Evaluating an innovative approach to the diagnostic processes for chronic eye disease: a feasibility study

Final Report for Special Trustees of Moorfields Eye Hospital

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Contents

Acknowledgements

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Lay summary

The aim of this study was to develop a framework that would support the evaluation of new ways of diagnosing and monitoring chronic eye disease being planned and implemented by Moorfields Eye Hospital. The study involved interviews with a range of health care professionals within the Trust, observation of glaucoma outpatient clinics and related meetings, analysis of routinely collected data, and planning an economic analysis to evaluate the cost and cost-effectiveness of the new service. The information used to inform this study was collected between February 2013 and June 2014. The framework highlights three areas that should be taken into account when evaluating innovation: (1) organisational context, (2) operational impact, and (3) cost and cost effectiveness relative to existing services. In relation to organisational context, those evaluating innovation should seek to understand how different professional groups are involved in, and affected by, the implementation of change and aim to identify the underlying social and organisational factors that may inhibit or support the implementation of innovation. Evaluation should also aim to capture patients' perceptions of existing services and proposed changes to services and how changes to the delivery of services may affect interactions between patients and clinical staff. From an operational perspective, quantitative analysis should aim to provide estimates of the level of improvement required to meet the challenges presented by anticipated increases in the burden of disease and the likely impact of the suggested changes on patient access metrics. To undertake an economic analysis of the new service, researchers should consider the main cost components of the new and existing services, how to collect resource use and unit cost data for each of these cost components, and a range of potential outcome measures.

1. Background

Glaucoma affects almost 10% of England's population over the age of 75, 2% of the population over 40, and accounts for over a million outpatient visits to health services annually. Once diagnosed, this potentially blinding condition requires lifelong and often complex treatment, which is key to the prevention of irreversible visual loss. Referrals to hospital of patients with suspected glaucoma have been increasing annually due to population ageing, and national clinical guidelines that lowered the clinical threshold for referral.[1]

Some providers are responding to the growth in demand for glaucoma services by developing and implementing new approaches to the delivery of outpatient clinics (see Appendix 2). As well as experimenting with change in staff roles within established clinics, Moorfields Eye Hospital has been developing 'streamlined' outpatient clinics that may be staffed by nurses, health care assistants or technicians who will conduct tests and collect patient data for later review by a consultant ophthalmologist. These outpatient services aim to reduce patient journey time and are organised around patients, and the clinical data required for their management, rather than the availability of their consultant.

Understanding the organisational context in which proposed changes to the delivery of outpatient services are being introduced is critical for improving the likelihood of their successful implementation.[2] For instance, implementing redesigned services is likely to require the management of changing inter-professional relationships as different staff groups may take on new roles.[3] Given the changes to outpatient services being tested by Moorfields, it is critical that an evaluation framework is developed to capture the likely impact that the proposed changes will have upon existing services, including their relative cost-effectiveness.

2. Research aims

The aim of this feasibility study was to design an evaluation framework for assessing the acceptability, implementation, cost, and cost-effectiveness of an innovative service configuration to improve the diagnostic processes for chronic eye disease. The study had the following objectives:

(1) To identify a set of factors likely to support and constrain the implementation of the new system configuration used in outpatient clinics for chronic eye disease.
(2) To understand the room for improvement associated with the current service, the system performance required to meet future challenges, and the implications for evaluating the new system configuration.

[1] National Institute for Health and Clinical Excellence. (2009). Glaucoma Diagnosis and management of chronic open angle glaucoma and ocular hypertension , NICE Clinical Guideline 85. April 2009.
[2] Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Quarterly, 82(4), 581-629.
[3] Ingram, D.V., & Culham, L. E. (2001). Ophthalmologists and optometrists—interesting times? British Journal of Ophthalmology, 85.7, 769-770.

(3) To plan an economic analysis of the new system configuration, considering both its cost and cost-effectiveness.
(4) To provide formative feedback concerning these factors to Moorfields Eye Hospital to support the implementation of the new system configuration.

3. Methods

The feasibility study used a mixed methods design combining implementation research, operational research, and cost-effectiveness analysis. These methods, as described below, were used to develop the three components of the evaluation framework for evaluating service innovation (see Appendix 1).

3.1 Implementation research to understand organisational context

Factors likely to support and constrain the implementation of service innovation, including perceived acceptability to patients, were explored using semi-structured interviews with stakeholders from the Trust and non-participant observation of relevant activities, including outpatient clinics and service-level meetings. In total, 28 interviews with a range of staff from within Moorfields and other organisations were conducted. From Moorfields, these were with senior managers (2), service-level managers (5), consultant ophthalmologists (4), doctors (4), optometrists (3), nursing staff (2), assistant clinic staff (4), and, from outside the Trust, contractors supplying technology services (3) and a glaucoma charity (1). The interviews explored: perceptions of the organisation of existing clinics including their strengths and weaknesses; the drivers for change; improvements to clinics and impact; key actors in leading improvement efforts; and receptivity of the organisational environment to innovation. The study also involved non-participant observation (40.5 hours) of outpatient clinics and managerial and clinical meetings of relevance to the planning and implementation of service improvement in glaucoma.

3.2 Operational research

Operational research was used to build an understanding of the problem the innovative service configuration was intended to address from the perspective of patient flows. This was achieved through the interviews and discussions with stakeholders (as described above), descriptive analysis of routinely available administrative data, and through observing the operation of the existing service. We generated a number of process maps of patient flow within the different types of glaucoma clinic and analysed routinely collected administrative data for a number of different clinics. We also developed a novel analytical model to help understand the impact of follow-up intervals on weekly demand for clinic appointments over time and the likely impact on the same demand of introducing the 'remove review' clinic. The model was implemented as a prototype spreadsheet tool with many of the input parameters values estimated from the administrative data obtained by the Trust.

3.3 Cost and cost-effectiveness

We conducted a feasibility study for an economic analysis of the new service configuration for outpatient clinics compared with current practice. This considered: (1) the main cost components; (2) the resource use and unit cost data required for each of these cost components and how best to source these data; (3) potential outcome measures to use in the cost-effectiveness analysis, including quality-adjusted life years; (4) sources of outcomes data using these measures and, if new data collection is required, how best to do this; (5) potential sources of data that could be used to estimate long term costs and outcomes. The above was achieved via interviews with clinical and managerial staff (as described in component 1) and literature reviews.

4. Findings

4.1 Implementation research

Two case studies of improvement within the Trust were examined: (1) the redesigning of staff roles within existing clinics, which was led by an external management consultancy, and (2) the development of a new 'streamlined' or 'remote review' clinic for treating stable glaucoma patients, which was led internally, with external IT support. Drawing upon the data obtained through the interviews and non-participant observation of clinics and other activities, we identified a number of potential barriers to, and enablers of, the implementation of service innovation (for more detail see Appendix 7).

4.1.1 Potential barriers to the implementation of innovation

Complexity of the system for running clinics The way in which traditional clinics were managed and organised was influenced not only by the style of the consultant ophthalmologist who led the clinic, but also by broader organisational factors that appeared to be more difficult to influence and control. Difficulties included: matching up patient flows with the resourcing of clinics (e.g. availability of medical equipment); aligning the working hours of the multiprofessional groups staffing the clinic, as staff groups fell under different lines of authority; and managing patients' preferences for appointment times (e.g. not late in the afternoon or early in the morning). A consultant described how the complex organisation of the outpatient clinics inhibited improvement: '*The problem is so big and it involves so many – the clerks, the booking centre, the patients, the consultants – there's so many bits to it, it all is too hard so nothing gets permanently changed'*.

Organisational strain The strain caused by the capacity issues appeared to create a context in which it was difficult to reflect upon or implement new services that might help to alleviate the original capacity problems. A service manager explained that they sometimes struggled to balance the need in their role to respond to issues associated with existing operations while also supporting the implementation of service improvements: '*A major problem for operational managers in the NHS… is the fact that you really, really want to improve the service, but you just find that you end up doing too much fire fighting, and you end up focusing on far too many very short term problems and don't feel that you have the head space or capacity you would like to make the real sustainable improvements*'.

Culture of intra- and inter-professional interaction A potential barrier to the implementation of innovation identified by a senior manager was disagreement within the organisation about what types of service innovation should be developed and implemented (*'we're a very consensual organisation. We don't do confrontation well. You can be having a conversation with somebody and you may be fundamentally at variance with what they want and you want, not saying anybody's right or wrong but what you both want is fundamentally different and you don't really address the issue*'). An impasse or *'false consensus'* could be reached as differences in opinion were expressed and mutually recognized but remained unresolved.

Attitudes toward potential change in professional roles Concerns were raised by some clinical staff about change to professional roles in the redesigned clinics and new roles in the 'streamlined' clinic. In relation to the redesigned clinics where patients were pre-allocated to named clinicians, optometrists and doctors in training expressed concern about inflexibility when the clinics were busy ('*it wouldn't kill people to do visions and pressures if it's really stacking up*') and training where practitioners received a less diverse case mix ('*you're not going to get allocated the complicated ones unless you're a consultant or a fellow*'). In 'streamlined' clinics, a doctor expressed concern about the consultant's role of reviewing patient data remotely ('*they'd be more useful actually being there teaching and seeing their patients*'). A technician stated that s/he preferred the '*variety*' of tasks in traditional clinics relative to 'streamlined' clinics ('*with this [streamlined clinic] you're focusing more and then you hand it over'*). It was also perceived to be more difficult sometimes to talk to colleagues in the 'streamlined' clinic ('*in this one, you don't have time to talk*'; '*sometimes you want to talk to your colleague, not personal, just for a patient*').

Attitudes toward potential change in interactions with patients A consultant was wary of losing all face-to-face contact with patients in 'streamlined' clinics ('*at some point someone physically should see the patient, whether that's at a year, or whether after two years*') and a doctor stated that patients should be informed of any change to their care (i.e. '*why they are being removed from that sort of clinic, and they know they can come back into it at any time should any problems be cited, then I think it's fine*'). While positive overall about the reduced waiting time for patients in 'streamlined' clinics, a technician expressed some concern about pressure to test patients in the allotted time (*'you are still giving them care, but because you know there is a patient outside waiting to come in, you're trying to go down the line, you're trying to do the visual fields as best you can, then pass it on to the next technician doing the photographs, but with the time gap you've got, you haven't got that much time, I wouldn't say to relax, but you haven't got that much leeway if the patients make a mistake'*).

Availability of organisational resources to support innovation The start date for piloting the 'streamlined' clinic was delayed by approximately 18 months due to difficulties with: securing access to a hospital space for testing the equipment ('*we have a space committee that tells us when we can use the space, which is empty half the time*'); arranging contracts for suppliers employed to support the linking of equipment and technology ('*we just work very much on an ad-hoc basis*'); and lack of an organisation-wide forum for supporting the development and implementation of new ideas ('*There is no formal structure to say we have an idea, we will go to this person, or we'll have a meeting with this group of people to help us*').

4.1.2 Potential enablers of the implementation of innovation

Use of data to evaluate existing and prospective services To aid the reaching of agreement concerning the planning and implementation of change, a Trust manager described the importance of such data to allow different stakeholders to understand the implications of different options for change or maintaining the status quo: ('*people's perceptions of what happened were very, very skewed… if you go away and actually dig round and find out what the reality is then you're able to present an argument that made more sense*').

Involving a range of stakeholders in the planning of innovation The receptiveness of staff to change in the delivery of services may be stronger where they are engaged in the planning and development of services, as a consultant suggested in relation to the redesigning of staff roles within existing clinics ('*People seem to get more value out of this and understanding if you sit down and go through the whole process with them, they can understand it*'). Similarly, a contractor working with the Trust on the development of 'streamlined' clinics stressed the importance of communicating with staff during the design process ('*you can't communicate too much actually… it's going forward, here it is, and obviously deliver and then hold their hand through the delivery phase'*').

4.2 Operational research

4.2.1 Analytical model

An analytical model was developed to illustrate the impact of the chronicity of the glaucoma disease on demand for outpatient appointments using routinely collected administrative data (Appendix 3). The model starts from 0 patients and assumes a stable stream of 10 new referrals per week for one consultant's clinic over a 15 year period (Figure 1). The case mix includes complex, unstable or surgical cases and stable patients. The data obtained suggests that about 30% of new referrals to the clinic and 8% of those on 12-month interval are discharged, with a much smaller discharge rate for those under the service for shorter follow-up periods. The tool can be used to demonstrate the likely impact of different discharge rates and of changes to follow-up intervals on weekly demand for appointment in the clinic.

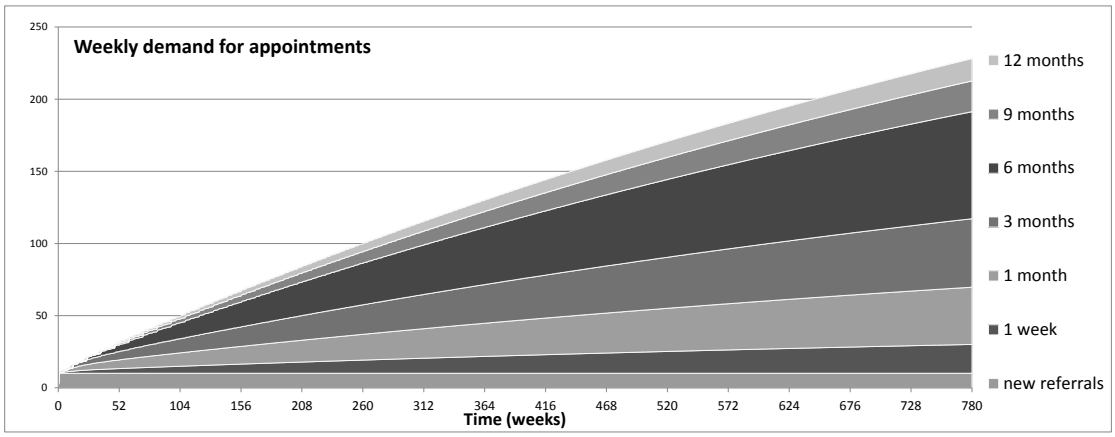

Figure 1: Projected weekly demand (number of patients) for an outpatient glaucoma clinic based on retrospective data obtained from Moorfields Eye Hospital glaucoma service over a 3 month period.

4.2.2 Process maps

Process maps of a typical glaucoma outpatient clinic as observed at City Road and that of a satellite clinic (St George's hospital) with redesigned staff roles (to enable "single piece flow") are included in Appendix 4. It was not possible to produce a process map of the 'remote review' clinic due to delay in the clinic being set up. Routinely collected administrative data from two City Road clinics and one clinic running at St George's Hospital were analysed (Appendix 5 and 6). The analysis showed that the two City Road clinics scheduled a similar number of appointments per week (mean 68 and 78 respectively) while the clinic at St George's scheduled about 23 patients on average per week. Similar differences were found in the ratio of new to follow-up appointments. The two City Road clinics had 5% and 9% respectively of all appointment slots allocated to new referrals. At the satellite clinic the percentage of new referrals was higher (18%). The practice of long periods of monitoring and its impact on resources was reflected in the data. In the two City Road clinics, patients with four or fewer appointments accounted for 20% of total appointment slots available while patients with five or more appointments were scheduled to the remaining 80% of slots. In the St George's clinic, patients with five or more appointments were scheduled to only 20% of the slots available. We also looked at the number of patients that that did not return for a follow-up appointment within 18 months of their last appointment. Again we identified differences between the two City Road clinics (17-22%

of patients did not return for an appointment) and St George's (48% of patients did not return within 18 months). The final outcome of these patients could not be determined from the available data.

4.3 Cost and cost effectiveness

4.3.1. Main cost components

In an economic analysis comparing new ways of diagnosing and monitoring chronic eye disease with existing approaches, there are likely to be differences in costs incurred by the NHS and by patients, and therefore both cost perspectives ought to be considered. Analyses ought to include all cost components that may potentially differ between new and existing services. When taking an NHS perspective, the following costs ought to be taken into account:

- Staffing costs, based on time inputs (patient and non-patient contact). Streamlined clinics are likely to require inputs from two technicians to undertake tests, a health care assistant to interact with patients, and a consultant to separately review patient notes and test results and make management decisions. Traditional clinics are likely to require inputs from technicians to undertake tests and more substantial input from consultants interacting with patients and making management decisions.
- Capital costs (visual fields machines, information technology to facilitate consultant review, separated by recurring and non-recurring costs).
- Medical supplies (e.g., consumables).
- Staff training (trainers and trainees).

From the perspective of patients the following ought to be taken into account:

- Travel costs incurred when travelling to appointments.
- Costs incurred by time away from work or usual activities.

4.3.2. Resource use and unit cost data

Resource use data are required on time inputs by staff (minutes per patient contact by staff type), capital expenditures (monetary amounts combined with data on equipment lifetime and usage), quantity of medical supplies used, and time inputs into staff training (trainers and trainees). Unit cost data can be taken from administrative data,[4,5,6] previously published studies (identified from the NHS Economic Evaluations Database)[7] and/or local Trust's finance department.

4.3.3. Potential outcomes measures

Based on an interview with a representative from a charity for people living with glaucoma, the new clinics are likely to have an effect on (1) waiting time (if patients are seen and treated more quickly in the new clinic) and (2) patient satisfaction (if patients are seen more quickly, patient satisfaction may increase, but potential sources of dissatisfaction include not seeing a consultant ophthalmologist face-to-face and not being able to have discussions in the clinic with a range of members of the clinical team (e.g. for reassurance)). Dissatisfaction may affect attendance. Potential outcome measures are therefore patient waiting time, patient satisfaction and 'Did Not Attend' ('DNA') rate. We also considered the suitability of measuring outcomes in terms of quality-adjusted life years (QALYs), which combine length of life and quality of life and are the recommended outcome for use in economic evaluations in the UK.[8] It would be appropriate to measure QALYs if we expected there to be differences in health outcomes between new and current services, but the expectation is that there will not be such differences; this would need to be confirmed empirically, but if it was the case then it would not be necessary to measure QALYs.

4.3.4. Sources of outcomes data

Outcomes (waiting time, patient satisfaction, DNA rates) could be collected prospectively for new and existing services. Some data may have been collected previously for existing services, so this could be accessed retrospectively. Waiting times and DNA rates could be collected from patient records; patient satisfaction would need to be collected using patient satisfaction questionnaires.

4.3.5. Potential sources of data to estimate long-term costs and outcomes

Given the recommended outcome and cost measures, estimation of long-term costs and outcomes would not be necessary.

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[4] Curtis L. Unit Costs of Health and Social Care 2011. PSSRU: University of Kent, 2011.
[5] Department of Health. National Schedule of Reference Costs - Year 2011-12 - NHS trusts and NHS foundation trusts: NHS own costs. Department of Health: London, 2012.
[6] British National Formulary 66 (September 2013 – March 2014)
[7] http://www.crd.york.ac.uk/CRDWeb/
[8] National Institute for Health and Care Excellence (NICE). Guide to the methods of technology appraisal 2013. NICE: London, 2013. http://publications.nice.org.uk/pmg9

5. Lessons for future implementation

We have produced a framework for evaluating service innovation which would form the basis of a future study with Moorfields should the Trust implement 'streamlined' clinics more widely (Appendix 1). The table outlines the three dimensions along which we suggest service innovation should be evaluated (implementation research, operational research, cost and cost-effectiveness), including suggested research questions or topics, research methods, and forms of analysis. We have the following additional recommendations for the Trust stemming from the three aspects of this feasibility study:

Implementation research

- To address the organisational complexity of 'traditional' clinics as well as focus on the implementation of 'streamlined' clinics.
- To recognise that views on service innovation, and its implications for staff, vary within and across different professional groups.
- To encourage forums which are sensitive to the expression and negotiation of professional differences in the planning and implementation of change.
- To establish an organisation-wide multi-professional forum for prioritising, planning, and resourcing the implementation of service innovation.

Operational research

- To use explicit maps of intended vs observed patient journeys through outpatient clinic for patients on different follow-up protocols as a way of addressing complexity of existing clinics.
- To explore available commercial/consultancy solutions for scheduling patients to existing clinics.

Cost and cost effectiveness

- To ensure that DNA rates, waiting times and patient satisfaction are collected routinely.

6. Outputs

Kotecha, A., Turner, S., Vasilakis, C., Utley, M., Fulop, N., Azuara-Blanco, A., Foster, P.J. (2014). 'Improving care and increasing efficiency – challenges in the care of chronic eye diseases' (Editorial), *Eye* (in press). See Appendix 2.

Turner, S., Vasilakis, C., Utley, M., Foster, P., Kotecha, A., Morris, S., Fulop, N. (2014). 'Developing and implementing health service innovation in glaucoma outpatient clinics', Health Services Research Network (HSRN) Symposium 2014, Nottingham, UK, 19-20 June.

Turner, S., Vasilakis, C., Utley, M., Foster, P., Kotecha, A., Morris, S., Fulop, N. (2014). 'Developing and implementing health service innovation in glaucoma outpatient clinics: the problem of aligning multiple public and private organisational actors', 9th Biennial International Conference in Organisational Behaviour in Healthcare Conference (OBHC), Copenhagen, Denmark, 23-25 April. See Appendix 7.

Vasilakis C, Yalabik B, Turner S, Kotecha A, Foster M, Morris S, Utley M, and Fulop N (2014) Evaluating an innovative approach to the diagnostic processes for glaucoma: the role for operational research in a mixed methods study (Abstract) The 40th meeting of the EURO Working Group on Operations Research Applied to Health Services ORAHS, Jul 2014, Lisbon, Portugal.

7. Future dissemination and research plans

We will hold a short workshop with a cross-section of staff from Moorfields Eye Hospital in September 2014 to feed back our findings, lessons learned from this study for the Trust, and establish priorities for further research to inform submissions to major research funders such as the National Institute for Health Research (NIHR). A paper summarising the findings from the implementation research will be submitted to the journal of *Social Science & Medicine* in August 2014.

Appendix 1 Framework for evaluating service innovation

Evaluation dimension	Method	Analysis
Implementation research to understand organisational context and patients' views		
How are different professional groups involved in, and affected by, the implementation of change?	Semi-structured interviews with representatives of different professional groups; focus group with multiprofessional group	Describe the planning and implementation of innovation from the perspective of different professional groups (e.g. identify 'core' and 'peripheral' groups and 'winners' and 'losers')
What underlying social and organisational factors may inhibit or support the implementation of innovation?	Record observations of interactions between different professional groups within clinics and other spaces where staff interact e.g. clinical governance meetings	Framework analysis of barriers to, and enablers of, implementation within the organisational context, drawing on literature from organisation studies and implementation science
What happens to innovations at different periods of time following implementation?	Conduct follow-up interviews with key stakeholders and repeat observations to assess adherence and wider adoption over time	Short narratives highlighting key influences on extent to which innovations sustained over time
What are patients' perceptions of existing and proposed services?	Focus groups with patients/carers and patient organisations	Summary of patients' perceptions, inc. positive and negative views
Operational research		
What level of improvement to the efficient use of resources is required to meet the challenge presented by anticipated increases in the burden of disease?	Model of future demand based on applying current follow-up protocols in context of forecast changes in demographics, incidence and prevalence.	Analysis of output from a number of plausible and best case / worst case scenarios given quantitative scale of service expansion required in absence of change to clinical protocols or clinic design.
What level of improvement to the efficient use of resources and patient access metrics could potentially be made through redesign of existing clinics but not using remote clinics?	Iterative use of model developed above to explore potential impact of changes to follow-up protocols. Review of OR literature on the scale of theoretical and delivered improvements to outpatient clinic operation with a focus on applicability to context of glaucoma.	Assessing plausibility of meeting anticipated future demand solely through revised follow-up protocol. Preparation of scenarios to facilitate qualitative research on professional acceptability of revised follow-up protocols. Quantitative synthesis to gauge plausibility of meeting anticipated future demand solely through changes to clinic organization.
What improvements to the efficient use of resources and patient access metrics would be expected if proposed service implemented as envisaged?	Use of demand model to explore implications of remote clinics. Simulation techniques of current and proposed protocols for clinic organisation (with and without remote clinics).	Analysis of model output to indicate scale of any theoretical improvements associated with redesigned services and to inform capacity planning. Feasibility of meeting anticipated future demand through adoption of remote clinics, alone or in combination with revised protocols for follow-up.
Cost and cost-effectiveness of new services		
Costs	Resource use data on time inputs by staff (minutes per patient contact by staff type), capital expenditures (monetary amounts combined with data on equipment lifetime and usage), quantity of medical supplies used, and time inputs into staff training (trainers and trainees). Unit cost data can be taken administrative data, previously published studies (identified from the NHS Economic Evaluations Database) and/or local Trust's finance department.	Multiply resources used and unit costs for each cost component and sum across all cost components to calculate mean costs per patient with new and existing services.
Outcomes	Waiting times, DNA rates collected prospectively from patient records, and patient satisfaction collected using questionnaires.	Summary statistics for new and existing services.

Appendix 2 Editorial in *Eye* (in press)

Editorial/ commentary

Improving care and increasing efficiency – challenges in the care of chronic eye diseases

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In March 2010, the government announced its Quality, Innovation, Productivity and Prevention (QIPP) initiative for England, which aimed to make £20 billion of efficiency savings in the NHS by 2015. [1] The scheme calls for reduction in hospital-based care through an increase in care closer to home, efficiency through new technology and innovation through medical research. [2]

As with most industrialised nations, the UK population is living longer; in 2010, there were 19 million individuals over the age of 60 years and this number is predicted to increase to 28 million by 2035. [3] Whilst evidence suggests that most people are enjoying more healthy older age now than ever before, older people are still at a greater risk of developing disease and remain disproportionate users of healthcare services. [4] Within ophthalmology, there is an increase in prevalence of age-related macular degeneration (AMD), diabetic retinopathy (DR) and glaucoma, all of which are potentially blinding conditions that frequently require lifelong monitoring, and often treatment, to prevent irreversible visual loss. [5-8]

Use of hospital outpatient services for ophthalmology ranked second only to orthopaedics and trauma (6.3 versus 7.1 million outpatient appointments in 2011-12, respectively). Hospital eye care accounts for 8.6% of all outpatient activity in NHS England. For example, at Moorfields Eye Hospital NHS Foundation Trust, glaucoma and medical retina follow up appointments constituted 146,707 attendances over the 2011/12 period, accounting for 45% of all follow up attendances across the Trust. With the 2014/2015 National Tariff Payment System recommending prices for ophthalmology out-patient services at approximately £100 for new patient and approximately £85 for follow up consultant-led attendances, [9] these attendances represent a major and ever increasing cost burden. Total costs will only increase when we consider the implementation of the 2009 NICE guidelines which prompted a considerable increase in the number of glaucoma-suspect referrals, [10, 11] and the advent of new treatments (such as anti-VEGF injections) for AMD [12] and more recently DR [13] that require regular administration and patient monitoring by ophthalmologists.

The increasing prevalence of chronic eye diseases, increasingly widespread use of diagnostic technology by opticians, and the chronicity of these conditions have been taken into consideration by some hospital eye departments to predict capacity problems in meeting demand for ophthalmology out-patient services. [14-16] To illustrate this, we have developed a model based on appointment interval outcome data obtained from patients attending the Glaucoma Service at Moorfields Eye Hospital between April 1st and June 30th 2013. The model starts from 0 patients and assumes a stable stream of 10 new referrals per week for one consultant's clinic. The case mix includes complex, unstable or surgical cases and stable patients. The data obtained suggests that about 30% of new referrals to the clinic and 8% of those on 12-month interval are discharged, with

a much smaller discharge rate for those under the service for shorter follow-up periods. Figure 1 illustrates the predicted weekly demand for appointments in this new consultant's service over a 15 year period.

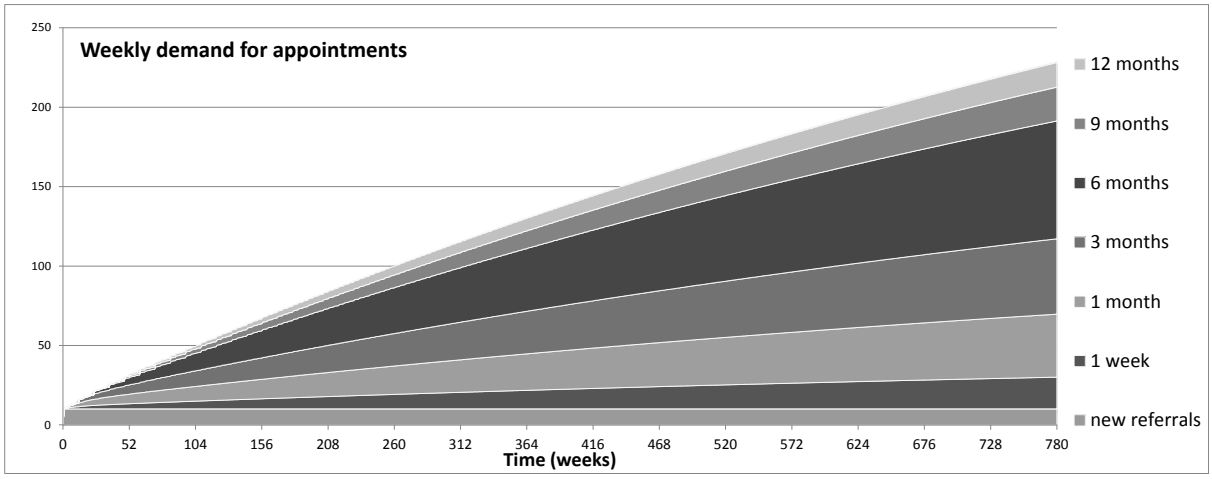

Figure 1: Projected weekly demand (number of patients) for an outpatient glaucoma clinic based on retrospective data obtained from Moorfields Eye Hospital glaucoma service over a 3 month period. The interval for follow-up appointment in the new clinic ranges from a single week to 12 months and there are 10 new referrals to the clinic every week.

Secondary care providers are under increasing pressure to keep new to follow-up ratios at or less than 1:2.5, with penalties being imposed if targets are not met. [17] However, ophthalmology departments often have very different new to follow-up ratios [18] as patients with chronic eye disease cannot be discharged to a primary care setting. Guidelines that outline the recommended intervals for patient monitoring have been developed to ensure that patients are monitored at intervals appropriate to their risk of disease progression and visual loss. [19, 20] Bringing patients back too frequently increases demand for appointments and may result in overbooked clinics, which in turn may lead to inappropriate appointment rescheduling. Delays in appointments have implications for patient safety. [21, 22]

There are a number of approaches to meeting the increasing demand for services. One is to increase clinic capacity, [23] which, although may in the short-term lead to a reduction of waiting times, is not be a viable long-term solution (as Figure 1 demonstrates). Another is to implement community eye care schemes, whereby 'stable' patients may be discharged from secondary care to be followed up within the community, usually by suitably trained optometrists. Whilst there has been a drive towards this model of care, [24] the anecdotal evidence suggests that the success of such schemes is very much dependent on a high level of secondary care input and overall supervision. [25] Furthermore, there is a concern that moving care from secondary to primary settings may be at the

expense of care quality and that costs for such services are often greater than expected. [26, 27] Whilst there are a number of successful community models of primary care ophthalmology that improve the quality of new referrals into secondary care [28-32], there is a scarcity of evidence concerning the viability of community monitoring services for people with stable eye diseases. Furthermore, there is evidence to suggest that non-attendances to non-ophthalmologist-led community services are greater than those in NHS secondary care settings. [33]

Even with such community schemes, there will always be a number of patients who are not suitable for, or who do not want, community monitoring. These patients need to be managed efficiently within the acute NHS setting.

In the care of chronic ophthalmic disease, the patient journey time per outpatient appointment can be lengthy [34] and depends on the number of pre-consultation monitoring tests and the availability of tests/staff on the day. Recommended guidelines for frequency of testing are often not followed due to time constraints within busy outpatient settings, [35] which may be detrimental to the patient. Whilst regular patient monitoring is necessary, there is no doubt that a more efficient approach to patient care is required if the hospital eye service is to cope with increasing demand.

Efficiency may sometimes be misinterpreted as a 100% utilisation of resources. [23, 36] This approach can lead to an increase in 'time wastage' whereby time is wasted triaging, prioritizing and managing patients rather than being used to diagnose and treat patient conditions. A more efficient use of resources would be to reorganise patient flow through the system. Patient flow describes the flow of patients between staff, departments and organisations through the care pathway. Poor patient flow increases the likelihood of harm to patients and increases healthcare costs when 'unnecessary' processes waste precious resources. [37]

The issue of optimising patient flow through ophthalmology clinics is not new and is being addressed by NHS and independent sector providers. As an example, The Royal Hallamshire Hospital in Sheffield has for over 20 years run a virtual Glaucoma Monitoring Unit for stable glaucoma patients, staffed by technicians. The service removes the face-to-face ophthalmologist consultation and data is reviewed remotely by a consultant ophthalmologist (personal communication Mr. S Longstaff, January 15th 2014). The average patient journey time is 40 minutes, with a review/GP and patient information turnaround of 2 weeks. A similar model for glaucoma care is run by an independent sector provider, [38, 39] although this model utilises specialist trained optometrists for the face-to-face consultation, with consultant ophthalmologist remote review of data to ratify clinical decisions. Both services make use of the electronic patient record (EPR) to deliver their service. Whilst the "virtual" approach has been used to facilitate specialist ophthalmological consultation in remote areas, [40, 41] these examples support the

possibility of removing some face-to-face doctor consultations as a more efficient way to manage some patients *within* the NHS. [42]

The NHS Operating Framework 2012/13 encourages Clinical Commissioning Groups to adopt innovation within their local reconfiguration plans, and cites removal of the face-to-face consultation as an efficient method to deliver care. [43] The use of this type of model remains contentious, may have unintended consequences, and needs to be assessed alongside, and relative to, other interventions to improve quality and efficiency. [44, 45]

Within the NHS, implementation of redesigned services may be inhibited by a lack of clinical engagement due to disagreement about their purpose, resistance to standardisation, and their perceived relevance to only some clinical groups. [46] There may be difficulties with aligning different managerial and clinical groups in the context of clinical service redesign, [47, 48] as well as changing inter-professional relationships. [49] A further barrier to the success of any new NHS care pathway is a lack of evidence on effectiveness, cost-effectiveness, viability, sustainability, safety and acceptability to patients and clinicians. The approach to such evaluations should combine the question 'what works, at what cost?' with a study of the development, implementation and sustainability of these models, including the views of the multiple stakeholders likely to be affected by the implementation. [50, 51] Ongoing evaluation of services, that may include non-participant observation or ethnographic methods, [52] coupled with analysis of outcomes, costs and modelling should be used to identify aspects of the organisational context that influence the implementation of change and to support the iterative development of services that builds on such evidence.

In the current climate of increasing demand and limited clinic capacity, radical change in provision is needed, but without good quality evidence, NHS ophthalmology providers will remain divided in their approach to the care of chronic eye disease. Ophthalmology services are in critical need of robust evaluation to determine which clinical pathways best suit the increasing demand for services. Without evaluation, we run the risk of taking distinctly disparate approaches to care with little idea of what is best for the patient.

References

1. *The NHS Quality, Innovation, Productivity and Prevention Challenge: an introduction for clinicians*, D.o. Health, Editor 2010.
2. Department of Health, *Making the NHS more efficient and less bureaucratic*, 25 March 2013.
3. Office for National Statistics, *National Population Projections, 2010-Based Statistical Bulletin*. 26 October 2011. http://www.ons.gov.uk/ons/dcp171778_235886.pdf
4. Rice, D.P. and N. Fineman, *Economic implications of increased longevity in the United States.* Annu Rev Public Health, 2004. **25**: p. 457-73.
5. Quigley, H.A. and A.T. Broman, *The number of people with glaucoma worldwide in 2010 and 2020.* Br J Ophthalmol, 2006. **90**(3): p. 262-267.
6. Ngai, L.Y., et al., *The prevalence and analysis of risk factors for age-related macular degeneration: 18-year follow-up data from the Speedwell eye study, United Kingdom.* Eye (Lond), 2011. **25**(6): p. 784-93.
7. Minassian, D.C., et al., *Modelling the prevalence of age-related macular degeneration (2010-2020) in the UK: expected impact of anti-vascular endothelial growth factor (VEGF) therapy.* Br J Ophthalmol, 2011. **95**(10): p. 1433-6.
8. Minassian, D.C., D.R. Owens, and A. Reidy, *Prevalence of diabetic macular oedema and related health and social care resource use in England.* Br J Ophthalmol, 2012. **96**(3): p. 345-9.
9. Monitor. *2014/15 National Tariff Payment System: Annex 5A - National prices*. Available from: http://www.monitor.gov.uk/NT.
10. Shah, S. and I.E. Murdoch, *NICE - impact on glaucoma case detection.* Ophthalmic Physiol Opt, 2011. **31**(4): p. 339-42.
11. de Silva, S.R., et al., *There is a trend for the diagnosis of glaucoma to be made at an earlier stage in 2010 compared to 2008 in Oxford, United Kingdom.* Ophthalmic Physiol Opt, 2013. **33**(2): p. 179-82.
12. Lanzetta, P., et al., *Different antivascular endothelial growth factor treatments and regimens and their outcomes in neovascular age-related macular degeneration: a literature review.* Br J Ophthalmol, 2013.
13. Zhao, L.Q., et al., *A systematic review and meta-analysis of clinical outcomes of vitrectomy with or without intravitreal bevacizumab pretreatment for severe diabetic retinopathy.* Br J Ophthalmol, 2011. **95**(9): p. 1216-22.
14. Chalk, D. and M. Smith, *Guidelines on glaucoma and the demand for services.* British Journal of Healthcare Management, 2013. **19**(10): p. 476-481.
15. RNIB *Saving money, losing sight. RNIB campaign report* November 2013.
16. Smith, R. *Our ophthalmology service is "failing", please help!* Professional Standards Committee, 15 August 2013.
17. Committee, R.P.S., *New to Followup ratios in ophthalmology outpatient services*, 2011.
18. Sparrow, J.M., *How nice is NICE?* Br J Ophthalmol, 2013. **97**(2): p. 116-7.
19. NICE, *National Institute of Clinical Excellence (NICE) guidance CG85 Glaucoma: diagnosis and management of chronic open angle glaucoma and ocular hypertension*, April 2009.
20. RCOphth, *The Royal College of Ophthalmologists - Age-related Macular Degeneration: Guidelines for Management*, September 2013.
21. Tatham, A. and I. Murdoch, *The effect of appointment rescheduling on monitoring interval and patient attendance in the glaucoma outpatient clinic.* Eye (Lond), 2012. **26**(5): p. 729-33.
22. *Preventing delay to follow-up for patients with glaucoma*, 2009, National Patient Safety Agency: London.

23. Silvester, K., et al., *Reducing waiting times in the NHS: is lack of capacity the problem?* Clinician in Management, 2004. **12**(3): p. 105 -10.
24. Department of Health, *Our health, our care, our say: a new direction for community services*, 2006: London.
25. McLeod, H., et al., *Evaluation of the chronic eye care services programme: final report*, N.E. Pathways, Editor 2006.
26. Coast, J., et al., *Comparing costs of monitoring glaucoma patients: hospital ophthalmologists versus community optometrists.* J Health Serv Res Policy, 1997. **2**(1): p. 19-25.
27. Sibbald, B., R. McDonald, and M. Roland, *Shifting care from hospitals to the community: a review of the evidence on quality and efficiency.* J Health Serv Res Policy, 2007. **12**(2): p. 110-7.
28. Ghazawy, S., M. Saldana, and M. McKibbin, *Patient pathways for macular disease: what will the new optometrist with special interest achieve?* Eye (Lond), 2007. **21**(4): p. 553-4; author reply 552-3.
29. Parkins, D.J. and D.F. Edgar, *Comparison of the effectiveness of two enhanced glaucoma referral schemes.* Ophthalmic Physiol Opt, 2011. **31**(4): p. 343-52.
30. Trikha, S., et al., *The Portsmouth-based glaucoma refinement scheme: a role for virtual clinics in the future?* Eye (Lond), 2012. **26**(10): p. 1288-94.
31. Amoaku, W., et al., *Action on AMD. Optimising patient management: act now to ensure current and continual delivery of best possible patient care.* Eye (Lond), 2012. **26 Suppl 1**: p. S2-21.
32. Ratnarajan, G., et al., *The effectiveness of schemes that refine referrals between primary and secondary care--the UK experience with glaucoma referrals: the Health Innovation & Education Cluster (HIEC) Glaucoma Pathways Project.* BMJ Open, 2013. **3**(7).
33. Mandalos, A., et al., *Shared care of patients with ocular hypertension in the Community and Hospital Allied Network Glaucoma Evaluation Scheme (CHANGES).* Eye (Lond), 2012. **26**(4): p. 564-7.
34. Glen, F.C., H. Baker, and D.P. Crabb, *A qualitative investigation into patients' views on visual field testing for glaucoma monitoring.* BMJ Open, 2014. **4**(1): p. e003996.
35. Malik, R., et al., *A survey of attitudes of glaucoma subspecialists in England and Wales to visual field test intervals in relation to NICE guidelines.* BMJ Open, 2013. **3**(5).
36. Allder, S., P. Walley, and K. Silvester, *Is follow-up capacity the current NHS bottleneck?* Clin Med, 2011. **11**(1): p. 31-4.
37. Foundation, T.H., *Improving patient flow: Learning Report*, 2013: London.
38. Diamond, J., *Waiting times in glaucoma care*, in *Health Service Journal*28 May 2010.
39. Havard, J., *A mobile clinic for glaucoma patients*, in *Pulse Today*26 February 2013.
40. Hautala, N., et al., *A mobile eye unit for screening of diabetic retinopathy and follow-up of glaucoma in remote locations in northern Finland.* Acta Ophthalmol, 2009. **87**(8): p. 912-3.
41. Kassam, F., et al., *The use of teleglaucoma at the University of Alberta.* J Telemed Telecare, 2012. **18**(7): p. 367-73.
42. Tuulonen, A., *Challenges of glaucoma care -- high volume, high quality, low cost.* Acta Ophthalmol, 2013. **91**(1): p. 3-5.
43. Department of Health, *The Operating Framework for the NHS England 2012/13*.
44. Jacklin, P.B., et al., *Virtual outreach: economic evaluation of joint teleconsultations for patients referred by their general practitioner for a specialist opinion.* BMJ, 2003. **327**(7406): p. 84.
45. Gornall, J., *Does telemedicine deserve the green light?* BMJ, 2012. **345**: p. e4622.
46. Evans-Lacko, S., et al., *Facilitators and barriers to implementing clinical care pathways.* BMC Health Serv Res, 2010. **10**: p. 182.
47. Wilson, T. and K. Sweeney, *Doctors and managers. "You just don't understand".* BMJ, 2003. **326**(7390): p. 656.

48. Marshall, M.N., *Doctors, managers and the battle for quality.* J R Soc Med, 2008. **101**(7): p. 330-1.
49. Ingram, D.V. and L.E. Culham, *Ophthalmologists and optometrists--interesting times?* Br J Ophthalmol, 2001. **85**(7): p. 769-70.
50. Webster, A.j., *Health Technology and Society*. A Sociological Critique. 2007, Basingstoke: Palgrave Macmillan.
51. Fulop, N., et al., *Innovations in major system reconfiguration in England: a study of the effectiveness, acceptability and processes of implementation of two models of stroke care.* Implement Sci, 2013. **8**: p. 5.
52. Dixon-Woods, M., et al., *Explaining Michigan: developing an ex post theory of a quality improvement program.* Milbank Q, 2011. **89**(2): p. 167-205.

Appendix 3 Analysis of routinely collected data from Moorfields Eye Hospital glaucoma outpatient clinics

Preamble

The anonymised data were received from MEH in February 2014 [file *Glaucoma Attendances (Apr – Jun 2013).xls*]. The total number of records obtained was 21848 and relate to outpatient appointments in all MEH glaucoma clinics (including satellite sites) over the period between 1 April 2013 and 30 June 2013 (3 months). The data were anonymised at source and no patient identifiers were included. The main purpose of this analysis was to estimate the values of the input parameters used in the prototype spreadsheet tool that was developed as part of the study.

Descriptive analysis

The dataset received contained 21848 records with the following information:

- Pseudonymised Referral Number,
- Pseudonymised Hospital Number,
- Attendance Date,
- Attendance Datetime,
- Clinic,
- SiteCode (13 codes),
- SpecialtyName (only one value 'GLAUCOMA'),
- Appointment Type ('New' or 'Follow up'),
- PathwayAttendanceNumber (ie number of previous visits),
- Previous GL Atttendance (date),
- Next GL Atttendance (date).

Only City Road clinics were included in the analysis (code 'CR' in variable SiteCode). In addition, the clinic codes {GLCRPF, GLCRPK, GLCRUV, GLCRJB} in variable Clinic were excluded from the remaining analysis resulting in a dataset with 9227 records.

Table 1. New vs. follow-up appointments (new appointment to follow up ratio approximately 1:12).

Year	#	%
New	716	92.2
Follow up	8511	7.8
Total	*9227*	*100*

Table 2. Number of appointments by clinic code (all City Road clinics).

Clinic code	# of appointments	Clinic code	# of appointments
GLCRAK	23	GLCRNS	377
GLCRAV	782	GLCRO1	74
GLCRAVM	86	GLCRPD1	99
GLCRAVT	71	GLCRPL	14
GLCRDG	923	GLCRPO	134
GLCRDS	501	GLCRPP	722
GLCRE1	2	GLCRPR	626
GLCRES	11	GLCRSAV	73
GLCRGE	217	GLCRSC	3
GLCRJBSPC	23	GLCRSDG	76
GLCRJBW	245	GLCRT	383
GLCRKB	793	GLCRT2	4
GLCRKM	890	GLCRWL	27
GLCRL1	39	GLCRWN	647
GLCRL4	65	GLCRWNT	450
GLCRMP	630	PHCR	45
GLCRNE	106	PHCRW	66
		Grand Total	*9227*

Follow up interval analysis

The previous appointment follow up interval was calculated as the difference between the values in the variables [Attendance Date] and [Previous GL Attendance] expressed in weeks and rounded to the next higher integer. Similarly, the next appointment follow up interval was calculated as the difference between the values in the variables [Attendance Date] and [Next GL Attendance] date.

Table 3. Number of patients according to previous and next appointment intervals.

	Next appointment interval							
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Un-known	Total
1 week	302	280	29	16	5		28	660
1 month	256	663	379	168	14		71	1551
3 months	97	272	534	549	45	2	144	1643
6 months	27	129	421	1231	211	11	424	2454
9 months	8	37	133	342	138	7	432	1097
12 months	1	28	82	208	66	3	641	1029
New referrals	15	69	148	101	36	3	344	716
Unknown								77
Total								*9227*

Table 4. Percentage of patients according to previous and next appointment intervals.

	Next appointment interval						
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Unknown
1 week	45.76	42.42	4.39	2.42	0.76	0.00	4.24
1 month	16.51	42.75	24.44	10.83	0.90	0.00	4.58
3 months	5.90	16.56	32.50	33.41	2.74	0.12	8.76
6 months	1.10	5.26	17.16	50.16	8.60	0.45	17.28
9 months	0.73	3.37	12.12	31.18	12.58	0.64	39.38
12 months	0.10	2.72	7.97	20.21	6.41	0.29	62.29
New referrals	2.09	9.64	20.67	14.11	5.03	0.42	48.04

In the following results, we also excluded new referrals and 41 records with no previous appointment date, giving a total of 8470 records

Table 5. Number of appointments and interval of follow up appointment (excludes new referrals; interval calculations were calculated as the difference in weeks between the previous and current date of appointment in each record; fractional intervals rounded to the next higher integer).

Actual interval	**Count**	**%**	**Potential interval values in a simple model***	**%**
Unknown	36	0.4	-	
1 week	660	7.8	1 week	8
2-6 weeks	1551	18.3	1 month	18
7-17 weeks	1643	19.4	3 months	20
18-30 weeks	2454	29.0	6 months	29
31-41 weeks	1097	12.9	9 months	13
≥42 weeks	1029	12.1	12 months	12
	8470	100		100

* a model in which the intervals are applied uniformly to all new and follow up patients

Model output

Table 6. Hypothetical proportions of patients by appointment follow up interval and discharge rates.

	Next appointment interval							
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Discharge	Total
1 week	0.5	0.3	0.2	0	0	0	0	1
1 month	0.1	0.4	0.3	0.2	0	0	0	1
3 months	0	0.2	0.5	0.2	0.1	0	0	1
6 months	0	0	0.2	0.5	0.2	0	0.1	1
9 months	0	0	0.1	0.2	0.4	0.1	0.2	1
12 months	0	0	0	0.1	0.2	0.4	0.3	1
New referrals	0.1	0.2	0.1	0.2	0.1	0	0.3	1

The following figure has been generated by the model using the data in Table 6 as input parameters. The number of new referrals was fixed at 10 patients per week.

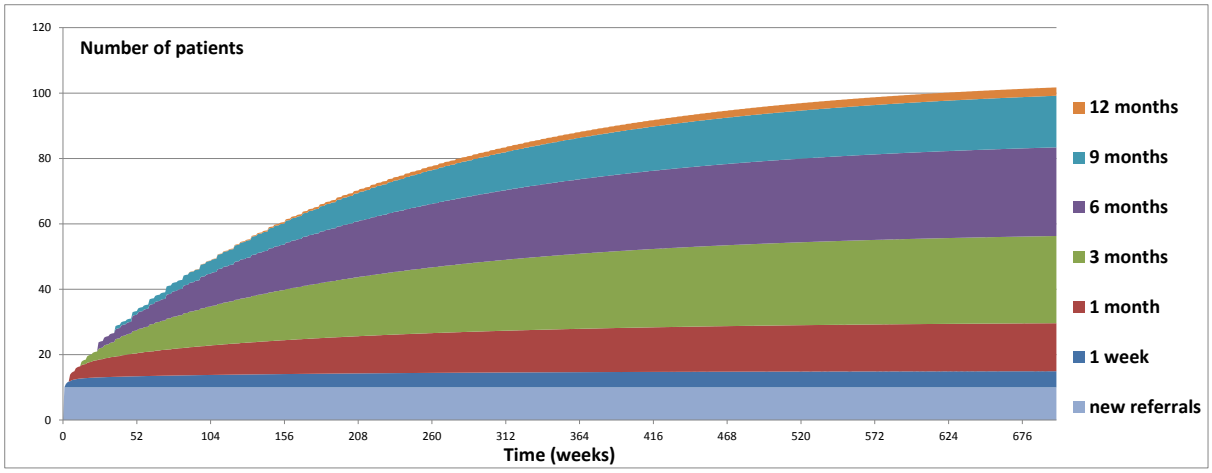

Figure 1. Projected weekly demand for outpatient clinic appointments using hypothetical input parameters.

New dataset (6 March 2014)

The data for this analysis were provided by MEH on 6th March 2014. It contains 21,849 records (one more than the first version) and an additional number of variables. In putting this dataset together, an effort was made by MEH to reduce the number of records with no information about the next appointment date and additional information about the next patient event was provided. As explained in accompanying email, in this new dataset:

> "'Next GL Attendance' has now been replaced with 'Next GL Appointment' & 'Attendance Status'. This means that GL patients whose next appointment was DNA'd, cancelled or is yet to be attended are now captured.
>
> There are still 1,300 (6%) attendances for which a future GL appointment cannot be found (marked as 'NULL'). For these rows I've tried to detect the next recorded 'Patient Event'. Here the next patient event could be an outpatient appointment in another service, or an inpatient admission or a discharge record, for a full breakdown see pivot table on 'Sheet 2'. Note that these events may not necessarily be on the same referral pathway at the original GL attendance".

In total, the number of records without next appointment date was reduced from 6044 to 1336. The number of records without next appointment date for the clinics included in the analysis was reduced from 2069 to 355. However, the number of records without previous appointment date for the clinics included in the analysis was increased from 753 to 1731 (consistent with the rise in the entire dataset, from 2327 records to without a previous appointment date to 4586). Out of 1731 records without a previous appointment date, 716 are classified as new referrals.

Table 7. Number of patients according to previous and next appointment intervals.

	Next appointment interval							
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Un-known	*Total*
1 week	367	257	28	18	6		1	677
1 month	259	620	367	167	14	13	10	1450
3 months	101	261	520	535	68	25	10	1520
6 months	30	124	396	1257	335	109	23	2274
9 months	10	31	111	319	273	173	16	933
12 months	4	17	44	111	95	320	49	640
New referrals	27	84	156	126	56	68	199	716
Unknown	87	142	202	313	111	116	47	1018
Total	885	1536	1824	2846	958	824	355	9228

Table 8. Percentage of patients according to previous and next appointment intervals.

	Next appointment interval						
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Unknown
1 week	54.21	37.96	4.14	2.66	0.89	0.00	0.15
1 month	17.86	42.76	25.31	11.52	0.97	0.90	0.69
3 months	6.64	17.17	34.21	35.20	4.47	1.64	0.66
6 months	1.32	5.45	17.41	55.28	14.73	4.79	1.01
9 months	1.07	3.32	11.90	34.19	29.26	18.54	1.71
12 months	0.63	2.66	6.88	17.34	14.84	50.00	7.66
New referrals	3.77	11.73	21.79	17.60	7.82	9.50	27.79
Unknown	8.55	13.95	19.84	30.75	10.90	11.39	4.62

Table 9. Interval composition.

Actual difference between dates in weeks	**Interval**
0 or 1	1 week
2-6	1 month
7-17	3 months
18-30	6 months
31-41	9 months
>=42	12 moths

Table 10. Status of next appointment

Next appointment status	#	%
Attended	6923	75.02
Cancelled	384	4.16
DNA	632	6.85
NULL	355	3.85
Patient to attend	934	10.12
Grand Total	**9228**	**100**

Table 11. Next detected event for those patients with no next appointment date.

Next detected event	#	%
Cancelled Follow-up Outpatient Appointment	3	0.85
Decision to Admit	2	0.56
DNA'd Follow-up Outpatient Appointment	3	0.85
Follow-up Outpatient Attendance	85	23.94
New Outpatient Attendance	4	1.13
NULL	106	29.86
Patient Discharged	147	41.41
Referral Received	5	1.41
Grand Total	**355**	**100**

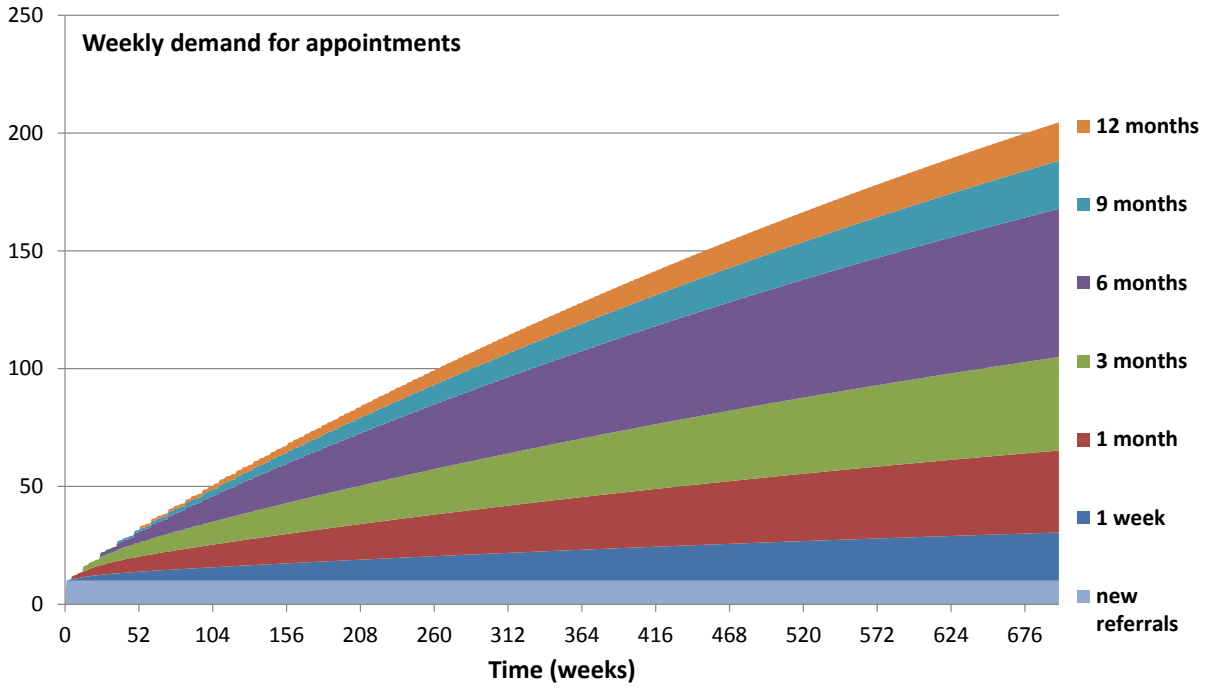

Figure 2. Projected weekly demand for outpatient clinic appointments using Table 8 as input parameters. The unknown percentage (last column was used as the discharge rate from each patient stream).

New dataset (25 March 2014)

Another dataset was received from MEH on 25th March 2014 to address the problem with the increased number of records without previous appointment date for the clinics included in the analysis. In this new dataset:

This version fixes the error which resulted in the previous attendance of some patients not being found (i.e. marked as null).

The error in the last version meant that if a patient didn't attend the appointment directly preceding their attendance during the study period (Apr to Jun 13) the 'Previous GL Attendance' field was showing null. The new code finds the preceding attendance regardless of whether the patient DNA'd/cancelled an appointment in between.

Additional clinic code removals

The following restrictions were made in the ensuing calculations.
Only City Road clinics were included in the analysis (code 'CR' in variable SiteCode). In addition, the clinic codes {GLCRPF, GLCRPK, GLCRUV, GLCRJB, GLCRJBSPC, GLCRJBW, GLCRKB, GLCRPO, PHCR, PHCRW, GLCRJBSPC, GLCRE1, GLCRWL, GLCRES, GLCRPD1, GLCRL4, GLCRL1, GLCRO1, GLCRPO, GLCRSAV, GLCRSDG} in variable Clinic were excluded from the remaining analysis resulting in a dataset with 7455 records.

Table 12. Number of patients according to previous and next appointment intervals.

	Next appointment interval							
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Un-known	*Total*
1 week	306	225	23	16	4	1	1	576
1 month	181	562	323	155	13	9	10	1253
3 months	62	195	433	484	57	22	10	1263
6 months	24	127	377	1067	283	97	21	1996
9 months	6	37	121	303	231	156	18	872
12 months	7	30	77	171	122	323	64	794
New referrals	26	74	144	118	55	69	194	680
Unknown	4	6	4	3		1	3	21
Total	616	1256	1502	2317	765	678	321	7455

Table 13. Percentage of patients according to previous and next appointment intervals (all figures %).

	Next appointment interval						
Previous appointment interval	1 week	1 month	3 months	6 months	9 months	12 months	Unknown
1 week	53.13	39.06	3.99	2.78	0.69	0.17	0.17
1 month	14.45	44.85	25.78	12.37	1.04	0.72	0.80
3 months	4.91	15.44	34.28	38.32	4.51	1.74	0.79
6 months	1.20	6.36	18.89	53.46	14.18	4.86	1.05
9 months	0.69	4.24	13.88	34.75	26.49	17.89	2.06
12 months	0.88	3.78	9.70	21.54	15.37	40.68	8.06
New referrals	3.82	10.88	21.18	17.35	8.09	10.15	28.53
Unknown	19.05	28.57	19.05	14.29	0.00	4.76	14.29

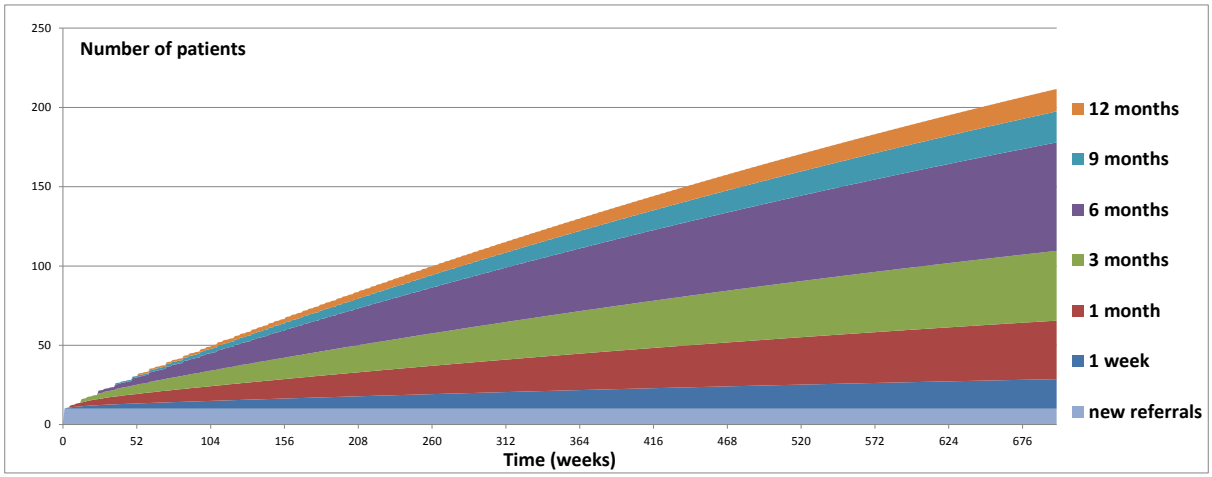

Figure 3. Projected weekly demand for outpatient clinic appointments using Table 13 as input parameters in the model (for exact parameters used in the model see Table 14). The unknown percentage (last column) was used as the discharge rate from each patient stream. The last row in Table 13 was excluded (21 records).

Table 14. Model parameters used in generating Figure 3.

Follow-up intervals		1 week	1 month	3 months	6 months	9 months	12 months	Discharge	Total
Arrivals	1 week	0.53	0.39	0.04	0.03	0.01	0	0	1
	1 month	0.14	0.45	0.26	0.12	0.01	0.01	0.01	1
	3 months	0.05	0.15	0.34	0.38	0.05	0.02	0.01	1
	6 months	0.01	0.06	0.19	0.54	0.14	0.05	0.01	1
	9 months	0.01	0.04	0.14	0.35	0.26	0.18	0.02	1
	12 months	0.01	0.04	0.1	0.21	0.15	0.41	0.08	1
	New referrals	0.04	0.11	0.21	0.17	0.08	0.1	0.29	1

Appendix 4 Process maps of two types of glaucoma outpatient clinics

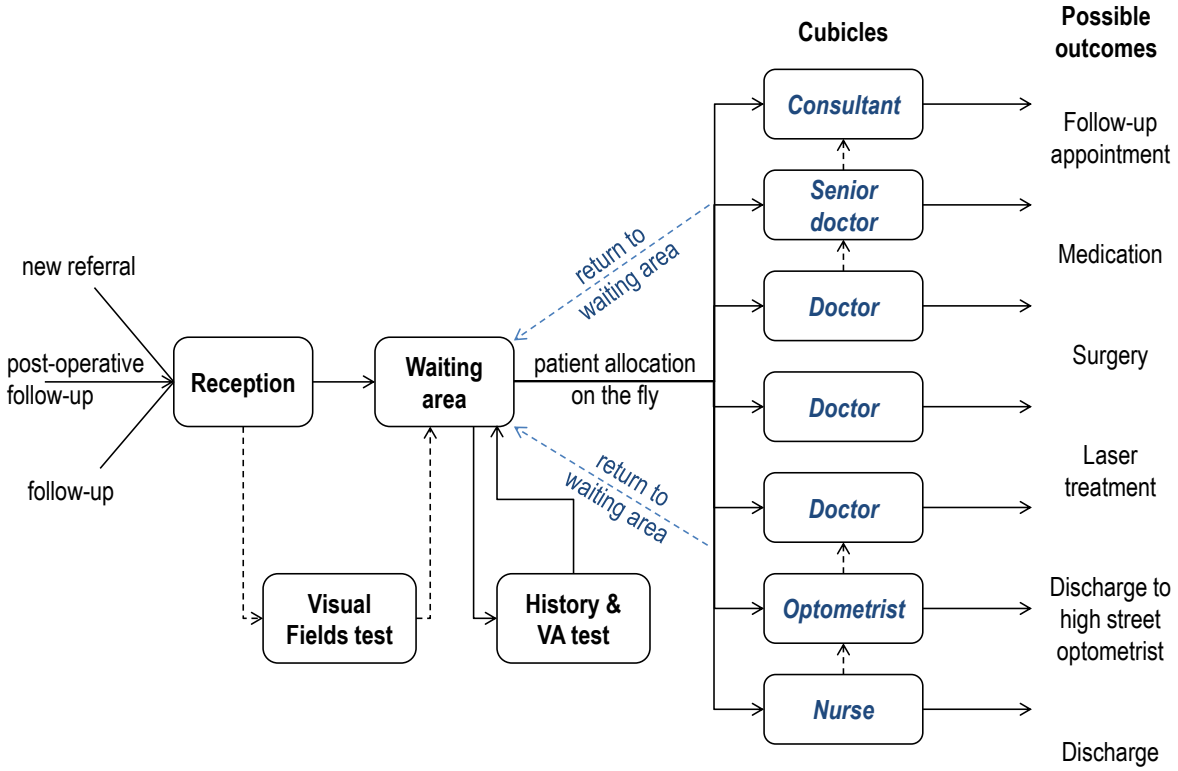

Figure 1. Typical glaucoma outpatient clinic (main site)

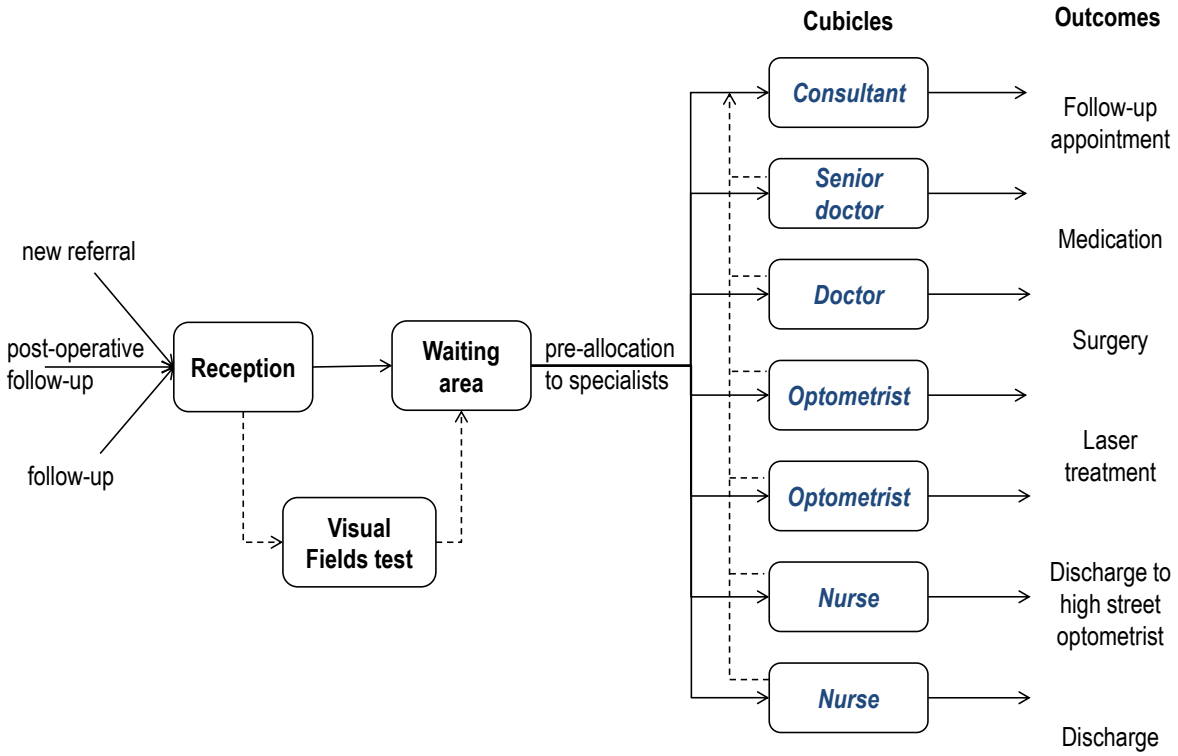

Figure 2. "Single piece flow" glaucoma outpatient clinic (as implemented in satellite clinic).

Appendix 5. Analysis of routinely collected data from two Moorfields Eye Hospital glaucoma outpatient clinics

Preamble

The anonymised data were obtained from an information manager at MEH. The total number of records obtained was 29603 and relate to patient appointments in the clinic over the period between 1 April 2009 and 30 April 2013 (4 years, 1 month). The subset of data analysed here concern two glaucoma outpatient clinics, one at the City Road site and the other run at St George's Hospital. The purpose of the analysis was to help develop an understanding of patterns of demand and case mix, different aspects of the service's capacity and the weekly scheduling of patients to appointment slots and the patterns of follow-up intervals.

City Road clinic

The clinic run at the main Moorfields Eye Hospital site specialises in patients with or suspected closed angle glaucoma. There were 14554 scheduled appointments over the time period covered, out of which 1277 (8.77%) were classified as new referrals and the remaining 13277 as follow-up appointments (91.23%). Almost two thirds of the appointments were with female patients (63.91%). The age of the patients seen in clinic ranged from 16 to 104, Figure 1.

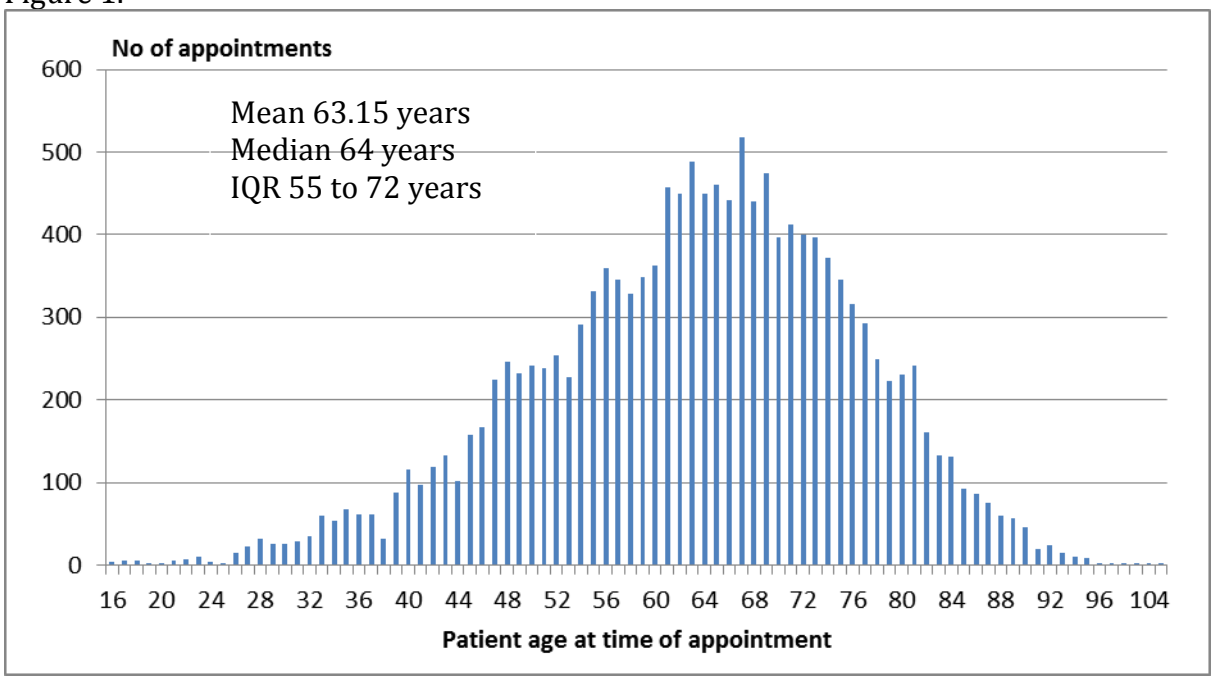

Figure 1. Patient age at appointment, City Road clinic.

WEEKLY CLINICS

The mean number of patients scheduled per week was 68.98 (95% confidence interval 68.38 to 71.58). Sixteen clinics out of a total of 211 had over 80 patients scheduled (7.58%) while 10 clinics (4.74%) had fewer than 40 patients scheduled (four of them were over the Christmas period, Figure 2).

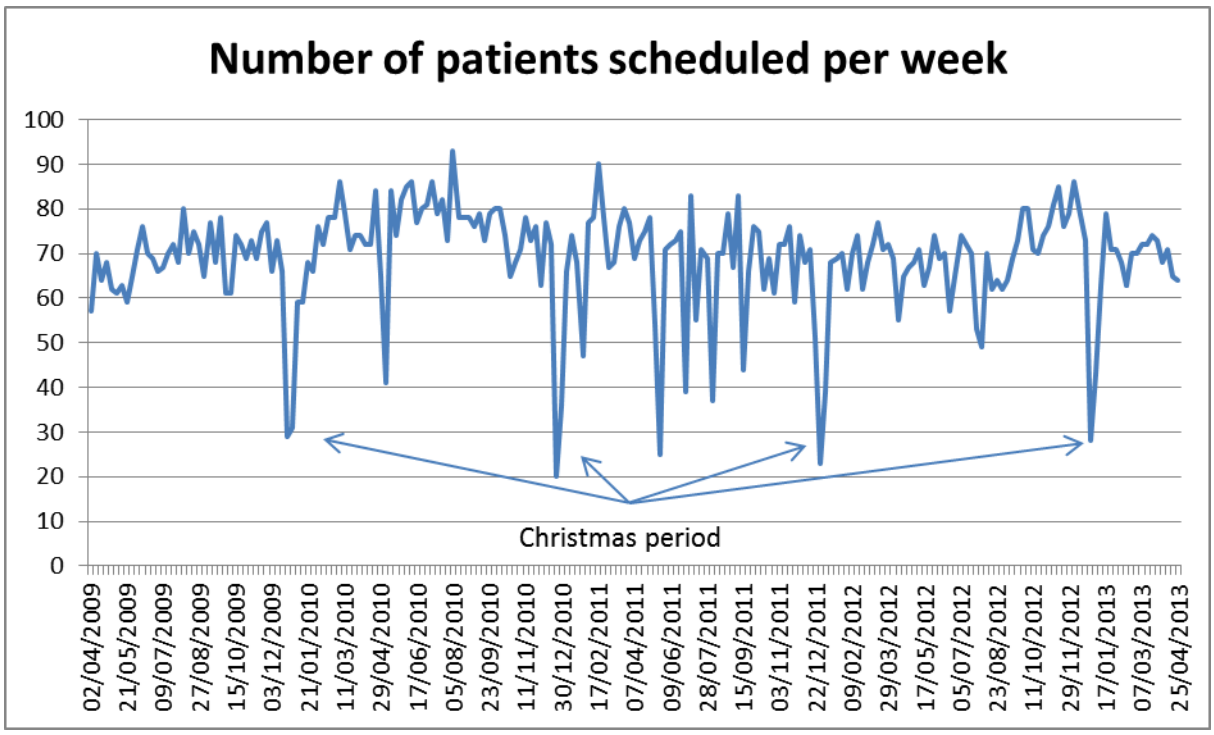

Figure 2. Number of patients scheduled per week, City Road clinic.

Approximately 80% of patients attended the clinic as scheduled, Table 1. About 12% had their appointment cancelled (both patient and hospital initiated cancellation) and almost 8% did not attend (DNA). A higher percentage of new referrals actually attended clinic compared to follow-ups (88.02% vs. 79.25%) again mainly due to a lower percentage of cancellations (5.32% vs. 12.66%) but also a lower percentage of DNAs (6.19% vs. 7.86%), Table 2.

Table 1. Appointment status, City Road clinic.

	N	**%**
Attended	11646	80.02
Cancelled	1749	12.02
Did not attend	1123	7.72
Other	36	.25
Total	14554	100

Table 2. Percentage of appointment status by appointment type, City Road clinic.

	Attended	**Cancelled**	**DNA[1]**	**Other**
New referrals	88.02	5.32	6.19	.47
Follow-up appointments	79.25	12.66	7.86	.23
Total	80.02	12.02	7.86	.25

[1] DNA: Did not attend.

In terms of weekly variation, there seems to be an increase in the percentage of patients attending clinic over time, Figure 3. This appears to be mainly due to the decrease in the percentage of patients that are cancelled on a weekly basis after around September 2010. The percentage of patients that do not attend appears to be fairly stable.

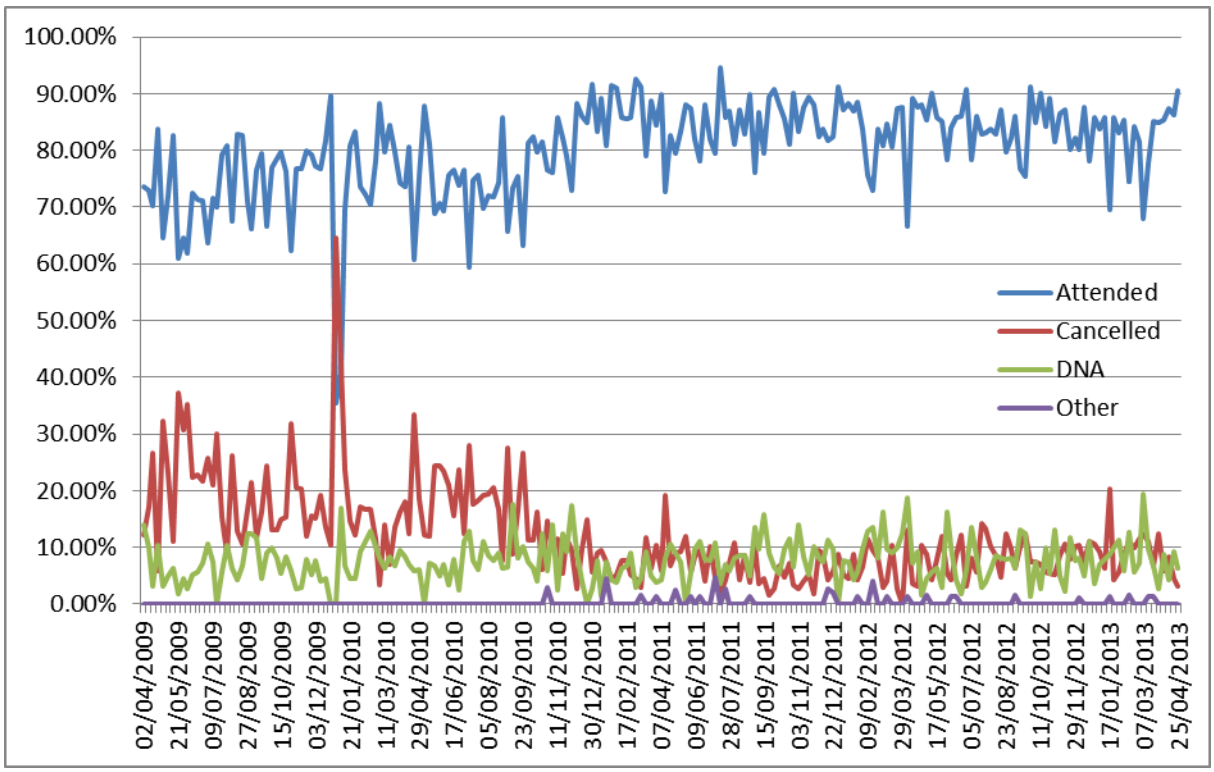

Figure 3. Percentage of patients that attended, were cancelled, did not attend and other per week, City Road clinic.

SCHEDULED APPOINTMENT TIMES

Most of the appointment appear to be scheduled towards the starting time of the clinic, in particularly 13:30 (24.39%), 14:00 (12.10%) and 14:15 (10.81%). The last scheduled appointment time is 16:15. We did not perform an analysis on time of arrival as, for this clinic, this information was not recorded in 60% of the records.

Table 3. Percentage of appointment by scheduled time of appointment.

Time of appointment	% of appointments
13:15	0.01
13:30	24.39
13:45	7.02
14:00	12.10
14:15	10.81
14:30	6.80
14:45	6.39
15:00	6.47
15:15	5.74
15:30	5.96
15:45	5.32
16:00	4.64
16:15	4.36
Total	100.00

FOLLOW-UP APPOINTMENTS

There were 2639 unique patients with at least one appointment scheduled in this clinic between 1 April 2009 and 30 April 2013. There were 551 patients with only one scheduled appointment (20.88%) while the remaining 2088 patients had two or more appointments,

Figure 4. The mean (standard deviation) number of appointment per unique patient was 5.51 (4.73) with a median (interquartile range) of 5 appointments (2 to 8 appointments). There were 1349 patients with 5 or more appointments, 385 patients with 10 or more and 50 patients with 20 or more. Seen from a different perspective, the patients with 5 or more appointments in the clinic representing over half the patients seen (51.12%) consumed more than 80% of scheduled appointment slots (80.77%), Figure 5.

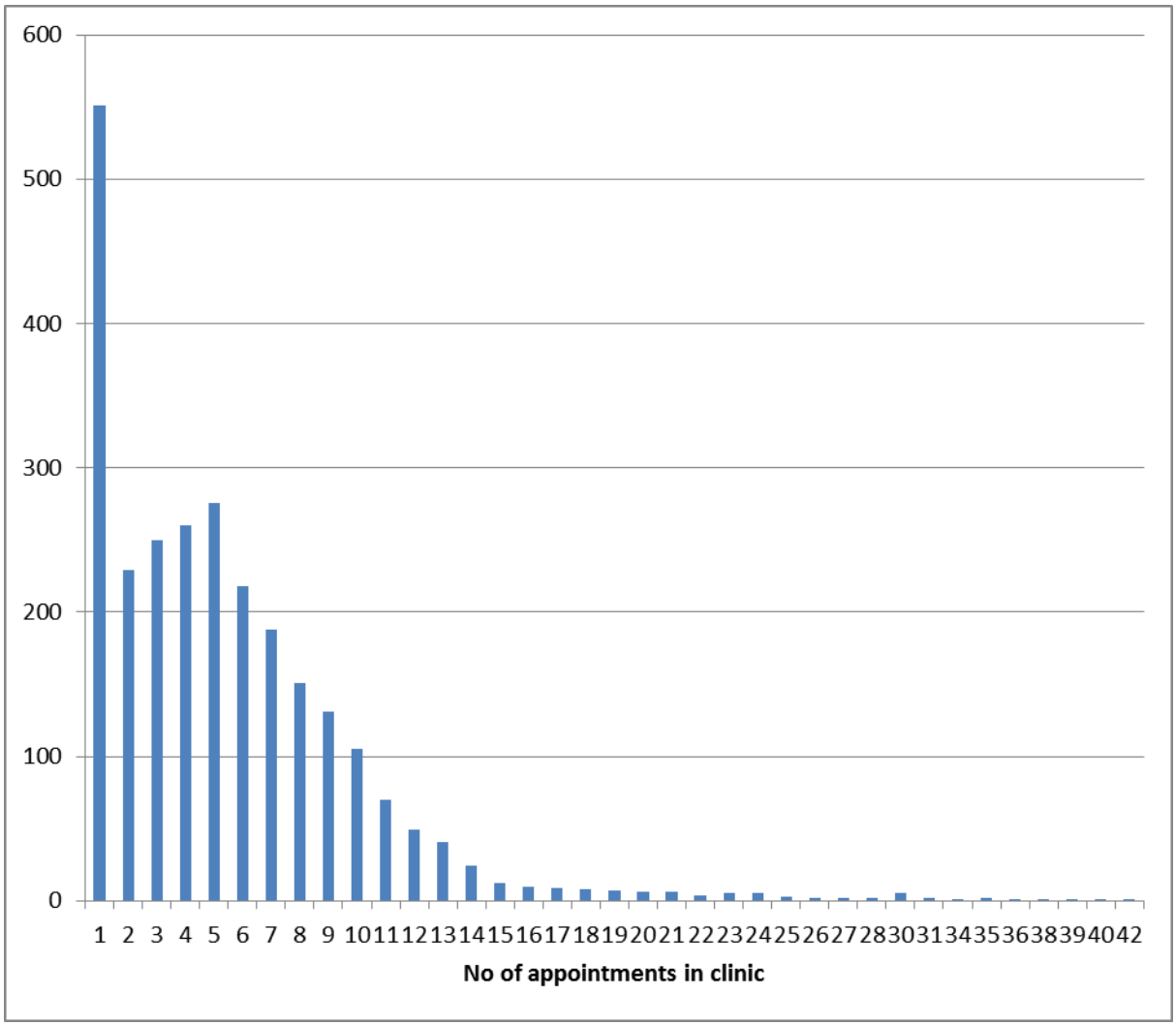

Figure 4. Total number of appointments per patient, City Road clinic.

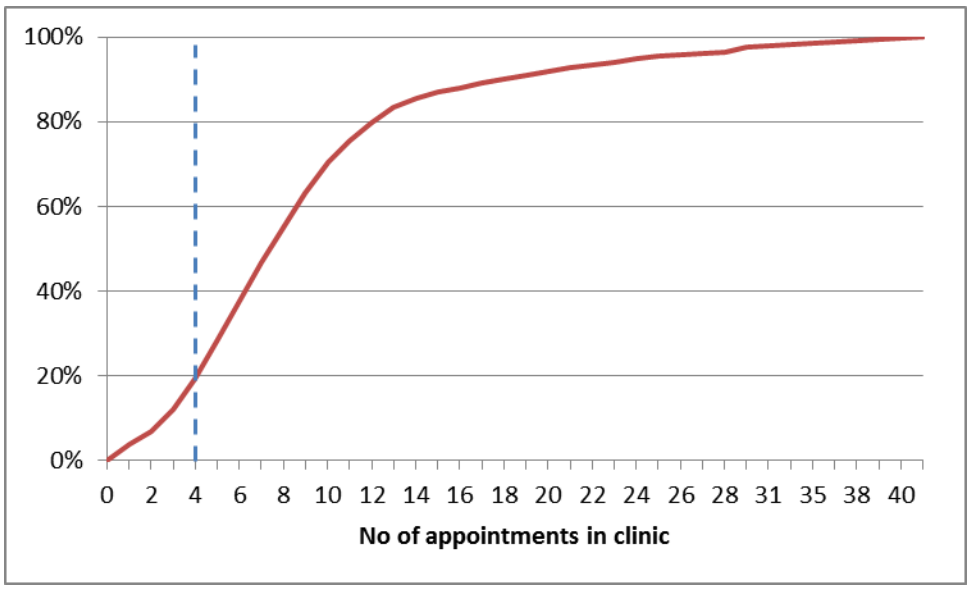

Figure 5. Patients with 4 or fewer appointment were scheduled to 20% of appointment slots available. Patients with 5 or more appointment were scheduled to the remaining 80% of appointment slots (City Road clinic).

For those patients with more than two appointments between 1 Apr 2009 and 30 Apr 2013 (2088 unique patients or 79.12% of the total with 14003 appointments or 96.21% of the total number of appointments), the mean (standard deviation) time interval between appointments was 131.5 days (126.8) with a median (interquartile range) of 98 days (35 to 189). We excluded 62 appointment intervals of zero days.

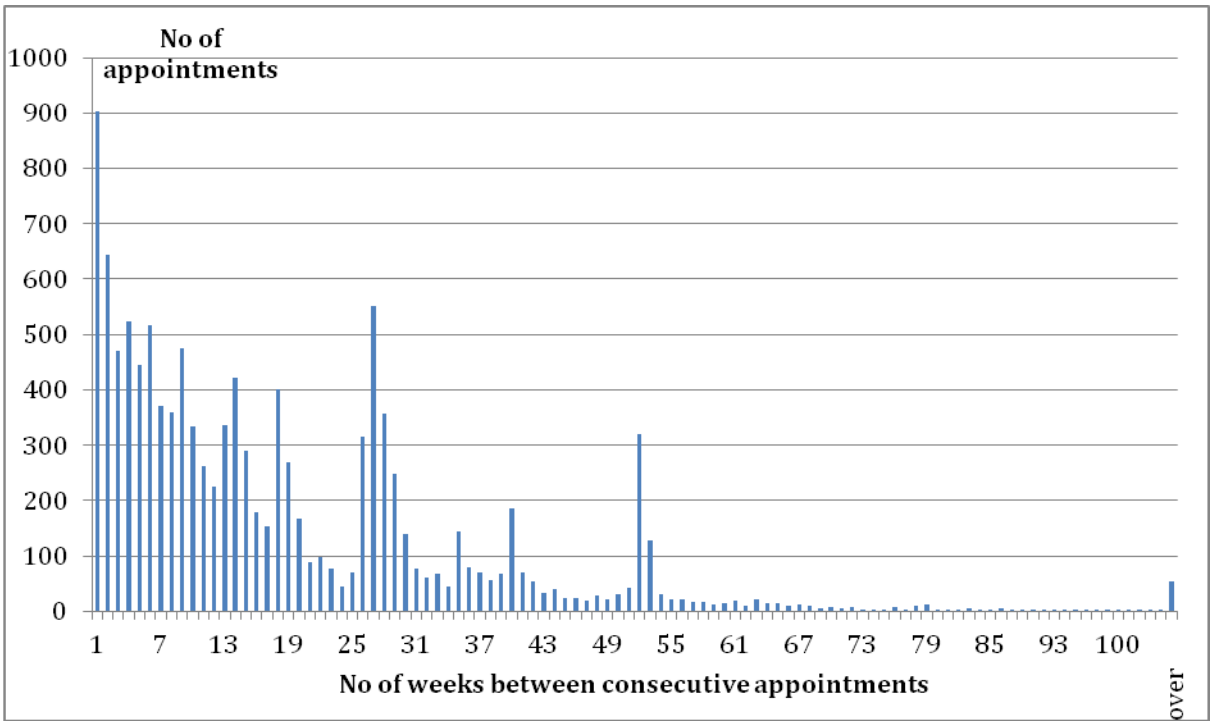

Figure 6. Follow-up appointments by number of weeks between consecutive appointments, City Road clinic.

The most frequent time interval for a repeat appointment appears to be between 5 and 16 weeks (approximately 1 to 4 months) with more than one appointment in three scheduled in this interval, Figure 7 and Table 4. There appears to be a higher percentage of cancellations in 1-week follow-up appointments compared to longer intervals. This may be due to the practice

of booking a number of weekly appointment for post-operation follow-up at the time of decision to operate and subsequently cancelling a number of them if the patient is recovering well. In terms of patients that do not attend their appointment, the percentage is lower in follow-up appointment of short intervals (1 week and 2 to 4 weeks).

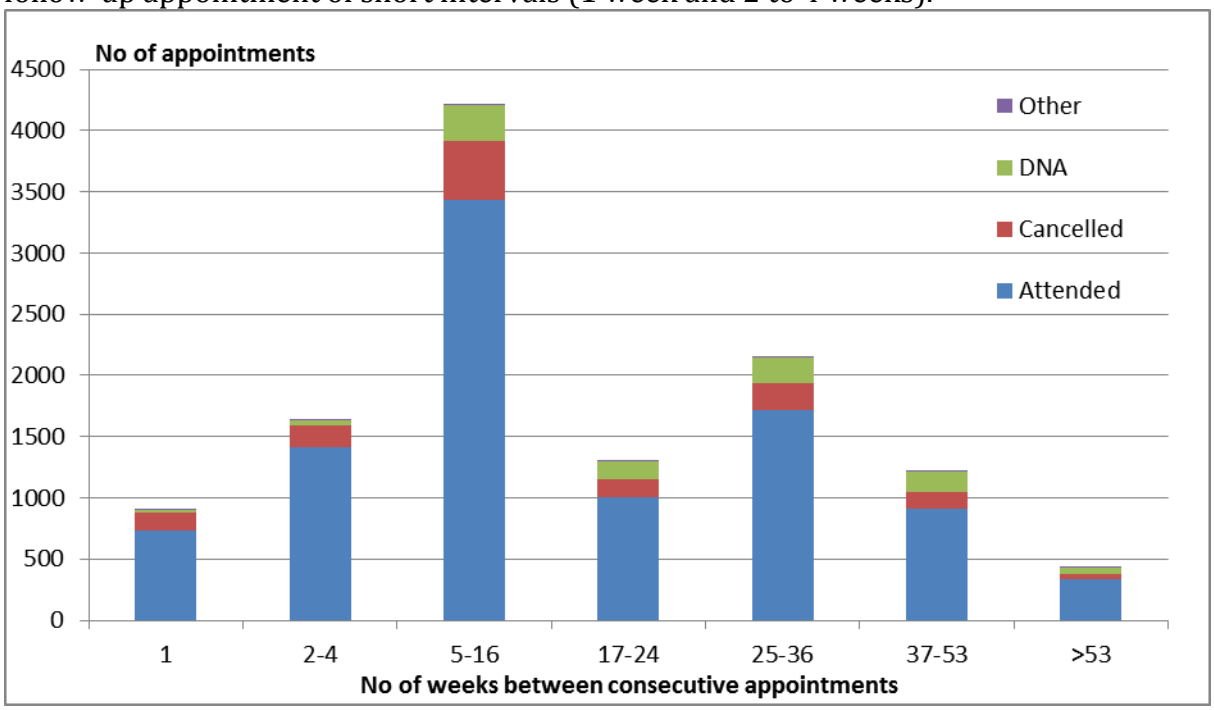

Figure 7. Follow-up appointments by time interval between consecutive appointments, City Road clinic.

Table 4. Follow-up appointments by time interval between consecutive appointments, City Road clinic.

Interval in weeks	Total number of follow-up appointments (% total)	Attended (% interval)	Cancelled (% interval)	DNA (% interval)	Other (interval %)
1	902 (7.61)	729 (80.82)	152 (16.85)	20 (2.22)	1 (0.11)
2-4	1637 (13.81)	1415 (86.44)	172 (10.51)	48 (2.93)	2 (0.12)
5-16	4213 (35.54)	3437 (81.58)	481 (11.42)	287 (6.81)	8 (0.19)
17-24	1300 (10.97)	1002 (77.08)	151 (11.62)	142 (10.92)	5 (0.38)
25-36	2155 (18.18)	1714 (79.54)	225 (10.44)	207 (9.61)	9 (0.42)
37-53	1214 (10.24)	909 (74.88)	135 (11.12)	168 (13.84)	2 (0.16)
>53	432 (3.64)	331 (76.62)	50 (11.57)	49 (11.34)	2 (0.46)
	11853 (100)				

OPERATIONS AND LASERS

There were 1358 operations associated with the patients seen in this clinic and performed by different surgeons (777 operations were by one consultant) and in different settings (mainly City Road and St. Ann's). The main types of operation were phacoemulsification with intraocular lens implant (918), trabeculectomy (88, with or without Mitomycin C) and vitrectomy (32). There were also 1240 laser procedures associated with these patients.

NOT RETURNING PATIENTS

Table 5. Number of patients not scheduled for a follow-up appointment within 18 months, City Road clinic.

Reference period (12 months)	Follow-up period (18 months)	No of patients in reference period	No of patients without an appointment in follow-up period	%
1/4/2009 - 31/3/2010	1/4/2010 – 30/9/2011	1347	268	20
1/4/2010 - 31/3/2011	1/4/2011 – 30/9/2012	1598	352	22

St. George's Hospital clinic

In this clinic run at St. George's Hospital, both glaucoma and cataract patients are being seen. There were 3284 scheduled appointments between 25 June 2010 and 26 April 2013, out of which 606 (18.45%) were classified as new referrals and the remaining 2678 as follow-up appointments (81.55%). The number of appointments with male and female patients was almost identical (1658 female, 1620 make and 6 other). The age of the patients seen in clinic ranged from 14 to 100, Figure 8.

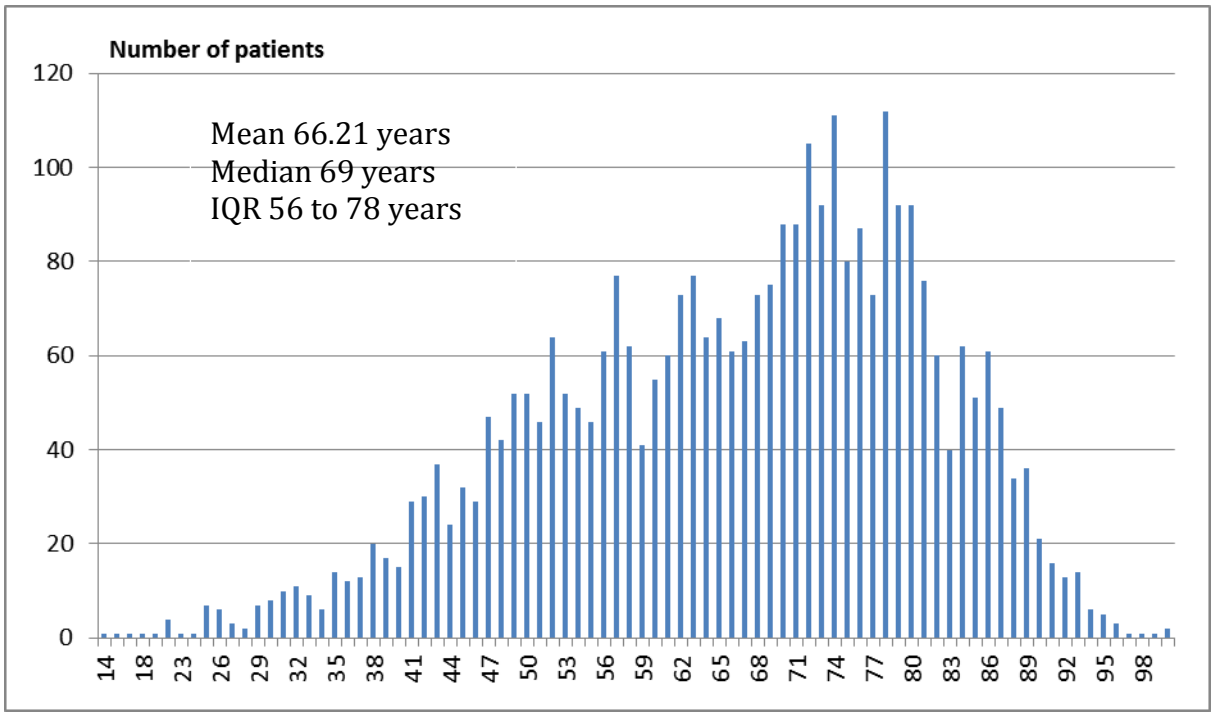

Figure 8. Patient age at appointment, St George's satellite clinic.

WEEKLY CLINICS

The mean number of patients scheduled per week was 23.46 (95% CI 22.04 to 24.88). Twenty five clinics out of a total of 139 had over 30 patients scheduled (11.85%) while 39 clinics (18.48%) had fewer than 20 patients scheduled (Figure 9). The role of lead consultant alternated.

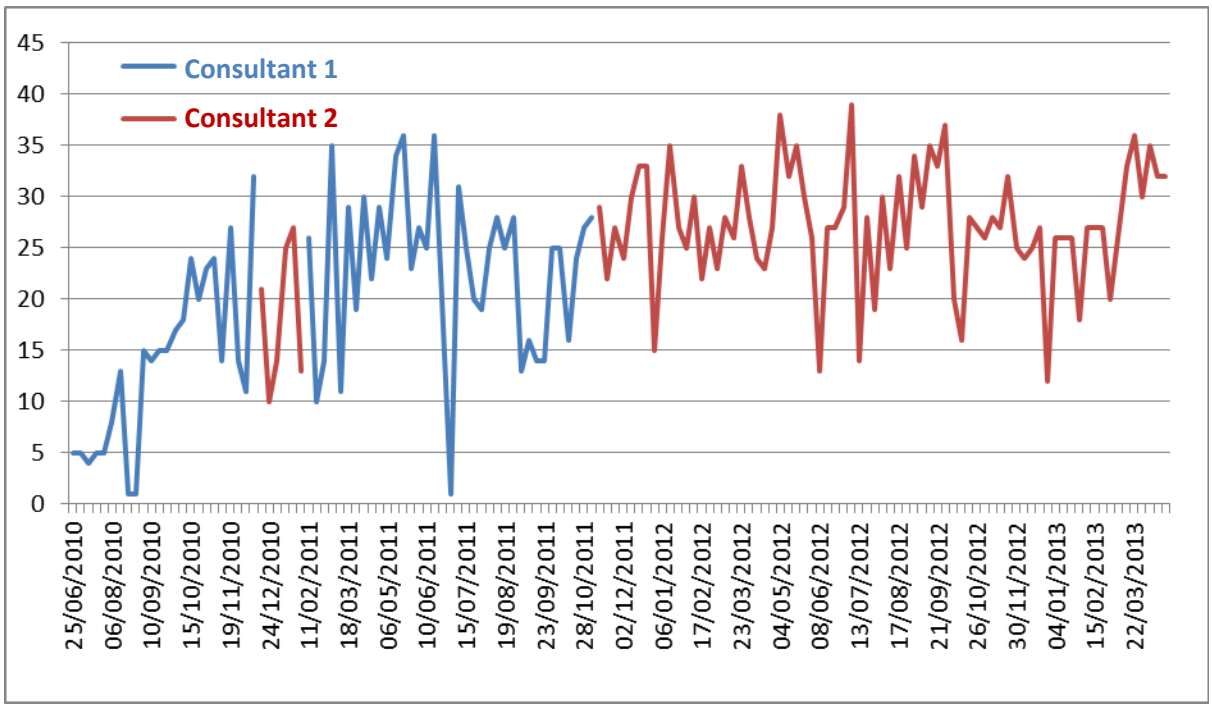

Figure 9. Number of patients scheduled per week by lead consultant, St. George's Hospital satellite clinic.

Approximately 80% of patients attended the clinic as scheduled, Table 6. About 8% had their appointment cancelled (both patient and hospital initiated cancellation) and 13% did not attend (DNA). Almost the same percentage of patients with new referrals and follow-up appointments actually attended clinic (77.56% vs. 79.20%) as the differences between cancelations (16.17% and 6.20% for new referrals and follow-up appointments respectively) and patients that did not attend (6.27% vs. 14.56%) almost cancelled each other out, Table 7.

Table 6. Appointment status, St. George's Hospital satellite clinic.

	N	**%**
Attended	2591	78.90
Cancelled	264	8.04
Did not attend	428	13.03
Other	1	.03
Total	14554	100

Table 7. Percentage of appointment status by appointment type, St. George's Hospital satellite clinic.

	Attended	**Cancelled**	**DNA[1]**	**Other**
New referrals	77.56	16.17	6.27	0
Follow-up appointments	79.20	6.20	14.56	.04
Total	78.90	12.02	13.03	.03

[1] DNA: Did not attend.

In terms of weekly variation, the percentage of patients attending clinic over time appears to be stable, Figure 10.

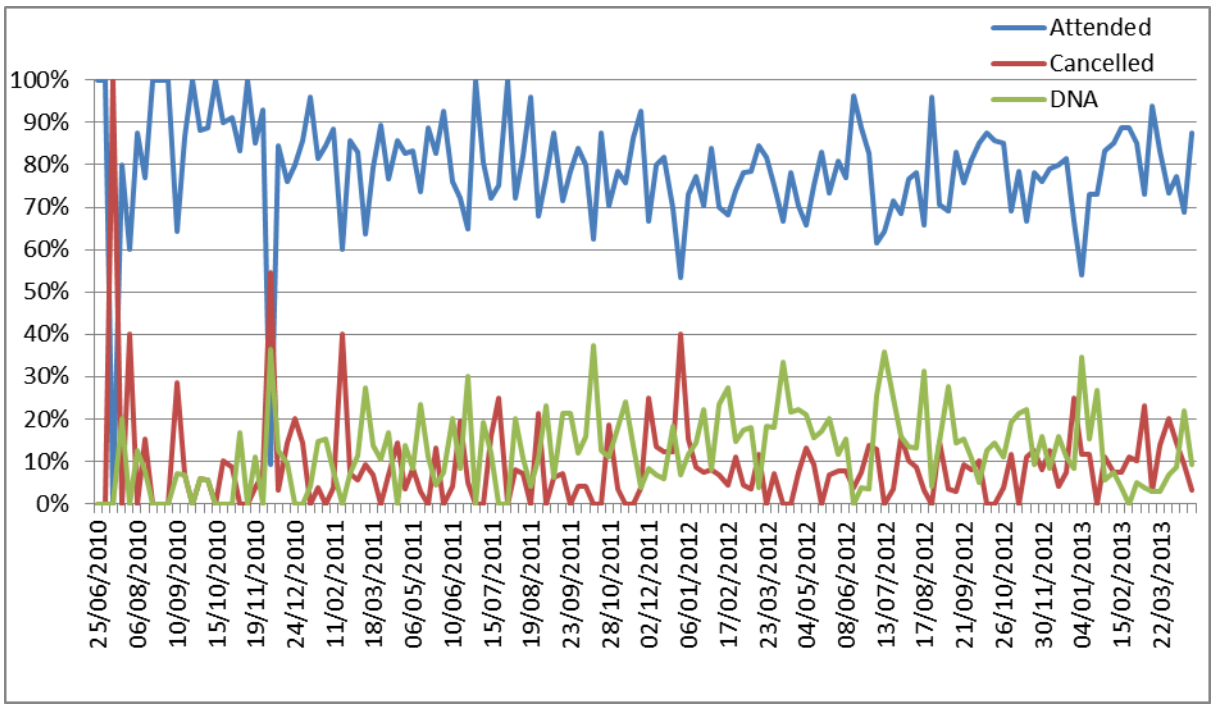

Figure 10. Percentage of patients that attended, were cancelled, did not attend and other per week, St. George's Hospital satellite clinic.

SCHEDULED APPOINTMENT TIMES

Most of the appointment appear to be scheduled towards the starting time of the clinic, in particularly and in particular in the time slots between 13:30 and 14:30 (60.60% of total appointments), Table 8. The last scheduled appointment time is 15:45. We did not perform an analysis on time of arrival as, for this clinic, this information was not recorded in 90.53% of the appointments.

Table 8. Percentage of appointment by scheduled time of appointment.

Time of appointment	% of appointments
13:30	14.71%
13:45	11.11%
14:00	11.75%
14:15	11.33%
14:30	11.69%
14:45	8.59%
15:00	7.89%
15:15	8.16%
15:30	7.64%
15:45	7.13%
Total	100.00

FOLLOW-UP APPOINTMENTS

There were 1676 unique patients with at least one appointment scheduled in this clinic between 25 June 2010 and 26 April 2013. There were 913 patients with only one scheduled appointment (54.47%) while the remaining 763 patients (45.53%) had two or more appointments, Figure 11. The mean (standard deviation) number of appointment per unique patient was 1.96 (1.49) with a median (interquartile range) of 1 appointments (1 to 2 appointments). There were 114 patients with 5 or more appointments and only 5 patients

with 10 or more. Seen from a different perspective, the patients with 2 or more appointments in the clinic representing just under half the patients seen (45.53%) consumed 72.10% of scheduled appointment slots, Figure 12.

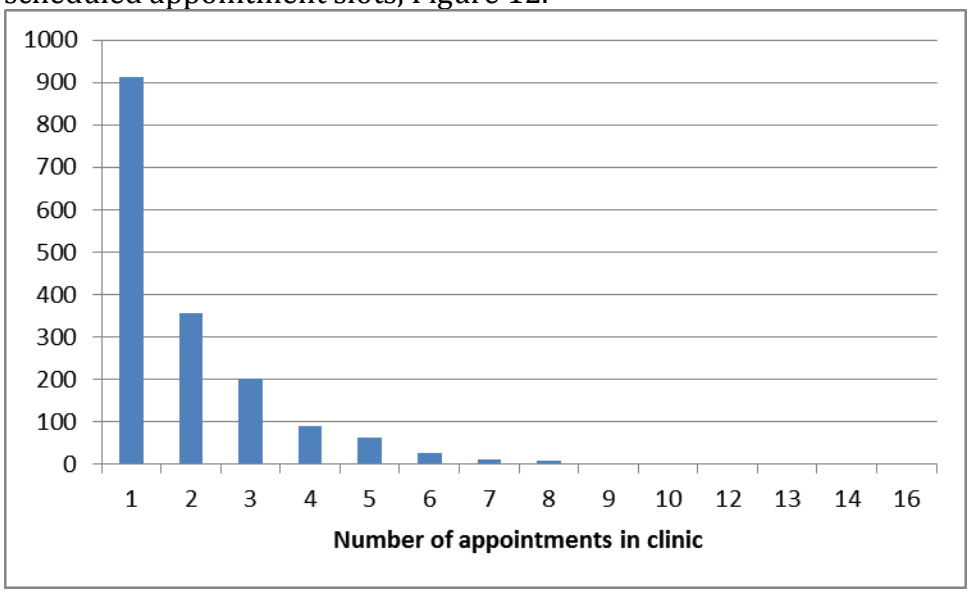

Figure 11. Total number of appointments per patient, St. George's Hospital satellite clinic.

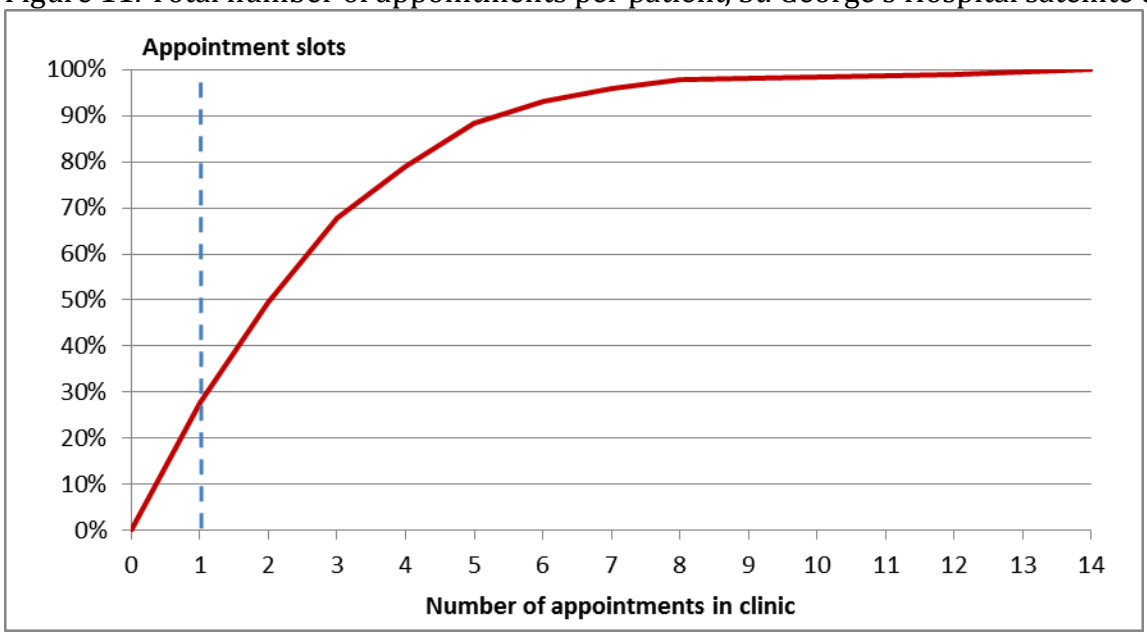

Figure 12. Patients with 2 or more appointments were scheduled to 72.10% of appointment slots available. (St. George's Hospital satellite clinic).

For those patients with more than two appointments between 25 June 2010 and 26 April 2013 (763 unique patients or 45.53% of the total number of patients with 2371 appointments or 72.10% of the total number of appointments), the mean (standard deviation) time interval between appointments was 161.7 days (118.2) with a median (interquartile range) of 147 days (70 to 210), Figure 13. We excluded 15 repeat appointments with a zero day interval.

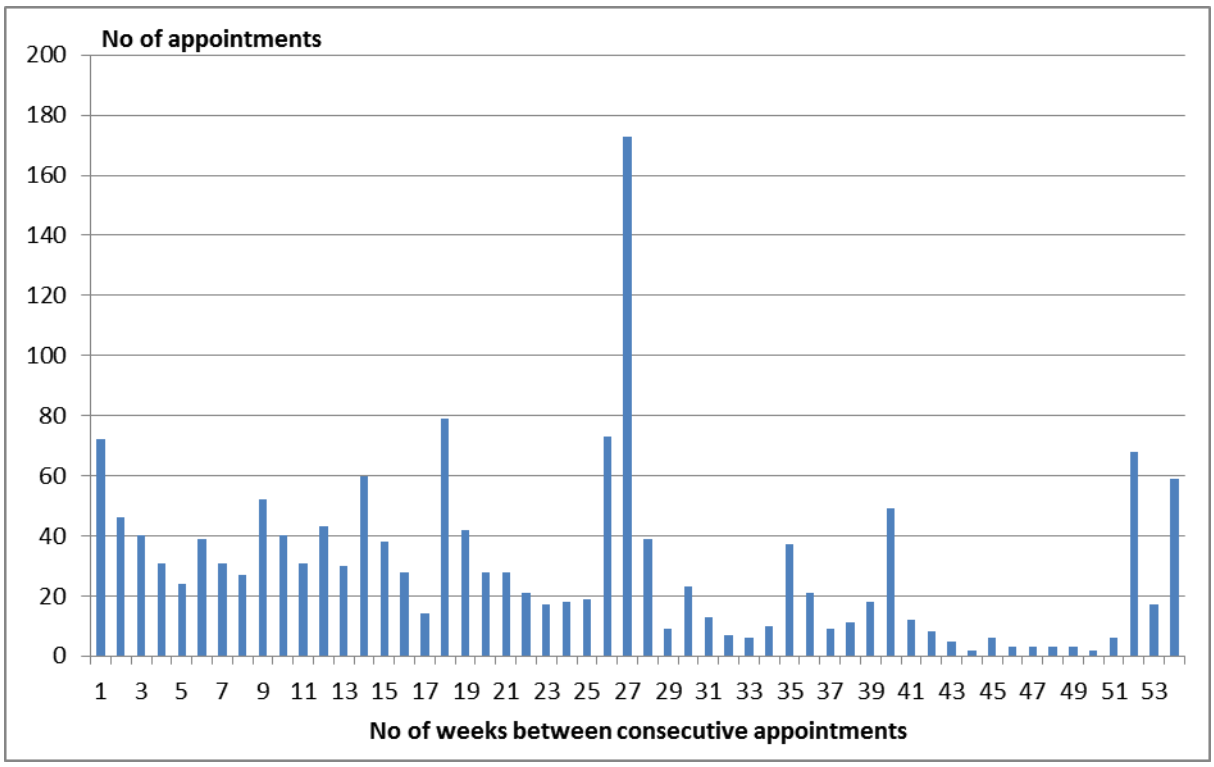

Figure 13. Follow-up appointments by number of weeks between consecutive appointments, St. George's Hospital satellite clinic.

The most frequent time interval for a repeat appointment appears to be between 5 and 16 weeks (approximately 1 to 4 months) and 25-36 weeks (approximately 6-9 months) with almost one third of follow up appointments in each interval, Figure 13 and Table 9. There appears to be a higher percentage of cancellations in follow-up appointments between 37-53 weeks. In terms of patients that do not attend their appointment, the percentage increases as the length of the interval increases to reach its maximum value at the 37-53 interval where almost one in five scheduled patients did not attend.

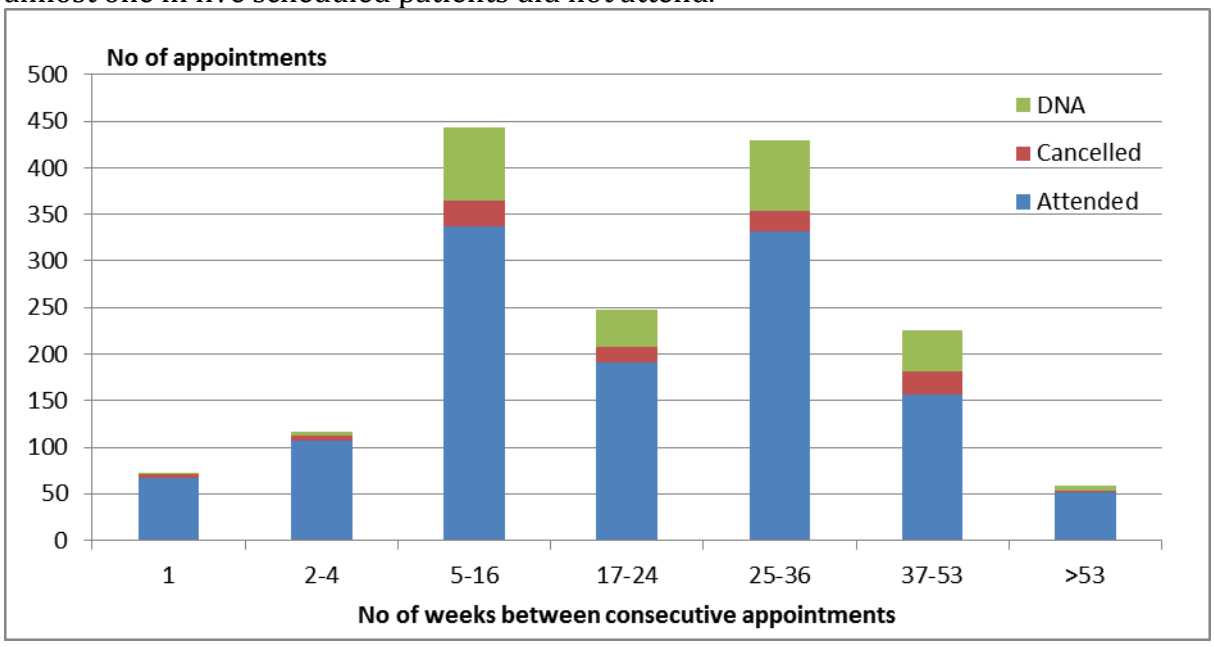

Figure 13. Follow-up appointments by time interval between consecutive appointments, St. George's Hospital satellite clinic. DNA: Did not attend.

Table 9. Follow-up appointments by time interval between consecutive appointments, St George's Hospital satellite clinic.

Interval in weeks	Total number of follow-up appointments (% total)	Attended (% interval)	Cancelled (% interval)	DNA (% interval)
1	72 (4.52)	67 (93.06)	4 (5.56)	1 (1.39)
2-4	117 (7.34)	107 (91.45)	5 (4.27)	5 (4.27)
5-16	443 (27.81)	337 (76.07)	28 (6.32)	78 (17.61)
17-24	247 (15.51)	191 (77.33)	16 (6.48)	40 (16.19)
25-36	430 (26.99)	332 (77.21)	21 (4.88)	77 (17.91)
37-53	225 (14.12)	157 (69.78)	24 (10.67)	44 (19.56)
>53	59 (3.70)	52 (88.14)	1 (1.69)	6 (10.17)
	1593 (100)	1243	99	251

OPERATIONS AND LASERS

In total, there were 805 operations associated with the patients seen in this clinic and performed at St. George's Hospital by different surgeons. The main types of operation were phacoemulsification with intraocular lens implant (451), trabeculectomy (100, with or without Mitomycin C) and vitrectomy (40). There were also 278 laser procedures associated with these patients.

NON RETURNING PATIENTS

Table 10. Number of patients not scheduled for a follow-up appointment within 18 months, St. George's Hospital satellite clinic.

Reference period (12 months)	Follow-up period (18 months)	No of patients in reference period	No of patients without an appointment in follow-up period	%
1/7/2010 – 30/6/2011	1/7/2011 – 31/1/2013	610	295	48
1/9/2010 – 31/8/2011	1/9/2011 – 31/3/2012	673	324	48

Appendix 6. Analysis of data collected routinely from Friday PM Moorfields Eye Hospital glaucoma outpatient clinics

Preamble

The anonymised data were obtained from an information manager at MEH. The total number of records obtained was 64658 (inclusive of those obtained in the first two versions) and relate to patient appointments in the clinic over the period between 1 April 2009 and 30 April 2013 (4 years, 1 month). The subset of data analysed here concern one glaucoma outpatient clinic at the City Road site.

Analysis

The clinic is considered to be a typical glaucoma outpatients clinic. There were 15430 scheduled appointments over the time period covered, out of which 815 (5.28%) were classified as new referrals and the remaining 14615 as follow-up appointments (94.72%). A few more of these appointments were with male patients (51.19%) than female (48.81%). The age of the patients seen in clinic ranged from 15 to 100 (mean age 65.78 years, median 69, IQR 57 to 78), Figure 1.

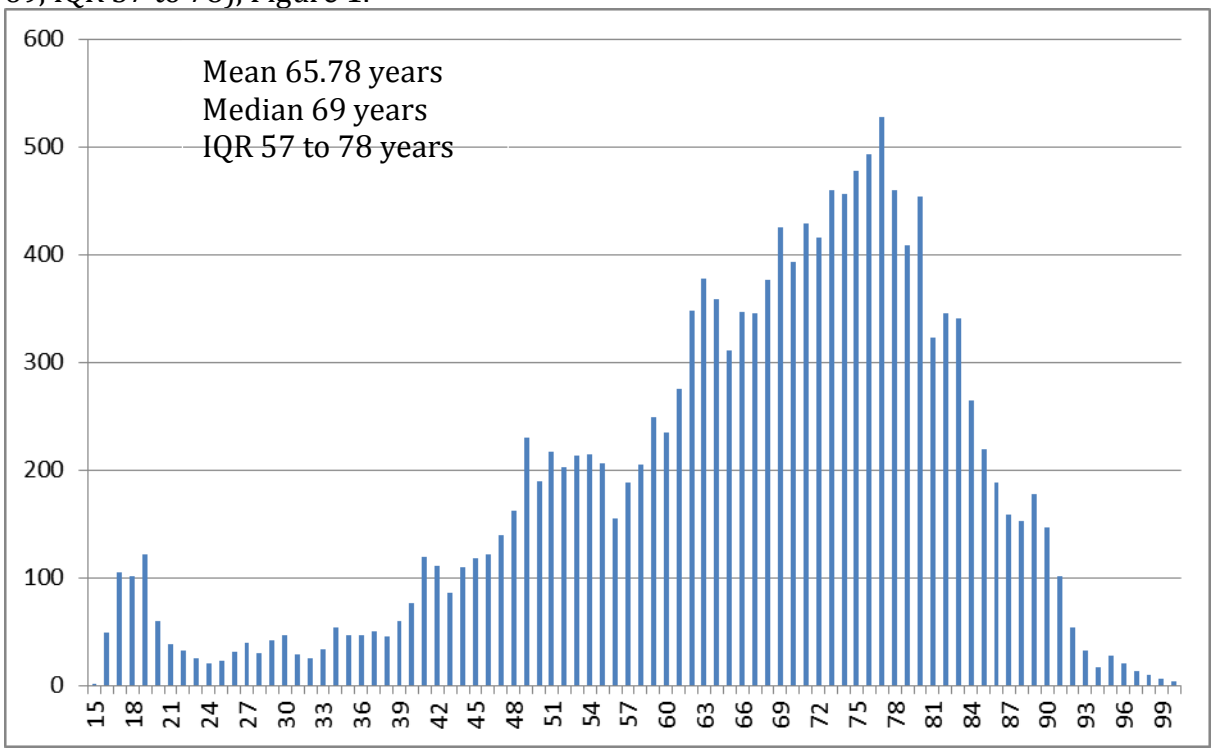

Figure 1. Patient age at appointment.

WEEKLY CLINICS

The mean number of patients scheduled per week was 77.54 (95% confidence interval 75.88 to 79.196), Figure 2.

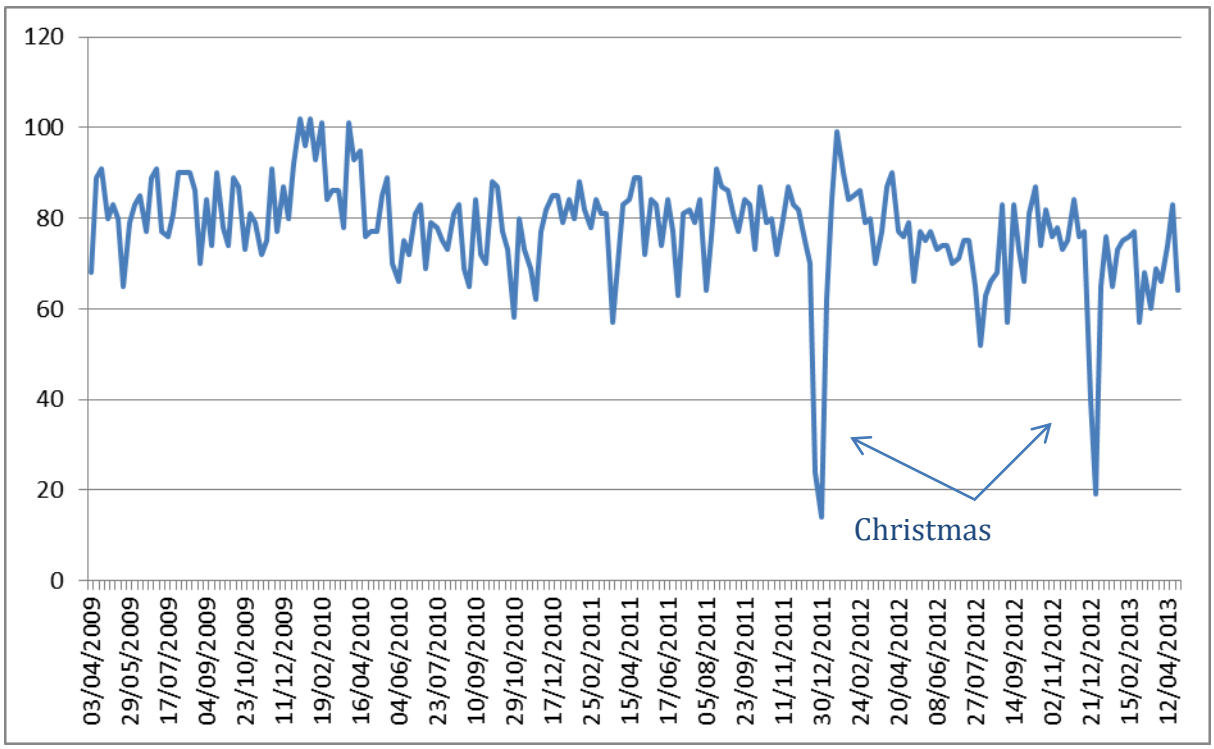

Figure 2. Number of patients scheduled per week.

Approximately 78% of patients attended the clinic as scheduled, Table 1. About one in 10 patients had their appointment cancelled (both patient and hospital initiated cancellations) and a similar proportion of patients did not attend (DNA). A higher percentage of new referrals actually attended clinic compared to follow-ups (80.37% vs. 78.13%) but the differences between new referrals and follow-up appointments were small.

Table 1. Percentage of appointment status by appointment type, City Road clinic.

	Attended	**Cancelled**	**DNA[1]**	**Other**
New referrals	80.37	10.31	9.08	.25
Follow-up appointments	78.13	10.74	10.86	.28
Total	78.24	10.71	10.76	.28

[1] DNA: Did not attend.

Of interest is the observation that in this clinic, there is a clear gradient between DNA rate and time of appointment with higher DNA rates associated with later scheduled appointment times, Figure 3.

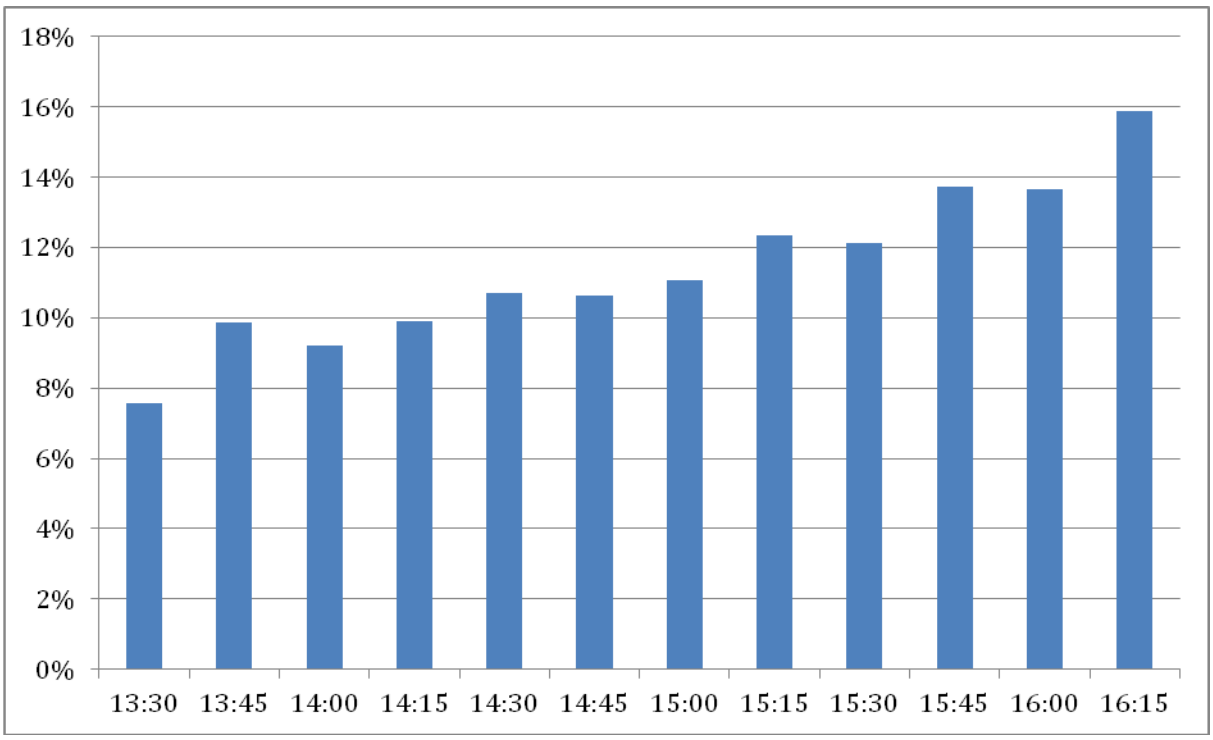

Figure 3. The later in the day the appointment is, the more patients do not attend (DNA), the clinic (figure shows % DNA).

In terms of weekly variation, there seems to be an increase in the percentage of patients attending clinic over time, Figure 4. This appears to be mainly due to the decrease in the percentage of patients that are cancelled on a weekly basis after around April 2010. The percentage of patients that do not attend appears to be fairly stable.

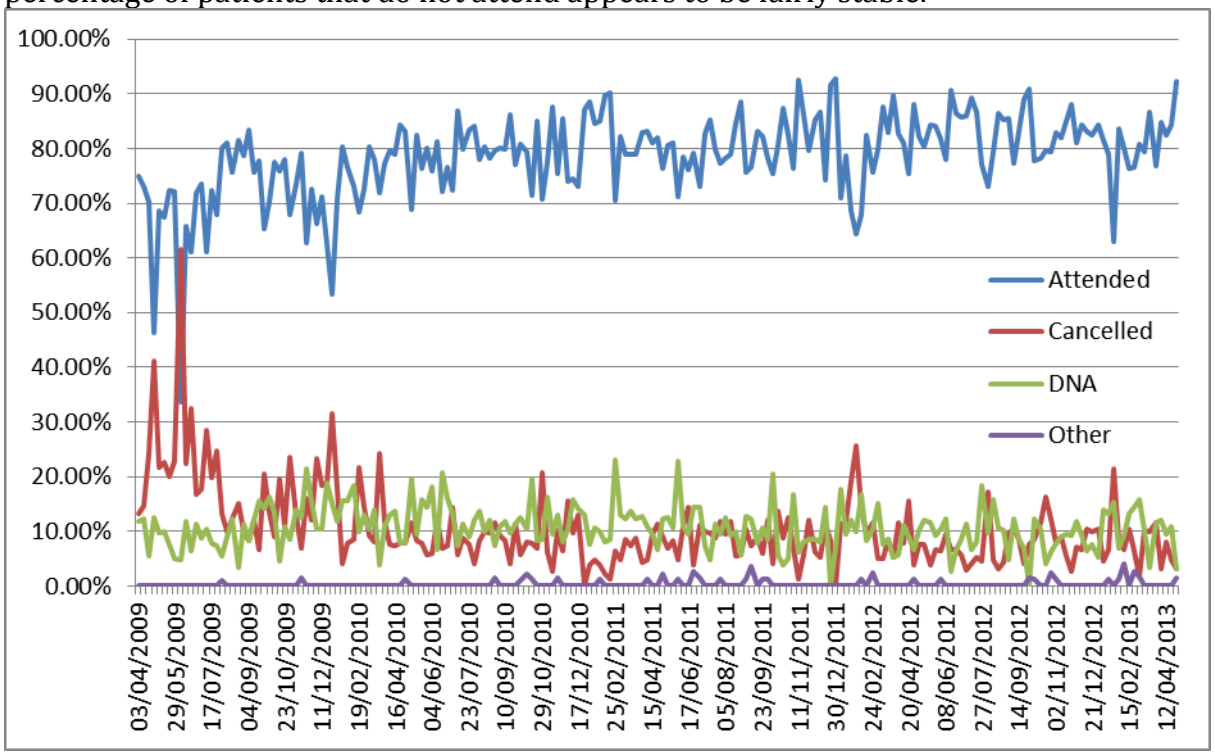

Figure 4. Percentage of patients that attended, were cancelled, did not attend and other per week.

SCHEDULED APPOINTMENT TIMES

Most of the appointments appear to be scheduled towards the starting time of the clinic, in particularly during the first slot at 13:30 (17.84%). The last scheduled appointment time according to the data is 16:15.

Table 3. Percentage of appointment by scheduled time of appointment.

Time of appointment	% of appointments
13:30	17.84
13:45	8.48
14:00	9.93
14:15	7.73
14:30	9.99
14:45	6.33
15:00	8.73
15:15	6.45
15:30	6.35
15:45	6.03
16:00	5.94
16:15	6.20
Total	100.00

FOLLOW-UP APPOINTMENTS

There were 2608 unique patients with at least one appointment scheduled in this clinic between 1 April 2009 and 30 April 2013. There were 497 patients with only one scheduled appointment (19.06%) while the remaining 2111 patients had two or more appointments, Figure 4. The mean (standard deviation) number of appointment per unique patient was 5.92 (5.43) with a median (interquartile range) of 5 appointments (2 to 8 appointments). There were 1333 patients with 5 or more appointments, 430 patients with 10 or more and 85 patients with 20 or more. Seen from a different perspective, the patients with 5 or more appointments in the clinic representing over half the patients seen (57.86%) consumed more than 80% of scheduled appointment slots (81.61%), Figure 5.

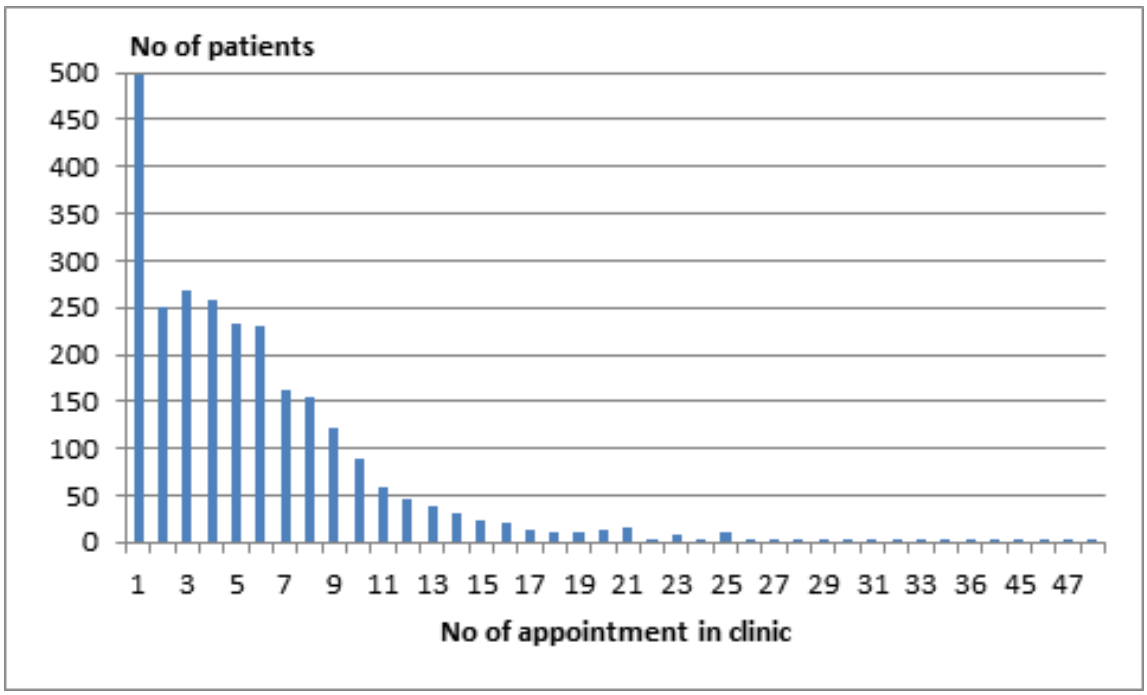

Figure 4. Total number of appointments per patient.

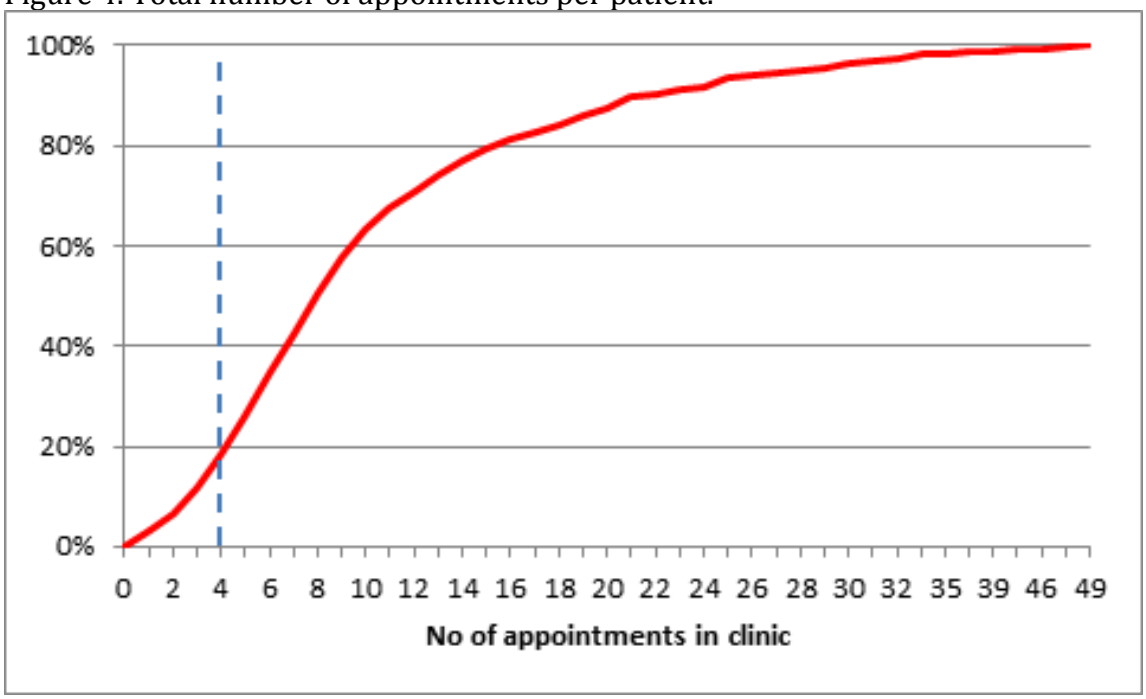

Figure 5. Patients with 4 or fewer appointment were scheduled to 18.39% of appointment slots available. Patients with 5 or more appointment were scheduled to the remaining 81.61% of appointment slots.

For those patients with more than two appointments between 1 Apr 2009 and 30 Apr 2013 (2111 unique patients or 80.94% of the total with 14933 appointments or 96.78% of the total number of appointments), the mean (standard deviation) time interval between appointments was 140.6 days (116.4) with a median (interquartile range) of 119 days (49 to 196). We excluded 78 appointment intervals of zero days.

The most frequent time interval for a repeat appointment appears to be between 5 and 16 weeks (approximately 1 to 4 months) with almost one appointment in three scheduled in this interval, Figure 7 and Table 4. There appears to be a lower percentage of cancellations (6.26%) in follow-up appointments that are between 2 and 4 weeks. In terms of patients that do not attend their appointment, the percentage is lower in follow-up appointment of short intervals (1 week and 2 to 4 weeks).

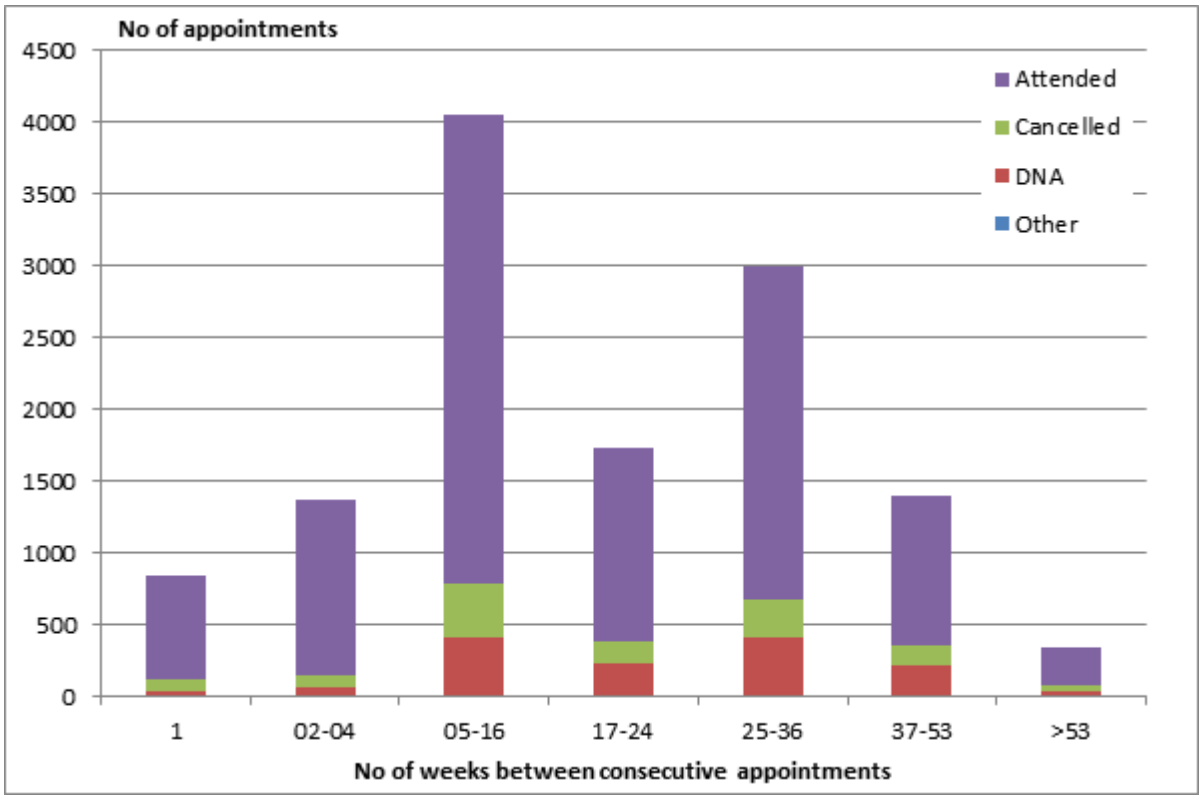

Figure 7. Follow-up appointments by time interval between consecutive appointments.

Table 4. Follow-up appointments by time interval between consecutive appointments.

Interval in weeks	Total number of follow-up appointments (% total)	Attended (% interval)	Cancelled (% interval)	DNA (% interval)	Other (interval %)
1	842 (6.61)	723 (85.87)	81 (9.62)	35 (4.16)	3 (0.36)
2-4	1374 (10.78)	1221 (88.86)	86 (6.26)	66 (4.80)	1 (0.07)
5-16	4051 (31.79)	3257 (80.40)	388 (9.58)	398 (9.82)	8 (0.20)
17-24	1738 (13.64)	1350 (77.68)	159 (9.15)	223 (12.83)	6 (0.35)
25-36	2998 (23.52)	2324 (77.52)	259 (8.64)	404 (13.48)	11 (0.37)
37-53	1402 (11.00)	1051 (74.96)	128 (9.13)	217 (15.48)	6 (0.43)
>53	339 (2.66)	260 (76.70)	37 (10.91)	38 (11.21)	4 (1.18)
	12744 (100.00)	10186	1138	1381	39

NOT RETURNING PATIENTS

Table 5. Number of patients not scheduled for a follow-up appointment within 18 months, GLCRPP clinic.

Reference period (12 months)	Follow-up period (18 months)	No of patients in reference period	No of patients without an appointment in follow-up period	%
1/4/2009 - 31/3/2010	1/4/2010 – 30/9/2011	1725	292	17
1/4/2010 - 31/3/2011	1/4/2011 – 30/9/2012	1746	345	20

Appendix 7 Developing and implementing health service innovation conference paper

2014 Organisational Behaviour in Health Care (OBHC) Conference 'When health policy meets every day practices', 23-25 April, Copenhagen Business School, Copenhagen, Denmark

Developing and implementing health service innovation in glaucoma outpatient clinics: the problem of aligning multiple public and private organisational actors

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Paper submitted to conference subtheme 4: 'Investigation of the way local translations, narratives, logics and discourses alter or sustain embedded routines and organisational change'

Abstract

The role of professional and organisational processes in mediating the implementation of service innovation within health care organisations is well documented. However, studies at the organisational level have tended to focus on intra-organisational processes, such as receptivity of the organisational culture, the nature of clinical-managerial relations, and inter-professional communication. This paper also focuses on organisational interactions in the innovation process, but emphasises the involvement of a wider range of stakeholders, public and private, in the development and implementation of service innovation, including clinicians, operational managers, management consultants, technology organisations, service users, and local clinical commissioning groups. Our argument is based on two case studies of the development of clinical service redesign projects that were focussed on increasing the capacity of outpatient glaucoma clinics within the ophthalmology service of an acute NHS hospital. Semi-structured interviews (22) were conducted with these stakeholders and non-participant observation (33.5 hours) took place of outpatient clinics and service and directorate level meetings in which the projects were discussed. The qualitative study of implementation processes was supported by operational research techniques that were used to map patient flows within the clinics. Drawing upon actor-network theory, socio-technical analysis was used to explore the ways in which these multiple stakeholders shape the implementation of innovation. We found that the need to accommodate stakeholders' different interests and actions hinders the implementation process.

1. Introduction

Following the 2008 financial crisis and the widespread introduction of austerity measures across Europe, health systems in many European countries are facing pressure to reduce public spending and are seeking ways to save costs and provide health services more efficiently (European Public Health Alliance, 2013). In response to this context, a priority for the English National Health Service (NHS) is strengthening the leadership of innovation to improve the adoption and spread of ideas, products and services that 'add value, not cost' (DH, 2012). This dual ambition is reflected in the Quality, Innovation, Productivity and Prevention (QIPP) programme that aims to support NHS organisations with making efficiency savings of up to £20 billion by 2015, key to which is innovation through clinical service redesign ('transformational change') that improves the quality of care for patients and also represents more financially sustainable service delivery models (DH, 2011). However, policymakers in England also recognise that barriers to the development and implementation of innovation within the health service need to be overcome, including potential resistance to service innovation where this may disrupt existing working practices and service arrangements (DH, 2012).

To create greater supply-side pressure for innovation, policymakers are introducing a number of measures in relation to the English NHS, including: improving procurement opportunities with industry especially small and medium-sized enterprises (SMEs) (DH, 2012); giving semi-autonomous foundation trust hospitals more leeway to pursue private patient income and form 'spin-off' companies to support the commercial exploitation of innovations (Health and Social Care Act, 2012); maintaining an 'any qualified provider' policy that builds on earlier reform to widen commissioning of care services from private and third sector organisations (DH, 2005); and placing a legal duty on local clinical commissioning groups to promote innovation and adoption processes in their localities (DH, 2011). On the one hand, these measures promise to widen the supply base for innovation but, on the other, they also mean that a wider range of potential stakeholders, public and private, may be involved in innovation processes, and the need to align their interests may have knock-on effects upon the development and implementation of innovation within health care organisations. Using socio-technical analysis informed by actor-network theory (Latour, 2005), this paper analyses this issue by exploring the use by an acute English NHS Trust of private management consultants, a technology company, and other internal and external actors to support the planning and development of service redesign projects to improve the capacity of overrunning outpatient clinics within ophthalmology.

In the next section, potential barriers to the implementation of service innovation identified in the health services research literature, use of external management consultancy as a potential facilitator

of innovation in this context, and the value of using a socio-technical approach for their study, are described. After the research context and methods are outlined, the study's findings are presented concerning the complex socio-technical organisation of glaucoma outpatient clinics, the stymying effect this has had on everyday improvement efforts, and the attempts by the hospital to improve the performance of clinics using two case study service improvement projects that involve use of external management consultancy knowledge and facilitation. It is important to explore how management consultants and other professional service organisations influence the development and implementation of innovation processes because their use within the English NHS is common at a system level (Davies, 2012), in programme management (Hendy et al., 2012), by provider organisations (Bloomfield and Danieli, 1995); and they are influential in public management reform more broadly (Pollitt, 2013).The paper concludes with a discussion of the implications for theory and policy regarding the implementation of innovation in health care provider organisations.

2. The implementation of service innovation in health care contexts

Departing from models depicting innovation diffusion as a rational, linear process (Rogers, 2003), studies of innovation contextualised in the health care sector often highlight the complex social and organisational processes which influence decisions to adopt innovations, and shape the ways in which they are translated into practice (Greenhalgh et al., 2004; Robert et al., 2009; 2010). These processes are context-specific, operate at multiple scales (micro, organisational, macro), can be either 'formal' or 'informal', and typically involve interactions among a range of stakeholders (Robert and Fulop, in press). At the organisational level, multiple factors are theorised to influence the receptivity of the context for innovation, including: quality and coherence of local policy, sources of leadership, environmental pressure, organisational culture and history, relations between management and clinicians (Pettigrew et al., 1992); as well as availability of information systems, resources for change, and having a patient or 'customer' focus (Kaplan et al., 2010). Variation in these supporting contextual factors at the local level means that aligning the multiple stakeholder groups involved in the implementation of innovation can often be problematic. In particular, tensions between managerial and clinical groups within hospitals (Bate, 2000), and differences in the interests of different professional groups (Ferlie et al., 2005), can have a negative impact upon the innovation process.

The alignment of different managerial and clinical groups has been shown to be a particular problem in the context of clinical service redesign (e.g. new clinical pathways) where multiple groups may be affected by the implementation of change. The implementation of new care pathways may be inhibited by a lack of clinical engagement; disagreement about their purpose, resistance to standardisation, their perceived relevance to only some clinical groups, and

inadequacy of organisational resources are some of the barriers found in the literature (Evans-Lacko et al., 2010). The implementation of redesigned services may also have an impact on intra- and inter-professional relations, as redesigned services may introduce new organisational roles, affect existing professional roles and jurisdictions, and alter the boundaries between different organisational groups. For example, to participate in clinical pathways that make use of telemedicine, established consultants may need to undergo retraining and, in the delivery of services, clinical teams may need to accommodate new occupational roles raising potential inter-professional tensions (Mork et al., 2010).

In exploring innovation processes at the organisational level, we argue that it is also important to take into account a range of external professional service organisations and other external intermediaries that may influence innovation processes in health care provider organisations, such as management consultancies and technology providers, and to explore how their interactions with different clinical and managerial groups within hospitals help to shape the development and implementation of innovation. Key to the growth of professional service firms in the 1970s and 1980s, management consultancy can be defined broadly as 'an advisory activity built on the client-consultant relationship' (Kipping and Clark, 2012, p.20). According to the Management Consultancies Association, over a fifth (22%) of fee income for the management consulting industry in the UK comes from the public sector and is second only to financial services in fee income[1]. The NHS spent an estimated £600 million on consultancy services in 2005/06, representing a fifth of all spending on consultants within the public sector (National Audit Office, 2006). Due to the 2008 financial crisis and change of government in 2010, public sector spending on management consulting declined in the period 2008-2011, but showed growth of 12% in 2012 according to the Management Consultancies Association[2].

According to the National Audit Office, management consultants are typically used to provide access to specialist skills, facilitate approaches to tasks, and to provide an independent perspective on a client's problem (NAO, 2006). Justifying use of management consultants at a system level within the English NHS, the then NHS Chief Executive told a House of Commons Health Committee (HCHC) in 2009 that consultants were used to bring in technical skills not available within the NHS and to improve the implementation of large scale service improvement programmes, such as the national IT improvement programme (HCHC, 2009). However, less is known about the ways in which management consultants and other professional service firms are used by individual provider organisations within the English NHS and how they influence the development and implementation of local service innovation.

Previous studies of management consultancy have largely focused on the relationship between consultants and their clients and the ability of consultants to influence processes of change within

client organisations (Lapsley and Oldfield, 2001). With respect to their involvement with public sector clients, the relative complexity and politics associated with the public sector appear to make the implementation of change challenging when compared with consultancy projects in the private sector (Lapsley and Oldfield, 2001). Management consulting organisations also appear to need to balance different interests during the lifecycle of projects. For instance, a qualitative study of an NHS Trust's use of a management consultancy to support the development and implementation of an IT system refers to the consultancy's use of power, deployed through the use of 'discursive resources' that weave together technical expertise and political skills, to establish and maintain a 'legitimate voice' throughout the development and implementation of projects (Bloomfield and Danieli, 1995).

Socio-technical analysis can be used to explore how the development and implementation of service innovations influences, and is influenced by, the relations within and between different managerial, professional, and external groups (including suppliers and commissioning organisations) within health care organisations. In particular, actor-network theory (ANT) (Latour, 2005) has been used in a health services context to study the adoption of complex socio-technical innovations and the reciprocal relationship between social relations and technology use that accompany innovation processes in different contexts (Cresswell et al., 2011; Prout, 2008; Timmermans and Berg, 2003). Actors, which can be human or material, are entities capable of aligning other intermediaries into a network of relations; through this process of alignment actors generate relational effects that shape the behaviour of others within a given context (Law and Hetherington, 2000, p.47). The power manifest in the alignment of relations can support innovation processes or serve to counteract them by maintaining the status quo. For instance, in the field of clinical genetics, Martin et al (2012) found that the sustainability of innovations led by frontline clinicians was often possible in the absence of clear evidence demonstrating effectiveness, and ascribed importance to the service leads' positional power, networks of support, and the innovation's alignment with other parts of the care pathway. However, little is known about the ways in which different networks of relations, originating both inside and outside health care organisations and involving multiple professional and organisational actors, may support or conflict with one another and the processes through which their alignment is negotiated in the context of the development and implementation of innovation.

This paper draws on ANT in order to explore how the development and implementation of new approaches to the delivery of ophthalmology outpatient clinics within a hospital is shaped by a range of social, organisational, and technological processes and public and private organisational actors. In particular, it describes the ways in which these processes inform the everyday practice of existing outpatient clinics, and how the array and complexity of these processes may inhibit the implementation of change to improve services. It then examines an attempt by the hospital to

address this complexity by drawing on external consultancy knowledge to redesign services, and attempt to explore innovative approaches to clinics in 'experimental' spaces within the hospital or new spaces outside, in order to potentially work around aspects of the context that inhibit change processes. However, the analysis centres on the interaction between the 'old' and 'new' approaches to delivering clinics and describes ways that the involvement of external actors to overcome complexity throws up a number of new organisational and technological challenges that would need resolving to support the innovation process.

3. Study context and methods

The study was conducted within the ophthalmology service of an acute NHS Trust hospital. Specifically, the study focused on the chronic eye condition of glaucoma which after cataracts is the most common cause of irreversible blindness worldwide. Glaucoma affects almost 10% of England's population over the age of 75, 2% of the population over 40, and accounts for over a million outpatient visits to the health service annually. The analysis is based on two case studies of attempts by the hospital to improve the capacity of glaucoma outpatient clinics. We were commissioned to conduct a feasibility study for evaluating new approaches to diagnosing chronic eye disease by the Trust. The first project was led by an external management consultancy and involved redesigning staff roles within existing clinics, and the second involved the planning and development of a new streamlined clinic for stable glaucoma patients that was to be piloted in a dedicated space outside existing clinics. The projects were undertaken as part of a portfolio of activity aimed at improving patient experience mainly by reducing the patient journey times for glaucoma outpatient clinics at the hospital. These services could overrun by as much as two to three hours because of the hospital's limited capacity to respond to the increased level of demand for new referrals and follow-up appointments for monitoring disease progression and treatment. Referrals to the hospital of patients with suspected glaucoma have been increasing annually due to population ageing and the recently introduced national clinical guidelines that had lowered the clinical threshold for referral (NICE, 2009). Both service improvement projects received Board-level support. The clinic redesign project, led by an external management consultancy, involved establishing a multiprofessional team within the hospital to reflect on the purpose and delivery of existing clinics, identifying new approaches to running clinics that may improve performance, and testing and refining these through process changes made to 'experimental' operational clinics allocated to the study. The new streamlined clinic, led by a small group of clinicians within the hospital, and supported by an external SME and others to provide technological and process design knowledge, involved the planning of a remote review clinic for stable glaucoma patients that would

be managed by technicians and the patient data collected would be available electronically to an ophthalmology consultant for review remotely.

From April to October 2013, two researchers (ST and CV) conducted 22 interviews related to both improvement projects with hospital managers (5), consultant ophthalmologists (4), doctors (4), optometrists (3), nursing staff (2), assistant clinic staff (2), and external technologists (2). The interviews, which lasted 45 minutes on average, were loosely structured using a topic guide that covered: perceptions of the organisation of existing clinics including their strengths and weaknesses; the drivers for change; improvements to clinics and impact; key actors in leading improvement efforts; and receptivity of the organisational environment to innovation. The interviews were recorded and professionally transcribed. The study also involved non-participant observation of four outpatient clinics (16.5 hours), three service and executive level meetings for the redesigned clinics (11.5 hours), and four planning meetings for the remote review clinic (5.5 hours). All observations were recorded contemporaneously in field journals kept by the researchers and normally typed up the same evening (including contextual details that were noted but could not be elaborated on at the time due to the need to keep up with ongoing events observed). The qualitative dataset (interview transcripts and notes of observations) was subsequently analysed thematically using inductive and deductive methods: data were categorised using an initial set of themes drawn from the study's research questions, interview topic guide, and key literature on innovation implementation, then further iterative analysis was performed in which the themes were developed and refined as patterns were identified in the data and the emerging themes were cross-referenced with relevant studies in the innovations literature.

4. Findings

The study's findings are now presented beginning with different stakeholders' perceptions of the organisation of existing outpatient clinics and the drivers within the hospital for improving the running of clinics. Then, the approaches to, and development of, the two case study service improvement projects are analysed.

The organisation of outpatient clinics and the drivers for change

A variety of patients were seen in the outpatient glaucoma clinics: new referrals for suspected glaucoma, post-operative follow-up in the weeks immediately after an operation, and routine monitoring and longer-term follow-up for all glaucoma patients in the system. A process map of the patient journey for these different patient types is provided in Figure 1.

Following registration with a receptionist, most patients entered the waiting room area. Those patients with a booked visual fields test typically first had this test before returning to the waiting area. A nurse occupying a private room in the clinic recorded the history of each patient and tested their visual acuity. Physicians (consultant, senior doctor, doctor), optometrists and nurses then

called each patient into the main area of the clinic, which had a number of appropriately equipped cubicles, sometimes with the help of a clinic co-ordinator. The allocation of patients to specialists was typically not pre-defined but organised 'on the fly' according to their availability and the complexity of each patient. Once a patient was in consultation with a specialist, a number of further tests was conducted (such as measuring intraocular pressures) and the case was discussed. Often the opinion of another specialist was required, such as the lead consultant or a senior doctor in the team, and in that case the patient typically returned to the waiting area to wait for the specialist to become available. Each consultation may result in a number of outcomes, including the start of or a change in medication, surgery or laser treatment, discharge to a high-street optometrist or full discharge from the service. A stable patient typically received a follow-up appointment sometime in the future (typically between six and twelve months), which was booked on the day with the receptionist.

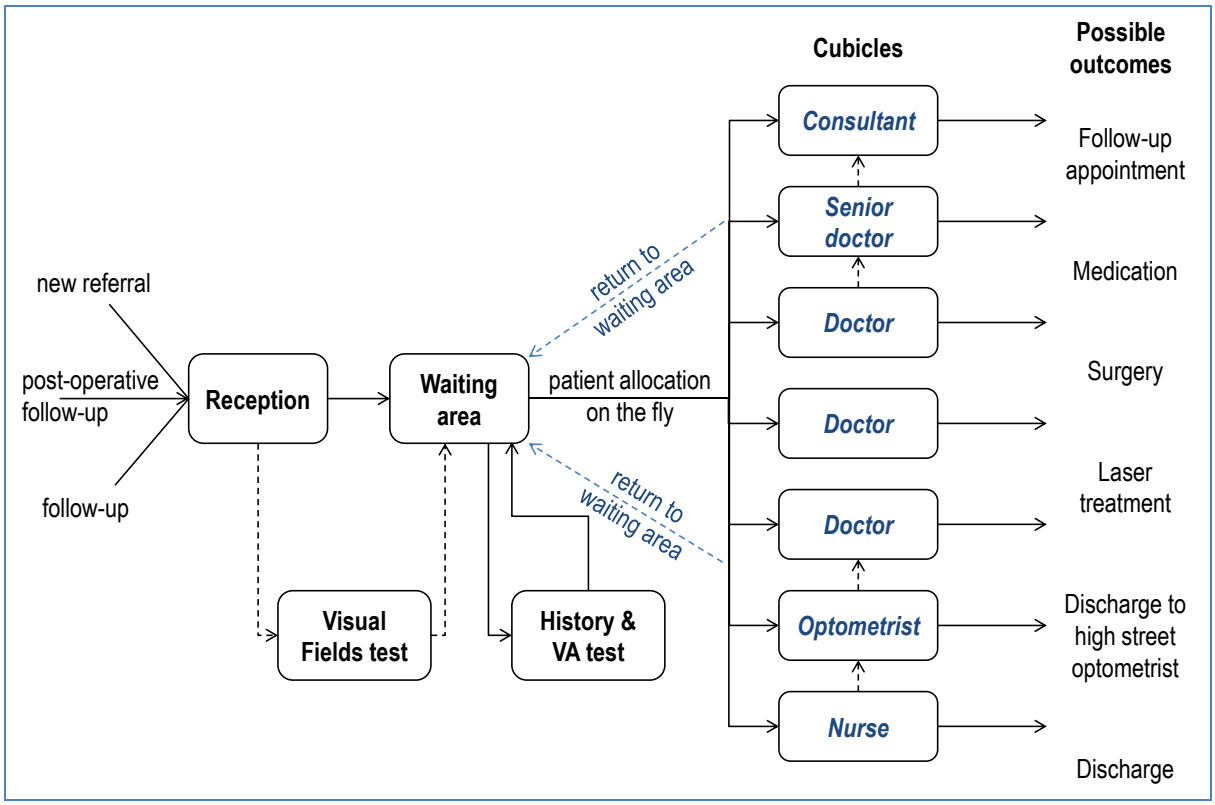

Figure 1. Patient flows in a typical glaucoma outpatient clinic. (VA: Visual Acuity)

There was consensus among the hospital staff interviewed for the study, both clinical and managerial, that capacity issues were associated with existing outpatient glaucoma clinics and that action was needed to improve patient journey times through the clinics and help alleviate what for many had become a strained working environment. An operational manager stated that 'Our demand outstrips our capacity quite significantly now in our glaucoma service', while a business manager suggested that the disorganised clinics were also affecting the hospital's ability to bid for new services, 'my mantra at the moment is that we don't have a service to sell' (Manager). In turn, the frontline staff involved in running the clinics readily acknowledged that they were not

functioning effectively: ‘Suddenly I think people have become aware that their clinics are totally out of control’ (ophthalmology consultant). A clerical officer responsible for booking in patients described one of the knock-on effects of the capacity problems felt while manning the reception desk: ‘I’ve been sworn at before by people who aren’t happy about the waiting times. You just have to take it’. Another glaucoma consultant described how the capacity problems engendered a pressured working environment which seemingly reduced opportunities for practice-based training within the clinic: ‘The deanery came last week to see us. One of the problems was our overloaded clinics; that’s what the [ophthalmic] trainees are complaining about. Who wants to be in clinic until seven thirty?’. In sum, a variety of staff – from managers engaged in developing the hospital’s strategy to clerks hearing patient complaints at the reception desk – broadly appeared to agree with the consultant’s view that glaucoma clinics were ‘out of control’ and therefore impetus existed for organisational change.

There was less certainty and agreement about what change should look like. The capacity problems at clinics had worsened over the last four or five years, due partly to the change in national guidelines for referral of patients with suspected glaucoma, and a number of tactics had been used to try to reduce patient journey times in the outpatient clinic, including provision of additional evening and weekend clinics, amalgamated reception points, a dedicated matron’s post, and recruiting new ophthalmology consultants each year. These changes had some impact on waiting times but appeared to represent more a costly ‘fix’ than a sustainable solution as patient volumes continued to grow year on year. Led by the Board, the Trust then initiated an integrated service improvement programme. As part of a feasibility study for evaluating new approaches to diagnosing chronic eye disease, we followed the progress of two service improvement projects within the programme, one represented an incremental approach to innovation based on adapting the organisation of existing clinics, and the other more radical solution was the piloting of a new clinic outside the hospital that involved nurses, health care assistants and technicians collecting patient data for subsequent remote review by a consultant.

Prior to studying the development of the service improvement projects, we observed the operation of existing outpatient clinics to try to understand how the social and technical organisation of the clinics may contribute to the capacity problems being felt by the hospital. The way in which clinics were managed and organised was influenced by the style of the consultant ophthalmologist who led the clinic, but also broader organisational factors that appeared to be more difficult to influence and control. There were difficulties with matching up patient flows with the resourcing of clinics. For instance, a clerk told us that post-operative and post-laser patients were allocated the first appointment time within the clinic as ‘standard procedure’, but then had to queue for the optical coherence tomography [OCT] machine ‘which sets the tone for the clinic’. There were also

difficulties with aligning the working hours of the multiprofessional groups staffing the clinic, as the consultant leading one of the clinics told us that it was difficult to change working practices within the clinic as staff groups fell under different lines of authority. Another factor that had to be taken into account was patients' preferences regarding appointment times as a clerk explained, 'patients don't want to come late in the afternoon or early in the morning', which meant that when booking appointments for patients, '[you] try and stagger it but it's really hard' (Clerk). Another consultant summed up the difficulties associated with the variety of actors involved in the organisation of outpatient clinics that inhibits attempts to improve them: 'The problem is so big and it involves so many – the clerks, the booking centre, the patients, the consultants – there's so many bits to it, it all is too hard so nothing gets permanently changed'.

The organisational strain caused by the capacity issues also created a context in which it was difficult to implement changes to the organisation of clinics that might help to alleviate the initial capacity problems. One operational manager explained that they sometimes struggled to balance the need in their role to respond to issues associated with existing operations while also supporting the implementation of service improvements: 'A major problem for operational managers in the NHS… is the fact that you really, really want to improve the service, but you just find that you end up doing too much fire fighting, and you end up focusing on far too many very short term problems and don't feel that you have the head space or capacity you would like to make the real sustainable improvements' (Manager). This view resonates with a recent study of hospital middle management which suggests that many middle managers' roles exhibit characteristics of 'extreme jobs', including 'being required to do more with fewer resources' and 'the need to involve many people before introducing improvements' (Buchanan et al., 2013). Some perceived tensions also stemmed from the broader context of austerity in which efficiency savings were increasingly sought by local Clinical Commissioning Groups (CCGs) in the types of health services being commissioned. The mismatch between the specification of the services being tendered by commissioners, and the different expectations of some consultants regarding clinical standards, was an emerging tension: 'You've got to find a balance between maintaining your clinical expertise and the quality of your service – that's what consultants get concerned about – if we start lowering our standards where does it end?' while at the same time 'the need to actually compete in the market now says we have to find ways to compromise because commissioners aren't going to pay for a gold standard service' (Business Manager).

In summary, there was broad agreement among different managerial and professional groups within the hospital that there was a need for organisational change, but the complexity of the organisational context in and through which glaucoma outpatients clinic were delivered had hindered the development and implementation of sustainable change to improve their performance,

as clinicians and managers alike struggled to deliver current services while searching for alternatives. This is a barrier that relates to the concept of organisational 'ambidexterity' or the ability of an organisation to combine the exploitation of existing capabilities with the exploration of new ones (Crilly et al., 2013). The strain caused by the capacity issues appeared to create a context in which it was difficult to reflect upon or implement new services that might help to alleviate the original capacity problems. A more radical approach appeared to be needed.

The service improvement projects described next made available dedicated resources to review existing clinics and find new ways of working to address the capacity problems and were endorsed by the Trust's board as part of an integrated service improvement programme. The development of the two improvement projects will now be discussed in turn.

Use of external management consultants to facilitate redesign of outpatient clinics

The Trust contracted a management consultancy specialising in supporting organisations with service redesign to review outpatient clinics within ophthalmology and work with local staff to improve services. A multidisciplinary group from the hospital was established to reflect on the operation of clinics (which included speaking to patients, observing patient journeys through the clinic and collecting time and motion data) and to develop, with the help of management consultants, new ways of running clinics that might improve their performance and reduce patient journey times. The main operational changes experimented with are represented in Figure 2. These included: a) pre-allocation of patients to specialists by the lead consultant; b) no or very few patients allocated to lead consultant who was thus able to spend time in different cubicles as-and-when needed; and c) 'single-piece' flow through the clinic, whereby the patient had the history taken and all the tests done by a single specialist.

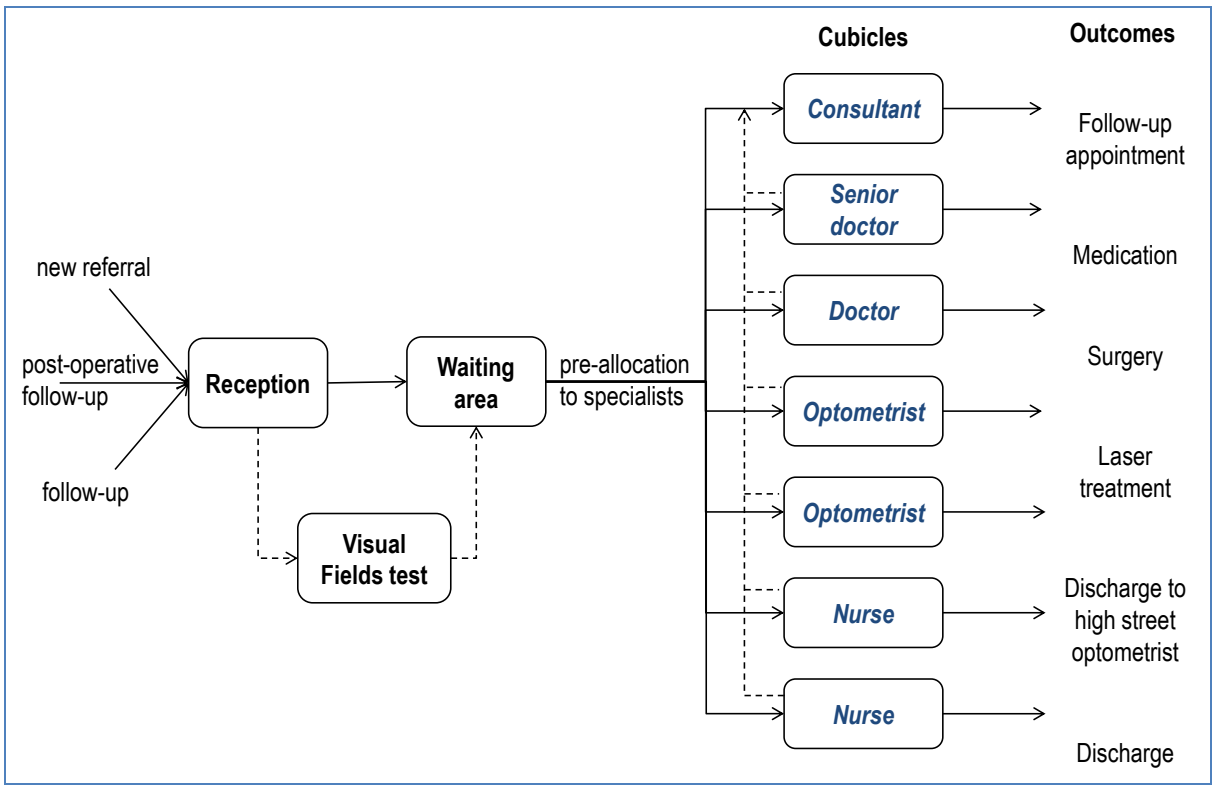

Figure 2. Patient flows in a redesigned glaucoma outpatient clinic

Views among frontline staff working within the redesigned clinics differed. An ophthalmology consultant leading one of the clinics described some of the benefits of the changes, that 'it feels more like you're running a team when you're running it this way because [of] things like you may have a team brief at the beginning' and that the consultant was now a 'floating resource' allowing more time for supporting other staff, including nurses; 'it gives me time to teach them, so [I] try and upskill them'. However, the consultant also recognised that some clinic staff were not as enthusiastic, particularly those more distant from the original review process with the management consultants, 'People seem to get more value out of this and understanding if you sit down and go through the whole process with them, they can understand it, but to have it imposed on them, they kind of think: it's just these management consultants and their project; it's another efficiency drive'. Some concerns were raised by other staff during the interviews about the pre-allocation of patients to named clinicians within the redesigned clinics. An optometrist told us that, firstly, the clinics were inflexible in certain situations, 'whenever it's really, really busy it wouldn't kill people to do visions and pressures if it's really stacking up' and, secondly, that the less diverse case mix may have a knock-on effect upon learning, 'we're seeing the same patients over and over and it's always "stables" and "new's" which is fine because we can cope with that but you're not really learning anymore […] whereas with the old system you just pick up any patient that is in the pile'. This issue was also highlighted by a trainee ophthalmologist working within the clinic, 'you're not going to get allocated the complicated ones unless you're a consultant or a fellow so there's less of an opportunity of teaching'. This doctor also raised concerns about dealing with all aspects of a

patient's treatment, rather than tasks being distributed among the team: 'it's quite time consuming for me, so as the doctor I would be there taking the visions, taking the pressure, doing the whole investigation which I wouldn't otherwise do. Now, I'm by no means saying I'm above that, but the reason that there's a hierarchy in the clinic is because our time is more valuable just as a consultant's time is more valuable than mine'. A trainee consultant explained that the approach to managing clinics advocated by the management consultants was not fully embedded and there was tension between the 'old' and 'new' style of managing clinics and, at the beginning of each clinic, 'the question is you know are we using [the redesigned clinic] or are we not, but the plan is we will see how it goes which I think is how we are doing it a lot of the time, just sort of trying to be flexible about it'.

Over a ten month period, the redesigned clinics had been tested within all glaucoma outpatient clinics at one of the Trust's sites, and a decision had to be made about whether to adopt the approach more widely within the organisation, either in other parts of the pathway (e.g. for surgical patients) or at another of the Trust's sites. In order to inform the Board's decision, a series of meetings were held with clinical and managerial staff that had been involved in, or would be affected by the continuation of, the clinic redesign project. We observed a clinical governance meeting in which a hospital manager involved in the project gave an overview of its rationale and some preliminary data showing a reduction in average patient journey time in one of the clinics. During questions from the audience, a trainee ophthalmologist asked 'what does success look like?' – did this mean saving money or improving patient experience – a technician also suggested that patients were not as happy as suggested because they 'see us and have a go, but are nice to doctors'. A representative from the management consultancy suggested that the focus was on 'value time'; if patients were seen more quickly, the time saved could be used in other ways and if clinics finished at a reasonable time this may improve morale, which may save cost by helping in turn to reduce staff turnover. Another audience member raised the issue of sustainability and where the internal resources would come from to support the process once the management consultants finish this project with the hospital.

At a subsequent feedback meeting with glaucoma consultants we observed, a member of clinical staff involved in the project gave a PowerPoint presentation summarising the approach taken of pre-allocating patients according to the clinical team's skill mix. 'Very original idea' mutters one of the consultants in a sarcastic tone. Another consultant suggested that the problem is the overbooking of clinics and only once patient numbers are down, is it appropriate to enter into any work redesigning the clinics. Increasing the capacity of clinics was an issue 'management should be addressing'. At a later point, the Trust decided that the clinic redesign project would not be extended for the time being.

Planning and developing the remote review clinic for stable glaucoma patients

In parallel to the redesign project, a project led by an ophthalmology consultant within the hospital was being undertaken to pilot a different approach to running outpatient clinics for stable glaucoma patients in which nurses, health care assistants and technicians would conduct tests and collect patient data for later review remotely by a consultant ophthalmologist. Making data available for remote review required the linking of different ophthalmic instruments (e.g. the tonometer for checking intraocular pressure) within the clinic with the Trust's electronic patient record system through a technology company, and other external researchers working on a consultancy basis, that were involved to help develop and test the technology platform. The clinicians leading the project at the hospital felt they were well placed to suggest ideas for improvement and support their adoption into practice, 'we're in the best position to do this because we are at that level where we see the patients, we see the impact on our work on patients and we want to work for them and make their experience better. That sounds cheesy but it's actually genuinely true'. This contrasted with management's more reactive approach to dealing with the capacity problem: 'At the minute we seem just to be throwing money in and saying, let's get a new consultant, let's get a new consultant, open clinics, open clinics, and we've got a gazillion consultants to try and absorb or manage our glaucoma caseload, but I don't think that's the way to do it. I think the way to do it is to actually improve'.

However, the start date for piloting the remote review clinic was delayed by approximately 18 months. There were a number of reasons for this. Firstly, there were difficulties in securing access to a space inside the hospital for testing the equipment, and a space outside in which to run the pilot clinic. The space needed for testing equipment was not always available to the project team, as one member explained: 'they haven't had access to [space] because there's so much bureaucracy. We have a space committee that tells us when we can use the space, which is empty half the time, and it's stuff like that which just drags and kills you'. Secondly, there were delays in sorting out contracts for the independent contractors that were employed to support the linking of equipment and technology. One explanation offered for this was a convention among clinicians of collaborating on a more informal basis when working together: 'When it comes to business, you have to have a contract right at the very start, you have to have all your things clarified, what the outcomes are going to be, which we don't because we just work very much on an ad-hoc basis, that's what clinicians do. I'll borrow your camera for three months, I'll collect this data and I'll publish something. That doesn't work in the real world so I think that's where not having this clear contract – [stating the technology company] will do this, and we'll give [the Trust] this [mattered] because that wasn't done right at the very start'. Finally, there did not appear to be a formal organisational structure for supporting the development and potential implementation of new ideas:

‘There is no formal structure to say we have an idea, we will go to this person, or we’ll have a meeting with this group of people to help us, there isn’t within the hospital, as far as I know actually, I don't think there is. I think it’s very ad hoc. You go with an idea and they say right, are you going to see more patients?’. Perhaps due in part to the absence of such a structure for managing potential innovations, there was a perceived lack of alignment between the types of service developments that clinicians would like to make and the ‘bottom line’ operational criteria that might be used by managers to assess their potential value.

Additionally, the Trust’s commissioning relationships in the broader local health economy also delayed piloting of the clinic. The shift in the commissioning organisation from the Primary Care Trust (PCT) to local CGGs delayed the piloting of the streamlined clinic because contract negotiations that had started with the PCT had to be reopened in the months following the CCG’s establishment. In a planning meeting between the hospital and the CCG, a loss of ‘organisational memory’ due to changes in personnel was acknowledged by both parties. The CCG was not able to agree access to a primary care space owned by the CCG until neighbouring CCGs had also been consulted, reflecting the wider geographical area from which patients attending the clinic would come from. The CCG also raised questions during the meeting about the hospital’s knowledge of patient views on the virtual clinics and the evidence base for introducing the new clinics. Outside the formal meeting one member of the team from the hospital suggested that negotiations were taking longer with the CCG because the commissioners regarded those attending the clinic within the locality as ‘their patients’.

5. Discussion

This paper examined the involvement of multiple stakeholders in the planning and implementation of different service innovations within the ophthalmology service in an English NHS hospital. A raft of organisational factors within the hospital affected the performance of outpatient glaucoma clinics (booking systems, different managerial lines of authority, ophthalmic devices, use of physical space) and the difficulty the hospital had, in the language of ANT, with aligning those processes into a coherent network of relations contributed to the clinics being ‘out of control’ in the face of rising patient numbers for suspected and diagnosed glaucoma. The Trust’s service improvement programme, that brought different approaches to bear on the problem including use of external management consultancy, aimed to introduce change by deconstructing and attempting to modify the underlying social and technical organisation of the clinics. The processes of planning and redesigning the clinics drew in new actors and intermediaries that interacted with the existing relations constitutive of the context in which clinics were delivered at the hospital. In attempting to (re)align the extant social and technical processes that appeared to contribute to the overrunning clinics, the actions of the management consultants and others introduced new social and technical

relations that, to succeed in producing innovation, had to confront the existing relations and align those with the desired vision for delivering clinics.

This was not straightforward. Managers and clinicians within the hospital differed in their views about the appropriate design and service specification of clinics and where responsibility lay for implementing change. The clinics that were redesigned with the support of management consultants were endorsed by some frontline clinicians (e.g. nursing staff), but the change in patient case mix was not received as positively by optometrists and doctors in training. While the planning of remote clinics outside the hospital could largely avoid the embedded routines associated with the delivery of existing clinics, it prompted protracted negotiations with a local CCG as the redesigned service would affect 'their patients'. The planning of this project was also stalled by internal difficulties with setting up contracts and securing space for testing the technology platform. While political power appeared to be central to making progress in both service improvement projects (to support the alignment of relations), the role of evidence or clear definition of expected outcomes in the development and implementation process was not as clear. For example, the management consultancy's use of the term 'value time' to point to potential benefits generated through the redesigned clinics was not perhaps linked sufficiently enough to outcomes and its meaning was questioned by others within the hospital.

As the planning of the remote review clinic is ongoing, our own role as 'outside' academic researchers in helping to inform the evaluation of the new approach to clinics will need to be judged at a later date. The difficulty of aligning multiple stakeholders, including the need perhaps for a more formal architecture within the Trust for planning, developing and evaluating operational service improvement projects – particularly where this involves collaboration with external organisations – is likely to be a recommendation that we will develop further through our ongoing research.

6. Conclusion

Supporting earlier research on the implementation of innovation, we found that the presence of multiple stakeholders, with different interests and perspectives on the need for innovation, impeded the implementation of change. Our study contributes to this literature by describing the diversity of stakeholders involved in planning and implementing the service innovations in ophthalmology studied, highlighting in particular the role of actors beyond the hospital's formal organisational boundaries in shaping implementation processes, including external management consultants, technology companies, and local commissioners. This study also provides insight into the nature of the interactions between different stakeholder interests in innovation processes. In explaining the obstacles these posed to the implementation of innovation, themes of conflict and resistance that might be expected to explain delays, impasse even, were not prominent in our case studies. Instead,

we found a more subtle social practice of difference at play, in which habit, uncertainty, loosely defined outcomes, and lack of time for reflection, brought the hospital back to old routines, and a host of mundane, administrative factors including contracts, space, and following due process, hampered progress with pursuing innovative alternatives.

Notes

[1] See http://mcaindustryinsightcentre.com/#who-is-buying-consulting/ (accessed 29 November 2013).
[2] See http://mcaindustryinsightcentre.com/#public-sector-consulting-in-the-age-of-austerity/ (accessed 29 November 2013).

References

Bate, P. (2000) Changing the culture of a hospital: from hierarchy to networked community, Public Administration, 78(3), 485-512.

Bloomfield, B. P., & Danieli, A. (1995) The role of management consultants in the development of information technology: the indissoluble nature of socio-political and technical skills, Journal of Management Studies, 32(1), 23-46.

Buchanan, D. A., Parry, E., Gascoigne, C., & Moore, C. (2013) Are healthcare middle management jobs extreme jobs?, Journal of Health Organization and Management, 27(5), 646-664.

Cresswell, K., Worth, A., & Sheikh, A. (2011) Implementing and adopting electronic health record systems: How actor-network theory can support evaluation. Clinical Governance: An International Journal, 16(4), 320-336.

Crilly T, Jashapara A, Trenholm S, Peckham A, Currie G, & Ferlie E. (2013) Knowledge mobilisation in healthcare organisations: Synthesising the evidence and theory using perspectives of organisational form, resource based view of the firm and critical theory. NIHR Health Services and Delivery Research programme.

Davies, P. (2012) Behind closed doors: how much power does McKinsey wield?, British Medical Journal, 344:e2905.

Department of Health. (2005) Creating a patient led NHS – Delivering the NHS improvement plan. London, UK: DH.

Department of Health (2011) The Operating Framework for the NHS in England 2012/13. London, UK: DH.

Department of Health. (2012) Innovation, Health and Wealth. London, UK: DH.

European Public Health Alliance. (2013) Reforming Health Systems in Times of Austerity, EPHA Position Paper, May, available at http://www.epha.org/ (accessed 23.11.13).

Evans-Lacko, S., Jarrett, M., McCrone, P., & Thornicroft, G. (2010) Facilitators and barriers to implementing clinical care pathways. BMC health services research, 10(1), 182.

Ferlie, E., Fitzgerald, L., Wood, M., Hawkins, C. (2005) The nonspread of innovations: the moderating role of professionals, Academy of Management Journal, 48(1), 117-134.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004) Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Quarterly, 82(4), 581-629.

Hendy, J., Chrysanthaki, T., Barlow, J., Knapp, M., Rogers, A., Sanders, C., ... & Newman, S. (2012) An organisational analysis of the implementation of telecare and telehealth: the whole systems demonstrator, BMC health services research, 12(1), 403.

House of Commons Health Committee. (2009) The use of management consultants by the NHS and the Department of Health. Fifth Report of Session 2008–09. Vol. HC 28. London: The Stationery Office.

Kaplan, H., Brady, P., Dritz, M., Hooper, D., Linam, M., Froehle, C., Margolis, P. (2010) The Influence of Context on Quality Improvement Success in Health Care: A Systematic Review of the Literature, The Milbank Quarterly, 88(4), 500-559.

Kipping, M., & Clark, T. (Eds.). (2012) The Oxford handbook of management consulting. Oxford University Press.

Lapsley, I., & Oldfield, R. (2001) Transforming the public sector: management consultants as agents of change. European Accounting Review, 10(3), 523-543.

Latour B (2005) Reassembling the social: An Introduction to Actor-Network-Theory. Oxford University Press: Oxford.

Law, J. and Hetherington, K. (2000) Materialities, spatialities, globalities, in J. Bryson, P.W. Daniels, N. Henry, and J. Pollard (eds.), Knowledge, Space, Economy, London: Routledge, 34-49.

Martin, G. P., Weaver, S., Currie, G., Finn, R., & McDonald, R. (2012) Innovation sustainability in challenging health-care contexts: embedding clinically led change in routine practice, Health Services Management Research, 25(4), 190-199.

Mork BE, Hoholm T, Ellingsen G, Edwin B, Aanestad M (2010) Challenging expertise: on power relations within and across communities of practice in medical innovation, Management Learning, 41, 575-92.

Murdoch, J. (1998) The spaces of actor-network theory, Geoforum, 29(4), 357-374.

National Audit Office. (2006) Central government's use of consultants. London: Stationery Office.

National Institute for Health and Clinical Excellence. (2009) 'Glaucoma Diagnosis and management of chronic open angle glaucoma and ocular hypertension', NICE Clinical Guideline 85, April 2009.

Pettigrew A,M., Ferlie, E., McKee, L. (1992) Shaping strategic change: The case of the NHS in the 1980s, Public Money & Management, 12, 27-31.

Pollitt, C. (2013) 40 Years of public management reform in UK central government–promises, promises..., Policy & Politics, 41(4), 465-480.

Robert, G. & Fulop, N. (in press) The role of context in successful improvement. London: The Health Foundation.

Robert, G., Greenhalgh, T., MacFarlane, F., & Peacock, R. (2009) Organisational factors influencing technology adoption and assimilation in the NHS: a systematic literature review. Report for the National Institute for Health Research Service Delivery and Organisation programme.

Robert, G., Greenhalgh, T., MacFarlane, F., & Peacock, R. (2010) Adopting and assimilating new non-pharmaceutical technologies into health care: a systematic review, Journal of Health Services Research & Policy, 15(4), 243-250.

Prout, A. (2008) Actor-network theory, technology and medical sociology: an illustrative analysis of the metered dose inhaler, Sociology of Health & Illness, 18(2), 198-219.

Robert, G., Greenhalgh, T., MacFarlane, F., & Peacock, R. (2010) Adopting and assimilating new non-pharmaceutical technologies into health care: a systematic review, Journal of Health Services Research & Policy, 15(4), 243-250.

Rogers, E.M. (2003) Diffusion of Innovations, Fifth Edition. Free Press, NY.

Timmermans, S., & Berg, M. (2003) The practice of medical technology, Sociology of health & illness, 25(3), 97-114.