WAITING TIMES FOR ELECTIVE SURGERY: A HOSPITAL-BASED APPROACH

ABSTRACT AND EXECUTIVE SUMMARY

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ABSTRACT

This report describes an extensive econometric study of hospital responses to waiting times in England. It uses the routine quarterly waiting list returns for all general acute Trusts from 1995 to 2002 to develop empirical economic models of demand side and supply side behaviour. Both outpatient and elective inpatient services are modelled. The models are developed for all specialities combined, for all routine surgery, and for each of the following individual specialities: orthopaedics, ear nose and throat, and urology. An extensive database of hospital characteristics was deployed to ensure that the models were sensitive to variations in hospital circumstances.

The results were consistent with economic theory, and with previous empirical results. On the demand side, longer waiting times serve to depress demand (in the form of additions to the waiting list) to a modest but measurable extent. On the supply side, longer waiting times serve to stimulate activity (in the form of admissions from the waiting list), again to a small but measurable extent. The study integrates these results into a systems dynamic framework to demonstrate how future policy scenarios could be explored further.

The relatively small effects detected are reassuring from a policy perspective. On the demand side, they suggest that the planned reductions in waiting times will not lead to an explosion of demand. On the supply side, they suggest that – other things being equal – Trusts will not 'ease up' on elective activity to any great extent as waiting times decrease.

The study offers advances in a number of ways. It uses a much more extensive dataset than was hitherto available; it models both inpatients and outpatients; it models individual specialities as well as combinations of specialities; it explores some novel uses of analytic techniques; and it has resulted in the development of an extensive database that may be valuable for exploring a range of other research questions.

A fuller executive summary is appended to this abstract.

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EXECUTIVE SUMMARY

Introduction

1. This study was commissioned by the Department of Health. It examines the influence of a number of factors - particularly waiting time - on the supply of and demand for inpatient and outpatient elective care in the English NHS. The central hypothesis is that waiting time is important both on the demand side (because a long wait might deter demand) and on the supply side (because of the managerial importance attached to waiting times).

2. The study builds on two earlier studies at York that suggested that the expected demand and supply side responses do occur. That work was based on small area population data, and obtained robust results relating to demand for inpatient care. However, the supply models, although statistically satisfactory, were rather constrained by data limitations. The motivation behind this study was to strengthen our understanding of both the supply of and demand for elective care through the estimation of more complex supply models and through consideration of outpatient as well inpatient models.

3. The study therefore relies on data provided at the hospital level, rather than small area data. In particular, it focuses on the quarterly waiting list data provided by NHS Acute Trusts. These relate to both outpatients and inpatients, and cover waiting times, referral rates, and activity rates. For inpatients the waiting time data reveals how long those still awaiting treatment have been waiting. For outpatients they report (a) how long those patients seen have waited and (b) how long those still awaiting treatment have been waiting. The immediate objective of this study is to measure the influence on hospital activity of its waiting list and waiting time performance, as measured by these returns.

4. However, in doing so, we found it necessary to develop general models of hospital activity that are much more comprehensive than has previously been possible, incorporating many additional determinants of supply such as hospital workload, clinical quality, workforce characteristics, patient characteristics, and the local health care market. This resulted in numerous research findings on the productivity of hospitals that extend well beyond the immediate concern with waiting times. The study may therefore be of interest from a number of other policy perspectives.

Waiting list data

5. Hospital level data on waiting times for a first outpatient appointment have been available from 1995. Over the period from 1995 to 2002, the number of GP referrals increased 16%, whilst the number of referrals seen increased by only 8%. The proportion of GP referrals seen within 13 weeks declined from 85% to 80%. At the beginning of 2002, just under 2 million GP referrals were seen and just under 250,000 had been waiting over 13 weeks and were still awaiting to be seen. Chapter 4 gives a detailed analysis of national trends, including speciality level results.

6. Inpatient waiting list statistics have been collected since the beginning of the NHS. Additions to the list and the total numbers waiting increased sharply between 1995 and 1998, but since 1998 demand (in the form of quarterly additions to waiting lists) has declined by about 10%. Over the same period, supply (in the form of quarterly admissions from the waiting list) declined by about 15%. Chapter 5 gives a detailed analysis of national trends, including speciality level results for both inpatients and day cases.

Theoretical models

7. We deploy economic models that seek to explain both demand side and supply side behaviour. Our demand side model is based on the belief that a long perceived waiting time might encourage patients to seek (immediate) care in the private sector, or forego hospital care entirely, and might discourage GPs from referring patients. In addition to any measure of delay, the relative costs of reaching NHS or private facilities might affect the demand for NHS care. Thus our demand model includes such factors as the accessibility of private health care and the local availability of General Practitioners, as well as a measure of the morbidity of the local population.

8. On the supply side we employ a model where hospital managers care about the waiting times (or waiting lists) that they report. However, their actions are subject to numerous constraints. Moreover, although increased activity might initially lower waiting times, the model recognizes that demand might therefore be stimulated, leading to a heavier workload. So the net impact of waiting times on hospital activity could in theory be positive or negative.

9. Demand may be affected by aspects of quality other than waiting time. There are numerous measures now employed, both locally and centrally, as indicators of hospital performance. These include: death rates, re-admission rates, the length of stay in hospital, and the proportion of elective admissions that are treated as day cases. Some of these indicators may be interpreted as indicators of supply quality and therefore indirectly affect demand. And some may be proxies for hospital efficiency. Managers may care about them for either reason. Our supply model therefore includes waiting time measures and a batch of variables which can be interpreted as reflecting various aspects of hospital performance, efficiency or quality.

10. We apply these demand and supply models to both inpatient and outpatient care, resulting in a suite of four models. These are applied first to all specialities combined, and then to each of the following: routine surgery, orthopaedics, ear nose and throat, and urology. We also apply the models to outpatient and inpatient care combined, and explore a method of capturing interactions between the four models. Full details of the theoretical models are given in Chapter 6.

Data

11. Before estimation of the regression models commenced, a substantial data set was assembled. Compilation of this database was a major exercise in itself, requiring the assembly of information from diverse sources, and considerable data validation and correction activities. The waiting and activity data were derived from quarterly waiting time, referral, and activity returns from 1995 to 2002 for both outpatients and inpatients for each Trust. Numerous alternative measures of activity and waiting have been used. From the quarterly data, we constructed three measures of demand, two measures of supply, and five measures of waiting time for the inpatient models. For outpatients four measures of demand, four measures of supply, and six measures of waiting time were constructed.

12. Before supply and demand models could be estimated, we needed to attach a catchment population to each Trust. To do this we employed a purchaser-provider matrix, which measures the flow of patients from each Health Authority to each hospital trust. This enabled us to construct a notional population and measures of population characteristics for each hospital.

13. To this hospital-based database we added a further batch of variables from a data set compiled by researchers at the Centre for Health Economics. This database comprises about 25 variables describing the hospital characteristics, such as: the bed occupancy rate, the average length of stay, an index of case mix complexity, the re-admission rate, the death rate, the day case percentage, and the number of beds per head of population. Full details of the hospital data are given in Chapter 7.

Model estimation

14. In order to estimate the models, we deployed appropriate econometric techniques, as described in Chapter 8. These are based on modern panel data methods, and tests of model specification were undertaken to ensure model assumptions were not violated. Specialist hospitals were deleted from the dataset as they were found to adversely affect model performance, resulting in the use of about 170 general acute hospitals.

15. For both inpatients and outpatients, the alternative measures of supply and demand were typically well correlated with each other, and the mean waiting time was highly correlated with most of the other waiting time measures. We therefore concluded that the models would be insensitive to which specific measures we used. The mean wait was negatively correlated with both the supply and demand measures, and the mean wait was highly correlated with its own lagged values (this correlation declined slowly as the lag increased). The results were broadly similar for each specialty grouping. They are described in detail in the opening sections of Chapters 9 and 10.

Results: inpatients

16. We found that waiting times had a significant negative effect on inpatient demand in all

five specialty groupings and that this effect declined as the lag on the waiting time variable increased. We measure the impact of waiting time on demand using the concept of elasticity – the percentage change in demand brought about by a one percent change in waiting time. We detect demand elasticities of between -0.135 and -0.235, relatively modest figures that are consistent with earlier studies. These elasticities imply that a one percent reduction in average waiting time will lead to between a 0.135 percent and 0.235 percent increase in demand, and that a ten percent reduction in average waiting time will lead to between a 1.35 percent and 2.35 percent increase in demand. We also found that the local availability of private beds had a negative impact on the demand for NHS care for all surgery and three of the four specialty groupings (but not ENT).

17. We found that waiting times had a positive impact on the supply of inpatient care, and that the supply response to waiting times was best modelled with a four quarter lag. The elasticity of supply with respect to the mean wait was between 0.052 and 0.103. These elasticities imply that a one percent reduction in waiting time is associated with between a 0.052 per cent and 0.103 percent reduction in the supply of elective surgical activity. Thus as waiting times fall there is a very small shift in resources away from elective surgery and into other areas of NHS activity (eg emergency, medical, and A&E services). We also found that a number of other variables (such as the number of beds and case mix complexity) were associated with the supply of elective care. With the exception of ENT and all specialties combined, the local availability of private beds was negatively associated with the supply of inpatient NHS care. Full details of the inpatient results are given in Chapter 9.

Results: outpatients

18. For each outpatient demand and supply model two equations were estimated: one based on GP referrals and the other based on all referrals (including referrals from other consultants as well as GP referrals). We found that waiting times, lagged one period, had a significant negative effect on demand and that this effect declined as the lag on the waiting time variable increased. For individual specialities, the elasticity of all referral demand with respect to the mean wait was between -0.034 and -0.059, while that for GP referral demand was between -0.055 and -0.173. There was some evidence that the local availability of private health care was negatively associated with the demand for NHS outpatient appointments.

19. With regard to the supply of outpatient appointments, we found it possible to develop good models only for all referrals (and not for GP referrals alone). Waiting times had a positive impact on supply and the supply response to waiting times was best modelled with an eight quarter lag. The elasticity of all referral supply with respect to the mean wait was between 0.027 and 0.070. We also found that a number of inpatient-related variables (such as the number of beds) also appeared to be associated with the supply of outpatient services. This effect is probably an indirect

one reflecting the fact that more pressure on inpatient resources is likely to be associated with less outpatient capacity. We also found some evidence that the local availability of private care was negatively associated with the supply of NHS outpatient care. Full details of outpatient results are given in Chapter 10.

Results: outpatients and inpatients combined

20. We also estimated combined inpatient and outpatient supply and demand models where the impact of total (outpatient plus inpatient) waiting time affects total (outpatient plus inpatient) demand and total (outpatient plus inpatient) supply. Generally, the results we obtained were similar to those for inpatients alone but in some cases the inclusion of outpatients enabled us to obtain a better statistical model. We found that waiting times had a significant negative effect on demand and that this effect declined as the lag on the waiting time variable increased. The elasticity of total demand with respect to the mean wait was between -0.133 and -0.238 and there was some evidence that the local availability of private health care had a negative impact on the demand for NHS care. On the supply side, the elasticity of all referral supply with respect to the mean wait varied between 0.054 and 0.087. We again found that a number of inpatient-related variables (such as the number of beds and case mix complexity) were associated with the total supply of services. Full details are given in Chapter 13.

Further work

21. We found that, for a given service (inpatients or outpatients), there was a positive correlation between divergences from the demand and supply models. For example, if our statistical model underestimated demand, it also tended to underestimate supply. One interpretation of this is that there is some unobserved factor that boosts both demand and supply but which has not been included in the model. We therefore experimented with the use of a seemingly unrelated regression (SUR) estimator, as reported in an Annex to the main report. This effectively seeks to correct for observed linkages between separate statistical models, of the sort we detected between demand and supply. Because the reason for the correlation between the demand and supply models cannot be established with any certainty, the SUR results are in an annex to the main report and should be viewed as a promising avenue for future research.

Systems dynamics simulations

22. Using some of the results from this study, we constructed a basic dynamic model of the demand for and supply of elective health care within a system dynamics framework. This model examined the dynamic consequences for waiting times and waiting lists of various scenarios (such as changes in funding levels). We also incorporated a consultant-held target waiting time into the model so that, when waiting times differ from the target level, consultants adjust their treatment thresholds in an attempt to bring waits back into line with the target wait. This part of the study is intended as a demonstration of how our statistical results could be used to explore

future policy scenarios.

Conclusions

23. Our inpatient supply and demand results are broadly consistent with our previous findings. This is a reassuring result, and notable because this study used an entirely different data set, based on hospitals, to that used in our previous work. Moreover, the current results are based on the most recently available data (from 1995 to 2002) whereas our previous study covered an earlier period (from 1992 to 1997). Our results are also in line with the small number of other studies that have examined this topic, confirming that waiting times have a small but significant impact on both the demand for and supply of inpatient NHS care.

24. The study offers some important messages for policy. First it confirms that lower waiting times give only a relatively modest stimulus to demand for inpatient and outpatient surgery. It reinforces previous findings that, other things being equal, the dramatic reductions in waiting times in the NHS are unlikely to lead to major increases in demand.

25. On the supply side, longer waiting times appear to have only a marginal positive impact on NHS activity, both in aggregate and in the three specialities studied. The precise response of the NHS supply side as waiting times are reduced in the future will depend heavily on the incentives put in place to sustain the improvements. However, this study suggests that – over the years studied – NHS hospitals did not 'ease up' in any major fashion when waiting times fell.

26. We have demonstrated how the results of this study could be used to simulate dynamic responses to extra resources, and have demonstrated the implications of a consultant-held target. These simulations probably have limited predictive power, but they can help policy makers understand the components of the waiting time problem and the potentially complex dynamics of the health system.

27. Our study offers some evidence that better access to private healthcare provision may depress both the demand for NHS services as well as NHS supply. This result must be viewed in the light of the rudimentary measures of private supply we had available, but it does suggest that interactions with private sector provision may be quite subtle and require careful examination before drawing policy conclusions.

28. Using new analytic techniques (SUR), we have for the first time modelled simultaneously the links between inpatients and outpatients and demand and supply. This analysis is exploratory, but it does suggest that the impact of waiting times on system behaviour may if anything be less than we had previously suggested, reinforcing our confidence that the new targets will not in themselves have a major influence on demand or supply.

29. This study offers an advance on previous research in a number of ways. First, we have been able to estimate demand and supply models for both outpatients and inpatients and have demonstrated the usefulness of Trust returns as data source for modelling the demand for and supply of health care. Second, by combining these returns with a database of Trust characteristics we have been able to estimate more general models of hospital supply (based not just on waiting time). We have examined the impact of many factors on hospital supply and have applied these models to both groups of specialties and individual specialties. Third, we have obtained a reasonably stable set of results, based on a panel that runs from 1995 to 2002. Use of a panel has allowed us to explore the lag with which demand and supply respond to waiting times, suggesting that the supply response is rarely instantaneous. Fourth, the exploratory use of the seemingly unrelated regression technique is in our view a promising approach to modelling hospital behaviour, and merits further development as an analytic tool. And fifth, we have assembled an important dataset that could in principle answer a number of other research questions unrelated to our original intentions.

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