

# A comparison of emergency department utilization by elderly and younger adult patients presenting to three hospitals in Hong Kong

Veronica W. T. Yim · Colin A. Graham ·  
Timothy H. Rainer

Received: 13 November 2008 / Accepted: 8 January 2009 / Published online: 14 February 2009  
© Springer-Verlag London Ltd 2009

## Abstract

**Background** The elderly population is increasing in absolute and relative terms in most developed countries, and this is predicted to have a major impact on the delivery of health care, particularly acute and emergency services. The aim of this study is to describe the pattern of utilization of emergency department (ED) services in Hong Kong by the elderly and to compare it to the utilization by younger adults. **Methods** Data on ED visits to three acute hospitals in the eastern New Territories were retrieved from a central computerized database of ED attendances. Data on all adult patients (aged  $\geq 15$  years) who attended the three EDs in 2006 were analyzed retrospectively. Patients aged 15 to 64 years were defined as younger adults; patients aged  $\geq 65$  years were defined as elderly. The attendance rate, ED consultation process, hospital admission rate and disease pattern of the two age groups were compared.

**Results** Elderly patients required significantly more emergency care resources than younger adults. Elderly ED patients were brought to hospital more frequently by ambulance (42.8% vs. 14.8%,  $p < 0.0001$ ) and required hospital admission more often (45.0% vs. 15.5%,  $p < 0.0001$ ) than younger adults. A significantly higher proportion of elderly patients were triaged as being in the critical, emergency or urgent categories compared to younger adults (44.4% vs. 18.2%,  $p < 0.0001$ ). Laboratory tests, radiography and CT scanning

were performed on elderly patients more frequently than on younger adults ( $p < 0.0001$ ), and their lengths of stay in EDs and emergency wards were significantly longer ( $p < 0.0001$ ). Neurological symptoms and chest pain were the most common presenting symptoms in elderly ED patients.

**Conclusion** With the foreseeable rapid growth of the elderly population, ED utilization by the elderly will increase. Health service delivery, including that in the ED, needs to take account of the specific features and requirements of the elderly population in each locale.

**Keywords** Elderly · Emergency department · Acute services · Hong Kong · Epidemiology

## Introduction

The increasing proportion of aged population is a worldwide concern. In 2003, 12.5% of the population in Hong Kong was aged over 65 years. It is postulated that by 2033, the proportion of the population that is elderly (defined as  $\geq 65$  years old) will increase to 25% [1]. The impact of this demographic change on the use of medical services is of great interest to health-care planners. Emergency departments (EDs) in Hong Kong are often utilized as the gateway to medical care. Local data from one large teaching hospital (Prince of Wales Hospital) suggested that 25% of ED patients were aged  $\geq 65$  years. Elderly patients constitute a disproportionately large group of ED attenders with respect to the proportion of elderly people in the general population. With its rapid growth, the consequences of the increasing aging population on ED service utilization need to be addressed.

The aim of this study is to describe the pattern of ED utilization of the elderly in the eastern New Territories in Hong Kong. Differences in ED service utilization and the

V. W. T. Yim (✉) · C. A. Graham · T. H. Rainer  
Accident & Emergency Medicine Academic Unit,  
Chinese University of Hong Kong, Prince of Wales Hospital,  
Shatin, New Territories, Hong Kong SAR  
e-mail: veronyim@hotmail.com

C. A. Graham  
e-mail: cagraham@cuhk.edu.hk

T. H. Rainer  
e-mail: thrainer@cuhk.edu.hk

ED consultation process in elderly patients (aged  $\geq 65$  years) and younger adults (aged 15 to 64) will be compared. This may provide a basis for planning the development of geriatric emergency medical services in the future in Hong Kong by identifying the emergency care needs of this special population.

## Methods

### Setting

The hospitals included in this study were those acute hospitals of the New Territories East cluster, namely Prince of Wales Hospital (PWH), Alice Ho Mui Ling Nethersole Hospital (AHNH) and North District Hospital (NDH).

PWH is an acute general hospital with 1,200 beds and is the primary teaching hospital of the Chinese University of Hong Kong. PWH functions as the regional major trauma center for the northeast New Territories, with all medical, surgical and intensive care facilities on site. It is the tertiary referral center for the New Territories East cluster. The ED has an annual attendance of around 150,000 patients. The Emergency Ward can accommodate 16 patients.

NDH is an acute district general hospital situated near the Hong Kong-China border. It has 600 beds with four in-patient specialties: general medicine, general surgery, orthopedics and pediatrics. The annual ED attendance is around 110,000 patients. The Emergency Ward can accommodate 26 patients.

AHNH is an acute general hospital with 400 in-patient beds, providing clinical services in general medicine, surgery, pediatrics, ophthalmology, otorhinolaryngology and orthopedics. The annual ED attendance is around 120,000. There are eight beds in the Emergency Ward in AHNH.

### Patients and definitions

All adult patients (aged 15 or above) who attended any of the three hospitals' EDs within the calendar year 2006 were included in the study. Patients aged 15 to 64 years on admission were defined as younger adults, and patients aged 65 years or above were defined as elderly for the purposes of the study. The emergency ward is a short-term care facility adjacent to the ED where patients with selected conditions (mild respiratory disease, mild heart failure, poor mobility, etc.) are admitted for monitoring and treatment. A designated specialist emergency physician is responsible for taking care of patients in the emergency ward at all times. Inpatient admission is defined as admission to a hospital ward (other than the emergency ward) under the care of a specialist who is not an emergency physician.

### Data source

Data were retrieved from the Clinical Data Analysis and Reporting System (CDARS) of the Hospital Authority of Hong Kong. CDARS is a computerized database that allows retrieval of clinical information captured through other computer systems in the hospital authority. CDARS has been in operation since 2002, and analysis of ED attendances has been possible since 2005. Data on patient age, gender, laboratory and radiological investigations, emergency ward and inpatient hospital admissions and lengths of stay were all retrieved for each patient and categorized by hospital and by age group (young adults and elderly). A retrospective analysis was undertaken.

### Statistics

The chi-square test was used to compare categorical or dichotomous variables. The Mann-Whitney test was used to compare total length of stay in EDs and in the emergency ward as data were not normally distributed.  $P < 0.05$  was considered statistically significant. Data were analyzed using SPSS version 13.0 (SPSS Inc., Chicago, Ill.).

## Results

Younger adults constituted 61% of the total ED attendance, while elderly patients constituted 24%. Table 1 shows the ED attendances by age and hospital for 2006. Of the patients, 14.8% (33,262/224,921) in the younger adult

**Table 1** Emergency department attendances, admissions to inpatient ward and number of ambulance admissions to ED, by age group and hospital

	Hospital	Age 15-64	Age $\geq 65$	Total
ED attendances	AHNH	71,952	23,232	115,044
	NDH	65,572	26,670	111,627
	PWH	87,397	37,721	143,852
	Total	224,921	87,623	370,523
ED attendances brought by ambulance	AHNH	6,625	9,077	
	NDH	12,570	13,401	
	PWH	14,067	15,066	
	Total	33,262	37,544	
ED patients who were admitted to inpatient wards	AHNH	8,159	11,089	
	NDH	9,199	12,855	
	PWH	17,621	15,511	
	Total	34,979	39,455	

ED: Emergency department

AHNH: Alice Ho Mui Ling Nethersole Hospital

NDH: North District Hospital

PWH: Prince of Wales Hospital

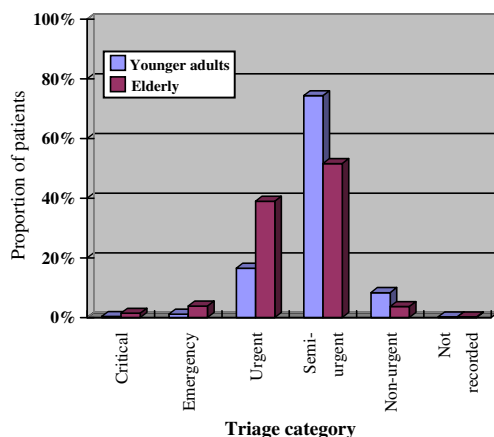
group were brought to the ED by ambulance compared to 42.8% (37,544/87,623) of the elderly group ( $p < 0.0001$ ,  $\chi^2$  test).

Figure 1 shows the proportion of elderly and younger adult patients in different triage categories. Elderly patients presented to EDs with more serious conditions than younger adults. Of the elderly patients, 44.4% (38,872/87,623) were triaged to the critical, emergency or urgent categories compared to 18.2% of younger adults (40,975/224,921) ( $p < 0.0001$ ,  $\chi^2$  test).

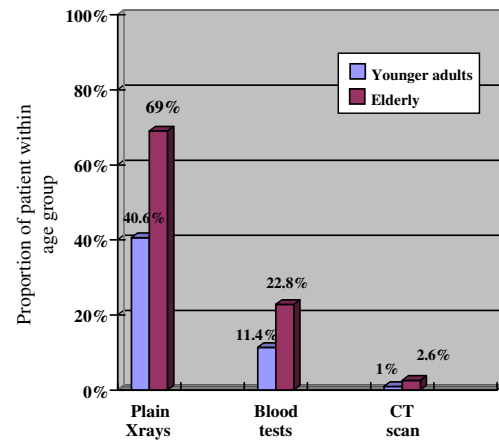
Elderly patients utilize more resources during the ED care process. Figure 2 shows the proportion of patients with investigations performed in ED. More diagnostic tests were performed on elderly patients compared to younger adults. The differences in the two groups are statistically significant for plain radiography, laboratory tests and CT scanning ( $p < 0.0001$ ,  $\chi^2$  test).

The difference in the process of care for elderly and younger adults is further demonstrated in their difference in the total length of stay in the ED. Table 2 shows the median length of ED stay for patients in the two groups by different triage category. Elderly patients in the critical and emergency categories stayed in EDs for a significantly shorter period of time when compared to younger adults in the same triage categories. In contrast, elderly patients in triage categories 3, 4 and 5 spend more time in the ED consultation process than younger adults.

Elderly patients presented to EDs with a different spectrum of disease when compared to younger adults. Figure 3 shows the ten most common diagnoses made by emergency physicians in the two groups. Elderly patients most commonly presented to EDs with neurological symptoms. These included loss of consciousness, syncope or dizziness. Chest pain was the second most common reason for the elderly to come to EDs for consultation. ‘Decreased



**Fig. 1** Proportion of younger adult and elderly patients in different triage categories



**Fig. 2** Proportion of patients with investigations performed in the ED

general condition,’ acute exacerbation of chronic obstructive pulmonary disease and congestive heart failure were common conditions presenting to EDs in the elderly, but not in the younger adult group.

Of the patients in the younger adult group, 15.5% (34,979/224,921) were admitted to the hospital, while 45.0% in the elderly group (39,455/87,623) were admitted ( $p < 0.0001$ ,  $\chi^2$  test).

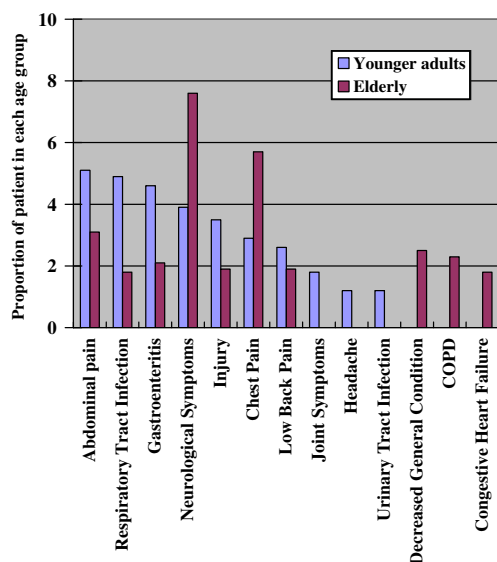
Of the younger adult patients, 5.1% (11,427/224,921) attending the ED were admitted to the emergency ward compared to 12.5% (10,947/87,623) in the elderly group ( $p < 0.0001$ ,  $\chi^2$  test). Apart from being admitted to the emergency ward more frequently than younger adults, elderly patients stayed in the emergency ward for a longer duration. Table 3 shows the difference in length of stay in the emergency ward in different hospitals, with elderly patients staying in the emergency ward for a longer period of time than younger adults.

There was also a significant difference in patients’ length of stay in the emergency ward among the three hospitals, both in the elderly group and the younger adult group. (1.6 h in AHNH vs. 10.5 h in NDH vs. 11.4 h in PWH for the younger adult group,  $p < 0.001$ , Mann-Whitney test; 2.1 h in AHNH vs. 15.4 h in NHD vs. 19.5 h in PWH for the elderly group,  $p < 0.001$ , Mann-Whitney test).

**Table 2** Median length of ED stay by triage category, in minutes

Triage category	Elderly	Younger adults	P value
Critical [1]	38 (60)	50 (95)	<0.0001
Emergency [2]	49 (99)	56 (137)	<0.0001
Urgent [3]	103 (254)	93 (192)	<0.0001
Semi-urgent [4]	133 (274)	97 (169)	<0.0001
Non-urgent [5]	94 (149)	73 (130)	<0.0001

Mann-Whitney test  
ED: Emergency department



**Fig. 3** Ten most common diagnoses in ED patients

Table 4 shows the patterns of ED utilization of elderly patients from old age homes and those living in the community; 80.7% (70,745/87,623) of the elderly attending the ED were from the community, and the remainder [19.3% (16,878/87,623)] came from old age homes.

Elderly patients from old age homes utilized the ambulance service significantly more frequently than those from the community, with 80.6% (13,600/16,878) transferred to the ED by ambulance compared to 33.8% (23,944/70,745) of those living in the community ( $p < 0.0001$ ,  $\chi^2$  test).

Of the elderly ED patients from old age homes, 68.8% (11,609/16,878) were admitted to the hospital, whereas

**Table 3** Emergency ward admissions and lengths of stay by age group and hospital

	Hospital	Age 15-64	Age $\geq 65$	
Admissions to emergency ward	AHNH	4,086	4,388	
	NDH	4,279	3,128	
	PWH	3,062	3,431	
	Total	11,427	10,947	
Median length of stay in emergency ward in hours (mean)	AHNH	1.6 (2.6)	2.1 (3.3)	*
	NDH	10.5 (13.0)	15.4 (18.0)	*
	PWH	11.4 (15.8)	19.5 (26.7)	*
	Overall	6.6 (10.0)	8.4 (14.9)	*

\*All  $P < 0.0001$ , Mann-Whitney test

ED: Emergency department

AHNH: Alice Ho Mui Ling Nethersole Hospital

NDH: North District Hospital

PWH: Prince of Wales Hospital

39.4% (27,846/70,745) from the community were admitted ( $p < 0.0001$ ,  $\chi^2$  test).

## Discussion

Emergency departments are important means of access to health-care service for the elderly, as indicated by the disproportionate representation of elderly patients in the ED population. Elderly patients constitute 25% of ED attendances, whereas the elderly represent only 12% of the general population. As the population ages, this overrepresentation of elderly ED patients may have serious impacts on health-care resources in the future.

We found that emergency care for the elderly utilizes more resources than for younger patients. Elderly patients were significantly more likely to use ambulances to get to hospital and to require hospital admission than younger adult patients. However, the elderly presented to EDs with more serious conditions than younger adults. A significantly higher proportion of elderly patients were triaged as being in the critical, emergency or urgent category when compared to younger adults. This pattern of a higher degree of urgency in the elderly patients is consistent with that reported by the Society for Academic Emergency Medicine Geriatric Task Force [3]. The admission rates in our hospital cluster are similar to those reported in the literature in the United States [2–5].

The elderly are a unique population of patients. They differ from younger adults not only in the pattern of ED use, but also in the presenting spectrum of disease. They present to the ED with more complex and acute medical problems. This results in a significant difference in the process of care in the two groups. Neurological symptoms, chest pain and ‘decreased general condition’ were the most common presenting symptoms in the elderly. These presenting complaints may signify underlying serious acute conditions and therefore utilize more resources in the ED diagnostic and consultation process.

Also, the elderly differ from younger adults physiologically; common diseases may present with atypical symptoms or non-specific ‘deterioration in general condition.’ More time and resources are required in making an accurate diagnosis for those with non-specific complaints. This may explain the more frequent laboratory and radiological investigations in the elderly group compared to younger adults.

The higher complexity of medical problems in the elderly results in a higher hospital admission rate, emergency ward admission rate and an increased ED length of stay in the elderly compared to younger adults. Length of ED stay in the two groups varies with triage category. Elderly patients in the critical or emergency categories

**Table 4** Emergency department attendances, admissions to inpatient ward and number of ambulance admissions to ED, by domicile and hospital

	Patients from elderly home			Patients living in the community		
	ED attendances	Ambulance attendances	IP ward admissions	ED attendances	Ambulance attendances	IP ward admissions
AHNSH	5,094	4,333	3,712	18,138	4,744	7,377
NDH	6,396	5,324	4,508	20,274	8,077	8,347
PWH	5,388	3,943	3,389	32,333	11,123	12,122
Total	16,878	13,600	11,609	70,745	23,944	27,846

ED: Emergency department

IP: Inpatient

AHNSH: Alice Ho Mui Ling Nethersole Hospital

NDH: North District Hospital

PWH: Prince of Wales Hospital

stayed in EDs for a significantly shorter period of time than younger adults. This may be explained by the fact that around 39% of the elderly in the critical category were in cardiac arrest on arrival to ED. These patients generally had brief resuscitation attempts due to advanced pre-morbid illness or clear failure of resuscitation in the prehospital arena, and these patients were certified dead shortly after ED arrival. In contrast, only 17% of patients in the younger adult group presented to the ED in cardiac arrest.

Furthermore, 16% of younger adult patients in the critical and emergency categories were victims of severe trauma compared to 2.5% in the elderly group. These severely injured patients undergo resuscitation and radiological investigations, including CT scans if indicated, before they are admitted for definitive treatment. Therefore, it takes longer to manage a patient with severe trauma compared to cardiac arrest. This contributes to the longer average staying time in the ED in younger adult patients in the critical and emergency triage categories.

However, elderly patients in the urgent, semi-urgent or non-urgent categories stayed in EDs for a significantly longer duration than younger adults. This reflects the more complex medical conditions that elderly patients present with to EDs and is directly related to the fact that more investigations are performed on elderly ED patients than younger adults.

Apart from the length of stay in the ED, elderly and younger adults also differ in their average length of stay in the emergency ward. The special health-care needs and more complex conditions in elderly patients result in a significantly longer length of stay in the emergency ward. All three hospitals in this study showed the same pattern of a longer median length of stay in the emergency ward in the elderly group, but the duration of stay varies in different hospitals. This is because the different hospitals use different criteria for admitting patients to emergency wards, and the spectrum of conditions managed in different hospitals depends on the resources available.

The health-care needs of the elderly living in old age homes require special attention. About 10% of the elderly in Hong Kong live in old age homes [6]. In our hospital cluster, 19.3% of elderly ED patients were from old age homes. Patients from old age homes utilized more health-care resources than other elderly. They used the ambulance service and in-patient care more frequently than those from the community. There are a number of reasons behind these findings. The old age home residents are often wheelchair bound or bed bound, and the ambulance service is often the only way to transfer them to EDs for consultation. Patients from old age homes are generally in a poorer pre-morbid state compared to those who live in the community. The level of nursing and medical care provided in the old age home may not be able to cope with the additional strains of acute illness in the elderly patient. Thus, staff in old age homes are more prone to send these acutely ill patients to EDs. In addition, the condition of the elderly may deteriorate very rapidly with acute illnesses, resulting in a higher rate of hospital admission.

The high utilization rates of the ED and ambulance service in old age home residents reflect to a degree the inadequacy in health-care services for this vulnerable group. The Hospital Authority has introduced a number of measures in order to reduce hospital utilization in this group of patients. Multidisciplinary outreach teams (comprising a geriatrician, nurse, physiotherapist and occupational therapist) provide community health-care services to old age home residents, including follow-up of chronic conditions and treatment of acute illnesses. Exploring further collaborations between ED service and this multidisciplinary team may reduce hospital admissions and ED attendances in this group of frail patients.

## Conclusion

The unique health-care needs of the elderly ED patients require special attention. The elderly require significantly



more emergency care resources compared to younger adults. Anticipation of greater demand on resources with the aging population in Hong Kong suggests the need for proactive planning, service delivery, education and research in geriatric emergency medicine.

## References

1. Census and Statistics Department, Hong Kong Special Administration Region. <http://www.censtatd.gov.hk>. Accessed 15 February 2007
2. Singal BM, Hedges JR, Rousseau EW et al (1992) Geriatric patient emergency visits part 1: comparison of visits by geriatric and younger patients. *Ann Emerg Med* 21:802–807
3. Strange GR, Chen EH, Sanders AB (1992) Use of emergency departments by elderly patients: projections from a multicenter data base. *Ann Emerg Med* 21:819–824
4. Baum SA, Rubenstein LZ (1987) Old people in the emergency room: Age-related differences in emergency department use and care. *J Am Geriatr Soc* 35:62–68
5. Lowebstein SR, Crescenzi CA, Kern DC et al (1986) Care of the elderly in the ED. *Ann Emerg Med* 15:528–535
6. Thematic Household Survey Report xVol.21. Census and Statistics Department, Hong Kong Special Administration Region. <http://www.censtatd.gov.hk>. Accessed 15 February 2007