Health-Economic Consequences of Diabetic Foot Complications
Review of International Studies
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Why health economics

- Health economics has been defined as a science concerned with issues relating to the allocation of scarce resources to improve health.
- Unfortunately, majority of medical firms are inefficient and therefore, they waste scarce resources.
- This statement is particularly true for countries like Georgia, where various types of health economic research is in embryonic stage or doesn’t exist at all.
- Without this type of research, individuals, health providers, insurance companies, state and at the end whole society waste valuable resources.
Economic consequences of diabetes....

In addition to causing suffering and morbidity, foot lesions in diabetic patients have substantial economic consequences, because

- Diabetes is a chronic disease that requires a life-long commitment of resources to prevent and treat complications.
- The disease affects an increasingly large number of people around the world, putting them at risk for disability and diminished quality of life.
- More expensive new technologies and treatment options have great impact on the health care budget.
- A modeling estimate shows that in USA a 50% improvement in diabetes management and control could reduce annual medical costs for patients with diabetes by $196 billion over a twenty-year period.
US economic data on diabetes foot

- Because of serious complications diabetes foot has significant cost.
- 33% percent of the $116 billion in direct costs of treatment of diabetes and its complications in the U.S. in 2007 were associated with the treatment of foot ulcers.
- Foot ulcers cause emotional, physical, productivity and financial losses;
- Hospital costs for adults with diabetes-related lower extremity amputations were more than $1.6 billion in 2006
- Patients who visited a podiatrist had $13,474 lower costs in commercial plans and $3,624 lower costs in Medicare plans during 2-year follow-up in a 2011 analysis
UK economic data on diabetes foot

- Approximately £1 in every £150 spent by the National Health Service (NHS) in England each year is on diabetes related foot disease.
- In England there are estimated to be 6,000 diabetes related amputations per year, with the estimated cost of diabetes related foot disease, in particular ulceration and amputation calculated to be between £639 and £662 million per annum.
- The Department of Health Audit Office estimated that reducing late referrals by 50% could save £34 million a year through reducing amputation rates. In order to achieve this saving, patients should have ready access to the services of podiatrists who have the necessary knowledge and skills to deal with these complex patients (C. Gooday et al. 2013).
Review of Health Economic studies on Diabetes Foot
METHODOLOGICAL AND PRACTICAL PROBLEMS IN HEALTH-ECONOMIC STUDIES

• The tendency in published reports to limit cost analysis to inpatient care in the surgical departments rather than to a defined end point, such as complete healing or death.

• Reasons

✓ Sometimes analysis is done from the perspective of the surgical department, so other costs are seen as not relevant

✓ Difficulty in obtaining resource-use data after hospital discharge limits the perspective in some cases.

✓ Lack of understanding of diabetic foot disorders that leads to a belief that the problem is solved by amputation might contribute to incomplete analyses. To fully estimate the total direct short-term cost of foot ulcers and amputations, patients must be followed for resource use until a final end point, irrespective of where they are treated.
Databases and other secondary data sources

- Recent studies describing the economic consequences of these problems have often been based on information from databases or claims data.
- Such studies make it more difficult to restrict the cost analysis to a single ulcer episode or to differentiate the various types of costs for different types of ulcers.
- The analyses are, however, often suitable for estimates of foot ulcer costs for large populations of diabetic patients during specified periods.
- The problems associated with cost analyses of diabetic foot lesions based on secondary sources are that some databases do not contain information about all types of resources used and that some databases are restricted to selected populations, thus preventing extrapolation to larger groups.
Costs of management and treatment

- Comparisons of results from various health-economic studies are complicated by differences in the study design (prospective vs. retrospective, primary vs. secondary data), patient populations, types of foot lesions, health care systems and settings, reimbursement systems, treatment practices, the time frame for analysis.
- In addition, some studies lack information about the year of costing, the monetary exchange rate, and the type of costs actually included.
- Other studies have included a mix of patients with and without diabetes
Costs of management and treatment

• Costs reported from many studies are probably underestimated, because it is often unknown how, and to what degree, patients were treated before referral. The period before referral for foot ulcer treatment may represent patient and physician delay, as has been reported in several centers.

• The total costs of a lower-extremity amputation include more than just inpatient care and surgery; outpatient visits and topical wound treatments, required until complete healing has been achieved, must be included as well.

• Despite the different methods used, many studies confirm the substantial economic consequences of diabetic foot lesions.
Cost of deep foot infections

- A Swedish study investigated costs for managing deep foot infections in 220 patients and categorized them according to clinical outcome.
- Mean healing time for patients who did not need an amputation was 29 weeks; for those who required minor or major amputation, it was 52 weeks and 38 weeks, respectively (minor amputations required longer healing times than did major amputations).
- Total cost (adjusted for inflation and converted to US$) for healing without amputation was $17,554 per patient, whereas the corresponding cost for healing with minor amputation was $33,540 and with major amputation was $30,135. The cost for patients whose infections were unhealed at death was $31,407.
Cost of deep foot infections

- Topical treatment during outpatient care accounted for 51% of all costs and was the largest cost for all outcome groups except for patients who healed after major amputation, for whom the inpatient costs dominated.
- The number of weeks between diagnosis of deep foot infection and healing and the number of surgical procedures were variables that explained 95% of the total costs.
- Costs of antibiotics accounted for <4% of the total costs.
Cost of deep foot infections

• In a study comparing resource use associated with diabetic foot infections for 3 European countries, the length of hospital stay was more than twice as long for patients in Germany than for those in Sweden and the United Kingdom.

• Other major differences among the countries in management strategies, and thus in resource use, were the rates of amputation and vascular surgery and the use of antibiotics.

• In the UK, all patients were treated with intravenous antibiotics, compared with only 58% in Sweden and 68% in Germany. The amputation rate was only 4% in the United Kingdom, compared with 16% and 17% in Germany and Sweden, respectively.
The authors concluded that these differences could largely be explained by variations in access to inpatient and outpatient facilities, in patient characteristics, in reimbursement schemes and in health care systems.
Cost of various types of foot ulcers

- In Sweden, the average cost for patients with superficial ulcers, all of whom healed primarily without amputation was US$5098.
- For patients with gangrene, the most severe ulcer type, the average cost was US$59,646 (costs adjusted for inflation and converted to US$). In this group of patients, the rate of amputation was 97%.
**Cost of various types of foot ulcers: Netherlands vs USA**

- In a comparison of diabetes-related foot lesions among patients in the Netherlands and California, the duration of hospitalization was significantly longer in the Netherlands, whereas the incidence of lower-extremity amputation was higher in the United States.

- The authors suggested that these differences may be explained by differences in access to health care, health care financing, and reimbursement systems.

- In the Netherlands, most people are ensured affordable governmental health care, whereas in the USA, costs are more often paid by the patient or by the patient’s insurance company.

- If the cost of an amputation procedure is reimbursed but the costs of outpatient care are not, this may influence the rate of lower-extremity amputation.
Long-term costs

• In addition to the short-term costs until an ulcer is completely healed, long-term costs for previously treated patients must be considered.
• These costs are especially high for patients who have undergone lower-extremity amputation, with a substantial part related to their increased need for home care and social services.
• Long-term costs associated with amputations include prosthesis, special footwear or other aids, rehabilitation, and costs related to any residual disability.
• The costs for home care and social services are highest among patients who have undergone major amputations.
• Among patients with limb-threatening ischemia, another study found that the economic consequences of amputation were 10–40 times those of successful limb salvage.
Cost-effectiveness of prevention

• Studies indicated that all diabetic patients at risk for foot ulcers and amputations with optimal prevention would be a cost effective or even cost saving strategy.

• A 1-year comprehensive prevention program, compared with standard care, resulted in a significant decrease in days affected by an ulcer, hospitalizations, foot surgery, and missed work days, in addition to fewer lower-extremity amputations.

• Several reports have focused on the importance of patient compliance with prevention and treatment. Compliance may be influenced by several factors, including the degree to which expenses are covered for the patient.

• A report from Belgium concluded that incentives for prevention are low, from the patient’s point of view, when the cost for prevention is paid by the patient and the cost for treatment is covered by the health care system.
**Other aspects of cost-effectiveness**

- US modelling study concluded that surgical debridement and a 10-week course of culture-guided oral antibiotic treatment may be as effective as and less costly than other alternatives, including more extensive diagnostic testing or immediate amputation.

- Other authors have argued that for osteomyelitis of the toe, a short course of antibiotic therapy and digit amputation is more cost effective than prolonged antibiotic therapy alone.

- One reason for the different conclusions is the use of different perspectives and a tendency not to consider certain costs, such as those that occur after a toe amputation. In a Swedish study, 76% of the total costs were incurred after amputations before complete healing was achieved. This was mainly attributable to costs for topical treatment after minor amputations.
Difficulties in performing health-economic studies

- Difficulties with conducting prospective randomized controlled studies of chronic wounds include the extensive research resources necessitated by the long duration of wound healing and the heterogeneous nature of the patients, resulting in small subgroups.
- Furthermore, foot ulcers differ during the healing process; treatments in different phases make comparisons of strategies difficult.
- In addition, it may be difficult to perform blinded studies of topical treatments.
Difficulties in performing health-economic studies

- A direct comparison of cost analyses of primary healed foot ulcers and ulcers healed after amputation is inadvisable, because the 2 groups are usually not comparable for patient characteristics and background variables.
- Patients in the amputation group often have more severe complications and co-morbidities that probably will influence the outcome and resource use.
- Ethical reasons preclude randomization of treatment alternatives to solve this methodological problem.
Difficulties in performing health-economic studies

• One reason for various incidences of lower extremity amputation from different settings is different indications for amputations

• In Sweden, strict criteria for amputation were used and a non-healing ulcer was not an indication for amputation. Other authors have reported the failure of a wound to heal, defined as no healing progress after 6 weeks, as an indication for amputation.

• If the foot has an adequate vascular supply and no significant infection, a non-healing plantar ulcer usually results from poor treatment and/or poor compliance
Diabetes Foot Care Project

- 11 diabetes foot rooms established and equipped in 6 regions of Georgia
- 14 nurses were trained in podiatric
- Health education materials prepared
- Doctors trained in diabetes foot care and management
- Mass screening and awareness raising campaigns
- Media campaigns and etc.
- Diabetes foot rooms started operations in February, 2016
- Half year later the project team decided to study and assess existing situation
Diabetes foot patients registered in established diabetes foot rooms were interviewed using semi-structured questionnaire. Questionnaire were developed together with experienced researchers and diabetes specialists. 126 patients from Adjara, Imereti, Samegrelo, Kvemo and Shida Kartli regions were interviewed after receiving an informed consent.
General findings

- **Age:** range from 39 to 79, mean - 61, median – 60, mode – 76
- **Sex:** male – 54%, female – 46%
- **Education:** secondary and professional – 56%, higher – 44%
- **Family status:** married – 91%, single -5%, widow – 4%
- **Ever have ulcer/wounds on foot** – 26%
- **undergone amputation** – 9% (minor, on toe)
When Diabetes was diagnosed (%)?
When Diabetes foot was diagnosed (%)?

- 2016: 28%
- 2015: 6%
- 2014: 8%
- 2013: 3%
- 2012: 8%
- Earlier: 45%
- Don't remember: 8%
Monthly household income in GEL (%)
Monthly healthcare expenditure in GEL (%)
How much did you pay during your last outpatient visit in GEL? (%)

- I paid nothing: 7%
- 10-50 GEL: 24%
- 50-100 GEL: 33%
- >100: 36%
Who covered your amputation cost? (%)

From those who were amputated

100%

- State Programme
- myself
- Private insurance
- Local municipality
Do you visit to your doctor during illness? (%)

- Yes: 48%
- No, because of health care cost: 27%
- No, because of time issue: 15%
- No, transportation issues: 10%
Healthy life style/disease prevention (%)

• 27% of patients are smokers
• 58% do not have regular, any type of physical activity
• 18% attended educational session on diabetes foot care/prevention (89% of them attended during last 6 months)
• 36% read any information on diabetes foot care/prevention
• 95% are interested to learn more about diabetes foot care/prevention
Do you wear special shoes (%)?

- Yes: 18%
- No, I can't afford to buy: 57%
- No, impossible to get in my town: 16%
- Doctor/podiatrist didn't advice me: 9%
Have you any type of medical insurance (%)
Does your insurance cover cost of pharmaceuticals (%)?

- Yes: 89%
- No: 11%
Could you afford to buy prescribed pharmaceuticals (%)?

- 64%: I could buy
- 36%: Couldn't buy because of high price
What are major barriers in terms of your accessibility to healthcare services (%)?

- High prices: 62%
- Low qualification of medical personnel: 17%
- Long distance: 14%
- Other: 7%
Conclusions from the survey

- Training of podiatrists and establishment diabetes foot rooms noticeably contributed to early detection of diabetes foot problems.
- In general, diabetes foot patients have considerably high medical expenditure in relation to their income.
- Almost all interviewed patients are covered by state Universal Healthcare Program (UHP), which mainly covers the cost of in-patient services (e.g. amputation).
- Expenditure for outpatient services mainly covered by the patients themselves, as a result they often delay/postpone visit to their doctors.
- UHC program does not cover pharmaceutical cost, 64% of patients can’t afford to buy prescribed medicines.
- Patients have low awareness on diabetes foot prevention/care and healthy life style.
Conclusions

- Diabetic foot infections are one of the most costly foot complications because of their long healing time and often poor outcome. The large costs and poor quality of life associated with diabetic foot complications indicate that management strategies that speed healing and reduce the number of amputations could be cost effective.

- The chronic lifelong multi-factorial problems associated with diabetes, the heterogeneous patient populations, the long duration of wound healing, the simultaneously occurring complications, the treatment by many specialists and professionals, and the complex causal relations are factors that complicate prospective health-economic studies of diabetic foot lesions.
Conclusions

- Important factors that influence the total costs and cost effectiveness of topical treatments and that have to be examined in health-economic analyses of the diabetic foot are costs of material, staff, and transportation; frequency of dressing changes; rate of healing; and final outcome.

- The major costs for infected diabetic foot ulcers that healed after an amputation occur between amputation and complete healing and are mainly related to topical treatments.

- The costs of antibiotics are low in comparison with the total costs for treatment of diabetic foot infections.

- The total costs for treatment of deep foot infections are high, especially for patients who have undergone amputations.
**Conclusions**

- Prevention, including patient education, foot care, and special footwear in accordance with present international recommendations, is cost effective or cost saving for all diabetic patients at high risk for foot ulcers and lower extremity amputation.

- A health-economic perspective of the diabetic foot implies consideration not only of the costs of the amputation procedure but also of the outcome of treatment, including quality of life, survival, and the possibility to save the limb.

- It is clear that amputation and its consequences result in very costly solutions, and approaches to saving the limb should therefore be the first
Thank you for your attention!
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