



The relative burden of diabetes complications on healthcare costs: The population-based CINECA-SID ARNO Diabetes Observatory

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KEYWORDS

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Abstract *Background and aims:* In the present population-based study, we aimed to describe the per patient annual healthcare cost of people with diabetes in 2007–2012, to assess the relative burden of diabetes complications and other potential determinants on healthcare costs in the 2012 cohort, and to describe and analyse the determinants of the cost of incident cases diagnosed in 2012.

Methods and results: We analysed data from a retrospective cohort of residents in four Italian areas that were served by Local Health Units participating in the ARNO Observatory. Per patient annual healthcare costs (Euros) were estimated as the sum of all the resources supplied during that year (drugs, outpatient care, and hospitalisations). The mean per patient annual healthcare cost increased from €2752 in 2007 to €3191 in 2010, before decreasing to €2791 in 2012. The largest component of these costs was represented by hospitalisations (around €1550, on average; 51.7% of total cost), followed by outpatient care (€422; 14.6%) and drugs (€973; 33.7%). In 2012, the most relevant cost determinants were chronic diabetes complications, with an additional cost due to nephropathy/end stage renal disease (€4683), amputations (€5042), lower extremity revascularization (€4808), and cerebrovascular diseases (€3861). Costs associated with incidence cases were higher than those associated with prevalent.

Conclusion: The present study provides evidence on the excess of healthcare costs due to diabetes complications in both prevalent and incident cases.

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Introduction

Diabetes determines a relevant economic burden on national healthcare systems. Direct healthcare costs related to diabetes accounted for 10.8% of the total health budget worldwide in 2013 [1] and for 144 billion US dollars in the

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European Union in 2014 [2]. As the prevalence of diabetes and its related complications are increasing, the direct costs of the disease, particularly for inpatient care, will continue to rise. The fourth edition of the International Diabetes Atlas indicated that in Europe, healthcare expenditures for diabetes will grow by around 20% between 2010 and 2030 [3]. The main determinants of this increase are the continuing growth in the prevalence of diabetes and its complications, as well as changing health care practices, technology, and cost of treatment, with a relevant increase in the use and price of prescription drugs [4].

People with diabetes have a higher lifetime healthcare expenditure than do those without diabetes [5], with an estimated cost ratio between average annual costs of 2.3 (range: 1.5–4.0, depending on the methodological approach) [6–12]. The average annual healthcare cost for a person with diabetes in the EU is around €2500, with some variations across countries [13], probably due to heterogeneity in the available data, as well as in adopted cost calculation methods. Studies from Europe [7–11,13–15] and the United States [6] on the distribution of the drivers of these costs have shown strong agreement. They reported that inpatient costs are consistently higher than outpatient costs, accounting for around half of total costs in all examined countries [10]. Moreover, many direct costs are associated with long-term diabetes complications [14,16,17]. In a global scenario of limited economic resources, health care planners need long-term projections of outcome and cost. In this context, one of the major limitations in the knowledge of costs is the lack of data on the cost of diabetes complications [18–21] and of standardised long-term data that would allow for trend analysis and identification of relevant determinants [22].

The objective of this study was to analyse the healthcare costs in a large sample of Italian patients with diabetes covered by the National Health Service (NHS). The specific objectives were: 1) to describe the per patient annual healthcare cost of people with diabetes in 2007–2012; 2) to assess the relative burden of diabetes complications and other potential determinants on healthcare costs in the 2012 cohort; and 3) to describe and analyse the determinants of the cost of incident cases diagnosed in 2012.

Methods

Data

The population-based multiregional ARNO Observatory is a healthcare monitoring system based on administrative data (demographics, disease-specific exemptions, outpatient drug prescriptions, inpatient hospital discharge records, lab tests prescriptions, and instrumental examination) from more than 30 Local Health Units (LHUs) in Italy. The ARNO Observatory was created by CINECA to provide local and national reports on the main epidemiological features and drug consumption of representative subgroups of the Italian population, such as children, the elderly, and those with chronic diseases [7,23–26]. Data on

drugs prescriptions are provided by all participating LHUs, whereas data on hospitalisations and health services utilisation are provided by only some LHUs. People using health care services in Italy can easily be identified through the Italian NHS, a universal system which allows all residents to receive health care, irrespective of their citizenship, social class or income. Moreover, individuals with diabetes receive free access (without any co-payment) to drugs, outpatient care, and hospitalisations within the NHS, making the use of private sector care negligible among people with diabetes.

This report includes data from the 2007–2012 population-based retrospective cohort of residents in four Italian area covered by LHUs participating to the ARNO Observatory, distributed as follows: 34% in the North, 39% in the Centre, and 27% in the South. All data referring to one subject were linked by means of a unique identification code. Subjects were considered to have diabetes if they satisfied at least one of the following criteria: 1) if they had received at least one prescription of glucose-lowering drugs (GLD), either oral agents or insulin (Anatomical Therapeutic Chemical Classification System [ATC], code A10A and A10B), during the course of the year; 2) if they had one hospital admission with a diagnosis of diabetes (ICD9-CM 250); or 3) if they were exempt from co-payments due to a diagnosis of diabetes. Incident cases in 2012 were identified by excluding subjects identified as having diabetes during the previous 5 years (2007–2011).

Per patient annual healthcare costs were estimated as the sum of all resources supplied during the year. For examinations, consultations, and hospitalisations, we used regional tariffs, which represent the reimbursement paid by the LHUs to healthcare providers, as the standard cost. Drug prices were those reimbursed by the NHS. All costs were expressed in Euros. Annual costs were adjusted for inflation to 2012 Euro value, using the Consumer Price Index obtained by the Italian National Institute of Statistics – ISTAT (<http://rivaluta.istat.it/Rivaluta/>).

For the 2012 cohort, we also collected the following data for each patient: age, gender, GLDs (oral agents, insulin, oral agents and insulin associated, no GLD), presence of diabetes complications (hypertension, heart diseases, nephropathy/end stage renal disease (ESRD), cerebrovascular diseases, amputations, lower extremity revascularisations, retinopathy, neuropathy), presence of acute complications of diabetes (ketoacidosis, coma, hyperosmolality), and presence of other comorbidities (chronic obstructive pulmonary disease, cancer, depression). Complications and comorbidities were identified using specific algorithms based on ICD9-CM codes of diagnosis (principal diagnosis) and procedures in hospital discharge records, and on outpatient examinations and specific drugs for the assessed diseases (Annex). Algorithms were developed based on published literature, the AHRQ Inpatient Quality Indicators, previous ARNO Observatory studies, and expert opinions. References are reported in the Annex.

The variable diabetes duration was defined as the duration a subject had diabetes during the study period, i.e., 0 (incident case) up to 5 years or more.

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