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MODELLING THE RESPONSE TO CHOICE: WAITING TIMES

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1. Introduction

This chapter presents the results for modelling the response of Trusts to Choice. A purpose of Patient Choice has been to reduce waiting times for patients in Trusts with long waits by giving patients the option of moving to Trusts with lower waiting times in the particular specialty. We would like to test whether Choice (LPCP) has had a significant effect on mean inpatient waiting times in the three specialties ophthalmology, general surgery and orthopaedics. We test whether Choice has been a successful instrument for reducing waiting times in two instances:

1.) for LPCP Trusts as a whole relative to comparator Trusts that engage in activity in the particular specialty, and
2.) within London for the three types of Trusts that engage in activity in the particular specialty, particularly those that export patients (originators), relative to comparator Trusts.

Since there were different incentives facing the three groups of London Trusts (recipients, originators and others), our main interest is to examine whether within the three groups there has been some convergence in mean inpatient waiting times. Our second analysis (within London) will enable us to explore this.

2. The methodology

The difference in difference (DID) methodology (Blundell and Costa Dias, 2000; Wooldridge, 2002) enables us to compare the change in waiting times for LPCP Trusts (using the terminology from the evaluation literature, they are called the treated group) before and after the LPCP Project (the treatment) with the change in waiting times (our treatment outcome) for Trusts in a comparator group such as the rest of England (the control group) over the same period. DID enables us to estimate the average effect of the LPC Project on the waiting times of the LPCP Trusts (referred to in the evaluation literature as the average effect of treatment on the treated or ATT). The treatment effect here should not be confused with treatment of patients in any way – the treatment here refers to the policy intervention of LPCP and the treatment group the LPCP Trusts.

Our data is set up in each of the 3 specialties to cover a period of 4 years, with 3 years of waiting times data prior to the introduction of LPCP and 1 year of waiting times data post LPCP. We construct an LPCP year dummy variable to capture the 4 years of LPCP data, including the treatment year. Our waiting times data is quarterly inpatient waiting times in each of the three specialties.

We estimate the following DID model of Trust waiting times to identify the ATT as follows:

$$w_{iq} = \beta_0 + \sum_{k=0}^{1} \beta_1 T_k + \sum_{s=2}^{4} \beta_2 D_s + \sum_{k=0}^{1} \sum_{s=2}^{4} \beta_3 T_k D_s + \beta_4 X_{iq} + \varepsilon_{iq} \quad (1)$$

where:

w_{iq} is waiting time for Trust i in quarter q
T_k is a dummy variable for LPCP Trusts where $T_k = 1$ if a Trust is in LPCP and 0 otherwise

D_s is a dummy variable for LPCP year where D_s = 1 to 4, 1 = base year and 4 = LPCP year

X_{iq} are observable factors affecting waiting times for Trust i in quarter q

We include LPCP year effects to control for all other unobserved temporal factors affecting waiting times. The LPCP main effect T_k controls for all time invariant differences in the characteristics of Trusts in the LPCP group and the control group. The interaction of the LPCP year and LPCP Trust main effect identifies the change in waiting times from the base LPCP year for LPCP Trusts relative to the Trusts in the comparator group (say rest of England). The difference in difference methodology assumes that all other temporal factors affecting waiting times have the same effects for LPCP Trusts and non-LPCP Trusts (control group). Thus we assume any changes over time which we do not control for in the models particularly between years 3 (the pre-treatment year) and year 4 (the LPCP treatment year) affect LPCP and non-LPCP Trusts in the same way.

The difference in difference estimates (DID) test for the significance of the difference in waiting times for the LPCP group (T_k = 1) between years 3 (D_s = 3) and 4 (D_s = 4) with that of the control group (T_k = 0) , and are derived from our equation (1) above as follows:

$$DID = \left[\left(E\left(w_{iq} \mid T_k = 1, D_s = 4\right) - E\left(w_{iq} \mid T_k = 1, D_s = 3\right)\right) - \left(E\left(w_{iq} \mid T_k = 0, D_s = 4\right) - E\left(w_{iq} \mid T_k = 0, D_s = 3\right)\right)\right]$$

$$E(w_{iq} \mid T_k = 1, D_s = 4) = \beta_0 + \beta_{11} + \beta_{24} + \beta_{313} + \beta_4$$
$$E(w_{iq} \mid T_k = 1, D_s = 3) = \beta_0 + \beta_{11} + \beta_{23} + \beta_{313} + \beta_4$$
$$E(w_{iq} \mid T_k = 0, D_s = 4) = \beta_0 + \beta_{10} + \beta_{24} + \beta_{304} + \beta_4$$
$$E(w_{iq} \mid T_k = 0, D_s = 3) = \beta_0 + \beta_{10} + \beta_{23} + \beta_{303} + \beta_4$$

$$\begin{aligned} DID &= \left[\left(\beta_{24} - \beta_{23} + \beta_{314} - \beta_{313}\right) - \left(\beta_{24} - \beta_{23} + \beta_{304} - \beta_{303}\right)\right] \\ &= \left[\left(\beta_{314} - \beta_{313}\right) - \left(\beta_{304} - \beta_{303}\right)\right] \\ &= \left[\left(\beta_{314} - \beta_{313}\right)\right] \end{aligned} \quad (2)$$

To test whether there is a significant difference in the change in waiting times between the pre-treatment year 3 and the post treatment year 4 for LPCP Trusts relative to the control group, we test whether equation (2) is significant.

Our treatment group (LPCP Trusts) consists of 3 groups of Trusts each of which face quite different incentives within the LPCP treatment regime. Originating Trusts with higher waiting times would be able to reduce their waiting times, hence the effect of the LPCP on their waiting times is likely to be more negative. Recipient Trusts with lower waiting times to start off with, would receive additional patients through the Choice mechanism but should still be able to maintain low waiting times. The third group of Trusts within London (others) participate in activity in the particular specialty but have chosen not to participate in the LPC Project for whatever reason, even though they were eligible to be included in the Project (or

exposed to the treatment option). This group of Trusts had very low waiting times but they did not have the investment in new capacity that would make it financially attractive to become recipients. The evidence suggests Trusts do not like exporting patients. The threat that under a choice regime these Trusts might in future have to export patients may have been an incentive to keep improving on their low waiting times. We evaluate the effect of LPCP on these three groups of Trusts.

We simply extend equation (1) to estimate the following model of Trust waiting times for the three groups of London Trusts relative to the control group:

$$w_{iq} = \beta_0 + \sum_{k=1}^{3} \beta_1 T_k + \sum_{s=2}^{4} \beta_2 D_s + \sum_{k=1}^{3} \sum_{s=2}^{4} \beta_3 T_k D_s + \beta_4 X_{iq} + \varepsilon_{iq} \quad (3)$$

where:

T_k is a dummy variable for Trust type where $T_k = 1$ for recipients, 2 for originators, 3 for others and the control group is the omitted category.

The rest of the notation is as before.

The difference in difference in waiting times for the recipient group in year 4 relative to year 3 is as follows:

$$DID = \left[\left(\beta_{314} - \beta_{313} \right) - \left(\beta_{304} - \beta_{303} \right) \right]$$

$$= \left[\left(\beta_{314} - \beta_{313} \right) \right] \quad (4)$$

The difference in difference in waiting times for the originator group in year 4 relative to year 3 is as follows:

$$DID = \left[\left(\beta_{324} - \beta_{323} \right) - \left(\beta_{304} - \beta_{303} \right) \right]$$
$$= \left[\left(\beta_{324} - \beta_{323} \right) \right] \quad (5)$$

The difference in difference in waiting times for the other group in year 4 relative to year 3 is as follows:

$$DID = \left[\left(\beta_{334} - \beta_{333} \right) - \left(\beta_{304} - \beta_{303} \right) \right]$$

$$= \left[\left(\beta_{334} - \beta_{333} \right) \right] \quad (6)$$

To test whether the difference in differences for these three groups of LPCP Trusts is significant, we test whether each of the equations (4), (5) and (6) is significant.

3. The data

Three databases were constructed, one for each specialty. The first full year of data for LPCP in ophthalmology ran from October 2002 to September 2003, and for general surgery and orthopaedics from April 2003 to March 2004. Our data is quarterly waiting time data for inpatients and covers a period of 4 years or 16 quarters, starting from October 1999 for ophthalmology and starting in April 2000 for general surgery and orthopaedics. Each database is set up to have 3 years (or 12 quarters) of waiting times data prior to the introduction of LPCP and 1 year (or 4 quarters) of waiting times data post LPCP (a full year in which LPCP has been running). We therefore have 3 equivalent calendar years of data prior to the introduction of LPCP to which we compare the effects of LPCP. The databases contain inpatient waiting times data in each of the specialties for all Trusts within England.

We match the above waiting times data with a large database of Trust data which is available on an annual basis, by financial year. This Trust data forms the X_{iq} in equations (1) and (3) above, observable Trust characteristics which influence waiting times. Since the data is only available annually as X_i, we merged the Trust data with the quarterly data on inpatient mean waiting times and assumed the annual Trust data to be constant across quarters, within the financial year, to form X_{iq}. For the quarters in which we require 2003/04 annual Trust data which is not available yet, we have assumed these constant from 2002/03.

The Trust data covers a very large number of variables on expenditure, resource use, performance and staffing. These include performance data and key targets from the Commission for Health Improvement (CHI), workforce census data from the Department of Health listing medical staff by specialty and by grade, Hospital Episodes Statistics (HES) aggregate data, hospital activity statistics, including capacity measures, vacancy rate survey data from the Department of Health, CIPFA data on expenditure, salaries, activity, staffing, and Reference Cost data.

We construct an LPCP year dummy variable to capture the 4 years of LPCP data and an LPCP treatment dummy variable which takes a value of one in the last four quarters of the database. We also construct dummy variables for each of the types of Trust within London (recipients, originators and others) in each of the three databases.

The following table shows how the database was set up in ophthalmology merging the quarterly waiting times data with the annual Trust level data. LPCP year 4 is the year in which the Trusts in the LPC Project were exposed to the treatment, while years 1 to 3 are the pre-treatment years.

Table 1: Quarterly dataset for ophthalmology merged with annual Trust level data for the introduction of LPCP and three years before

Quarter (calendar year)		LPCP treatment	LPCP-year	Annual Trust data (financial year)
1	Oct-Dec 1999	0	1	1999-00
2	Jan-Mar 2000	0	1	1999-00
3	Apr-Jun 2000	0	1	2000-01
4	Jul-Sept 2000	0	1	2000-01
5	Oct-Dec 2000	0	2	2000-01
6	Jan-Mar 2001	0	2	2000-01
7	Apr-Jun 2001	0	2	2001-02
8	Jul-Sept 2001	0	2	2001-02
9	Oct-Dec 2001	0	3	2001-02
10	Jan-Mar 2002	0	3	2001-02
11	Apr-Jun 2002	0	3	2002-03
12	Jul-Sept 2002	0	3	2002-03
13	Oct-Dec 2002	1	4	2002-03
14	Jan-Mar 2003	1	4	2002-03
15	Apr-Jun 2003	1	4	assume constant 2002-03
16	Jul-Sept 2003	1	4	assume constant 2002-03

While the Trusts within LPCP, particularly in ophthalmology have switched between the three (within-treatment) groups over the course of the LPCP treatment, we have taken their status within LPCP as it stood in quarter 4 of the first year of LPCP (quarter 16).

The following table shows how the databases were set up in general surgery and orthopaedics starting instead in April 2000. Again LPCP year 4 represents the treatment year.

Table 2: Quarterly dataset for general surgery and orthopaedics merged with annual Trust level data for the introduction of LPCP and three years before

Quarter (calendar year)		LPCP treatment	LPCP-year	Annual Trust data (financial year)
1	Apr-Jun 2000	0	1	2000-01
2	Jul-Sept 2000	0	1	2000-01
3	Oct-Dec 2000	0	1	2000-01
4	Jan-Mar 2001	0	1	2000-01
5	Apr-Jun 2001	0	2	2001-02
6	Jul-Sept 2001	0	2	2001-02
7	Oct-Dec 2001	0	2	2001-02
8	Jan-Mar 2002	0	2	2001-02
9	Apr-Jun 2002	0	3	2002-03
10	Jul-Sept 2002	0	3	2002-03
11	Oct-Dec 2002	0	3	2002-03
12	Jan-Mar 2003	0	3	2002-03
13	Apr-Jun 2003	1	4	assume constant 2002-03
14	Jul-Sept 2003	1	4	assume constant 2002-03
15	Oct-Dec 2003	1	4	assume constant 2002-03
16	Jan-Mar 2004	1	4	assume constant 2002-03

Trusts within LPCP were again assigned to their three within-treatment groups according to their status within LPCP at quarter 16.

4. Control groups

When using the DID methodology, we test the difference in mean waiting times between our treatment group (LPCP Trusts) in the treatment year and the pre-treatment year relative to the difference in mean waiting times for a control group (non-LPCP Trusts) in the treatment year and the pre-treatment year. We used three types of comparator or control groups in this study (non-LPCP Trusts):

1.) Rest of England
2.) Matched control
3.) Metropolitan areas

4.1 Rest of England

The first control group, rest of England, is intuitively plausible, since we wish to test whether changes in waiting times in LPCP Trusts are the result of a specific London effect. In the baseline and monitoring of waiting times, we have compared London Trusts to the rest of England as a comparator group. However, this is a much larger sample of Trusts than LPCP. The advantage of a large control group is that coefficient estimates in the regressions may be more robust, since we have a large sample size. However the disadvantage of rest of England as a control group is that we may be comparing LPCP Trusts to several non-LPCP Trusts in the rest of England that are very different in terms of their circumstances, characteristics and operating environments which we would otherwise not deem as useful comparisons.

4.2 Matched control

The second control group is matched control, where we try to match LPCP Trusts with non-LPCP Trusts using a statistical technique called propensity score matching. Since the assignment of Trusts to the treatment (LPCP) and control (non-LPCP) groups is not random, the estimation of the treatment effect may be biased by the existence of confounding factors (Becker and Ichino, 2002). Propensity score matching is a way to 'correct' the estimation of treatment effects controlling for the existence of these confounding factors based on the idea that the bias is reduced when the comparison of treatment outcomes (waiting times) is performed using treated and control groups who are as similar as possible. The method summarizes pre-treatment characteristics of each Trust into a single propensity score which is the conditional probability of receiving the treatment given pre-treatment characteristics. The balancing property of these pre-treatment variables is then tested to ensure that observations with the same propensity score have the same distribution of observable (and unobservable) characteristics independent of treatment status.

We are evaluating the treatment effect for a particular policy intervention (LPCP) with an observational dataset. We therefore match treatment hospitals (LPCP) with non-treatment hospitals from the set of Trusts in the rest of England in LPCP year 3 on the basis of observable characteristics, other than their waiting times. We employ a logit model for the propensity to be an LPCP hospital, invoking the common support modelling option which restricts the set of data points over which the test of the balancing property is sought to those

belonging to the intersection of the supports of the propensity score of treated and controls. Imposing the common support condition in the estimation of the propensity score may improve the quality of the matching process. Thus, for a given propensity score, exposure to LPCP treatment is random and LPCP and control Trusts should on average be observationally identical.

In order to run the propensity score logit model, we preferred to use a straightforward model with annual data rather than quarterly data, since we are interested in matching Trusts on characteristics, other than their waiting times, which are all constant within a financial year. We collapsed the quarterly data for LPCP year 3 (for quarters 9 to 12) to produce annual data on which to match LPCP Trusts on their pre-treatment characteristics. We also incorporated the differenced time varying variables between years 4 (collapsed for quarters 13 to 16) and year 3 to see whether Trusts differ in terms of any changes they experience over time. We thus took the difference between the annual data in year 4 and the annual data in year 3. Thus matching could be done on the basis of baseline characteristics in year 3 as well as those experiencing similar changes over the two time periods (year 4 minus year 3).

The logit model essentially models the conditional probability of receiving the LPCP treatment given the pre-treatment characteristics in year 3. The model splits the sample into approximately equally spaced intervals of the propensity score and tests within each interval that the average propensity score of treated and control units does not differ. Within each of these intervals the model also tests that the means of each characteristic do not differ between treated and control units. This is a necessary condition for the balancing property. Thus within each block the propensity score and the characteristics of Trusts do not differ for treated and control units.

Using these blocks of Trusts is a more refined way of matching treated and control Trusts, however, this would lead to comparing in 1 block, for instance, 1 LPCP Trust with 2 rest of England Trusts which would give problems with small numbers. Hence we used the very general method of matching by pooling all blocks for the treated together and pooling all blocks for the controls together. It is therefore possible that there may be some heterogeneity across these different blocks of Trusts within the treated and control groups respectively, but on aggregate, the method provides a good match of treated and control Trusts under the common support assumption.

The results for the logit model are shown in the following table. Since we are matching on characteristics other than waiting times, the analysis of matching to non-LPCP Trusts would be the same for all specialties, however this analysis was run using the ophthalmology database. The sample consisted of 132 Trusts and the model produced a respectable Pseudo R-squared of 73 percent. There were 5 blocks of Trusts in the final propensity score model, although these were pooled together to produce a control group of 18 Trusts under common support, compared to 20 in the LPCP treatment group with the balancing property satisfied.

Significant matching variables were sought over the database of Trust variables. These include data on performance measures, key targets, staffing and vacancy rates, activity, capacity, expenditure, salaries, income and reference costs. We applied a variety of search techniques within the database including stepwise regression to narrow the search for significant variables from about 100 key variables. The following seven variables produced the highest number of Trusts in the control group under the common support assumption.

Table 3: Logit results for propensity score for London Patient Choice in year 3

rci	-0.153
	(2.45)**
daycase_theatres	0.511
	(1.68)*
ipd_spell	3.758
	(2.41)**
daycase_spell	-23.109
	(2.27)**
emerg_spell	-69.829
	(2.96)***
hrgindrc	-0.147
	(1.94)*
agnurspcx	0.327
	(3.06)***
Constant	42.29
	(2.60)***
Observations	132
Pseudo R2	0.726

Absolute value of z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

rci - Reference Cost Index (Reference Cost dataset)
daycase_theatres - The number of available daycase theatres (Department of Health hospital activity statistics)
ipd_spell - Inpatient days per spell or length of stay (Hospital Episodes Statistics)
daycase_spell - Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
emerg_spell - Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
hrgindrc - Standardised HRG casemix index based on Reference Costs set to national average of 100 (NHS Information Authority)
agnurspcx - Proportion of non-NHS salary expenditure on agency nursing staff or bank nurses (CIPFA)

LPCP Trusts in the pre-treatment year appear to have significantly lower reference costs, have more available dedicated daycase theatres, have longer lengths of stay and fewer daycases per inpatient spell. They also have lower rates of emergency admissions, a less complex HRG casemix and higher expenditure on agency (bank) nurses as a proportion of non-NHS salary expenditure, compared to the rest of England control group. Variables such as teaching and size were not significant. As mentioned, it is possible that there may be heterogeneity within the LPCP Trusts on some of these characteristics, hence the apparent contradiction that LPCP Trusts have more dedicated daycase theatres but lower daycase rates. The reason is that Trusts are matched within blocks which are similar on these characteristics even though there may be some heterogeneity across blocks. None of the time differenced variables between years 3 and 4 were significant and Trusts were ultimately matched only on year 3 characteristics.

The advantage of this matched control group is that statistically there is a strong match between LPCP and non-LPCP Trusts on their pre-treatment characteristics. The disadvantage is that the control group is small and therefore coefficient estimates in the regressions may be less reliable. As a result, this control group was tested for the first specialty ophthalmology and then subsequently dropped for the other two specialties.

4.3 Metropolitan areas

The third control group is metropolitan areas. The reason for this choice of control group was to counteract concerns with the other two control groups that we may be comparing LPCP Trusts to non-LPCP Trusts in the rest of England that are very different in terms of their circumstances, characteristics and operating environments which may not be relevant. We therefore chose as the third control group the main metropolitan areas outside of London which would likely each have a similar local health economy to London in terms of travel distances, size and concentration. Four Strategic Health Authorities have been used as representative of the conurbations for control purposes. Although the 28 Strategic Health Authorities only came into existence in 2002, the Trusts which fall within their boundaries are chosen as the control group and hence they remain controls across the whole period (SHA codes have been extended backwards). The four Strategic Health Authorities are listed in the following table.

Table 4: Strategic Health Authorities which represent major metropolitan areas

SHA code	Strategic Health Authority name	Number of Trusts within SHA
Q12	West Yorkshire	5
Q14	Greater Manchester	5
Q27	Birmingham and the Black Country	6
Q28	West Midlands South	4

The advantages of this control group are that it is slightly larger than the matched control group and likely to therefore produce more reliable coefficient estimates in the regressions, and the Trusts are likely to be quite well matched to LPCP Trusts in that they operate within a similar type of health economy.

5. The modelling approach

5.1 The estimation methods

Using the DID methodology, for each of the above control groups we ran three types of estimation techniques.

Firstly, we ran an Ordinary Least Squares (OLS) model, clustering on Trusts since we have repeated observations for each Trust, which specifies that the observations are independent across Trusts (clusters) but not necessarily independent within Trusts. We also specified the Huber / White sandwich estimator of variance be used to calculate robust standard errors. We tested for multicollinearity using the variance inflation factors (VIFs) for the independent variables specified in the fitted model and dropped variables if there was evidence of collinearity.

Second, we ran the equivalent of a fixed effects model using the areg estimator in Stata 7 (Stata, 2001) which runs a linear regression absorbing one categorical factor, in this case the Trust identifier. It specifies the categorical variable which is to be included in the regression as if it were specified by dummy variables, hence approximating the fixed effects model. The model again allows the option of clustering on Trusts and the calculation of robust standard errors.

The third estimation method is a population-averaged panel-data model which is equivalent to a random effects model. Using the xtgee estimator in Stata 7 (Stata, 2001), it estimates a general linear model and allows one to specify the within-group correlation structure for the panels. The random effects model is set up in a similar way to a within and between group estimator in that we have included the mean of the time-varying variables as well as the deviation from the mean for these variables, differentiating the within and between group effects of time varying variables respectively. Including within variable means on all time-varying variables in the random effects model is often termed the Mundlak adjustment (Mundlak, 1978). The model again allows the option of calculating robust standard errors.

In all three estimation methods a regression specification error test (RESET) for misspecification was performed (Ramsey, 1969) and results are shown in each of the regression tables.

The three estimation techniques provide a useful comparison to one another regarding the stability of coefficient estimates. The fixed effects estimator effectively conditions on the Trust-specific effect when estimating the other parameters in the model. The estimator relies on there being sufficient within-Trust variation over time. The random effects estimator assumes that Trust effects are random draws from a population. Thus the estimator does not condition on the Trust-specific effect but has the advantage of using information about variation within individual Trusts over time (within-variation) and between Trusts in the sample (between-variation). It is therefore a more efficient estimator (Baltagi, 2001). However, given that the random effects in the error term may be correlated with the regressors in the model, the fixed effects estimator may be deemed more appropriate. The fixed effects model may pick up much of the unobserved heterogeneity in the Trust-specific effect. Hence when comparing the DID results under different estimation techniques, the fixed effects are the preferred results.

The fixed effects model does not however provide an estimate of all the coefficients of interest within the DID model, namely the β_1 coefficients, either the overall LPCP effect from equation (1), or the 3 within London LPCP Trust group effects (recipients, originators and others) from equation (3), depending on which model is specified. Both the OLS and random effects models provide estimates of these β_1 coefficients and it is therefore useful to use all three estimation methods to compare results. These coefficients are necessary to derive some of the graphs used to illustrate the DID results. For these graphical representations of the DID models, the random effects results have been used.

5.2 Other modelling considerations

We ran all models with and without Strategic Health Authority effects, using dummy variables for the 28 SHAs as fixed for the whole period, even though they only came into existence in 2002, part-way through the study. It could be argued that SHA effects may wash out any fixed effects between SHAs such as differences in data quality. However these may also potentially wash out some differences between Trusts which we do wish to pick up. In some cases when we have small control groups we also loose additional degrees of freedom by including these SHA effects. We therefore chose to report results without SHA effects. However, on the whole, results were qualitatively similar.

We also ran all models with dummy variables for seasonal effects, since waiting times are reported quarterly and tend to show some patterns in seasonality. For reasons of space, the results for these coefficients are not however presented in the regression tables.

6. Descriptive statistics

The following section gives the descriptive statistics for the mean inpatient waiting times and the distribution of the variable over time, for each of the three specialities.

6.1 Ophthalmology

The following table shows the descriptive statistics for the mean inpatient waiting times in ophthalmology for the different groups of Trusts within the study. Within LPCP there are 20 Trusts (4 recipients, 10 originators and 6 others) while in the matched control group under common support there are 18 Trusts and in the metropolitan areas control group there are 26 Trusts.

The mean waiting time across all treatment and control groups has fallen over the 4 periods. However our interest is whether this decrease in the waiting times is significantly greater for the LPCP group between years 3 and 4, relative to the control group. Furthermore, we can break down this comparison for LPCP into the 3 groups within LPCP relative to the control group. The difference in difference methodology enables us to do this.

It is clear from these descriptive statistics that originators have higher waiting times than all other groups of Trusts, particularly in the first 3 years although there is a big decline in year 4. The other group have consistently lower waiting times than any of the other groups within London over the 4 years. Waiting times for the rest of England group and the matched control group are not too dissimilar. Mean waiting times in metropolitan areas appear to be lower than for the other two control groups, and not too dissimilar from the others Trust group within London, particularly for the last 2 years of data, year 3 and 4.

The table also shows the descriptive statistic for the coefficient of variation which provides a relative measure of data dispersion compared to the mean. It is calculated as the standard deviation over the mean. When the coefficient of variation is small, the data scatter compared to the mean is small. When the coefficient of variation is large compared to the mean, the amount of variation is large. The variance provides a similar measure of dispersion, but the coefficient of variation indicates the variation relative to the mean.

From this measure, it is clear that across all groups (except metropolitan areas) there has been a reduction in the coefficient of variation. This trend provides an important indication of convergence in mean waiting times within each of these groups towards their mean waiting time respectively. This in itself can be considered an important improvement within the system, even if waiting times weren't falling, since it provides greater equity across Trusts with respect to the length of wait which patients are likely to receive and removes some of the randomness of patients potentially waiting much longer at certain Trusts than others simply by virtue of their being referred to one Trust rather than another.

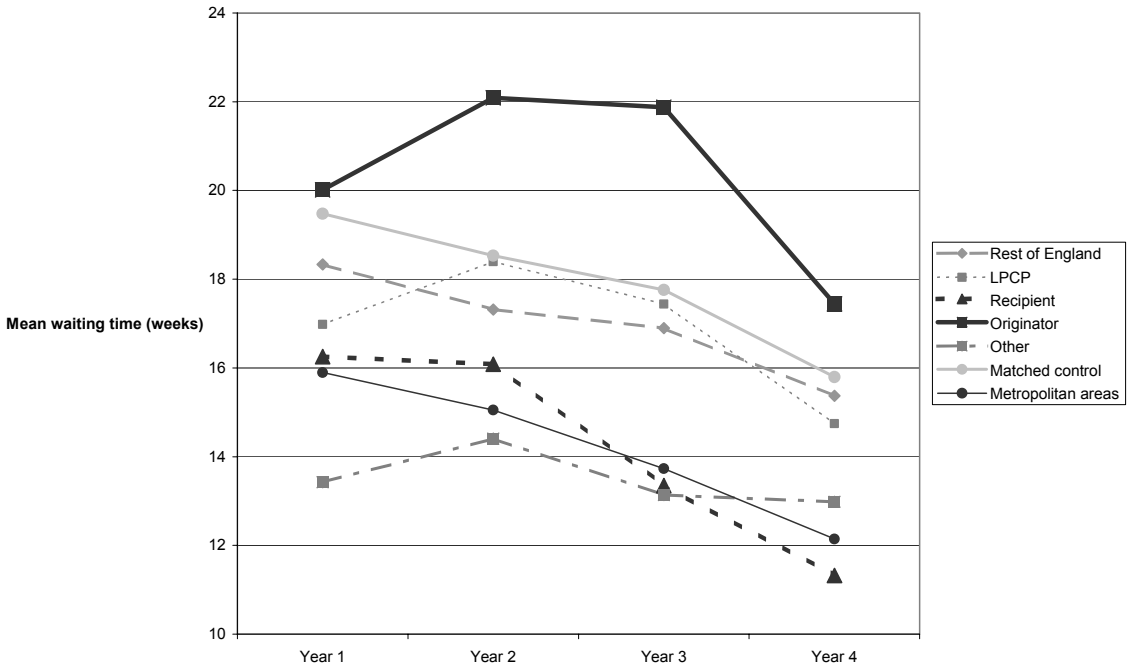
The reduction in waiting times along with the reduction in variation are therefore two distinct and important trends in the data.

Table 5: Descriptive statistics for inpatient mean waiting time in weeks in ophthalmology by group over 4 years

	Number of Trusts	LPCP year	Number of observations	Mean	Std Dev	Coefficient of variation	Variance	Min	Max
Rest of England	n=163	1	515	18.332	5.56	0.303	30.91	7	35
		2	488	17.318	5.32	0.307	28.30	7	32
		3	458	16.896	5.05	0.299	25.50	7	32
		4	447	15.372	4.46	0.290	19.89	7	26
LPCP	n=20	1	72	16.982	5.84	0.344	34.11	9	27
		2	76	18.397	5.85	0.318	34.22	9	31
		3	78	17.438	5.87	0.337	34.46	7	29
		4	76	14.746	3.77	0.256	14.21	9	27
Recipients	n=4	1	16	16.254	4.63	0.285	21.44	9	23
		2	16	16.082	4.31	0.268	18.58	11	24
		3	16	13.347	3.12	0.234	9.73	10	19
		4	16	11.322	2.06	0.182	4.24	9	15
Originators	n=10	1	32	20.014	4.73	0.236	22.37	10	27
		2	36	22.087	4.71	0.213	22.18	13	31
		3	38	21.878	4.48	0.205	20.07	13	29
		4	36	17.442	3.30	0.189	10.89	12	27
Others	n=6	1	24	13.426	5.88	0.438	34.57	9	26
		2	24	14.404	4.91	0.341	24.11	9	25
		3	24	13.136	3.63	0.276	13.18	7	23
		4	24	12.983	2.07	0.159	4.28	9	17
Matched control	n=18	1	60	19.475	6.33	0.325	40.07	7	31
		2	66	18.531	6.23	0.336	38.81	7	32
		3	70	17.760	5.03	0.283	25.31	9	28
		4	70	15.796	3.67	0.232	13.47	9	24
Metropolitan areas	n=26	1	52	15.898	4.37	0.275	19.13	7	23
		2	62	15.050	4.20	0.279	17.60	8	23
		3	74	13.730	3.71	0.270	13.77	7	21
		4	80	12.144	3.48	0.287	12.09	8	24

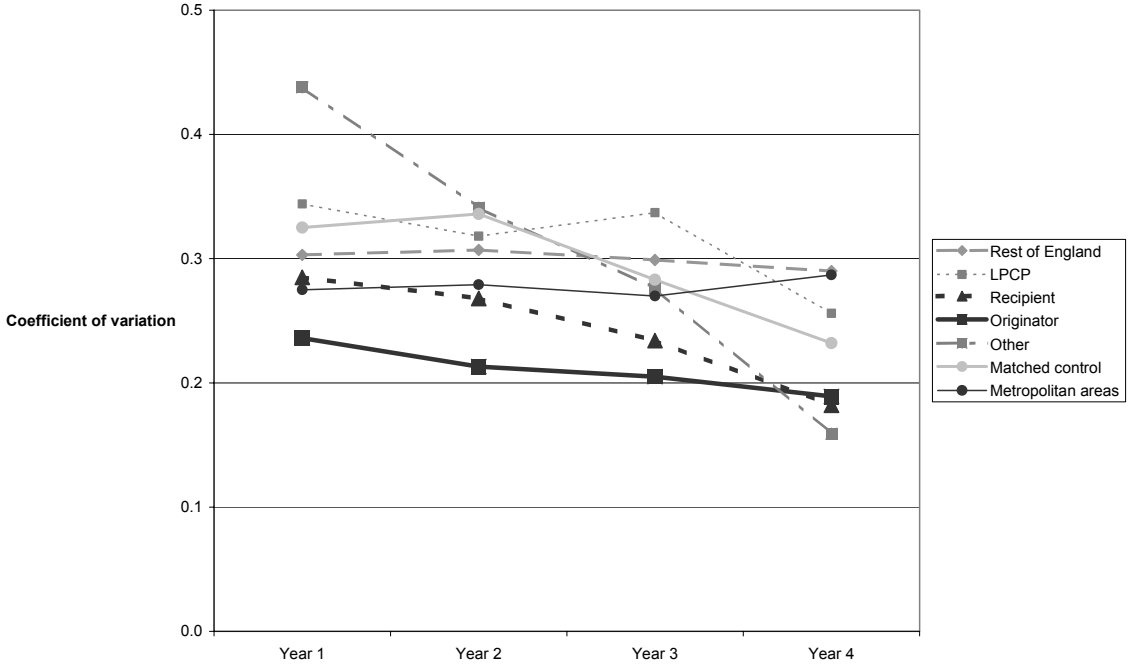
The following figure plots the mean waiting times in weeks for each of these groups. It is clear that originators have the highest waiting times but have seen the largest decline in year 4. Recipients and other Trusts have the lowest waiting times, though recipients have seen some decline over the last two years while others have not seen much of a decline between years 3 and 4, and in fact see a slight increase between years 1 and 2.

Figure 1: Plot of inpatient mean waiting times in ophthalmology by group over 4 years



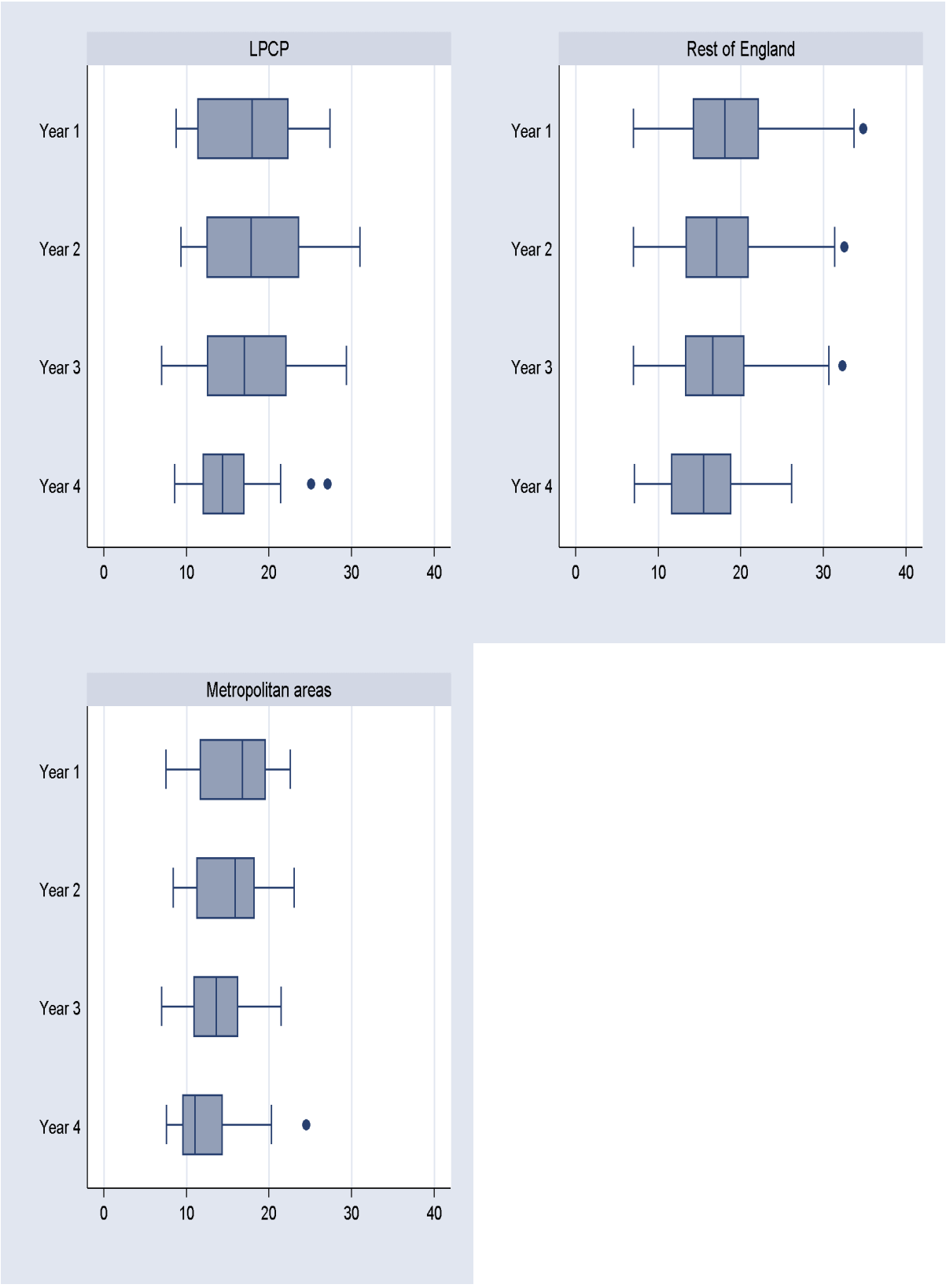
The following figure plots the coefficient of variation in mean waiting times for ophthalmology for each of the Trust groupings over time. The largest drop has been for the group of other Trusts within London, though all groups have shown some reduction in variation or convergence towards the mean respectively. The only exception is metropolitan areas, where the coefficient of variation has remained relatively unchanged over time.

Figure 2: Plot of coefficient of variation in mean waiting times in ophthalmology by group over 4 years



Box plots are another way of presenting the location and variation in data, particularly the changes between different groups of data. The following box plots depict the distribution for the mean waiting time variable over time for the LPCP group relative to each of the main comparator groups. The box shows the interquartile range from the 25th to 75th percentile with the line in the middle of the box showing the median value (of the mean waiting time). The lines extending from either side of the box show the upper and lower adjacent values of the variable while the dots show any outside values that may exist in the distribution (those values that lie more than ±3 times the interquartile range, or equivalently above or below the adjacent values). The box plots are therefore a useful visual way of summarising the distribution of the mean waiting time variable over time.

Figure 3: Distribution of mean waiting time in weeks for ophthalmology by year for LPCP Trusts and the comparator groups Rest of England and Metropolitan areas

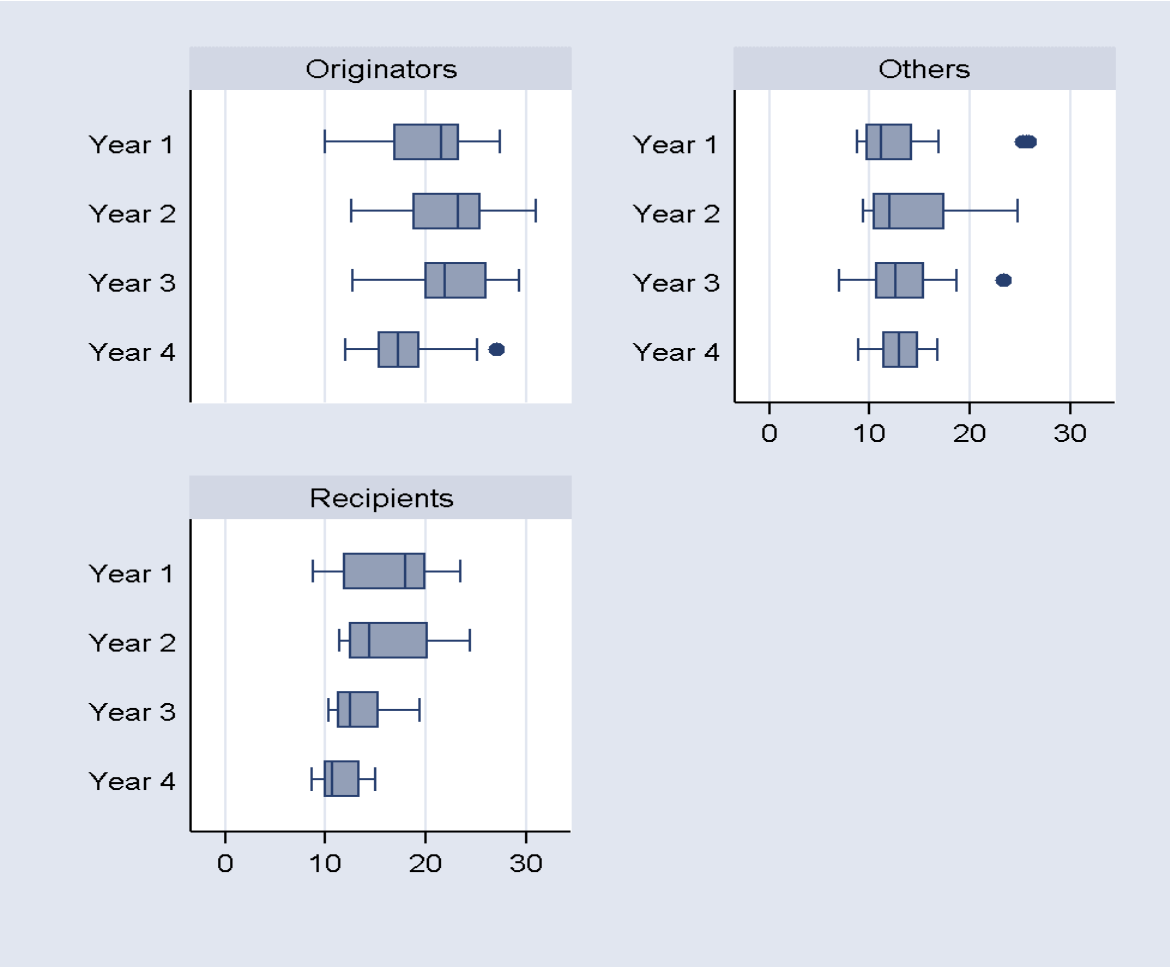


The figure shows a reduction in the median value of waiting times across all groups over time. While the median value of waiting time for metropolitan area Trusts has fallen, there has been less reduction in the distribution of mean waiting times. The most dramatic reduction in the

dispersion of mean waiting times appears to have been in the LPCP group, which again underscores the important equity implications this is likely to have for LPCP Trusts.

The following boxplots show the distribution of mean waiting times for the three LPCP Trust groupings within London.

Figure 4: Distribution of mean waiting time in weeks for ophthalmology by year for LPCP Trusts within London



The figure shows a very large reduction in the median value of waiting times for originating Trusts between years 3 and 4. All groups also show a reduction in dispersion between years 3 and 4.

6.2 General surgery

The following table shows the descriptive statistics for mean inpatient waiting times in general surgery across the different Trust groupings over time. In general surgery there are 28 LPCP Trusts (19 originators, 4 recipients and 5 others), with 35 Trusts in the metropolitan areas control group.

Mean waiting times in all groups have dropped over time, with a large drop for originator Trusts between years 3 and 4. Other Trusts within London have extremely low (and declining)

waiting times. Metropolitan areas have similar waiting times to recipient Trusts, particularly in years 3 and 4.

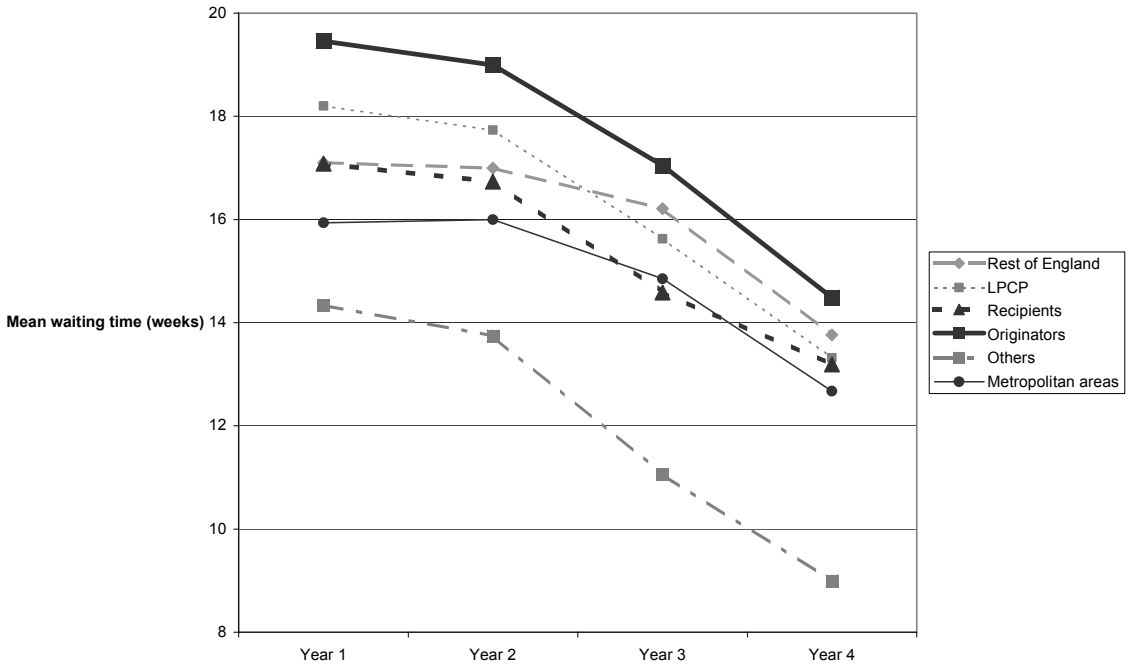
In terms of the coefficient of variation, there has again been some reduction over time for most groups, though much less markedly than in ophthalmology. Other London Trusts are the exception with a large reduction in the dispersion around the mean for this group over time.

Table 6: Descriptive statistics for inpatient mean waiting time in weeks in general surgery by group over 4 years

	Number of Trusts	LPCP year	Number of observations	Mean	Std Dev	Coefficient of variation	Variance	Min	Max
Rest of England	n=188	1	609	17.102	4.87	0.285	23.73	7	30
		2	565	16.995	4.44	0.262	19.75	7	29
		3	519	16.212	3.52	0.217	12.42	8	26
		4	504	13.761	2.96	0.215	8.76	7	23
LPCP	n=28	1	112	18.203	4.81	0.264	23.17	7	30
		2	112	17.735	5.11	0.288	26.08	7	31
		3	112	15.624	3.92	0.251	15.40	7	24
		4	112	13.318	3.05	0.229	9.30	7	20
Recipients	n=4	1	16	17.084	2.53	0.148	6.41	13	20
		2	16	16.733	2.96	0.177	8.77	11	20
		3	16	14.586	2.59	0.178	6.72	10	19
		4	16	13.187	1.84	0.139	3.37	11	16
Originators	n=19	1	76	19.456	4.23	0.218	17.93	12	30
		2	76	18.995	4.37	0.230	19.11	11	31
		3	76	17.043	3.18	0.186	10.09	10	24
		4	76	14.485	2.49	0.172	6.18	10	20
Others	n=5	1	20	14.335	6.04	0.421	36.43	7	26
		2	20	13.747	6.79	0.494	46.08	7	28
		3	20	11.062	3.74	0.338	13.98	7	20
		4	20	8.990	1.44	0.160	2.06	7	11
Metropolitan areas	n=35	1	88	15.934	3.95	0.248	15.59	9	25
		2	96	15.998	3.60	0.225	12.93	8	24
		3	108	14.851	3.18	0.214	10.09	9	22
		4	108	12.673	2.81	0.222	7.88	8	21

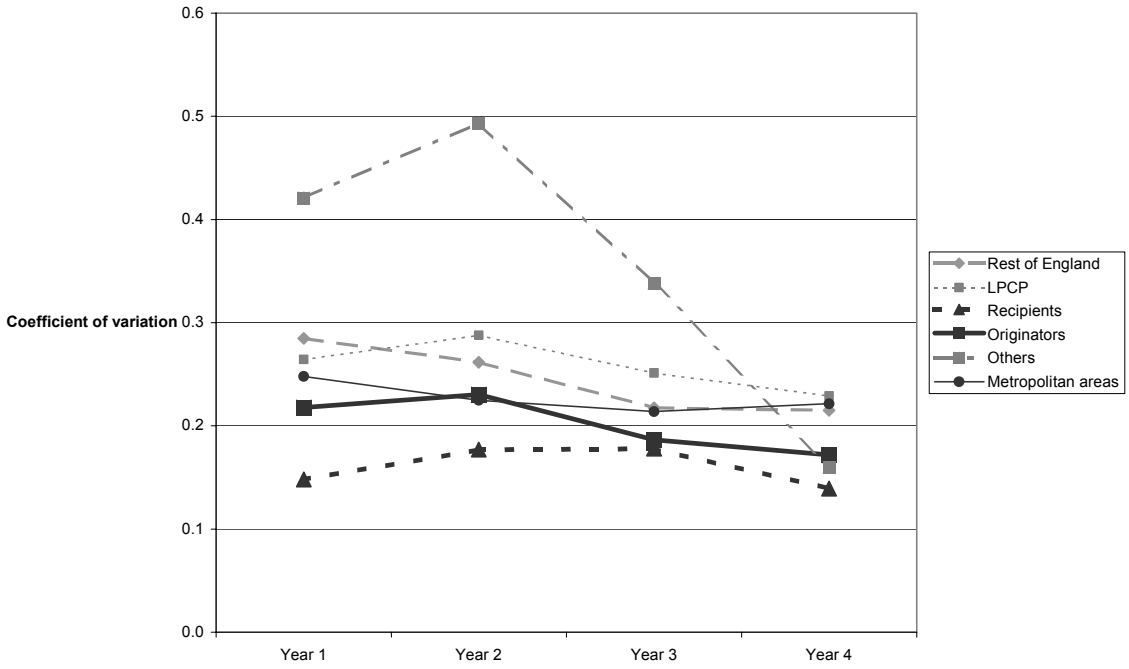
The following figure plots the mean waiting time in weeks for each of these groups. All Trust groups show reductions in mean waiting times over time and it is interesting to note that many of the trend reductions started occurring before the introduction of LPCP. Originators have the highest waiting times but also show large reductions over time, while other Trusts within London have by far the lowest waiting times.

Figure 5: Plot of inpatient mean waiting times in general surgery by group over 4 years



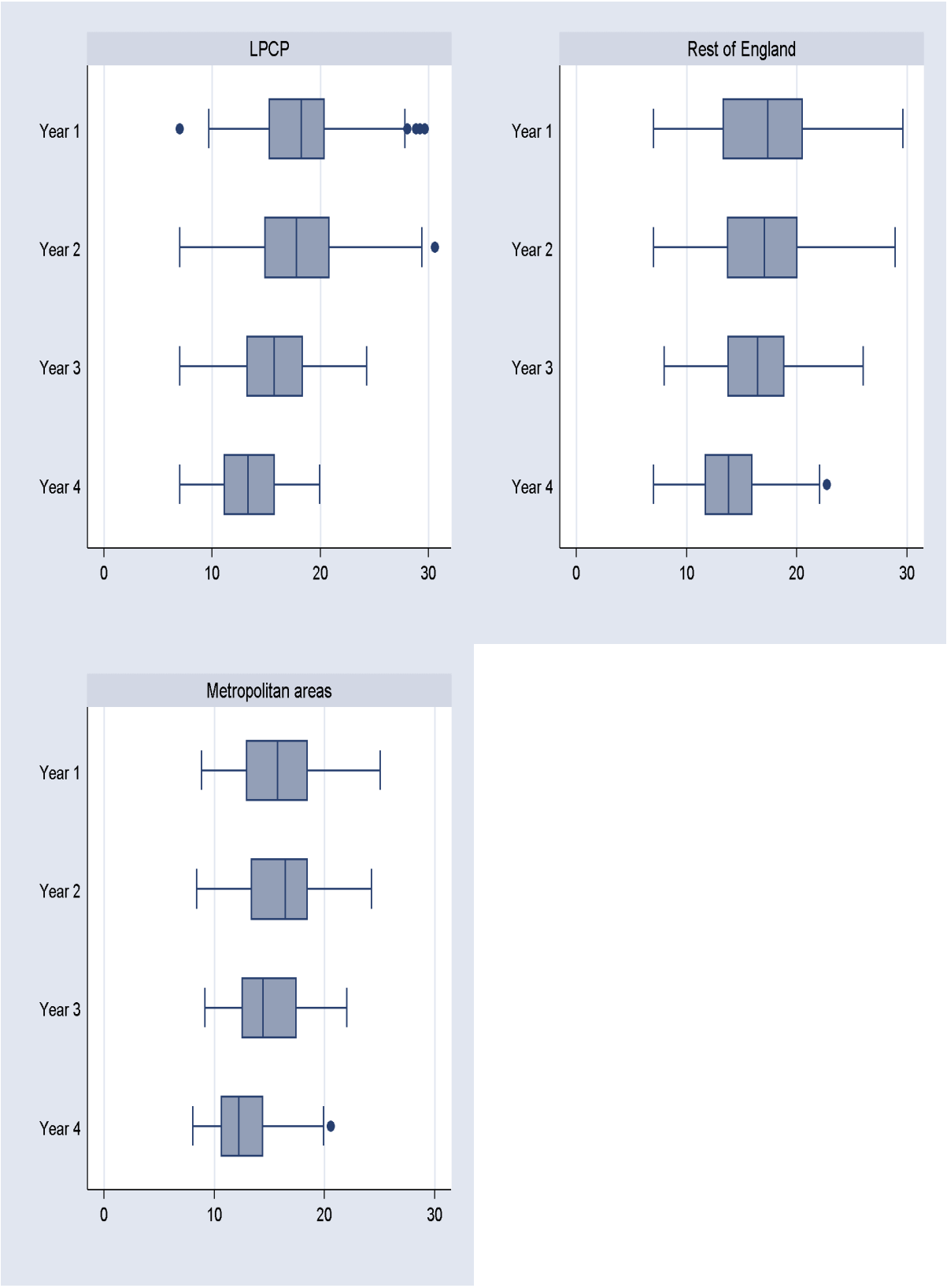
The following figure plots the coefficient of variation in mean waiting times for general surgery for each of the Trust groupings over time. The largest drop has been for the group of other Trusts within London, while for all other groups the coefficient of variation has dropped slightly or remained relatively stable over time.

Figure 6: Plot of coefficient of variation in mean waiting times in general surgery by group over 4 years



The following boxplots show the distribution of mean waiting times for LPCP relative to the comparator groups over time. There has been a marked drop in the value of the median waiting times across all groups over time, as well as a reduction in the dispersion of mean waiting times for each group over time.

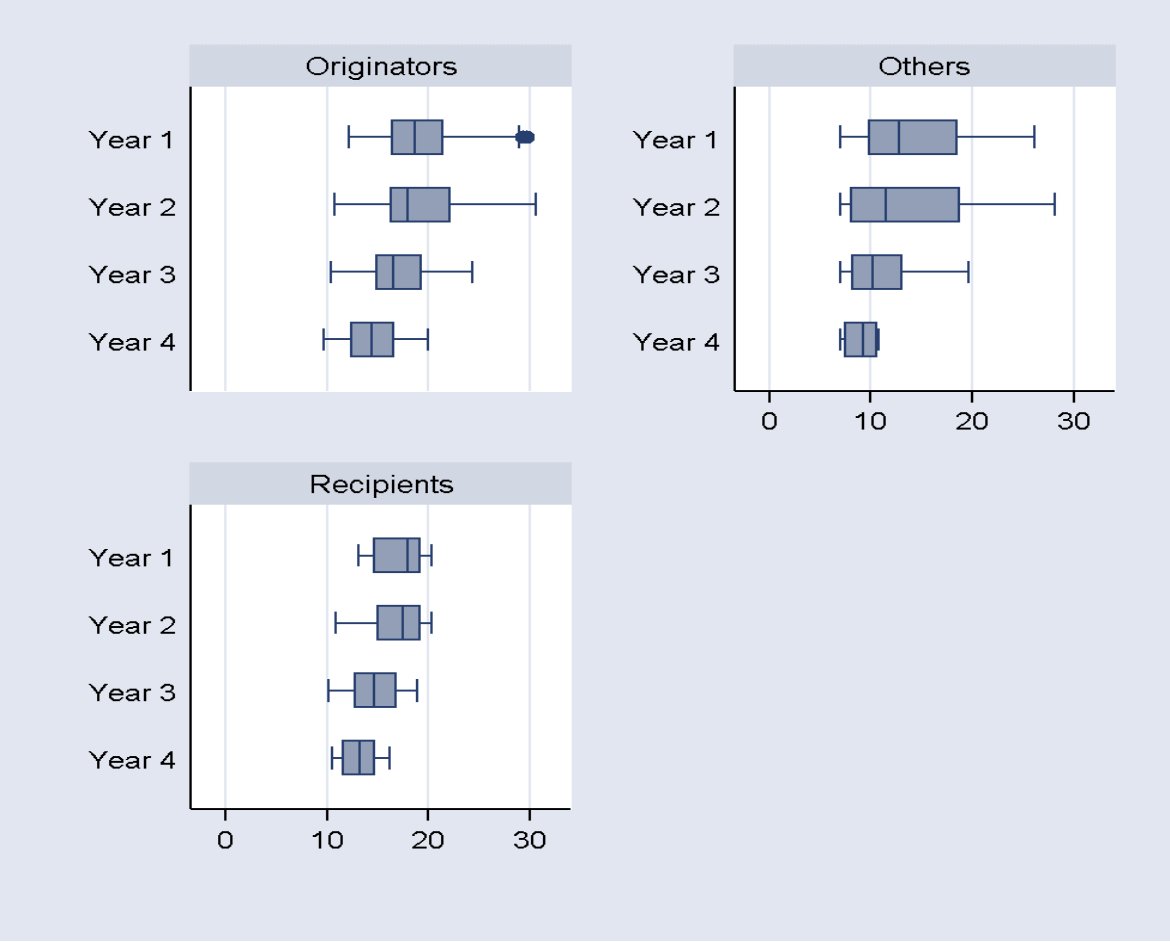
Figure 7: Distribution of mean waiting time in weeks for general surgery by year for LPCP Trusts and the comparator groups Rest of England and Metropolitan areas



The following boxplots show the distribution of mean waiting times for the three LPCP Trust groupings within London.

Again each figure shows independently the drop both in the median value of waiting times over time and the reduction in variation of waiting times.

Figure 8: Distribution of mean waiting time in weeks for general surgery by year for LPCP Trusts within London



6.3 Orthopaedics

The following table shows the descriptive statistics for mean waiting times in orthopaedics for the various groups of Trusts over time. There are 29 LPCP Trusts, comprising 20 originators, 5 recipients and 4 others. Metropolitan areas provide a comparator group of 34 Trusts.

Mean waiting times in orthopaedics are generally higher than the other specialties with a wider range of waiting times (min and max values). Mean waiting times have again fallen across the board. Mean waiting times are by far the lowest for the other group of Trusts within London, followed by metropolitan areas also with lower waiting times than the rest of the groups. Originators have the highest mean waiting times although they have seen some large reductions over time particularly between years 3 and 4.

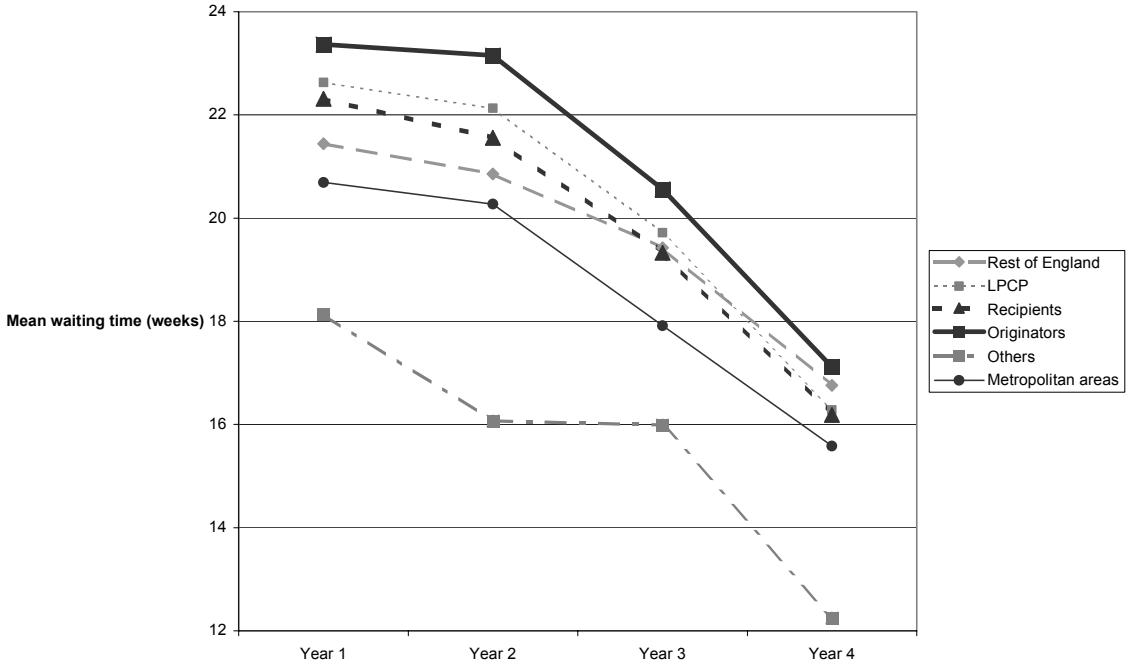
The coefficient of variation seems to be declining slightly in most groups, with a sharp decline for the other group within London and somewhat of an increase for recipient Trusts.

Table 7: Descriptive statistics for inpatient mean waiting time in weeks in orthopaedics by group over 4 years

	Number of Trusts	LPCP year	Number of observations	Mean	Std Dev	Coefficient of variation	Variance	Min	Max
Rest of England	n=184	1	592	21.440	5.18	0.242	26.83	7	36
		2	564	20.854	4.60	0.221	21.16	8	33
		3	532	19.424	3.69	0.190	13.64	8	29
		4	522	16.756	3.27	0.195	10.68	7	25
LPCP	n=29	1	108	22.630	4.91	0.217	24.10	7	32
		2	108	22.131	4.88	0.221	23.86	9	33
		3	116	19.715	3.67	0.186	13.45	9	27
		4	116	16.285	3.12	0.191	9.72	8	23
Recipients	n=5	1	16	22.311	1.59	0.071	2.54	20	25
		2	16	21.558	2.96	0.137	8.78	17	27
		3	20	19.325	2.17	0.112	4.69	14	23
		4	20	16.184	2.55	0.158	6.52	11	20
Originators	n=20	1	80	23.367	4.15	0.177	17.19	13	32
		2	80	23.155	4.36	0.188	18.99	12	33
		3	80	20.558	3.28	0.159	10.73	13	27
		4	80	17.117	2.75	0.160	7.55	12	23
Others	n=4	1	12	18.137	9.02	0.497	81.42	7	32
		2	12	16.069	5.97	0.371	35.58	9	24
		3	16	15.987	4.67	0.292	21.85	9	24
		4	16	12.250	2.34	0.191	5.47	8	16
Metropolitan areas	n=34	1	84	20.694	4.37	0.211	19.12	10	33
		2	92	20.271	4.18	0.206	17.49	12	31
		3	112	17.914	3.56	0.199	12.69	10	26
		4	112	15.582	3.33	0.214	11.12	9	22

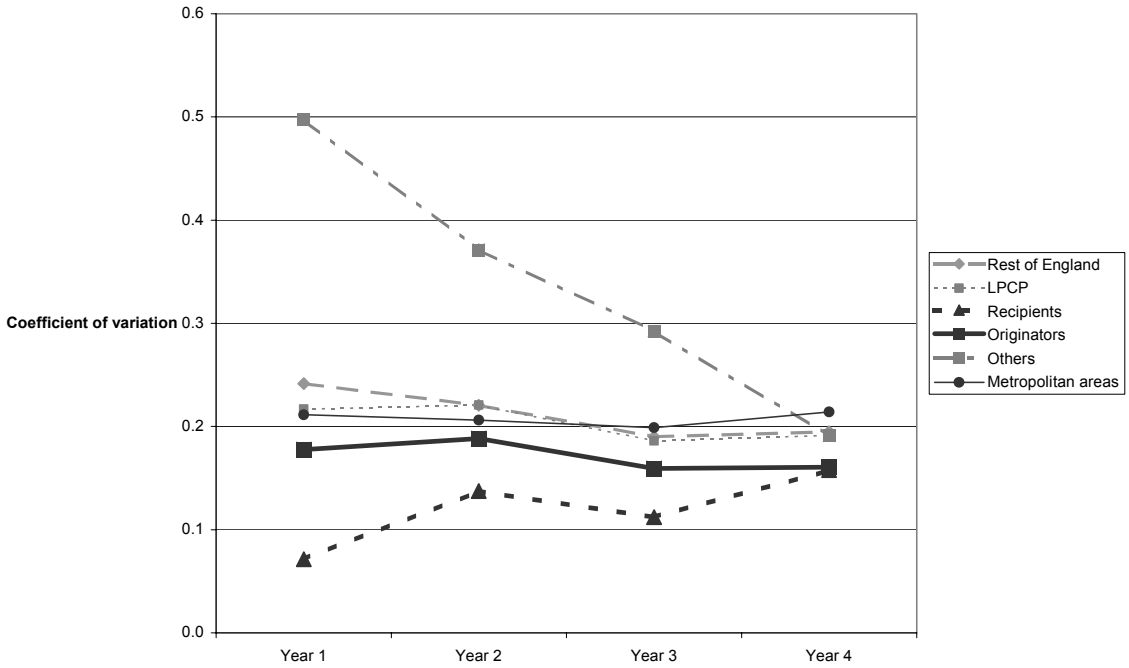
The following figure shows the plot for mean inpatient waiting times in orthopaedics for each of the groups over time. It is noticeable that the downward trend in waiting times has been evident already before the introduction of LPCP in year 4.

Figure 9: Plot of inpatient mean waiting times in orthopaedics by group over 4 years



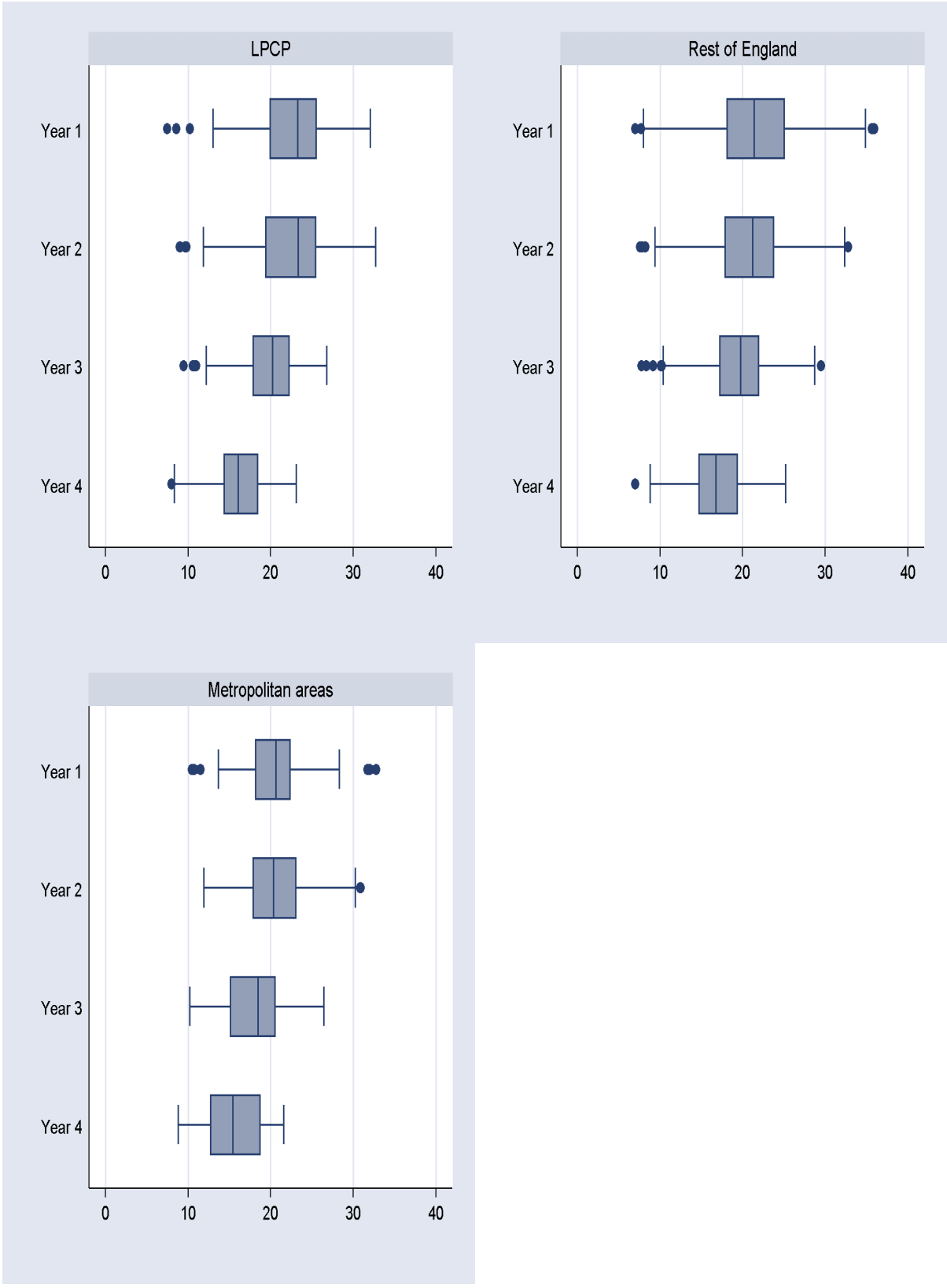
The following plot of the coefficient of variation shows the sharp decline in the variation around the mean for the other group within London and somewhat of an increase in the variation around the mean for recipient Trusts.

Figure 10: Plot of coefficient of variation in mean waiting times in orthopaedics by group over 4 years



The boxplots for orthopaedics waiting times in the following figure show the drop in the median value of waiting times for all groups over time with some reduction in dispersion in year 4 for all groups compared to previous years.

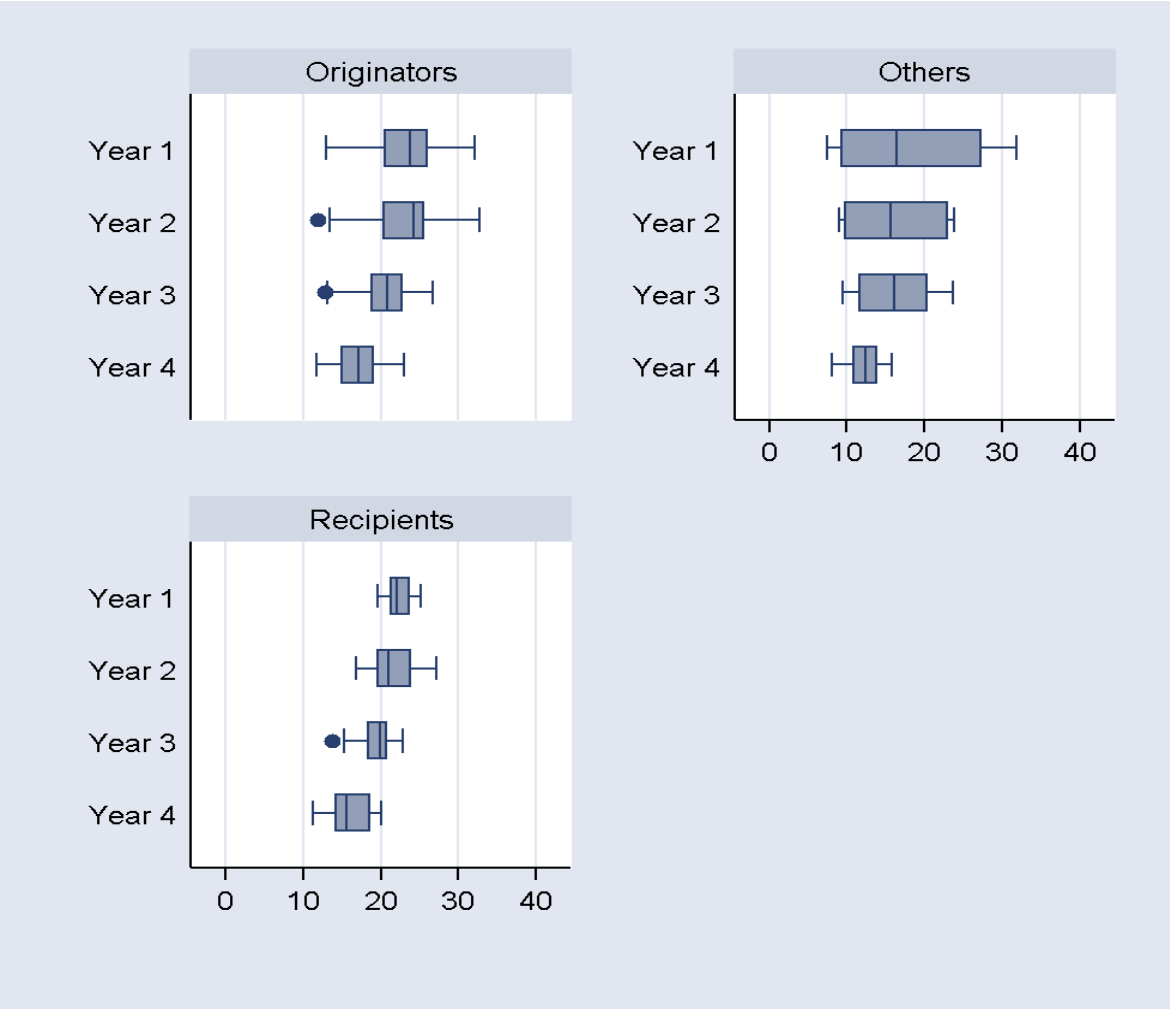
Figure 11: Distribution of mean waiting time in weeks for orthopaedics by year for LPCP Trusts and the comparator groups Rest of England and Metropolitan areas



The following figure shows the distribution of mean waiting times for orthopaedics for Trusts within London that do orthopaedics. Both originators and others show a decline in the

dispersion of their mean waiting times distributions, while for recipients the pattern seems to be the opposite. All groups have however seen a drop in the median value of mean waiting times over time.

Figure 12: Distribution of mean waiting time in weeks for orthopaedics by year for LPCP Trusts within London



7. Difference in difference results for LPCP Trusts

In this section we present the results for the difference in difference (DID) model in which we test whether the overall treatment group (LPCP) relative to the control groups (non-LPCP Trusts) were any different in their change in mean waiting times between years 3 and 4. We present results for all three specialties.

In the following we present the results for the (DID) model in which we test whether there was a significant change in mean waiting times for the 3 groups of London Trusts (recipients, originators and others) relative to the respective control groups between years 3 and 4.

7.1 Ophthalmology

The following table shows the regression results for the difference in difference model as set out in equation (1) using the three control groups, rest of England, matched control under common support (as derived by the propensity score), and metropolitan areas. For each group we have run the DID model using the three estimation procedures outlined, namely OLS, fixed effects and random effects. All are run with seasonal effects although these are not reported.

Table 8: Regression results for difference in difference model for overall effect of London Patient Choice on inpatient waiting times

	Rest of England comparator			Matched control under common support			Metropolitan areas comparator		
	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects
_Ilpcp_1 (β_{11})	-3.332		-2.841	-3.493		-3.236	-0.302		0.317
	(4.19)***		(1.61)	(3.48)***		(1.49)	(0.30)		(0.16)
_Ilpcp_year_2 (β_{22})	-1.334	-1.004	-0.955	-1.428	-1.28	-0.891	-1.571	-0.752	-0.759
	(3.99)***	(3.55)***	(3.53)***	(1.51)	(1.65)*	(1.36)	(1.82)*	(1.03)	(1.11)
_Ilpcp_year_3 (β_{23})	-1.752	-1.462	-1.251	-2.619	-1.744	-1.656	-3.73	-1.865	-1.846
	(5.21)***	(3.73)***	(3.45)***	(2.91)***	(1.19)	(1.4)	(4.82)***	(2.10)**	(2.25)**
_Ilpcp_year_4 (β_{24})	-3.357	-3.101	-2.838	-4.72	-3.72	-3.699	-5.488	-3.131	-3.167
	(10.45)***	(6.88)***	(6.65)***	(5.74)***	(2.41)**	(2.81)***	(7.46)***	(2.83)***	(3.06)***
_IlpcXlpc_1_2 (β_{312})	2.472	1.967	2.007	2.232	2.183	2.019	2.392	1.759	1.760
	(2.46)**	(2.39)**	(2.57)**	(1.68)*	(2.06)**	(2.05)**	(1.90)*	(1.68)*	(1.78)*
_IlpcXlpc_1_3 (β_{313})	2.29	0.918	0.463	2.618	1.133	0.959	3.254	1.253	1.102
	(2.38)**	(0.88)	(0.49)	(2.07)**	(0.67)	(0.66)	(2.86)***	(0.99)	(0.93)
_IlpcXlpc_1_4 (β_{314})	1.655	-0.284	-0.984	2.455	0.391	-0.034	2.124	-0.364	-0.525
	(1.94)*	(0.27)	(0.98)	(2.15)**	(0.22)	(0.02)	(2.03)**	(0.26)	(0.38)
rci (β_4)s	-0.041								
	(3.86)***								
teaching	-2.323			-3.767			-3.455		
	(7.35)***			(7.83)***			(7.81)***		
avbeds	0.002			0.002	0.024		0.003	0.01	
	(7.50)***			(3.39)***	(1.99)**		(9.93)***	(1.83)*	
daycase_spell	-5.033							-6.827	
	(3.53)***							(2.93)***	
emerg_spell	5.039						-9.535		
	(2.42)**						(2.32)**		
daycase_theatres	0.097								
	(1.79)*								
agnurspcx	0.206			0.178			0.154		
	(10.25)***			(7.34)***			(5.63)***		
opthalmology_ consultpc					-3.836				
					(2.78)***				
bedph					-5.652				
					(1.78)*				
dtc							-3.453		
							(3.12)***		
prop_nurse							-136.684		
							(3.10)***		
avbedsbar			0.001						0.003

			(1.80)*						(3.22)***
devavbeds			0.003						0.010
			(1.26)						(1.89)*
daycase_spellbar			-2.644			10.683			11.345
			(0.54)			(1.02)			(1.22)
devdaycase_spell			-9.122			-12.149			-6.772
			(2.68)***			(2.79)***			(3.14)***
agnurspcxbar			0.213			0.219			0.207
			(2.73)***			(2.81)***			(2.31)**
devagnurspcx			-0.060			-0.032			-0.046
			(1.64)			(0.72)			(1.37)
Constant (β_0)	20.813	18.309	17.552	17.568	13.859	12.125	21.695	11.198	6.014
	(13.32)***	(82.26)***	(6.07)***	(17.99)***	(3.74)***	(2.36)**	(10.66)***	(2.18)**	(1.18)*
Observations	2047	2210	2167	540	536	568	570	614	610
R-squared	0.14	0.79		0.22	0.75		0.31	0.77	
RESET	0.0003	0.130	0.158	0.0004	0.270	0.127	0.558	0.008	0.218
Test for equation (2)									
LPCP	-0.635	-1.202	-1.447	-0.163	-0.741	-0.993	-1.129	-1.617	-1.628
	(0.83)	(1.44)	(1.86)*	(0.16)	(0.67)	(0.93)	(1.31)	(1.71)*	(1.79)*

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

_Ilpcp_1	- Dummy variable for LPCP Trusts, gives main LPCP effect
_Ilpcp_year_2 to 4	- Dummy variable for LPCP year effects (2 to 4), baseline year 1 is omitted
_IlpcXlpc_1_2 to 4	- Interaction of LPCP Trust dummy and LPCP year dummies
rci	- Reference Cost Index (Reference Cost dataset)
teaching	- Dummy variable for teaching status based on hospital type (CIPFA)
avbeds	- Average number of available beds (Department of Health hospital activity statistics)
daycase_spell	- Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
emerg_spell	- Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
daycase_theatres	- The number of available daycase theatres (Department of Health hospital activity statistics)
agnurspcx	- Proportion of non-NHS salary expenditure on agency nursing staff or bank nurses (CIPFA)
opthalmology_consultpc	- Proportion of consultants in ophthalmology from the total number of hospital consultants (NHS Workforce Survey)
bedph	- Number of available beds per head of population (Department of Health hospital activity statistics)
dtc	- Dummy variable for whether a Trust has a Diagnostic Treatment Centre (DTC) (Department of Health)
prop_nurse	- Nursing staff WTEs as a proportion of total staff WTEs (Department of Health)
avbedsbar	- Mean of the variable average number of available beds over the 4 years
devavbeds	- Deviation from the mean of the variable avbeds (avbeds – avbedsbar)
daycase_spellbar	- Mean of the variable daycase rate over the 4 years
devdaycase_spell	- Deviation from the mean of the variable daycase_spell (daycase_spell – daycase_spellbar)
agnurspcxbar	- Mean of the variable expenditure on agency nursing staff over the 4 years
devagnurspcx	- Deviation from the mean of the variable agnurspcx (agnurspcx – agnurspcxbar)

The coefficient β_1 (_Ilpcp_1) in the OLS and random effects results give the main effect for LPCP Trusts which is negative in five of the six cases, suggesting overall lower mean waiting times for LPCP Trusts relative to each control group, but is significant only under OLS relative to the rest of England and matched control comparator groups. The size of the coefficients in these two control groups suggest that LPCP waiting times were about 3 weeks lower overall. However, compared to metropolitan areas, the coefficient is close to zero and is not significant suggesting no overall difference.

The next 3 β_2 (_Ilpcp_year) coefficients give the change in mean waiting times relative to the base year 1 and suggest a decline in waiting times for each year relative to the base year. All three sets of results for all three comparator groups show significant declines in year 4 relative to the base year of around 3 to 5 weeks. The next 3 β_3 (_IlpcXlpc_1) coefficients give the interaction effects between LPCP status and the LPCP year effects. These pick up differences for LPCP Trusts over and above the overall year trends in the β_2 coefficients.

We searched for significant β_4 explanatory variables in the database of Trust variables. A different set of explanatory variables was used in each of the 9 regressions, depending on which emerged as significant. In the random effects models as mentioned the Mundlak adjustment is used, thus including the mean of the particular explanatory variable and the deviation from the mean of that variable. Similar sets of control variables appear to be significant across many of the models. Of particular interest is the dummy variable for DTCs in the OLS regression for metropolitan areas suggesting that the availability of this new capacity enables a significant reduction in waiting times. Other control variables show teaching Trusts have lower waiting times, larger Trusts with more beds have higher waiting times, Trusts with a higher daycase rate have lower waiting times, Trusts which spend more on agency (bank) nurses have higher waiting times, while Trusts with a higher proportion of nurses have lower waiting times. Trusts with a higher proportion of consultants in ophthalmology also have lower waiting times.

The R-squared for the fixed effects models are around 75 to 80 percent, but substantially lower in the OLS models around 14 to 30 percent. The RESET test for omitted variable bias and specification error is passed in six of the nine models.

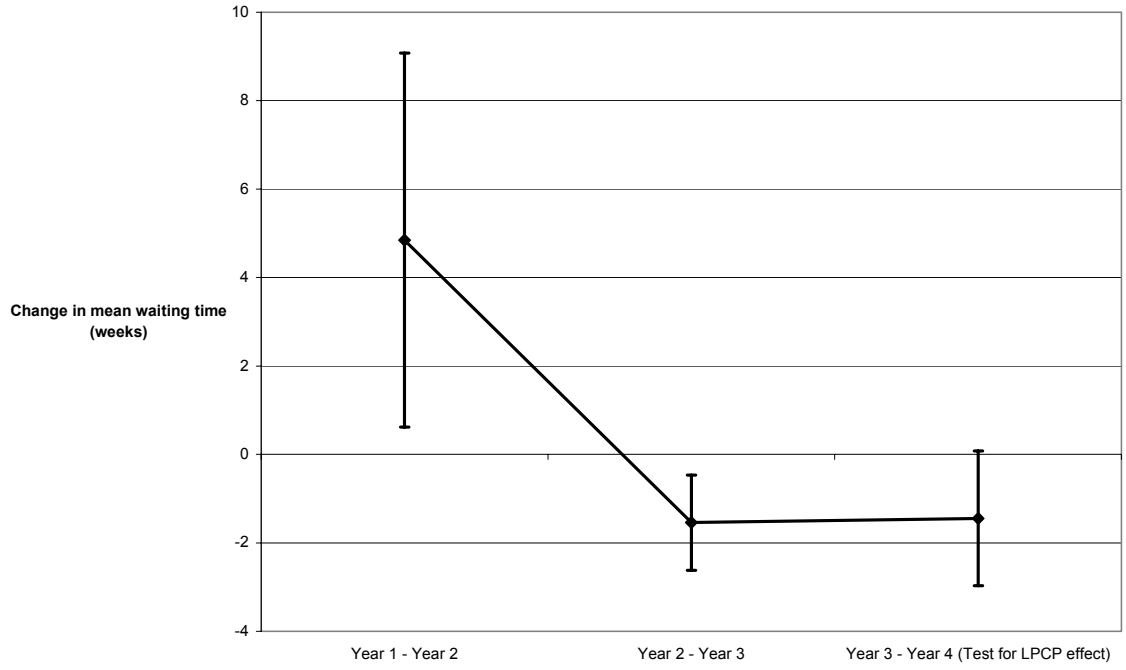
Our main interest in these results is to test the overall difference in difference in waiting times for the LPCP group relative to the comparator groups in year 4 versus year 3. We do this by testing whether equation (2) is significant, or in effect whether (_IlpcXlpc_1_4) (β_{314}) minus (_IlpcXlpc_1_3) (β_{313}) is significant (for example in the random effects model with rest of England as comparator -0.984 minus 0.463 = -1.447).

In all the models the DID is negative, suggesting that on average the effect of the LPCP treatment (policy intervention) on the LPCP treatment group was to reduce waiting times by around 1 week between year 3 and year 4 compared to the different control groups. However these DID estimates are only significant in three of the models at the 10 percent level.

The following figure shows the change in mean waiting times between years plotted for the LPCP Trusts relative to the rest of England comparator group. We use the random effects estimates from the previous results to show this. We choose the random effects estimates because they are very similar to the fixed effects estimates and because we require the overall LPCP effect, the β_1 coefficient, to calculate the changes over time. We estimate the treatment outcome for LPCP Trusts in each year using equation (1), test whether the difference between each year is significant and produce confidence intervals for each estimate. The change between years 3 and 4 therefore illustrate the DID of interest for our analysis (as presented in the results above). The other changes are calculated in a similar fashion for example the difference between year 2 and 3 is the test of whether (_IlpcXlpc_1_3) (β_{313}) minus (_IlpcXlpc_1_2) (β_{312}) is significant (0.463 – 2.007 = -1.544). The change between years 1 and 2 is 2.007 minus -2.841 = 4.848. Changes from one year to the next are all relative to zero and show either a positive increase or a negative decrease and hence fluctuate around zero. A confidence interval is a range of values (one of the vertical bars in the Figure) that has a high probability (usually set at a 95% certainty) of containing the parameter being estimated (our estimated change in treatment outcome or DID). Thus is the confidence intervals are very long we have less certainty about the precision of the parameter estimate. If the confidence intervals overlap zero, the change is not significant.

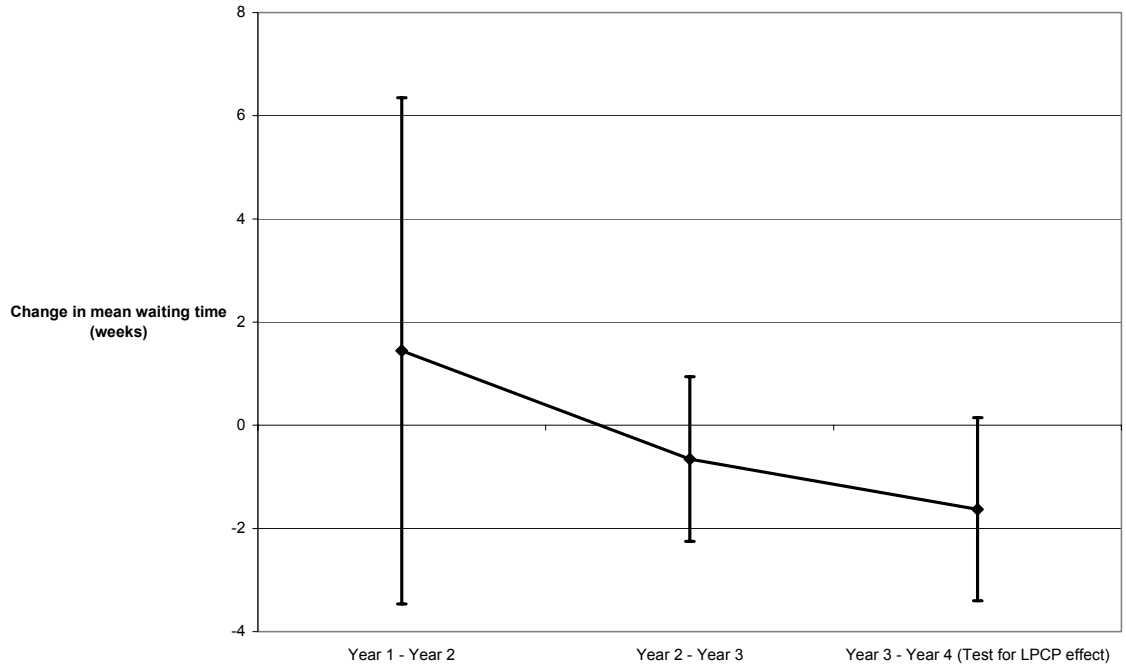
We see that there is a decline in mean waiting times from year 3 to year 4 for LPCP Trusts relative to the rest of England. From the results in the table above we know that this estimate is –1.447 (a reduction of around 1.4 weeks) although the change is only just significant at the 10 percent level. Hence the confidence intervals just overlap zero. It is interesting to note that there was already a significant reduction in mean waiting times between years 2 and 3 for LPCP Trusts compared to the rest of England, before the introduction of LPCP.

Figure 13: Change in mean waiting time in weeks for ophthalmology for LPCP group relative to rest of England comparator group



The following figure shows the change in mean waiting times again, this time relative to metropolitan areas. From the results the DID estimate between years 3 and 4 is –1.628 weeks and only just significant the 10 percent level. Hence the confidence interval just overlaps at zero. The change between year 2 and 3 is again negative suggesting a drop in waiting times, but it is not significant relative to metropolitan areas.

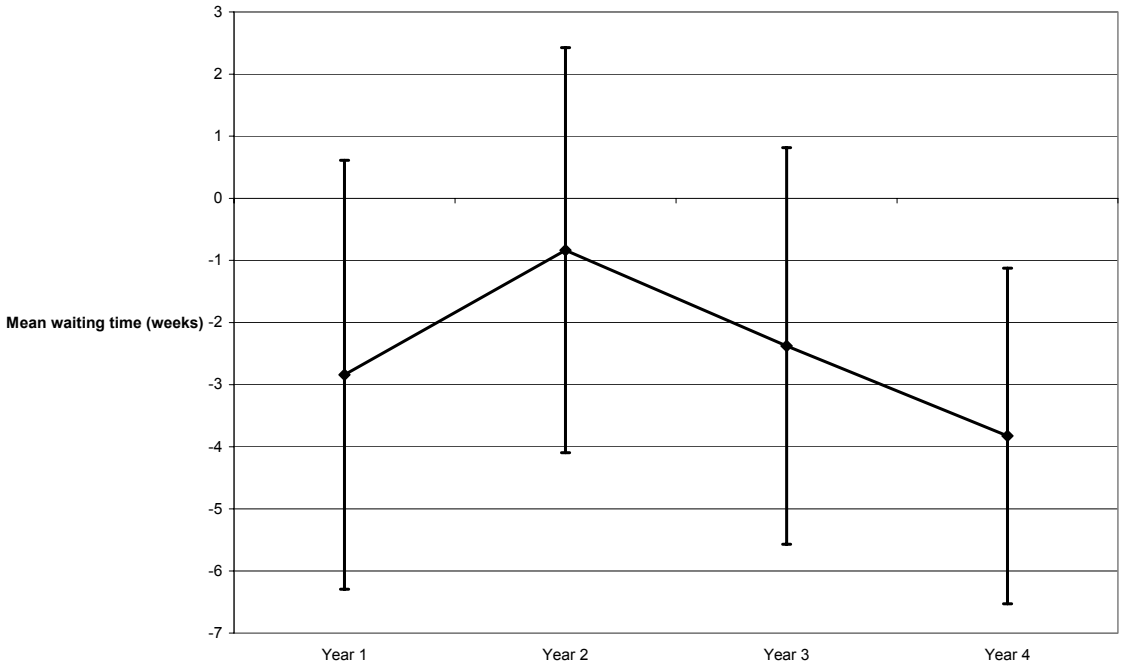
Figure 14: Change in mean waiting time in weeks for ophthalmology for LPCP group relative to metropolitan areas control group



The following three figures show the mean waiting times in weeks for LPCP Trusts relative to each of the comparator groups for each of the four years. We use the random effects estimates from the previous results to show this. We estimate the treatment outcome for LPCP Trusts in each year using equation (1) and produce confidence intervals for each estimate. Zero in this case represents the comparator group. Thus if the confidence intervals overlap zero, the change is not significant relative to the comparator group. The coefficient estimate for the baseline year 1 from the above results corresponds to the LPCP effect (β_{11}) –2.841. The coefficient estimate for year 2 is therefore the main LPCP effect (β_{11}) -2.841 plus the interaction effect in year 2 (_IlpcXlpc_1_2) (β_{312}) 2.007 = -0.834. The coefficient estimate for year 3 is the main LPCP effect (β_{11}) -2.841 plus the interaction effect in year 3 (_IlpcXlpc_1_3) (β_{313}) 0.463 = -2.378. Similarly the coefficient estimate for year 4 is (β_{11}) -2.841 plus (β_{314}) -0.984 = -3.825.

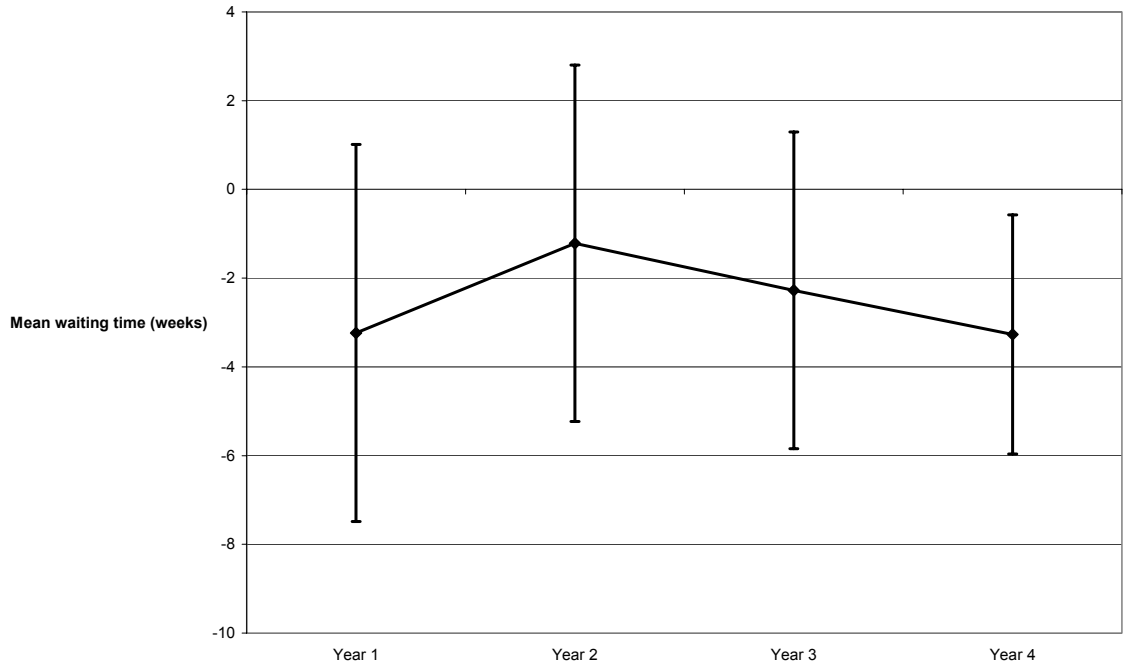
The figures shows a downward trend in waiting times from year 2 onwards and results suggest that waiting times for LPCP Trusts in year 4 were significantly lower than the rest of England comparator group.

Figure 15: Mean waiting time in weeks for ophthalmology for LPCP group relative to rest of England comparator group



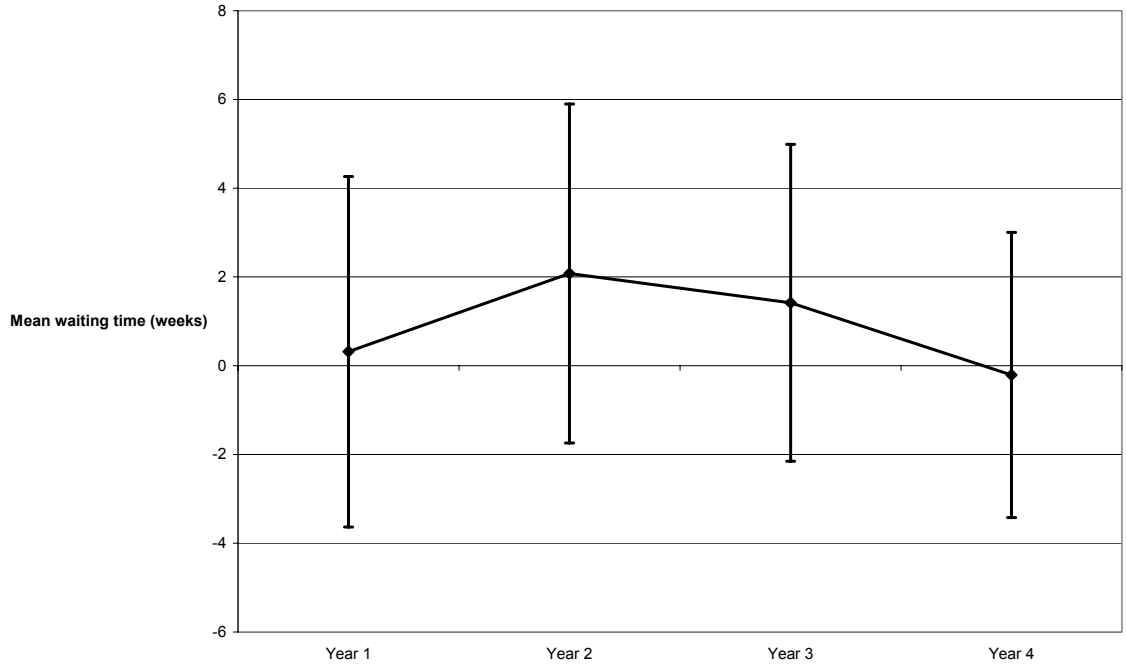
Using instead the matched control group under common support, we see in the next figure a similar decline in mean waiting times for LPCP Trusts from year 2 onwards. In year 4 LPCP Trusts have significantly lower waiting times compared to the matched control group under common support, since the confidence intervals do not overlap zero.

Figure 16: Mean waiting time in weeks for ophthalmology for LPCP group relative to matched control group under common support



When comparing LPCP to metropolitan areas as in the next figure, we see there is no significant difference between waiting times for LPCP and metropolitan areas across all 4 years, since the confidence intervals overlap in each period.

Figure 17: Mean waiting time in weeks for ophthalmology for LPCP group relative to metropolitan areas control group



7.2 General surgery

The following table shows the regression results for the difference in difference model as set out in equation (1) for general surgery using the two control groups, rest of England and metropolitan areas. For each group we have run the DID model using the three estimation procedures OLS, fixed effects and random effects. All are run with seasonal effects although these are not reported.

Table 9: Regression results for difference in difference model for overall effect of London Patient Choice on inpatient waiting times

	Rest of England comparator			Metropolitan areas comparator		
	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects
_Ilpcp_1 (β_{11})	-0.865		0.152	4.353		3.327
	(1.56)		(0.16)	(7.93)***		(3.04)***
_Ilpcp_year_2 (β_{22})	-0.141	-0.395	-0.263	0.894	0.06	0.498
	(0.46)	(2.07)**	(1.31)	(1.76)*	(0.10)	(0.90)
_Ilpcp_year_3 (β_{23})	-1.72	-1.521	-1.354	0.311	-0.93	-0.864
	(5.61)***	(5.12)***	(4.71)***	(0.66)	(1.45)	(1.38)
_Ilpcp_year_4 (β_{24})	-3.868	-3.968	-3.794	-1.806	-3.109	-3.042
	(12.79)***	(11.48)***	(11.46)***	(3.88)***	(4.73)***	(4.64)***
_IlpcXlpc_1_2 (β_{312})	-0.876	-0.597	-0.958	-1.705	-0.791	-1.161
	(1.03)	(1.40)	(1.74)*	(2.18)**	(1.15)	(1.74)*
_IlpcXlpc_1_3 (β_{313})	-1.311	-1.516	-1.875	-2.964	-1.897	-1.927
	(1.82)*	(2.45)**	(3.08)***	(4.38)***	(2.24)**	(2.35)**
_IlpcXlpc_1_4 (β_{314})	-1.385	-1.374	-1.599	-3.295	-2.024	-2.054
	(2.01)**	(1.72)*	(2.00)**	(5.06)***	(2.06)**	(2.15)**
rci (β_4)s	0.046	0.044		0.075		
	(4.86)***	(2.21)**		(4.57)***		
avbeds				0.002		
				(6.81)***		
emerg_spell					18.205	
					(2.60)***	
gensurop1pc	-9.801					
	(3.31)***					
gensuropxpc	14.478			20.691		
	(3.30)***			(4.53)***		
ipd_spell	0.317					
	(2.99)***					
gen_surg_consultpc	-9.621			-14.751		
	(2.06)**			(1.76)*		
vacy_nurse_qual	14.414					
	(4.78)***					
readmisnpc	-0.474					
	(3.98)***					
sick_ratepc	-0.584					
	(4.94)***					
daycase_spell	-4.163			7.247		
	(3.36)***			(4.08)***		
daycase_theatres	0.344			0.669		
	(7.75)***			(11.35)***		
avbedsbar			0.001			0.003

			(2.43)**			(3.00)***
devavbeds			-0.001			-0.005
			(0.40)			(1.25)
vacy_nurse_qualbar			23.518			
			(2.75)***			
devvacy_nurse_qual			-5.224			
			(0.88)			
gensurop1pcbar			-15.096			
			(2.37)**			
devgensurop1pc			-1.878			
			(0.38)			
occupancbar			0.103			
			(1.68)*			
devoccupanc			-0.007			
			(0.17)			
sick_ratepcbar			-0.891			
			(2.58)***			
devsick_ratepc			0.436			
			(1.34)			
Constant (β_0)	19.503	14.127	13.423	-0.719	11.919	13.869
	(12.84)***	(7.45)***	(2.19)**	-0.42	(5.15)***	(12.07)***
Observations	1592	2625	2461	644	848	848
R-squared	0.26	0.8		0.49	0.8	
RESET	0.000	0.000	0.049	0.004	0.000	0.891
Test for equation (2) LPCP	-0.074	0.142	0.275	-0.331	-0.127	-0.127
	(0.12)	(0.38)	(0.75)	(0.59)	(0.26)	(0.28)

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

_Ilpcp_1	- Dummy variable for LPCP Trusts, gives main LPCP effect
_Ilpcp_year_2 to 4	- Dummy variable for LPCP year effects (2 to 4), baseline year 1 is omitted
_IlpcXlpc_1_2 to 4	- Interaction of LPCP Trust dummy and LPCP year dummies
rci	- Reference Cost Index (Reference Cost dataset)
avbeds	- Average number of available beds (Department of Health hospital activity statistics)
emerg_spell	- Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
gensurop1pc	- Proportion of general surgery first outpatient attendances from total first outpatient attendances (CIPFA)
gensuropxpc	- Proportion of general surgery outpatient expenditure from total outpatient expenditure (CIPFA)
ipd_spell	- Inpatient days per spell or length of stay (Hospital Episodes Statistics)
gen_surg_consultpc	- Proportion of consultants in general surgery from the total number of hospital consultants (NHS Workforce Survey)
vacy_nurse_qual	- Three month vacancy rate for qualified nursing staff (DH vacancy rate survey)
readmisnpc	- Emergency readmission rate within 28 days, all ages, age and sex standardised (Healthcare Commission)
sick_ratepc	- Sickness absence rate for directly employed NHS staff (Healthcare Commission)
daycase_spell	- Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
daycase_theatres	- The number of available daycase theatres (Department of Health hospital activity statistics)
avbedsbar	- Mean of the variable average number of available beds
devavbeds	- Deviation from the mean of the variable avbeds (avbeds – avbedsbar)
vacy_nurse_qualbar	- Mean of the variable three month vacancy rate for qualified nursing staff
devvacy_nurse_qual	- Deviation from the mean of the variable vacy_nurse_qual (vacy_nurse_qual - vacy_nurse_qualbar)
gensurop1pcbar	- Mean of the variable proportion of general surgery first outpatient attendances from total first outpatient attendances
devgensurop1pc	- Deviation from the mean of the variable gensurop1pc (gensurop1pc - gensurop1pcbar)
occupancbar	- Mean of the variable occupancy rate (Department of Health)
devoccupanc	- Deviation from the mean of the variable occupanc (occupanc – occupancbar)
sick_ratepcbar	- Mean of the variable sickness absence rate for directly employed NHS staff
devsick_ratepc	- Deviation from the mean of the variable sick_ratepc (sick_ratepc - sick_ratepcbar)
daycase_spellbar	- Mean of the variable admissions per elective inpatient spell or daycase rate
devdaycase_spell	- Deviation from the mean of the variable daycase_spell (daycase_spell – daycase_spellbar)
agnurspcxbar	- Mean of the variable proportion of non-NHS salary expenditure on agency nursing staff or bank nurses (CIPFA)
devagnurspcx	- Deviation from the mean of the variable agnurspcx (agnurspcx – agnurspcxbar)

The coefficient β_1 (_Ilpcp_1) in the OLS and random effects results give the main effect for LPCP Trusts which show mixed (insignificant) results for LPCP Trusts relative to the rest of England. Compared to metropolitan areas LPCP Trusts appear to have significantly longer waiting times of around 3.3 to 4.3 weeks.

The next 3 β_2 (_Ilpcp_year) coefficients give the change in mean waiting times relative to the base year 1 and suggest a decline in waiting times for almost all years relative to the base year. All results for both comparator groups show significant declines in year 4 relative to the base year of around 2 to 3 weeks. The next 3 β_3 (_IlpcXlpc_1) coefficients give the interaction effects between LPCP status and the LPCP year effects. These are significant and negative for all specifications in years 3 and 4.

A similar set of β_4 explanatory variables emerges as significant across many of the models. Larger Trusts with more beds have higher waiting times, Trusts with a higher daycase rate have lower waiting times, Trusts which have more emergency admissions per inpatient spell have higher waiting times, as do Trusts with longer lengths of stay. Trusts with a higher nurse vacancy rates have higher waiting times, while Trusts with a lower proportion of first outpatient attendances in general surgery also have higher waiting times.

The R-squared for the fixed effects models are 80 percent, and lower in the OLS models around 26 and 49 percent. The RESET test for omitted variable bias and specification error is passed only in the random effects models.

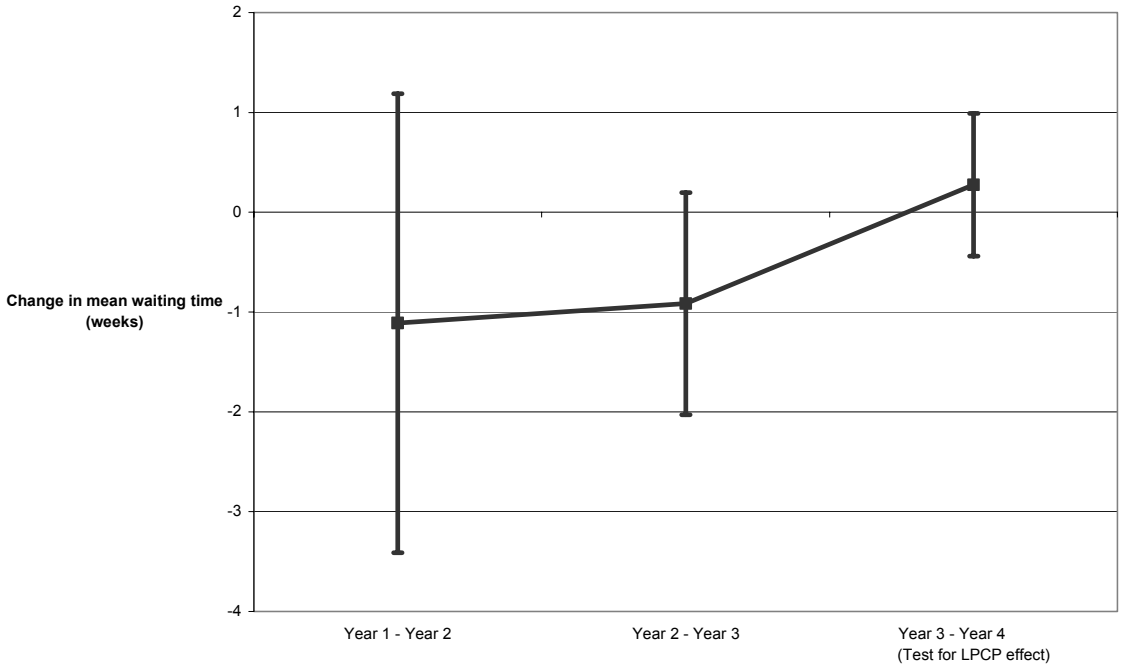
Our main interest in these results is to test the overall difference in difference in waiting times for the LPCP group relative to the comparator groups in year 4 versus year 3. We do this by testing whether equation (2) is significant, or whether (β_{314}) minus (β_{313}) is significant (for example in the random effects model with rest of England as comparator -1.599 minus -1.875 = 0.276).

In four of the six models the DID is negative, but it is insignificant in all specifications.

The following figure shows the DID or the change in mean waiting times between years for the LPCP Trusts relative to the rest of England comparator group. The change between years 3 and 4 illustrate the DID of interest for our analysis (as presented in the results above). The other changes are calculated in a similar fashion for example the difference between year 2 and 3 is (β_{313}) minus (β_{312}) or (-1.875 minus -0.958 = -0.917). The change between years 1 and 2 is -0.958 minus 0.152 = -1.110. If the confidence intervals overlap zero, the change is not significant.

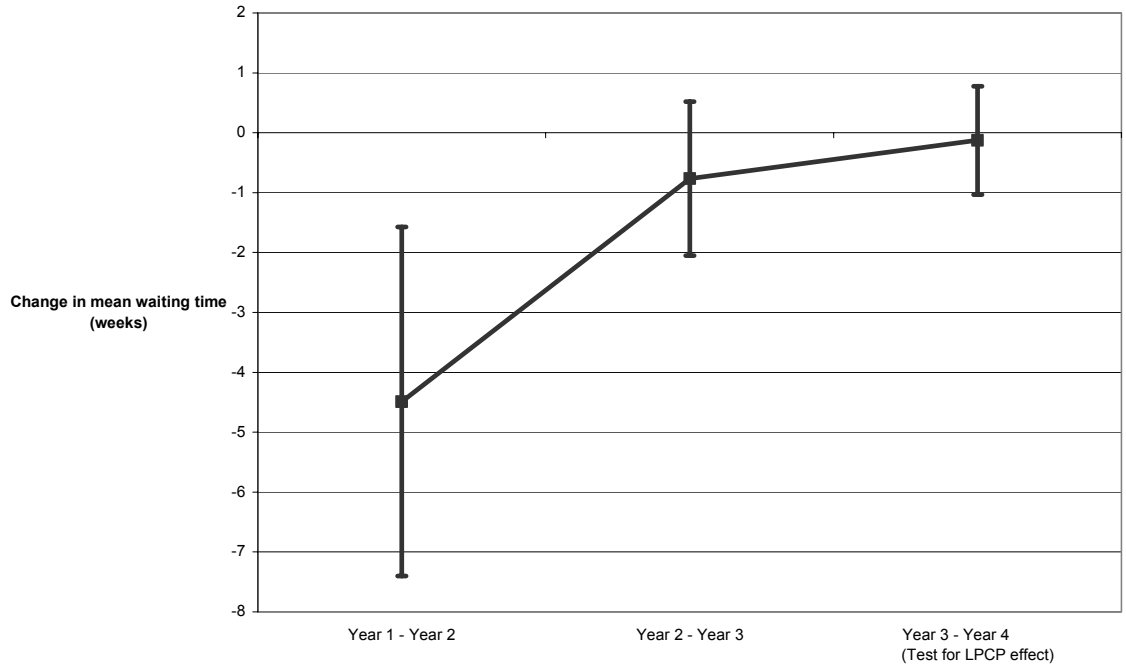
We see that in fact there is an increase in mean waiting times of 0.276 from year 3 to year 4 for LPCP Trusts relative to the rest of England. However this change is not significant.

Figure 18: Change in mean waiting time in weeks for general surgery for LPCP group relative to rest of England comparator group



The following figure shows the change in mean waiting times, this time relative to metropolitan areas. From the results the DID estimate between years 3 and 4 is -0.127 weeks and is not significant. In fact there was a significant drop in mean waiting times for LPCP Trusts relative to metropolitan areas between years 1 and 2, well before the introduction of LPCP.

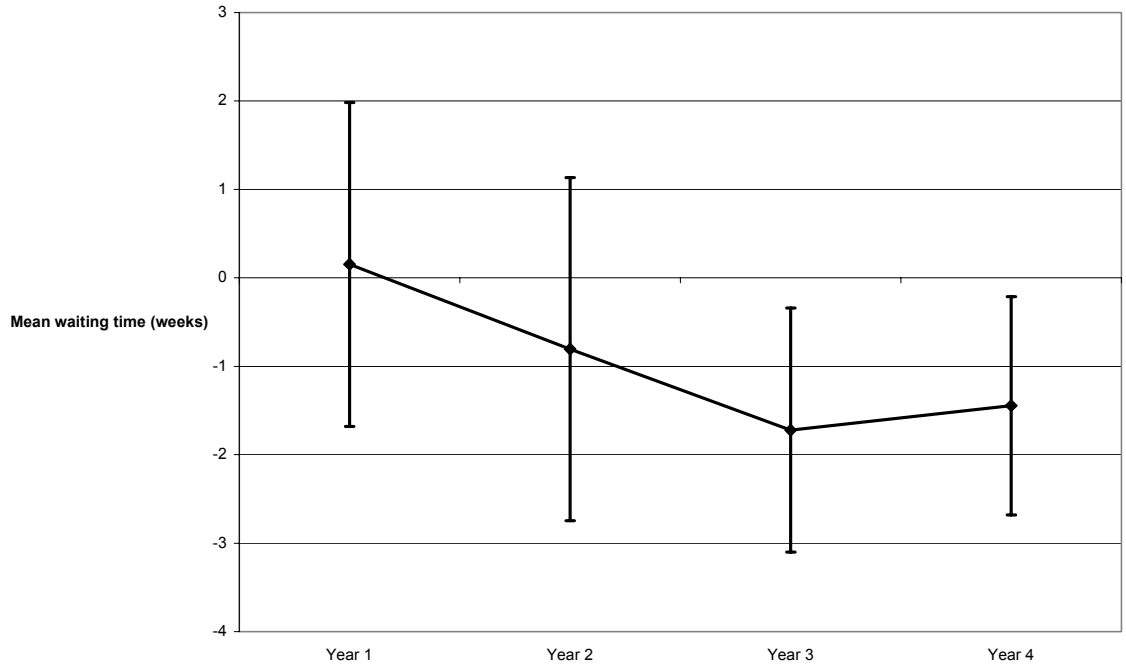
Figure 19: Change in mean waiting time in weeks for general surgery for LPCP group relative to metropolitan areas



The following two figures show the mean waiting times in weeks for LPCP Trusts relative to each of the comparator groups for each of the four years. Zero represents the comparator group. Thus if the confidence intervals overlap zero, the change is not significant relative to the comparator group. The coefficient estimate for the baseline year 1 from the above results corresponds to the LPCP effect (β_{11}) 0.152. The coefficient estimate for year 2 is therefore the main LPCP effect (β_{11}) 0.152 plus the interaction effect in year 2 (β_{312}) -0.958 = -0.806. The coefficient estimate for year 3 is the main LPCP effect (β_{11}) 0.152 plus the interaction effect in year 3 (β_{313}) -1.875 = -1.723. Similarly the coefficient estimate for year 4 is (β_{11}) 0.152 plus (β_{314}) –1.599 = -1.447.

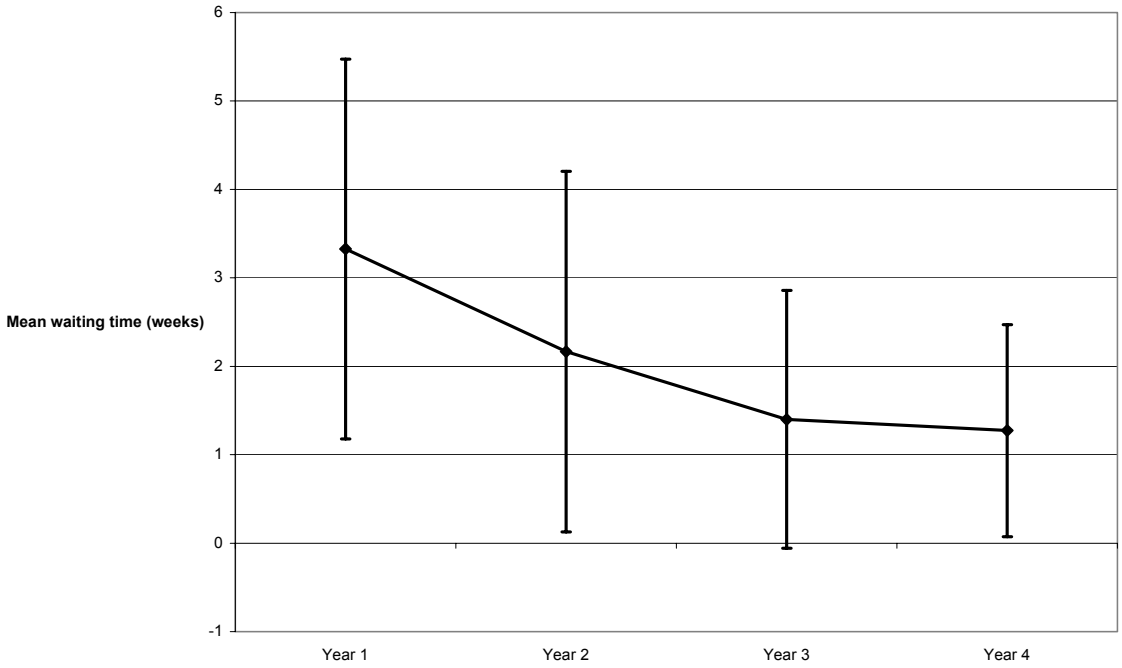
The figure shows a downward trend in waiting times from years 1 to 3 followed by a slight increase between years 3 and 4, although the difference between years 3 and 4 is not significant. However LPCP Trusts had significantly lower waiting times than the rest of England in general surgery in both years 3 and 4.

Figure 20: Mean waiting time in weeks for general surgery for LPCP groups relative to rest of England comparator group



Using instead the metropolitan areas control group, we see in the next figure a similar decline in mean waiting times for LPCP Trusts across all 4 years relative to metropolitan areas. In years 1 and 2 LPCP Trusts have significantly higher waiting times compared to metropolitan areas, while in year 3 this difference is insignificant. In year 4 the confidence intervals once again do not overlap zero and LPCP Trusts again have significantly higher waiting times compared to metropolitan areas, although the difference in years 3 and 4 is small.

Figure 21: Mean waiting time in weeks for general surgery for LPCP group relative to metropolitan areas control group



7.3 Orthopaedics

The following table shows the regression results for the DID model for orthopaedics using the two control groups and three estimation procedures.

Table 10: Regression results for difference in difference model for overall effect of London Patient Choice on inpatient waiting times

	Rest of England comparator			Metropolitan areas comparator		
	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects
_Ilpcp_1 (β_{11})	0.391		1.062	4.528		3.054
	(0.66)		(1.05)	(6.89)***		(2.45)**
_Ilpcp_year_2 (β_{22})	-0.691	-0.969	-0.66	0.595	-0.556	-0.172
	(2.27)**	(4.21)***	(3.05)***	(0.88)	(1.01)	(0.28)
_Ilpcp_year_3 (β_{23})	-2.575	-2.46	-2.274	-1.069	-2.325	-2.166
	(7.88)***	(7.58)***	(7.33)***	(1.74)*	(3.12)***	(2.57)**
_Ilpcp_year_4 (β_{24})	-5.14	-5.095	-4.902	-3.747	-4.657	-4.498
	(16.01)***	(13.28)***	(13.37)***	(6.26)***	(6.11)***	(5.30)***
_IlpcXlpc_1_2 (β_{312})	-0.516	0.036	-0.039	-2.112	-0.071	-0.408
	(0.63)	(0.07)	(0.06)	(2.27)**	(0.09)	(0.52)
_IlpcXlpc_1_3 (β_{313})	-1.582	-0.799	-0.475	-2.422	-0.666	-0.82
	(2.09)**	(1.09)	(0.59)	(2.97)***	(0.65)	(0.78)
_IlpcXlpc_1_4 (β_{314})	-2.518	-1.593	-1.342	-3.165	-1.764	-1.918
	(3.48)***	(1.84)*	(1.46)	(4.01)***	(1.57)	(1.70)*
rci (β_4)s	0.058	0.049		0.123		
	(5.57)***	(2.15)**		(6.80)***		
avbeds				0.001		
				(3.74)***		

orthoop1pc	-3.12			4.761		
	(2.11)**			(2.64)***		
orthoxpc	7.918					
	(3.70)***					
cons_beds	0.09					
	(2.90)***					
readmisnpc	-0.782					
	(6.59)***					
vacy_nurse_qual	7.897			-11.491		
	(2.22)**			(2.42)**		
daycase_spell	-3.517			8.23		
	(2.32)**			(2.45)**		
daycase_theatres	0.349			0.465		
	(8.31)***			(7.28)***		
emerg_spell					23.52	
					(2.62)***	
avbedsbar			0.001			0.002
			(2.09)**			(2.48)**
devavbeds			-0.002			-0.001
			(0.83)			(0.29)
sick_ratepcbar			-0.718			
			(2.08)**			
devsick_ratepc			-0.53			
			(1.61)			
Constant (β_0)	20.109	17.899	24.496	0.44	14.616	19.141
	(12.37)***	(8.27)***	(14.52)***	-0.18	(4.76)***	(14.77)***
Observations	1819	2646	2518	656	848	848
R-squared	0.26	0.81		0.42	0.81	
RESET	0.025	0.000	0.005	0.0001	0.016	0.254
Test for equation (2) LPCP	-0.936	-0.794	-0.867	-0.743	-1.098	-1.098
	(1.53)	(2.19)**	(2.47)**	(1.19)	(2.60)***	(2.72)***

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

_Ilpcp_1	- Dummy variable for LPCP Trusts, gives main LPCP effect
_Ilpcp_year_2 to 4	- Dummy variable for LPCP year effects (2 to 4), baseline year 1 is omitted
_IlpcXlpc_1_2 to 4	- Interaction of LPCP Trust dummy and LPCP year dummies
rci	- Reference Cost Index (Reference Cost dataset)
avbeds	- Average number of available beds (Department of Health hospital activity statistics)
orthoop1pc	- Proportion of orthopaedics first outpatient attendances from total first outpatient attendances (CIPFA)
orthoxpc	- Proportion of orthopaedics expenditure from total inpatient expenditure (CIPFA)
cons_beds	- Number of consultants per bed (derived from Department of Health data)
readmisnpc	- Emergency readmission rate within 28 days, all ages, age and sex standardised (Healthcare Commission)
vacy_nurse_qual	- Three month vacancy rate for qualified nursing staff (DH vacancy rate survey)
daycase_spell	- Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
daycase_theatres	- The number of available daycase theatres (Department of Health hospital activity statistics)
emerg_spell	- Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
avbedsbar	- Mean of the variable average number of available beds
devavbeds	- Deviation from the mean of the variable avbeds (avbeds – avbedsbar)
sick_ratepcbar	- Mean of the variable sickness absence rate for directly employed NHS staff
devsick_ratepc	- Deviation from the mean of the variable sick_ratepc (sick_ratepc - sick_ratepcbar)

The coefficient β_1 (_Ilpcp_1) is insignificant for the results relative to the rest of England. Compared to metropolitan areas LPCP Trusts appear to have significantly longer waiting times of around 3 to 4.5 weeks.

Once again almost all β_2 (_Ilpcp_year) coefficients are negative suggesting a decline in waiting times for each year relative to the base year. All three sets of results for both

comparator groups show significant declines in year 4 relative to the base year of around 3 to 5 weeks. The β_3 (_IlpcXlpc_1) coefficients are negative for all specifications in years 3 and 4 and significant in both OLS models.

Of the β_4 explanatory variables, the results suggest that Trusts with higher reference costs have longer waits. Larger Trusts with more beds have higher waiting times, Trusts which have more emergency admissions per inpatient spell have higher waiting times, as do Trusts with higher nurse vacancy rates. Trusts with a higher daycase rate have lower waiting times, while Trusts with a lower proportion of first outpatient attendances in orthopaedics also have higher waiting times.

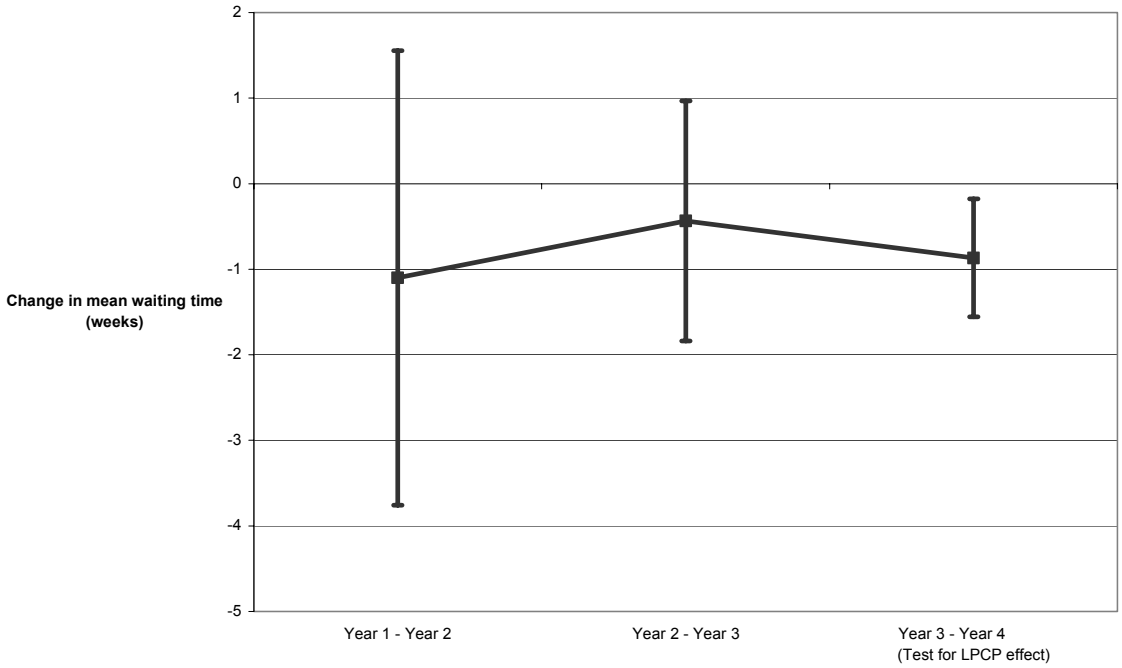
The R-squared for the fixed effects models is 81 percent, while for the OLS models it is 26 and 42 percent. The RESET test for omitted variable bias is passed in only one of the models.

Testing the overall DID in waiting times for the LPCP group relative to the comparator groups in year 4 versus year 3, we find a negative coefficient across the board and significant results for all the random and fixed effects models. This suggests that in orthopaedics the effect of the LPCP intervention on LPCP Trusts was to lower their waiting times by around 1 week in the treatment period relative to the comparator groups in the same period.

The following figure shows the change in mean waiting times between years plotted for the LPCP Trusts relative to the rest of England comparator group. The DID for each year is -1.101, -0.436, and -0.867.

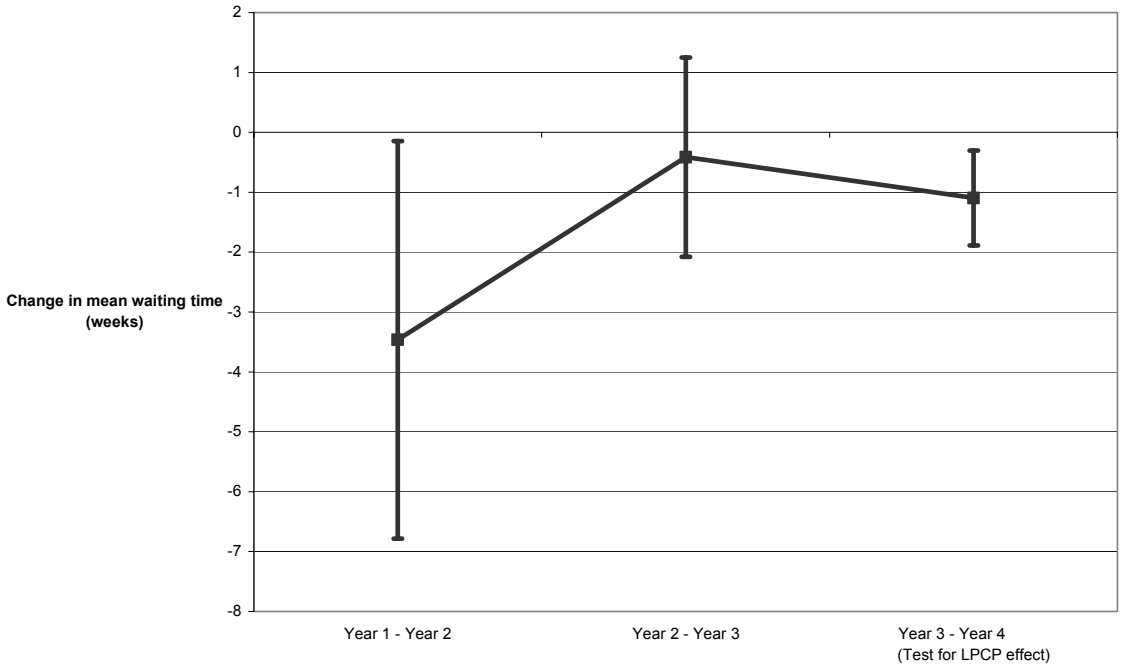
We see that there is a significant decline in mean waiting times from year 3 to year 4 for LPCP Trusts relative to the rest of England. From the results in the table above we know that this estimate is -0.867 (a reduction of around 0.8 weeks). Changes in previous years were also negative but not significant.

Figure 22: Change in mean waiting time in weeks for orthopaedics for LPCP group relative to rest of England comparator group



The following figure shows the change in mean waiting times relative to metropolitan areas. From the results the DID estimate between years 3 and 4 is -1.098 weeks and is significant. Another significant change took place between years 1 and 2 suggesting a drop in waiting times for LPCP Trusts relative to metropolitan areas, well before the introduction of LPCP.

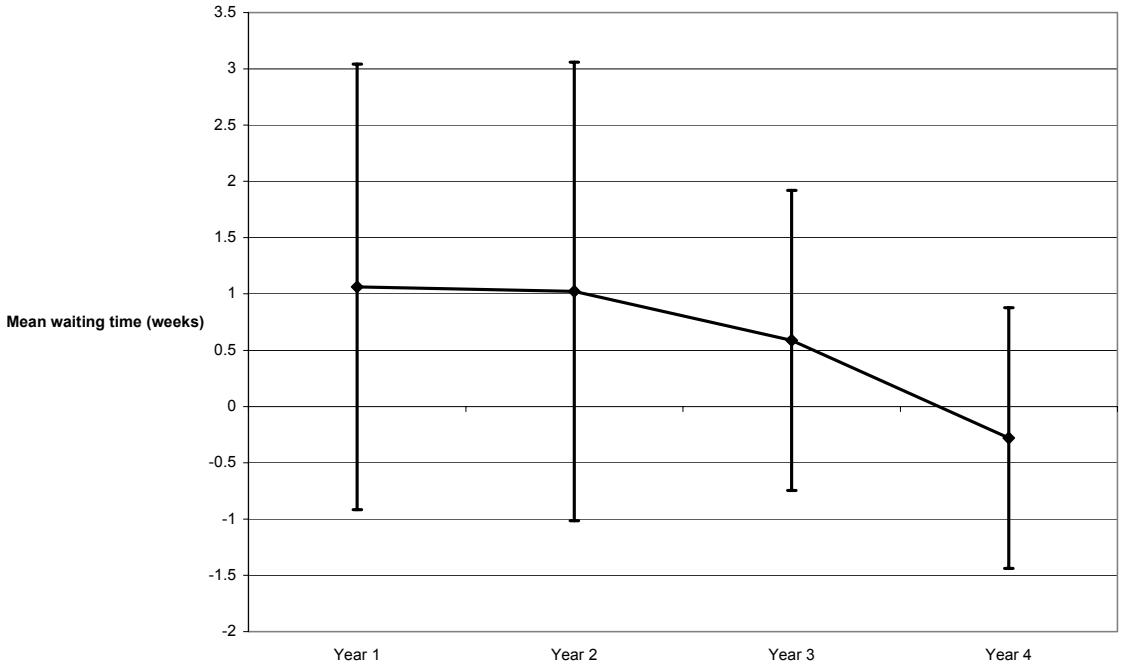
Figure 23: Change in mean waiting time in weeks for orthopaedics for LPCP group relative to metropolitan areas



The following two figures show the mean waiting times in weeks for LPCP Trusts relative to each of the comparator groups for each of the four years. The coefficient estimates for each of the 4 years are 1.062, 1.023, 0.587, and -0.280.

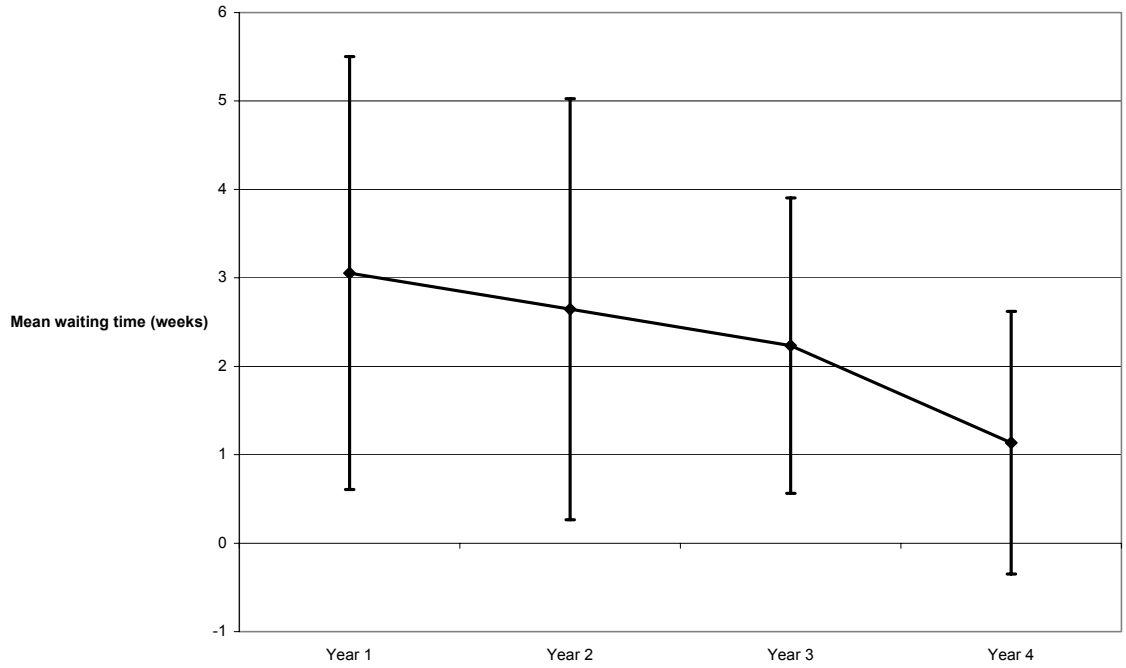
The figures shows a downward trend in waiting times over the four years although waiting times for LPCP Trusts in the 4 years are never significantly different from the rest of England.

Figure 24: Mean waiting time in weeks for orthopaedics for LPCP groups relative to rest of England comparator group



Compared to metropolitan areas, we see in the next figure a similar decline in mean waiting times for LPCP Trusts across the four years. In the first 3 years, LPCP Trusts have significantly higher waiting times compared to metropolitan areas, but in year 4, the treatment year, they are no longer significantly different since the confidence intervals overlap zero.

Figure 25: Mean waiting time in weeks for orthopaedics for LPCP group relative to metropolitan areas control group



8. Difference in difference results for the three groups of LPCP Trusts

While we may be interested in the overall LPCP effect relative to the rest of England and other comparator groups, there were of course very different incentives facing Trusts within LPCP and we therefore wish to distinguish any changes in waiting times for the three groups of Trusts within London. We therefore use the difference in difference model again to explore whether there were significant changes between years 3 and 4 for any of the 3 groups of Trusts within LPCP relative to the comparator groups. In particular, we are interested in whether originating Trusts were able to significantly reduce their waiting times.

We now explore the DID results for three groups of LPCP Trusts within London for each of the three specialties.

8.1 Ophthalmology

The following table shows the regression results for the difference in difference model for inpatient waiting times in ophthalmology for the three groups of London Trusts relative to the three comparator groups (rest of England, matched control under common support, and metropolitan areas). We again use OLS, fixed effects and random effects models in each case and control for seasonal effects though these coefficients are not reported.

Table 11: Regression results for difference in difference model for effect within London on inpatient waiting times

	Rest of England comparator			Matched control under common support			Metropolitan areas comparator		
	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects
opth_rec (β_{11})	-5.078		-3.941	-4.606		-4.381	-1.765		-0.820
	(3.75)***		(1.73)*	(2.94)***		(1.89)*	(1.24)		(0.32)
opth_or (β_{12})	-0.719		0.262	-1.112		0.104	2.166		3.424
	-0.73		(0.13)	(0.97)		(0.04)	(1.94)*		(1.48)
opth_oth (β_{13})	-6.658		-6.528	-6.449		-6.559	-4.214		-3.541
	(6.15)***		(2.95)**	(4.84)***		(2.57)**	(3.48)***		(1.49)
_Ilpcp_year_2 (β_{22})	-1.27	-0.936	-0.961	-1.233	-1.288	-0.867	-0.873	-0.51	-0.782
	(3.78)***	(3.28)***	(3.55)***	(1.25)	(1.66)*	(1.34)	(1.03)	(0.73)	(1.18)
_Ilpcp_year_3 (β_{23})	-1.655	-1.267	-1.260	-2.425	-1.731	-1.635	-3.127	-1.709	-1.86
	(4.91)***	(3.30)***	(3.48)***	(2.61)***	(1.18)	(1.39)	(4.28)***	(1.94)*	(2.34)**
_Ilpcp_year_4 (β_{24})	-3.254	-2.89	-2.850	-4.539	-3.694	-3.697	-4.862	-3.238	-3.179
	(10.13)***	(6.40)***	(6.68)***	(5.42)***	(2.41)**	(2.80)***	(7.01)***	(2.90)***	(3.14)***
_IoptXlpc_1_2 (β_{312})	0.996	0.584	0.619	0.854	1.093	0.506	0.723	0.278	0.585
	(0.58)	(0.58)	(0.64)	(0.41)	(0.97)	(0.46)	(0.40)	(0.23)	(0.50)
_IoptXlpc_1_3 (β_{313})	0.043	-2.271	-2.275	0.133	-1.358	-1.811	0.929	-1.638	-1.437
	(0.03)	(1.70)*	(1.80)*	(0.07)	(0.74)	(1.10)	(0.62)	(1.00)	(0.95)
_IoptXlpc_1_4 (β_{314})	0.254	-2.939	-2.974	0.611	-1.419	-1.952	0.854	-2.408	-2.387
	(0.18)	(2.05)**	(2.19)**	(0.37)	(0.65)	(1.07)	(0.60)	(1.27)	(1.36)
_IoptXlpca1_2_2 (β_{322})	2.878	2.384	2.391	2.728	2.549	2.375	2.333	1.928	2.11
	(2.23)**	(1.59)	(1.70)*	(1.76)*	(1.60)	(1.53)	(1.59)	(1.17)	(1.39)
_IoptXlpca1_2_3 (β_{323})	3.308	1.326	1.346	3.63	1.766	1.860	4.289	1.67	1.865
	(2.79)***	(0.92)	(0.98)	(2.54)**	(0.87)	(1.03)	(3.30)***	(0.98)	(1.19)
_IoptXlpca1_2_4 (β_{324})	1.018	-2.052	-2.012	1.769	-1.048	-1.004	2.092	-1.857	-1.71
	(0.91)	(2.51)**	(2.57)**	(1.32)	(0.63)	(0.68)	(1.73)*	(1.38)	(1.36)
_IoptXlpcb1_3_2 (β_{332})	2.664	2.262	2.292	2.07	2.37	2.291	1.667	1.461	1.766
	(1.83)*	(2.65)***	(2.91)***	(1.17)	(2.18)**	(2.31)**	(1.00)	(1.38)	(1.91)*
_IoptXlpcb1_3_3 (β_{333})	2.026	0.744	0.753	2.226	1.592	1.135	2.79	1.276	1.494
	(1.51)	(0.48)	(0.53)	(1.36)	(0.81)	(0.62)	(1.84)*	(0.72)	(0.97)
_IoptXlpcb1_3_4 (β_{334})	3.31	1.765	1.731	4.282	3.417	2.516	4.414	2.6	2.567
	(2.77)***	(0.85)	(0.89)	(2.93)***	(1.39)	(1.06)	(3.21)***	(1.13)	(1.23)
rci (β_4)s	-0.052								
	(5.06)***								
teaching	-1.772			-2.38			-2.452		
	(5.88)***			(5.28)***			(5.78)***		
avbeds	0.002			0.001	0.024		0.003		
	(6.56)***			(2.08)**	(2.07)**		(10.52)***		
mortal_indx	-0.028						-0.043		
	(2.37)**						(2.17)**		
daycase_spell	-5.65	-7.858							
	(3.95)***	(2.06)**							
emerg_spell	4.375						-12.064		
	(2.13)**						(3.96)***		
daycase_theatres	0.098								
	(1.84)*								
agnurspcx	0.188	-0.073		0.144			0.129	-0.074	
	(9.16)***	(1.85)*		(5.83)***			(4.73)***	(2.09)**	
bedph					-5.936				
					(1.97)**				

opthalmop1pc					12.093				
					(2.01)**				
opthalmology_ consultpc					-14.408				
					(2.35)**				
avbedsbar			0.001						0.003
			(1.74)*						(3.69)***
devavbeds			0.003						0.009
			(1.20)						(1.79)*
daycase_spellbar			-3.030			10.419			
			(0.64)			(1.42)			
devdaycase_spell			-7.790			-9.742			
			(2.17)**			(2.00)**			
agnurspcxbar			0.195			0.169			0.171
			(2.56)**			(2.50)**			(1.84)*
devagnurspcx			-0.074			-0.050			-0.068
			(1.97)**			(1.15)			(2.02)**
Constant (β_0)	25.487	22.847	17.919	18.3	13.951	12.676	22.006	17.629	12.486
	(12.81)***	(11.34)***	(6.42)***	(18.55)***	(4.02)***	(3.48)***	(9.95)***	(30.55)***	(9.06)***
Observations	2047	2169	2167	540	536	568	572	612	612
R-squared	0.18	0.79		0.34	0.77		0.44	0.78	
RESET	0.105	0.006	0.247	0.267	0.191	0.091	0.140	0.0001	0.901
Test for equation (4) recipients	0.212	-0.667	-0.699	0.478	-0.061	-0.141	-0.076	-0.770	-0.950
	(0.24)	(0.83)	(0.91)	(0.40)	(0.05)	(0.13)	(0.09)	(0.83)	(1.04)
Test for equation (5) originators	-2.290	-3.378	-3.360	-1.860	-2.814	-2.863	-2.198	-3.527	-3.575
	(2.49)**	(2.98)***	(3.11)***	(1.62)	(2.09)**	(2.19)**	(2.28)**	(2.88)***	(3.08)***
Test for equation (6) others	1.284	1.020	0.978	2.056	1.825	1.380	1.624	1.324	1.073
	(1.37)	(1.21)	(1.22)	(1.74)*	(1.54)	(1.26)	(1.51)	(1.44)	(1.19)

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

opth_rec	- Dummy variable for recipient Trusts
opth_or	- Dummy variable for originator Trusts
opth_oth	- Dummy variable for other Trusts
_Ilpcp_year_2 to 4	- Dummy variable for LPCP year effects (2 to 4), baseline year 1 is omitted
_IoptXlpc_1_2 to 4	- Interaction of recipient Trust dummy and LPCP year dummies
_IoptXlpca_1_2 to 4	- Interaction of originator Trust dummy and LPCP year dummies
_IoptXlpcb_1_2 to 4	- Interaction of other Trust dummy and LPCP year dummies
rci	- Reference Cost Index (Reference Cost dataset)
teaching	- Dummy variable for teaching status based on hospital type (CIPFA)
avbeds	- Average number of available beds (Department of Health hospital activity statistics)
mortal_indx	- Standardised three-year average mortality index (Dr Foster)
daycase_spell	- Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
emerg_spell	- Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
daycase_theatres	- The number of available daycase theatres (Department of Health hospital activity statistics)
agnurspcx	- Proportion of non-NHS salary expenditure on agency nursing staff or bank nurses (CIPFA)
bedph	- Number of available beds per head of population (Department of Health hospital activity statistics)
opthalmop1pc	- Proportion of ophthalmology first outpatient attendances from total first outpatient attendances (CIPFA)
opthalmology_consultpc	- Proportion of consultants in ophthalmology from the total number of hospital consultants (NHS Workforce Survey)
avbedsbar	- Mean of the variable average number of available beds over the 4 years
devavbeds	- Deviation from the mean of the variable avbeds (avbeds – avbedsbar)
daycase_spellbar	- Mean of the variable daycase rate over the 4 years
devdaycase_spell	- Deviation from the mean of the variable daycase_spell (daycase_spell – daycase_spellbar)
agnurspcxbar	- Mean of the variable expenditure on agency nursing staff over the 4 years
devagnurspcx	- Deviation from the mean of the variable agnurspcx (agnurspcx – agnurspcxbar)

The 3 β_1 coefficients (opth_rec, opth_or and opth_oth) in the OLS and random effects models give the overall difference in mean waiting time relative to the respective comparator groups for the three LPCP groups, receivers, originators and others. Recipients have lower waiting

times (significantly so compared to the rest of England and matched control group). Others also have significantly lower waiting times in almost all specifications. Originators have higher waiting times, as expected, in four of the six specifications, although these are not generally significant. This corresponds with the descriptive statistics of mean waiting times for the different groups. The next 3 β_2 (_Ilpcp_year) coefficients give the change in mean waiting times relative to the base year 1 and suggest a decline in waiting times for each year relative to the base year across all specifications. All models show significant declines in year 4 relative to the base year. The next 9 β_3 coefficients give the interaction effects between each of the 3 types of Trust and the LPCP year effects.

β_4 explanatory variables which emerge as significant show teaching Trusts have lower waiting times, as do Trusts with a higher daycase rate, larger Trusts with more beds have higher waiting times, while Trusts with a higher proportion of consultants in ophthalmology have lower waiting times. Interestingly, Trusts with a lower standardised mortality index have higher waiting times.

The fixed effects models all have an R-squared of around 77 to 79 percent, while the OLS R-squared results range from 18 percent to 44 percent. Seven of the nine models pass the RESET test.

Our main interest with these results is again to test the overall difference in difference (DID) in waiting times for the 3 groups of LPCP Trusts relative to the comparator groups in year 4 versus year 3. We therefore test whether equations (4), (5) and (6) are significant. This equates to a test of significance for _IoptXlpc_1_4 (β_{314}) minus _IoptXlpc_1_3 (β_{313}) for recipients, _IoptXlpca1_2_4 (β_{324}) minus _IoptXlpca1_2_3 (β_{323}) for originators, and _IoptXlpcb1_3_4 (β_{334}) minus _IoptXlpcb1_3_3 (β_{333}) for others. We are most interested in whether there has been a significant decline in mean waiting times for originating Trusts, which would suggest some convergence in mean waiting times within London Trusts. However, we also wish to test whether such a decline has been at the expense of patients at the other groups of Trusts now taking on the additional activity. In other words, if waiting times significantly increase for recipient Trusts as a result of taking on additional choice patients, then some patients lose while others gain. If the decline is significant for originators only, this would suggest the benefit to patients at originating Trusts was not at the expense of patients at receiving Trusts, suggesting an equity improvement to the system as a whole.

In all 9 models we find a negative effect for originating Trusts suggesting that they have lowered their waiting times in the LPCP treatment year relative to the previous year. This effect is significant across eight of the nine models including the preferred fixed effects and random effects models. These results suggest originating Trusts lowered their waiting times in the LPCP treatment year relative to the previous year by approximately 3 weeks.

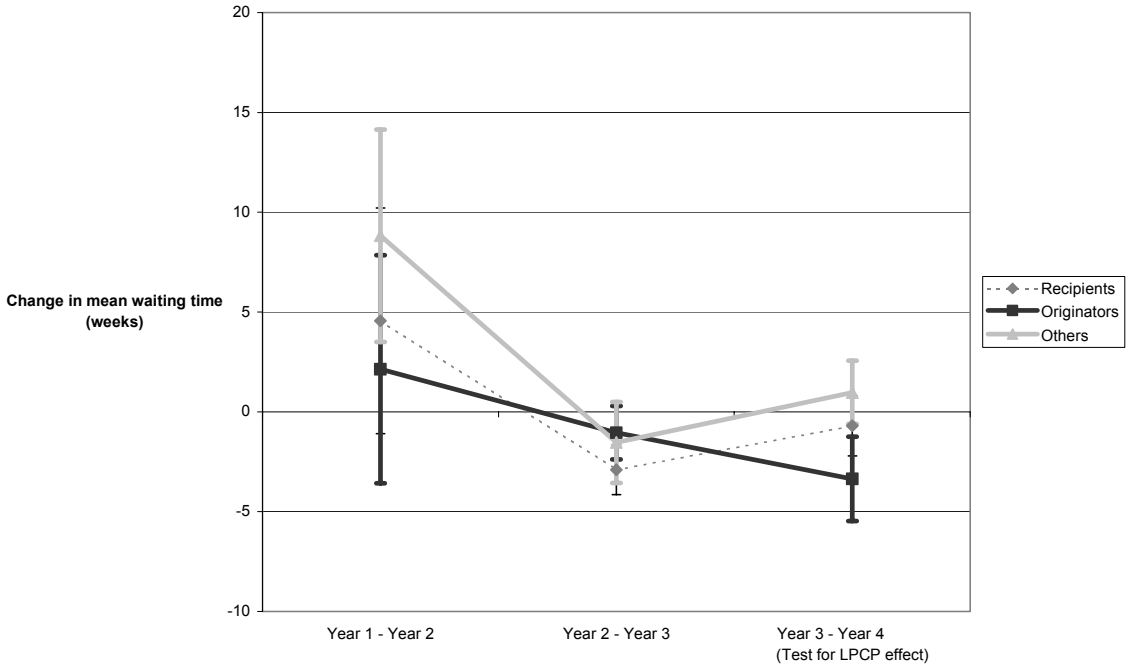
Results for recipient Trusts were not significant in any of the models suggesting an overall improvement in equity of access for the whole London system.

The following figure shows the change in mean waiting times between years plotted for the three groups of LPCP Trusts relative to the rest of England comparator group. Again we use the random effects estimates from the previous results to show this. We estimate the treatment outcome for each of the three groups of Trusts in each year using equation (3), test whether the change between years is significant, and produce confidence intervals for each estimate.

The change between years 3 and 4 illustrate the DID of interest for our analysis (as presented in the results above). The other changes are calculated in a similar fashion for each of the groups of Trusts. For example the difference between year 1 and 2 for recipients is the test of whether _IoptXlpc_1_2 (β_{312}) minus opth_rec (β_{11}) is significant (0.619 minus -3.941 = 4.560). The change between years 1 and 2 for originators is _IoptXlpca1_2_2 (β_{322}) minus is opth_or (β_{12}) or (2.391 minus 0.262 = 2.129), while for others it is (β_{332}) minus (β_{13}) or (2.292 minus -6.528 = 8.820). The change between years 2 and 3 are calculated in a similar way, for example for recipients it is a test of significance for the difference between _IoptXlpc_1_3 (β_{313}) and _IoptXlpc_1_2 (β_{312}) or (-2.275 minus 0.619 = -2.894). For originators and others these values are -1.045 and -1.539 respectively. The changes between years 3 and 4 are again calculated in the same way and from the DID results above, we know these are -0.699, -3.360 and 0.978 respectively. Changes from one year to the next are all relative to zero and show either a positive increase or a negative decrease and hence fluctuate around zero. If the confidence intervals overlap zero, the change is not significant.

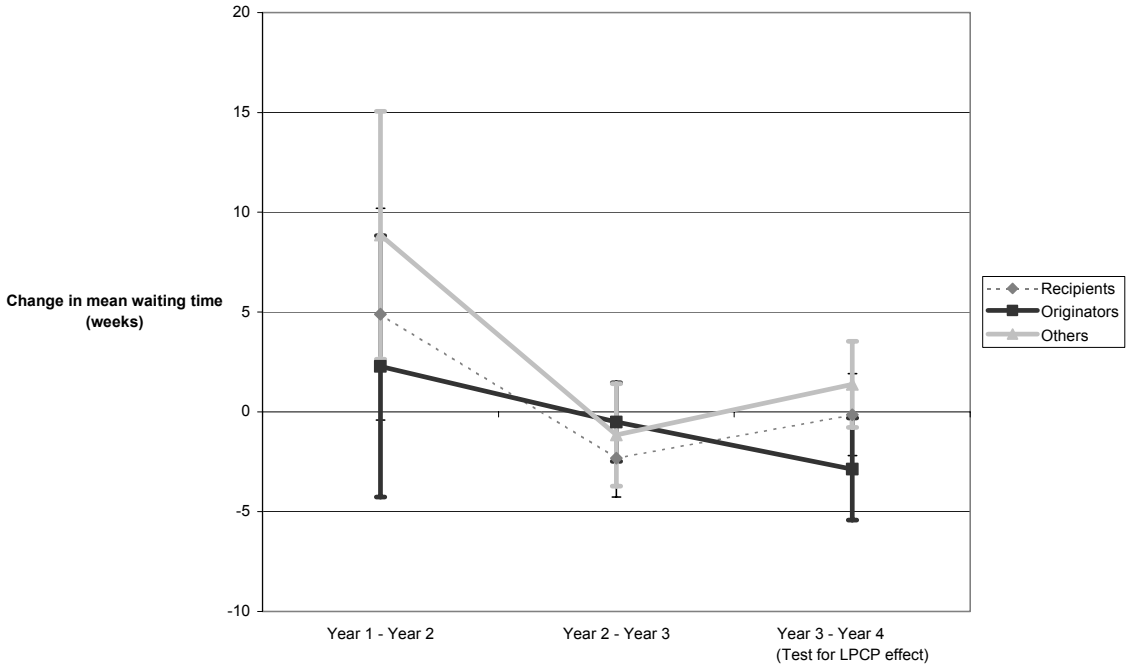
We see from the figure that for all three groups of Trusts between years 1 and 2 there was an increase in mean waiting times compared to the rest of England, although this was only significant for others. Between years 2 and 3 all 3 groups of London Trusts experienced a reduction in waiting times compared to the rest of England although this is only significant for recipients. Finally both originators and recipients again experience a decline in mean waiting times from year 3 to year 4 relative to the rest of England, although this is only significant for originators. From the results in the table above we know that this estimate is -3.360 (a reduction of around 3.3 weeks). The fact that recipients also experience a decrease (even though it is not significant) bodes well for the system as a whole since it suggests that these significant reductions for originating Trusts were not achieved at the expense of recipient Trusts.

Figure 26: Change in mean waiting time in weeks for ophthalmology for LPCP groups relative to rest of England comparator group



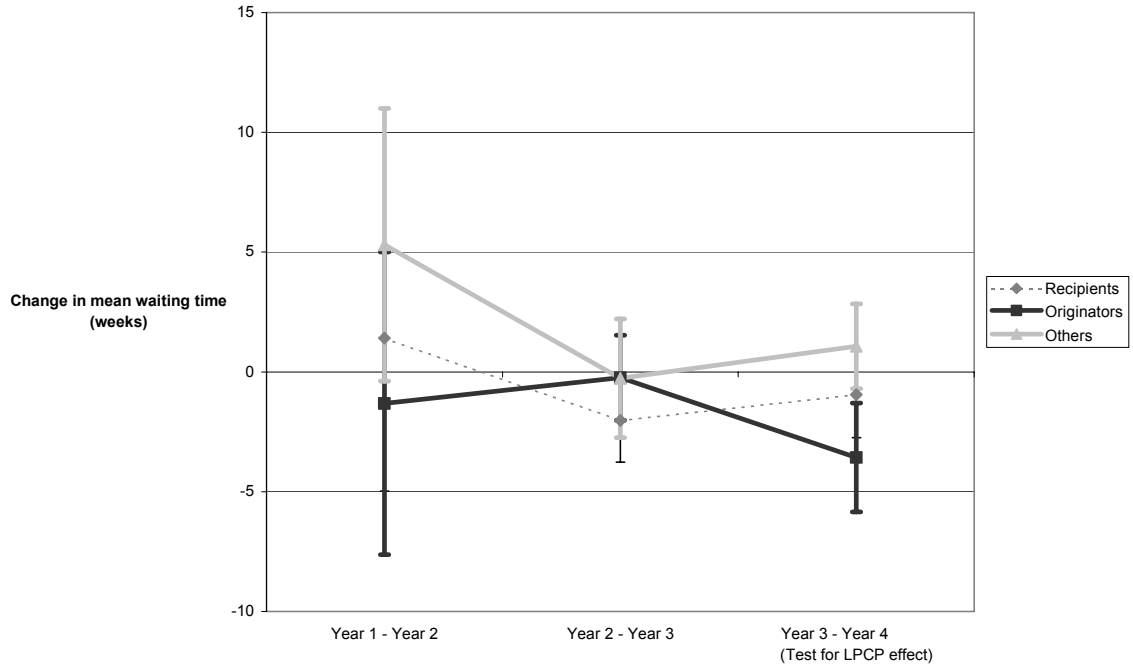
Using instead the matched control under common support as the control group, we see a similar pattern for all 3 groups of Trusts. Once again the DID for originating Trusts between years 3 and 4 shows a significant decline of -2.8 weeks.

Figure 27: Change in mean waiting time in weeks for ophthalmology for LPCP groups relative to matched control group under common support



Finally, using the metropolitan area as a control group, we see that changes between each of the 4 years for originators are negative but are only significant between years 3 and 4, giving a reduction of 3.6 weeks. Changes for recipients and others fluctuate relative to metropolitan areas, but are never significant.

Figure 28: Change in mean waiting time in weeks for ophthalmology for LPCP groups relative to metropolitan areas control group

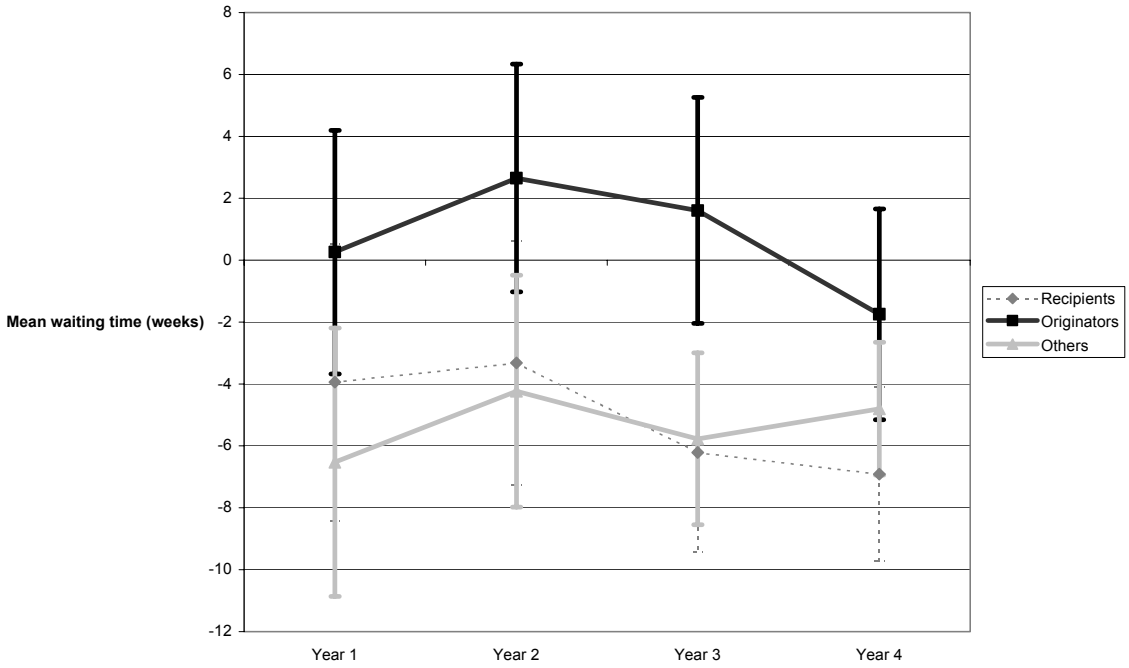


The following three figures show the mean waiting times in weeks for the three groups of LPCP Trusts in London relative to each of the comparator groups for the four years. Again we use the random effects estimates from the previous results to show this. We estimate the treatment outcome for each of the three groups of LPCP Trusts in each year using equation (3) and produce confidence intervals for each estimate. Zero in this case represents the comparator group. The coefficient estimates for the baseline year 1 from the above results correspond to the three β_1 coefficients for receivers, originators and others respectively. The coefficient estimate for year 2 for recipients is (β_{11}) -3.941 plus the interaction effect in year 2 (_IoptXlpc_1_2) (β_{312}) 0.619 = -3.322. The coefficient estimate for year 3 for recipients is (β_{11}) -3.941 plus the interaction effect in year 3 (_IoptXlpc_1_3) (β_{313}) -2.275 = -6.216. Similarly the coefficient estimate for year 4 for recipients is (β_{11}) -3.941 plus (β_{314}) -2.974 = -6.915. The year on year coefficient estimates for originators and others are calculated in a similar fashion.

The figure shows a downward trend in waiting times from year 2 onwards for originators. However, in all 4 years the mean waiting times for originating Trusts is not significantly different from the rest of England comparator group. Recipients and others always have significantly lower waiting times than the rest of England comparator group over all four periods although there is some reduction for recipients in year 4 relative to the rest of England, and some increase for others in year 4 relative to the rest of England, although none of these changes are significant.

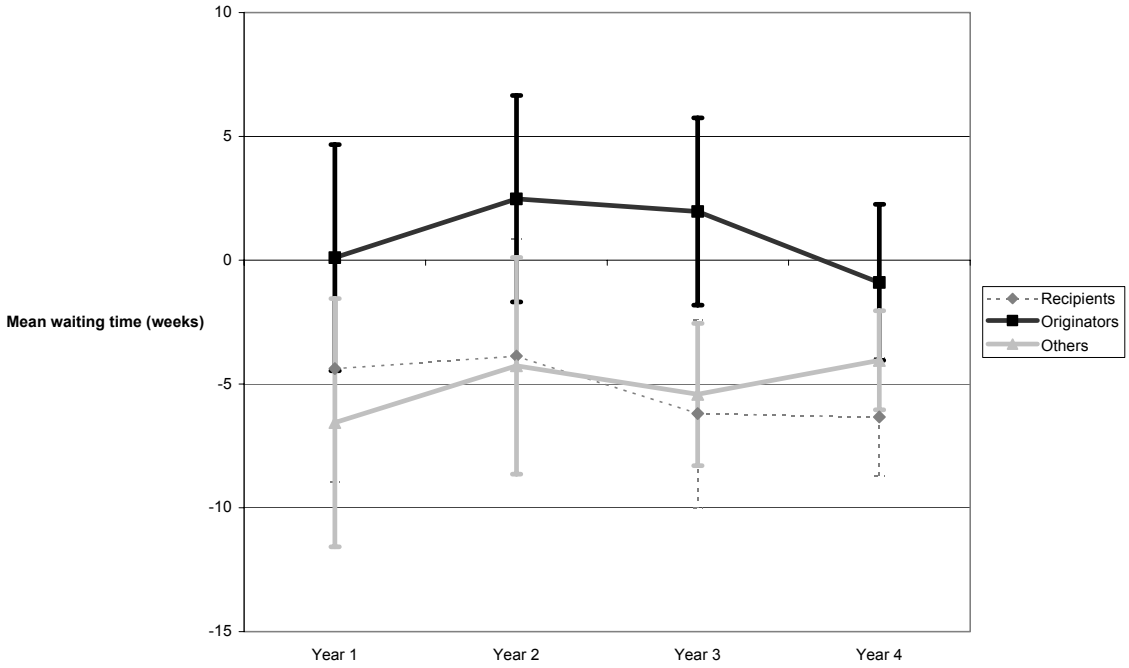
The overall effect however is a convergence within London of inpatient waiting time for ophthalmology with originators moving closer to the other two London groups. This would appear to be the main achievement of LPCP over this period, by increasing equity with respect to waiting times between London Trusts.

Figure 29: Mean waiting time in weeks for ophthalmology for LPCP groups relative to rest of England comparator group



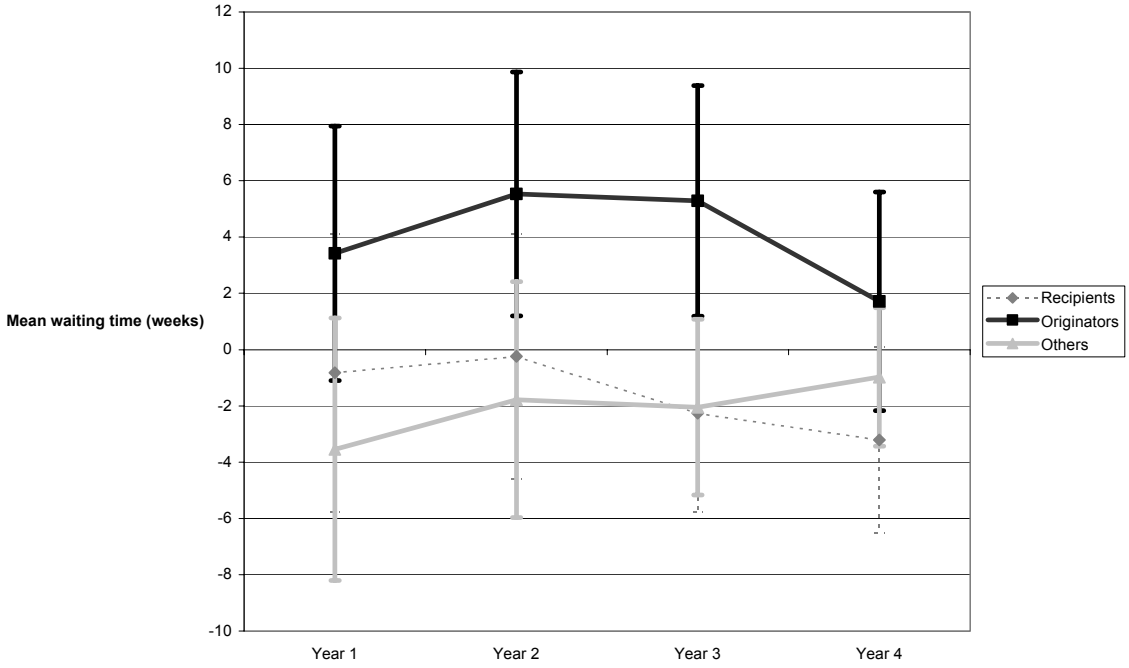
Using instead the matched control group under common support in the following figure, we see again a decline in mean waiting times for originating Trusts from year 2 onwards, although their waiting times are not significantly different from the control group in any of the periods, since the confidence intervals overlap zero. Both recipients and others have significantly lower waiting times from the matched control group under common support over all four periods (except for others in year 2) and again there is evidence of some convergence between the 3 groups in year 4.

Figure 30: Mean waiting time in weeks for ophthalmology for LPCP groups relative to matched control group under common support



Finally, using metropolitan areas as the control group, we again see a decline in waiting times for originating Trusts from year 2 onwards. In years 2 and 3 mean waiting times for originating Trusts were significantly higher than for metropolitan areas, however in year 4 this is no longer the case and originating Trusts are no longer significantly different. In all four years waiting times for recipients and others are not significantly different from waiting times for Trusts in metropolitan areas.

Figure 31: Mean waiting time in weeks for ophthalmology for LPCP groups relative to metropolitan areas control group



8.2 General surgery

The following table shows the regression results for the difference in difference model for inpatient waiting times in general surgery for the three groups of London Trusts relative to the two comparator groups (rest of England and metropolitan areas). We again use OLS, fixed effects and random effects models in each case and control for seasonal effects though these coefficients are not reported.

Table 12: Regression results for difference in difference model for effect within London on inpatient waiting times

	Rest of England comparator			Metropolitan areas comparator		
	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects
gensur_rec (β_{11})	-2.717		-1.968	1.781		1.908
	(4.07)***		(1.18)	(3.18)***		(1.53)
gensur_or (β_{12})	-0.074		0.546	3.946		4.313
	(0.13)		(0.52)	(5.94)***		(3.44)***
gensur_oth (β_{13})	-2.214		-3.369	4.526		-0.41
	(1.26)		(1.58)	(3.75)***		(0.16)
_Ilpcp_year_2 (β_{22})	-0.104	-0.604	-0.399	0.625	-0.005	0.589
	(0.34)	(3.02)***	(1.95)*	(1.15)	(0.01)	(1.03)
_Ilpcp_year_3 (β_{23})	-1.642	-1.658	-1.538	0.65	-0.982	-0.667
	(5.36)***	(5.54)***	(5.43)***	(1.28)	(1.52)	(1.08)
_Ilpcp_year_4 (β_{24})	-3.789	-4.102	-3.976	-1.735	-3.16	-2.846
	(12.48)***	(11.62)***	(12.05)***	(3.28)***	(4.78)***	(4.25)***
_IgenXlpc_1_2 (β_{312})	0.337	-0.364	-0.06	1.562	-0.505	-0.822
	(0.31)	(0.26)	(0.03)	(1.36)	(0.30)	(0.56)

_IgenXlpc_1_3 (β_{313})	-3.315	-0.748	-0.868	-2.908	-0.932	-1.754
	(3.30)***	(1.39)	(1.05)	(3.45)***	(0.93)	(1.91)*
_IgenXlpc_1_4 (β_{314})	-1.937	0.297	0.171	-1.292	-0.153	-0.976
	(1.70)*	(0.67)	(0.21)	(1.48)	(0.19)	(1.26)
_IgenXlpca1_2 (β_{322})	0.23	-0.395	-0.573	-0.71	-0.801	-1.019
	(0.27)	(0.83)	(1.07)	(0.78)	(1.11)	(1.40)
_IgenXlpca1_3 (β_{323})	-0.655	-0.848	-1.177	-2.061	-1.819	-1.682
	(0.94)	(1.18)	(1.49)	(2.52)**	(1.89)*	(1.76)*
_IgenXlpca1_4 (β_{324})	-0.846	-0.962	-1.112	-2.269	-2.198	-2.061
	(1.24)	(1.09)	(1.14)	(2.80)***	(2.00)**	(1.86)*
_IgenXlpcb1_2 (β_{332})	-4.781	-0.555	-2.55	-2.644	-0.699	-1.095
	(2.42)**	(0.60)	(1.67)*	(1.39)	(0.83)	(1.27)
_IgenXlpcb1_3 (β_{333})	-3.693	-2.372	-2.712	-5.722	-2.74	-2.27
	(1.90)*	(1.73)*	(2.89)***	(4.51)***	(2.00)**	(1.96)*
_IgenXlpcb1_4 (β_{334})	-4.149	-1.999	-2.345	-5.94	-2.633	-2.163
	(2.31)**	(0.89)	(1.39)	(4.74)***	(1.18)	(1.10)
rci (β_4)s	0.042	0.043		0.101		
	(4.55)***	(2.03)**		(6.59)***		
gensurop1pc	-8.768					
	(3.02)***					
gensuropxpc	12.724			30.937		
	(2.87)***			(4.79)***		
ipd_spell	0.266					
	(2.53)**					
gen_surg_consultpc	-10.219			-32.805		
	(2.33)**			(3.81)***		
vacy_nurse_qual	19.12					
	(6.56)***					
readmisnpc	-0.513			0.408		
	(4.32)***			(2.50)**		
sick_ratepc	-0.44					
	(3.86)***					
daycase_spell	-6.455			9.414		
	(5.37)***			(3.77)***		
daycase_theatres	0.274			0.713		
	(6.33)***			(10.80)***		
agnurspcx		0.336				
		(2.07)**				
emerg_spell		18.48			22.376	
		(3.10)***			(3.52)***	
avbedsbar			0.002			0.002
			(2.53)**			(2.63)***
devavbeds			-0.001			-0.006
			(0.58)			(1.57)
vacy_nurse_qualbar			27.754			
			(2.86)***			
devvacy_nurse_qual			-7.053			
			(1.24)			
agnurspcxbar			0.191			
			(1.29)			
devagnurspcx			0.363			
			(2.13)**			
gensurop1pcbar			-11.086			

			(1.79)*			
devgensurop1pc			-1.604			
			(0.33)			
sick_ratepcbar			-0.749			
			(2.29)**			
devsick_ratepc			0.286			
			(0.82)			
occupancbar						-0.051
						(0.51)
devoccupanc						-0.104
						(1.93)*
Constant (β_0)	20.985	6.959	20.516	-4.238	10.57	18.668
	(14.20)***	(2.74)***	(9.90)***	(2.14)**	(5.19)***	(2.20)**
Observations	1592	2613	2449	544	848	848
R-squared	0.31	0.8		0.51	0.8	
RESET	0.000	0.003	0.000	0.0004	0.0001	0.988
Test for equation (4) recipients	1.377	1.044	1.039	1.616	0.779	0.779
	(1.19)	(2.45)**	(2.54)**	(2.16)**	(1.49)	(1.56)
Test for equation (5) originators	-0.191	-0.114	0.066	-0.208	-0.379	-0.379
	(0.34)	(0.26)	(0.15)	(0.30)	(0.72)	(0.75)
Test for equation (6) others	-0.456	0.373	0.367	-0.217	0.107	0.107
	(0.49)	(0.40)	(0.41)	(0.28)	(0.11)	(0.11)

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

gensur_rec - Dummy variable for recipient Trusts
gensur_or - Dummy variable for originator Trusts
gensur_oth - Dummy variable for other Trusts
_Ilpcp_year_2 to 4 - Dummy variable for LPCP year effects (2 to 4), baseline year 1 is omitted
_IgenXlpc_1_2 to 4 - Interaction of recipient Trust dummy and LPCP year dummies
_IgenXlpca_1_2 to 4 - Interaction of originator Trust dummy and LPCP year dummies
_IgenXlpcb_1_2 to 4 - Interaction of other Trust dummy and LPCP year dummies
rci - Reference Cost Index (Reference Cost dataset)
gensurop1pc - Proportion of general surgery first outpatient attendances from total first outpatient attendances (CIPFA)
gensuropxpc - Proportion of general surgery outpatient expenditure from total outpatient expenditure (CIPFA)
ipd_spell - Inpatient days per spell or length of stay (Hospital Episodes Statistics)
gen_surg_consultpc - Proportion of consultants in general surgery from the total number of hospital consultants (NHS Workforce Survey)
vacy_nurse_qual - Three month vacancy rate for qualified nursing staff (DH vacancy rate survey)
readmisnpc - Emergency readmission rate within 28 days, all ages, age and sex standardised (Healthcare Commission)
sick_ratepc - Sickness absence rate for directly employed NHS staff (Healthcare Commission)
daycase_spell - Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
daycase_theatres - The number of available daycase theatres (Department of Health hospital activity statistics)
agnurspcx - Proportion of non-NHS salary expenditure on agency nursing staff or bank nurses (CIPFA)
emerg_spell - Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
avbedsbar - Mean of the variable average number of available beds
devavbeds - Deviation from the mean of the variable avbeds (avbeds – avbedsbar)
vacy_nurse_qualbar - Mean of the variable three month vacancy rate for qualified nursing staff
devvacy_nurse_qual - Deviation from the mean of the variable vacy_nurse_qual (vacy_nurse_qual - vacy_nurse_qualbar)
agnurspcxbar - Mean of the variable proportion of non-NHS salary expenditure on agency nursing staff or bank nurses (CIPFA)
devagnurspcx - Deviation from the mean of the variable agnurspcx (agnurspcx – agnurspcxbar)
gensurop1pcbar - Mean of the variable proportion of general surgery first outpatient attendances from total first outpatient attendances
devgensurop1pc - Deviation from the mean of the variable gensurop1pc (gensurop1pc - gensurop1pcbar)
sick_ratepcbar - Mean of the variable sickness absence rate for directly employed NHS staff
devsick_ratepc - Deviation from the mean of the variable sick_ratepc (sick_ratepc - sick_ratepcbar)
occupancbar - Mean of the variable occupancy rate (Department of Health)
devoccupanc - Deviation from the mean of the variable occupanc (occupanc – occupancbar)

The 3 β_1 coefficients (gensur_rec, gensur_or and gensur_oth) in the OLS and random effects models give the overall difference in mean waiting time relative to the respective comparator

groups for the three LPCP groups, receivers, originators and others. Recipients have lower waiting times in three of the four specifications (significantly so in the OLS models). Others also have lower waiting times in almost all specifications, although this is only significant in one. Originators have higher waiting times, in three of the four specifications (significantly so compared to metropolitan areas). The next 3 β_2 (_Ilpcp_year) coefficients give the change in mean waiting times relative to the base year 1. All models show significant declines in year 4 relative to the base year. The next 9 β_3 coefficients give the interaction effects between each of the 3 types of Trust and the LPCP year effects.

β_4 explanatory variables which emerge as significant show that Trusts with higher reference costs (more inefficient) have higher waiting times, as do Trusts with longer lengths of stay (inpatient days). Trusts that have a higher proportion of outpatient expenditure on general surgery have higher waiting times, while Trusts with a higher proportion of first outpatient attendances in general surgery have lower waiting times. Trusts which spend a high proportion on agency nursing staff or bank nurses, have longer waits, as do Trusts with a more emergency admissions.

The fixed effects models all have an R-squared of 80 percent, while the OLS R-squared results are 31 and 51 percent respectively. Only one of the models passes the RESET test.

Our main interest is again to test the overall difference in difference (DID) in waiting times for the 3 groups of LPCP Trusts relative to the comparator groups in year 4 versus year 3. We therefore test whether equations (4), (5) and (6) are significant.

In five of the six models we find a negative effect for originating Trusts suggesting that they have lowered their waiting times in the LPCP treatment year relative to the previous year, however this effect is not significant in any of the models.

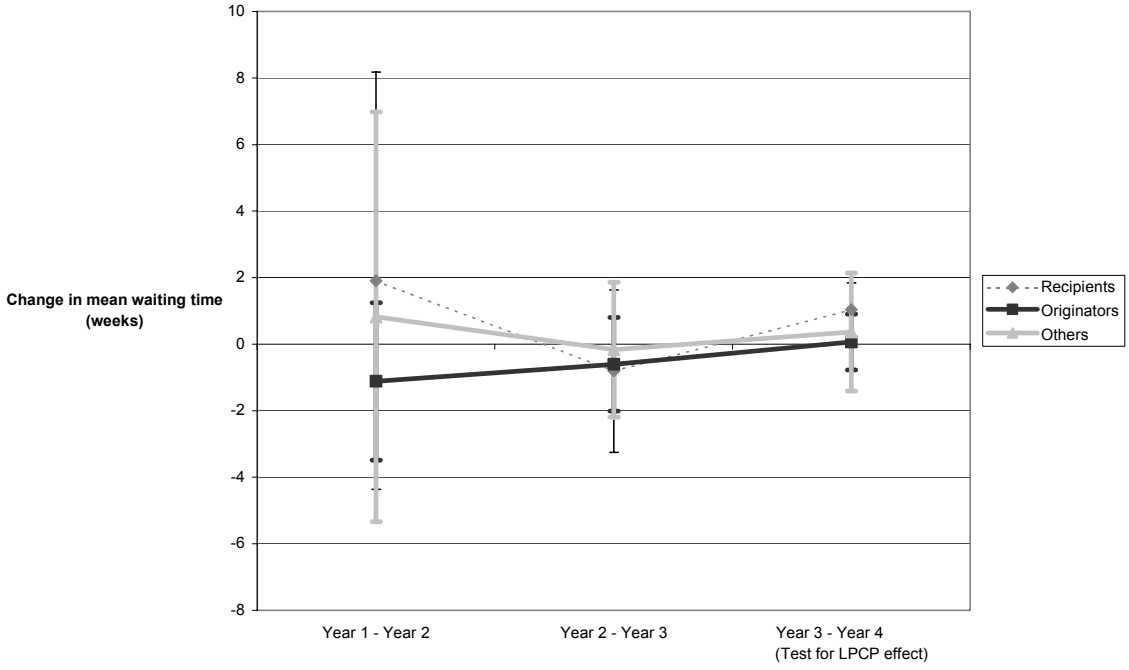
Results for recipient Trusts show a positive effect across all model specifications and are significant in three of the models. This means that overall waiting times in recipient Trusts did not fall as fast as in the rest of England over the LPCP treatment period and since there were no significant changes over this period for originators or others, the increase of 1 week in waiting times for recipients relative to the rest of England suggests the gain for patients at originating Trusts may have been at the expense of patients in receiving Trusts.

The following figure shows the change in mean waiting times between years plotted for the three groups of LPCP Trusts relative to the rest of England comparator group. The change between years 3 and 4 illustrates the DID of interest for our analysis. The other changes are calculated as before for each of the groups of Trusts. For example the difference between year 1 and 2 for recipients is the test of whether (β_{312}) minus (β_{11}) is significant (1.908). The change between years 1 and 2 for originators is (β_{322}) minus (β_{12}) or (-1.119), while for others it is (β_{332}) minus (β_{13}) or (0.819). The change between years 2 and 3 are calculated in a similar way, for example for recipients it is (β_{313}) minus (β_{312}) or (-0.808). For originators and others these values are -0.604 and -0.162 respectively. The changes between years 3 and 4 from the DID results above are 1.039, 0.066 and 0.367 respectively. If the confidence intervals overlap zero, the change is not significant.

We see from the figure that changes for all three groups of Trusts fluctuate between years, however since the confidence intervals for all three groups overlap zero, none of these

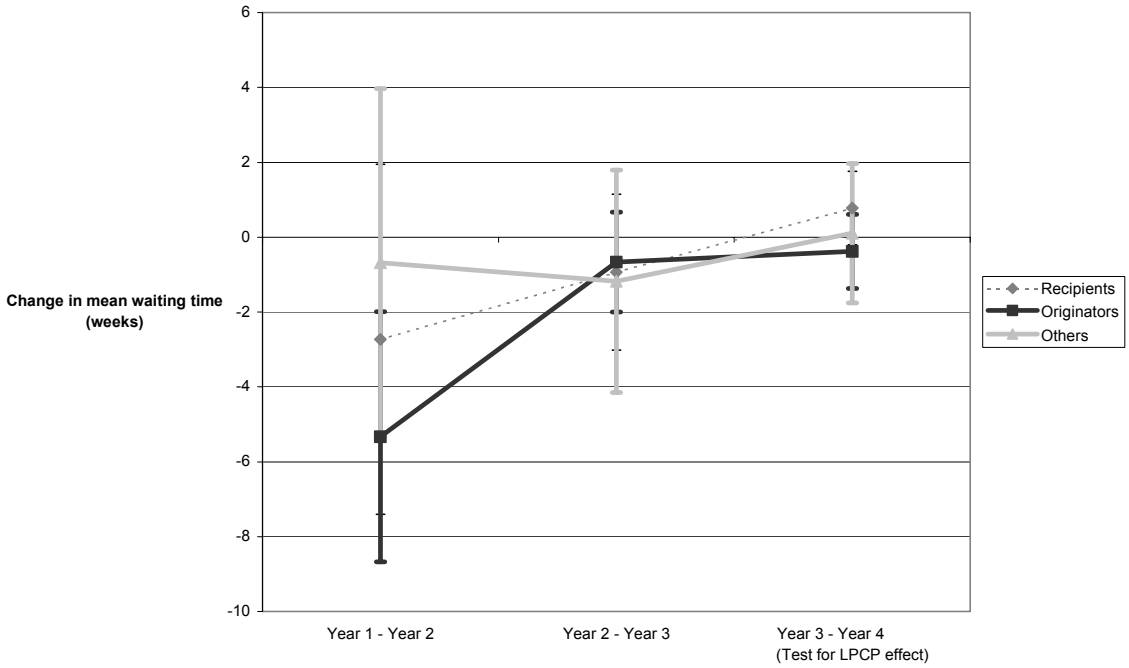
changes are significantly different compared to the rest of England. The only exception is that recipients experience a significant increase in mean waiting times between years 3 and 4 which has implications for the system as a whole since it suggests that additional Choice patients at recipient Trusts came at the expense of their maintaining lower waiting times relative to the rest of England.

Figure 32: Change in mean waiting time in weeks for general surgery for LPCP groups relative to rest of England comparator group



Using the metropolitan areas as a control group, we see that changes between each of the 4 years for originators are negative but are only significant between years 1 and 2, well before the introduction of LPCP. Changes for recipients and others fluctuate relative to metropolitan areas, but are never significant.

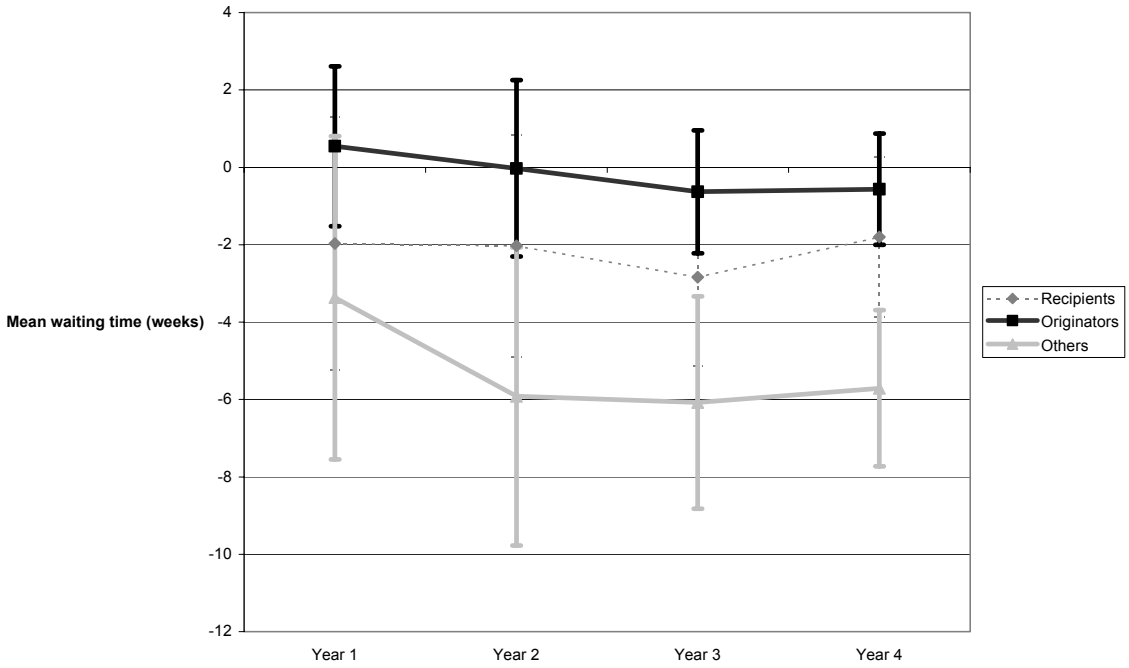
Figure 33: Change in mean waiting time in weeks for general surgery for LPCP groups relative to metropolitan areas



The following two figures show the mean waiting times in weeks for the three groups of LPCP Trusts in London relative to each of the comparator groups for the four years. We estimate the treatment outcome for each of the three groups of LPCP Trusts in each year using the random effects estimates from equation (3) and produce confidence intervals for each estimate. Zero represents the comparator group. The coefficient estimates for the baseline year 1 from the above results correspond to the three β_1 coefficients for receivers, originators and others respectively (-1.968, 0.546 and –3.369). The coefficient estimate for year 2 for recipients is (β_{11}) -1.968 plus the interaction effect in year 2 (β_{312}) -0.060 = -2.028. The coefficient estimate for year 3 for recipients is (β_{11}) -1.968 plus the interaction effect in year 3 (β_{313}) -0.868 = -2.836. Similarly the coefficient estimate for year 4 for recipients is (β_{11}) -1.968 plus (β_{314}) 0.171 = -1.797. The year on year coefficient estimates for originators and others are calculated in a similar way.

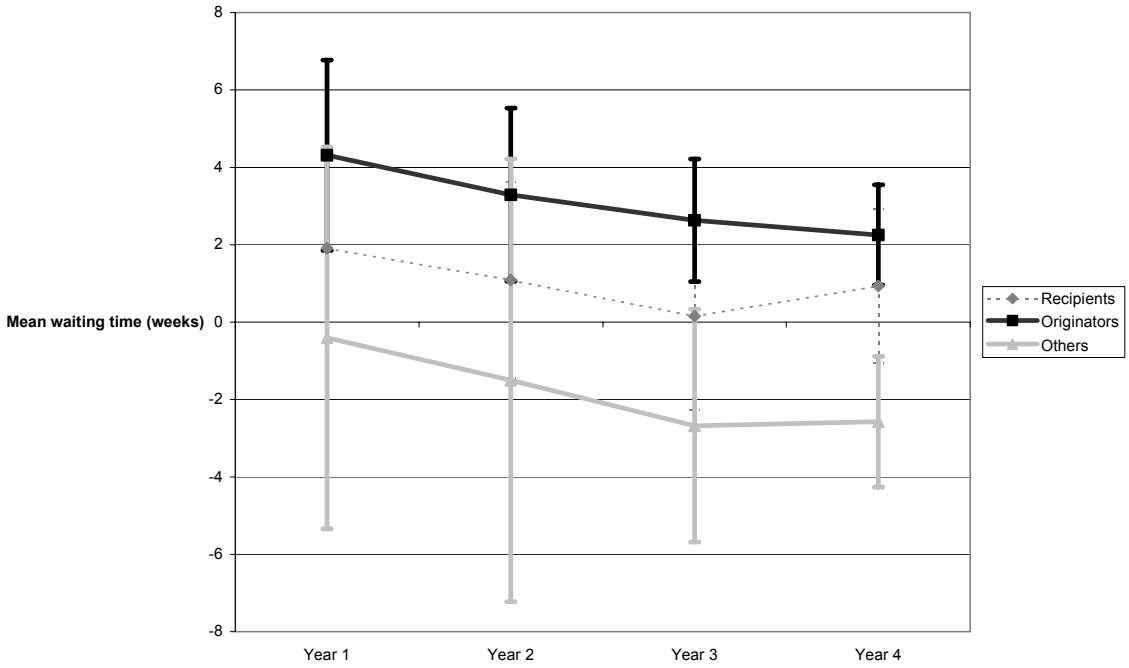
The figure shows a downward trend in waiting times for originators. However, in all 4 years the mean waiting times for originating Trusts is not significantly different from the rest of England comparator group. Recipients have significantly lower waiting times than the rest of England in year 3 but not in any of the other periods, while others have significantly lower waiting times than the rest of England in all years except year 1.

Figure 34: Mean waiting time in weeks for general surgery for LPCP groups relative to rest of England comparator group



Using instead the metropolitan areas as a control group in the following figure, we see again a decline in mean waiting times for originating Trusts across the four periods, although their waiting times always remain significantly higher than for metropolitan areas, since the confidence intervals never overlap zero. Recipients waiting times over all four periods are never significantly different from the metropolitan areas, while for others they become significantly lower in year 4.

Figure 35: Mean waiting time in weeks for general surgery for LPCP groups relative to metropolitan areas control group



8.3 Orthopaedics

The following table shows the regression results for the DID model for inpatient waiting times in orthopaedics for the three groups of London Trusts relative to the comparator groups rest of England and metropolitan areas. Again we use OLS, fixed effects and random effects models in each case.

Table 13: Regression results for difference in difference model for effect within London on inpatient waiting times

	Rest of England comparator			Metropolitan areas comparator		
	OLS	Fixed effects	Random effects	OLS	Fixed effects	Random effects
orthop_rec (β_{11})	1.283		1.432	3.655		2.323
	(2.93)***		(1.55)	(4.92)***		(1.59)
orthop_or (β_{12})	1.174		2.364	4.463		3.392
	(1.84)*		(2.54)**	(6.76)***		(2.77)***
orthop_oth (β_{13})	-2.916		-1.937	-1.183		-0.693
	(1.08)		(0.42)	(0.46)		(0.14)
_Ilpcp_year_2 (β_{22})	-0.524	-0.974	-0.822	0.931	-0.55	-0.519
	(1.69)*	(4.22)***	(3.94)***	(1.40)	(0.99)	(0.93)
_Ilpcp_year_3 (β_{23})	-2.421	-2.466	-2.322	-0.952	-2.321	-2.46
	(7.37)***	(7.59)***	(7.65)***	(1.57)	(3.10)***	(3.33)***
_Ilpcp_year_4 (β_{24})	-4.984	-5.102	-4.96	-3.543	-4.653	-4.792
	(15.51)***	(13.28)***	(13.73)***	(6.01)***	(6.09)***	(6.42)***
_IortXlpc_1_2 (β_{312})	-2.875	-0.476	0.018	-2.482	-0.121	-0.215
	(4.39)***	(0.32)	(0.01)	(2.39)**	(0.08)	(0.14)
_IortXlpc_1_3 (β_{313})	-3.96	-1.802	-1.038	-2.701	-0.959	-0.869

	(3.92)***	(1.19)	(0.81)	(2.91)***	(0.63)	(0.61)
_IortXlpc_1_4 (β_{314})	-4.809	-2.307	-1.541	-3.444	-1.769	-1.678
	(5.92)***	(2.26)**	(1.86)*	(3.63)***	(1.57)	(1.60)
_IortXlpca1_2 (β_{322})	-1.226	0.371	0.524	-1.979	0.104	0.074
	(1.17)	(0.68)	(0.99)	(2.14)**	(0.14)	(0.10)
_IortXlpca1_3 (β_{323})	-1.285	-0.529	-0.577	-2.017	-0.52	-0.38
	(1.66)*	(0.72)	(0.80)	(2.44)**	(0.49)	(0.37)
_IortXlpca1_4 (β_{324})	-2.351	-1.335	-1.38	-2.947	-1.629	-1.488
	(3.16)***	(1.56)	(1.64)	(3.68)***	(1.42)	(1.34)
_IortXlpcb1_2 (β_{332})	-8.291	-1.405	-1.192	-2.701	-1.108	-1.06
	(2.93)***	(0.80)	(0.75)	(0.92)	(0.57)	(0.59)
_IortXlpcb1_3 (β_{333})	-1.964	-1.111	-0.544	-1.957	-1.185	-0.93
	(0.60)	(0.32)	(0.17)	(0.71)	(0.35)	(0.29)
_IortXlpcb1_4 (β_{334})	-3.322	-2.212	-1.642	-2.537	-2.59	-2.335
	(1.16)	(0.49)	(0.40)	(0.97)	(0.59)	(0.57)
rci (β_4)s	0.058	0.051		0.086		
	(5.58)***	(2.27)**		(5.21)***		
cons_beds	0.107					
	(3.01)***					
orthoxpc	8.704			-12.259		
	(3.99)***			(3.06)***		
orthoop1pc	-4.996			9.936		
	(3.33)***			(4.99)***		
readmisnpc	-0.643					
	(5.14)***					
sick_ratepc	-0.289					
	(2.02)**					
daycase_spell	-3.007			12.209		
	(2.07)**			(4.75)***		
daycase_theatres	0.263			0.485		
	(6.05)***			(8.41)***		
emerg_spell					23.163	
					(2.44)**	
avbedsbar			0.001			0.002
			(2.25)**			(2.17)**
devavbeds			-0.002			-0.002
			(0.89)			(0.45)
emerg_spellbar						-1.027
						(0.13)
devemerg_spell						23.849
						(2.38)**
Constant (β_0)	20.631	17.709	20.885	3.798	14.735	20.153
	(12.34)***	(8.35)***	(28.14)***	(1.94)*	(4.63)***	(6.94)***
Observations	1755	2646	2654	656	848	848
R-squared	0.28	0.81		0.49	0.81	
RESET	0.239	0.000	0.000	0.009	0.013	0.001
Test for equation (4) recipients	-0.849	-0.506	-0.503	-0.743	-0.809	-0.809
	(0.78)	(0.77)	(0.80)	(0.97)	(1.16)	(1.21)
Test for equation (5) originators	-1.067	-0.805	-0.803	-0.929	-1.108	-1.108
	(1.74)*	(2.01)**	(2.09)**	(1.44)	(2.43)**	(2.54)**
Test for equation (6) others	-1.358	-1.101	-1.098	-0.579	-1.405	-1.405
	(0.74)	(0.96)	(1.00)	(0.58)	(1.19)	(1.25)

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

orthop_rec	- Dummy variable for recipient Trusts
orthop_or	- Dummy variable for originator Trusts
orthop_oth	- Dummy variable for other Trusts
_Ilpcp_year_2 to 4	- Dummy variable for LPCP year effects (2 to 4), baseline year 1 is omitted
_IortXlpc_1_2 to 4	- Interaction of recipient Trust dummy and LPCP year dummies
_IortXlpca_1_2 to 4	- Interaction of originator Trust dummy and LPCP year dummies
_IortXlpcb_1_2 to 4	- Interaction of other Trust dummy and LPCP year dummies
rci	- Reference Cost Index (Reference Cost dataset)
cons_beds	- Number of consultants per bed (derived from Department of Health data)
orthoxpc	- Proportion of orthopaedics expenditure from total inpatient expenditure (CIPFA)
orthoop1pc	- Proportion of orthopaedics first outpatient attendances from total first outpatient attendances (CIPFA)
readmisnpc	- Emergency readmission rate within 28 days, all ages, age and sex standardised (Healthcare Commission)
sick_ratepc	- Sickness absence rate for directly employed NHS staff (Healthcare Commission)
daycase_spell	- Number of daycase admissions per elective inpatient spell or daycase rate (Hospital Episodes Statistics)
daycase_theatres	- The number of available daycase theatres (Department of Health hospital activity statistics)
emerg_spell	- Number of emergency admissions per inpatient spell (Hospital Episodes Statistics)
avbedsbar	- Mean of the variable average number of available beds
devavbeds	- Deviation from the mean of the variable avbeds (avbeds – avbedsbar)
emerg_spellbar	- Mean of the variable number of emergency admissions per inpatient spell
devemerg_spell	- Deviation from the mean of the variable emerg_spell (emerg_spell – emerg_spellbar)

The 3 β_1 coefficients (orthop_rec, orthop_or and orthop_oth) in the OLS and random effects models give the overall difference in mean waiting time relative to the respective comparator groups for the three LPCP groups. Recipients have higher waiting times, but this is only significant in the OLS models. Others have lower waiting times in all specifications, although this is not significant. Originators have, as expected, significantly higher waiting times in all four specifications. The next 3 β_2 (_Ilpcp_year) coefficients give the change in mean waiting times relative to the base year 1. All models show significant declines in year 4 relative to the base year. The next 9 β_3 coefficients give the interaction effects between each of the 3 types of Trust and the LPCP year effects.

β_4 explanatory variables which emerge as significant show that Trusts with higher reference costs (more inefficient) have higher waiting times. Trusts that have a higher proportion of inpatient expenditure on orthopaedics have higher waiting times, while Trusts with a higher proportion of first outpatient attendances in orthopaedics have lower waiting times. As before, Trusts which have more emergency admissions have longer waits.

The fixed effects models all have an R-squared of 81 percent, while the OLS R-squared results are 28 and 49 percent respectively. Only one of the models passes the RESET test.

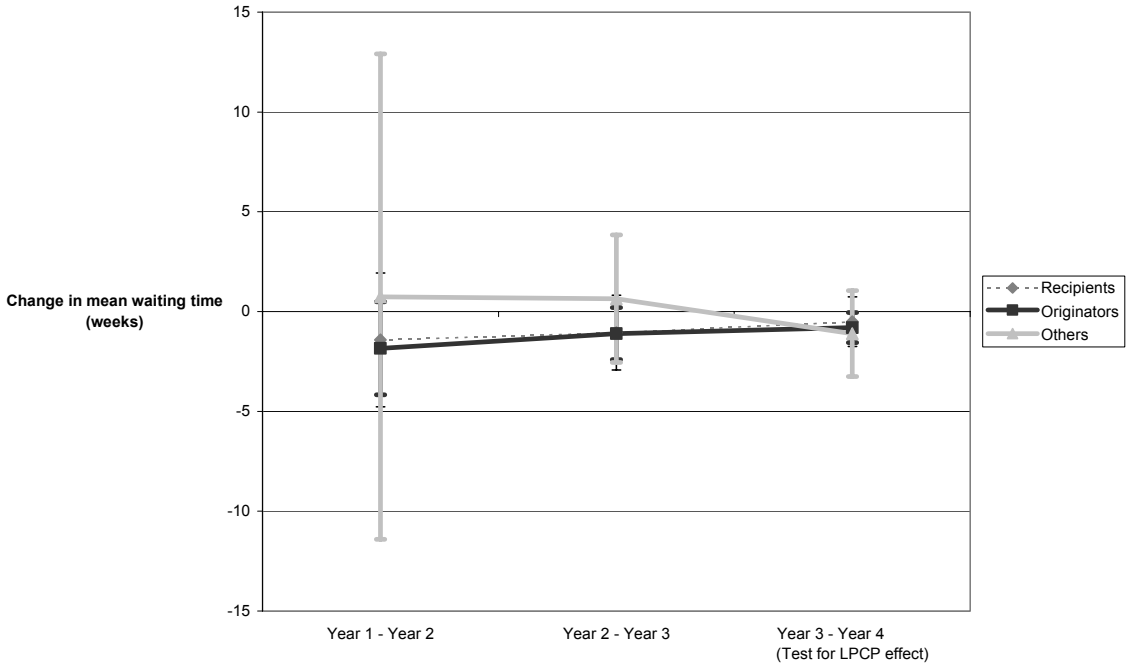
Again we test the overall difference in difference (DID) in waiting times for the 3 groups of LPCP Trusts relative to the comparator groups in year 4 versus year 3, with equations (4), (5) and (6).

In all six models we find a negative effect for originating Trusts suggesting that they have lowered their waiting times in the LPCP treatment year relative to the previous year. In five of the six models this effect is significant. More promisingly, the coefficients for all models for both recipients and others are all negative and insignificant. This means that reductions in waiting times for originating Trusts did not come at the expense of waiting times in other Trusts. The results suggest that waiting times in originating Trusts fell by around 1 week in the treatment period relative to the comparator groups, representing a welfare gain to the London system as a whole.

The following figure shows the change in mean waiting times between years plotted for the three groups of LPCP Trusts relative to the rest of England comparator group. The change between years 3 and 4 illustrates the DID of interest. The other changes are calculated as before for each of the groups of Trusts. The changes between years 3 and 4 from the DID results above are -0.503, -0.803 and -1.098 respectively. If the confidence intervals overlap zero, the change is not significant.

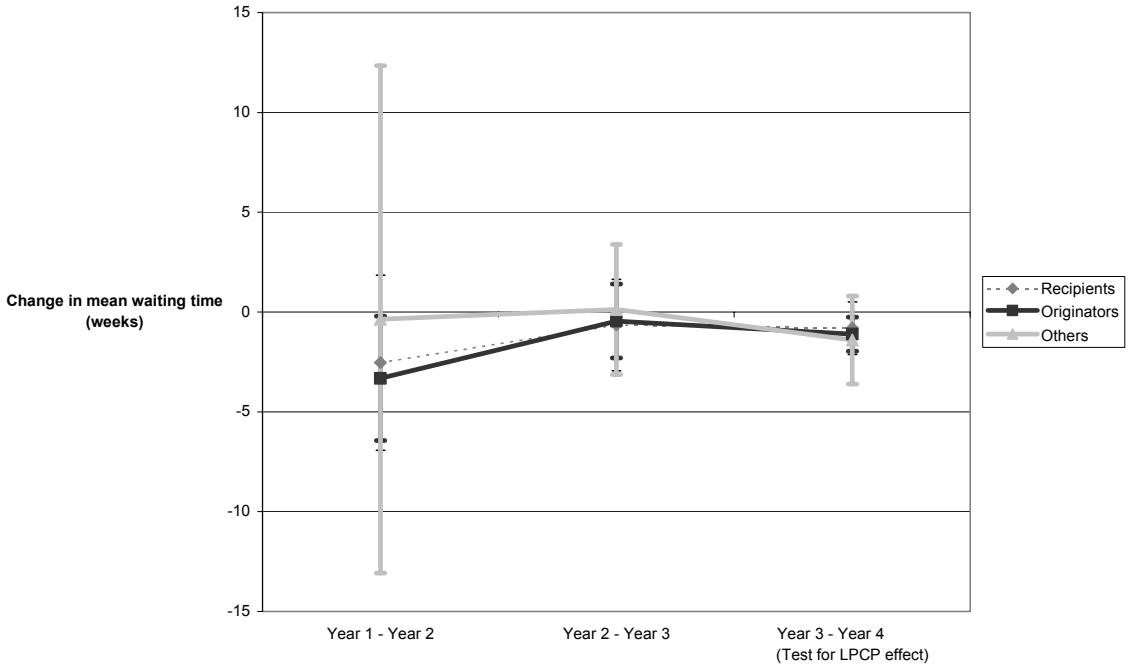
We see from the figure that changes for originators and recipients have always been negative relative to the rest of England, however for recipients, none of these changes are significantly different compared to the rest of England. For originators, as we know, the change between years 3 and 4 is negative and significant. For others, the confidence intervals overlap at each change and are therefore not significantly different from the rest of England.

Figure 36: Change in mean waiting time in weeks for orthopaedics for LPCP groups relative to rest of England comparator group



Comparing instead to metropolitan areas, we see that changes for originators are again negative and are significant between years 1 and 2, as well as between years 3 and 4. Changes for recipients and others are never significant.

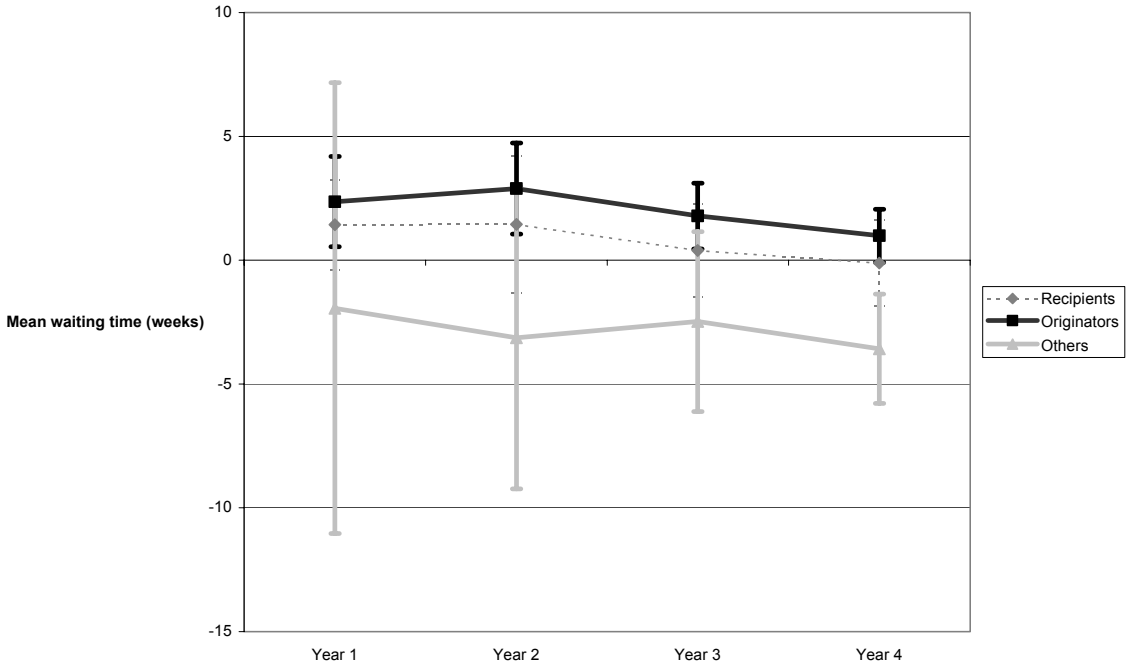
Figure 37: Change in mean waiting time in weeks for orthopaedics for LPCP groups relative to metropolitan areas



The following two figures show the mean waiting times in weeks for the three groups of LPCP Trusts in London relative to each of the comparator groups for the four years. Zero represents the comparator group. The year on year coefficient estimates are calculated as before.

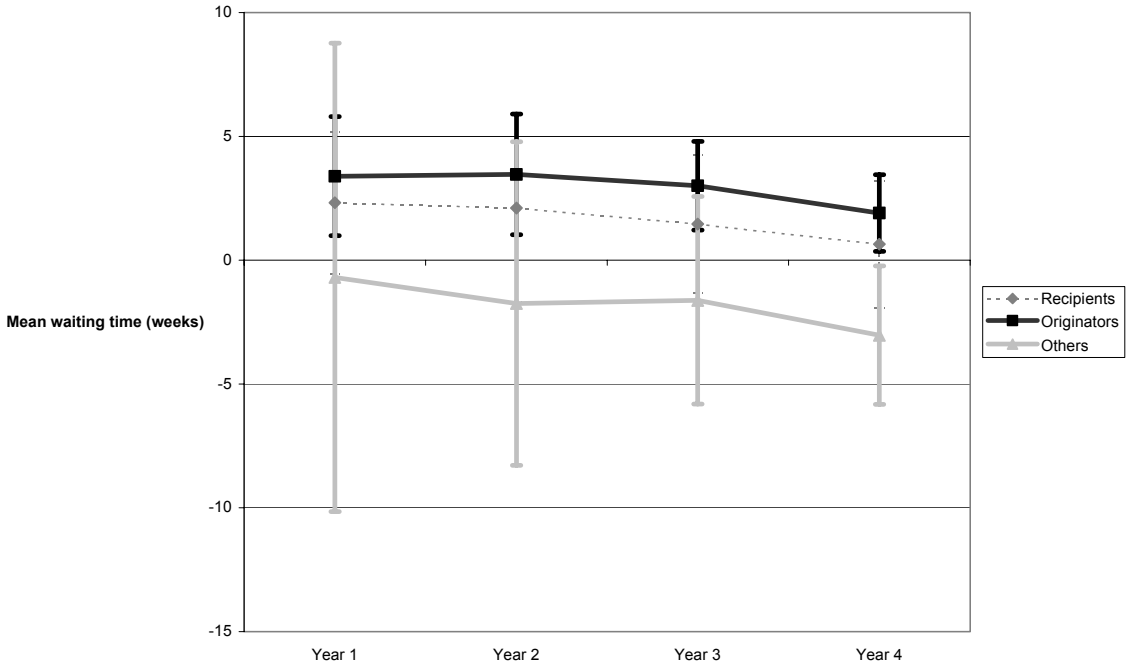
The figure shows a downward trend in waiting times for originators from year 2 onwards. In the first 3 years mean waiting times for originating Trusts are significantly higher than the rest of England comparator group, but in year 4 this difference disappears. Recipients have waiting times are never significantly different than the rest of England, while others waiting times become significantly lower than the rest of England in year 4.

Figure 38: Mean waiting time in weeks for orthopaedics for LPCP groups relative to rest of England comparator group



A similar pattern emerges relative to metropolitan areas although for originators, their waiting times always remain significantly above the control group, even though they are moving closer. Recipients and others error bars always overlap with metropolitan areas and their mean waiting times are therefore never significantly different.

Figure 39: Mean waiting time in weeks for orthopaedics for LPCP groups relative to metropolitan areas control group



9. Discussion

The results for the three specialties presented suggest that LPCP as a policy intervention was successful in the two specialties of ophthalmology and orthopaedics, in as much as we saw a significant reduction in mean waiting times for these 2 specialties in the treatment year relative to the pre-treatment year compared to the various control groups we have used in this study. General surgery on the other hand was not significant and in fact it would appear that there may have been an equity loss for the system with the introduction of Choice being associated with increased waiting times for patients at Trusts dealing with the additional choice activity.

One possible reason which has been put forward for these different results, may relate to the proportion of total activity undertaken in any particular specialty which included LPCP procedures. The data we use for mean waiting times is by specialty and covers some non-LPCP activity. Hence, the waiting times we report by specialty may underestimate the true impact of LPCP if a large proportion of activity in the specialty is non-LPCP procedures.

To test this hypothesis, we drew data from the Hospital Episodes Statistics (HES) for the year 2002/03 for all finished consultant episodes (FCEs) undertaken with an elective admission. The data was drawn by HRG code, by specialty code, and by Trust. The following table lists the LPCP HRG procedures undertaken within each specialty and their HRG codes. We then calculated the proportion of total FCEs for each Trust which these LPCP HRGs represent. These are summarised for the 3 groups of Trusts in each specialty. These HRGs are also coded under other specialties in the HES data, but for consistency with the previous analyses, these have been ignored and FCEs are only counted if they are recorded within the three specialities we are examining.

It is evident that a large proportion of total ophthalmology activity (between 61 and 73 percent) is represented by just 2 HRGs which are the two LPCP procedures, while a small proportion of total general surgery activity (between 21 and 27 percent) is represented by the HRGs which were covered by Choice. In orthopaedics a larger proportion of activity (between 37 and 50 percent) is represented by the Choice HRGs. This may therefore mean that we were unable to detect any successful reductions in mean waiting times for general surgery under the LPCP regime, simply because only a small part of waiting times in the specialty are actually covered by Choice procedures. It may be the case that waiting times in general surgery for LPCP activity did fall significantly for originating Trusts, but with waiting times data at specialty level, we have been unable to detect this.

The HES data does not coincide exactly with the quarterly data by specialty in the rest of this analysis, but the volume of activity within Trusts which these HRGs represent, is unlikely to change dramatically over time.

Table 14: Proportion of finished consultant episodes which are LPCP procedures in ophthalmology, general surgery and orthopaedics, 2002/03

HRG procedure	HRG code	Trust group	n	mean	std. dev	min	max
Ophthalmology							
Phako cataract extraction with lens implant	B02	Recipients	4	0.635	0.140	0.540	0.843
Other cataract extraction with lens implant	B03	Originators	9	0.615	0.193	0.193	0.796
		Others	6	0.727	0.106	0.564	0.818
		Rest of England	115	0.632	0.155	0.024	0.989
General surgery							
Repair of hernias	F74, F73	Recipients	4	0.223	0.049	0.152	0.265
Varicose Veins	Q11	Originators	19	0.268	0.074	0.168	0.398
Laparascopic cholecystectomy	G13, G14	Others	5	0.207	0.141	0.002	0.396
Haemorrhoidectomy	F92, F93, F94, F95	Rest of England	132	0.259	0.074	0.022	0.639
Pilonidal sinus	F92, F93, F94, F95						
Orthopaedics							
Hip replacement	H02	Recipients	5	0.497	0.130	0.335	0.672
Knee replacement	H04	Originators	20	0.479	0.071	0.277	0.559
Knee arthroscopy	H10	Others	4	0.368	0.241	0.006	0.503
Shouler replacement (from June 2004)	H07	Rest of England	137	0.490	0.112	0.011	0.684
Shoulder arthroscopy	H10						
Revision of hip replacement (from June 2004)	H05, H06						
Hand surgery (from June 2004)	H13, H14						

10. Conclusions

This paper has presented the results for modelling the response of Trusts to Choice. The purpose of Patient Choice has been to reduce waiting times for Trusts with long waits by giving patients the option of moving to Trusts with lower waiting times in the particular specialty. We have tested whether Choice (LPCP) has had a significant effect on mean inpatient waiting times in the three specialties ophthalmology, general surgery and orthopaedics. We tested whether Choice was successful as an instrument for reducing waiting times using two different sets of treatment groups:

1.) LPCP Trusts as a whole, and
2.) within London - recipients, originators, and others.

We used the difference in difference methodology to test whether the change in waiting times for our respective treatment groups between the treatment year (the introduction of the LPCP regime) and the pre-treatment year was significantly different from the change in waiting times for our control groups. We used three types of comparator or control groups in this study (non-LPCP Trusts):

1.) Rest of England
2.) Matched control
3.) Metropolitan areas

We used several different estimation techniques to test the stability of coefficient estimates across different model specifications. We applied the usual tests of model specification.

Three datasets were constructed, one for each specialty, covering quarterly mean inpatient waiting times in the particular specialty, as well as a large set of observable factors which affect waiting times. The datasets were constructed to cover three years prior to the LPCP intervention as well as the 1 year of the LPCP intervention respectively.

It is difficult to generalise across all three specialties since the results were different for each. However, from the descriptive statistics, across the board, there were large reductions in mean waiting times for LPCP Trusts. This was particularly the case for originating Trusts between years 3 and 4. Furthermore, there was a reduction in the coefficient of variation for most groups of Trusts, though this was often quite small. This trend provides an important indication of convergence in mean waiting times within each of these groups towards their mean waiting time respectively. From the boxplots there did appear to be important reductions in variation in mean waiting times for the different groups of Trusts in all three specialties. This in itself can be considered an important improvement within the system, since it provides greater equity across Trusts with respect to the length of wait which patients are likely to receive and removes some of the randomness of patients potentially waiting much longer at certain Trusts than others simply by virtue of their being referred to one Trust rather than another.

The reduction in waiting times along with the reduction in variation are therefore two distinct and important trends in the data.

In terms of the DID results for LPCP as a whole, ophthalmology results suggest that waiting times for LPCP Trusts were around a week lower in the treatment year compared to the pre-treatment year relative to comparator groups, although this effect only had a weak significance. In orthopaedics a similar result was obtained, but the effect was stronger, while in general surgery, there was no significant effect of LPCP Trusts having different waiting times relative to comparator groups over this period.

In terms of the DID results within London, ophthalmology results suggest that waiting times for originating Trusts were around 3 weeks lower in the treatment year compared to the pre-treatment year relative to comparator groups an this was highly significant in virtually all specifications. A similar result holds for orthopaedics, except the reduction is around 1 week. In both specialties, recipient and other Trusts have insignificant changes over this period, suggesting that these reduction were beneficial to the London system as a whole - other waiting times did not rise in response to accommodate the additional Choice activity. Thus the policy intervention of offering patients the choice of an alternative provider for their elective care made an impact in the way it was intended to, by acting as an effective instrument to reduce waiting times.

The results for general surgery, however, are more disappointing since not only do these suggest no significant reduction in waiting times for originating Trusts, but a significant rise in waiting times for recipient Trusts over the treatment period. This result raises questions about the impact on equity for the London system between years 3 and 4.

One reason which has been posited for this result is that only a small proportion of waiting times in general surgery (between 21 and 27 percent) are actually covered by Choice procedures, whereas the waiting times we report are for the specialty as a whole and include the non-LPCP procedures. In ophthalmology and orthopaedics, the proportion of Choice procedures within the specialties are much higher, ranging from around 40 to 70 percent.

The overall effect for ophthalmology and orthopaedics is therefore a convergence within London of inpatient waiting times with originators moving closer to the other two London groups. This would appear to be the main achievement of LPCP over this period, by increasing equity with respect to waiting times between London Trusts. These preliminary results appear to be very encouraging for the LPC Project since they suggest Choice has been a successful instrument for reducing waiting times for Trusts with long waits in these two specialties.

11. References

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