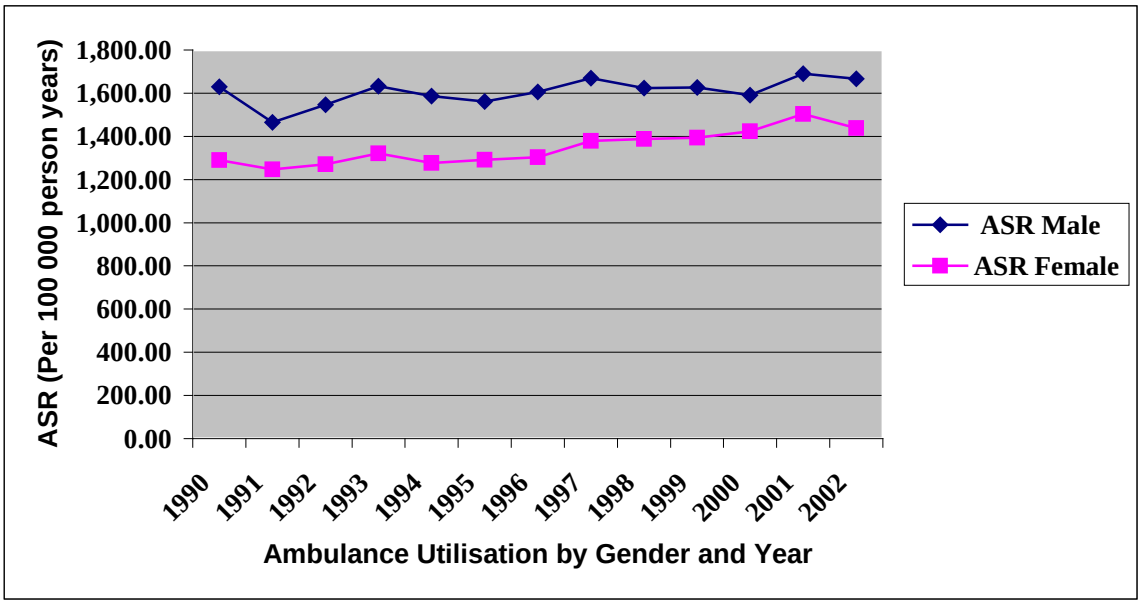
Figure 2 Age Standardised Rates for Ambulance Utilisation by Age Group between 1990-2002



In 1990 the episodes of ambulance care/transportation of Perth metropolitan elderly patients was 19 501, with this figure increased by 63% to 30 781 episodes by 2002. Ambulance utilisation episodes were directly standardised to the 2001 Western Australian metropolitan population. Analysis of trends showed the age-standardised rate (ASR) for all prehospital care episodes in 1990 was 2 142 episodes per 100 000 persons (SE 13.1). By 2002 this had increased to 2 220 episodes per 100 000 persons (SE 10.9), with a significant difference observed between the prehospital utilisation rates between 1990 and 2002 for this sample ($t=4.601$; $p<=0.001$).

Interestingly, ambulance use by elderly males was found to be at a consistently higher rate than elderly females over the 13 year time period (see Figure 3).

Figure 3 Age Standardised Rates of Ambulance Utilisation by Gender and Year



The overall frequency of prehospital care and transportation ranged from one to 185 episodes. Over this 13 year period the majority of patients utilised only 1 episode of prehospital care (59.2%; n=106 126: See Table 6). A small proportion of the sample (n=101; 0.5%) had more than 35 episodes of prehospital care, with one person recording 185 visits over this 13 year period.

Table 6 Frequency of Presentation by Hospital by Age Group between 1990-2002

Hospitals	65-74 Years		75-84 Years		85+ Years		Total Episodes	
	n	%	n	%	n	%	n	%
1 Episode	42 885	69.5	41 854	57.7	21 387	47.6	106 126	59.2
2-6 Episodes	14 237	23.1	23 266	32.1	17 701	39.4	55 204	30.8
7+ Episodes	4 542	7.4	7 463	10.3	5 871	13.0	17 876	10.0
Total	**61 664**	100.0	**72 583**	100.0	**44 959**	100.0	**179 206**	100.0

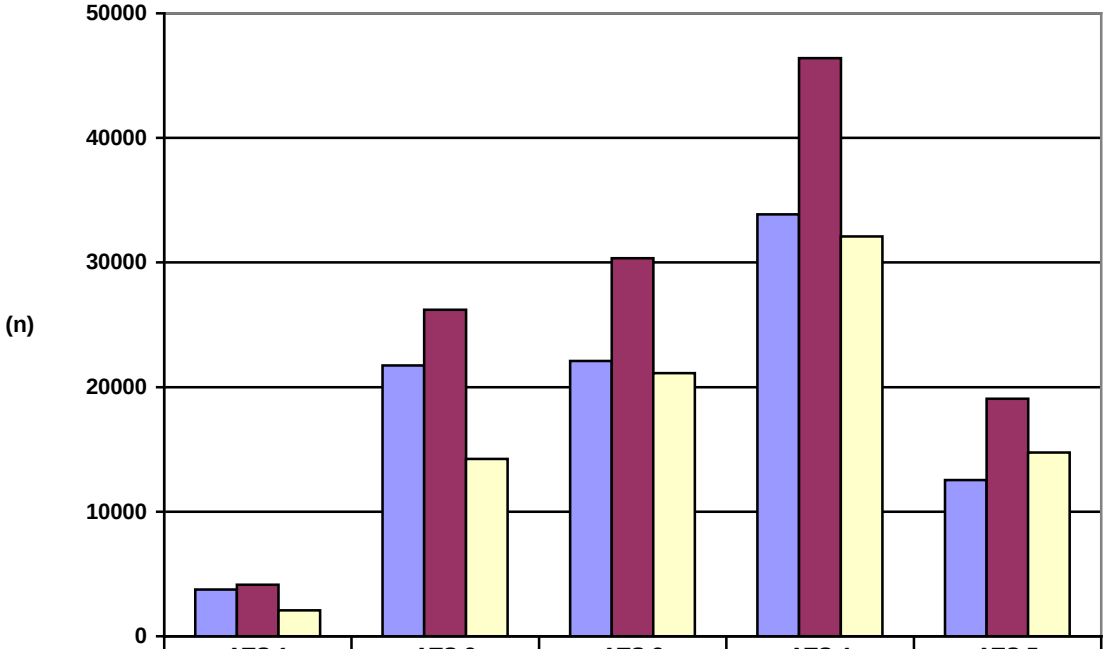
The number of elderly patients utilising prehospital care seven or more times during 1990 constituted only 0.3% (n=68) of all callouts. By 1996 this had increased to 6.2% (n=1404) and in 2002, 11.2% (n=3447) of ambulance attendances were made by recurrent users. The age standardisation rate in 1990 for utilisation of prehospital care

seven or more times was 7.4 per 100 000 (SE 0.9) with this figure rising dramatically to 249.9 per 100 000 (SE 4.1) by 2002. Results also showed that there was a significant difference between the prehospital utilisation rates (7+ episodes) in 1990 and 2002 for this sample (t=56.612; p=0.000). Aside from the abovementioned presentation rates, representations by elderly people within seven days of the index episode was only 1.4 % (n=4200) over the 13 year period. This frequency did increase slightly to 3.4% (n=10 672) for representations within 28 days.

5.1.2 Urgency Status of Ambulance Patients who Attended ED between 1990-2002

Using the Australasian Triage Scale (ATS), across all age groups the most frequent treatment urgency code used was "semi urgent" referring to treatment being required within 60 minutes (see Figure 4). Significant associations were observed between the groups with regard to urgency status (X^2 = 17771.566; df 8; p=0.000).

Figure 4 Frequency of Ambulance Urgency Status by Group between 1990-2002



	ATS 1	ATS 2	ATS 3	ATS 4	ATS 5
65-74 Yrs	3741	21740	22095	33852	12528
75-84 Yrs	4145	26200	30346	46396	19059
85+ Yrs	2086	14242	21114	32079	14753

* Missing data = 5 059

5.1.3 Frequency of Death Amongst Elderly Ambulance Users between 1990-2002

A total of 44 842 (25.4%) of people died between 1990 and 2002 with results showing that the nearly 95% (n= 35 545) of elderly patients actually died in the community, outside of the ambulance or hospital episode of care they received (see Table 7).

Table 7 Frequency of Place of Death by Group between 1990-2002

Place of Death	65-74 Years		75-84 Years		85+ Years		Total	
	n	%	n	%	n	%	n	%
At scene or in transit	604	1.3	579	1.3	261	0.5	1 444	0.8
Hospital	2 310	5.2	3 209	7.2	2 334	5.0	7 853	4.4
Community	9 624	21.5	15 551	34.7	10 370	23.1	35 545	94.8
Total	**12 538**	28.0	**19 339**	43.2	**12 965**	28.6	**44 842**	100.0

5.1.4 Ambulance Patients' Dispatch and Problem Code Utilisation

Symptom codes are assigned at the time of dispatch and problem codes are obtained after initial assessment at the scene. The top 8 codes were compared for accuracy. Results in Table 8 showed that respiratory problems, neurological problems and cardiac problems were the most congruent with high correlations calculated.

Table 8 Comparison between Ambulance Dispatch Codes and Problem Codes For the Top 8 Frequently Mentioned Problems

Ambulance Codes	Dispatch		Problem		Agreement
	n	%	n	%	%
Respiratory	37 633	14.3	36 810	13.9	97.8
Neurological	39 029	14.8	37 393	14.1	95.8
Cardiac	66 652	25.3	61 161	23.1	91.8
Abdominal	22 447	8.5	20 047	7.5	89.3
Trauma	48 915	18.6	40 864	15.4	83.5
Musculoskeletal	18 557	7.0	13 493	5.1	72.7
Debility	17 827	6.8	29 876	11.3	59.7
Unknown illness	12 543	4.8	25 158	9.5	49.8

Cardiac problems were the most frequent ambulance problem cited by those younger than 85 years while trauma was the most cited problem for those older than 85 years (see Table 9).

Table 9 Frequency of Ambulance Problem Codes by Age Group

Problem Codes	65-74 Years		75-84 Years		85+ Years		Total	
	n	%	n	%	n	%	n	%
Cardiac	23 250	24.4	25 959	20.2	11 952	13.9	61 161	19.7
Trauma	9 188	9.6	16 037	12.5	15 639	18.2	40 864	13.3
Neurological	11 279	11.8	16 284	12.7	9 830	11.5	37 393	12.0
Respiratory	12 620	13.2	15 468	12.1	8 722	10.2	36 810	11.9
Debility	8 312	8.7	11 983	9.3	9 581	11.2	29 876	9.7
Illness	6 920	7.3	10 538	8.2	7 700	9.0	25 158	8.1
Abdominal	6 528	6.8	8 174	6.4	5 345	6.2	20 047	6.5
Musculoskeletal	3 040	3.2	5 403	4.2	5 050	5.9	13 493	4.4
Malignancy	2 466	2.6	2 156	1.7	809	0.9	5 431	1.7
Renal	1 434	1.5	1 980	1.5	1 363	1.6	4 777	1.5
Psycho/social	477	0.5	589	0.5	374	0.4	1 440	0.5
Poisonings	608	0.6	362	0.3	212	0.2	1 182	0.4
Other problem*	9 272	9.7	13 306	10.4	9 225	10.8	31 803	10.3
Total	**95 394**	100.0	**128 239**	100.0	**85 802**	100.0	**309 435**	**100.0**

* Please note the 'other problem category" were originally categorised as 'unable to code'.

Cardiac problem codes were reviewed further with 'chest pain' noted as the most frequent ambulance cardiac problem code used across all age groups (see Table 10). For patients under 85 years angina and dysrhythmia were the next most frequently mentioned cardiac problems. However, for those older than 85 years congestive cardiac failure was the second most frequently reported problem.

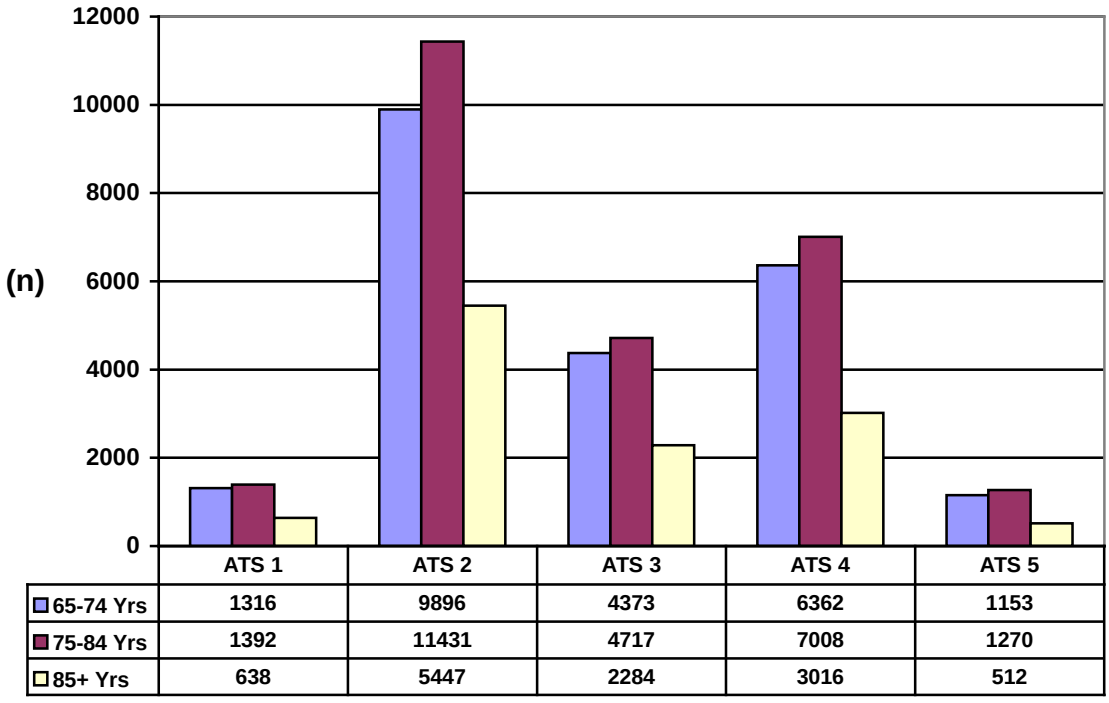
Table 10 Frequency of Cardiac Ambulance Problem Codes by Age Group 1990-2002

Cardiac Codes	65-74 Years		75-84 Years		85+ Years		Total	
	n	%	n	%	n	%	n	%
Chest Pain	16 884	72.6	18 679	72.0	8 259	69.1	43 822	71.7
Angina	2 314	10.0	2 281	8.8	854	7.1	5 449	8.9
Dysrhythmia	1 610	6.9	1 974	7.6	940	7.9	4 524	7.4
CCF*	922	4.0	1 769	6.8	1 426	11.9	4 117	6.7
Cardiac Arrest	1 307	5.6	1 054	4.0	372	3.1	2 733	4.5
Pacemaker Failure	94	0.4	140	0.5	84	0.7	318	0.5
Cardiac Procedure	119	0.5	62	0.2	17	0.1	198	0.3
Total	**23 250**	100.0	**25 959**	99.9	**11 952**	99.9	**61 161**	**100.0**

* CCF = Congestive Cardiac Failure

Of the 61 161 episodes that were categorised as cardiac problems, most patients (n=26 774; 43.8%) were given an 'emergency' ATS urgency status requiring treatment within 10 minutes (see Figure 5). Less than six percent (n=3 346) of all patients with a cardiac problem code required immediate (resuscitation) treatment.

Figure 5 Ambulance Patients with Cardiac Problems by Urgency Status and Group between 1990-2002



Traumatic injury was observed to increase with age. Specifically, for patients with a main problem code of trauma, the majority of injuries (n=30 560; 75%) across all age groups were categorised as a result of domestic trauma such as falls (see Table 11). Motor vehicle injury (n=4 423; 10.8%) was the next most frequently recorded trauma injury with a decreasing trend observed as age increased.

Table 11 Frequency of Ambulance Trauma Problem Codes by Age Group Between 1990-2002

Trauma	**65-74 Years**		**75-84 Years**		**85+ Years**		**Total**	
Codes	n	%	n	%	n	%	n	%
Domestic	5 298	57.7	11 980	74.7	13 282	84.9	30 560	75.0
MVA*	2 075	22.6	1 754	10.9	594	3.8	4 423	10.8
Shooting	192	2.1	289	1.8	266	1.7	744	1.8
Sporting	230	2.5	184	1.1	95	0.6	509	1.2
Assault	196	2.1	127	0.8	76	0.5	418	1.0
Industrial	86	0.9	40	0.2	26	0.2	152	0.5
Suicide	16	0.2	13	0.1	14	0.1	43	0.1
Stabbing	9	0.1	5	0.0	2	0.0	16	0.0
Rape	5	0.1	5	0.0	2	0.0	12	0.0
Hanging	5	0.1	-	-	1	-	6	0.0
Murder	-	-	3	0.0	3	0.0	6	0.0
Other**	1 076	11.7	1 637	10.2	1 278	8.2	3 991	9.7
Total	**9 188**	100.0	**16 037**	100.0	**15 639**	100.0	**40 864**	100.0

* MVA= Motor Vehicle Accident ** No further details were recorded for the 'other trauma category'.

Of the 75% of patients who experienced domestic trauma, 50.4% (n=11 347) of injuries were located on a limb while 13.3% (n=4064) were reported as a fracture. Comparisons of ASR trauma rates that occurred in 1990 and those that occurred in 2002 revealed that there was a significant difference noted for domestic trauma (t=14.778; p=0.000), which increased from 172.4 per 100 000 episodes in 1990 (SE= 6.8) to 315.6 per 100 000 episodes in 2002 (SE=6.8). A significant difference was also observed for motor vehicle injuries in elderly patients with 14.5 per 100 000 episodes occurring in 1990 (SE 1.3) decreasing to 8.3 per 100 000 episodes in 2002 (SE 0.8).

5.1.5 Age Standardised Rates of Problem Codes for Elderly People 1990-2002

Ambulance problems code rates were compared between 1990 and 2002. Table 12 highlights that rates for trauma, respiratory, abdominal problems, unknown illness, renal, psychosocial problems and inflammatory/musculoskeletal problems were all observed to increase significantly overtime (as indicated by the arrow symbol). Significant differences were also observed for rates of cardiac, debility, poisoning, neurological problems, and "other problems" however these results showed that rates had decreased over time (as indicated by the arrow symbol).

Table 12 Age Standardised Rates for Ambulance Problem Codes for the Total Group between 1990 and 2002

Ambulance Problem Codes	Comparison Between Years	ASR per 100 000 Episodes	SE	Lower CI	Upper CI	t	p Value
Trauma	1990	226.6	5.0	216.8	236.4		
	2002	↑283.8	4.4	275.2	292.5	8.589	0.000
Respiratory	1990	166.2	4.2	157.9	174.5		
	2002	↑272.4	4.4	264.2	281.4	17.525	0.000
Abdominal	1990	66.0	2.7	60.8	71.2		
	2002	↑173.8	3.5	162.8	166.9	24.429	0.000
Unknown Illness	1994	28.6	1.7	25.3	31.9		
	2002	↑367.2	5.0	357.4	377.1	63.919	0.000
Inflammatory musculoskeletal	1994	20.3	1.4	17.5	23.0		
	2002	↑227.7	4.0	219.3	235.0	48.904	0.000
Renal	1994*	10.2	1.0	8.3	12.2		
	2002	↑44.3	1.8	40.8	47.8	16.650	0.000
Psycho/social	1990	6.2	0.8	4.5	7.8		
	2002	↑14.7	1.0	12.7	16.7	6.434	0.000
Malignancy	1990	37.3	2.0	33.4	41.2		
	2002	↓34.2	1.6	31.1	37.3	1.211	0.257
Cardiac	1990	453.5	6.8	440.1	466.9		
	2002	↓368.8	5.1	358.9	378.8	9.933	0.000

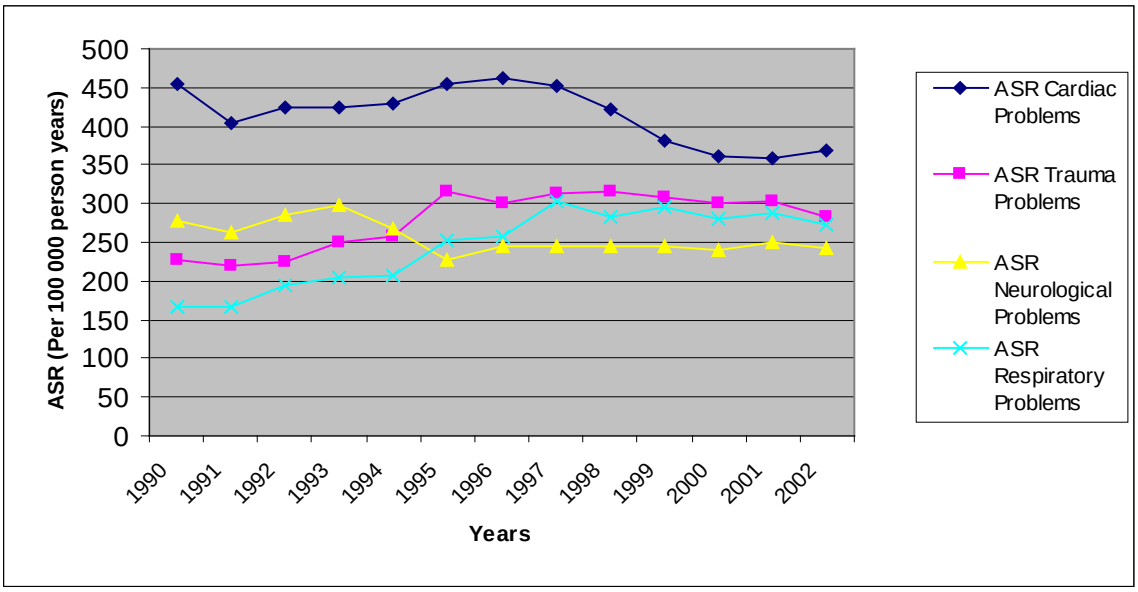
Table 12 Age Standardised Rates for Ambulance Problem Codes for the Total Group between 1990 and 2002 Cont

Ambulance Problem Codes	Comparison Between Years	ASR per 100 000 Episodes	SE	Lower CI	Upper CI	t	p Value
Neurological	1990	278.2	5.5	267.5	289.0		
	2002	↓243.5	4.1	235.4	251.6	5.056	0.001
Debility	1990	268.9	5.4	258.4	279.5		
	2002	↓179.8	3.6	172.9	186.8	13.766	0.000
Poisoning	1990	12.6	1.2	10.2	15.0		
	2002	↓7.9	0.8	6.4	9.4	3.297	0.009
Other problems	1990	1 750.2	19.1	1 712.8	1 787.6		
	2002	↓109.2	4.5	100.4	118.1	83.677	0.000

* Please note that data collection for renal codes commenced in 1994.

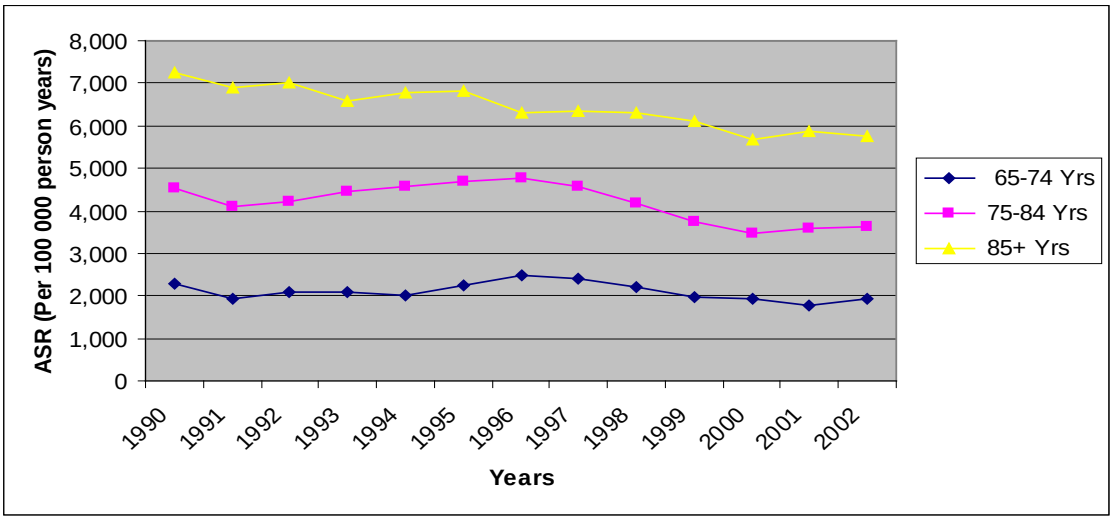
Trends for the four most frequently reported health problems over a 13 year period showed that ASR trends for cardiac problems were consistently higher than trends for trauma, neurological or respiratory problems (see Figure 6). However after peaking in 1996, cardiac problems were observed to decrease over time but rising slightly again in 2002. Neurological problems were shown to sharply decrease in 1994/1995, while sharp rises were observed for trauma and respiratory problems.

Figure 6 Comparison of the Four Most Frequently Reported Ambulance Problem Rates between 1990 -2002



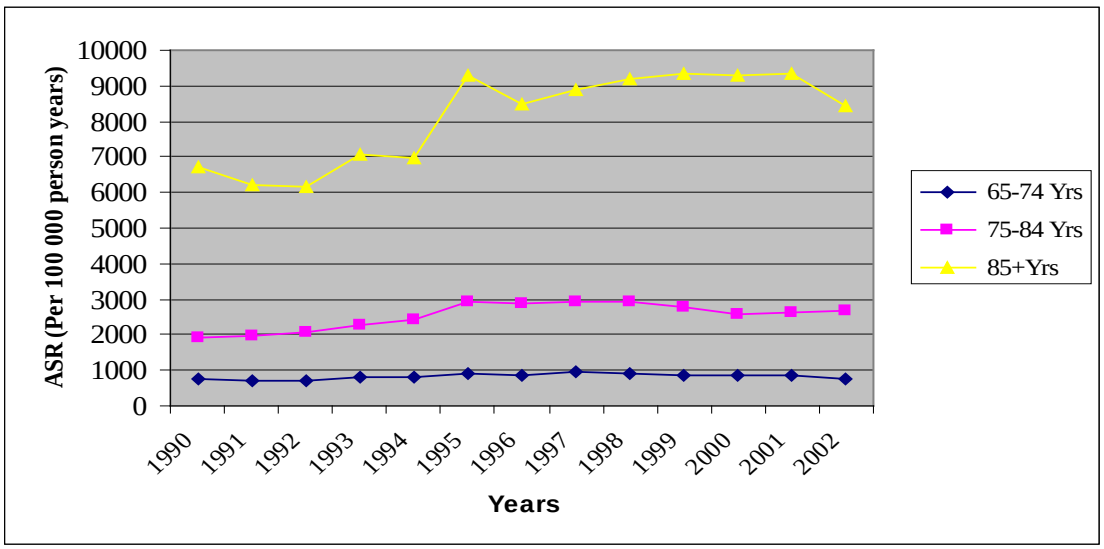
Each health problem was also analysed to identify ASR over time by age group. Figure 7 highlights that while cardiac problem were experienced at a substantially higher rate for those 85 years or more, however a decreasing trend was observed overtime.

Figure 7 Comparison of Cardiac Problem Rates by Age Group between 1990-2002



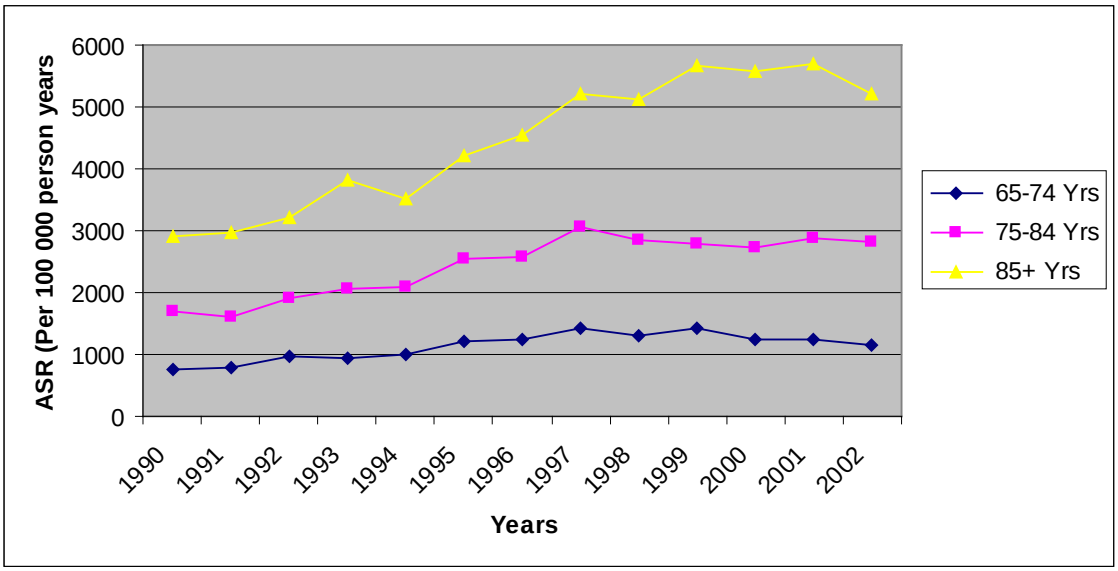
Patients in the younger age groups showed a more consistent trend over time with regard to sustaining traumatic injuries (see Figure 8). Once again trauma was experienced at a substantially higher rate by those aged 85 years or more. A sharp peak was observed in 1995 in this elderly cohort with this high rate continuing over time.

Figure 8 Comparison of Trauma Problem Rates by Age Group between 1990-2002



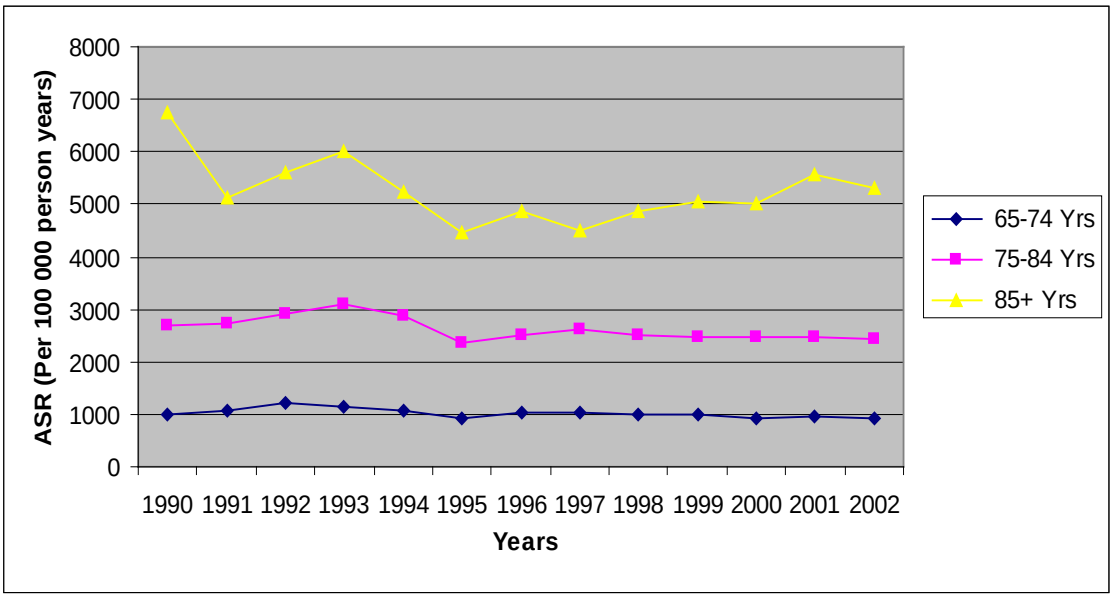
Once again those aged 85 years or more reported higher rates of respiratory problems than younger age groups. Respiratory problems peaked at an ASR of 5,688 per 100 000 episodes in 2001 for those in the oldest age group (see Figure 9).

Figure 9 Comparison of Respiratory Problem Rates by Age Group 1990-2002



Fluctuating ASR trends were observed for neurological problems by those aged 85 years or more, which again were substantially higher rates than those experienced by the younger age groups (see Figure 10).

Figure 10 Comparison of Neurological Problems Rates by Age Group 1990-2002



5.1.6 Temporal Variation Trends for Ambulance Utilisation 1990-2002

Utilisation trends for prehospital care increased from April to August across all age groups, peaking in the winter months of July and August (see Figure 11). Utilisation decreased during the spring months of September to November but a slightly elevated response from those younger than 85 years was observed for the month of December. A significant association was also noted between the different age groups and what month they required prehospital care (X^2 =233.366; df 22; p=0.000). Elderly patients across all age groups requested prehospital care predominantly during the hours of 0800 to 1800 (see Figure 12). A significant association was also noted between the different age groups and what time they required prehospital care (X^2 =1053.792; df 22; p=0.000).

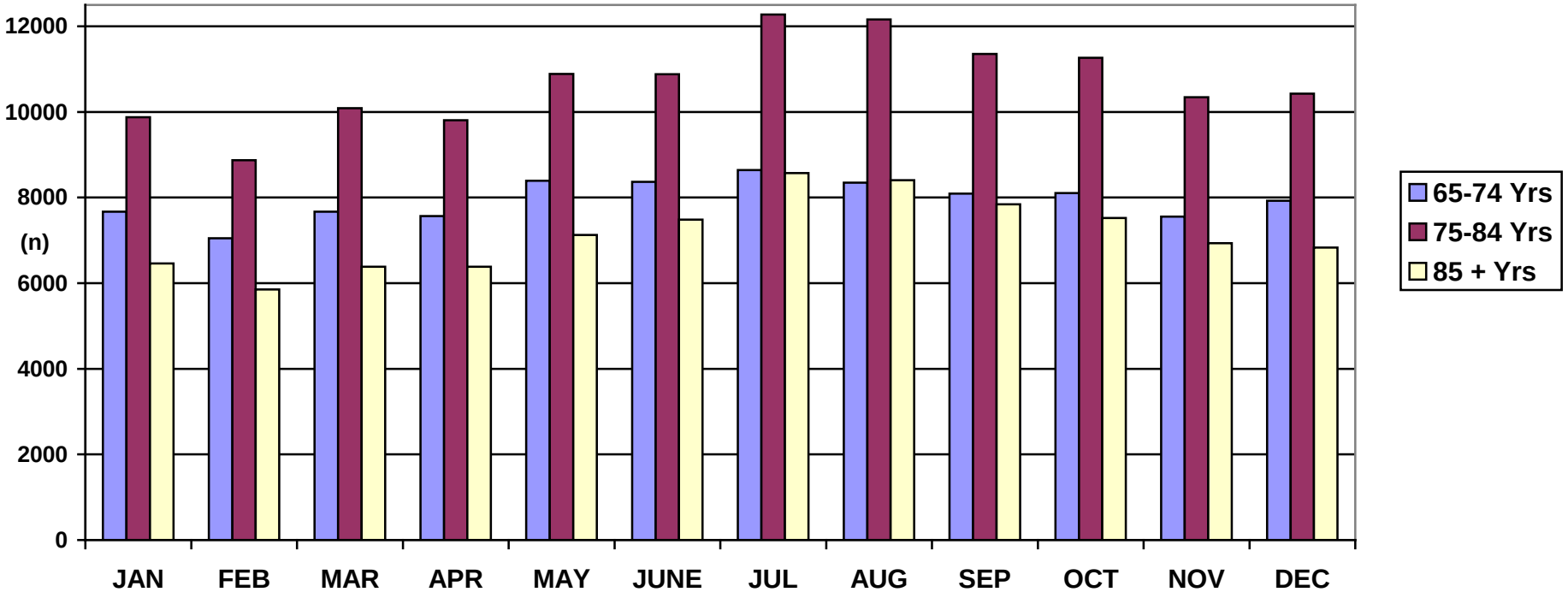


Figure 11 Frequency of Ambulance Utilisation by Month and by Group between 1990-2002.

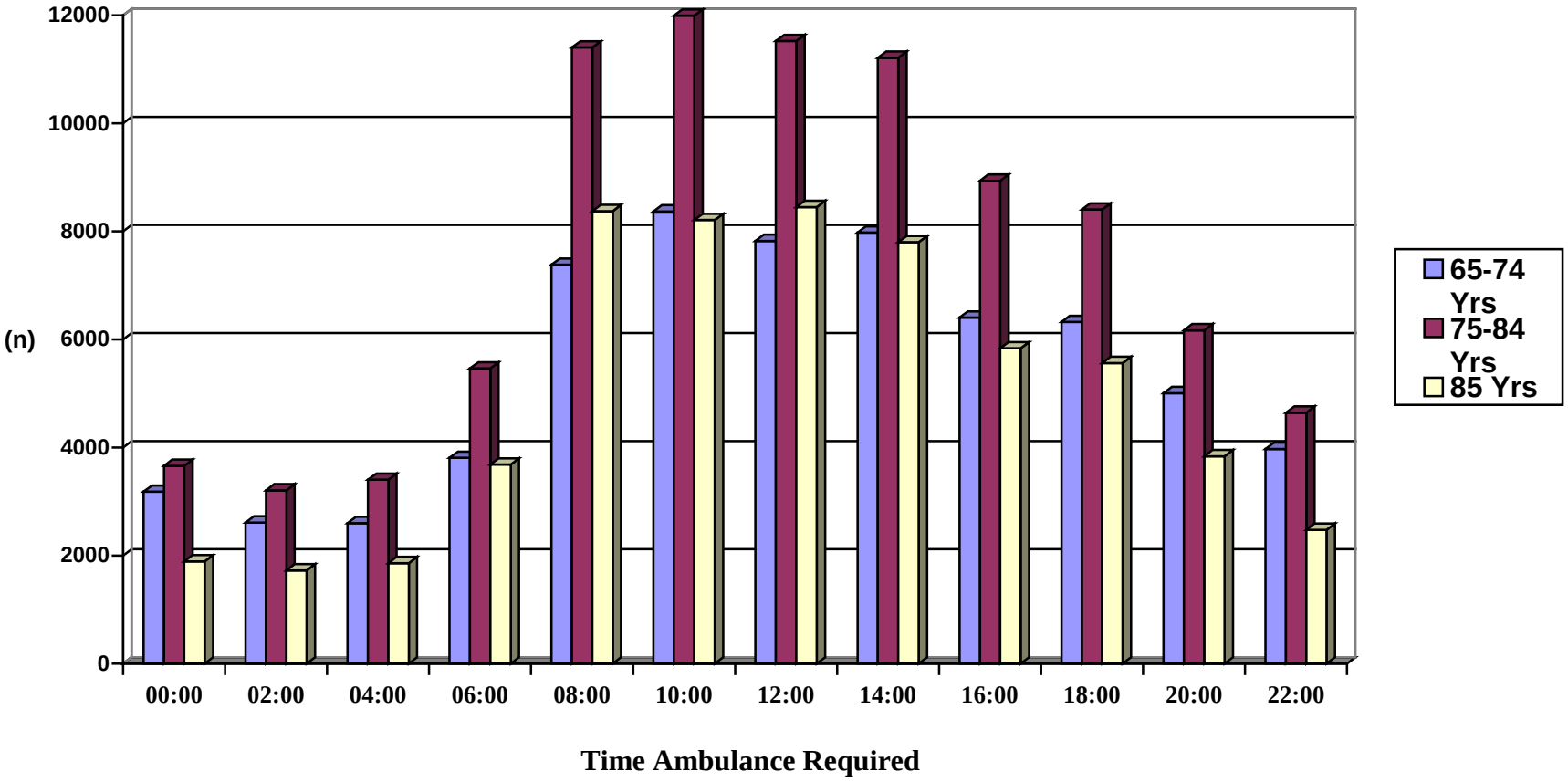
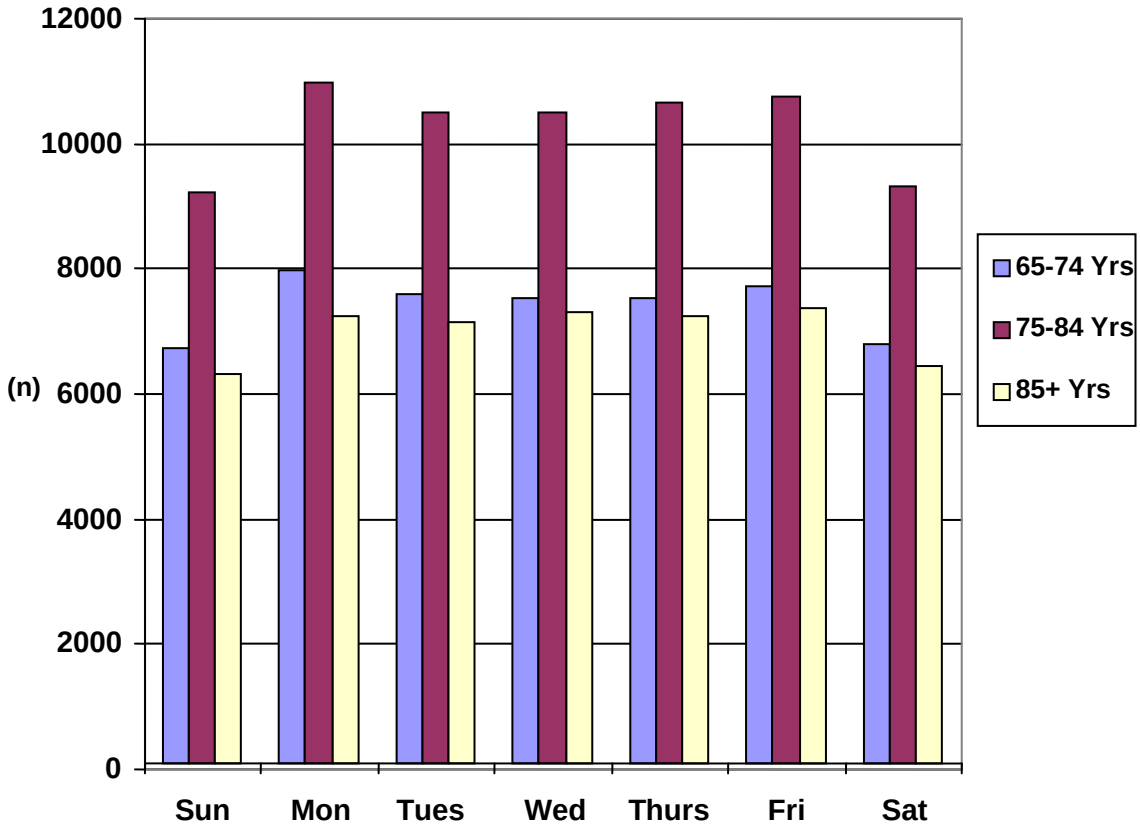


Figure 12 Frequency of Ambulance Use by Time Ambulance Required by Group between 1990-2002.

All age groups tended to follow a similar pattern when using an ambulance to attend the ED, with Monday observed with the highest proportion of presentations. Sharp decreases for ambulance utilisation were observed for weekend days (see Figure 13).

Figure 13 Frequency of Ambulance Use by Day and by Group 1990-2002



5.1.7 Admission Status of Elderly People Presenting to ED 1990-2002

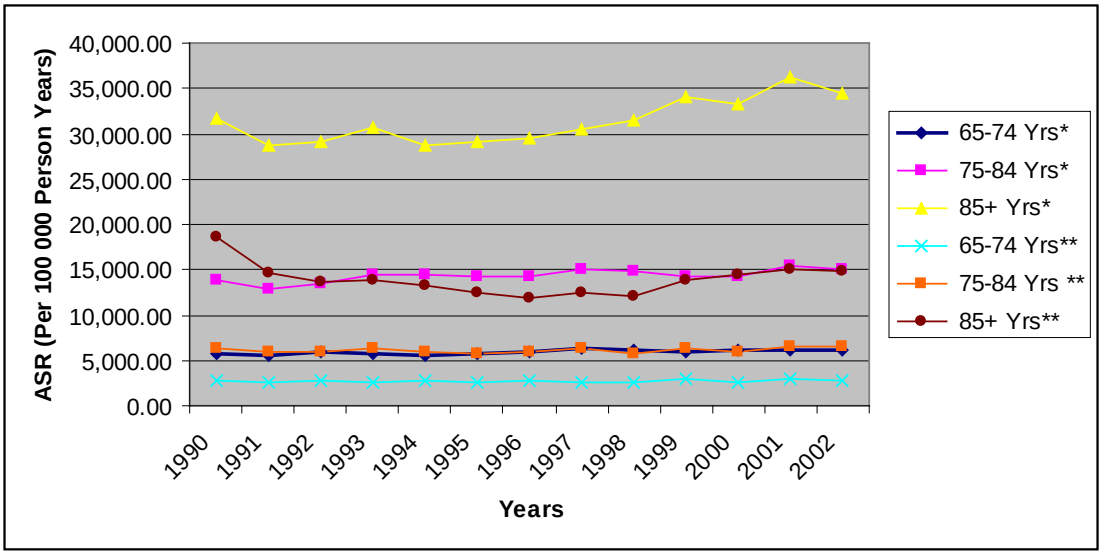
Of the 179 206 patients who attended the ED, 88 756 were admitted to hospital with a slightly higher amount of patients (n=90 450) treated and discharged home. Admitted patients were observed to attend ED on 215 146 (70%) occasions compared to non admitted patients who attended far less (30%; n=94 289; see Table 13). Significant associations between admission status, gender, age grouping and type of hospital and main health problem experienced were observed.

Table 13 Comparisons of Characteristics between Admitted and Non Admitted Patients (1990-2002)

Characteristics of those who presented	**Admitted** n=88 756	**Non Admitted** n=90 450	**Statistic and P value**
Gender: Female Male	48 859 (55%)	52 999 (59%)	X^2 = 132.54; df 1, p=0.000
No. of ED Episodes	215 146 (70%)	94 289 (30%)	
Age Group: 65-74 Yrs	33 280 (37.5%)	28 357 (31.4%)	X^2 = 64.27; df 2, p=0.000
75-84 Yrs	35 695 (40.2%)	36 855 (40.8%)	
85+ Yrs	19 781 (22.3%)	25 130 (27.8%)*	*Missing data =108
Hospital Type: Tertiary Secondary	187 054 (86.9%) 28 092 (13.1%)	78 720 (83.5%) 15 569 (16.5%)	X^2 = 645.67; df 1, p=0.000
Mean number of ED Visits (SD)	3.64 (SD 5.73)	4.41 (SD 7.38)	
Range	1-185	1-170	
Mean LOS for hospital admission (SD)	9.78 (SD 14.0)	N/A	
Range	1-620		
Main Problem: Cardiac problems	45 776 (21.3%)	15 385 (22.1%)	X^2 = 3763.61; df 3, p=0.000
Respiratory Problems	29 133 (13.5%)	7 677 (11.1%)	
Neurological problems	25 111 (11.7%)	12 282 (17.7%)	
Trauma	25 044 (11.6%)	15 820 (22.8%)	

Age standardisation rates for those patients who were admitted were compared to those patients who were treated and discharged. Figure 14 shows that regardless of admission status those in the 85 years or more age group still reported higher rates of presentation for those who were aged 65-74 years who were admitted to hospital.

Figure 14 Comparison of Presentation Rates by Age Group and Admission Status between 1990-2002



*= admitted to hospital; **= not admitted to hospital.

5.1.8 Summary of Stage 1 Results

The Elderly Prehospital and Emergency Department Dataset (TEPEDD) was useful in describing the epidemiology of ambulance and ED utilisation by elderly patients. Specifically, this stage of the study used record linkage data to describe ambulance and ED utilisation outcomes for a cohort of elderly people who attended one of seven public hospitals within the Perth metropolitan area during 1990-2002.

Key findings from Stage 1 included that:

- Elderly males, despite accounting for only 43% of the sample were found to use ambulances at a consistently higher ASR than elderly females over the 13 year time period.

Key findings from Stage 1 included that:

- Utilisation of the EMS was found to significantly increase over the data collection period.
- Of the 309 435 episodes of ambulance utilisation, the majority of elderly patients attended ED only once (59.2%; n=106 126). However an increasing trend was observed for elderly patients who accessed ambulance and ED treatment more than 7 times between 1990 and 2002. Specifically, the ASR was 33 times greater in 2002 compared to 1990.
- Nearly 50% of elderly patients were admitted to hospital over the data collection period, with a lower mean number of ED visits (3.64; SD 5.73) compared to non admitted patients (4.41; SD 7.38).
- Emergent health problem experienced by this elderly cohort differed according to age group with those younger than 85 years of age reporting cardiac problems as the most frequent problem experienced compared to those 85 years or older who cited trauma as the most frequent health problem.
- Traumatic injury accounted for 13.3% (n=40 864) of emergent health problems experienced by this cohort with domestic trauma accounting for 75% (n=30 560) of injuries. Trauma rates in the elderly were shown to increase significantly between 1990 and 2002.
- Seasonal utilisation trends for ambulance and ED attendance across all age groups peaked during the winter months of July and August.
- Elderly patients utilised ambulances and EDs predominantly during business hours with Mondays reporting the highest proportion of presentations.
- Those aged 85 years or more were observed to have substantially higher age standardised rates for cardiac, trauma, respiratory and neurological problems than those in the younger age groups.
- Regardless of admission status those in the 85 years or more age group still reported higher rates of presentation for those who were aged 65-74 years who were admitted to hospital.
- Differences were observed with a higher percentage of non admitted patients aged 85 years or more and had higher mean attendance episodes.

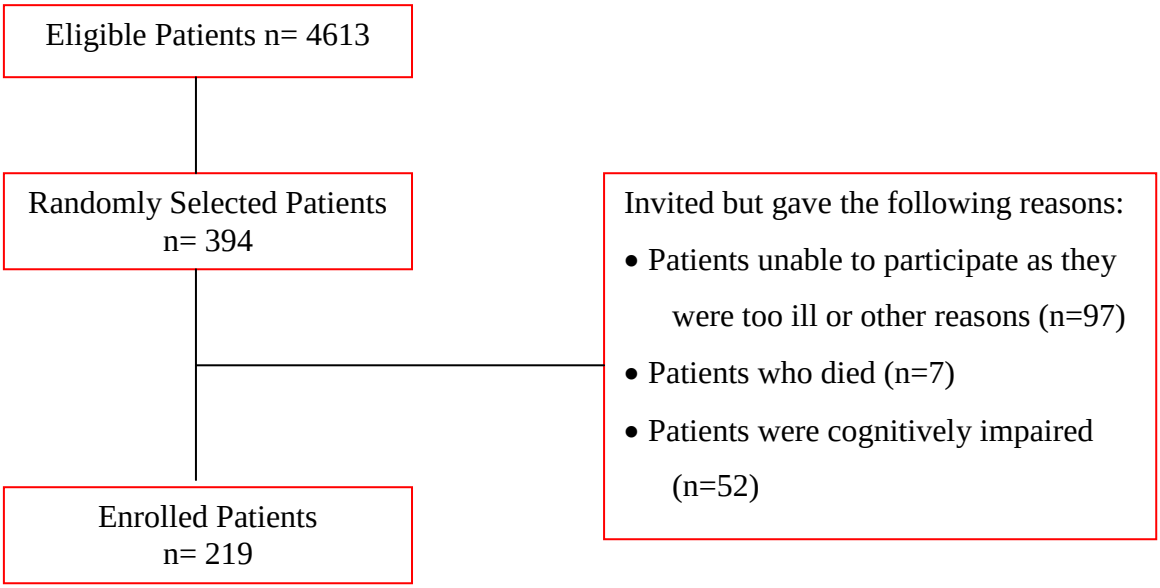
5.2 Introduction: Stage 2

Results from Stage 2 were obtained from a randomly selected group of elderly patients who attended the ED of a major metropolitan tertiary hospital. ED utilisation by elderly people aged 65 years and older was examined and characteristics and risk factors associated with ED attendance, ambulance and general practitioner utilisation identified. This part of the results chapter addressed the study objectives identified for Stage 2.

5.2.1 Attendance and Response Rate: Stage 2

During the data collection period of November 26 2007 to March 22nd 2008, 17 846 patients attended the ED of the participating hospital. Of these patients, 4613 (25.8%) were elderly patients aged 65 years or older. From the sample of 4613 elderly patients who attended ED, 394 were randomly selected (using a computerised program) to participate in the study, with a final response rate of 56% (n=219) achieved (See Figure 15).

Figure 15 Patient Recruitment Flow Diagram



5.2.2 Demographic Information on Emergency Department Attendance

5.2.2.1 Gender, Age and Education

This sample comprised 219 elderly patients (≥ 65 years) who were treated at a tertiary hospital ED in the Perth metropolitan area. Age was shown to range from 65-95 years, with a mean age of 76.5 years (SD 7.7 years). The majority of patients in this sample were female (56.1%; n=123) (see Table 14). A significant association between age and gender was observed with females in this sample found be slightly older than males (Mean age females; 77.5 yrs; SD 8 yrs; Mean age males; 75.1 yrs; SD 7.4yrs; t=2.29; df=217; p=0.023). No significant association was noted between the groups for gender (X^2 =5.05; df 2; p=0.08). The majority of patients (54.8%; n=120) reported their highest level of education as completing high school with no significant association found between age group and education level (X^2=3.36; df=6; p=0.762).

Table 14 Demographic Characteristics of ED Users By Age Group

Characteristics	65-74 Years		75-84 Years		85+ Years		Total	
	n =98	%	n=80	%	n=41	%	n=219	%
Age	98	44.7	80	36.5	41	18.7	219	100
Gender								
Male	49	50	35	43.8	12	29.3	96	43.9
Female	49	50	45	56.2	29	70.7	123	56.1
Education								
Primary School	8	8.2	6	7.5	5	12.2	19	8.7
High School	52	53.0	43	53.8	25	61.0	120	54.8
Technical School	24	24.5	22	27.5	6	14.6	52	23.7
University	14	14.3	9	11.3	5	12.2	28	12.8

5.2.2.2 Living Arrangements

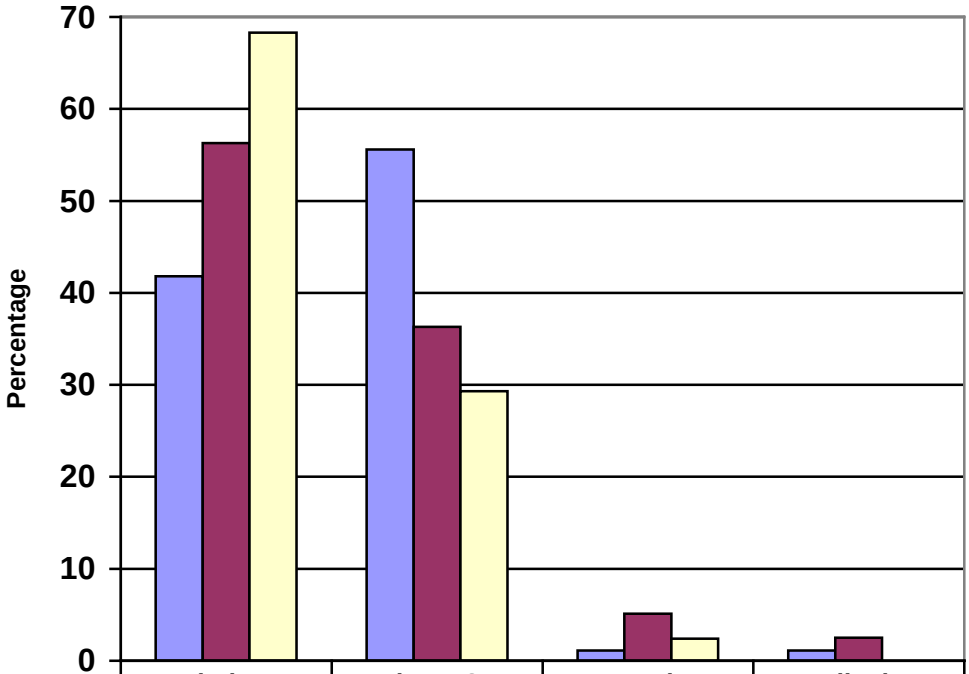
Sixty six percent (n=144) of patients reported living with family, with 32.4% (n=71) living on their own and the remainder in assisted accommodation. A significant association was observed between age group and residential status (X^2 =7.72; df=2;

p=0.021). A higher proportion of those younger than 85 years reported living with family rather than on their own. When asked who provides the patient with support when sick, the majority of patients stated their family members (n=184; 86.8%) while the remainder of the sample stated friends or health professionals.

5.2.2.3 Transportation of Elderly Patients to ED

Over half the sample reported using an ambulance to attend ED (n=114; 52%). Three people who 'walked in' were already at the hospital when they required assistance (see Figure 16). Ambulance use was shown to significantly increase with age (X^2=8.99; df=2; p=0.011).

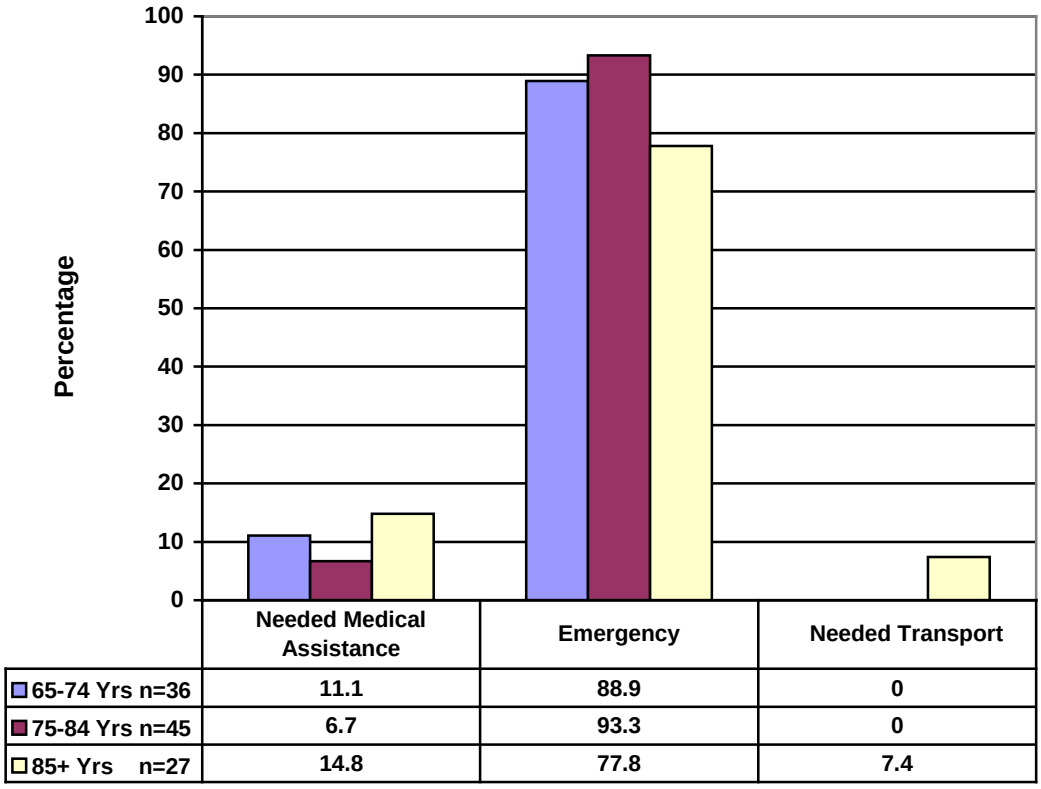
Figure 16 Mode of Transportation to ED by Age Group



	Ambulance	Private Car	Taxi	Walked In
65-74 Yrs n=98	41.8	55.6	1.1	1.1
75-84 Yrs n=80	56.3	36.3	5.1	2.5
85+ Yrs n=41	68.3	29.3	2.4	0

The majority of ambulance patients across all three age groups (n=97) reported that the main reason for using an ambulance was because they deemed that their health problem was a medical emergency (see Figure 17).

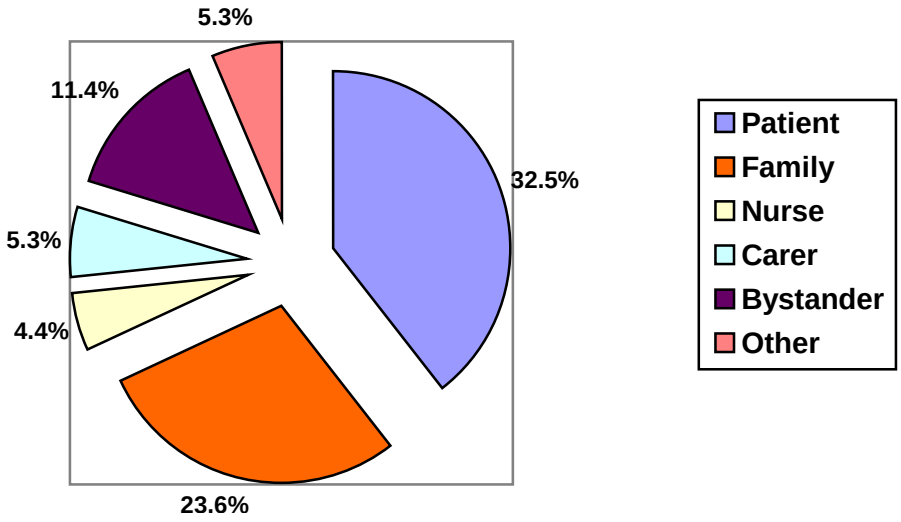
Figure 17 Reasons for Ambulance Utilisation to ED by Age Group



	Needed Medical Assistance	Emergency	Needed Transport
65-74 Yrs n=36	11.1	88.9	0
75-84 Yrs n=45	6.7	93.3	0
85+ Yrs n=27	14.8	77.8	7.4

Of the 114 patients who arrived at the hospital by ambulance, 32.5% of patients made the decision to call an ambulance themselves (see Figure 18). The next most frequent group to call for an ambulance was a family member, followed by a bystander. Patients were asked if they agreed with the decision to call an ambulance with results showing that 86.8% (n=99) of ambulance users agreeing agreed with the decision to call an ambulance. While the remainder of the sample either did not agree with this decision to call an ambulance (n=6; 5.3%) or were not sure (n=9; 7.9%).

Figure 18 Proportion of People Who Made the Decision to Call an Ambulance



5.2.3 Primary Health Care

Several items in the patient telephone interview schedule addressed issues to do with primary health care access, frequency of utilisation and satisfaction. The majority of elderly patients (n= 218; 99.5%) reported they used a general practitioner (GP) for their primary health care needs. Eighty one percent (n=178) of elderly patients reported visiting their GP within the previous four weeks, with the majority (n=137; 77%) in all age groups, attending 1-2 times in the past month (SD=2.0; range 1-10 visits). The majority of patients reported visiting the GP less than six times in the last six months (n=151; 74.4%). As the data were not normally distributed the non-parametric Kruskall Wallis test was conducted to explore the relationship between frequency of GP visits and age group. No significant difference was observed at either one month (*KW*=1.43; df=2; p=0.489) or at six months (*KW*=0.30; df=2; p=0.858).

The relationship between age and satisfaction with GP services was also reviewed and results showed that there was no significant difference between age group and satisfaction with the GP (X^2=4.6; df=2; p=0.097). The actual difference in mean satisfaction scores between age groups was quite small, ranging from 8.6-9.3. These high satisfaction scores with GP services were also reflected in the positive comments given,

with 98.2% (n=211) describing their GP as 'good', 'very good' or 'excellent', and only 1.8% of the sample stating that their GP was 'not good'.

5.2.4 Reasons for ED Utilisation

When patients were asked to state which health problem resulted in them attending ED, the most frequent health problem reported across all age groups was chest pain, which accounted for 17.3% (n=38) of all problems (see Table 15). However, this sample of elderly patients attended ED with a variety of emergent health problems.

Table 15 Reason Stated for ED Attendance by Age Group

Health Problem as stated by the Patient	65-74 Years		75-84 Years		85+ Years		Total	
	n=98	%	n=80	%	n=41	%	n=219	%
Chest Pain/ Palpitations	19	19.4	10	17.5	5	12.2	38	17.3
Falls	14	14.3	13	16.3	4	9.8	31	14.2
Respiratory Problems	10	10.2	4	5.0	4	9.8	18	8.2
Gastroenterology problems	7	7.1	10	12.5	1	2.4	18	8.2
Other problems*	7	7.1	10	12.5	11	26.8	28	12.8
Stroke	6	6.1	3	2.5	1	2.4	10	4.6
Infected/swollen Limbs	6	6.1	4	5.0	2	4.9	12	5.5
Continence Problems	6	6.1	5	6.3	2	4.9	13	5.9
Pain	5	5.1	6	7.5	3	7.3	14	6.4
General malaise	4	4.1	3	3.8	1	2.4	8	3.7
Unconscious	4	4.1	6	7.5	4	9.8	14	6.4
Eye problems	4	4.1	2	2.5	-	-	6	2.7
Lacerations	3	3.1	-	-	2	4.9	5	2.8
MVA**	3	3.1	-	-	1	2.4	4	1.8
Total	**98**	100	**80**	100	**41**	100	**219**	100

* Other problems included: shingles, fever, vertigo, allergic reactions, kidney stones, nose bleeds and side effects of chemotherapy treatment.** Motor Vehicle Accident

Seventy percent (n=153) of elderly patients stated that their current health problem was not previously diagnosed. Of those whose emergent health problem had been previously diagnosed, 59.1% (n=39) of presentations to ED were for cardiac, respiratory or pain management problems. Patients reported having these health problems from between 2 weeks and 40 years (Mean=4.5yrs; SD=7yrs). No significant association was observed between age groups and previous diagnosis (X^2=2.13; df=2; p=0.345).

Using a multiple response format, elderly people across all age groups had a variety of co-morbid conditions which included; cardiac problems, arthritis, hypertension or diabetes (see Table 16). The majority of patients (60.3%; n=132) reported 1 to 2 chronic health conditions and 23.3% (n=51) reported between 3 and 8 co-morbidities, while 16.4% of patients (n=36) stated they did not have any co-morbidities.

Table 16 Frequency of Co-morbidities by Age Group

Co-morbidities	65-74 Years		75-84 Years		85+ Years		Total	
	n=74	%	n=64	%	n=35	%	n=183	%
Cardiac	18	14.4	15	15.0	7	14.0	40	14.6
Arthritis	17	13.5	14	14.0	7	14.0	38	13.8
Hypertension	16	12.8	19	19.0	6	12.0	41	14.9
Other*	13	10.3	9	10	10	20.0	32	11.6
Diabetes	12	9.6	16	16.0	1	2.0	29	10.6
Cancer	9	7.2	7	7.0	5	10.0	21	7.6
Neurological**	8	6.4	5	5.0	2	4.0	15	5.5
Respiratory	7	5.6	1	1.0	1	2.0	9	3.3
Paraplegia	6	4.8	1	1.0	-	-	7	2.5
Visual	5	4.0	6	6.0	1	2.0	12	4.4
Gastroenterological	4	3.2	1	1.0	1	2.0	6	2.2
Thyroid	4	3.2	2	2.0	2	4.0	8	2.9
Asthma	4	3.2	1	1.0	2	4.0	7	2.5
Prostate	2	1.8	3	3.0	5	10.0	10	3.6
Total	**125**	100	**100**	100	**50**	100	**275**	100

* Other co-morbidities included: gout, leg ulcer, renal problems, high cholesterol, nerves, depression, low BP.
** Neurological co-morbidities included: stroke, tremors, motor neurone disease.

For patients under 85 years of age, the main reason given for attending ED was because they were advised to attend after contacting a health professional, who in the majority of cases was their GP (see Table 17). For those in the oldest age group, 32.5% (n=44) stated they requested to go directly to ED. No significant association was observed for reason for ED attendance and age group (X^2=8.75; df=6; p=0.188).

Table 17 Reasons for Choosing to Attend ED by Age Group

Reason	65-74 Years		75-84 Years		85+ Years		Total	
	n	%	n	%	n	%	n	%
Advised by HP* to attend ED	50	51	34	43.0	12	30.0	96	44.2
Emergency	25	25.5	19	24.1	11	27.5	55	25.4
Out of GP Hours	7	7.1	11	13.9	4	10.0	22	10.1
Pt wanted to attend ED	16	16.3	15	19.0	13	32.5	44	20.3
Total	**98**	**100**	**79****	**100**	**40****	**100**	**217****	**100**

*HP= Health Professional **Missing data

Patients were asked to rate on a scale of 0-10, the urgency of receiving medical treatment, how worried they were about their health condition and how sick or injured they were. As shown in Table 18 high mean ratings were observed across all groups for each item.

Table 18 Patients' Mean Rating of Need for Medical Treatment by Age Group

Rating	65-74 Years		75-84 Years		85+ Years		Total	
(Scale 0-10)	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Urgency in seeing a doctor	7.8	2.1	7.7	2.0	6.8	2.8	7.6	2.1
Worried about health condition	7.3	2.4	7.3	2.5	6.1	2.3	7.0	2.6
Sick/injury rating	7.6	2.4	7.5	2.1	6.5	2.3	7.4	2.2

Borderline significant differences were observed for the urgency and worry items between age group (See Table 19). While a significant difference was observed between rating of sickness or injury between age groups, with those 65-74 years ranking their sickness or injury higher than those 85 years or older.

Table 19 Comparisons between Youngest Age Group and Oldest Age Group for Urgency, Worry and Sickness/Injury Ratings

Variables	**65-74 Years** n=94* Mean Rank	**75-84 Years** n=75* Mean Rank	**85+ Year** n=37* Mean Rank	***KW*** (df=2)	**P value**
Urgency in seeing a doctor	107.4	105.1	80.3	5.86	**0.053**
Worried about health condition	107.0	107.4	81.4	5.94	**0.051**
Sick/injury rating	109.5	104.0	79.4	7.27	**0.26**

*Missing Data=13

Patients were asked to indicate the immediacy of their medical treatment. Results showed that 33% (n=61) of patients across all age groups stated that their medical problem required immediate treatment, while 15.3% of patients (n=28) reported that their health problem could be treated within 24 hours. Those younger than 85 years indicated that medical treatment was warranted within 10 minutes (see Table 20).

Table 20 Perceived Immediacy of Medical Treatment by Age Group

Medical Treatment required:	**65-74 Years**		**75-84 Years**		**85+ Years**		**Total**	
	n	%	n	%	n	%	n	%
Immediately	35	42.2	20	29.4	6	18.8	61	33.3
Within 10 minutes	4	4.8	4	5.9	1	3.1	9	4.9
Within 30 minutes	8	9.6	9	13.2	6	18.8	23	12.6
Within 1 hour	15	18.1	20	29.4	6	18.8	41	22.4
Within 2 hours	10	12.0	8	11.8	3	9.4	12	6.6
Within 24 hours	11	13.3	7	10.3	10	31.3	28	15.3
Total	**83***	**100**	**68***	**100**	**32***	**100**	**183***	**100**

*n=36 patients responded ‘not sure’ to this item.

5.2.5 Accompanying Persons

In 55% (n=120) of cases, patients were accompanied to hospital by family or friends, with no significant association observed between the age groups and the presence or absence of accompanying persons (65-74yrs=60.2%; 75-84 yrs=50%; 85+ yrs=51.2%; X^2=2.11; df=2; p=0.348).

5.2.6 Current and Previous ED Presentations

Including the current ED presentation, the majority of elderly patients (n=189; 86.3%) reported attending ED only once within the previous four weeks (SD=0.5; Range 1-5 visits). Excluding this current ED presentation, the majority of patients (n=151; 70.9%) stated they had **not** attended ED within the last six months. The remainder of the group had between one and seven previous visits to ED within the last six months. Of these previous attendances to ED, patients aged 65-74 years reported the highest frequency of visits (n=30; 44.1%), followed by those aged 75-84 years (n=25; 36.8%) and those 85 years or older (n=13; 19.1%).

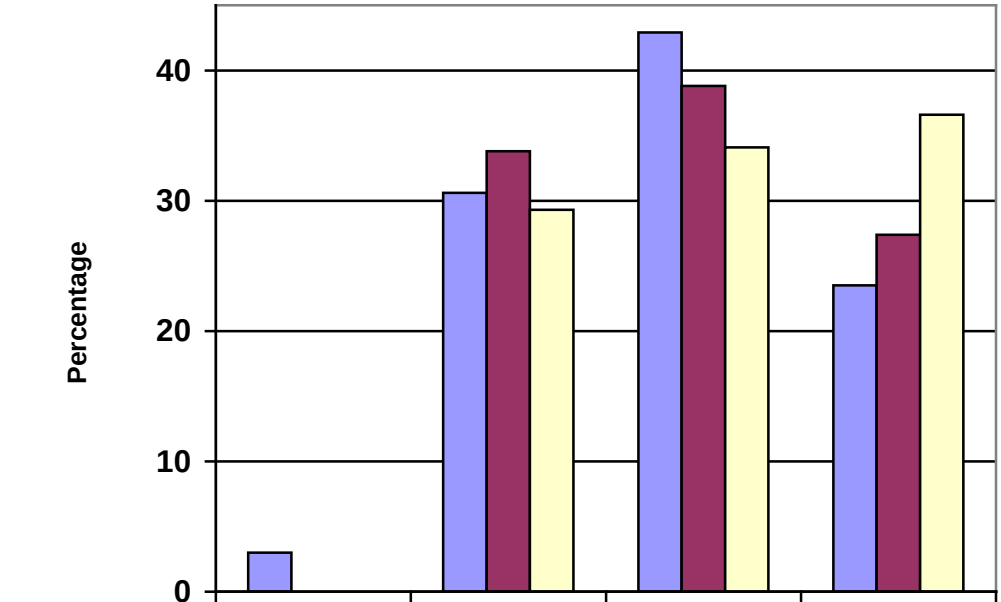
When asked the reason for previous attendances to ED, 52.6% (n=37) stated it was for the same health problem they presented with currently, with the remainder stating it was for other reasons. Health problems included: chest pain (n=6; 19.4%), shortness of breath (n=8; 25.8%), falls (n=3; 9.7%) and continence problems (n=3; 9.7%), with a variety of other problems reported.

Ninety seven percent (n= 218) of elderly patients stated there was no-where else to receive treatment for their emergent health problem other than at the ED. Only one patient stated they could have been treated by their GP.

5.2.7 Australasian Triage Scale

Using the ATS across all age groups the most frequent treatment urgency code used was ATS 3 'urgent', referring to treatment being required within 30 minutes. No elderly patients in this sample were rated as category 5, which refers to 'non-urgent' treatment (see Figure 19). No significant associations were observed between the age groups with regard to urgency status (X^2 = 25.98; df 3; p=0.627).

Figure 19 Frequency of ED Urgency Status by Group

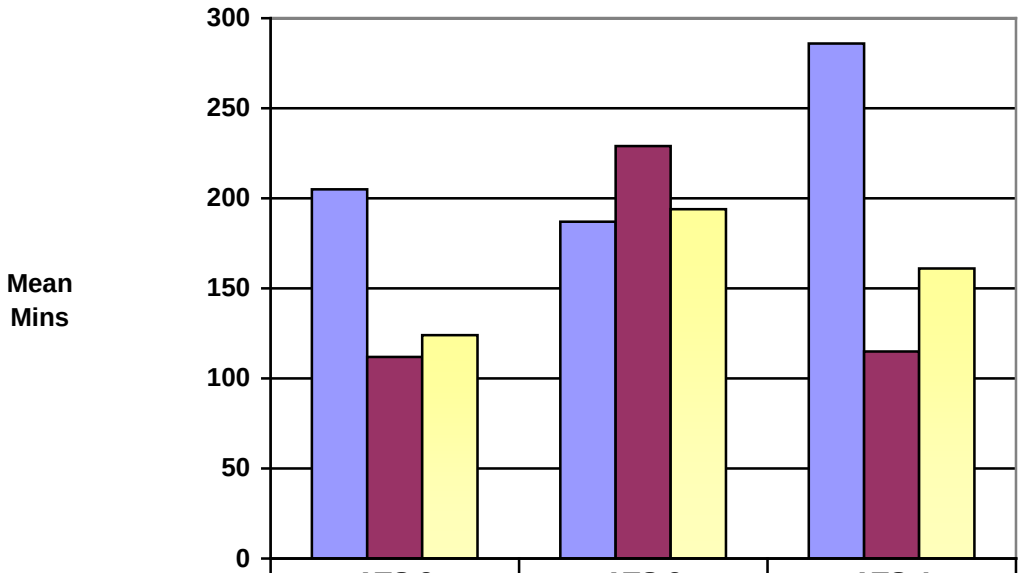


	ATS 1	ATS 2	ATS 3	ATS 4
65-74 Yrs n=98	3	30.6	42.9	23.5
75-84 Yrs n=80	0	33.8	38.8	27.4
85+ Yrs n=41	0	29.3	34.1	36.6

5.2.8 Duration of Symptoms

Patients in the younger age group (65 –74 years) who were categorized by the ATS as requiring 'emergency treatment', took longer to seek ED treatment compared to those in the older age groups (see Figure 20). Specifically, patients in the youngest age group who were triaged as 'emergency patients' took on average 205 minutes (3.42hrs) to attend ED after the onset of symptoms. In contrast those in the ATS 3 category ('urgent'), who were aged 65-74 years waited less time between symptom onset and ED presentation (187 minutes; 3.12hrs) compared to the other age groups. For patients with an ATS 4 category of 'semi-urgent', patients aged 65-74 years took much longer to attend ED (286 minutes; 4.76 hrs). No significant difference was observed between age groups with regard to symptom onset/ED attendance and ATS category (X^2 = 2.59; df 4; p=0.627).

Figure 20 Mean Duration of Symptoms (mins) by ATS Category and Age Group



	ATS 2	ATS 3	ATS 4
65-74 yrs n=98	205	187	286
75-84 yrs n=80	112	229	115
85+yrs n=41	124	194	161

5.2.9 Length of Stay in ED

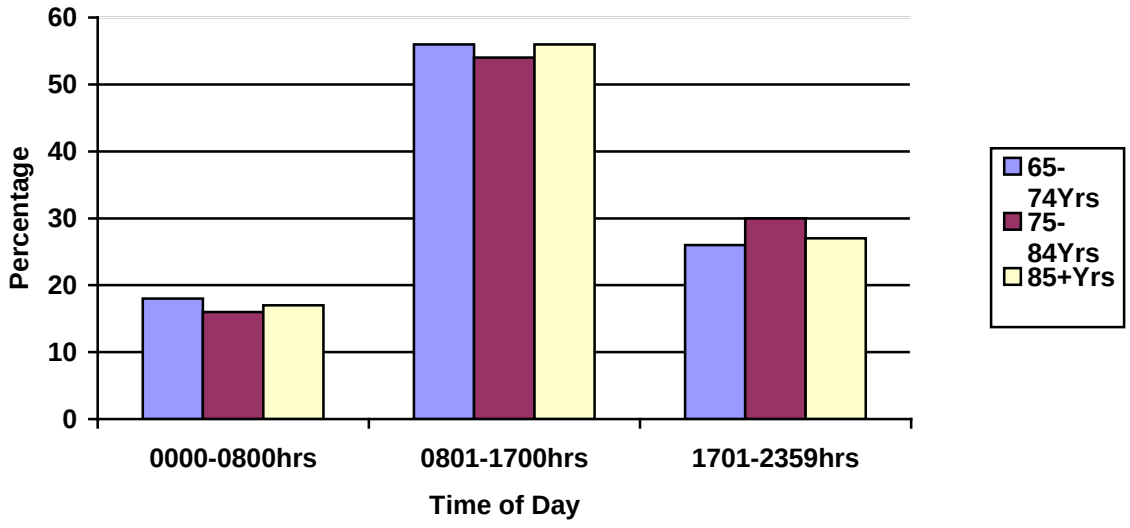
Length of stay in ED for this sample of patients ranged from 13 minutes to 23.09hrs. Results highlighted that the median time spent in the ED by elderly patients was 3.2 hours (see Table 21). No significant difference was observed for median ED LOS by age group (KW X^2 = 4.97 df 2; p=0.084).

Table 21 Mean Length of Stay in ED (HRS) By Age Group

LOS (Hrs/mins)	65-74 Years n=98	75-84 Years n=80	85+ Years n=41	Total n=219
Mean LOS	3.41	4.13	3.31	3.51
Median LOS	3.10	3.46	2.54	3.20
SD	2.51	3.05	3.41	3.06
Minimum LOS	0.13	0.13	0.16	0.13
Maximum LOS	18.44	21.14	23.09	23.09

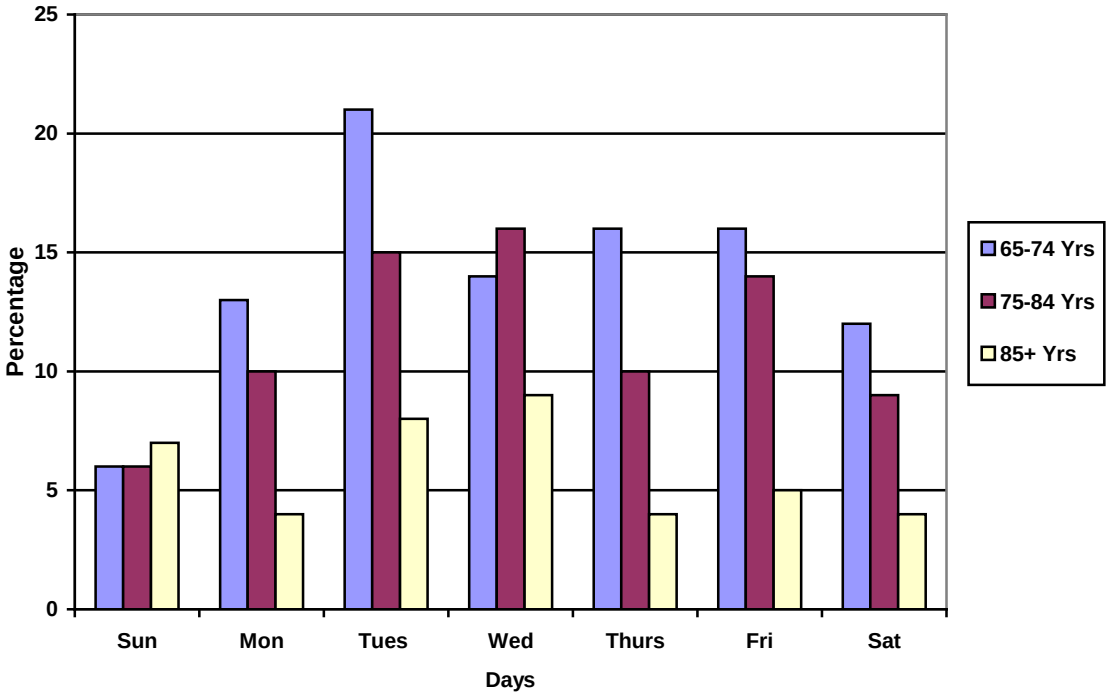
5.2.10 Temporal Characteristics of ED Utilisation by Elderly Patients

Fifty five percent of elderly patients across all age groups presented to ED predominantly during the hours of 0800 to 1700 (see Figure 21). No significant association was noted between the different age groups and the time of arrival to ED (X^2=0.28; df=2; p=0.871).



All age groups tended to follow a similar pattern when attending the ED, revealing that the highest proportion of presentations were on a Tuesday or Wednesday. Decreases in ED utilization by elderly patients were observed for the weekend days (see Figure 22).

Figure 22 Frequency of Day of ED Presentation by Group



5.2.11 Hospital Admission Status

Fifty four percent (n=118) of ED attendances resulted in the patient being treated and discharged back into the community. Comparisons based on hospital admission status showed similar proportions of patients in each age group were admitted to hospital, with no significant difference observed (X^2=1.40; df=2; p=0.496; see Table 22). A significantly higher proportion of admitted patients were observed to use an ambulance to attend ED (X^2 =7.52, df=1, p=0.007; see Table 22) and be admitted with a previously diagnosed health problem (X^2 =14.89, df=1, p=<0.000). A significant difference was observed between admitted patients who showed a slightly lower mean ED LOS of 3.27 hrs compared to non-admitted patients (4.19 hours; z=2.055 , df 217, p=0.041).

Table 22 Comparisons of Characteristics between Admitted and Non Admitted Patients (Stage 2)

Characteristics	**Admitted** n=101	**Non Admitted** n=118	**Statistic and P value**
Gender: Female	50%	61%	X^2 =2.04, df=1, p=0.153
65-74 Yrs	42.6%	46.6%	
75-84 Yrs	40.6%	33.1%	
85+ Yrs	16.8%	20.3%	X^2 =1.40, df=2, p=0.496
Lives with someone	67.3%	67.8%	X^2 =0.00, df=1, p=1.00
Completed High school	56.4%	50.0%	X^2 =0.66, df=1, p=0.415
Number of GP Visits in last:			
4 weeks	2.0 (SD1.3)	1.93 (SD1.4)	X^2 =0.63, df=1, p=0.555
6 months	6.2 (SD 4.8)	5.3 (SD 4.0)	X^2 =0.46, df=1, p=0.143
Mean ED LOS	3.27hrs (SD 2.24) hrs)	4.19hrs (SD 3.39 hrs)	X^2 =2.05, df=217, p=0.041
Median ED LOS	3.00 hrs	3.43 hrs	
Ambulance Transport Used	62.6%	43.2%	X^2 =7.52, df=1, p=0.007
Problem previously Diagnosed	44%	19%	X^2 =14.89, df=1, p=<0.000
Main Reason for ED Attendance**:**			
Falls	5.9%	21.2%	
Chest Pain	23.8%	11.9%	
Respiratory Problems	12.9%	4.2%	
Reasons for Attending:			
Advised by GP to attend ED	61.4%	34.7%	
Emergency	22.2%	28%	
Afters Hours	5.1%	14.4%	
Wanted to go to ED	10.1%	22.9%	X^2 =19.32, df=3, p=<0.000

5.2.12 Hospital Admission Model Results

Risk factors associated with hospital admission were identified from the literature and included in a logistic regression model (see Table 23). Preliminary results identified three risk factors of hospital admission, with a p value of less than 0.1, these risk factors included: Transport used to attend ED (p=0.008)

Advised by health professional to attend ED (p=0.000)

ATS (p=0.090).

Gender was found to have borderline significance and was therefore included in the final model (p=0.104).

Table 23 Factors Associated with Hospital Admission by Elderly People Presenting to ED

Variables	OR	95% CI	P value
Age Grouping			
65-74 years	1.00		
75-84 years	1.34	0.74-2.43	0.327
85 years or more	0.90	0.43-1.89	0.793
Residential status			
Lives with someone	1.00		
Lives alone	0.85	0.41-1.78	0.672
Education			
Completed high school and further studies	1.00		
Didn't complete high school or less	1.27	0.64-2.49	0.495
Patient perceived immediate medical attention required			
Other responses	1.00		
Immediate medical attention required	1.80	0.84-3.86	0.129
Transport used to attend ED			
Other transport	1.00		
Ambulance	2.65	1.28-5.46	0.008
Arrival time to ED			
Arrived to ED during business hours	1.00		
Arrived to ED after hours	1.54	0.78-3.05	0.212
Reason for ED presentation			
New health problem	1.00		
Same health problem as diagnosed at last ED visit	1.45	0.53-3.93	0.470

Table 23 Factors Associated with Hospital Admission by Elderly People Presenting to ED Cont

Variables	OR	95% CI	P value
Duration of symptom onset to ED arrival in minutes	1.58	0.28-8.48	0.609
Cardiac Problem			
All other responses	1.00		
Patient presented with a cardiac problem	1.18	0.41-3.42	0.755
Shortness of Breath			
All other responses	1.00		
Patient presented with shortness of breath	2.43	0.68-8.65	0.171
Fall			
All other responses	1.00		
Patient sustained a fall	0.46	0.15-1.38	0.165
Length of time in ED in hours	1.00	0.99-1.04	0.635
Advised by health professional to go to ED			
All other responses	1.00		
Told to go to ED by health professional	4.53	2.14-9.60	0.000
ATS*			
Categories 3,4,5	1.00		
Categories 1,2	2.04	0.90-4.66	0.090
Gender			
Females	1.00		
Males	1.78	0.88-3.58	0.104
Age grouping * Gender	1.00		
	0.67	0.43-2.87	0.149
If problem previously diagnosed			
Problem not previously diagnosed	1.00		
Problem diagnosed previously	1.67	0.76-3.72	0.204

* Due to the small sample size and for the purposes of Logistic Regression, ATS categories were grouped into those that required treatment immediately or within 10 minutes and those who required treatment within 30-120 minutes.

The full model containing all risk factors associated was statistically significant (X^2 = 58.45; df 17; p< 0.000), indicating that the model was able to distinguish between patients who were admitted and not admitted to hospital. Furthermore, the model as a whole explained between 25.2% (Cox and Snell R square) and 33.7% (Nagelkerke R square) of the variance in admission status and correctly classified 70.6% of cases.

To examine the influence of the four significant variables on admission to hospital, a final model was fitted. Results were similar with previous associations for both p values and odds ratios remaining significant (see Table 24). However, the influence of being advised to go to ED by a health professional was observed to decrease slightly, while associations for transportation to ED, ATS scores, gender and hospital admission strengthened slightly (see Table 24).

The final model containing all four risk factors associated with admission to hospital was found to be statistically significant (X^2 = 39.86; df 4; p< 0.000), indicating that the model was able to distinguish between patients who were admitted and not admitted to hospital. Furthermore, the model as a whole explained between 16.5% (Cox and Snell R square) and 22% (Nagelkerke R square) of the variance in admission status and correctly classified 71.3% of cases.

Table 24 Factors Associated with Hospital Admission for Elderly People Presenting to ED: Final Model

Variables	OR	95%CI	P value
Advised by health professional to go to ED			
All other responses	1.00		
Told to go to ED by health professional	3.75	2.02-6.97	0.000
Transportation used to attend ED			
All other types of transport	1.00		
Ambulance transportation	2.48	1.32-4.65	0.005
ATS*			
Categories 3,4,5	1.00		
Categories 1,2	2.49	1.35-4.58	0.003
Gender			
Females	1.00		
Males	1.98	1.08-3.60	0.025

* Due to the small sample size and for the purposes of Logistic Regression, ATS categories were grouped into those that required treatment immediately or within 10 minutes and those who required treatment within 30-120 minutes.

5.2.13 Ambulance Utilisation Model Results

The aim of this analysis was to identify factors associated with ambulance use by elderly people to attend ED. Table 25 shows all the variables that were fitted into the model. Being aged 85 years or more (p=0.005), perception that immediate medical attention was required (p=0.005) and the presence of a cardiac problem were found to be significant.

Table 25 Risk Factors Associated with Ambulance Utilisation by Elderly People Presenting to ED

Variables	OR	95%CI	P value
Duration of symptom onset to ED arrival in minutes	0.280	0.05-1.75	0.174
If problem previously diagnosed			
Problem not previously diagnosed	1.00		
Problem diagnosed previously	1.38	0.63-2.99	0.417
Gender			
Females	1.00		
Males	1.14	0.59-2.19	0.704
Arrival time			
Arrived during business hours	1.00		
Arrived after hours	1.43	0.75-2.73	0.274
Advised by health professional to go to ED			
All other responses (reference group)	1.00		
Told to go to ED by health professional	0.64	0.32-.1.26	0.197
Residential status			
Lives with someone	1.00		
Lives alone	1.09	0.53-2.24	0.822
Education			
Completed high school and further studies	1.00		
Didn't complete high school or less	0.95	0.49-1.81	0.869
Age Grouping			
65-74 years	1.00		
75-84 years	1.78	0.98-3.24	0.561
85 years or more	2.99	1.38-6.47	0.005

Table 25 Risk Factors Associated with Ambulance Utilisation by Elderly People Presenting to ED Cont

Variables	OR	95%CI	P value
Patient perceived immediate medical attention required			
Other responses	1.00		
Immediate medical attention required	2.81	1.38-5.75	0.005
Cardiac problem			
All other responses	1.00		
Patient presented with a cardiac problem	2.49	1.00-6.13	0.048
Shortness of Breath			
All other responses	1.00		
Patient presented with shortness of breath	2.43	0.68-8.65	0.161
Fall			
All other responses	1.00		
Patient sustained a fall	0.79	0.31-2.23	0.622
Patient has a general practitioner			
All other responses	1.00		
Patient has a general practitioner	0.24	0.01-5.20	0.360
Number of visits to the GP in the last month	0.95	0.49-1.81	0.617
Number of visits to the GP in the last six months	1.83	0.48-7.03	0.381
Age grouping * Gender	1.00		
	1.33	0.91-3.87	0.824

The full model containing all risk factors associated with ambulance used was statistically significant (X^2 = 53.45; df 16; p< 0.000), indicating that the model was able to distinguish between patients who used an ambulance to attend ED and those who used other forms of transport to attend ED. Furthermore, the model as a whole explained between 22.5% (Cox and Snell R square) and 30% (Nagelkerke R square) of the variance in ambulance use and correctly classified 69.7% of cases.

The three significant risk factors associated with ambulance use were included in a final model which was statistically significant (X^2 = 45.78; df 3; p< 0.000), indicating that the model was able to distinguish between patients who used an ambulance to attend ED and

those who used alternative means to attend ED (see Table 26). Furthermore, the model as a whole explained between 18.9% (Cox and Snell R square) and 25.2% (Nagelkerke R square) of the variance in admission status and correctly classified 69.9% of cases. The strongest risk factor associated with ambulance use was being aged 85 years or more with an odds ratio of 4.96, indicating that patients in the oldest age group nearly five times more likely to use the ambulance service to attend ED (see Table 26). Elderly patients aged 75-84 years were more than twice as likely to use an ambulance to attend ED. Patients who believed that their health condition required immediate medical treatment were 3.8 times more likely to use an ambulance to attend ED (OR 3.83), while patients whose emergent health problem was cardiac, were nearly three times more likely to use an ambulance to get to ED (OR 2.85).

Table 26 Risk Factors Associated with Ambulance Utilisation by Elderly People Presenting to ED: Final Model

Variables	OR	95%CI	P value
Age grouping			
65-74 years	1.00		
75-84 years	2.27	1.18-4.36	0.013
85 years or older	4.96	1.89-9.09	0.001
Perception that immediate medical treatment was required			
All other responses	1.00		
Immediate medical treatment required	3.83	1.98-7.41	0.000
Cardiac Problem			
All other health problem	1.00		
Patient presented with a cardiac problem	2.85	1.27-6.37	0.011

5.2.14 GP Contact Prior to ED Model Results

Forty four percent of patients (n=96) contacted their GP prior to attending ED. Logistic regression was undertaken to identify factors which may predict GP consultation prior to ED attendance. Table 27 shows all the variables fitted into the model. Seven variables were found to be significant, these included: number GP visits in the last month (p=0.071), if the problem was previously diagnosed (p=0.106), living alone (p=0.85), being aged 85 years or more (p=0.048), perception that immediate medical attention was

required (p=0.009), arrive to ED after hours (p=0.96) or experiencing a fall (p=0.048) were found to be significant.

Table 27 Risk Factors Associated with GP Utilisation Prior to ED Attendance by Elderly People

Variables	OR	95%CI	P value
Number of visits to the GP in the last month	2.319	0.93-5.77	0.071
If problem previously diagnosed			
Problem not previously diagnosed	1.00		
Problem diagnosed previously	1.946	0.87-4.36	0.106
Residential status			
Lives with someone	1.00		
Lives alone	1.908	0.92-3.98	0.085
Perception that immediate medical treatment was required			
All other responses	1.00		
Immediate medical treatment required	0.354	0.16-0.77	0.009
Age grouping			
65-74 years	1.00		
75-84 years	0.890	0.49-1.61	0.702
85 years or older	0.447	0.20-0.99	0.048
Arrival time to ED			
Arrived to ED during business hours	1.00		
Arrived to ED after hours	0.570	0.29-1.10	0.096
Fall All other responses	1.00		
Patient presented after sustaining a fall	0.333	0.11-0.99	0.048
Duration of symptom onset to ED arrival in minutes	0.554	0.07-3.98	0.557
Shortness of Breath			
All other responses	1.00		
Patient presented with shortness of breath	0.719	0.21-2.48	0.602
Cardiac Problems			
All other responses	1.00		
Patient presented with a cardiac problem	0.598	0.24-1.52	1.521
Gender Females	1.00		
Males	0.674	0.34-1.34	0.260
Number of visits to the ED in the last month	1.122	0.50-2.51	0.780
Number of visits to the ED in the last six months	0.849	0.52-1.384	0.505
Number of visits to the GP in the last six months	1.125	0.24-5.17	0.879
Urgency in seeing a Dr	1.013	0.85-1.20	0.890
Age grouping*Gender	1.013	0.94-1.06	0.941

The full model containing all risk factors associated with GP advice prior to attending ED was statistically significant (X^2 = 34.50; df 16; p< 0.011), indicating that the model was able to distinguish between patients who consulted their GP prior to ED and those who did not. This full model was found to explain between 16.6% and (Cox and Snell R square) and 22.5% (Nagelkerke R square) of the variance in GP utilisation and correctly classified 67.4% of cases.

In the final model of risk factors associated with GP consultation prior to attending ED, only three variables were statistically significant. Results showed that sustaining a fall was the strongest risk factor of GP consultation prior to ED attendance with an odds ratio of 2.56 (see Table 28). A Likert Scale of 0-10 was used to rate patients' perception that immediate medical treatment was necessary. Results showed that for each additional rating point, respondents were 0.41 times more likely to contact their GP prior to attending ED. Finally, for each additional year over the age of 85 years patients were 0.34 times more likely to consult with a GP prior to going to ED.

Risk factors associated with of GP consultation were included in a final model which was statistically significant (X^2 = 29.87; df 3; p< 0.000), indicating that the model was able to distinguish between patients who consulted a GP prior to ED attendance and those who did not seek GP advice before attending ED (see Table 28). Furthermore, the model as a whole explained between 13.2% (Cox and Snell R square) and 17.8% (Nagelkerke R square) of the variance in admission status and correctly classified 68.2% of cases.

Table 28 Risk Factors Associated with GP Consultation by Elderly Patients Prior to Presenting to ED: Final Model

Variables	OR	95%CI	P value
Fall			
All other responses (reference group)	1.00		
Patient sustained a fall	2.56	1.13-5.85	**0.025**
Perception that immediate medical treatment was necessary			
All other responses (reference group)	1.00		
Immediate medical treatment required	0.41	0.22-0.74	**0.007**
Age grouping			
65-74 years	1.00		
75-84 years	0.83	0.45-1.55	0.570
85 years or older	0.34	0.14-0.75	**0.012**

5.2.15 Summary of Stage 2 Results

This chapter explored the characteristics of elderly patients who presented to a tertiary hospital for treatment to identify risk factors associated with hospital admission, ambulance utilisation and GP consultation prior to attending ED.

Key findings from this study include that:

- Elderly patients aged 65 years or more constituted 25.8% of all ED attendances during the four month study period.
- The majority of participants were female (56%; n=123) with no significant association observed between groups for gender.
- Nearly one in three elderly people lived alone (n=71) with nearly one in two of those aged 85 years or more.
- The most frequent form of transport used to attend ED by this sample of patients was by ambulance (n=114; 52%) and ambulance use was shown to significantly increase with age (X^2=8.99; df=2; p=0.011).
- The most frequent health problem reported across all age groups was chest pain, (17.3%; n=38) of all problems. However, there was a variety of emergent health problems reported such as falls (14.2%; n=31), respiratory and gastroenterology problems each accounting for 8.2% (n=18) of presentations.

5.2.15 Summary of Stage 2 Results Cont

- Thirty percent (n=66) of the sample stated that the health problem with which they presented to ED had already been previously diagnosed. Co-morbidities such as cardiac, respiratory or pain management problems accounted for 59.1% (n=39) of those presentations to ED.
- For patients under 85 years of age, the main reason given for attending ED was because they were advised to attend after contacting a health professional, who in the majority of cases was their GP.
- Significant differences were observed for mean scores for urgency in seeing a doctor (p=0.022), being worried about health condition (p=0.023) and sickness/injury ratings (p=0.029), with patients in the younger group rating items higher than those in the oldest age group.
- After excluding the current ED presentation, the majority of patients (n=151; 70.9%) stated they had **not** attended ED within the last six months.
- When asked the reason for previous attendances to ED, 52.6% (n=37) stated it was for the same health problem they presented with currently.
- Ninety seven percent (n=218) of elderly patients stated there was no-where else to receive treatment for their health problem other than at the ED.
- Length of stay in ED for these patients ranged from nearly 4 hours to 23 hours. Results highlighted that the median time spent in the ED by elderly patients was 3.51 hours, with no significant difference observed between age groups.
- Fifty four percent (n=118) of ED attendances resulted in the patient being treated and discharged back into the community.
- A higher proportion of patients who were admitted to hospital had been transported to ED by ambulance (62.6%; n=63).
- Falls were the most frequently mentioned health problem stated by patients who were not admitted to hospital.
- A significant association was observed between hospital admission status and previously diagnosed emergent health problem (X^2 =14.89; df 1; p< 0.000).

5.2.15 Summary of Stage 2 Results Cont

- Nearly 63% (n=62) of admitted patients stated they had contacted their GP and were advised to attend ED.
- Patients who were admitted to hospital rated the urgency (p=0.043) of their medical condition and level of sickness/injury (p=0.010) significantly higher than those who were treated and released.
- The strongest risk factors for hospital admission was health professional advice to attend ED (OR 3.75), followed by using an ambulance to attend ED (OR 2.48), being triaged with an ATS category of ‘resuscitation’ or ‘emergency’ (OR 2.49) or being male (OR 1.98).
- The strongest risk factors for ambulance utilisation was being over 85 years (OR 4.96), the perception that their health condition required immediate treatment (OR 3.83) or the emergent health problem was cardiac (OR 2.85).
- Risk factors associated with GP consultation prior to attending ED were for sustaining a fall (OR 2.56), perception that immediate medical treatment was necessary (OR 0.41) or were aged 85 years or more (OR 0.34).

Chapter 6
DISCUSSION

6.0 Introduction

The overall aims of this study were to describe ambulance and ED utilisation in a cohort of elderly patients over a 13 year period and then to identify risk factors of ED presentation for a group of randomly selected elderly patients who attended a major tertiary hospital in Perth, Western Australia. This final chapter discusses the results within the context of the literature and highlights the differences and similarities with other studies that have addressed the issue of ambulance use and ED attendance by elderly people.

6.1 Characteristics of Elderly Patients and Outcomes of Ambulance and ED Utilisation (Stage 1 and Stage 2)

Ambulance and ED's are seeing an overall increase in access demand resulting in the need for health care providers to scrutinise attendances in an attempt to highlight areas for potential improvement. Given that elderly patients utilise a disproportionate percentage of emergent health care, coupled with projected increases in this segment of the population, gaining a better understanding of the determinants of ambulance and ED utilisation by elderly Australian people would seem essential.

The linked data for Stage 1 of this study did not include all patients who attended ED between 1990 and 2002 and therefore the proportion of ambulance and ED utilisation from a population based perspective cannot be reported. However, Stage 2 study findings did reveal that 25% (n=4613) of patients attending ED were aged 65 years or older despite constituting only 12% of the population.[100] Furthermore the WA ED utilisation by elderly patients has remained constant when compared to 2003 data which reported that one in four people who attended a public hospital ED in Perth was elderly.[111] But this figure is slightly less than the self reported ED prevalence results

cited in a 2007 WA Health and Wellbeing Survey, which stated that one in three ED attendances were by people aged 65 years and over.[129]

Previous EMS and ED utilisation studies have tended to divide sample populations into those equal to or older than 65 years of age or those patients younger than 65 years thereby combining all elderly patients into one group.[1, 30, 123] This study chose to stratify results into three distinct age groups to provide more meaningful data that would allow health professionals to gain a better understanding of which segment of the elderly population actually required greater access to health care services.

Despite the highest proportion of patients in Stage 1 and 2 shown to be those aged between 75 and 84 years (40.5%; n=72 583; 44.7%; n=98) respectively, it is those in the 85+ year group who were observed to have used the EMS/ED at a slightly higher rate. Specifically, those aged 85 years or more constituted only 25% of the sample in Stage 1 yet they consumed nearly 28% of episodes. Additionally, the frequency of ambulance usage by those aged 85 years or more was also shown to steadily increase over a 13 year period, surpassing those in the youngest age group from 2000 to 2002. Furthermore, those in the oldest age group were also observed to have a higher proportion of representations (52.4%) than those in the younger age groups.

International population based studies have identified that longevity is increasing with people aged 80 years or more projected to become the largest age group in the developed world and China by 2050.{Wan H, 2005 #188} US Census Bureau population statistics have also highlighted that as a result of the 'baby boomer' generation, this older age group (85 yrs+) is projected to double from 4.7 million in 2003 to 9.6 million by 2030 and increase to 20.9 million by 2050.{Wan H, 2005 #188} Australian population statistics reported that in 2007, 1.7% (n=355 300) of the national population was aged 85 years or older, with this figure projected to increase to 2.7% (n=683 100) by 2027 and to 5.6% (n=1.6 million) by 2047.[27] This type of population growth, combined with increasing ambulance and ED utilisation rates by those in the oldest age group, increases in life expectancy and the fact that people aged 85 years or more consume a

disproportionate amount of health care services[21, 26, 64, 91-93] must be taken into consideration when planning for future health care delivery.[1, 21, 26, 64, 91-93]

Gender differences in ED presentations have been reported in the literature, with females shown to utilise the ED more frequently that males. [7, 78, 81, 135] Specifically, between 56% and 77% of ED presentations were made by females aged 50 years or more. [7, 78, 81, 135] Results from this present study support those cited in the literature, with 56.9% (Stage 1) and 56% (Stage 2) of the sample found to be female. This figure is understandable given that population statistics have Australian males aged 65 years or more at an 8 to 10 ratio with elderly females.[139] Yet despite a higher proportion of females presenting to ED, results showed that males presented at a consistently higher ASR than females and were twice as likely to be admitted to hospital.

Another finding of interest obtained in Stage 2 of this present study was that one third of elderly patients lived on their own with a higher proportion (44% n=18) found to be those 85 years or older. This finding concurs with findings from several studies which have reported that elderly people living alone attend ED at a significantly higher rate than those who are younger than 65 years and that population projections have reported substantial growth in this segment of the population.[13, 45, 63] The growth in elderly people remaining in their own homes in Australia has resulted in some part from the funding made available by the Australian Federal and State Government to support Home and Community Care Programs (HACC). Funding for these programs has nearly doubled, up from $743.5 million 1996-1997 to $1.408 million in 2005-2006.[102] Finally, understanding the demographic structure of a population with regard to age composition, population size and gender ratios is important as these types of population characteristics not only reflect past events but also are instrumental in influencing current and future health care need. Specifically, the findings from this study can be used to tailor staff education and training and ensure the appropriate allocation of scarce health care resources.

6.2 Ambulance and ED Utilisation by Elderly People (Stage 1 and Stage 2)

During the 13 year study period there was a significant increase in ambulance and ED usage by elderly people. Specifically, ambulance and ED presentation rates were shown to rise from 19 501 episodes in 1990 to 30 781 episodes in 2002 which is an increase of 63%. Of greater concern is the significant increase in recurrent ambulance and ED utilisation with rates of 7 or more presentations shown to increase from 7.4 per 100 000 person years in 1990 to 249.9 per 100 000 person years by 2002.

Furthermore, 52% of the sample in Stage 2 reported using an ambulance to attend ED, with 90% of ambulance patients across all age groups, stating that their medical condition constituted a medical emergency. Australian studies have shown that elderly people were disproportionately high users of the ambulance service, with utilisation rates as high as 65%.[31, 70] Ambulance use was also shown to significantly increase with age (X^2=8.99; df=2; p=0.011), rising from 41.8% for those aged 65-74 years to 68.3% for patients aged 85 years or more. One major contributing factor in the utilisation of ambulances could be due to the fact that elderly patients in Australia are fully covered financially for this service by the Federal Government.[27] It could therefore be argued that this ambulance utilisation figure of 52% is not high given that ambulance transport is free to elderly Australians. Increased ambulance use by those in the oldest age group may be due to the fact that a higher proportion of the sample lived on their own and require transport, or they simply preferred to go directly to ED via ambulance because of seriousness of their condition.

6.3 Main Problem Codes Reported by Elderly Patients (Stage 1 and Stage 2)

Study results from both Stage 1 and Stage 2 highlighted that elderly people presented to ED with a variety of problems ranging from general malaise to injuries from a fall. The most frequent health problem reported for those younger than 85 years in Stage 1 was cardiac problems, which accounted for 16.9% (n=49 435) of attendances. Further

analysis of cardiac problems revealed that chest pain, followed by angina and dysrhythmias was the most frequently mentioned cardiac problems experienced by those patients younger that 85 years. For those aged 85 years or more trauma was reported as their main emergent health problem (18.2%; n=15 639) with the majority of injuries (n=13 282; 84.9%) occurring as a result of domestic trauma and in particular injuries to limbs. In this elderly population ASR for domestic trauma was observed to nearly double between 1990 and 2002. Reasons for this include ageing, the increasing prevalence of osteoporosis and falls in this generation of people.[56, 167] Also shown to impact on domestic trauma rates is the lack of residential accommodation, which is forcing a greater proportion of elderly people to still live in their own homes and therefore undertaking all aspects of activities of daily living generally unassisted. [102]

Further analysis of this elderly cohort also revealed that in addition to trauma, those aged 85 years or more were also observed to experience substantially higher rates of neurological and respiratory problems. These results highlight the growing demands being made on the WA health system by a small segment of the population who are aged 85 years or more. It is therefore crucial that greater understanding of the health care needs of this oldest age group is undertaken in order to meet future health care requirements.

Age standardised rates for other health problems reported by this elderly cohort in Stage 1 were also found to significantly increase overtime and these included; respiratory problems, abdominal problems, unknown illnesses, renal problems, psychosocial problems and inflammatory/musculoskeletal problems. The underlying causes of increased age specific rates of the abovementioned ED presentations by elderly patients is not fully understood and requires further investigation.

Interestingly, decreasing rates were observed for cardiac problems, debility, poisoning, and neurological problems amongst elderly patients over this 13 year period. These findings are encouraging as it suggests that progress is being made by the different health programs which promote healthier lifestyles and increase peoples' knowledge of

preventative health measures.[90] However, effective health strategies cannot solely focus on changing the knowledge, beliefs and attitudes of individuals but must also include improving the efficiency and effectiveness of health care delivery at a system wide level. For this reason 'demand management' strategies have also been implemented in WA to ensure access to quality primary care. These strategies include management of chronic diseases in the community or ambulatory models of care such as 'Hospital in the Home" which cares for acutely ill patients in the community. Additional demand management strategies which address workforce issues, improvements in technology and enhancement of communication amongst health care professionals have also been implemented.[90]

Similar health problems were observed in Stage 2 with cardiac problems accounting for 17.3% (n=38) of all attendances followed by injuries from a fall (14.2%; n=31). An old but relevant systematic review of older peoples' ED patterns of use and outcomes was undertaken by Aminzedeh & Dalziel (2002),[84] which concurred with many aspects from this current study. Specifically, Aminzedeh & Dalziel (2002),[84] reported that the most common medical and surgical diagnoses for older patients attending ED were: heart disease, cardiac dysrhythmias, cerebrovascular accidents, pneumonia, abdominal disorders and traumatic injuries predominantly as a result of a fall.[36, 84] These results are understandable given that ageing is often accompanied by deterioration in health status due to the presence of co-morbid conditions.

Studies have also shown that older people often present to the ED with acute medical problems that are further compounded by complex co-morbidities, cognitive and functional decline and social issues.[30, 85] Thirty percent of the study sample in Stage 2 stated that their presenting health problem had been previously diagnosed. Only 16% of the sample stated they did not have any co-morbidities, with 60.3% reporting between 1- 2 chronic health conditions, with the remainder reporting between 3-8 co-morbidities. It is therefore not surprising that exacerbation of co-morbidities such as cardiac, respiratory or pain management problems were the primary reason for 59.1% of ED presentations in Stage 2. Increases in these types of ED presentations are

to be expected given our ageing population and the fact that people living with chronic comorbid conditions tend to be on a downward health trajectory due to their illnesses.[168] What isn't clear is if these patients have access to an escalation plan for their chronic health problem. Such a plan, devised by their clinician, would identify strategies on how to deal with serious symptoms associated with their health problem. Thereby giving patients or their families, support in how to treat exacerbations of their chronic condition and helping to reduce anxiety associated with deciding if emergency medical treatment is needed.

This current study demonstrated a high level of accuracy between the top 4 ambulance dispatch codes and designated ambulance problem codes which ranged from 91.8% to 97.8%. These results highlight the important role played by ambulance dispatch staff is obtaining accurate information at the time an ambulance is requested. The accuracy between dispatch and problems codes for problems such as debility and unknown illness were not as accurate but given the lack of specific symptoms this finding is understandable.

Despite the ambulance urgency status coding system undergoing modifications during the data collection period, results showed that the ATS urgency code did not change substantially over time. The most utilised ATS urgency code across all age groups for the stage 1 cohort was found to be 'semi urgent' referring to treatment being required within 60 minutes. This finding provides current evidence on the clinical urgency of elderly patients requiring prehospital care and concurs with findings from an ambulance study undertaken in Australia more than 10 years ago.[89] However, urgency status in the current study was observed to change if the presenting problem was cardiac in nature, with 44% of cardiac patients assigned an 'emergency' ATS requiring treatment within 10 minutes.

6.4 Exploration of Reasons for EMS Usage by Elderly Patients in Stage 2

Contrary to overseas studies which have cited that lack of a primary care physician tends to result in greater ED attendances, results from this study found that nearly 100% of elderly patients did have access to a GP but attended ED for other reasons. Only one patient stated their emergent health condition could have been treated by their GP. When asked to state why patients chose to attend the ED, 44% (n=96) of patients stated they attended on the advice of their doctor/health professional. This finding is encouraging as it highlights that ED is not the automatic option when elderly people are experiencing an emergency medical problem. Only four studies[66, 131, 132, 134], one by Rassin et al [132] described the outcomes of decision making processes prior to ED attendance and reported that only 17.4% (n=13) of patients sought advice prior to going to hospital. In the second study, 38% (n=24 709) of patients were referred to ED by their GP.[66] It should be noted that both these overseas studies were not restricted to elderly patients.

For the remainder of the sample in the current study, ED appeared to be their only choice as patients stated it was either a 'medical emergency' or they required medical treatment outside of GP practice hours or that they simply chose to attend ED for their treatment. For this latter group, 75% (n=33) of patients attended with a condition that was not previously diagnosed. One possible explanation for this group requesting prehospital and ED assistance could be that as this was a new health problem, elderly patients had no point of reference in how to deal with it other than seek emergency help.

Younger patients were found to rate 'urgency in seeing a doctor' (p=0.022), 'worried about health condition' (p=0.023) and 'sickness/injury' ratings (p=0.029) significantly higher than those in the oldest age group. While younger patients actually sought medical advice prior to attending ED, interestingly those in the oldest age group decided to directly attend ED as they believed it was the best place to treat their emergent health problem. Another possible explanation for those aged 85 years or

more choosing to directly attend ED maybe due to previous experience for the treatment of emergency condition, however further exploration is warranted on order to gain a better understanding of elderly patients' decision making processes.

It is perfectly reasonable for patients to attend ED when there are no after hours clinics open or when their health condition is an emergency yet findings revealed that the majority of elderly patients presented to ED during business hours and were treated and discharged home. That is not to say that elderly people were presenting inappropriately, as this study did not clinically assess the appropriateness of each patients' presentation. However results do indicate that elderly people need to be made aware of other alternatives to ED attendances especially when seeking care for conditions such as constipation, urinary tract infections, blocked catheters, fever, vomiting, general malaise, shingles, nose bleeds etc.

6.5 Temporal Patterns of Ambulance and ED Usage by Elderly Patients

Results from this study concurred with evidence from the literature that elderly patients predominantly use ambulances to present to the ED during business hours with Mondays reporting the highest presentations. [52, 66, 149, 169] One reason for increased ED demand during the week maybe due to elderly people having more contact with people such as their general practitioner, home help, domiciliary nurses or even 'meals on wheels' staff who on viewing/assessing the patient's health status contacted the ambulance/GP service. Understanding temporal data patterns of ambulance and ED presentations by elderly patients has important implications in the resource provision of health care services, especially when elderly patients are known to present with more complex conditions, which require greater rates of diagnostic testing. [1, 7, 13, 85] It is therefore essential that ambulance and ED staffing levels are sufficient not only to address the expected throughput of all patients but must also reflect the clinical complexities of their elderly clients.

6.6 Comparison of Elderly Patients' Characteristics based on Admission Status

Similarities between Stage 1 and 2 were observed for admission status with 50.5% (n=90 450) of patients not admitted to hospital and a similar percentage reported in Stage 2 (54%; n=118). Additionally, at both stages, significant associations between admission status by gender, age grouping and main health problem experienced were also observed. Indicating that despite the data collection period for the two cohorts spanning different decades, the main characteristics of elderly people who presented to ED have not changed dramatically.

As mentioned, 54% of patients in Stage 2 were not admitted to hospital, a figure which is much higher than those reported by overseas studies which found that between 18% and 47% of elderly people were treated but not admitted to hospital. [21, 22, 130] Even results from a 2007 national report on Australian public hospital utilisation cited lower non admission rates with 46% of 65-74 year olds, 36% of 75-84 year olds and 32% of those older than 85 years attending public emergency departments treated and discharged home.[130]

Non admitted elderly patients in Stage 2 were also observed to be quite different from elderly patients who were admitted to hospital. Specifically, they were significantly less likely to:

- attend ED via ambulance (p=0.007).
- contact their GP prior to attending ED compared with admitted patients (p=0.000).
- have had their emergent health problem previously diagnosed (p=0.000).
- rate highly the urgency of their medical condition (p=0.043), level of sickness/injury (p=0.010) or perceived immediacy of medical treatment (p= 0.017).

Further analysis of Stage 2 results showed that non admitted patients attended ED with emergent complaints which included; fever, pain, blocked catheter, swollen joints, malaise, constipation, hypertension, allergic reactions etc. Given the economic and resource implications of emergency health care utilisation, such high attendance rates for patients who are not requiring inpatient treatment warrants further exploration. This is not to say that non admitted patients presented to ED inappropriately but more so to identify subgroups of patients who could have been treated in another setting.

Unlike other studies, which excluded participation of patients based on medical acuity, Stage 2 of this study invited all randomly selected ED patients to participate. This study was therefore able to provide more detailed evidence on associations between acuity and admission. When asked why patients chose to attend the ED, 65% of non admitted patients stated that they either required emergency medical treatment, couldn't access their GP after hours or simply preferred to attend ED. Ninety three percent of non admitted patients stated there was no where else they could go for medical treatment other than an ED, which is interesting given that all non admitted patients were registered with a GP and 44% (n=52) arrived during business hours. There findings clearly shows the confusion faced by elderly people in seeking medical assistance.

International studies have reported similar reasons for attending ED which included that patients stated they didn't know where else to go, that other care was not available to them or patients believed that treatment in the ED was better. [131-134] It should be noted that these studies presented aggregate data with no differentiation made for age. [131-134] However in the absence of studies focussing solely on elderly patients reasons for attending ED, these studies at least provide some generic evidence.

6.7 GP Utilisation by Elderly People Presenting to ED and Identified Risk Factors

Universal health care provision at the primary care level in Australia is accessed through GPs, who assess and treat patients within the community.[97] The structure of the Australian health care system enables subsidised payments for patients accessing primary care services such as visiting a GP. Additionally, in order for patients to access subsidised pharmaceuticals, it is necessary for them to visit a GP.[27] Furthermore, GP consultations for the majority of people aged over 65 years is generally charged at the scheduled medical benefits fee, enabling elderly patients to avoid the need for an up front co-payment.[98] With this type of structure in place it is understandable that 99.5% (n=218) of participants reported using a GP for their primary health care needs. Primary care utilisation in Australia is much higher than reported in USA studies (56%; n=157; 58.5%; n=207 547).[36, 131] These findings further highlights the differences in health care provision between the two countries where unlike Australia, individuals in America rather than the Government, need to underwrite the total cost of their health care. Furthermore, the study by Northington et al., (2005) which included patients aged 18 years or more also reported that at least 27% of patients actually relied on the ED for all their medical care rather than from primary care providers.[131]

Despite elderly Australians generally not needing to pay for their medical visits, data from Stage 2 on GP utilisation did not show an overall high frequency of GP visits by this cohort of patients. Specifically, findings revealed that the majority of patients had on average attended their GP only once per month, with no significant difference observed between age groups.

A substantial proportion of elderly people were found to exercise discretion when choosing to attend ED. As previously stated, elderly people who required emergency treatment reported contacting a health professional prior to attending ED. Specifically, 43% (n=94) of the sample contacted their GP while two people (1%) contacted a

Government run telephone health advice helpline and were then advised to go to hospital. Findings also showed that those aged 65-74 years were more likely to seek advice before attending ED (n=50; 52%) compared to those in the older age groups, however no significant differences was observed between the age groups for this outcome.

As previously mentioned a review of the literature located only four studies which included primary care consultation prior to attending ED but none of these studies identified primary care consultation as a predictor or risk factor of ED attendance by elderly patients.[66, 131, 132, 134] Results from this current study did reveal that elderly patients who sustained a fall were two and a half times more likely to contact their GP prior to attending ED. Additionally, if the patient perceived that immediate medical treatment was necessary, then for every increase in incremental rating, they were 41% more likely to contact a GP before attending ED. Finally, for each year over 85 years of age patients were 34% more likely to consult with a GP prior to going to ED.

6.8 Ambulance Utilisation by Elderly People and Identified Risk Factors

Results from this study revealed that the majority of elderly people used ambulances to attend ED (n=114; 52%), which is comparable to those reported elsewhere in Australia.[31, 33, 70, 89] While this finding concurs with both national and international studies, it should be noted that wide variations in ambulance utilisation rates by elderly patients have been reported in the literature. Specifically, population based studies reported more conservative ambulance utilisation rates ranging from 12% (n=11 million) to 15.4% (n=18.4 million) while smaller single site studies have reported utilisation rates as high as 65% (n=74) and 93% (n=108).[70), 97, 121, 123] Additionally, unlike overseas countries, ambulance cover for elderly Australians is free which may have some bearing on utilisation rates within this current study.

Results from Stage 2 also showed that ambulance use increased significantly with age (p=0.011), a finding that is also reiterated in the literature. [11, 12, 15, 19, 31, 33, 39] This

higher utilisation rate combined with the rapid ageing of the Australian population has serious implications on ambulance service delivery. Health care planners and policy makers must ensure that service provision will be available to meet future demand. These provisions not only include additional staff and resources but must also consider specialist education and training to address the needs of an increasing geriatric population who are living longer and presenting more frequently with acute medical conditions. Review of the current paramedic university curriculum in WA showed there were no specific units addressing geriatric education, which is a concern given that geriatric medicine is just as specialised as obstetrics or paedicatrics.[171]

Even after adjusting for gender, triage category, diagnosis, marital status, being aged 85 years or more was found to be a strong risk factor of ambulance utilisation. While this finding concurs with both national and overseas studies it should be noted that there is a paucity of Australian research in this area with available studies between 10-18 years old.[31, 33, 70, 89] This finding in it self strongly highlights the need to gain a better understanding of the health care treatment and support required by this segment of the population.

The impact of gender on ambulance utilisation in Stage 1 continues to be contentious with significant gender differences by females within the different age groups observed but not when ambulances utilisation ASR were performed. Furthermore in Stage 2 males were shown to have a slightly higher likelihood of ambulance utilisation (OR 1.14) compared to females but this finding was not significant.

Between 78% and 93% of Stage 2 patients from all three age groups reported calling an ambulance because they needed emergency medical treatment. Patients who believed that their health condition required immediate medical treatment were found to be 3.8 times more likely to utilise an ambulance to attend ED (OR 3.83), while elderly patients whose emergent health problem was cardiac were 2.8 times more likely to also use an ambulance to attend ED (OR 2.85). These findings are not surprising given that elderly people who utilised the EMS were observed to be in more urgent need of

clinical treatment than younger patients, as observed by higher acuity scores, [17, 45, 60] admission to hospital [7, 13, 15, 23, 52, 85] and longer lengths of stay. [60, 84]

6.9 Hospital Admissions by Elderly Patients and Identified Risk Factors

Several national and international studies have clearly demonstrated that elderly patients are more likely to be admitted to hospital as they present with more complex and severe health problems.[1, 7, 18, 30, 31, 35, 45, 47, 52, 70, 84, 86] This study reported that nearly 50% (n=88 756) of Stage 1 patients were admitted to hospital while slightly less were admitted in Stage 2 (46%; n=118). These finding essentially concur with two overseas population based studies which reported admission rates of 43% and 46%.[1, 7] However, it is slightly lower than previously reported Australian and US results where hospital admissions by elderly people ranged between 52-59%.[13, 21, 31, 76],[126] Building on these descriptive results are findings from both national and international studies which have undertaken regression modelling to identify that elderly patients were 3-5 times more likely to be admitted to hospital than younger patients.[31, 70, 76, 80, 143]

Despite the small sample size observed in Stage 2, findings are still useful as they provide updated evidence on the hospitalisation of elderly people within the current Australian context. Stage 2 results which reported an admission rate of 46% concur with findings from older Australian studies such as those stipulated by Gray et al., who reported that hospital bed utilisation by elderly patients over a 10 year period (1993 to 2002) had actually remained stable at 47%.[18] However, in a more recent study published in 2007, 35% (n=2.38 million) of separations from both public and private Australian hospitals were by those aged 65 years or more, who occupied 47% of all bed days.[130] With elderly Australians comprising only 13.2% of the Australian population, it is interesting that nearly half of all hospital beds are occupied by this segment of the population.[130]

A further explanation for increased utilisation of hospital beds/admissions by elderly people is their proximity to death.[144, 145] Elderly patients aged between 65 and 74

years in their last year of life were observed to have an average of 2.9 hospital admissions in 1985 rising to 4.3 admissions in 1994.[145] Research has revealed that hospital admissions in the last year of life increased consistently, with a strong correlation observed between proximity to death, age and hospital admission.[145] Risk factors associated with hospital admission were examined in this current study, with the strongest risk factor of hospital admission found to be medical advice to attend ED. Elderly people who contacted their GP were 3.75 times more likely to be admitted to hospital. While numerous studies identified characteristic of ambulance use, ED attendance and admission to hospital by elderly people, no such study included analysis of medical advice prior to hospital admission as a risk factor. This finding is of interest and while it highlights the important role that GP's play within the health care system, it really requires further exploration.

Other risk factors of hospital admission included using an ambulance to attend ED (OR 2.48), being triaged with an ATS category of 'resuscitation or emergency' (OR 2.49) or being male (OR 1.98). One Australian study by Clark et al.,[33], did identify predictors of emergency prehospital care but not specifically focusing on older patients. Clark et al.,[33] reported that admitted patients were more than twice as likely to have used an ambulance to attend ED (PR 2.15), which is comparable to the current study's findings.[33] Conversely, an older population based study of 100 million patients, which did look at elderly patients use of EDs throughout the USA, found that elderly patients were 4.75 times more likely to use an ambulance to attend ED compared to younger patients. This result is more than double what was observed in this current study but this is likely to be attributed to the huge discrepancy between the samples sizes and the different methodologies used.

Only one study was found that assessed the ATS and hospital admission. Results from this study by Chu et al.,[30] which were stratified by gender and age grouping (65-79 years or 80 years or more) showed that elderly females 80 years or more were 32% more likely to be admitted with an ATS score referring to 'resuscitation' than younger females. There was no difference noted between the male age groups or for the ATS

categories. As previously mentioned, males in this present study were found to have nearly double the risk of being admitted to hospital. This finding adds to the literature, with many studies citing evidence to corroborate or refute such a relationship.[7, 20, 45, 60, 78, 81] It is interesting that elderly males were shown to have an increased risk of being admitted, indicating that men possibly present at a later stage with their emergent medical conditions.

6.10 Representation to ED by Elderly Patients

Representation rates to ED by elderly patients in Stage 1 was relatively small with only 1.4% (n=4 200) of patients returning within 7 days of the index episode. This figure increased slightly to 3.4% (n=10 672) for patients who represented within 28 days. Previous studies have highlighted that elderly patients are more likely to return to the ED within 28-30 days of the index presentation, however, these studies reported much higher representation rates of between 19.3% and 39.4%.[46, 50, 54]

6.11 Limitations and Recommendations (Stage 1 and Stage 2)

Stage 1

The retrospective design of this study is recognised as a limitation with the possibility that there were errors and omissions in manually inserting data into large record linkage datasets used. However, the use of probabilistic methods of matching and linking ensured the integrity of the data. Furthermore every variable within the TEPEDD was extensively checked and cleaned. This meant that correct response codes for each variable were checked, missing data identified and duplicate data removed.

As a result of this extensive cleaning, detailed information on actual ambulance treatment given to elderly patients was not able to be analysed due to the majority of the data fields being incomplete. This is not to say that ambulance officers were not compliant in recording aspects of care but more likely used different assessment/treatment modes for different emergent health problems. It is therefore

recommended that to enhance data validity, future population based studies also include a manual review of a proportion of ambulance patient care records.

Another limitation of Stage 1 is that TEPEDD did not include all elderly people who attended ED regardless of their mode of transport. While the original intent of this study was to focus on the determinants and outcomes of utilisation by elderly patient who used ambulances to attend ED, hindsight clearly indicated that a much broader perspective was needed.

Similarly, the fact that TEPEDD was not complimented by detailed ED data for each of the 309 435 presentations nor was any community medical information is clearly a limitation. Despite these limitations, study results from Stage 1 provide important population based findings from a unique database that is outcome linked. Secondly, data were collected from a geographically isolated community of over 1.6 million people, which is overseen by one main public health authority and supported by one EMS provider. With very few recent population based studies undertaken in the area of EMS/ED utilisation, this study's findings greatly add to the literature from a local, national and international perspective. Future research studies would benefit from ensuring that full ED assessment and treatment data are included to provide a complete health care episode. However, future record linkage studies should obtain ED data to enable a complete patient journey to be reviewed.

The data collection period used for this population based study (1990-2002) is now relatively old, nonetheless the results of this study do provide substantial evidence as to the utilisation trends and outcomes for this cohort of elderly patients who come from one geographical area and provide population based evidence within the Australian context.

Stage 2

A methodological weakness of Stage 2 included using only a single hospital site for data collection. It could be argued that the use of a hospital which is situated within an affluent area may have elicited a demographically different segment of the population. However, this hospital is the only tertiary hospital within the northern metropolitan corridor of Perth Western Australia and as such includes a catchment area which encompasses all socioeconomic index categories.

Despite randomly selecting patients to participate in this study, selection bias is inherent with only 56% of the sample agreeing to participate. Nonetheless, unlike others studies which set strict exclusion criteria such as acuity of illness or injury, this current study did not. Every one of the 4 613 elderly patients who attended ED during the data collection period was eligible to be randomly selected to be interviewed. Selection bias was therefore a result of patients themselves choosing to participate or not. However, it is noted that patients who were not well, chose not to participate. Similarly, patients who were cognitively impaired or did not speak English did not participate either thereby limiting the generalisability of the results. Further validation and reliability testing of the TEDEPI schedule is required both in different settings and with different raters. It is acknowledged that a slightly large sample of patients could have been used during the pilot stage and also for the inter rater reliability testing.

6.12 Policy Implications

The increasing EMS/ED utilisation rate by elderly people combined with the rapid ageing of the Australian population has serious implications on service delivery. Emergency Medical Service and ED providers need to:

- Enhance their treatment protocols and best practice guidelines to address the distinct health care needs of elderly patients who utilise the EMS/ED services.

Emergency Medical Service and ED providers need to:

- Implement strategies such as 'escalation plans' that assist elderly patients presenting to ED to better manage their chronic health conditions in the community thereby preventing or postponing subsequent visits.
- Ensure that both ambulance and ED staff are educated to deal with the complex health care issues associated with the treatment and management of elderly patients.

6.13 Conclusion

This appears to be the first population based study in Australia to determine the frequency and characteristics of ED attendance by elderly people coupled with elderly peoples actions/reasons prior to attending hospital. This study also showed that elderly people are using ambulance and ED's at significantly higher rates than in 1990. With trends showing distinct differences in utilisation based on age, especially by those aged 85 years or more who are substantially higher users of these services (ASR ranging between 40 000 and 51 000 per 100 000 person years). This outcome is to be expected as this age group are at greatest risk of requiring emergent services, given that the majority of these patients are living with serious chronic conditions such as angina, congestive heart failure, stroke and respiratory problems. With their health compromised and increasing frailty, elderly people aged 85 years or more are essentially on a downward trajectory with regard to their health. It is therefore acknowledged that this segment of the population require and will continue to require, prehospital and emergency care services more frequently than those who are younger. Building on this premise, health care professionals and planners need to focus on strategies such as individually designed health escalation plans that have the potential to lengthen the periods between emergency service utilisation. These types of strategies will help relieve the demand made on the health care system, especially by this group of patients.

Results from this study actually challenge some of the negative stereotypes about ambulance and ED utilisation by elderly people. Firstly, the ASR for ambulance and

ED utilisation by those aged 65-74 years was observed to remain stable between 1990 and 2002, with rates just below 10 000 per 100 000 person years. Secondly, the majority of elderly patients in this cohort (59.2%; n=106 126) only utilised these services once during the 13 year data collection period. This is a surprising finding given that this dataset comprised of all ambulance and ED attendances to all the public hospitals within the Perth metropolitan area made by elderly people. It could be argued that elderly patients did attend the ED more frequently but did not use an ambulance as their primary mode of transport. However, the significant association found between age and increasing ambulance use this is less likely to have occurred.

Currently, older Australians are living longer and healthier lives than previous generations. Findings from this study clearly demonstrate the medical and demographic disparities between those aged 65 years compared those aged 85 years old or older. In particular, results highlight that health care professionals and health policy makers can no longer crudely identify anyone over 65 years as elderly, as health care service utilisation is vastly different for those aged 85 years or more. As such health care planning must also be cognisant of these differences in age. If baby boomers continue this trend of healthy ageing then demographers and health care providers will need to shift their health care delivery focus to the older age group which are set to become the largest segment of the population within the western world.[104]

Despite the current economic situation, improvements in socioeconomic status amongst elderly Australians continue as observed by rising levels of education, incomes and general living conditions.[27] These improvements play an important role in enabling elderly people to live independently, prevent or manage chronic health conditions more effectively and facilitate functional well being by being able to perform activities of daily living. Research has also provided evidence of how advances in medical care and pharmaceutical treatments have been attributable to reducing disability and health care needs previously required in old age. [27, 50, 73, 140, 170] Findings from this current study provide further evidence on the health care needs and demands made by this

cohort of elderly patients and also enable the comparison of standardised data across locations and countries.

Seventy percent of elderly patients stated that their emergent health problem was not previously diagnosed. With patients having no frame of reference on how to deal with their health crisis such as a fall (20.3%) or chest pain (11%) it would seem reasonable for them to seek ambulance and emergency medical assistance when their only other alternative was their GP. However, given the increasing demand placed in the health care system, strategies such as medically approved protocols to deal with the less urgent health problems must be implemented and evaluated if the culture that all emergency calls must attend ED is to be challenged. Public awareness, education and acceptance that not all emergency ambulance calls require ED treatment is imperative. Educating the public and making them more discerning as to their emergency treatment options would benefit patients and the health care system as a whole, by ensuring the public are treated by the most appropriate health care professional in the most appropriate setting. In some ways elderly patients are becoming more discerning when seeking emergency assistance as demonstrated by their attempts to obtain medical advice from GP's prior to attending ED. This finding is encouraging but further improvements are still warranted.

Multivariate logistic regression analysis was undertaken to identify risk factors of GP and ambulance use and hospital admission. As would be expected findings revealed that use of an ambulance and higher ATS scores resulted in patients being were nearly two and a half times more likely to be admitted to hospital. Interestingly, patients who contacted their GP for advice prior to ED attendance were nearly four times more likely to be admitted to hospital.

The strongest risk factor for ambulance utilisation to attend the ED was being aged 85 years or more with older patients four times more likely to seek prehospital care and assistance to attend the ED (OR 4.15). Additionally, if there was a perception that the patients' health condition required immediate medical treatment then they were three

times more likely to use an ambulance (OR 3.13) or if their emergent health problem was cardiac (OR 2.86). Given that a higher proportion of patients aged 85 years or more lived on their own, obtaining ambulance transport to attend ED may be their only option, with results showing that ambulance utilisation was found to significantly increase with age. Additionally, one major contributor to the utilisation of ambulances could be due to the fact that this service is free of charge to elderly Australians.

Finally prehospital and emergency medical care both have a strategic position in the health care system. As the main entries into the hospital system, the efficiency of the ambulance service and the ED is integral to the smooth running of patient care. For this reason greater understanding of emergency health care usage by elderly people is vital if appropriate health planning and reforms are to meet these demands made by this fastest growing segment of the population. Results from this study have provided empirical evidence on ambulance and ED utilisation by elderly people within the Australian context and have also identified several risk factors or hospital admission and ambulance and GP utilisation.

Chapter 7

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APPENDIX

Appendix A

Telephone Interview Questions of Elderly Patients on why they attended ED.

For each item tick or write in the participant's response.

1. How did you arrive at the hospital?

Ambulance	Private vehicle	Taxi	Bus	Volunteer transport	Walked in	Not Sure

If ambulance not used go to Q 6

2. Do you have Ambulance Cover?

Yes	No	Not Sure

3. Who made the decision to call an ambulance for you?

Patient	Wife/husband	Family	Friend	Nurse	Carer

GP	Bystander	Not Sure	Other

4. At the time did you agree with the decision to call for an ambulance?

Yes	No	Not Sure N/A

5. What was the main reason for calling an ambulance?

Needed assistance	Health problem was an emergency	Couldn't get into a GP	Needed transport	Insured so able to use the ambulance	Not Sure

Other

6. Do you use a health care practitioner? Who is it

Yes	No	Not Sure

6a If you don't have a health care practitioner, why not? **Go to Q 10**

7. Who is your health care practitioner?

GP	Clinic Nurse	Naturopath	Psychiatrist	Medical Specialist

Health Care Direct	Not Sure	Ed Dr's	Other

8. How would you describe your health practitioner?

9. On a scale of 0-10, with 0=not satisfied and 10=extremely satisfied, how satisfied are you with your health care practitioner?

0	1	2	3	4	5	6	7	8	9	10

10. Have you visited a health care practitioner within the last month?

Yes	No	Not Sure

10.a If yes how many times have you visited them in the last month?

11. Have you visited a health care practitioner within the last 6 months?

Yes	No	Not Sure

11a If yes how many times have you visited them in the last 6 months?

These next questions are about your recent visit to the ED.

12. What was the health problem that led you to go to the ED?

13. What were your reasons for choosing to go to an ED with this health problem?

14. Has this a health problem been diagnosed previously?

Yes	No	Not Sure

15. How long have you had this particular health problem? (state in days/weeks/years)

16. Do you have any other long term health problems?

17. From the time the symptoms/injury occurred, how much time elapsed before you presented to ED?

Weeks	Days	Hours	Not Sure

18. On a scale of 0-10, with 0= not urgent and 10=extremely urgent, how urgent was it that you saw an ED Dr?

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

19. On a scale of 0-10, how worried were you about the condition that brought you to the ED?

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

20. On a scale of 0-10, how sick/injured did you believe you were?

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

21. Did you believe that your health problem required:

Immediate medically treatment	Medical treatment within 10 mins	Medical treatment within 30 mins	Medical treatment within 1 hr	Medical treatment within 2 hrs	Medical treatment within 24 hrs

More than 24 hrs	Not Sure	Other

22. Did someone accompany you to ED?

Yes	No	Not Sure

23. How many times in the last month have you visited an ED?

24. How many times in the last 6 months have you visited an ED?

25. What was the reason for those visits?

Same health problem as mentioned above	Not Sure	Other

26. Apart from ED is there any other place where you could have received treatment for your recent health condition?

27. Do you have support when you are sick/injured at home?

Yes	No	Not Sure

28. Who provides you with support when you are sick/injured at home?

Patient	Wife/husband	Family	Friend	Nurse	Carer

GP	Not Sure	Other

29. Have you ever been married?

Married	Never Married	Separated Divorced	Widowed	Other

30. What is the highest level of education that you completed?

No formal schooling	Some primary school	Finished primary school	Some secondary or high school	Completed high school	Some technical college

Graduated technical college	Accepted to university	Bachelor's Degree	Master's degree	PhD	Other

31. Residential Status:

Lives alone	Lives with Family	Lives in aged care hostel	Lives in aged care nursing home	Lives in retirement village with call bell access* * if not stated ask if call bell avail

Other

OFFICE USE:

32. Age in years

33. Gender

Male	Female

34. Time of presentation (24hrs clock):

35. Date of presentation

36. Day of presentation

37. After hours presentation

Yes	No

38. ATS

39. LOS in ED (hrs)

40. LOS in hospital (days/hrs)

41. Primary Diagnosis