Social Science & Medicine 110 (2014) 74–80

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Examining regional variation in the use of cancer screening in Germany

Verena Vogt [a,*], Martin Siegel [a], Leonie Sundmacher [b]

[a] Department of Health Care Management, Berlin Centre of Health Economics Research, Technische Universität Berlin, Straße des 17. Juni 135, 10623 Berlin, Germany
[b] Department of Health Services Management, Munich School of Management, Ludwig-Maximilians-Universität München, 80539 Munich, Germany

ARTICLE INFO

Article history:
Received 3 June 2013
Received in revised form
20 December 2013
Accepted 30 March 2014
Available online 31 March 2014

Keywords:
Germany
Cancer screening
Health care access
Spatial analysis

ABSTRACT

The detection of cancer in its early latent stages can improve a patient's chances of recovery and thereby reduce the overall burden of the disease. Cancer screening services are, however, only used by a small part of the population and utilization rates vary widely amongst the 402 German districts. This study examines to which extent geographic variation in the use of cancer screening can be explained by accessibility of these services and by spillover effects between adjacent areas, while controlling for a wide range of covariates. District level data on cancer screening utilization rates were calculated for breast, cervical, prostate, skin, and colorectal cancers using German data provided by the National Association of Statutory Health Insurance Physicians (Kassenärztliche Bundesvereinigung – KBV) between 2008 and 2011. We estimated the impact of health service variables on cancer screening utilization using spatial and non-spatial regression models. Spatial autocorrelation in the residuals was estimated using Moran's I statistic. After controlling for socioeconomic and other regional covariates, screening rates for breast, prostate, skin, and colorectal cancers are significantly higher in areas with higher physician density. The utilization of Pap-tests, skin cancer screening and colonoscopies is inversely related with average travel time to physicians. The coefficients for the spatial lag are significant and positive in all models. The positive spatial lags indicate that screening utilization rates are determined by knowledge spillovers between neighboring districts. In terms of public policy, our study demonstrates the potential to increase the use of cancer screening services through improving knowledge regarding cancer screening and by ensuring patient access to cancer screening services.

1. Introduction

Cancer is the second leading cause of death in most developed countries (WHO, 2008). In Germany, for example, about 28% of all deaths in 2011 were caused by malignant tumors (Destatis, 2012). Strategies for early detection of cancer can reduce the burden of the disease as the chances of recovery improve if cancer is detected in its early latent stages, when the cancer has not yet spread and is still curable (IARC, 2002; IARC, 2005; Atkin et al., 2010). The effectiveness of screening programs largely depends, however, upon the utilization rate (Perry et al., 2006; Arbyn et al., 2008; Segnan et al., 2010). Identifying both the determinants of and barriers to screening participation and increasing the uptake of cancer screening services are, accordingly, major priorities for health policy-makers (U.S. Department of Health and Human Services, 2013).

A number of studies have drawn attention to regional variation in cancer screening utilization and demonstrate the importance of the geographic accessibility of health care services. For example, areas with a higher physician density offer a better accessibility of cancer screening services and demonstrate, in turn, a higher utilization of these services (Benjamins et al., 2004; Coughlin et al., 2008; Vallée et al., 2010; Litaker and Tomolo, 2007; Roetzheim et al., 1999; Benarroch-Gampel et al., 2012). In addition, utilization of cancer screening increases as the distance or the travel time to screening services decreases (Jensen et al., 2013; Weiss et al., 2013; Dupont-Lucas et al., 2011; Lyimo and Beran, 2012; Lairson et al., 2005).

Another body of literature, mainly published by geographers and economists, emphasizes the importance of aspects that are attributable to the relative position of the area in geographic space (Anselin, 1988). According to this body of literature, cancer

* Corresponding author.
E-mail address: verena.vogt@tu-berlin.de (V. Vogt).

http://dx.doi.org/10.1016/j.socscimed.2014.03.033
0277-9536/

screening utilization rates may cluster geographically due to spatial spillover effects. These spillover effects are caused by informal communication, where individual preferences and knowledge regarding cancer screening are transmitted through personal contacts within cross-regional social networks (Anselin and Bera, 1998).

Although the economic and geographic literature on spatial analysis emphasizes the importance of spatial spillover effects in explaining regional variation (Anselin and Griffith, 1988), the existing studies on cancer screening utilization have not considered these effects so far. The present study contributes to the existing literature by combining these two strands of research and examining the effects of accessibility of health services and spatial spillovers on cancer screening participation. We hypothesized that:

a) There are significant regional variations in the use of cancer screening services;
b) Accessibility of health care services explains a significant part of the variation in rates, even after controlling for socioeconomic and other regional covariates;
c) Rates are clustered regionally due to spillover effects from informal communication and observational learning.

We examined whether low screening rates are associated with low accessibility of health services and estimated the extent of spatial spillover effects by applying spatial lag models. District level data on the use of breast, cervical, colon, prostate, and skin cancer screening were provided by the National Association of Statutory Health Insurance Physicians (Kassenärztliche Bundesvereinigung – KBV) in Germany. In Germany, a district is an administrative unit between federal states and the local municipal levels.

2. Conceptual approach

Our conceptual framework follows Andersen's (1995) behavioral model of health services use in combination with the notion of spatial dependence. In accordance with Andersen (1995) and previous studies that analyzed determinants of cancer screening utilization (Benjamins et al., 2004; Coughlin et al., 2008), we assume that the use of cancer screening services depends on predisposing factors and enabling resources. Furthermore, regional spillover effects may influence the use of cancer screening services indirectly through informal communication and observational learning.

Characteristics related to the social structure of the region and attitudes toward or knowledge about screening services may *predispose* to screening utilization (Andersen, 1995). Prior studies suggest that higher median income (Datta et al., 2006; Kreuger et al., 1999; Vallée et al., 2010) and higher educational level (Wells and Horm, 1998; Engelman et al., 2002; Coughlin et al., 2006) of an area are associated with higher participation in cancer screening. Even in countries where screening is offered free of charge, higher socioeconomic deprivation in an area is associated with lower participation in cancer screening (Grillo et al., 2012; McCaffery, 2002; Neilson and Whynes, 1995; Bentham et al., 1995). McCaffery (2002) argue that psychosocial barriers and indirect economic constraints may lead to socioeconomic differences in screening uptake.

Enabling resources, namely the regional accessibility of health care services, are necessary conditions for health services use. Previous studies suggest that higher physician density is associated with higher uptake of Pap testing (Benjamins et al., 2004; Coughlin et al., 2008; Vallée et al., 2010), mammography (Benjamins et al., 2004; Litaker and Tomolo, 2007), and colorectal cancer screening (Roetzheim et al., 1999; Benarroch-Gampel et al., 2012). In addition, a number of studies suggest that utilization of breast cancer (Jensen et al., 2013), colorectal cancer screening (Weiss et al., 2013; Dupont-Lucas et al., 2011), and cervical cancer screening (Lyimo and Beran, 2012) increases as the distance or the travel time to where the screening services are provided decreases.

Enabling resources also comprise characteristics regarding the affordability of health services, such as health insurance coverage and higher income. In Germany as well as in most of the European countries, the relevant cancer screening services are, however, covered by the statutory health insurance schemes. Accordingly, financial barriers to the utilization of cancer screening are largely removed and the importance of affordability factors is reduced (Carrieri and Bilger, 2009).

Regional *spillover effects* may explain regional clustering of cancer screening utilization rates, i.e. correlations of utilization rates of neighboring districts (Anselin and Bera, 1998). We consider two potential pathways for regional spillovers in our analysis. The first is informal communication, where individual preferences and knowledge regarding cancer screening are transmitted through personal contacts within cross-regional social networks. Although the geographic reach of these networks is limited, people living in the same or in neighboring districts are likely to communicate and influence one another regarding the decision to use cancer screening services. The second potential pathway is the concept of observational learning derived from Bandura's (1986) social cognitive theory. Following from this, an individual's behavior is determined by observing the actions of others and their results, where an individual is a responder and a social stimulus of behavior at the same time. Thus, screening uptake rates in one district may influence rates in neighboring districts if individuals imitate the behavior of people living in adjacent districts.

3. Methods

3.1. Data

The utilization of cancer screening was calculated using claims data provided by the KBV. The data provide information on the number of times the service is used per patient, and additional information about age, sex and residence of the patients. Our study sample comprises all individuals in the statutory health insurance scheme (SHI) in Germany who visited a physician in the outpatient sector at least once in the year of analysis.

We computed utilization rates at the district level as the number of patients within a district who used a service at least once within a year, divided by the number of patients who were eligible to use these services in the same district. Table 1 provides an overview of the fee schedule positions (Gebührenordnungsposition – GOP) for the service items and the respective eligible population. By this method, we obtained utilization rates for the 402 districts in Germany (latest territorial boundaries from 2011).

As is the case for skin cancer screening, a patient is not eligible to have a colonoscopy or a mammogram every year. Thus, we calculated average rates for the last two to four years (see Table 1 for an overview). The rates were adjusted for sex and age using the direct standardization method to obtain a weighted average of the district's age- and sex-specific cancer screening rates. The weights represent the age- and sex-specific sizes of the standard population (insured in SHI).

The accessibility of preventive services was measured using physician density and average travel time to physicians who perform the screening. Physician density variables were computed for each district as the number of specialists per 10,000 inhabitants who perform the following screenings: dermatologists for skin cancer screening, internists for colonoscopy, gynecologists for Pap-test and urologists for prostate cancer screening. In addition, we included the average travel time to the specialists who perform the