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BMJ Open Retrospective economic analysis of the transfer of services from hospitals to the community: an application to an enhanced eye care service

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ABSTRACT

Objective This research aims to evaluate the wider health system effects of the introduction of an intermediate-tier service for eye care.

Setting This research employs the Minor Eye Conditions Scheme (MECS), an intermediate-tier eye care service introduced in two London boroughs, Lewisham and Lambeth, in April 2013.

Design Retrospective difference-in-differences analysis comparing changes over time in service use and costs between April 2011 and October 2014 in two commissioning areas that introduced an intermediate-tier service programme with changes in a neighbouring area that did not introduce the programme.

Data sources MECS audit data; unit costs for MECS visits; volumes of first and follow-up outpatient attendances to hospital ophthalmology; the national schedule of reference costs.

Main outcome measures Volumes and costs of patients treated.

Results In one intervention area (Lewisham), general practitioner (GP) referrals to hospital ophthalmology decreased differentially by 75.2% (95% CI –0.918% to –0.587%) for first attendances, and by 40.3% for follow-ups (95% CI –0.489% to –0.316%). GP referrals to hospital ophthalmology decreased differentially by 30.2% (95% CI –0.468% to –0.137%) for first attendances in the other intervention area (Lambeth). Costs increased by 3.1% in the comparison area between 2011/2012 and 2013/2014. Over the same period, costs increased by less (2.5%) in one intervention area and fell by 13.8% in the other intervention area.

Conclusions Intermediate-tier services based in the community could potentially reduce volumes of patients referred to hospitals by GPs and provide replacement services at lower unit costs.

INTRODUCTION

GPs in the English National Health Service (NHS) perform a gate-keeping function; rationing patient access to secondary care. This function is intended to prevent unnecessary use of secondary care, but it can risk delay in patients receiving specialised treatment.¹ Such delays can cause patients to make

Strengths and limitations of this study

- We exploit data on costs and activity to show the relationship between the introduction of intermediate-tier services and supply and demand/need.
- We use a difference-in-differences approach to identify the effects of the scheme over time compared with an area with similar characteristics.
- We provide a breakdown of referral patterns.
- While we compare areas that have similar characteristics, we could not rule out all potential sources of confounding.
- The findings of this study are not necessarily generalisable across the UK.

multiple trips to visit a GP, generating higher costs to the patient and imposing additional demands on primary care that, if avoided, would free up primary care capacity to serve other patient needs more appropriately.

Patients may not obtain secondary care quickly due to waiting lists for hospital-based care. While this may not induce a large burden on patients who have non-urgent conditions, there is evidence to suggest that patients will experience disutility from waiting.² Waiting times across England's NHS hospitals have declined,³ but new strategies are being implemented to maintain this performance.

A recent initiative has been to introduce intermediate-tier services (ITS) for selected services, such as ophthalmology, dermatology⁴ and diabetes.⁵ ITS are intended to reduce demand on secondary care by creating a substitute for hospital-based care to which GPs may refer patients or patients may access directly. Sibbald *et al*⁶ described four forms of ITS: (1) transfer of services from hospitals to primary care; (2) relocation of hospital services to primary care; (3) joint working between primary and secondary care; and



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(4) interventions that change the referral behaviour of primary care practitioners.

Very few previous studies have sought to assess the wider healthcare system effects of introducing ITS, and these studies suggest that further research is needed to assess the costs and benefits of ITS. Sibbald *et al*⁶ suggest that both transferring secondary care services into primary care and changing referral patterns are effective in reducing hospital outpatient activity, but note that the quality of care may decline and costs may increase. Sibbald *et al*⁷ conducted an evaluation of the economic impact of shifting care within six specialities from hospitals to non-hospital settings. They found that ITS reduced the time patients waited for treatment, improved the technical quality of care and increased overall satisfaction with access to care when compared with hospital-based services. Coast *et al*⁴ carried out cost effectiveness and cost consequences analyses of ITS in dermatology finding that, although waiting times reduced and patient satisfaction increased, costs were also higher for patients treated by ITS compared with those referred to hospital.

In this paper, we examine how the introduction of an ITS for eye care services in two commissioning areas in England affected the numbers of patients treated by hospital ophthalmology by comparing changes in the number of patients treated at hospital between the areas with ITS and a neighbouring area in which no ITS was introduced. We also examine the cost consequences of introducing an ITS by considering total costs at hospitals and of the ITS.

The minor eye conditions scheme

Changes to the regulations governing optometry in 2000 allowed community optometrists to 'decide not to refer patients with a disease or abnormality of the eye to a medical practitioner'.⁸ Further amendments in 2005 allowed optometrists to refer patients to more specialised optometry services.⁹ This change has led to the development of enhanced eye service schemes (community optometric services) across the UK, which allow for the treatment and management of acute eye care conditions by accredited optometrists in non-hospital settings.¹⁰ General Ophthalmic Service (GOS) provision is not identical across the UK. Notably in Scotland, where a new GOS contract has been in operation since April 2006. Among the differences that apply in Scotland compared with the rest of the UK, a supplementary eye examination on a glaucoma suspect could be performed in Scotland under the GOS contract; however, this would fall outside the GOS in the rest of the UK.

The Minor Eye Conditions Scheme (MECS) is an NHS-funded ITS providing patients with access to specialised eye care within the community. Under this scheme, patients presenting to their GP with an eye problem, and satisfying specific inclusion criteria, are referred to accredited community optometrists.

Patients can be referred to the ITS for a range of eye conditions including (but not limited to) red eye, sticky eye, watery eye, irritation or inflammation of the eyes and recently occurring flashes and floaters. The scheme also allows patients direct access to an accredited MECS optometrist without a GP referral.

DATA

We obtained administrative data for the ITS for the period 2 September 2013 to 30 August 2014. These data describe the volume of patients being referred to the MECS, the presenting eye condition, the number of patients referred onward for hospital-based ophthalmology care and the main types of treatments given.

We also obtained counts of first and follow-up outpatient attendances to hospital ophthalmology clinics in the two areas that introduced the MECS. The data were provided for the period 1 April 2011 to 31 October 2014. Equivalent data were also obtained for a neighbouring commissioning area in which an ITS was not introduced. We distinguish between referrals from three possible sources: GPs, consultant-to-consultant and 'other', which included accident and emergency, national screening programmes and self-referrals.

We acquired the National Schedule of Reference Costs for 2012/2013 which contains the average cost per outpatient attendance to ophthalmology clinics in hospitals for the middle year of the analysis period. The unit costs for the MECS were obtained from the commissioning organisations. The costs of each type of visit were first hospital outpatient attendance £144.04, follow-up hospital outpatient attendance £83.92, first MECS attendance £47.00 and follow-up MECS attendance £28.00.

METHODS

We compare numbers of first and follow-up attendances at hospitals and the ITS in the two commissioning areas over time. We use difference-in-differences to estimate the impact of the introduction of the ITS on outpatient attendances at hospital ophthalmology clinics. The intervention areas are two commissioning areas (Lambeth and Lewisham) in close geographical proximity in Greater London who jointly introduced the ITS in April 2013. The comparison area (Southwark) is a neighbouring commissioning area that did not introduce an ITS.

We compare baseline data covering the period September 2011 to April 2013 to data from April 2013 to October 2014, after the introduction of the ITS. We analysed the natural logarithm of the volume of outpatient attendances at each hospital from each commissioning area, which allows for simple presentation of relative changes. There were three commissioning areas with populations served by three hospitals, giving nine hospital-commissioning area combinations. We observe patient volumes for each of these combinations for 13 quarters.



We estimate the difference-in-differences model using ordinary least squares regression. Difference-in-differences measures the change over time in the intervention areas minus the change over time in the comparison area. We use linear regression and include binary indicators for each quarter and for each hospital–commissioner combination to control for baseline differences in activity rates. The difference-in-differences effect is given by the coefficient on an interaction between an indicator for an intervention area and an indicator for the quarter in the postintervention period.

The key assumption underpinning the difference-in-differences estimator is that the changes over time are expected to be the same in the intervention areas as in the comparison area in the absence of the intervention.¹¹ We examined area-level characteristics for Lambeth, Lewisham and Southwark: three boroughs located in South East London. Southwark lies between Lambeth and Lewisham with Lambeth to the west and Lewisham to the east. These areas are similar across many characteristics

including population density, mean and median age, gender, level of deprivation, education, employment, ethnicity and religion. **Table 1** presents key characteristics for the three local authority areas.

RESULTS

We show volumes of hospital outpatient ophthalmology attendances for first and follow-up visits from all referral sources in **table 2** for the three areas. In Lambeth, total hospital attendances increased by 3.3% between February 2012 and 2014. Hospital attendances in Lewisham decreased by 5.3% over the same period. In the comparison area (Southwark), hospital attendances increased by 7.4% between February 2012 and 2014.

The difference-in-differences analysis reveals diverging patterns for the two ITS areas (**table 3**). For Lambeth, first attendances of ophthalmology at Hospital B referred by GPs were differentially reduced by 30.2% (95% CI -0.468% to -0.137%) compared with Southwark.

Table 1 Characteristics of the two intervention areas and the comparison area

Characteristics	Lambeth (Intervention)	Lewisham(Intervention)	Southwark(Comparison)
Resident population	303 086	275 885	288 283
Age and gender			
Mean age	33.7	34.6	33.7
Median age	31.0	33.0	32.0
Female, %	50.21	51.08	50.53
Deprivation			
Not deprived, %	39.90	38.40	36.20
Deprived 1–2 dimensions, %	52.50	53.90	55.70
Deprived 3–4 dimensions, %	7.60	7.70	8.50
Education: 5+ O-levels/GCSEs, %	40.70	35.50	37.40
Economically active, %	46.50	40.10	42.20
Ethnicity			
White, %	57.10	53.50	54.20
Mixed, %	7.60	7.40	6.20
Asian, %	6.90	9.30	9.43
Black, %	26.00	27.20	26.90
Arab, %	0	0.50	0.90
Other, %	0	2.10	2.40
Religion			
Christian, %	52.50	52.80	53.10
Muslim, %	8.50	6.44	7.10
Other, %	3.70	4.70	3.10
No religion, %	26.70	27.24	28.00

Education (no person in the household has at least level 2 education (GCSE Equiv) and no person aged 16–18 is a full-time student); Health and disability (any person in household with 'bad' or 'very bad' health or long-term health problem); Housing (household is overcrowded, is in a shared dwelling or has no central heating).

Source: Office for National Statistics, Neighbourhood Statistics, 2011 census (<https://www.neighbourhood.statistics.gov.uk/dissemination/>); %20Deprivation dimensions: employment (any member of household that is not a full-time student that is unemployed or long-term sick).

GCSE, General Certificate of Secondary Education.

Table 2 Volumes of hospital outpatient ophthalmology attendances from September 2011 to August 2014

	September 2011 to February 2012	March 2012 to August 2012	September 2012 to February 2013	March 2013 to August 2013	September 2013 to February 2014	March 2014 to August 2014
First attendances						
Lambeth	5109	5056	4963	4923	4740	4711
Lewisham	4077	4189	4030	3197	2747	2691
Southwark	4397	4387	4330	4100	4143	4102
Follow-ups						
Lambeth	11 448	11 611	12 244	11 699	12 365	12 292
Lewisham	9599	10 909	11 318	9719	10 209	9875
Southwark	9429	10 112	10 450	9910	10 707	10 829

Follow-up attendances were differentially reduced by 16.7% (95% CI -0.313% to -0.021%) at Hospital A and by 14.6% (95% CI -0.232% to -0.059%) at other providers.

The picture is different for Lewisham—at the largest provider (Hospital B), GP referrals to hospital ophthalmology were differentially reduced by 75.2% (95% CI -0.918% to -0.587%) compared with Southwark for first attendances and by 40.3% (95% CI -0.489% to -0.316%) for follow-up visits. We also find that referrals from hospital consultants differentially increased by 68.6% (95% CI 0.365% to 1.007%) for first attendances, and 49.4% (95% CI 0.348% to 0.639%) for follow ups (compared with Southwark).

Table 4 shows the volumes of patients treated at hospitals and ITS in 2011–2012 and 2013–2014 and associated

costs in each of the three areas. The unit costs are fixed across areas and time periods and so changes in total costs are attributable only to changes in the volume of activity. The overall changes are summarised in table 5. Overall, the total costs for hospital and ITS activity were 2.5% higher for Lambeth in 2013–2014 compared with 2011–2012. They were 13.8% lower in Lewisham. In the comparison area (Southwark), total costs were 3.1% higher in 2013–2014 compared with 2011–2012.

Tables 6 and 7 present data on the reasons for patient referral into MECS, the proportion of patients managed by community optometrists, the proportion discharged with no pathology and the percentages referred to the Hospital Eye Service (HES) and GP. The majority of patients presented with minor anterior eye disease

Table 3 Difference-in-differences estimates by referral type for first and follow-up visits

		First attendances			Follow-ups		
		GP referral	Consultant referral	Other referral source	GP referral	Consultant referral	Other referral source
Lewisham	Hospital A	-0.136 (0.0834)	-0.320 (0.162)	-0.0520 (0.149)	-0.0617 (0.0436)	-0.103 (0.0733)	-0.0795 (0.0836)
	Hospital B	-0.752*** (0.0834)	0.686*** (0.162)	-0.238 (0.149)	-0.403*** (0.0436)	0.494*** (0.0733)	-0.521*** (0.0836)
	Other providers	-0.269** (0.0834)	-0.254 (0.162)	-0.329* (0.149)	-0.154*** (0.0436)	-0.222** (0.0733)	-0.130 (0.0836)
Lambeth	Hospital A	0.0383 (0.0834)	-0.178 (0.162)	-0.119 (0.149)	0.0208 (0.0436)	-0.167* (0.0733)	-0.0971 (0.0836)
	Hospital B	-0.302*** (0.0834)	-0.0650 (0.162)	0.0377 (0.149)	-0.0165 (0.0436)	-0.0416 (0.0733)	0.0362 (0.0836)
	Other providers	0.0185 (0.0834)	0.0415 (0.162)	-0.129 (0.149)	-0.146** (0.0436)	0.103 (0.0733)	-0.0661 (0.0836)
Constant		7.018*** (0.0661)	5.047*** [0.128]	5.423*** (0.118)	6.986*** (0.0345)	6.779*** (0.0581)	6.105*** (0.0662)
No of observations		117	117	117	117	117	117
Adjusted R ²		0.978	0.907	0.765	0.991	0.989	0.943

SE in brackets.

*p<0.05, **p<0.01, ***p<0.001; quarter dummies and provider-commissioner combination fixed effects included.

Table 4 Volumes of patients at hospitals and ITS in 2011–2012 and 2013–2014 and associated costs by area

	2011–2012						2013–2014					
	Volume of patients		Costs (£s)		Total (000s)		Volume of patients		Costs (£s)		Total (000s)	
			Unit						Unit			
Lambeth	Hospital	First	10165	144.04	1464	9451	144.04	1361				
	ophthalmology	Follow-up	23059	83.92	1935	24567	83.92	2062				
	ITS	First				1260	47	59				
		Follow-up				119	28	3				
Lewisham	Hospital	First	8266	144.04	1191	5438	144.04	783				
	ophthalmology	Follow-up	20508	83.92	1721	20084	83.92	1685				
	ITS	First				860	47	40				
		Follow-up				65	28	2				
Southwark	Hospital	First	8784	144.04	1265	8245	144.04	1188				
	ophthalmology	Follow-up	19541	83.92	1640	21536	83.92	1807				
												% Change in volume

and over 80% of these patients were managed by their community optometrist.

DISCUSSION

There is very little previous research that investigates whether shifting care from hospitals to community providers is successful in reducing overall healthcare system costs. In particular, little is known about how new ITS affect demand and supply in the wider healthcare system. This study used an application from ophthalmology to consider how introducing enhanced eye services in the community changed the number of first and follow-up attendances to hospital. We used a difference-in-differences approach, comparing two areas (Lambeth and Lewisham) that introduced an ITS to a neighbouring comparison area (Southwark) that did not.

The results of this study describe a complicated picture—the changes we observe are not wholly consistent across the two intervention areas and are especially concentrated at the largest provider for Lewisham patients (the commissioning area in which we find the largest reductions in activity). We find that first and follow-up attendances for GP referrals were substantially reduced in the post-ITS period, and that first and follow-up attendances for consultant referrals were increased. [Figure 1](#) shows that GP referrals comprise the majority share of overall activity—and so the net effect of these changes is still a significant reduction in hospital activity.

Annual costs in Lewisham decreased by 13.8% between 2011–2012 and 2013–2014—the consequences of larger reductions to more costly activity (hospital treatment) being considerably greater than the increase in less costly activity (ITS treatment). Annual costs increased by 2.5% in Lambeth and by 3.1% in the comparison area (Southwark) during the same period.

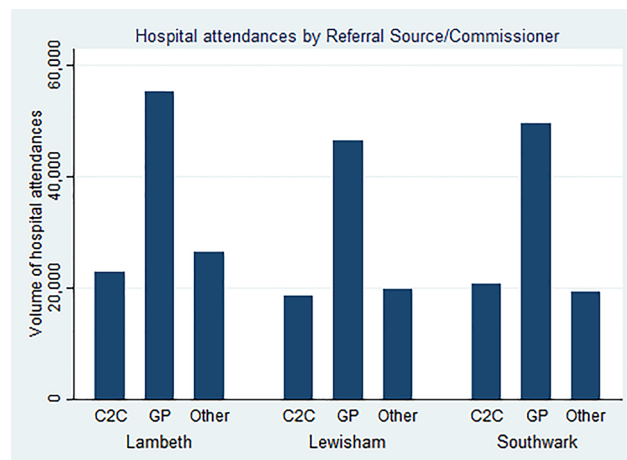
The increase in consultant referrals observed for Lewisham patients treated at Hospital B might theoretically be explained by changes to coding practices at Hospital B (or a similar change such as diagnostic practice), but we do not observe consistent changes for Lambeth patients treated at Hospital B. This increase is smaller in percentage terms than the reduction in GP referrals and there is a much smaller number of consultant to consultant referrals than referrals from GPs.

Differences in how the enhanced services were structured and used between the two intervention areas may offer possible explanations for the variation in the estimated effects. The Lewisham scheme was concentrated in just five optometry practices, whereas eight practices participated in Lambeth and rates of use varied substantially. There was a difference between the two areas in the referral sources into MECS, with approximately 56% of all patients seen in Lambeth referred by a GP compared with 75% in Lewisham. Finally, there was much higher level of GP engagement in the scheme in Lewisham: 90% of GP practices registered compared with 78% in Lambeth.

Table 5 Total costs by area in 2011–2012 and 2013–2014

	Total costs (£000s)		
	2011–12	2013–14	% Change
Lambeth	3399	3486	2.5
Lewisham	2912	2511	-13.8
Southwark	2905	2995	3.1

It is possible that the changes in patient volumes in the areas that introduced an ITS were caused by factors other than the ITS. The lack of reductions in patient volumes in Southwark might have been caused by changes in other factors in Southwark. These areas, however, had very similar characteristics and are geographically very close. Patients in these areas make use of the same hospitals and would therefore be expected to experience similar changes in access over this short time period. There were no other policy initiatives or care pathway changes introduced during this period. Our findings are not necessarily generalisable across the UK. Future

**Figure 1** Hospital attendances by referral source/ commissioner. C2C, consultant to consultant; GP, general practitioner.**Table 6** Management of patients by provisional diagnosis

Optometrists' provisional diagnosis	Patients retained in the community (%)	Patients referred to hospital (%)	Patients referred to the GP (%)
Eyelid, lacrimal system, orbit (n=412)	81.3	14.6	4.1
Diseases of the conjunctiva (n=408)	87.5	4.7	7.8
Disorders of the cornea and sclera (n=536)	82.6	13.8	3.5
Disorders of the iris and ciliary body (n=29)	3.4	93.1	3.4
Disorders of the lens (n=45)	60	40	0
Disorders of choroid and retina (n=96)	6.3	90.6	3.1
Glaucoma (n=38)	10.5	86.8	2.6
Disorders of vitreous body and globe (n=142)	82.4	17.6	0
Disorders of optic nerve and visual pathway (n=6)	0	100	0
Disorders of ocular muscles, binocular movement, accommodation and refraction (n=63)	87.3	11.1	1.6
Visual disturbances and blindness (n=58)	60.3	24.1	15.5

Table 7 Management of patients by reason for presentation

Reason for MECS visit N (%)	% of patients managed by the community optometrist	Patients with no ocular pathology identified (%)	Patients referred to the HES (%)	Patients referred to GP (%)
Red eye (n=777)	79.3	1.3	14.7	4.5
Painful white eye (n=216)	64.4	15.7	14.0	5.9
Flashes/floaters (n=236)	61.6	10.6	25.9	1.4
Loss of vision (n=194)	22.7	21.1	51.0	4.6
Headaches (n=112)	11.6	51.8	9.8	26.8
Trauma (n=36)	63.9	27.8	8.3	0.0
Diplopia (n=8)	12.5	0.0	75.0	12.5
Other (n=538)	22.7	21.1	51.0	4.6

Swollen lid/lid lump 21.7%; Watery eyes 19.8%; Itchy eyes 10.0%; Foreign body sensation, sore/dry/gritty eyes 14.8%; A reason for MECS visit was not provided for six patients.

GP, general practitioner; HES, Hospital Eye Service; MECS, Minor Eye Conditions Scheme.



studies should evaluate the cost-effectiveness of these schemes and the impact on patient outcomes.

A high proportion of MECS patients are retained in the community, of whom a considerable proportion have no eye disease (tables 6 and 7). Although we have no data on patients who might be subsequently referred by their GP to the HES or who self-refer to Accident and Emergency (A & E) after their MECS evaluation, it is likely that the majority of these patients will not reach the HES as a result of this episode and so will avoid the higher hospital tariff. Recently published qualitative research on MECS revealed a very high degree of satisfaction among patients with the scheme which suggests only a minority of patients would be likely to represent at HES clinics.¹²

Introducing community-based enhanced services may potentially reduce the pressure on secondary care providers, possibly as a result of reduced referrals from primary care. Although we do not know the effect on final patient outcomes, the proportion of cases seen at the ITS that were judged to have been appropriately managed was very high and patients reported high levels of satisfaction.¹³ The potential success of these ITS schemes requires broad support from participating optometrists, ophthalmologists and GPs.¹⁴

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