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Tracking Regional Variation in Healthcare
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Abstract

ZENTRALINSTITUT FÜR DIE KASSENÄRZTLICHE VERSORGUNG IN DEUTSCHLAND

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Nature of the paper (check boxes)

☐ report on implementation project / experience / policy perspectives

☒ scientific research a) describing work in progress ☐ b) new methods ☐ c) presenting results ☒

Title

Geographically Weighted Regression Modelling to Target Future Screening Interventions for Hepatitis C Virus Infections

Background

A large proportion of Hepatitis C Virus (HCV) infections is hidden to healthcare due to its often asymptomatic nature. Highly effective therapeutic options are becoming avaliable but require the prior diagnosis of HCV. Population-based screenings and screenings targeted at behavioural risk groups have not proven to be very effective to reveal the total number of hidden infections. Geographic Information Systems (GIS) and spatial regression modelling based on census data could provide a more practically applicable basis for screening interventions through the identification of socio-economic determinants. While current research on regional variation in healthcare often relies on global or non-spatial regression modelling, regional variation of the association between potential determinants and healthcare utilization remains unidentified. The prevalence of HCV and associated risk factors display large regional variance, highlighting the necessity to account for local differences in spatial regression modelling to determine which population groups in specific locations are at higher risk of infection.

Objectives

The goal of this research is:
(i): To determine local clusters to prioritize future screening interventions.
(ii): To determine socio-economic and demographic determinants associated with HCV prevalence.
(iii): To determine local variation of the association between socio-economic and demographic determinants to HCV infections to effectively guide future interventions targeted directly at population groups in specific locations that are at higher risk for HCV infection.

Methods

Analysed data included all geocoded HCV positive persons between 2002 - 2008 (n = 781) in South-Limburg, the Netherlands. HCV positivity was defined as positive immunoblot or polymerase chain reaction test. Census-based data from statistics Netherlands were matched based on the four-digits postal codes to the geocoded HCV positive test data.
The spatial scan statistic (SaTScan) was applied to identify local clusters of elevated HCV risk.
Global regression models were used to identify socio-economic and demographic determinants signifcant associated to HCV prevalence.
Geographically weighted Poisson regression models (GWPR) were then constructed to determine the spatially varying association between identified determinants and HCV prevalence.

Results

The prevalence of HCV displayed large regional variance and clustered significantly in urban areas.
The main population at risk for HCV were males aged 36 - 45, divorced persons and non-western immigrants. Socio-economic determinants included one-person households, low income at personal level and mean property value.
The results of GWPR revealed that the association between the identified demographic and socio-economic determinants displays important regional variance, reflecting that associated determinants of HCV prevalence depend largely on the place of residence.

Conclusion/Discussion/Policy Perspective

Our results underline that future screening interventions for HCV need to take into account the spatially varying demographic and socio-economic determinants of HCV prevalence. A one-size-fits-all approach is not appropriate for future identification of HCV positive persons that are currently hidden to healthcare.

The presented approach could also be applied in Germany on data for infectious diseases of the Robert Koch-Institute in combination with socio-economic data. Geographically weighted regression modelling could help to design future targeted, cost-effective public health interventions aimed directly at those population groups in specific locations that are at higher risk of infection.

Literature

Kauhl, B., Heil, J., Hoebe, CJPA, Schweikart, J., Krafft, T., Dukers-Muijrers, NHTM. (2015): The spatial distribution of Hepatitis C virus infections and associated determinants - an application of a geographically weighted Poisson regression for evidence-based screening interventions in hotspots. (In Review)