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Costs associated with emergency care and hospitalization for severe hypoglycemia

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Abstract *Background and aims:* We aimed to determine the direct economic cost of the management of severe hypoglycemia among people with diabetes in Italy.
Methods and results: Data of cases with an acceptance diagnosis of hypoglycemia between January 2011 and June 2012 were collected in 46 Emergency Departments (EDs). Emergency care costs were computed by estimating the average cost per ambulance service, ED visit and short-term (<24 h) observation period. Hospitalization expenditure was estimated using the average cost reimbursed by the Italian healthcare system for hospital admission per patient with diabetes in a specific hospital ward. We retrieved 3516 hypoglycemic episodes occurring in subjects with diabetes. Half the cases (51.8%) required referral to EDs by means of the emergency ambulance services. A total of 1751 cases (49.8%) received an ED visit followed by discharge; 604 cases (17.2%) received a short-term observation period; 1161 (33.1%) were hospitalized. Unit costs for emergency care management were estimated at €205 for an ambulance call, €23 for an ED visit, and €220 for a short-term observation. The mean hospitalization cost was estimated at €5317; the average cost per each severe hypoglycemic event totaled €1911. From a base case assumption, the total direct cost of severe hypoglycemia in patients with diabetes in Italy was estimated to be approximately €23 million per year.
Conclusion: Severe hypoglycemia in patients with diabetes constitutes a remarkable economic burden for national healthcare systems. Measures for preventing hypoglycemia are mandatory in diabetes management programs considering the impact on patients and on health spending.

Introduction

Hypoglycemia is a major limiting factor in the glycemic control of patients with diabetes [1]. Mild episodes may be frequent and markedly impact quality of life [2,3]. Recurrent hypoglycemia favors the loss of physiologic defenses against hypoglycemia that in turn increases the risk of severe hypoglycemia [4]. Severe events, defined as episodes requiring third-party assistance, have been associated with adverse clinical outcomes, including hospitalization and death [5–8].

The risk of hypoglycemia is particularly high in type 1 diabetes. Nonetheless, also in type 2 diabetes, the broader use of insulin in elderly patients with long-standing disease and a frailty profile contribute to a very high risk of hypoglycemia [9]. The magnitude of the problem has been

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highlighted by recent studies. A combined analysis of different US databases estimated a total of nearly 100 000 emergency department (ED) visits per year for insulin-related hypoglycemia, with almost one third of events resulting in hospital admission [10]. In an Italian study including more than 3500 events of severe hypoglycemia in patients with diabetes needing ED access, half the cases required emergency ambulance services and a third of ED visits were followed by hospital admission [5]. As it often involves emergency care management and hospital stay, the impact of hypoglycemia goes well beyond the personal burden, resulting in a major economic impact on health-care systems.

Despite increasing attention to the economic aspects of hypoglycemia management [11], only few attempts have been made so far to capture the cost of hypoglycemia [12]. In a cost-of-illness analysis from Sweden, total direct costs per event of moderate (requiring medical attention) and severe (leading to hospitalization) hypoglycemia were estimated at €335 and €2807, respectively [13]. In the US, on the basis of a validated hypoglycemia model analysis, the direct costs for severe episodes requiring assistance by a healthcare practitioner totaled $1161 per episode [14]. Similarly, in a retrospective analysis of 320 severe hypoglycemic events occurring in patients with diabetes attending a single ED in Korea in the years 2006–2009, the largest average medical cost per event was $1385 [15].

From a health system perspective, the economic burden of hypoglycemia should be taken into account as a relevant part of clinical decision making. Using derived data from the HYPOglycemia Treatment in the Hospital Emergency System - Italian Study (HYPOTHESIS study), we aimed to determine the direct economic cost of severe hypoglycemia among people with diabetes in Italy in order to highlight the need for improvements in the management of type 2 diabetes and strategies to reduce the hypoglycemic risk.

Methods

Data collection and definition of cases

A detailed description of the organization of the HYPOTHESIS data collection has been published elsewhere [5]. In brief, 46 EDs covering an area of approximately 12 million inhabitants, collected data on all cases with an acceptance diagnosis of hypoglycemia between January 2011 and June 2012. Information on patient characteristics, comorbidities, prescribed drugs, resource use (emergency ambulance service; ED treatments), as well as information on disposition (referral to general practitioners (GPs) or diabetes units; short-term (<24 h) intensive observation; hospitalization) was collected through the ED medical records. A predefined case report form was developed by the researchers and was used to collect all data. The study was approved by the ethical committee of the university hospital of Bologna, Italy, in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Considering the retrospective nature of the study and the fact that data were completely anonymized before being entered in the general database, no formal consent was specifically asked in the affiliated units.

Cost calculations

Unit and total direct costs of hypoglycemia were computed. Direct costs were defined as costs for the medical treatment of hypoglycemia, including emergency care services and hospitalizations. Emergency care costs included the cost per ambulance service, ED visit and short-term intensive observation period. We estimated the emergency care costs using the regional cost book, created for establishing reimbursements among different Italian regions, where costs per each ambulance service, ED visit and short-term intensive observation period are detailed [16,17]. Hospitalization costs were calculated using the Diagnosis Related Group (DRG) reimbursement methodology. Since the final diagnoses were not available in the HYPOTHESIS database, the overall direct cost of hospital admissions was estimated on the basis of the average reimbursed cost per hospitalized patient with diabetes, stratified according to the specific ward of admittance (e.g. Internal Medicine; Critical Care units; Endocrinology, Diabetes and Metabolism units, etc). These average values were derived from a different dataset, where the exact DRG costs per hospitalized patient with diabetes were available [18]. Total and mean direct costs per severe episode of hypoglycemia were also computed according to age (0–50, 51–65, 66–80, >80 years), number of comorbidities (0, 1–2, >2 comorbidities) and associated glucose-lowering drugs (insulin, oral agents, insulin plus oral agents). All costs are referred to the Italian context and are presented in Euros (2012 value).

Results

Study population characteristics and direct costs per severe hypoglycemic event

Descriptive data are summarized in Table 1 and may be also found in a previous publication [5]. We identified a total of 3516 events occurring in subjects with diabetes (median age, 76; range, <1–102), 50.5% of patients were males. The duration of disease varied from less than one month to 60 years (median, 8.3 years). Focusing on the purpose of the present report, almost half the cases (n = 1822, 51.8%) were transferred to the ED by means of the emergency ambulance services. A total of 1751 cases (49.8%) received an ED visit followed by discharge and referral for outpatient visits to their GPs/diabetes units or transfer to nursing homes; 604 cases (17.2%) received a short-term intensive observation; 1161 (33.1%) were admitted to different departments according to specific conditions and/or local hospital organization (Internal Medicine, 44.7%; Critical Care units, 24.5%; Geriatric units, 13.2%; Endocrinology, Diabetes and Metabolism units, 6.3%). Unit and total costs for hypoglycemia emergency