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The impact of economic recession on the use of treatment technology for peripheral arterial disease

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Stent;
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Abstract
Objectives: There is broad concern that economic recessions may have adversely affected both population health and healthcare. This study investigates whether economic changes may have affected the treatment of one of the major diseases in Germany, peripheral arterial disease (PAD), using femoropopliteal stent angioplasty.
Methods: This retrospective longitudinal study uses multivariate linear regression to examine associations between changes of five principal economic indicators between 2000 and 2010 and the demand for femoropopliteal stents in Germany between 2005 and 2010, controlling for the prevalence of PAD risk factors, cardiovascular drug demand, reimbursement of healthcare providers for stent implantation, stent selling prices of manufacturers and evidence from clinical studies.
Results: Unemployment in the population aged 25–74 years and the harmonized index of consumer price indices were associated with femoropopliteal stent demand in Germany with a time lag of 2.5 and 3 years, respectively.
Conclusions: There was an association between economic change and femoropopliteal stent demand. Results suggest a role of practice related variables at a center and individual physician level. More research is needed at this center and individual level to examine changes in decision making in PAD treatment following economic change.

Introduction

There is widespread concern that the recent economic crisis has adversely affected both population health and health

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care [1,2]. Peripheral arterial disease (PAD) is highly prevalent in industrialized countries. Data suggest that up to 15% of the adult population suffer from pain, reduced walking distance, and trophic disorders in their lower extremities associated with PAD [3].

A majority of symptomatic PAD lesions are located in the femoropopliteal arterial segment. In treating these lesions, plain balloon angioplasty (PTA) has been considered the standard of care. The additional use of stents in such lesions following PTA (Stent PTA) presents a promising, minimally-invasive treatment option and facilitates increased acute technical success rates and prolonged patency rates as compared to plain balloon angioplasty alone [4].

However, the research question arises whether the use of femoropopliteal stents may be affected by the changes wrought by an economic downturn. Current research suggests that the mechanism of this impact may be two-fold. First, recession is often accompanied by increased unemployment which can result in a worsening of PAD risk factors such as physical inactivity, smoking or poor nutrition, and in delays in seeking medical care due to financial constraints, mental stress or patient concern about co-payments [5]. In addition, reductions in GDP and increases in unemployment may lead to greater healthcare expenditure constraints [6]. Those constraints may then result in suboptimal prevention, diagnosis and treatment of PAD. While clinical evidence in support of its use is forthcoming, femoropopliteal stent use may be particularly affected by such healthcare expenditure constraints due to its increased cost compared to PTA alone.

Robust evidence about the effect of economic change on the use of femoropopliteal stents is lacking. Existing evidence from research in coronary heart disease (CHD) [7,8] and coronary stent use [9,10] on both aggregated and individual patient-level data have revealed inconsistent results. Findings range from positive to negative effects of economic change on CHD risk factors and on coronary stent use. Moreover, in these studies, the populations varied by age group, sex, ICD diagnosis and cause of mortality; and the studies were conducted using different explanatory variables for economic change and different modeling approaches. That said, these results may provide only limited evidence for femoropopliteal stent use; because while CHD and PAD share atherosclerosis as a root cause, they differ in terms of their specific pathophysiology, clinical practice and device technology.

Therefore, we collected aggregated time series data and used multivariate linear regression aiming to examine associations between the change in five principal economic indicators between 2000 and 2010 and the demand for femoropopliteal stents in Germany between 2005 and 2010.

Material and methods

Definition of variables and data collection

While data on Stent-PTA procedures, data on exposure to economic change and data on the control variables considered relevant in this study were not available at individual patient or physician level, we collected aggregated time series data.

Table 1 Notations and descriptions of variables.

Dependent variable	
FEM	Demand for femoropopliteal stents
Explanatory variables	
CON	Real private final consumption per capita, price-adjusted
GDP	Real gross domestic product per capita, price-adjusted
INF	Harmonized index of consumer price indices
PRO	Industrial production
UNE	Unemployment in population aged 25–74 years
Control variables	
AGE	Population, aged 65 years and older
ASP	Average selling price for femoropopliteal stents, price-adjusted
B1C	Platelet aggregation inhibitors
C10A	Cholesterol and triglyceride regulators
C10C	Lipid regulators in combination with other lipid regulators
C2A	Antihypertensives of non-herbal origin, plain
C2B	Antihypertensives of non-herbal origin, combination with diuretics
C2C	Rauwolfia alkaloids and other antihypertensives of herbal origin
C2D	Rauwolfia alkaloids and oth. antihypert. of herbal origin in comb. with diuretics
C3A	Diuretics
C4A	Cerebral/peripheral vasotherapeutics
C7A	Beta-blocking agents, plain
C7B	Beta-blocking agents, combinations
C8A	Calcium antagonists, plain
C8B	Calcium antagonists, combinations
C9A	ACE inhibitors, plain
C9B	ACE inhibitors, combinations
C9C	Angiotensin-II-antagonists, plain
C9D	Angiotensin-II-antagonists, combinations
C9X	Other renin–angiotensin agents
DM	Diabetes mellitus, prevalence in population aged 40–79 years
DRG	Reimbursement for DRG tariff F54Z, price-adjusted
FEMneg	Femoropopliteal publication at EbM Level One, contra stent PTA
FEMnegCS	Cumulative sum of femoropop. public. at EbM Level One, contra Stent PTA
FEMneu	Femoropopliteal publication at EbM Level One, neutral to stent PTA
FEMneuCS	Cumulative sum of femoropop. public. at EbM Level One, neutral to Stent PTA
FEMpos	Femoropopliteal publication at EbM Level One, pro stent PTA
FEMposCS	Cumulative sum of femoropop. public. at EbM level one, pro Stent PTA
ILC	Demand for iliac stents
SMO	Population, aged 15 years and older who are daily smokers