The Effects of Immigration on NHS Waiting Times

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Abstract

This paper analyzes the effects of immigration on access to health care in England. Linking administrative records from the Hospital Episode Statistics (2003-2012) with immigration data drawn from the UK Labor Force Survey, we analyze how immigrant inflows affected waiting times in the National Health Service. We find that immigration reduced waiting times for outpatient referrals and did not have significant effects on waiting times in Accident and Emergency (A&E) and elective care. However, there is evidence that immigration increased waiting times for outpatient referrals in more deprived areas outside London. These effects are concentrated in the years immediately following the 2004 EU enlargement and vanish in the medium-run (e.g., 3 to 4 years). Our findings suggest that these regional disparities are explained by both differences in the health status of immigrants moving into different local authorities and in natives' internal mobility across local authorities.

Keywords: Immigration, waiting times, access to health care, welfare
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1 Introduction

The impact of immigration on the welfare of host country residents has long been a contentious topic. In the UK, a majority of the public has been opposed to more immigration since at least the 1960s and a majority also perceives the costs of immigration to be greater than the benefits (Blinder, 2014).[1] The EU enlargement of 1 May 2004 exacerbated this debate as citizens of eight new members states (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia), commonly referred to as the A8, were granted immediate unrestricted right to work in the country. The UK was only one of three EU countries which opened labour markets to A8 citizens immediately upon accession, a decision which led to a substantial immigrant inflow to the UK.

Residents of the UK, including non-UK nationals born abroad, have free access to the National Health Service (NHS). This free access has resulted in speculation that immigrants may increase the demand for NHS services disproportionately and that in some cases immigrants move to the UK with the explicit purpose of abusing the health care system (i.e. health tourism). These arguments and the potential health care costs associated with immigration have resulted in the introduction of a NHS surcharge for non-EU citizens. This surcharge is payable at the time of visa application and it currently stands at £150 to £200 per year per immigrant.[2] [3]

While previous papers analysed the effect of immigration on welfare use in the UK (Dustmann et al., 2010; Dustmann and Frattini, 2014), and estimated its impact on health care costs (Nuffield Trust Report, 2013), we know less about the effects of immigration on waiting times, which is one of the most pressing issues of the NHS system. There is substantial variation across local authorities in both the share of immigrants (Sá, 2014) and the average waiting times for secondary care. Table 1 shows the local authorities with the longest waiting time for outpatient services. In 2012, patients waited the longest in Bournemouth, where the average waiting time

[1] http://www.migrationobservatory.ox.ac.uk/briefings/uk-public-opinion-toward-immigration-overall-attitudes-and-level-concern.

[2] More recently, UK Primer Minister David Cameron announced a series of proposals to curb immigration restricting unemployment benefits to immigrants who have been in the UK for at least four years and invoking EU leaders to review the EU policy on immigration. In his speech the Prime Minister explicitly referred to the pressure put by the large inflow of immigrants who arrived after the accession of the A8 countries to the EU on state schools and hospitals (see The Economist, Nov 28, 2014).

[3] http://www.economist.com/news/britain/21635186-david-cameron-proposes-make-britain- less-hospitable-immigrants -more-miserabler

for outpatients (referrals) was roughly three months. Most services in the NHS are free for users, a factor unaffected by immigration. However, the arrival of immigrants combined with the fact that the supply of NHS services is mostly inelastic in the short-run, suggest that waiting times may rise as a result of immigration. This in turn may push some patients to seek private health services or move to different areas. Using a basic theoretical framework, this paper investigates the effects of immigration on waiting times in the NHS. We exploit a unique dataset built by merging administrative records and survey data. To the best of our knowledge there are no studies that have directly looked at the impact of immigration on NHS waiting times. The purpose of this paper is to fill this gap in the literature.

Waiting times are one of the leading factors of patient's dissatisfaction with the health care system (Dansky and Miles, 1996). Postponing treatment delays the benefits associated with it and can have negative effects on patient health. Furthermore, by increasing uncertainty, waiting times negatively affect individual well-being. As they are not based on socio-economic status, waiting times are usually viewed as an equitable rationing mechanism in publicly-funded healthcare systems. However, recent research provides evidence of marked inequalities in waiting times Cooper et al. (2009); Laudicella et al. (2012). Waiting times in NHS Accident and Emergency (A&E) services reached a nine-year high in 2012 with more than 6% of the patients waiting longer than the 4 hours maximum target (King's Fund Quarterly Monitoring Report, 2013). While part of the increase could be explained by other factors, including coding issues as argued by Clare Gerada, the Chair of Royal College of General Practitioners, several British politicians have suggested that immigration is a key factor contributing to the observed rise in A&E waiting times.[4]

Despite the intense debate on the impact of immigration on NHS performance, research on the topic has been limited by the paucity of data. Steventon and Bardsley (2011) provide evidence suggesting that the view that immigrants use more secondary care than British natives may be unfounded. Wadsworth (2013) using longitudinal data from the British Household Panel Survey finds that immigrants use hospital and GP services at broadly the same rate as the UK-born. Yet, his findings suggest that immigrants who arrived as adults and those who arrived in the 1960s

[4] http://www.huffingtonpost.co.uk/2013/06/04/tory-mp-says-migrants-are-contributing-to-nhs-waiting-list-crisis_n_3382401.html

and 1970s make greater use of GPs than the UK-born. While these are valuable findings, these studies do not provide information on the impact of immigration on NHS efficiency.

Following previous studies on the effects of immigration in the UK (Sá, 2014; Bell et al., 2013), we analyse the correlation between spatial variation in the immigrant inflows and waiting times across local authority areas in England. Similarly to Sá (2014), who studies the effects of immigration on house prices in the UK, we use immigration data at the local authority level (LA) drawn from the special license access version of the UK Labour Force Survey (LFS), obtained via an agreement with the Office of National Statistics (ONS). The dataset used in the estimations covers 141 local authorities in England. To study the effects of immigration on waiting times in the NHS, we merge this information with data drawn from the Hospital Episodes Statistics (HES) provided by the Health and Social Care Information Centre.

One of the major challenges of the spatial correlation approach is that the location of immigrants across different areas may be endogenous. Natives may respond to the wage impact of immigration on a local area by moving to other areas, and immigrants may cluster in areas with better economic conditions. To address the concern that immigration may be endogenous to the demand for health services and correlated with unobserved determinants of waiting times in the NHS, we used an instrumental variable approach exploiting the fact that historical concentrations of immigrants are a good predictor of current immigrant inflows. By including region and year fixed effects and controlling for the local authorities time-varying characteristics of the local labour market, we can reasonably assume that past immigrant concentrations are uncorrelated with current unobserved labour demand shocks that may be correlated with demand for health care services.

Though the political debate has mostly focused on the possible effects on A&E, we find no evidence of significant effects of immigration on waiting times in A&E and elective care (Inpatients). Furthermore, we find evidence of a reduction in waiting times for outpatients. We show that this reduction in waiting times for outpatients can be partially explained by the effects of immigration on internal mobility and the fact that recent cohorts of immigrants are relatively young and healthy upon arrival ("healthy immigrant effect"), suggesting the demand may have increased less than predicted by the NHS (Sá, 2014; Wadsworth, 2013; Steventon and Bardsley, 2011). However, we do find evidence that immigration increases the average waiting time for

outpatients living in deprived areas outside London in the period immediately following the 2004 EU enlargement. Our findings suggest that the short-run increase of outpatient waiting times in deprived areas in response to immigration can be explained by both the lower mobility of incumbent residents in these areas and the higher morbidity observed among immigrants moving into more deprived areas.

This paper is organised as follows. Section 2 illustrates the theoretical framework. Section 3 provides a discussion of the empirical specification, the identification strategy and the data. Section 4 presents the main results of the paper. Concluding remarks are reported in Section 5.

2 Theoretical framework

We illustrate the relationship between immigration and the demand and supply of health care services with the help of a simple model for the demand and supply of care. Our model builds on Lindsay and Feigenbaum (1984); Windmeijer et al. (2005); Martin et al. (2007); Siciliani and Iversen (2012) and extends it to explicitly incorporate the effects of immigration in a given area. In the NHS, patients must join the list of a GP to access NHS secondary care. Unless admitted through A&E, all patients are referred by their GP to access NHS elective care. GPs act as gatekeepers deciding whether a patient needs elective care in which case they refer the patient to a specialist hospital consultant at a hospital outpatient clinic. If patients are referred to a specialist they join a waiting list for outpatients. The consultant can decide whether the patient needs elective hospital care, in which case the patient will be placed on the waiting list for day case or inpatient treatment. Patients benefit from treatment, but the delay in the receipt of the treatment can lower the value of the treatment to the patients. As the health care services are free in the NHS, waiting times function as a rationing mechanism and play the role of a price (Lindsay and Feigenbaum, 1984). Patients can alternatively look for private care or renounce and get no care at all if waiting time becomes too long. The demand for NHS care at time t will depend on the expected waiting time (w^p), on various demand shifters (x_t^d) such as population morbidity, the health needs of the population in the area, the proportion of elderly in the area, the overall size of the population, and other variables (z_t) that may affect both the supply and demand of healthcare services (e.g., the quality of NHS care, the level of competition).

Formally, the demand function ($D^j_{t,j}$) for outpatients visits by practice j a time t and the total number of patients added to the outpatient waiting list (D_t) will be:

$$D^j_t = (w^p_t, x^d_t, z_t) \tag{1}$$

$$D_t = \sum_j D^j_t \tag{2}$$

$$w^p_t = w^p_{t,OA} + w^p_{t,IA} + w^p_{t,DA} \tag{3}$$

where w^p_t is patient's expected waiting time (the sum of the waiting time for outpatient visits (OV), elective inpatient admission (IA), and daycase elective admissions (DA) for those added to the NHS list in period t and z^d_t is a vector of demand shifters (e.g., perceived quality of care, population morbidity, local competition, number of GP per head of population). The supply will be a function of waiting time, demand shifters and exogenous supply shifters (e.g., a policy change). Hospitals supply four types of care: outpatient visits (OV), elective inpatient admission (IA), and daycase elective admissions (DA), and emergency inpatient admissions ($EMIA$). An increase in the number of immigrants (IMM) may shift the demand by affecting the population size as well as by changing its demographic composition and health needs. Formally,

$$\frac{\partial D_t}{\partial IMM_t} = \frac{\partial D_t}{\partial x^d_t}\frac{\partial x^d_t}{\partial IMM_t} + \frac{\partial D_t}{\partial w^p_t}\frac{\partial w^p_t}{\partial IMM_t} \tag{4}$$

Following Gravelle et al. (2003), the supply decisions are taken by hospital manager who maximized their utility function at time t:

$$u_t = u(S_t, w^{m_t}; w^m_{t-1}, x^s_t, z_t) \tag{5}$$

where S_t is the supply of care in period t, w^m_t is the manager's perception of the period t waiting time,w^m_{t-1} captures the effect of past performance on managers'utility, and x^s_t is a vector of supply shifters including the number of doctors, beds and the type of hospital. The manager's forecast of waiting time at time t is a function of waiting lists (L_{t-1}) at time $t-1$, the demand at time t

(D_t) and supply at time t (S_t).

$$w_t^m = f(S_t, L_{t-1}, D_t(W_t^p, x_t^d, z_t) \tag{6}$$

The waiting list for different types of care (outpatient visits, inpatient elective admission and daycase elective admissions) evolves as

$$L_{kt} = L_{kt-1} + D_{kt} - k_t - \delta_{kt}, \quad k = OV, IA, DA \tag{7}$$

where δ_t is the number of patients leaving the waiting list because they move away, decide to get care in the private sector or die. As in Windmeijer et al. (2005), we assume that decisions on emergency admissions and on the first three types of care are taken by different decision makers. Optimal supply in period t is

$$u(S_t, w^{m_t}; w_{t-1}^m, z_t^s) + \lambda_t V(L_t + D_{t+1}, w^{m_t}, z_t^s) \tag{8}$$

where λ_t is the manager's discount rate.

$$S_t^* = S(L_{t-1}, w_{t-1}^m, D_t, x_t^s, z_t, \lambda_t) = S_t^*(L_{t-1}, w_{t-1}^m, w_t^p, x_t^s, x_t^d, z_t, \lambda_t) \tag{9}$$

An increase in the number of immigrants (IMM_t) will affect supply through its effects on demand shifters (x_t^d), patient's and manager's expected waiting time.

$$\frac{\partial S_t}{\partial IMM_t} = \frac{\partial S_t}{\partial x_t^d}\frac{\partial x_t^d}{\partial IMM_t} + \frac{\partial S_t}{\partial w_t^p}\frac{\partial w_t^p}{\partial IMM_t} + \frac{\partial S_t}{\partial w_{t-1}^m}\frac{\partial w_{t-1}^m}{\partial IMM_t} \tag{10}$$

In the short run, managers may be constrained by annual budget setting process. As managers forecast waiting times are based on the predicted change in population based on what observed at $(t-1)$, unexpected immigration inflows may result in excess demand if population morbidity is distributed homogenously among immigrants and natives. In equilibrium, health care demand equals the supply of health care.

The sign of the effect of immigration on waiting times is ambiguous. The effect will tend to

be positive if the increase in the immigrant population is not offset by an increase in the supply. As mentioned earlier the supply may not adjust immediately because of differences between predicted and actual inflows or because of budget constraints. On the other end the effect will tend to be negative if the supply increases more than the actual demand for health care services. This may occur if immigrants have lower incidence of morbidities or, more generally, demand less health care services or if immigration leads natives to move to or seek care in different areas or in the private sector. If, as in (Sá, 2014), natives with higher income are more likely to move (or seek private care) as a response to immigration inflows, one may expect the negative effect of native out-migration on waiting times to be amplified. One may instead expect larger positive effects in areas where the demand for health care services is less elastic (higher mobility costs) or in areas that attract less healthy immigrants. Ultimately, whether immigration increases waiting times is an empirical question. We turn to the empirical evidence by first examining the effects of immigration on NHS waiting times and then investigate the possble underlying mechanisms with in mind the theoretical framework presented in this section.

Following Siciliani and Iversen (2012), we can describe the demand and supply function in the following way:

$$Y_i^d = \alpha_0 + \alpha_1 w_1 + \alpha_2 x_i^d + \alpha_3 z_i + e_i^d \tag{11}$$

$$Y_i^s = \beta_0 + \beta_1 w_1 + \beta_2 x_i^s + \beta_3 z_i + e_i^s \tag{12}$$

where Y_i^d and Y_i^S are the demand and supply of health care in area i and w_i is the waiting time. Under the equilibrium assumption Y_i^d=Y_i^S, we can write the waiting time as a function of demand and supply shifters:

$$w_i = \gamma_0 + \gamma_1 x_i^d + \gamma_2 x_i^s + \gamma_3 z_i + e_i \tag{13}$$

where $\gamma_1 = \frac{\alpha_2}{\beta_1 - \alpha_1}$, $\gamma_2 = \frac{-\beta_2}{\beta_1 - \alpha_1}$. We can adapt this framework to analyze the effects of immigration as an exogenous shock to the demand for healthcare services. Formally,

$$w_{it} = \lambda_0 + \lambda_1 IMM_{it} + \lambda_2 X_{d,it} + \lambda_3 X_{s,it} + \lambda_4 Z_{it} + \mu_i + \eta_t + e_{it} \tag{14}$$

where w_{it} is the average waiting time in local area i, λ_1 capture the effect of an increase in the number of immigrants living in local area i on waiting times, λ_2 (λ_3) are the parameters associated to vector of variable controlling for other demand (supply) shifters, λ_4 captures the effects of variables affecting both the supply and demand for healthcare services (e.g., the quality of the healthcare system), μ_i and η_t are local area and time fixed effects.

3 Data and Empirical Specification

3.1 Data

To identify the effects of immigration on waiting times in the NHS, we use information on foreign born population by local authority and year drawn from the UK Labour Force Survey (LFS), a annual household survey, conducted by the Office for National Statistics (ONS), between 2003 and 2012. The public version of the UK LFS provides regional data by government office region (ten regions in England, plus Wales, Scotland and Northern Ireland). Under an agreement with the Office for National Statistics (ONS), we obtained the special license version of the LFS, which contains data at the local authority level. This is only available since 2003. To construct our instrument we use the geographical distribution of immigrants in the UK in 1991 and rely on the 1991 Census data.

We merge the ONS data with administrative data on waiting times extracted from the Hospital Episode Statistics (HES) provided by the Health and Social Care Information Centre. The HES dataset includes patients treated by the publicly-funded National Health Service (NHS) in England. The HES database is a records-based system that covers all NHS trusts in England, including acute hospitals, primary care trusts and mental health trusts. We extracted data from the HES at the lower super output area (LSOA) level.

Each HES record contains information about individuals admitted to NHS hospitals, including: clinical information about diagnoses and operations, patient characteristic information, such as age group, gender, ethnicity, and also administrative information, such as methods of admission, and geographical information such as where patients are treated, and area of residence. The information is collected into three main datasets: Inpatient (including maternity), Outpatient and Accident and Emergency.

The HES dataset provides counts and time waited for all patients admitted to a hospital within a given period, whereas the published waiting list statistics count those waiting for treatment on a specific date and how long they have been on the waiting list.[5] Data on waiting times for outpatients and elective care are available for the entire period under analysis (2003-2012), while we only have data on A&E 2007 onwards. We merge the HES data on waiting times with the LFS data on immigration at the local authority level. Table 2 presents the summary statistics on waiting times, immigration share and a vector of variables affecting the demand and supply of health care services.

The native population of the UK has remained stable for the last decades at around 52 million. In contrast, the foreign-born population of the UK has increased continuously over the same period, with a particularly large increase in those born in other EU countries since the 2000s. Figure 1 shows the growth in the foreign-born share of the UK population between 2003 and 2012. During that period the foreign-born share of the working-age population increased from 9% to 13%. The 2004 and 2007 European enlargements induced a sharp increase in the number of recent immigrants -defined as foreign-born people who have been living in the UK for 5 years or less- which increased from 2% to 4%.[6]. Figure 2 illustrates this effect focusing on the share of Polish immigrants, which increased from less than 0.1% to 1% throughout the period with a sharp increase between 2004 and 2008. [7]

Figure 3 describes the corresponding growth in the number of immigrants registering with a GP in the NHS. The increase in GP registrations would suggest possible effects on waiting times if the supply of health care services did not immediately adjust and demand composition was not affected by immigration. Figure 4 describes the trends in waiting times for outpatients, elective care for the period 2003-2012 and A&E for the period 2007-2012. Waiting times have been decreasing for outpatients and elective care as an effect of NHS policies. However, there has been a new increase in waiting times between after 2008. Instead, between 2007 and 2012 waiting times increased in A&E (see Figure 4).[8]

[5]For outpatients and inpatients, we restrict the analysis to first admissions and exclude maternity data.

[6]See also http://www.migrationobservatory.ox.ac.uk/briefings/migrants-uk-labour-market-overview

[7]Polish immigrants are currently the second largest group by country of birth and the first by citizenship status. http://www.migrationobservatory.ox.ac.uk/sites/files/migobs/Migrants%20in%20the%20UK-Overview_0.pdf

[8]2007 is the earliest year for which we have information on waiting times in the HES data.

Identification Strategy

To identify the effect of immigration on waiting times in the NHS, we exploit variation over time in the share of immigrants living in a local authority between 2003 and 2012. In our baseline specification, we estimate the following model:

$$w_{it} = \alpha + \beta S_{lt} + X'_{it}\gamma + \mu_l + \eta_t + \epsilon_{it}, \tag{15}$$

where w_{it} is the average waiting time for outpatient services in a lower layer super output areas (LSOA) i at time t; S_{it} is the share of immigrants in local authority l at time t; X'_{it} is a vector of time-varying LSOA characteristics; μ_l and η_t are Primary Care Trust Areas (PCT) and years fixed effects, respectively; and ϵ_{it} captures the residual variation in waiting times.

The use of geographical variation in the share of immigrants (often called an "area approach") has been criticised by many scholars (e.g., Borjas et al., 1996; Borjas, 2003) for two main reasons. First, natives may respond to the wage impact of immigration on a local area by moving to other areas, and healthier natives may be more likely to migrate.

The second critique to the area approach is that immigrants might endogenously cluster in areas with better economic conditions. To address the concern of a local unobserved shock affecting both native and immigrant labour demand, we include local authority-specific time trends and use an instrumental variables approach. Following Altonji and Card (1991) and Card (2001), we use an instrumental variable based on a "shift-share" of national levels of immigration into local authorities to impute the supply-driven increase in immigrants in each local authority.

In practice, we exploit the fact that immigrants tend to locate in areas that have higher densities of immigrants from their own country of origin, and we distribute the annual national inflow of immigrants from a given source country across the LAs using the 1991 distribution of immigrants from a given country of origin.

Specifically, let us define F_{ct} as the total population of immigrants from country c residing in the England in year t and $s_{cl,1991}$ as the share of that population residing in LA l as of year 1991. We then construct $\hat{F}_{cit}$, the imputed population from country c in LA l in year t, as follows:

$$\hat{F}_{clt} = s_{cl,1991} F_{ct} \tag{16}$$

and the imputed total share of immigrants as:

$$\hat{S}_{lt} = \sum_{c} \hat{F}_{clt} / P_{l,1991} \tag{17}$$

where $P_{l,1991}$ is the total population in LA l as of 1991. The variation of $\hat{S}_{lt}$ is only driven by the changes in the imputed foreign population (the denominator is held fixed at its 1991 value) and is used as an instrument for the actual share of immigrants in LA l at time t (S_{lt}). Using the distribution of immigrants in 1991, we reduce the risk of endogeneity because annual immigration inflows across LAs might be driven by time-varying characteristics of the LA that are associated with health outcomes.

One potential threat to the validity of this instrument is that the instrument cannot credibly address the resulting endogeneity problem if the local economic shocks that attracted immigrants persist over time. However, this problem is substantially mitigated by including LA and year fixed effects and by controlling for the time-varying characteristics of the local authority; thus we can reasonably assume that past immigrant concentrations are not correlated with current unobserved LA-specific shocks that might be correlated with health. Under the assumption that the imputed inflow of immigrants is orthogonal to the LA-specific shocks and trends in labour market conditions after controlling for fixed effects and observed variables, the exclusion restriction holds.

4 Results

Waiting Times for Outpatients

Table 3 presents the main results on the effects of immigration on waiting times for outpatients. In column 1, we report the OLS estimate controlling for year and primary care trust (PCT) fixed effects. The coefficient is negative and statistically significant. An increase in the stock of immigrants equal to 10% of the initial local authority's population decreases the average waiting time for outpatients by approximately 3 days (6%, with respect to the mean of the dependent variable). The coefficient becomes non-significant when we include LSOA time-varying characteristics. Time-varying LSOA characteristics include an Index of Deprivation (we use dummies

for each decile of the index), hospital beds' availability, number of GPs per capita, number of GP practice per capita, number of health consultants per capita, health expenditure per capita, a rural index, share of women, share of over 65, LSOA incidence of most common diseases. Including LSOA size (column 3) does not substantially change the results suggesting that the negative association between immigration and waiting time is not correlated with changes in the LSOA size. These results suggest that immigration was associated with a reduction in the average waiting time for outpatients.

To take into account the endogeneity of immigrants distribution across local authorities, we then estimate 2SLS regression using the typical shift-share instrumental variable approach proposed by Card (1990) and Card (2001) (see column 3). The first-stage F (17.11) is above the weak instruments threshold. Column 4 presents the second-stage estimates including only year and PCT fixed effects. The coefficient diminishes by approximately 30% when including regional time-varying characteristics (column 5) but it is still negative and significant, suggesting that an increase in the stock of immigrants equal to 10% of the initial local authority's population would reduce the average waiting time for outpatients by approximately 9 days (19%, with respect to the mean of the dependent variable). Again, including population size does not change the results.

4.1 Waiting Times in Elective Care

In Table 4, we examine the effects of immigration on waiting times for elective care. The OLS estimate reported in column 2 -including LSOA time-varying characteristics, year and PCT fixed effects- suggests that immigration is negatively associated with waiting time for elective care. A 10 percentage points increase in the immigration share is associated with a 5 days reduction in the average waiting time for elective care (a 7% reduction with respect to the average waiting time for elective care observed in the sample). However, the 2SLS estimate presented in column 4 is positive and non-significant and the point-estimate suggests a relatively small effect (+2% with respect to the mean).

4.2 Waiting Times in A&E

Table 5 illustrates the effects of immigration on waiting times in A&E. Unfortunately, at the LSOA level we only have information for the years 2007-2012. We find no evidence of significant effects on A&E waiting time. OLS estimates are negative and non-significant. The 2SLS estimate (column 4) is positive, but non precisely estimated. Because this analysis is restricted to the period 2007-2012, these results should be consider with caution. The point-estimate, which is not precisely estimated, suggests that a 10 percentage point increase in the immigration share would increase waiting times by 10 minutes, a 23% increase with respect to the average waiting time in A&E (approximately a hour).

4.3 Polish Immigration

Similarly to Bell et al. (2013) who use the distribution of A8 nationality in 2001 and the subsequent national flow of A8 migrants to identify the effects of immigration on crime, we use an alternative instrument based on the initial distribution of Polish immigrants as of 1991 across local authorities (using the full 100% sample) and the subsequent inflow of Polish immigrants and replicate the results presented in Table 3. In Table 6 we focus on Polish immigrants, as the LFS data contain less observations for other A8 countries and may be therefore less representative. As most Polish immigrants arrived in the UK after the 2004 EU enlargement, the distribution of Polish immigrants across UK local authorities in 1991 is less likely to be endogenous to other factors that may be both correlated with immigrant location choices and NHS waiting times. Panel A presents the results obtained using the initial distribution of Polish immigrants as an instrument for the share of immigrants in the population. Panel B replicates this analysis using the initial distribution of Polish immigrants as an instrument for the share of Polish immigrants in the population. Overall, these estimates confirm the negative effect of immigration on waiting times for outpatients reported in Table 3 and if anything suggest an even larger reduction in waiting times. Yet, the results are less precisely estimated than those presented in Table 3. We also confirm the non-significant effects on waiting times in elective care and A&E when using this alternative instrumental variable.[9]

[9]These results are available upon request.

5 Potential Mechanisms

The model presented above suggests that immigration may reduce waiting times by two main channels. Immigration may be increase native internal mobility (Sá, 2014). Because of immigration natives may move (or seek care) in a different local authority or seek care in the private sector decreasing the pressure on local authorities where immigration is surging. If immigration leads natives to move towards different local authorities, the size of the population in the local authority may not change. At the same time the fact that recent cohorts of immigrants (Wadsworth, 2013; Steventon and Bardsley, 2011) are relatively young and healthy upon arrival ("healthy immigrant effect"), suggests that they may demand less care than what predicted by the NHS. In this case, a reduction in the average waiting time could be explained by a decrease in the demand for health care services which may be explained by the different composition of the population. If immigrants are healthier or, regardless of their health status, less likely to seek care, then waiting times may decrease even if the supply did not adjust.

A second reason why immigration may reduce waiting times is related to the NHS funding system. As the allocation of funds across England regions depends on the size of the population, a predicted increase in the local authority population would lead to more resources and increase the capacity of the system. Even if the size of the population increased, the higher capacity may lead to a reduction in waiting times if the demand of care would not increase as predicted. This may occur both because of lower morbidity in the immigrant population or because of the effects of immigration on native mobility which may leave the local authority population size unchanged. In this section, to understand the possible mechanisms behind the negative effect of immigration on waiting times, we examine how immigration affected population size and average morbidity in the population across local authorities in England.

Hatton and Tani (2005) and Sá (2014) analyzed the displacement effects of immigration in the UK. Hatton and Tani (2005) using regional level data from the National Health Service find that for every 10 immigrants arriving in region, 3.5 natives will leave to other regions. Sá (2014) using the UK LFS and focusing on working-age population finds even larger effects pointing at a one-for-one native displacement. In table 7, we conduct a similar analysis using the same data but focusing on the entire population living in the local authority. As we are interested in the

effects of immigration on the NHS it is important for us to consider the effects on the elderly who represent an important share of the demand of health care services. Overall, our results go in the same direction of previous studies. The differences in the magnitude with respect to Sá (2014) are likely to be explained by demographic differences in the sample analyzed.

Our own estimates suggest that immigration does not have effect on the population of the local authority (column 2). A one percentage point increase in the stock of immigrants relative to the initial population living in a local authority would lead to a two percentage point decrease in the stock of immigrants with respect to the initial population living in the local authority. These results suggest that the increase in the population induced by the change in the stock of immigrants is in large part offset by native migration across local authorities. Consistently with what found by Sá (2014), column 3 shows that immigration increase outmigration. The point estimate indicates that a 1 percentage point increase in the stock on natives with respect to the initial population increases natives likelihood of leaving a local authority by 35%. However, the coefficient is not statistically significant when we cluster standard errors at the local authority level. Like Sá (2014), we find a positive coefficient of immigration on native in-migration rate (column 5) and a positive effect on native net out-migration rate (column 6), though both coefficients are not precisely estimated. Overall, these results suggest that immigration affected the demographic composition of the population but had non-significant effects on the local authority population size. The fact that immigration did not have significant effects on population size explains why we find no differences in the effect of immigration on waiting times when we include population size as a control variable (see column 5 and 6 in Table 3). Yet, as pointed out in the model above, the demand for healthcare services may be importantly affected by the demographic composition of the population because of differences in morbidity incidence and likelihood of seeking care between immigrants and natives.

Immigration and Health

Previous studies show evidence of a healthy immigrant effect among immigrants in the UK. As returns to migration (costs of migration) are higher (lower) for healthier individuals, immigrants are likely to self-select on health, along other dimensions (e.g., education). Kennedy et al.

(2006) show that this is particularly true for low-educated immigrants who have much healthier outcomes than the average low-educated native. Using individual data from the Labor Force Survey (2003-2012), in Table 8, we analyze immigrant-native differences in the likelihood of reporting any health problem or disability. We show that foreign-born individuals are on average 30% less likely to report any health problem lasting for more than a year than the average UK-born (column 1), 20% less likely to report any disability (column 2), and 11% less likely to report days off for illness or injury (column 3). This evidence suggests that in areas where the population size did not change, but the share of immigrant population increased, the demand for health-care services may decrease and waiting times may decrease even if the supply did not adjust to the predicted (but not realized) increase in population size, because of the lower morbidity in the immigrant population. Interestingly, even when aggregating data at the local authority level we find evidence that immigration decreases the average share of individuals reporting health problems in a local authority. While this effect is not statistically significant when including local authorities fixed effects and clustering at the local authority level, the sign of the coefficient suggests that immigration decreased the incidence of morbidities in a local authority. However, we may expect that the extent of immigrant health selectivity may be very different across local authorities in England. Indeed, Figure 5 shows that both natives and immigrants in deprived areas -defined as the local authority with an Index of Deprivation above the median- are more likely to report health problems lasting more than 12 months and are also more likely to report some disability. This suggests that the effects of immigration on waiting times may be very different in deprived areas, particularly as these are areas where the supply tend to be more inelastic and where the population faces higher mobility costs.

The Heterogeneous Impact of Immigration Across Local Authorities

Consistent with our conjecture, we find that the effects are substantially different when we exclude London from the analysis and focus on more deprived areas in England before 2008. In particular, columns 4-5 of Table 9 show that immigration had an heterogeneous impact across England and that, at least in the first years following the 2004 EU enlargement, immigration increased the average waiting time in deprived areas outside London. Column 4 shows that in

the first three years after the 2004 EU enlargement, a 10 percentage points increase in the share of immigrants living in a local authority increased waiting times by approximately 14 days (a 25% increase with respect to the mean of the dependent variable) when restricting the analysis to local authority with a Index of Multiple Deprivation above the median. The effect becomes even larger (20 days, + 38% of the mean of the dependent variable) when further restricting the sample to the 4 highest deciles of the index of multiple deprivation. We discuss two possible and non-competing explanations for this result.[10]

First, as suggested by Figure 5 immigrants moving to more deprived areas may be less selected on health. Chiswick et al. (2008) present evidence that non-economic migrants (e.g., refugees and asylum seekers) tend to be less selected on health than economic migrants. Bell et al. (2013) note that asylum seekers were disproportionately sent to deprived areas. Figure 6 confirms that asylum seekers are disproportionately represented in deprived areas. Using data from the Home Office, Immigration Statistics, in Table 10, we show that a larger number of asylum seekers in a local authority is associated with higher waiting times. Columns 1 and 2 report OLS estimates including PCT and year fixed effects (column 2). Column 3 and 4 repeat this analysis for asylum seekers in dispersal accommodation. The coefficient is positive, but becomes non-significant when including year fixed effects. The sign of this relationship between the share of asylum seekers and the average waiting time for outpatients is confirmed when using asylum seekers in dispersal accomodation to instrument for the total number of asylum seekers in an area (column 5) as in (Bell et al., 2013). Again, the coefficient is not precisely estimated once we include year fixed effects (column 6) and the estimated effect is relatively small: a one standard deviation in the share of asylum seekers is associated with approximately a 1% increase in waiting time with respect to the mean of the dependent variable. Yet, these results suggest that the larger presence of asylum seekers in deprived areas may contribute to the increase in waiting times found in table 9.

Second, Sá (2014) shows that immigration increases the likelihood of natives to migrate to a different local authority, but the mobility costs are considerably higher for individual at the bottom of the income distribution. Therefore, in deprived areas immigration may shift demand

[10]We replicated Table 9 for waiting times in elective care and A&E, but found no evidence of significant effects even when restricting the analysis to deprived areas outside London.

for healthcare services more than in less deprived areas, because of the different selection of immigrants and because of the lower likelihood of incumbent residents of moving or seeking healthcare services in a different local authority.

6 Conclusion

Immigrant free access to the NHS and the perceived associated health care costs have generated much debate in the UK and even resulted in the introduction of a fee for non-EU citizens to access NHS services. While previous papers analysed the effect of immigration to the UK on welfare use (Dustmann et al., 2010; Dustmann and Frattini, 2014), and estimated its impact on health care costs (Nuffield Trust Report (2013), Steventon and Bardsley (2011),Wadsworth (2013)) we know less about the effects of immigration on NHS waiting times, which is one of the most pressing issues of the NHS system.

This article contributes to the previous literature on the effects of immigration by estimating the effect of immigration on waiting times in the NHS. Using data on immigration and NHS waiting times for 141 local authorities in England, we analyse the effects of immigration on NHS performance. We find that immigration reduced waiting times for outpatient referrals. A 10 percentage points increase in the share of migrants living in a local authority would reduce waiting times by 9 days on average. We do observe an increase in waiting times for outpatients in the years immediately following the 2004 EU enlargement in the more deprived areas outside London. We find no evidence that immigration increases waiting times in A&E and in elective care.

The results are likely to be driven by three key factors. First, migrants tend to be young and healthy upon arrival (healthy immigrant effect) and unlikely to have a big impact on the demand for NHS services. Second, less healthy migrants tend to move into more deprived areas increasing the demand for NHS services in those areas. Third, the arrival of migrants increases the likelihood of natives moving and accessing health services in a different local authority. However, this is less likely to occur in deprived areas where there is lower mobility of the resident population.

Our results suggest that NHS planning should take into account not only the total inflow

immigrants to the UK and their potential destination within the country, but also the selection process of immigrants into local areas, including the higher propensity of less healthy migrants to move into deprived areas where hospitals and GPs may be at capacity limits.

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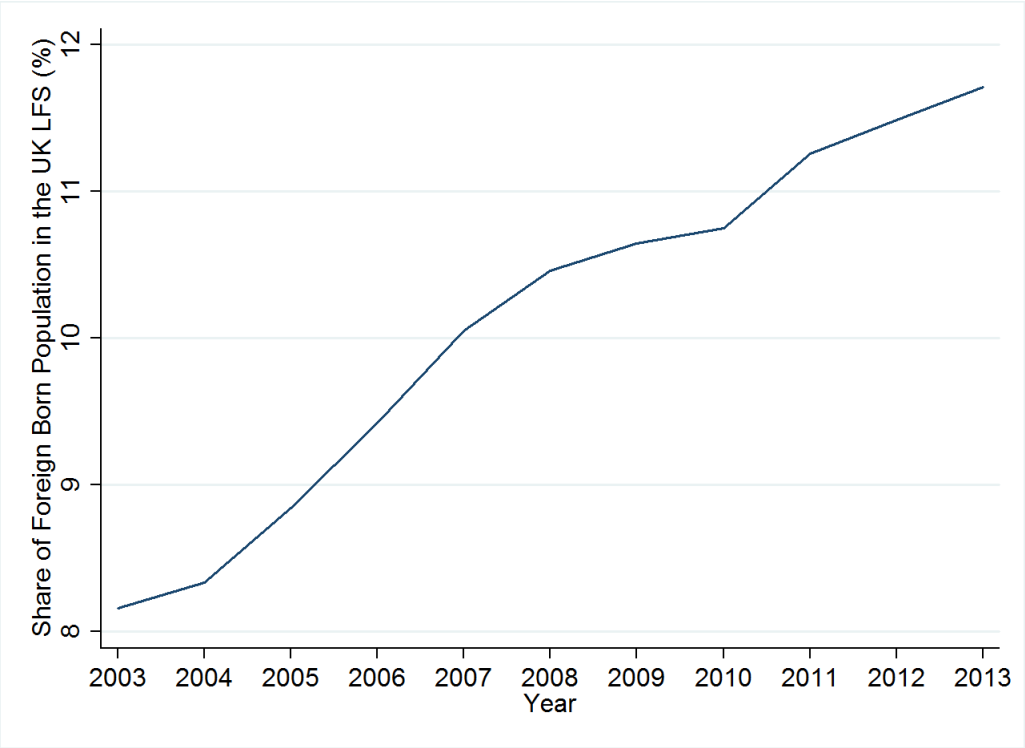
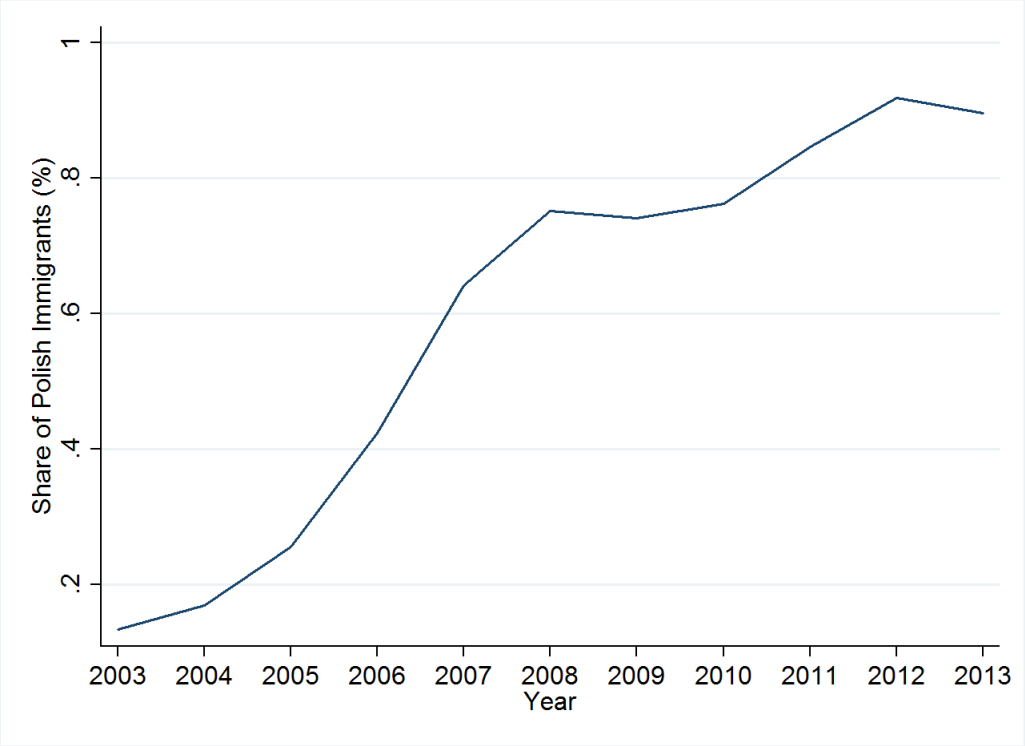
Figure 1: Foreign-born share of the Population in the UK LFS (2003-2012)



Notes - Data on immigrant distribution across local authorities are drawn from the UK Labor Force Survey.

Figure 2: Share of the population born in Poland in the UK LFS, 2003-2012

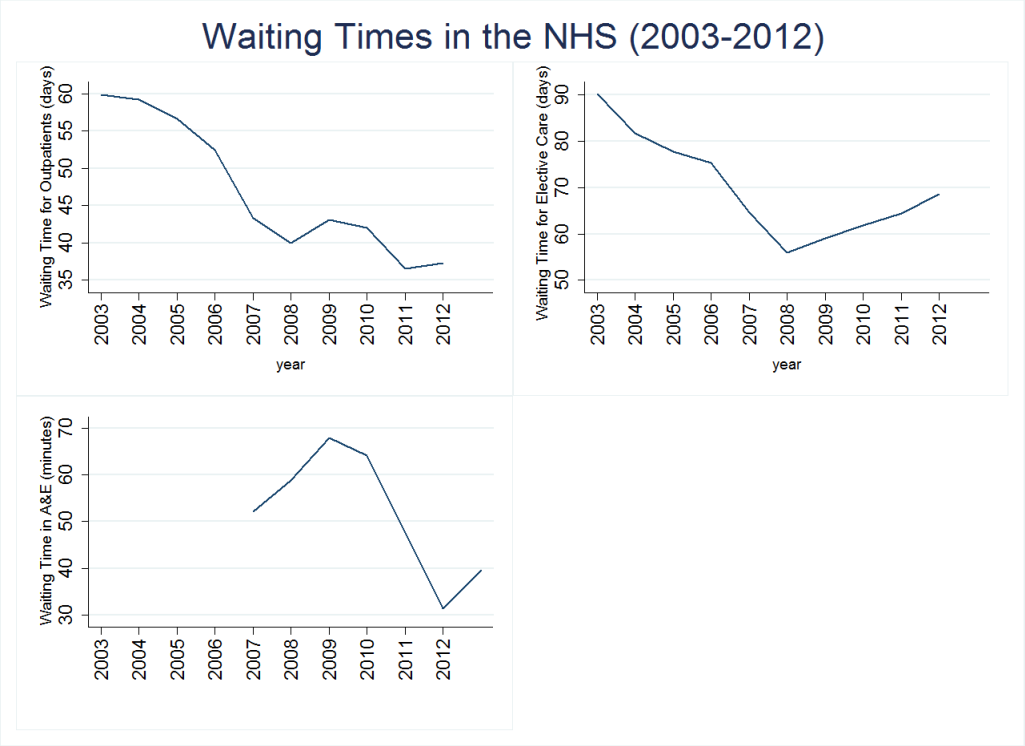


Notes - Data on immigrant distribution across local authorities are drawn from the UK Labor Force Survey.

Figure 3: New Migrant GP Registration as a Share of Total Population in England (2004-2012)

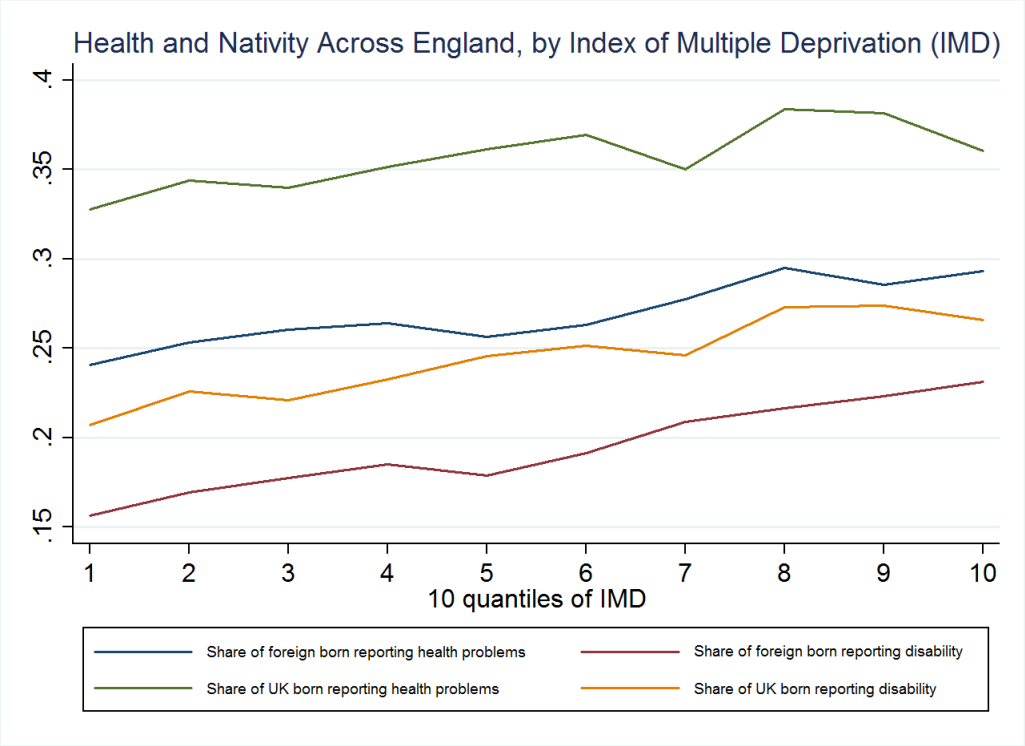
Notes - Source: Patient Register Data Service, 2004-2012

Figure 4: Waiting Times in the NHS (2003-2012)



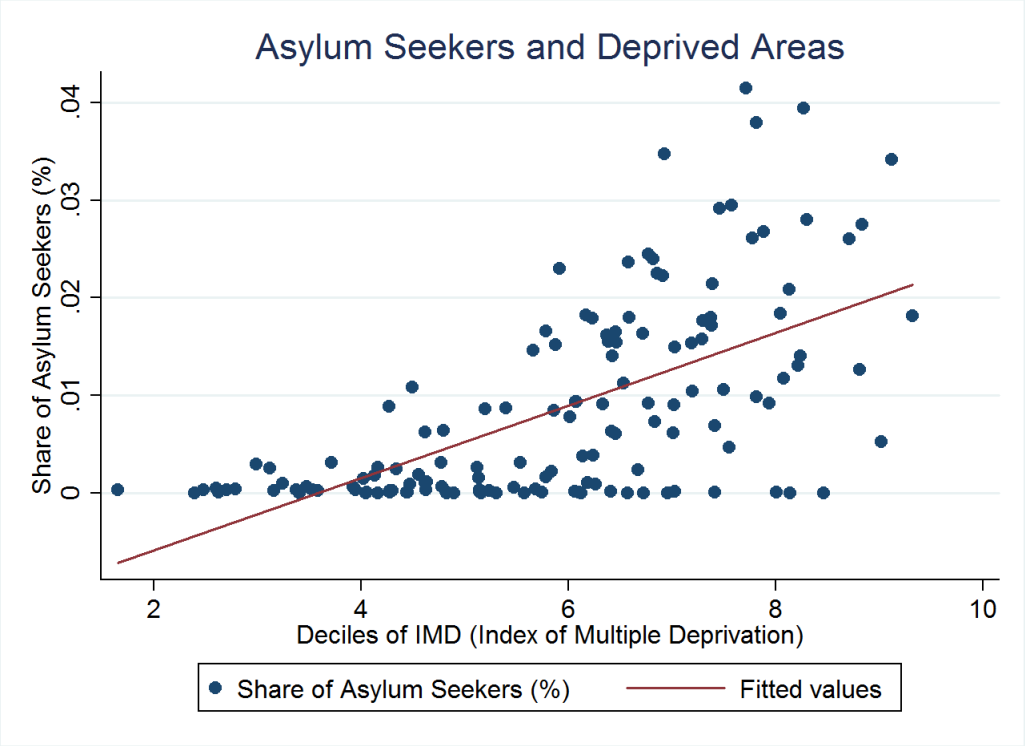
Notes - Data on average waiting times for outpatient services are drawn from the Hospital Episodes Statistics.

Figure 5: Health and Nativity Across England, by Index of Multiple Deprivation (IMD)



Notes - Data are drawn from the UK Labor Force Survey (2003-2012).

Figure 6: Health and Nativity Across England, by Index of Multiple Deprivation (IMD),(2003-2012)



Notes - Data are drawn from the UK Home Office.

Table 1: Local Authorities with Longest Waiting Times, HES, 2012

London	Average Waiting Time Outpatients	Outside London	Average Waiting Time Outpatients
Hillingdon	52.06	Bournemouth	90.37
Lewisham	44.01	Herefordshire, County of	64.38
Croydon	43.80	Poole	60.62
Sutton	43.76	Luton	58.77
Southwark	43.09	Dorset	57.49
Lambeth	41.36	Oxfordshire	55.04
Harrow	41.05	Slough	53.47
Camden	38.20	Hertfordshire	49.75
Barnet	38.01	Kingston upon Hull, City of	48.29
Redbridge	37.91	Windsor and Maidenhead	47.86

Notes - Data on average waiting times for outpatient services are drawn from the Hospital Episodes Statistics.

Table 2: Summary Statistics, 2003-2012

	Mean	Std
Waiting time for Outpatients (Days)	47.06	(16.61)
Waiting time for Elective (Days)	69.82	(39.51)
Waiting time for A&E (Hours)	0.59	(1.25)
GPs per 1k pop	0.94	(0.17)
Specialists per 1k pop	0.16	(0.03)
Share occupied beds	0.82	(0.19)
NHS expenditure per capita , (000s)	1.11	(0.59)
Log total population	7.35	(0.15)
Share of Women over 60	0.12	(0.05)
Share of Men over 65	0.07	(0.03)
Share of Women	0.51	(0.03)
Index of Multiple Deprivation	5.49	2.37
Rural Indicator	5.49	2.37
Incidence of Disease (per 1000)		
Stroke	16.61	(3.88)
Coronary disease	37.28	(8.57)
Hypertension	138.25	(18.60)
Diabetes	39.14	(7.11)
Pulmonary Disease	15.19	(4.80)
Epilepsy	6.32	(1.04)
Hypothyroidism	26.60	(6.20)
Cancer	9.43	(4.17)
Mental Health	7.00	(2.13)
Ventricular Disfunction	5.30	(0.86)

Notes - Data are drawn from the Hospital Episodes Statistics, the UK Labor Force Survey, and the UK ONS (2003-2012).

Table 3: Immigration and Waiting Times (days) in the NHS (Outpatients), 2003-2012

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
Share of Immigrants	-0.324*	-0.163	-0.164	-1.575**	-0.933**	-0.935**
	(0.178)	(0.158)	(0.158)	(0.701)	(0.461)	(0.461)
Year f.e.	YES	YES	YES	YES	YES	YES
PCT f.e.	YES	YES	YES	YES	YES	YES
LSOA time-varying characteristics	NO	YES	YES	NO	YES	YES
LSOA population	NO	NO	YES	NO	NO	YES
Observations	292,370	286,111	286,111	292,370	286,111	286,111
IV F-stat				17.11	16.07	16.05

Notes - Data on average waiting times for outpatient services are drawn from the Hospital Episodes Statistics. Data on immigrant distribution across Local Authorities are drawn from the UK Labor Force Survey. LSOA characteristics include: an Index of Deprivation, hospital beds' availability, density of GP practices, Rural Index, share of women, share of over 65, LSOA incidence of most common diseases. Columns 3 and 6 include LSOA size. Standard errors are clustered at the Local Authority level.

Table 4: Immigration and Waiting Times (days) in the NHS (Elective Care - Inpatients), 2003-2012

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
Share of Immigrants	-0.103	-0.477*	-0.475*	2.463*	0.203	0.208
	(0.317)	(0.261)	(0.262)	(1.378)	(0.596)	(0.597)
Year f.e.	YES	YES	YES	YES	YES	YES
PCT f.e.	YES	YES	YES	YES	YES	YES
LSOA time-varying characteristics	NO	YES	YES	NO	YES	YES
LSOA population	NO	NO	YES	NO	NO	YES
Observations	292,370	286,111	286,111	292,370	286,111	286,111
IV F-stat				17.11	16.07	16.05

Notes - Data on average waiting times for elective care are drawn from the Hospital Episodes Statistics. Data on immigrant distribution across Local Authorities are drawn from the UK Labor Force Survey. LSOA characteristics include: an Index of Deprivation, hospital beds' availability, density of GP practices, Rural Index, share of women, share of over 65, LSOA incidence of most common diseases. Columns 3 and 6 include LSOA size. Standard errors are clustered at the Local Authority level.

Table 5: Immigration and Waiting Times (minutes) in the NHS (A&E), 2007-2012

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
Share of Immigrants	-0.780	-0.522	-0.522	1.772	1.203	1.203
	(1.151)	(0.978)	(0.978)	(1.295)	(1.147)	(1.147)
Year f.e.	YES	YES	YES	YES	YES	YES
PCT f.e.	YES	YES	YES	YES	YES	YES
LSOA time-varying characteristics	NO	YES	YES	NO	YES	YES
LSOA population	NO	NO	YES	NO	NO	YES
Observations	119,785	117,657	117,657	119,785	117,657	117,657
IV F-stat				129.2	142.3	142.3

Notes - Data on average waiting times for A&E are drawn from the Hospital Episodes Statistics. Data on immigrant distribution across Local Authorities are drawn from the UK Labor Force Survey. LSOA characteristics include: an Index of Deprivation, hospital beds' availability, density of GP practices, Rural Index, share of women, share of over 65, LSOA incidence of most common diseases. Columns 3 and 6 include LSOA size. Standard errors are clustered at the Local Authority level.

Table 6: Polish Immigration and Waiting Times (days) in the NHS (Outpatients), 2003-2012

	Panel A					
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Immigrants	-0.325*	-0.164	-0.165	-2.387	-1.745	-1.749
	(0.178)	(0.158)	(0.158)	(1.510)	(1.688)	(1.689)
Observations	293,382	287,092	287,092	293,382	287,092	287,092
IV F-stat				4.653	2.444	2.443
	Panel B					
Share of Polish immigrants	0.101	0.200	0.200	-1.714**	-1.064	-1.066
	(0.190)	(0.162)	(0.161)	(0.715)	(0.668)	(0.668)
Observations	292,562	286,296	286,296	292,562	286,296	286,296
IV F-stat				34.48	24.97	24.98
Year f.e.	YES	YES	YES	YES	YES	YES
PCT f.e.	YES	YES	YES	YES	YES	YES
LSOA time-varying characteristics	NO	YES	YES	NO	YES	YES
LSOA population	NO	NO	YES	NO	NO	YES

Notes - Data on average waiting times for outpatient services are drawn from the Hospital Episodes Statistics. Data on immigrant distribution across Local Authorities are drawn from the UK Labor Force Survey. LSOA characteristics include: an Index of Deprivation, hospital beds' availability, density of GP practices, Rural Index, share of women, share of over 65, LSOA incidence of most common diseases and LSOA size. Standard errors are clustered at the Local Authority level.

Table 7: Immigrant inflows and native mobility, LFS, 2004-2012

	(1) log(total population)	(2) $\frac{N_{it}}{Pop_{it-1}}$	(3) Native out migration rate	(4) Native in-migration rate	(5) Native net out-migration rate
$\frac{FB_{it}}{Pop_{it-1}}$	0.019	-2.305***	0.007	0.005	0.002
	(0.014)	(0.891)	(0.005)	(0.003)	(0.003)
Observations	1,554	1,413	1,413	1,413	1,413

Notes - Data are drawn from the UK Labor Force Survey (2004-20012. Information on previous year residence is not available in 2003. Standard errors (in prentheses) are clustered at the local authority level. Regressions include year and local authority fixed effects.

Table 8: Healthy Immigrant Effect, LFS, 2003-2012

	(1) Any health problem	(2) Current disability	(3) Absent for illness/injury
Foreign born	-0.068***	-0.036***	-0.003***
	(0.001)	(0.001)	(0.000)
Observations	3,441,128	3,429,619	1,988,487
Mean of Dep.Var.	0.350	0.245	0.024
St. Dev.	0.477	0.429	0.153

Notes -
Standard errors (in prentheses) are clustered at the local authority level. Regressions include year and local authority fixed effects.

Table 9: Immigration and Waiting Times (days) for Outpatients (Referrals), 2003-2012

	(1) Overall 2003-2012	(2) Overall 2003-2007	(3) Outside London 2003-2007	(4) Outside London 2003-2007 More Deprived Areas (6-10)	Outside London 2003-2007 More Deprived Areas(7-10)
Share of Immigrants	-0.934**	-0.818***	0.479	1.499*	2.085*
	(0.461)	(0.317)	(0.350)	(0.788)	(1.143)
IV F-stat	15.99	28.72	54.54	20.60	14.09
Observations	286,111	144,476	122,067	57,146	44,964

Notes - Data on average waiting times for outpatient services are drawn from the Hospital Episodes Statistics. Data on immigrant distribution across Local Authorities are drawn from the UK Labor Force Survey. LSOA characteristics include: an Index of Deprivation, hospital beds' availability, density of GP practices, number of specialists and GPs, Rural Index, share of women, share of over 65, LSOA incidence of most common diseases and LSOA size. Standard errors are clustered at the Local Authority level.

Table 10: Asylum Seekers and Waiting Times for Outpatients, 2003-2012

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) 2SLS	(6) 2SLS
Share of Asylum Seekers in a Local Authority	80.421***	24.499***			68.646***	3.985
	(9.077)	(7.397)			(12.180)	(13.322)
Share of Asylum Seekers in Dispersal Accommodation			76.776***	3.733		
			(13.963)	(12.548)		
PCT F.E.	YES	YES	YES	YES	YES	YES
Year F.E.	NO	YES	NO	YES	NO	YES
Observations	293,382	293,382	293,382	293,382	293,382	293,382
IV F-stat	924.7	924.7	924.7	924.7	1529	627.2

Notes - Data on average waiting times for outpatient services are drawn from the Hospital Episodes Statistics. Data on asylum seekers are drawn from Home Office, Immigration Statistics (2003-2012). Standard errors (in parentheses) are clustered at the local authority level.