

Research Article

Demographic Changes and Their Implications in a Nonacademic Emergency Department in Switzerland: An 11-Year Trend Analysis (2000–2010) of 104,510 Patients

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Background. Recent demographic developments outline a worldwide increase in the older population. The aim of the present study was to assess whether the sociodemographic characteristics of patients with emergency department (ED) admissions have changed over time. **Methods.** This study utilized the database of a level I accident and emergency unit in eastern Switzerland, a prospective database of consecutive patients aged ≥ 16 admitted between 2000 and 2010. Sociodemographic data were extracted as well as date and time of admission, instances of referral, diagnosis, time needed for ED treatment, and nursing effort. **Results.** Data from 104,510 patients were utilized. There was a significant increase in the percentage of patients aged ≥ 65 years (from 25.7 per cent (1,775/6,905) to 29.6 per cent (3,845/12,340); $P_{\text{trend}} < 0.01$). The mean length of stay in the ED was significantly longer (from 140.3 minutes, SD 91.9 to 169.5 minutes, SD 101.1; $P_{\text{trend}} < 0.01$) and the percentage of illness as the cause of admission was significantly higher over time (from 58.3 per cent to 59.4 per cent; $P_{\text{trend}} < 0.01$). **Conclusions.** The change in patients' demographics found and the resulting considerably increasing workload in EDs might be helpful for planning purposes, future training of ED personnel, and allocating resources.

1. Introduction

Recent demographic developments outline a worldwide increase in the older population. It is predicted that the number of people over the age of 85 will double between 1995 and 2025 [1] and that by 2050 those aged ≥ 65 years will constitute over 20 percent of the US population [2]. In Switzerland, population statistics show similar changes. In 2009 16.8 percent of the Swiss population were aged ≥ 65 years, and it is assumed that by 2050 this percentage will increase to 27.7 percent [3].

Most developed countries in the world have accepted the chronological age of 65 years as a definition of an “elderly”

or older person [4]. Aging leads to irreversible changes of various organ systems with a loss of functional reserve [2]. This includes an elevated risk of developing cardiovascular diseases, diabetes, and cognitive impairment due to degenerative diseases such as dementia [5]. Older people are more vulnerable than younger adults to being acutely ill, which leads to a higher rate of emergency consultations [6].

Due to the complexity and chronicity of diseases and the social life situation, the type and quantity of emergency care is different for older people compared with other age groups [7, 8]. Furthermore, older patients discharged from the emergency department (ED) have a high rate of adverse health outcomes and readmission [9, 10]. An incomplete

investigation by the emergency staff of environmental factors such as underlying health and social problems, except for the initial cause of attendance, may be a possible reason [8]. Given the demographic changes, these findings could have a significant negative effect on ED crowding [11]. ED crowding is an increasing problem, leading to higher health-care costs [12], frustration of patients and ED personnel [13], and greater risk of poor outcomes [14].

Little is known about the national changes affecting emergency consultations in Switzerland and the impact of the growing group of patients aged ≥ 65 years on the work in Swiss EDs. The objective of the present trend analysis based on a large single-centre prospective cohort was to assess whether the sociodemographic characteristics of patients with ED admissions have changed over the last eleven years.

2. Methods

This study utilized the database of the Kantonsspital Graubünden, a level I accident and emergency unit in eastern Switzerland, a prospective database of consecutive patients aged at least 16 years admitted to the ED. For the present retrospective analysis all of the patients admitted to our centre between 1 January 2000 and 31 December 2010 were reviewed in our computerized database. Patients were excluded from the analysis if they were not at least 16 years of age. The data were collected, stored, analysed, and shared in accordance with the ethics committee standards of our institution. The data were collected prospectively by the shift supervisor, independently from the study authors. The sociodemographic data were extracted as well as the following data: date of admission (weekend (i.e., Saturday 0:00 AM to Sunday 12:00 PM) versus weekday (i.e., Monday 0:00 AM to Friday 12:00 PM)), time of admission (day [i.e., 7:00 a.m. to 7:00 p.m.] versus night [i.e., 7:00 p.m. to 7:00 a.m.]), instances of referral (e.g., general practitioner, self-referral, etc.), diagnosis, time needed for ED treatment, subjective nursing effort for each patient (e.g., small, medium, and large), and subsequent treatment (inpatient versus outpatient). The nursing staff had undergone specific training on how to rate the nursing effort. To prevent multiple entries for an organ-related disease (e.g., infection of the ear, nose, or throat (ENT)) an entry was made only for the affected organ itself (ENT) in contrast to a systemic disease (e.g., fever) with an entry for "infection."

2.1. Statistical Analysis. All statistical computations were performed by an experienced statistician (SH). The rates and median values of variables were tested for changes over time using correlation/standardized regression coefficients. All statistical tests were two-sided imposing a significance level of 0.05. The collected data were analysed with SPSS version 20.0 (SPSS; Chicago, IL, USA).

3. Results

Between 2000 and 2010 104,510 patients admitted to the ED were enrolled in the study. The median age at the

time of admission was 48 (range 16–103) years, and 42.9 percent (44,854/104,469) were women. In total, 28.2 percent (29,460/104,434) of the patients were ≥ 65 years. The following results represent the median value of the yearly average of different parameters over the study period (2000–2010): the cause of consultation in 59.3 percent (95% CI 58.9–59.6%) was illness, in 40.4 percent (95% CI 40.1–40.7%) accident, and in 0.3 percent (95% CI 0.3–0.4%) another reason; the mean length of stay in the ED was 155.3 (± 95.5) minutes; subjective nursing efforts in 16.4 percent (95% CI 16.2–16.7%) were small, in 77.0 percent (95% CI 76.7–77.3%) medium, and in 6.6 percent (95% CI 6.4–6.7%) large. The percentage of self-referral admissions was significantly higher on weekends compared to weekdays (48.7 percent (14,806/30,431) versus 32.4 percent (23,994/74,079); $P < 0.01$) and at night compared to during the day (51.7 percent (15,720/30,402) versus 31.1 percent (23,080/74,108); $P < 0.01$). The median age of patients admitting themselves autonomously was significantly lower compared to the remainder (37 (range 16–102) years versus 56 (range 16–103) years; $P < 0.01$).

Table 1 depicts the case number development between 2000 and 2010. The ten most frequent diagnoses averaged over the study period are shown in Figure 1. The causes of hospitalization of patients aged < 65 years versus ≥ 65 years are summarized in Table 1.

A trend analysis showed a significant increase in the percentage of female patients compared to their male counterparts over time (from 42.0 percent to 43.7 percent; $P_{\text{trend}} = 0.01$). Concurrently, there was a significant increase in both the patients' median age (from 47 (range 17–99) years to 50 (range 16–103) years; $P_{\text{trend}} < 0.01$) and the percentage of patients aged ≥ 65 years (from 25.7 percent (1,775/6,905) to 29.6 percent (3,845/12,340); $P_{\text{trend}} < 0.01$) (Figure 2). The population in Switzerland aged ≥ 65 years increased from 15.4 percent (1'109'200/7'204'100) in 2000 to 16.9 (1'329'700/7'870'100) in 2010 (<http://www.bfs.admin.ch/bfs/portal/de/index/themen/01/02/blank/key/alter/gesamt.html>; data not shown). Figure 3 depicts the percentage of admissions due to different instances of referral over time. While the percentage of admissions by emergency medical services among patients aged < 65 years significantly decreased (from 70.5 percent to 51.0 percent; $P_{\text{trend}} < 0.01$), there was a significant increase among patients ≥ 65 years (from 29.5 percent to 49.0 percent; $P_{\text{trend}} < 0.01$).

Over time the percentage of illness as the cause of admission was significantly higher (from 58.3 percent to 59.4 percent; $P_{\text{trend}} < 0.01$), with a significant decrease in the percentage of accidents (from 41.2 percent to 40.3 percent; $P_{\text{trend}} = 0.01$). While the percentage of illness among patients aged < 65 years did not show a significant difference over time (from 38.3 percent to 36 percent; $P_{\text{trend}} = 0.07$), it significantly increased among patients ≥ 65 years (from 19.9 percent to 23.4 percent; $P_{\text{trend}} < 0.01$). The percentage of three different degrees of subjective nursing efforts over time of patients aged < 65 years versus ≥ 65 years is shown in Figure 4. Similarly, the mean length of stay in the ED was significantly longer over time (from 140.3 (± 91.9) minutes to 169.5 (± 101.1) minutes; $P_{\text{trend}} < 0.01$).

TABLE 1: Cause of hospitalization regarding the patients' age and sex.

Sex	Cause of hospitalization	<65 years % (number of cases)	≥65 years % (number of cases)	P value
Male	Illness	55.1 (11761)	44.9 (9588)	$P < 0.01$
	Accident	79.6 (6623)	20.4 (1701)	
	Other	54.1 (40)	45.9 (34)	
	All	61.9 (18424)	38.1 (11323)	
Female	Illness	50.0 (8157)	50.0 (8171)	$P < 0.01$
	Accident	56.1 (3544)	43.9 (2770)	
	Other	43.4 (23)	56.6 (30)	
	All	51.7 (11742)	48.3 (10971)	

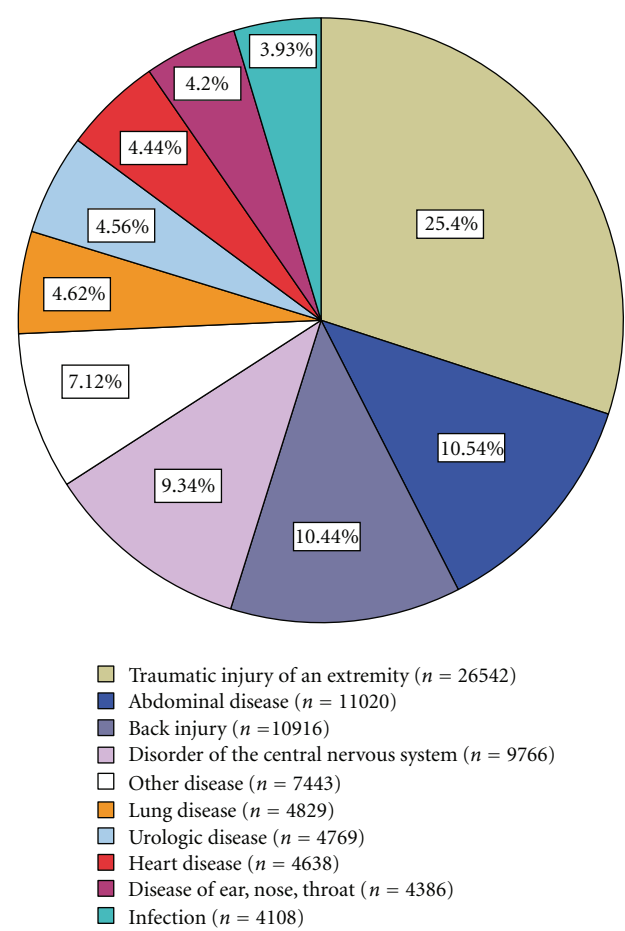


FIGURE 1: The 10 most frequent diagnoses, years 2000–2010.

Regarding the triage over time, there was a significantly lower percentage of inpatient treatment among patients aged <65 years, with a significantly higher percentage among patients ≥65 years ($P_{\text{trend}} = 0.01$ and < 0.01 , resp.) (Table 2).

Regarding the ten most frequent diagnoses, there was a significant decrease in the percentage of back injuries and disorders of the central nervous system ($P_{\text{trend}} = 0.01$ and < 0.01 , resp.) and a significant increase in the percentage

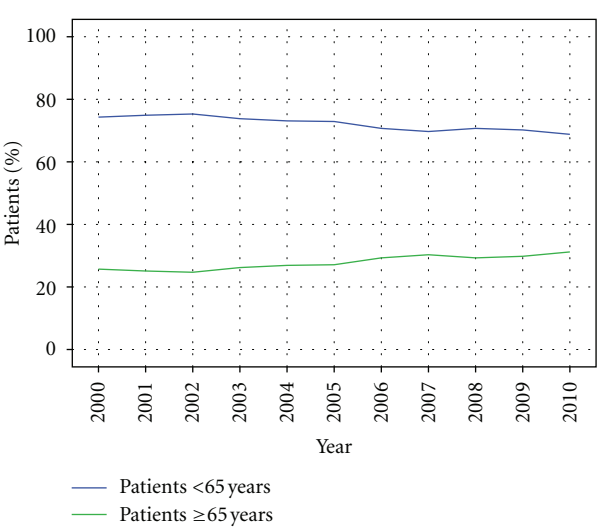


FIGURE 2: Development of the percentage of patients <65 years versus ≥65 years over time ($P_{\text{trend}} < 0.01$).

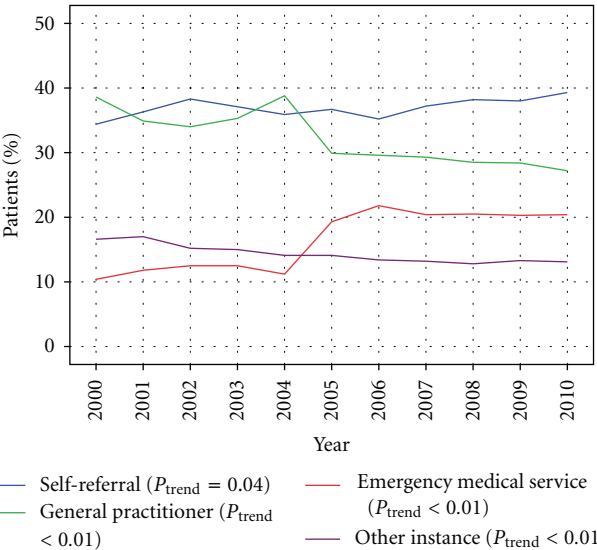


FIGURE 3: Change of referral instances over time (2000–2010).

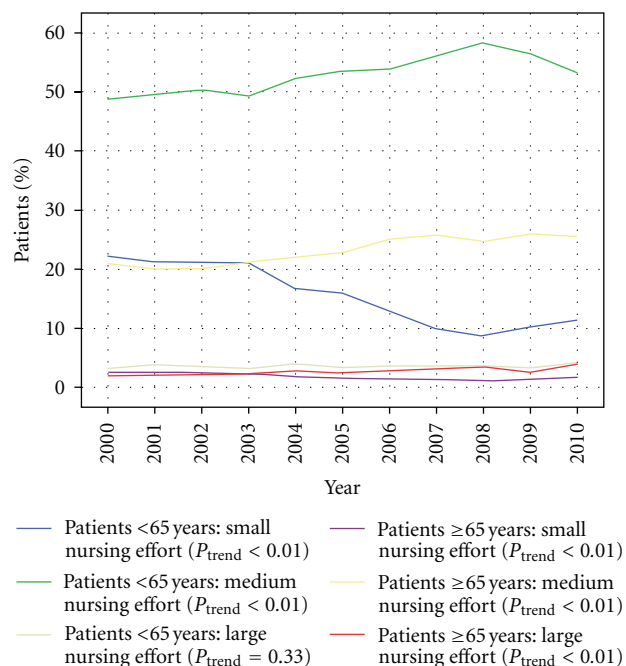


FIGURE 4: Nursing efforts over time (2000–2010).

of heart diseases of patients aged <65 years ($P_{\text{trend}} = 0.01$). Patients aged ≥ 65 years showed a significant increase in the percentage of traumatic injuries of extremities ($P_{\text{trend}} < 0.01$), back injuries ($P_{\text{trend}} < 0.01$), disorders of the central nervous system ($P_{\text{trend}} = 0.01$), other diseases ($P_{\text{trend}} < 0.01$), lung diseases ($P_{\text{trend}} = 0.02$), urologic diseases ($P_{\text{trend}} < 0.01$), and heart diseases ($P_{\text{trend}} = 0.05$).

4. Discussion

The present paper describes a study of patients admitted to the ED of a large nonacademic hospital to examine the referral and demographic changes and their impact on treatment and hospitalizations over the last eleven years. Our results show a significant increase in the percentage of patients aged ≥ 65 years in the ED. Concurrently, self-referral and emergency medical admissions, subjective nursing efforts and length of stay in the ED as well as illness as the cause of admission were significantly higher. The percentage of inpatient treatment of patients aged ≥ 65 years was significantly higher over time.

With the worldwide rapid growth in the proportion of older patients, particularly also in the oldest segment of the older patients (≥ 85 years), it is evident that, in accordance with our results, there is also a significant increase in the percentage of this age group in EDs [1, 3]. Furthermore, older patients are known to have higher visit rates [15]. After being discharged from the ED, about 24 percent are known to return within three months [16]. While in the present study the percentage of patients aged ≥ 65 years accounted for almost a third of the ED patients in 2010, a US study found percentages ranging from 11.6 percent to 23 percent [17].

Compared to their younger counterparts older patients more often have a general practitioner by whom they are referred to the ED more frequently [18–20]. Our results are consistent with this observation as the mean age of patients admitting themselves was significantly lower compared to the remainder.

Regarding admissions by emergency medical services, we found a significantly increased percentage due to the population of older patients. Older people are known to use ambulance transport more than younger people [16, 18, 21]. Simultaneously, we also found a significant increase in the percentage of self-referral admissions. A possible reason for this might be the increasing number of patients using the ED as their primary health-care provider [22].

The problems of older patients are more often of an internal medical nature compared with their younger counterparts who have more injuries [23, 24]. Similarly, we found a significantly higher percentage of illness as the cause of admission over time.

An ageing population with an increasing prevalence of multiple and complex medical problems takes more physician time and nursing time to diagnose and treat [25]. These people are also more likely to require extensive diagnostic workups and have laboratory, radiographic, and other types of tests and complex therapeutic interventions more often [26, 27]. Similarly, we found a significantly increased percentage of subjective medium and large nursing efforts and, in accordance with Singal et al., a significantly longer mean length of stay in the ED over time [27].

The hospitalization rate of patients aged ≥ 65 years in our study is higher with three out of four compared to other studies, showing that between a third and a half of all ED visits by older patients are followed by a hospital admission [16]. Aminzadeh et al. found that hospitalization rates for older patients were 2.5 to 4.6 times higher compared to their younger counterparts, which is comparable with our results [16]. It is known that older patients presenting in the ED are more seriously ill than younger patients [28]. Regarding the triage over time, we found a significantly higher percentage of inpatient treatment of patients aged ≥ 65 years.

We acknowledge the limitations of this study. Firstly, the reported data are based on a single-centre nonacademic ED in Switzerland. As a consequence, our results may only be generalized to other hospitals, especially academic hospitals, with caution. Secondly, in addition to the acknowledged changes over time, there were further changes that could not be investigated with the database used but which might have influenced the presented results: (a) there was a change in the admission policy for medical illnesses (e.g., patients were admitted to the ED first and not directly to the intensive care unit). (b) By 1 January 2006 the emergency unit of the second hospital in the area of Chur, Switzerland (i.e., Kreuzspital), was closed and integrated into the existing ED of the Kantonsspital Graubünden, Chur, Switzerland. The ED that closed had not served a different population in the same area. (c) There is a nationwide trend in increased inpatient hospitalization via an ED rather than in a regular and elective way (80 percent of all inpatient admissions). Thirdly, over the time several patients were referred more

TABLE 2: Change in triage over time (2000–2010).

Age	All	Patients <65 years			Patients ≥65 years		
Year	Case number development (n = 104,510)	Surgery outpatient % (number of cases)	Internal medicine outpatient % (number of cases)	Inpatient % (number of cases)	Surgery outpatient % (number of cases)	Internal medicine outpatient % (number of cases)	Inpatient % (number of cases)
2000	6907	31.5 (2168)	11.4 (786)	31.5 (2168)	3.6 (251)	2.1 (147)	19.9 (1368)
2001	7381	31.0 (2287)	13.5 (998)	30.3 (2235)	4.2 (311)	2.5 (185)	18.4 (1356)
2002	7399	30.1 (2219)	13.7 (1014)	31.5 (2324)	3.8 (284)	1.7 (122)	19.2 (1418)
2003	8052	29.3 (2354)	13.9 (1115)	30.7 (2468)	4.2 (338)	1.9 (156)	20.0 (1605)
2004	8083	27.3 (2197)	12.6 (1013)	33.4 (2692)	3.8 (306)	2.0 (161)	21.0 (1692)
2005	9001	29.0 (2607)	12.8 (1154)	31.1 (2794)	3.9 (349)	2.2 (196)	21.0 (1884)
2006*	10385	27.3 (2828)	11.7 (1214)	31.7 (3286)	3.8 (396)	1.9 (202)	23.5 (2440)
2007	1148	27.0 (3010)	13.4 (1495)	29.3 (3259)	4.0 (447)	2.7 (306)	23.5 (2613)
2008	11877	27.9 (3302)	14.6 (1727)	28.4 (3364)	4.1 (490)	2.8 (329)	22.3 (2643)
2009	11933	27.5 (3271)	14.3 (1698)	28.5 (3392)	4.5 (533)	2.6 (314)	22.7 (2706)
2010	12344	28.3 (3484)	13.9 (1710)	26.7 (3292)	4.5 (559)	2.3 (281)	24.3 (2998)
P_{trend}	<0.01	<0.01	0.14	0.01	0.04	0.11	<0.01

* By January 1, 2006 the emergency unit of the second hospital in Chur, Switzerland was closed.

than once to the ED, which might overrepresent some diagnoses. The distinct strengths of the study are the large sample size and the statistical power to detect changes over time. The data gathered prospectively are very complete.

5. Conclusion

To our knowledge this is the first study conducted to analyse demographic changes and their impact on the work in a Swiss ED in recent years. It showed an increasing percentage of patients aged ≥65 years according to the ageing Swiss population. An ageing population is known to have an increasing prevalence of multiple and complex medical problems with a higher percentage of internal diseases compared to injuries. Therefore, the subjective nursing efforts and the length of stay in the ED as well as illness as the cause of admission were significantly higher. The percentage of inpatient treatment of patients aged ≥65 years was significantly higher over time. The change in patients' demographics found in our study and the resulting considerably increasing workload in EDs are helpful for planning purposes, future training of ED personnel, and allocating resources. Further studies investigating the utilization of academic hospital EDs are needed to refine the knowledge obtained in our study.

Authors' Contribution

A. P. Businger contributed by the study conception and design, A. P. Businger and R. Osinga by the acquisition of data, R. Kaderli, A. P. Businger, and L. R. Burghardt by the analysis and interpretation of data, R. Kaderli, A. P. Businger, and L. R. Burghardt by drafting of the paper, A. P. Businger, R. Kaderli, L. R. Burghardt, R. Osinga, M. Liesch, and M. Furrer by the critical revision of paper, S. Heinz by statistical

analysis, A. P. Businger by the administrative, technical and material support, and A. P. Businger by the study supervision. Dr. A. P. Businger had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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