Original Article

Utilization of the Accident & Emergency Departments by Chinese elderly in Hong Kong

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BACKGROUND: The epidemiological data on elderly patients attending Accident and Emergency Departments (AEDs) in Hong Kong is lacking. The study aimed to examine the epidemiology of geriatric patient visits to AEDs in Hong Kong, including demographic data and predictors of life-saving interventions (LSI) and admission.

METHODS: A retrospective cross-sectional study of geriatric patients older than 64 years old attending three AEDs during the year 2012, with a sample of 1 200 patient visits recruited. The data were retrieved from the medical records of the respective hospitals. Descriptive characteristics of the visits were provided. Multivariate logistic regression was performed to evaluate the predictors of LSI and hospital admission.

RESULTS: The mean age of the patients was 79.1 years. Totally 49.7% of the patients were male. "Diseases of the respiratory system" was the commonest diagnosis in AEDs as well as that required admission. The admission rate was 56.8%. Logistic regression demonstrated that dependent activity of daily living (ADL), arrival by ambulance, and the higher number of co-morbidities were predictors of LSI, while advanced age, dependent ADL, institutionalized patients, arrival by ambulance, and higher number of co-morbidities were predictors of hospital admission.

CONCLUSIONS: Ageing population is creating an imminent burden on the emergency service in Hong Kong. Previously unavailable epidemiological information about geriatric attendance to AEDs was described. This forms the basis for development of future studies concerning the medical services on this specific group of patients.

KEY WORDS: Elderly; Geriatric; Emergency department; Epidemiology

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INTRODUCTION

Ageing population is a worldwide phenomenon. By 2050, the number of people aged 60 or above will reach 2 billion or 22% of the global population.^[1] The population in Hong Kong is also on an ageing trend. The proportion of people aged 65 or above would rise from 13% in 2011 to 30% in 2041.^[2] Similar phenomenon is expected in other metropolises of China. With an ageing population comes an increased burden on healthcare services. All

aspects of the healthcare services, including emergency care, are affected. People aged 65 or older make up a significant proportion of attendances of the Accident & Emergency departments (AEDs). They are often more ill on presentation and are more likely to be admitted.^[3] With regard to patient volume and disease complexity, the elderly patients are major users of emergency care.

The aim of this study was to investigate the epidemiological characteristics of elderly patients

attending the AEDs of Queen Mary Hospital (QMH), Tuen Mun Hospital (TMH) and Caritas Medical Centre (CMC) in Hong Kong, including the demographic data and various predictors of life-saving interventions (LSI) and admission. The three AEDs serve a population of 1.4 million. About 19.5% are people aged 65 or more. This in turn represents 19.9% of all those aged 65 or more in Hong Kong.^[4] Knowing their characteristics is important because they are unique. Their characteristics include atypical presentation, multiple pathology, poor physiological reserve, prevalent impaired cognition and bigger need for psychosocial support.^[5] All these demand a different skillset of the clinician. Because of these and other reasons, the provision of high quality geriatric care poses a great challenge to all practitioners of emergency medicine (EM). In order to derive evidence based strategies to optimize geriatric emergency care, research on the epidemiology of elderly patients attending the AED is indicated. The data can serve as the baseline against which changes can be measured. It gives clues as to what intervention that may impact geriatric emergency care. It is also hoped that the findings can be taken reference by the rapidly developing emergency medicine systems in China.

METHODS

Design and subjects

It was a retrospective cross-sectional study of elderly patients attending the AEDs of QMH, TMH and CMC. Patients older than 64 years attending the AED of the three hospitals in the year 2012 were eligible.

Data collection

The medical records of the respective hospitals were reviewed by experienced clinicians. The data were retrieved from the AED records and the electronic database of the hospitals. Data on recruited patients' demographic and clinical characteristics were collected. Demographic data included age, gender, basic activities of daily living status (ADL), home location (home dweller versus institutionalized) and mode of arrival. Clinical data included cognitive status, number of co-morbidities, triage category, AED and discharge diagnosis, need for and type of LSI within 24 hours of AED presentation, disposition, mortality (certified death in AED), and re-attendance within 48 hours of AED discharge.

ADL was categorized into either independent, partially dependent, or dependent according to the patients'

ability to perform self-care tasks, like dressing, showering, self-feeding, ambulation, and toileting.^[6] Cognitive impairment was defined as any clinically significant mental function impairment. Both the ADL and cognitive status were subjectively determined by the reviewing clinicians according to the information available from the medical records. Co-morbidities were defined as clinical conditions requiring regular follow-up or medications. Diagnoses were aggregated and categorized based on ICD-10 Version 2010. The list of LSI was based on the work of Gilboy et al^[7], including airway and breathing support, circulatory support, emergency procedures, and emergency medications.

Sampling and sample size

To obtain a representative sample of the elderly attendance of AED with confidence level of 0.05 and margin of error of $\pm 3\%$, the minimal sample size was 1067.9. In the calendar year 2012, there were 22 914, 25 663 and 19 069 patients aged 65 or older attending the AEDs of QMH, TMH and CMC respectively. A sample of 1 200 cases was recruited from these 67 646 patient visits. Random sampling for patient selection was done by Microsoft Excel 2010 (version 14.0.7140.5000). The sampling frame was created by running the list of A&E numbers according to the date of attendance. Each A&E number was unique.

The research was approved by the Institutional Review Board of the three hospitals. There was no major ethical issue in this study, and the study only involved reviewing patients' records. The consent requirement was waived.

Statistical analysis

Data were entered into SPSS (IBM SPSS version 20 for Windows). Analysis and interpretation of data were done using the same statistical software. Means and standard deviations were used to describe continuous variables. Counts and percentages were used for categorical variables. Multivariate logistic regression was used to evaluate the predictors of need for LSI and hospital admission. Variables were entered to the regression model with the forward stepwise method. Adjusted odds ratios, their 95% confidence interval and *P* values were reported. Model calibration and goodness-of-fit was assessed by the Hosmer-Lemeshow test, whereas model discrimination was assessed by the area under receiver-operating-characteristic curve of the predicted probabilities. A *P* value of less than 0.05 was regarded as statistically significant.

RESULTS

There were totally 67 646 visits by patients ≥ 65 years old attending the three centers during the study period, which represented about 14% of the total number of AED visits. A total of 1 200 cases from these 67 646 visits were examined, with 413, 457 and 330 cases from QMH, TMH and CMC respectively. The study population comprised about 2% of total AED visits of patients aged ≥ 65 years old.

The mean age of the patients was 79.1 years. Gender distribution was about equal. About 5% belonged to the emergency or critical triage category. About 56.7% of

the patients were admitted. LSI was performed in 238 (19.8%) patients. Airway and breathing support was most commonly required (Table 1). Multiple co-morbidities were also common (Figure 1).

Table 2 shows the factors that predicted the need for LSI. Independent predictors of LSI were dependent ADL (*OR* 2.28, 95%*CI* 1.58–3.28), arrival by ambulance (*OR* 2.17, 95%*CI* 1.58–2.99), higher number of co-morbidities (*OR* 1.16, 95%*CI* 1.07–1.24), and certain diseases, including infectious diseases, that of circulatory or respiratory systems (*OR* 4.92, 95%*CI* 3.58–6.75).

For AED diagnoses, the top 3 were "diseases of the

Table 1. Basal demographics and outcomes of the geriatric patients (*n*=1 200)

Parameters	Patients (%)
Age (median, IQR)	79 (12)
Gender, male	596 (49.7)
ADL	
Independent	767 (64.4)
Partially dependent	211 (17.6)
Dependent	213 (17.8)
Unknown	9 (0.8)
Residence	
Institution	264 (22)
Home	936 (78)
ED arrival	
By self	654 (54.5)
By ambulance	540 (45)
Others	6 (0.5)
Cognitive impairment	257 (21.4)
Triage category	
Category 1 Critical	23 (1.9)
Category 2 Emergency	34 (2.8)
Category 3 Urgent	509 (42.4)
Category 4 Semi-urgent	586 (48.8)
Category 5 Non-urgent	44 (3.7)
Unknown	4 (0.3)
Life-saving intervention	238 (19.8)
Airway and breathing	181 (15.1)
Circulatory support	54 (4.5)
Procedures	21 (1.8)
Drugs	56 (4.7)
Disposal	
Home	497 (41.4)
Admission	680 (56.7)
Death in ED	7 (0.6)
DAMA	10 (0.8)
Disappeared	4 (0.3)
Mortality	21 (1.8)
Re-attendance in 48 hours	65 (5.4)

Figure 1. Number of medical comorbidities in the geriatric patients.

Table 2. Logistic regression predicting life-saving interventions

Predictors	Adjusted odds ratio (95% confidence interval)	<i>P</i> value
Age	1.02 (0.99–1.05)	0.08
Dependent ADL*	2.28 (1.58–3.28)	<0.001
Institutionalized	0.79 (0.49–1.27)	0.336
Carried in by ambulance*	2.17 (1.58–2.99)	<0.001
Cognitive impairment	0.86 (0.51–1.46)	0.581
Number of comorbidities*	1.16 (1.07–1.24)	<0.001
Diseases of infectious diseases, circulatory or respiratory system in AED diagnosis*	4.92 (3.58–6.75)	<0.001

*: Included in the final model; Method: forward stepwise by likelihood ratio; Model calibration: Hosmer-Lemeshow test *P*=0.904 indicating satisfactory goodness-of-fit; Model discrimination: area under ROC curve of the predicted probabilities=0.782 (0.75–0.81).

Table 3. Most frequent diagnoses of geriatric AED patients

Rank	ICD-10 Code	Description	Frequency	%
1	10	Diseases of the respiratory system	226	18.8
2	11	Diseases of the digestive system	177	14.8
3	19	Injury, poisoning and certain other consequences of external causes	140	11.7
4	13	Diseases of the musculoskeletal system and connective tissue	125	10.4
5	9	Diseases of the circulatory system	122	10.2
6	6	Diseases of the nervous system	103	8.6
7	14	Diseases of the genitourinary system	79	6.6
8	18	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	64	5.3
9	1	Certain infectious and parasitic diseases	55	4.6
10	12	Diseases of the skin and subcutaneous tissue	31	2.6

Table 4. Commonest diagnoses requiring hospitalization (*n*=682)

Rank	ICD-10 Code	Description	Frequency	%
1	10	Diseases of the respiratory system	163	23.9
2	11	Diseases of the digestive system	122	17.9
3	9	Diseases of the circulatory system	108	15.8
4	6	Diseases of the nervous system	59	8.7
5	14	Diseases of the genitourinary system	52	7.6

Table 5. Logistic regression predicting hospital admission

Predictors	Adjusted odds ratio (95% confidence interval)	<i>P</i> value
Age*	1.05 (1.03–1.06)	<0.001
Dependent ADL*	2.46 (1.50–4.04)	<0.001
Institutionalized†	2.07 (1.33–3.23)	0.001
Carried in by ambulance*	1.35 (1.04–1.76)	0.023
Cognitive impairment	1.23 (0.77–1.96)	0.38
Number of comorbidities*	1.18 (1.11–1.26)	<0.001
Diseases of infectious diseases, circulatory or respiratory system in AED diagnosis*	2.68 (2.03–3.56)	<0.001

*: Included in the final model; Method: forward stepwise by likelihood ratio; Model calibration: Hosmer-Lemeshow test *P*=0.978 indicating satisfactory goodness-of-fit; Model discrimination: area under ROC curve of the predicted probabilities=0.713 (0.68–0.74).

respiratory system" (18.8%), "diseases of the digestive system" (14.8%), and "injury, poisoning and certain other consequences of external causes" (11.7%) (Table 3). Of patients requiring hospitalization, the top 3 diagnoses were "diseases of the respiratory system" (23.8% of admitted patients), "diseases of the digestive system" (17.6%), and "diseases of the circulatory system" (15.6%) (Table 4). Advanced age (*OR* 1.05, 95%*CI* 1.03–1.06), dependent ADL (*OR* 2.46, 95%*CI* 1.5–4.04), institutionalized patients (*OR* 2.07, 95%*CI* 1.33–3.23), arrival by ambulance (*OR* 1.35, 95%*CI* 1.04–1.76), and higher number of co-morbidities (*OR* 1.18, 95%*CI* 1.11–1.26) were predictors of hospital admission. Those with infectious diseases, or diseases of circulatory or respiratory systems were also more likely to be admitted (*OR* 2.68, 95%*CI* 2.03–3.56) (Table 5).

DISCUSSION

This study demonstrated the basic demographic data of local geriatric patients attending the AED in Hong Kong as well as different predictors of LSI and hospital admission.

Local research on geriatric patients attending the AED is few and sparse. A literature search for peer reviewed publications between January 1985 and March 2013 identified only two papers that studied the general

characteristics of elderly AED patients. The first study was published in 1987.^[8] It was done in a single AED and recruited patients aged 60 or older who attended the AED in one month. It was found that in comparison to younger patients, the elderly patients were more ill and more likely to arrive at AED by ambulance, and had a longer AED stay and a higher admission rate. As this study was done more than 2 decades ago, updated data are needed. The second study was published in 2009.^[9] It studied patients aged 65 or older attending the three AED in the New Territories in 2006. It reported similar findings to the first one. In addition, they also found that neurological symptoms and chest pain were common reasons of AED presentation. However, apart from the already known facts, details are lacking. In this study, the epidemiology of geriatric patients attending AED in 3 regional hospitals in Hong Kong during a 1-year period was described. This is the first multi-center study providing previously unavailable details on the epidemiology of geriatric patients attending AED across different districts in this locality.

Our results demonstrated certain specific demographics and patterns of AED utilization, with subgroup analysis provided some possible factors predicting admission. Indeed, geriatric population created a high demand on local health care system, as reflected by the high admission rate (more than half of the population being admitted) and high dependence on ambulance service (near half of this population arrived AED with ambulance). Moreover, analysis of diagnoses revealed that a plenty of these patients suffered from respiratory or digestive problems (more than 30% of those attending AED or being admitted). While "injury, poisoning and certain other consequences of external causes" and "diseases of the musculoskeletal system and connective tissue" ranked high in AED patients, they were not that common among those requiring hospitalization. Most of the injuries or pain these patients suffered were relatively minor. They could be discharged early after proper investigations and adequate pain relief. On the other hand, in view of large admission of respiratory, digestive, and circulatory diseases, targeted strategies may help reduce the admission burden, like close outpatient follow up of those suffering from pneumonia or airway diseases, or prompt investigations and treatment in AED for those suffering from chest or abdominal pain.

It was found that advanced age, dependent ADL, and higher number of co-morbidities were predictors of either admission or LSI requirement. With the trend of ageing population in our locality, it is expected that such factors

would be boosted up in near future. Higher admission rates and incidences of interventions taking part in the department would create extra burdens to the hospitals as well as the whole healthcare system. Several ways could be considered to solve such forthcoming crisis. Firstly, promotion of disease prevention and better health education in the public could prevent the burden on AED service. Secondly, strengthening of AED service and support could replace some of the work in the ward and hence reduce admissions. For example, more advanced investigations could be performed in AED, establishment of more clinical pathways or short stay facilities could help to screen out unnecessary admissions. For example, Misch et al^[10] found that for patients with non-specific complains, the accuracy of disposition planning regarding hospitalization of patients with acute morbidity was improved after observation in an AED.

In comparison to studies overseas, there are similarities and differences. A review by Samaras et al^[11] found that older people accounted for 12% to 24% of all AED visits, which is similar to our findings (14%). Another review by Aminzadeh and Dalziel^[12] found that older emergency patients were more likely to arrive at the ED by ambulance (30%–55%), which is also similar to our results (45%). Biber et al^[13] and Latham and Ackroyd-Stolarz^[14] found that older adults were more likely to be hospitalized subsequent to AED visits, which are similar to our findings. On the other hand, in contrast to our results, the study in 4 hospitals in Nova Scotia of Canada by Latham and Ackroyd-Stolarz^[14] found that their attendance had a higher proportion of urgent or emergent cases (Canadian Triage and Acuity Scale 1–3, 74%) but a lower admission rate (21%). Moreover, the proportion of primary AED diagnoses of their population was also quite different from ours. Their top diagnoses were "symptoms, signs, and ill-defined conditions" (25%) and "injury and poisoning" (17%). Salvi et al^[15] also reported their findings in Italy that dyspnea and abdominal pain were the most frequent non-trauma presenting complains among geriatric patients and represented the main causes for admission. These are similar to our findings.

It is unavoidable that more resources should be put into various sectors of the healthcare system to cope with the future increasing demands on the service. Future research should be considered to study this issue and improve the efficiency of the system, especially on the geriatric service.

AED is an important component of and serves as the entry point to the health care delivery system

for much elderly patients in our locality. Hence, it is critical to develop an accurate understanding of the true epidemiological and ecological features of the population of the geriatric AED users. However, there are surprisingly little data being published regarding this issue. Indeed, it is difficult to collect data prospectively in the practical setting in this locality owing to several reasons, including busy working environment, incomplete electronic data, and lack of appropriate system or manpower for such purpose.

There are several potential limitations in this study. First, not all patient visits were included for analysis. Instead, a sample of 1 200 cases was selected. To minimize the potential bias, a random sampling of adequate case numbers (more than 1 067) was conducted. Second, due to practical difficulties, not all data were available on all patients. In our study, the medical records of all the selected cases were reviewed by experienced medical staff for data entry. In general, the missing data in our study were minimal. Third, there may be systemic variation in clinical management or service provision across different centers. The generalizability of the findings may be affected.

Ageing population is creating an imminent burden on the healthcare system in Hong Kong, including the emergency and in-patient service. Improving our understanding on the geriatric patients and their potential impacts to the system is important. This study could serve as a starting point and create a baseline as reference for any potential future changes or possible interventions. Future studies on pre-hospital or other geriatric medical care in this locality based on these findings would be possible leading to better clinical care or allocation of our resources.

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Ethical approval: The research was approved by the Institutional Review Board of the three respective hospitals. There was no major ethical issue in this study, and the study only involved reviewing patients' records. The consent requirement was waived.

Conflicts of interest: All the authors have no financial interests or potential conflicts of interest relating to this study.

Contributors: Yip WL proposed the study, analyzed the data and wrote the first draft. All authors contributed to the design and interpretation of the study and to further drafts.

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