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Original Article

Acute admissions to medical departments in Denmark: Diagnoses and patient characteristics

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ABSTRACT

Background: Despite extensive research on individual diseases, population-based knowledge about reasons for acute medical admissions remains limited. Our aim was to examine primary diagnoses, Charlson Comorbidity Index (CCI) score, age, and gender among patients admitted acutely to medical departments in Denmark.
Methods: In this population-based observational study, 264,265 acute medical patients admitted during 2010 were identified in the Danish National Registry of Patients (DNRP), covering all hospitals in Denmark. Reasons for acute admissions were assessed by primary diagnoses, grouped according to the *International Classification of Diseases 10th edition*. Additionally, the CCI score, age and gender were presented according to each diagnostic group.
Results: Two-thirds of the patients had one of the four following reasons for admission: cardiovascular diseases (19.3%), non-specific Z-diagnoses ("*Factors influencing health status and contact with health services*") (16.9%), infectious diseases (15.5%), and non-specific R-diagnoses ("*Symptoms and abnormal findings, not elsewhere classified*") (11.8%). In total, 45% of the patients had a CCI score of one or more and there was a considerable overlap between the patients' chronic diseases and the reason for admission. The median age of the study population was 64 years (IQR 47–77 years), ranging from 46 years (IQR 27–66) for injury and poisoning to 74 years (IQR 60–83) for hematological diseases. Gender representation varied considerably within the diagnostic groups, for example with male predominance in mental disorders (59.0%) and female predominance in diseases of the musculoskeletal system (57.8%).
Conclusion: Our study identifies that acute medical patients often present with non-specific symptoms or complications related to their chronic diseases.

1. Introduction

Acute medical patients comprise a high proportion of hospitalized patients, and they often present with complex problems and multiple chronic conditions [1,2]. Despite extensive research on individual diseases, population-based knowledge about reasons for acute medical admissions remains limited [3–5].

Two European studies have reported that cardiovascular diseases are the leading causes for admissions to departments of internal medicine [3,4]. However, both studies lacked detailed information on comorbidity, age, and gender according to diagnostic groups. The non-specific diagnoses from the Z-chapter of *the International Classification of Diseases 10th edition* (ICD-10) have been found to have a surprisingly high prevalence among acute admissions [6–8]. This reflects failure to classify the patients in specific diagnostic groups or failure to meet the patients' diagnostic or consultative needs.

Currently, services provided by inpatient medical departments face the challenge of demographic change. As the population ages, the prevalence of multiple chronic conditions is increasing [1,9]. Knowledge about reasons for acute medical admissions and associated comorbidity levels, age, and gender is important both for physicians in departments of internal medicine and acute medical admission units and for healthcare planners.

We therefore conducted a population-based observational study of patients with acute admissions to inpatient medical departments in Denmark during 2010. We examined the primary diagnostic groups, Charlson Comorbidity Index (CCI) scores, age, and gender. In addition, we determined the source of admission, the length of hospital stay, and the distribution of individual conditions in the CCI, according to the primary diagnostic groups.

2. Methods

2.1. Study setting

We conducted this population-based observational study in Denmark using the Danish National Registry of Patients (DNRP), a national

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healthcare registry covering all hospitals [10]. Every Danish citizen is assigned a unique personal identification number at birth or immigration (CPR number), with embedded information on birth date and sex. These identifiers permit unambiguous individual-level linkage among all Danish population-based registries.

The Danish population (5,535,000 million people as of 1 January 2010) has unrestricted access to the tax-supported healthcare system, assuring equal access to specialist treatment and hospital care. Virtually all Danish citizens are under the care of general practitioners (GPs), who are responsible for referrals to outpatient specialist care or hospital admission. Thus GPs act as gatekeepers in the Danish health care system. Exceptions include patient contacts with hospital emergency rooms, which operate on a 24-hour basis, caring for patients who present on their own or by ambulance. These emergency facilities do not provide inpatient care [11].

2.2. Study population

The study included all adult (defined as age ≥ 15 years) medical inpatients with an acute hospital admission between 1 January and 31 December 2010, who were residents of Denmark at the time of admission. We examined only the first acute admission to a medical department in the study period (index admission).

We identified eligible patients through the DNRP, using the unique code for each medical department (general internal medicine and the subspecialties of neurology, cardiology, pulmonology, gastroenterology, nephrology, rheumatology, hematology, endocrinology, geriatric medicine, infectious diseases) and the acute medical admission units (AMAU), the admission date (index date), and acute admission type. It is mandatory for all hospitals to report to the DNRP, which is run by the National Board of Health. The DNRP has recorded all non-psychiatric admissions to hospitals since 1977 and all hospital contacts with emergency rooms and hospital specialist clinics since 1995. Hospital specialist clinics provide specialist outpatient services in virtually all fields of medicine. Hospitals report one primary diagnosis and up to 19 secondary diagnoses to the DNRP, according to the International Classification of Diseases, 10th edition. Before 1993 diagnoses were coded according to the International Classification of Diseases, 8th edition. Because the DNRP data are used for quality monitoring and government financial reimbursement to hospitals, the incentive to report all admissions is high.

2.3. Discharge diagnoses

According to Danish guidelines and those of the *World Health Organization*, the primary diagnosis assigned at hospital discharge should be the main reason for a patient's hospitalization [12,13]. We therefore described the distribution of primary diagnoses assigned at discharge from the index admission according to the chapters of the ICD-10 (detail is outlined in the online Supplementary Appendix A). We defined the diagnostic groups based on single ICD-10 chapters except for infectious diseases (chapters A and B), which were combined with diagnoses of infectious diseases in the remaining organ-specific chapters. The non-infectious diseases in the chapters of diseases of the eyes and ears, skin diseases, diseases associated with pregnancy, childbirth and puerperium, diseases originating in the perinatal period, and congenital malformations (chapters H, L, O, P, and Q) were merged into a single diagnostic group. The grouping of diagnoses in our analyses was chosen by a consensus among colleagues experienced in diagnostic coding.

2.4. Charlson Comorbidity Index score

We abstracted data from the DNRP on each of the 19 conditions included in the Charlson Comorbidity Index (CCI) and computed CCI scores using the weights assigned to each condition (see online Supplementary Appendix B for the ICD-10 codes of the CCI conditions) [14,15]. We computed the CCI score based on all primary and secondary diagnoses from the five years preceding the index date and on all secondary diagnoses from the index admission. The five year period was chosen to capture clinically significant chronic disease. For purposes of computing the CCI score, the following comorbid conditions were considered mutually exclusive: diabetes with chronic complications and diabetes without chronic complications; mild liver disease and moderate or severe liver disease; and any malignancy and metastatic solid tumor. We divided CCI scores into three levels; low level (Index score 0), moderate level (Index score 1–2), and high level (Index score 3+).

Table 1
Patient characteristics.

Characteristics	Overall n = 264,265
	n (%)
Gender	
Female	135,457 (51.3)
Male	128,808 (48.7)
Age group, years	
15–39	43,864 (16.6)
40–59	66,043 (25.0)
60–79	100,016 (37.9)
80+	54,342 (20.5)
Charlson Comorbidity Index (CCI) score	
Low (0)	145,156 (54.9)
Moderate (1–2)	83,987 (31.8)
High (3+)	35,122 (13.3)
Primary diagnosis	
Infectious diseases incl. pneumonia	40,865 (15.5)
Neoplasm	3483 (1.3)
Hematological diseases	5214 (2.0)
Endocrine, nutritional and metabolic disorders	12,925 (4.9)
Mental and behavioral disorders	7755 (2.9)
Diseases of the nervous system	11,192 (4.2)
Diseases of the circulatory system	51,056 (19.3)
Diseases of the respiratory system	12,719 (4.8)
Diseases of the digestive system	10,186 (3.9)
Diseases of the musculoskeletal system	9560 (3.6)
Diseases of the genitourinary system	3886 (1.5)
Injury and poisoning	16,508 (6.3)
Factors influencing health status and contact with health service	44,570 (16.9)
Symptoms and abnormal findings, not elsewhere classified	31,200 (11.8)
Other	3146 (1.2)
Source of admission[a]	
Hospital departments	81,130 (30.7)
Outpatient clinics	14,172 (5.4)
Emergency rooms	64,397 (24.4)
Direct (e.g. from GP)	132,119 (50.0)
Diseases in the Charlson Comorbidity Index	
Myocardial infarction	9981 (3.8)
Congestive heart failure	17,616 (6.7)
Peripheral vascular disease	13,090 (5.0)
Cerebrovascular disease	26,204 (9.9)
Dementia	6841 (2.6)
Chronic pulmonary disease	30,982 (11.7)
Connective tissue disease	8286 (3.1)
Ulcer disease	7326 (2.8)
Mild liver disease	7843 (1.8)
Diabetes without end organ damage	23,526 (8.9)
Diabetes with end organ damage	13,895 (5.3)
Hemiplegia	1060 (0.4)
Moderate to severe renal disease	9723 (3.7)
Non-metastatic solid tumor	22,958 (8.7)
Leukemia	1466 (0.6)
Lymphoma	2698 (1.0)
Moderate to severe liver disease	1713 (0.7)
Metastatic cancer	3814 (1.4)
AIDS	473 (0.2)

[a] Adds up to more than 100% because patients can be seen in more than one hospital location during the index date.