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Regional Innovation Systems of Medical Technology: A knowledge production function of cardiovascular research and funding in Europe

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Key Findings

- Knowledge production of cardiovascular devices is largely spread across the regions of Europe.
- Receiving external funding strongly contributes to a region's knowledge output.
- Innovatory efforts in the form of external research funding are effective for promoting innovation in the medical device industry at the regional level.

What Problem Was This Research Addressing?

The development of new medical devices results from the interplay of scientific advancements, learning in medical practice, and technological development, with physicians often as key contributors (1). Many cardiovascular device innovations, in particular, are products of research (2). However, the effectiveness of external funding from national and supranational levels on research output is unclear (3). Understanding what leads to new knowledge and subsequent innovation in the cardiovascular devices is important from two perspectives: First, the effectiveness of external funding received by regions on innovatory output in Europe; Second, an analysis of knowledge inputs and outputs to provide insight into why some regions innovate in the medical device industry more than others.

What This Research Adds

The present study aimed to investigate the role of external funding in cardiovascular device innovation. For this purpose, we relied on the knowledge production function (KPF) framework that establishes the knowledge output of a region as a function of innovatory effort (4, 5); therefore, we examined external funding. Using cross-sectional analysis, we investigated regional variation in knowledge production by the number of publications in cardiovascular device research from bibliometric data obtained from the world's largest biomedical library, the US National Library of Medicine (NLM) (6). We evaluated the effectiveness of grants reported in the publications and the volume of European Union Horizon 2020 funding received by the innovating regions across Europe (31 countries consisting of EU27, the UK, Switzerland, Iceland, and Norway).

Project Partner:

Methods

We developed a spatial knowledge production function (KPF) of cardiovascular device publications for 2014–2017. We investigated the impacts of: grants reported in the publications and the volume of EU Horizon 2020 funding at regional level. We considered GDP as regional characteristic. We accounted for the spatial dependency: endogenous interaction by publications of neighbors (ρ), exogenous interaction by funding to the KPF of the neighbors (θ), and correlated effects by unobserved of the neighbors (λ). We first performed Moran's I test, following the combined approach for spatial effects selection. The first step is robust Lagrange multiplier tests of ρ and λ . The second step is to specify a Durbin model, including θ and either ρ or λ for a likelihood ratio test excluding θ , to select final model specification.

Research Findings

Of the 1,394 regions within the 31 countries that we considered, 1,051 (75%) regions were active in having at least one cardiovascular device-related publication between 2014 and 2017. The estimates of the (spatial) KPF models suggest an elasticity of 0.51–0.68 for the innovatory effort in the form of funding mechanisms. The effect is robust across different model specifications and by type of funding mechanism. Considering the Spatial Durbin Model in natural units, one more grant reported increases the number of publications by 1.27, *ceteris paribus*. The estimates specified at the log-scale, the elasticities for grants range between 0.54 and 0.62 and for EU Horizon 0.64 and 0.68 depending on inclusion or exclusion of regions with no funding.

Policy Relevance of Research

- The study provides implications for R&D policy makers and the industry, given the high burden of cardiovascular diseases and the high global demand for R&D in its research.
- Providing a funding as innovatory incentive is highly effective for generating new ideas and, subsequently, devices because large parts of the industry, organized in SMEs, relying on the knowledge of clinicians and academics.
- The regional innovation systems in Europe can be fostered by external research investments to promote innovation in the medical device industry.

We also find sizeable effects by the regional GDP, with elasticities in the range between 0.24–0.56 and 0.28–0.45 in grant and EU Horizon models respectively. The spatial spillover effects of grants is consistently negative, albeit not always significant. This means that higher innovatory effort in one region may attract that away from another region. Regions in close proximity clusters may compete for grants of the same type, and the funders may not award grants for similar research to networks in geospatial proximity. When we considered the volume of EU Horizon 2020 funding that is not targeted towards cardiovascular device research, the spatial correlation vanished. This study provides implications for R&D policy makers as well as the industry.

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