

Understanding the burden of chronic back pain: a spatial microsimulation of chronic back pain at small area level across England

Harrison Smalley, Kimberley Edwards

School of Medicine, Queens Medical Centre, University of Nottingham, Nottingham, United Kingdom

Background

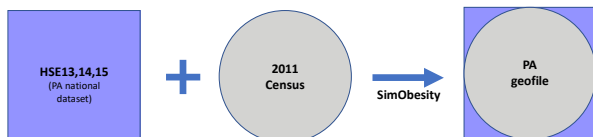
- Chronic back pain (CBP) prevalence is estimated at approximately 14% in England (1).
- In the United Kingdom, CBP carries a direct health care cost of £1.5 billion annually and total cost to the economy of £10 billion annually (2,3).
- Understanding how and why CBP prevalence varies spatially, as well as the potential impact of policies to decrease CBP, would prove valuable for public health planning.

Aims

- Simulate the prevalence of CBP at ward-level across England.
- Identify associations which may explain variation.
- Explore 'what-if' scenarios for the impact of policies to increase physical activity on CBP.

Method

Stage 1 simulation



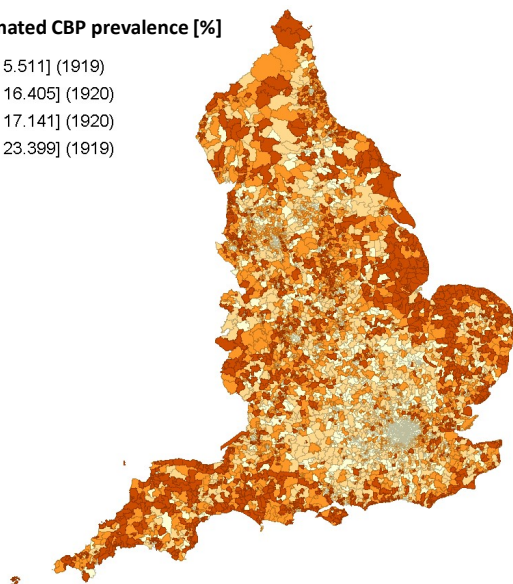
Stage 2 simulation



- A two-stage static spatial microsimulation approach was used.
- The simulation 'combined' national CBP and physical activity data from the Health Survey for England with spatially disaggregated demographic data from the 2011 Census.
- The output was validated, mapped, and analysed using geographically weighted regression (GWR).
- "What-if" analysis altered individuals weekly moderate-to-vigorous physical activity (MVPA) levels and repeated the simulations.

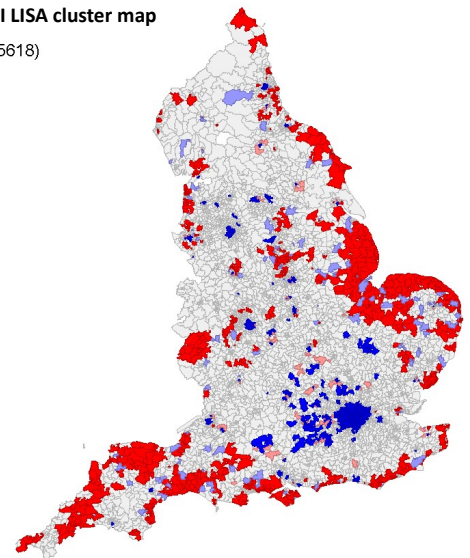
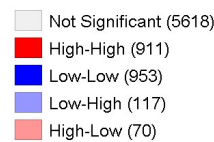
Results

Map of estimated CBP prevalence [%]



There is a clear pattern of high prevalence along the east coast and in the South West. Prevalence appears to be relatively low in the southern central area.

CBP Local Moran's I LISA cluster map



This map shows areas of significantly high or low prevalence in the context of their neighbouring wards. For example, "High-high" indicates a high prevalence ward amongst other high wards (a cluster of high prevalence), whilst "High-Low" indicates a high prevalence ward in a relatively low prevalence region.

Geographically weighted regression

Univariate geographically weighted regression (GWR) found a strong positive correlation between physical inactivity and CBP prevalence at ward-level.

This relationship was largely explained in the multivariate multiscale-GWR (MGWR) model by confounders; the proportion of residents that are: >60, in low skilled jobs, female, obese, smokers, white/black, disabled.

Model	β mean	Bandwidth	R ²
Univariate GWR	0.833	52	0.815
Multivariate MGWR	0.070	7675	0.924

"What-if" analysis

The "what-if" analysis showed a detectable reduction in CBP prevalence for increases in MVPA of 30 and 60 minutes. No detectable change was found for a 15minute increase.

	Baseline	+ 15 minutes	+ 30 minutes	+ 60 minutes
CBP prevalence (%)	15.87	15.86	13.16	13.16
Reduction from baseline		-0.01	-2.71	-2.71

Conclusions

- CBP prevalence varies across England.
- At ward-level physical inactivity is highly positively correlated with CBP. This relationship is largely explained by geographic variation in confounders.
- Policies to increase physical activity by at least 30 minutes per week will likely result in a significant reduction in CBP prevalence.
- To maximise their impact, policies could be tailored to high prevalence areas.

References

- 1) Bridges S. Chronic pain. Heal Surv Engl - 2011 [Internet]. 2012 [cited 2021 Jul 5];1.
- 2) Hong J, Reed C, Novick D, Hapich M. Costs associated with treatment of chronic low back pain: An analysis of the UK general practice research database. Spine (Phila Pa 1976) [Internet]. 2013 Jan 1 [cited 2021 Mar 5];38(1):75-82.
- 3) Maniadakis N, Gray A. The economic burden of back pain in the UK. Pain [Internet]. 2000 Jan 1 [cited 2021 Jan 30];84(1):95-103.



University of
Nottingham
UK | CHINA | MALAYSIA