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Costs of Hospital Stay in Specialized Diabetic Foot Department in Russia

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ABSTRACT

Background: Diabetic foot ulcer (DFU) is considered to be one of the most common and costly diabetic complications. The approach unanimously recommended for patients with DFU is treatment by a multidisciplinary foot care team, which in Russia mainly is limited to few federal and regional hospitals. Currently, financing schemes for medical institutions are changing, thus raising the issue of setting adequate tariffs. **Objective:** To identify the cost of treatment in the specialized diabetic foot department and determinants of variation in cost among individual patients with DFU in the Russian setting from the perspective of a health care organization. **Methods:** We collected data on treatment cost per admission to the Diabetic Foot Department of the Endocrinology Scientific Center and information on patients' characteristics derived from medical records. Data on costs were analyzed, and descriptive statistics are reported. A standard multiple regression analysis was performed to identify the main drivers of treatment cost for patients with DFU. **Results:** The mean treatment cost was €3051. The mean cost of treatment for patients with DFU was significantly higher than that for diabetic patients without this complication. The most relevant predictors of the costs of treatment for patients with DFU were surgery provided and length of stay in hospital. **Conclusions:** The cost for treatment of DFU by a multidisciplinary team in the federal medical institution was substantially higher than basic medical insurance tariff for this disease. Because revascularization procedures appeared to be the main cost driver, our results stress the need for careful implementation of this type of treatment for patients with DFU.

Keywords: cost drivers, cost of treatment, diabetic foot ulcer.

Introduction

Diabetic foot ulcer (DFU) is considered to be one of the most common and costly diabetic complications. It is suggested that the lifelong incidence of foot ulcer for diabetic patients may reach 25% [1]. The prevalence of DFUs varies between 1.5% and 10% in different populations [2]. According to the International Working Group on the Diabetic Foot, patients with DFU consume 12% to 15% of the health care resources for diabetes. In a developing country, this figure is expected to be even higher, up to 40% [2]. The World Health Organization estimated this proportion to be around 15% to 25% [3]. Research conducted in the United States showed that patients with DFU had $11,710 in incremental annual health care costs for Medicare, and $16,883 for private insurance, compared with matched patients with diabetes without DFU. These results prove that DFU imposes a substantial burden on public and private payers, ranging from $9 million to $13 billion in addition to the costs associated with diabetes itself (2012 US dollars) [4]. Kerr et al. [5] estimated the cost of diabetic foot care in the period 2010 to 2011 at £580 million, almost 0.6% of National Health Service expenditure in England [5].

More than half of the DFU episode treatment costs (reported proportion ranged from 62% to 80.7%) were attributed to the provision of inpatient care according to studies carried out in the United States and Belgium and in a European multicenter study [6–10]. This proportion is dependent on the severity of the DFU episode and its outcome as was demonstrated by Apelqvist et al. [11] in Sweden in 1990—the in-hospital stay contributed only 37% of total costs in case of primary healing and 82% in case of amputation [11].

Researchers from several countries consistently showed that increase in severity of DFU is followed by the enormous growth in cost. The total treatment cost of superficial ulcer was 5 times lower than the treatment cost of abscess/osteitis and 10 times lower than the treatment cost of gangrene in the above-mentioned Swedish study [11]. The same trend, even with a more pronounced difference, was observed in the US-based study, conducted in the period 2000 to 2001, in which the cost

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of DFU episodes ranged from $1892 (superficial ulcer) to $27,721 (gangrene or amputation) [6]. The total direct cost for patients with DFU in the group of patients with the most severe disease (combination of infection and peripherial arterial disease [PAD]) was almost 4 times higher than that for patients with the least severe disease (no infection or PAD) in the prospective multicenter study with 14 participating DFU treatment centers from 10 European Union countries (Eurodiale) [10].

The most feared outcome of DFU is amputation, which leads to permanent disability, loss of mobility, and significant decrease in the quality of life [12–14].

Many new treatments and strategies, aimed at decreasing the time to healing of DFU and, consequently, the rate of amputations, appeared during recent decades. Evidence of their effectiveness, however, is often insufficient to recommend their adoption in routine practice [15,16]. Treatment of patients with DFU by multidisciplinary foot care teams, who are able to address critical healing issues for DFU, such as glycemic control, infection, off-loading of high plantar surface pressures, restoration of lower-extremity blood supply, and local wound care, appears to be one of the main recommendations unanimously given by national and international guidelines [2,16–18].

Most of the studies on DFU epidemiology and related costs come from the industrialized countries, whereas studies from the former Soviet Union and Eastern European countries are extremely rare.

The prevalence of DFU among registered diabetic patients in Russia varies between 2.2% and 8.5% [19–21]. The annual rate of amputations related to DFU is estimated to be between 6.7 and 8.9 per 1000 diabetic patients [22]. The proportion of above-ankle amputations is higher in Russia than the one reported in industrialized countries and reaches 45% to 47% of all DFU-related amputations [10,23]. Although the existing Russian guidelines on the treatment of diabetic foot conform to the international standards, practitioners point out that the level of care that patients with DFU receive in Russia is far from it, mainly because of inadequate organization and financing [23,24].

The outpatient care to patients with DFU in Russia in most of the cases is provided by general surgeons, but the network of outpatient diabetic foot care clinics is also expanding and now there are almost 200 offices in Russia. The inpatient care is provided in the municipal hospitals, mainly in the general surgery departments for patients with infected wounds. All these services are paid through the system of public medical insurance, according to the reimbursement rates, which are different for every Russian region.

The provision of the recommended complex treatment for patients with DFU by multidisciplinary foot care teams is limited mostly to the few federal and regional hospitals. For several years, access to these hospitals for patients with DFU was ensured by the state program "Provision of highly technological medical care" (HTMC). The HTMC program, annually approved by the Russian government, specified the covered diseases, types of treatment, reimbursement rates, as well as the planned number of admissions to specialized medical centers. More than 30% of the planned HTMC admissions of the "Endocrinology" profile (the category that includes patients with DFU) were allocated to the Endocrinology Scientific Center (ESC) in Moscow [25]. Currently, the HTMC program is gradually transferred into the public medical insurance system, raising the issue of adequate pricing for these treatments to ensure access to them for the general population.

Therefore, our objective was to identify the cost of treatment in the specialized diabetic foot department and determinants of variation in cost among individual patients with DFU in the Russian setting from the perspective of a health care organization.

Methods

We collected data on all admissions to the ESC Diabetic Foot Department reimbursed by the federal budget through the HTMC program in 2011.

Data on individual patient treatment cost were obtained from ESC's Economic Department database, where it was presented as total cost per admission. It included costs of medical procedures and medications provided, as well as the cost of staying in the hospital ("hotel services"). All costs were retrospectively calculated using the data on consumption derived from individual patients' medical records and internal ESC's prices. Internal price per procedure was defined following the World Health Organization recommendations and included labor costs, cost of consumables, which type and amount did not depend on individual patient's characteristics, equipment depreciation, and overhead costs [26] (Personal communication with an employee of the ESC's Economic Department, responsible for calculating the costs data and maintaining the costs database, March 3, 2014). The amount of labor and consumables required per procedure was assessed by ESC's Economic Department employees using expert opinion. Labor costs were calculated on the basis of standard salary of the specialist executing the procedure. The medications' and consumables' costs were estimated using the procurement prices for the institution. In case the procedure required using consumables, the type or quantity was dependent on individual patient's characteristics (e.g., balloon catheters or stents); their costs were calculated individually and added to the price of the procedure. The price per day in hospital ("hotel services") was retrospectively based on annual hospital's expenditures on hospital facilities and number of hospital days provided (Personal communication with an employee of the ESC's Economic Department, responsible for calculating the costs data and maintaining the costs database, March 3, 2014). Some of the prices used for calculating treatment cost are presented in Table 1.

Costs in Russian rubles were converted into euros using the average annual exchange rate for year 2011 (€1 = 40.8848 Russian rubles).

Besides data on treatment costs for individual patients, we have collected information from their medical records on full diagnosis, including the presence of PAD, severity of disease according to Wagner classification (clinical classification of the severity of the lesion, where grade 1 is superficial ulcer; grade 2—deep ulcer with no bone involvement; grade 3—osteitis, abscess, or osteomyelitis; and grade 4—local gangrene) and provision of renal dialysis and surgery.

All admissions were analyzed as separate cases, although some patients had more than one admission during the year. Our decision was determined by the objective of our research—to define cost drivers for the individual hospitalization, not the total process of treatment of a patient. Other patients in the case of severe DFU may also have more than one admission during the year but to different hospitals; therefore, this information was unavailable for the analysis.

We identified three main reasons for the admissions: 1) DFU; 2) Charcot foot or history of foot ulcers; this group was considered as requiring treatment for the prevention of ulceration in future; and 3) severely decompensated diabetes with sensory neuropathy and PAD, but without the history of previous ulceration. We studied costs for all three groups. Because the number of observations for each reason of admission was quite small and the treatment costs were skewed to the right (Shapiro-Wilk test was significant proving the non-normal distribution of data), we used bootstrapping (1000 replications) to examine the variation in costs in the three groups. The non-normal