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Short communication

## An exploratory analysis of spatial variations in organ donation registration rates in Wales prior to the implementation of the Human Transplantation (Wales) Act 2013



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## ABSTRACT

Spatial variations in rates of registered organ donors have not been studied in the UK at detailed spatial scales despite some evidence of national and regional differences. By drawing on the findings from the existing literature, this study examines associations between small-area variations in rates of new registrants to the UK organ donor register (ODR) within Wales and key demographic factors. Using map-based visualisations and statistical regression methods, spatial patterns in new registrants to the ODR are identified within Wales, a country which moved to an opt-out system of consent for organ donation following the Human Transplantation (Wales) Act 2013. By identifying the underlying factors associated with trends in rates of new ODR sign-up, this study aims to highlight the types of approaches that could be used to help to inform future targeted interventions aimed at improving registration rates.

## 1. Introduction

Globally, the demand for transplantable organs continues to outweigh the available supply with thousands of people currently on waiting lists throughout developed countries (Domínguez-Gil and Matesanz, 2017). In the UK, recent activity figures show that despite an encouraging 4% annual increase in the number of organs available for transplant from deceased donors, resulting in around 3700 transplants in 2016/17, more than 6000 patients remain on the transplant waiting list (NHS Blood and Transplant [NHSBT], 2017a). Procedurally, there are many challenges to the procurement and transplantation of organs - from identifying potential donors and obtaining consent, to considerations of organ-patient suitability and the logistics of transporting organs between places. Registering as an organ donor enables a person to make clear their willingness to donate their organs after death and can greatly assist the process of procurement. By the end of March 2017, 23.6 million people had opted to join the UK Organ Donation Register (ODR); representing 36% of the population (NHSBT, 2017a). In the UK, familial consent is required before any organ can be procured for transplant, regardless of the prior wishes of the deceased. Whilst recent authorisation rates suggest consent is granted in almost two-thirds of cases, this rises to over 90% when the patient's ODR status is known (NHSBT, 2017a). Of the 1413 deceased UK donors whose organs were

made available for transplant in 2016/17, 44% were registered donors (NHSBT, 2017a).

At an individual level, motivations for registering as an organ donor are likely to be multifaceted and complex and may involve a combination of socio-economic, religious/cultural and psychosocial factors. For example, level of education, religiosity, donation-related knowledge, positive attitude, social influence, and altruism have all been identified as factors positively associated with registered donor status (Nijkamp et al., 2008). Table 1 summarises the findings of previous studies of variations in registered donor status. In summary, several US-based studies have also identified larger proportions of registered donors in areas characterised by greater levels of education, as well as areas with higher levels of residential mobility and median household income (Grubestic, 2000; Ladin et al., 2015; Reibel et al., 2016). In contrast, lower levels of donor registration were associated with higher proportions of black, ethnic minority, younger- (under 18 years) or older-aged (above 65 years) residents.

Figures released by NHSBT suggest spatial variations in organ donation registration rates may exist within the UK – for example, at national level, registration rates are lower in England (35% of the population), compared with Wales (38%), Northern Ireland (40%), and Scotland (44%: NHSBT, 2017a). Regional variation is also evident between health authorities in England, with higher rates in the south

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**Table 1**  
A selection of relevant studies on correlates of registered organ donor status drawn from the empirical literature.

Author-year	Country	Outcome measure	Level of analysis (sample size)	Method	Findings/conclusion(s)
Grubbs et al. (2000)	USA, Ohio	Percentage of designated organ donors (identified via driving license)	Ecological (88 Ohio counties)	OLS regression models (no spatial autocorrelation)	Percentage of designated organ donors positively associated with median household income and high education levels, but negatively related to the proportion of black residents. Proximity to organ procurement organisations also shown to be an important mediating factor.
Ladin et al. (2015)	USA, Massachusetts	Percentage of designated organ donors (identified via driving license)	Ecological (4466 census block groups)	OLS regression models (including spatial dependence model)	High levels of education and residential mobility associated with higher levels of organ donor designation. Levels of organ donor designation shown to be lower in block groups with higher proportions of minority residents, greater residential segregation, or persons aged < 18 or > 65 years.
Nijkamp et al. (2008)	North America, UK, Netherlands, & Germany	Registered organ donors vs. non-registered persons	Individual (varied)	Meta-analysis (24 studies)	Levels of education (college vs. less) and religion (religious vs. non-religious) found to be significantly and positively related to registered donor status. Odds ratios for gender, ethnicity and marital status showed no significant relationship. A weak negative association between age and registration was consistently identified. Other predictors of registration were knowledge, attitude, social influence, family discussion, and altruism. Negative factors included fear of death and organ donation-related fears.
Reibel et al. (2016)	USA, northern California	Number of registered organ donors (approx. 3.6 m)	Ecological (835 zip code areas)	OLS regression models (plus a K-means cluster analysis)	Controlling for population size, lower numbers of registered organ donors identified in high minority areas, lower-income areas, and immigrant-heavy areas. Zip codes where residents had higher levels of education found to have greater numbers of registered donors.
Shah et al. (2018)	USA, Kentucky	Familial authorised donation vs. familial declined consent	Individual (1059 potential organ donor referrals)	Case-control comparison. Multivariate logistic regression model	In addition, significant non-linear factor combinations also identified; some higher socio-economic status areas had high numbers of registrants despite their racial and ethnic heterogeneity. Familial authorisation obtained in 47% of cases. Odds ratios for increased rates of authorisation increased linearly with levels of education and decreased with age. Authorisation also shown to be more likely if the deceased was a registered donor and had lived in a county with a poverty level below the national average. Donor registration most strongly associated with higher organ donation authorisation rates.
Wakefield et al. (2010)	USA, Spain, Netherlands, Switzerland, Hong Kong, China, & Pakistan	Attitudes towards organ donation and donor behaviour	Individual (varied)	Systematic review (33 studies)	Younger people and those with higher levels of education and socioeconomic status more likely to have positive attitudes toward organ donation. Less consistency shown regarding gender, ethnicity, or religious beliefs. One study reported stronger religious beliefs were predictive of less favourable attitudes towards donation. Other predictors of favourable attitudes were better knowledge of organ donation, knowing others with positive attitudes toward organ donation, and altruistic behaviour.

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