

ECHE Helsinki 2010

# What determines the use of innovative technologies? The case of drug-eluting stents in German AMI patients

Michael Bäumlér, MSc Econ.

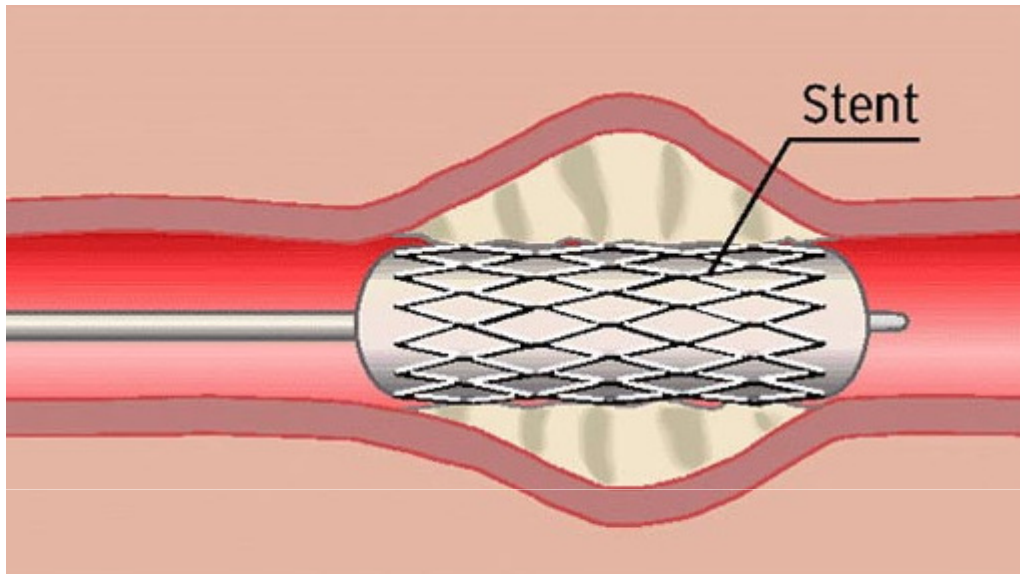
Dept. Health Care Management, Berlin Institute of Technology  
(WHO Collaborating Centre for Health Systems Research and Management)

&

European Health Technology Institute  
for Socio-Economic Research



## Bare-metal stents vs. drug-eluting stents in a nutshell

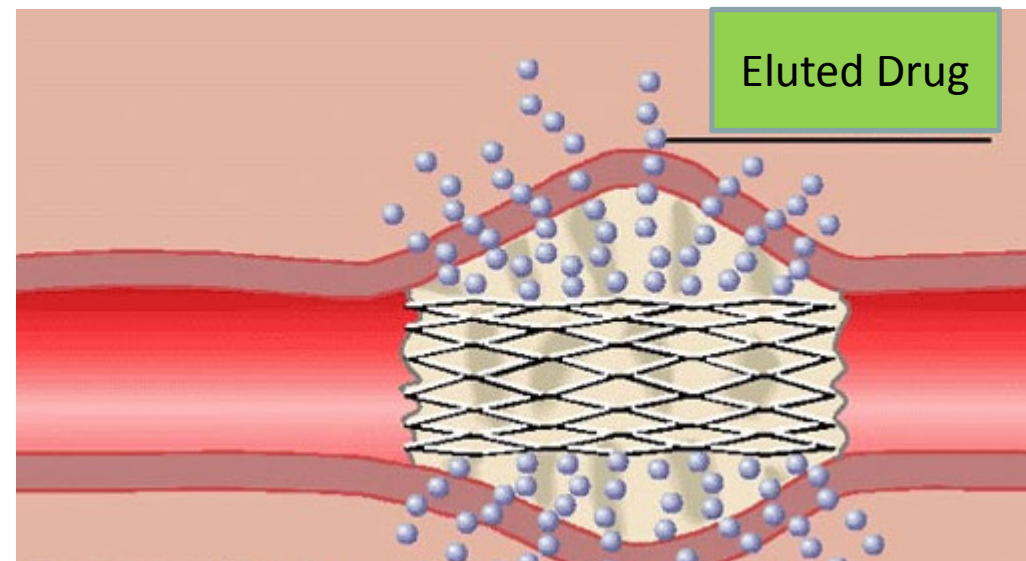


### Bare-metal stents (BMS)

- Mechanical
- Potential problem: Restenosis due to cell proliferation

### Drug-eluting stents (DES)

- Elute drug to minimize cell proliferation



## Background

- DES is taken as an example of an innovative technology
- Share of DES among all coronary stents is low in Germany
  - Especially in first years after introduction
  - Even compared to similar countries
- Literature available on use of DES in other countries but not for Germany
- Research questions to address:
  - Are physicians adhering to guidelines for this indication?
  - Which organizational characteristics encourage the use of the innovative technology?
  - Is Germany different to other countries?

## Hypotheses: Treatment decision is influenced by...

- Patient characteristics

- Health status (adherence to guidelines)

⇒ Patients with higher risk of restenosis are implanted a DES

- Socio-economic status (Hannan 2007)

⇒ Wealthier people are more likely to receive a DES

- Payment policies

- Higher payments encourage diffusion (Shih 2008)

⇒ Influence of hospital-individual base-rate x relative weight  
+ hospital individual add-on payment

- Hospital characteristics

- Hospital ownership (Grilli 2006) and teaching status

⇒ Private and University hospitals use DES more often

- Regional characteristics

- Per capita income correlates with diffusion (Slade 2001)

⇒ Wealthier regions are more likely to use DES

## Data and estimation method

- Observational data from a German sickness fund
  - 10,253 patients with diagnosis AMI between 2004 and 2006
  - Information about comorbidities and hospital
  - Information on hospital and county was merged
- Binary logistic three-level-regression

$$\text{Treatment}_{ijk} = \beta_{0jk} + \beta_{1jk} \text{YEAR2005} + \beta_2 \text{YEAR2006} + X_{ijk} \beta_3 + Z_{jk} \beta_4 + C_k \beta_5 + \varepsilon_{ijk}$$

$$\text{Random intercepts: } \beta_{0jk} = \beta_0 + v_{0k} + u_{0jk}$$

$$\text{Random slopes for years: } \beta_{1jk} = \beta_1 + u_{1jk} \quad \text{and} \quad \beta_{2jk} = \beta_2 + u_{2jk}$$

Patient-level i: Covariates  $X_{ijk}$

Hospital-level j: Covariates  $Z_{jk}$

County-level k: Covariates  $C_k$ , including dummies for respective state

## Covariates

- Health status, 33 variables

Age, gender, Ontario Acute Myocardial Infarction Mortality Prediction Rules, Charlson Comorbidity Index, estimation of AMI severity (based on epidemiological studies), number of vessels affected and stents implanted, Emergency implantation

- Socio-economic Status, 6 variables

Estimate using occupation and (voluntary) insurance status (approximation for income in employed and retired insured)

- Hospital, 15 variables

5 classes for hospital size and teaching status, number of beds available for AMI patients (+ squared), presence of cardiologic and cardio-surgical department, 2 dummies for ownership, dummy variable for city >200,000 inhabitants, hospital base rate, hospital's share of total hospital beds in county

- County, 5 variables + dummy variables for state

Inhabitants per km<sup>2</sup>, bankruptcy rate, employment rate, price of land, number of hospital beds in county

## Selected regression results (I)

Base characteristics	Co-Morbidities	Behaviour
Preliminary results		

Reference: 60-65, Male, Employed, 2004, No comorbidities, 1 stent,  
North-Rhine-Westfalia, continuous variables evaluated at mean

## Selected regression results (II)

Preliminary results

Reference: 60-65, Male, Employed, 2004, No comorbidities, 1 stent,  
North-Rhine-Westfalia, continuous variables evaluated at mean



## Results and discussion (I)

### **Patient characteristics**

- Apparent adherence to guidelines
  - Diabetes patients are more likely to receive drug-eluting stents
- Older patients are less likely to receive new technology
  - Reasonable from an economic point of view
  - Questionable from an equity perspective
- No differences between men and women

### **Occupation and insurance status → minor influence on treatment decision**

- Occupation status has no impact
- Retired individuals with voluntary statutory health insurance are more likely to receive innovative technology
  - Wealthier retired persons, possibly higher life expectancy

## Results and discussion (II)

### Payment policies

- Data on add-on payments for DES were not available
- No correlation between base rate and DES implantation

### Hospital characteristics

- University hospitals are more likely to use DES
  - Researchers are more open to innovation OR patients differ
- Not-for-profit hospitals as well
  - Fewer budget constraints than other hospitals?

### Area characteristics

- Big cities are more likely to adopt new technology
  - ⇒ Competition and more information on innovations
- County bankruptcy rates are negatively correlated
  - ⇒ Wealthier areas are more likely to adopt the new technology

## Limitations

- Strictly speaking the first level would actually be the lesion or the vessel
  - No detailed information about vessels or lesions
- Accuracy of coding may influence results
  - Incentives to code correctly and plausibility checks
  - Correlation between coding and certain types of hospitals?
- No detailed information about socio-economic status
  - Further data needed to judge effects
  - Rather homogeneous sample, all part of Statutory health insurance System (SHI)
- Unobserved hospital characteristics are of major importance
- Results are not necessarily transferable to other technologies

## Conclusion

- There seems to be adherence to treatment guidelines
- University hospitals adopt innovative technologies earlier
  - All other hospitals are less likely to choose DES
  - Wealthier areas and large cities are more likely to use innovative technologies
- Socio-economic status seems to be of minor importance for treatment decision within the German SHI system
- No differences between men vs. women and east vs. west German states
- Large part of variance is explained by factors on hospital level that are not captured in public available data

# Thanks to the audience

[michael.baeumler@tu-berlin.de](mailto:michael.baeumler@tu-berlin.de)

[www.mig.tu-berlin.de](http://www.mig.tu-berlin.de)

This analysis is a one of a range of research activities conducted by the European Health Technology Institute for Socio-Economic Research.

This institute represents a collaboration of Bocconi University, LSE Health and Social Care, Berlin Institute of Technology and Eucomed, the European trade association for medical devices

[www.ehti.info](http://www.ehti.info)

