

**Implementing innovation in the UK National Health Service
A case study in patient compliance**

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Abstract

Missed appointments are a common form of patient non-compliance. One reason often given is they had been forgotten. We evaluate two recent innovations to address this problem introduced at one of the Scottish health boards to increase compliance at consultant-lead outpatient clinics. Patients with long waits were more likely to miss their appointment, but not, apparently, because they were more likely to forget it. Nevertheless, both innovations made a big difference and, combined, reduced recorded non-attendance rate by 90%.

The administrative innovation changed the way appointments were made. At its most basic, bookings were made no more than five to seven weeks in advance, at no additional cost. Some of these patients also had to confirm their appointment. This reduced non-attendance still further, but at a cost of at least £150 per missed appointment avoided.

The technological innovation used SMS and E-mail messages to send last minute reminders. It more than halved non-attendance, but the inability to collect contact details limited its applicability, and few of the patients reached provided contact details. Some fifty to one hundred messages have had to be sent to avoid one missed appointment. However, the use of the NHS network avoided significant recurrent costs.

Keywords:

Outpatient services; Did not attend; SMS messages; Partial booking; Patient focussed booking

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Introduction

Patient compliance can take many forms. The issue addressed in this paper is attendance at booked appointments. Missing appointments is a widespread practice, as much for the United Kingdom National Health Service [NHS] as for other organisations. This paper looks at consultant-lead outpatient appointments, an important route for specialist advice. A number of innovations have been introduced to reduce this form of non-compliance, and we look at two: one administrative, the other technological. The administrative innovation concerns the way appointments are booked; the technological innovation makes use of the widespread ownership of cellular phones and access to the World Wide Web to send last minute reminders.

The innovations might have been analysed in separate papers but, as this study shows, they are closely linked. On the one hand, they are alternative ways to reduce non-compliance. On the other, at the very least, one complements the other. Finally, both innovations illustrate the importance of the institutional setting for their successful implementation. One might say: “The Devil’s in the detail”; something policy makers often overlook. In this paper we examine their implementation at one Scottish health board, and the impact they have had on missed appointments.

We start with some background information. Next, each innovation is described in general terms, with details for the health board studied, Dumfries & Galloway, in Scotland. We then model and estimate the impact of the two innovations on missed appointments. The paper ends with a discussion of the results. We conclude, first, that both innovations had a major impact on missed appointments; but second, that the cost of one and the failure to implement the other in full limited their scope.

Background

Outpatient services in the NHS

Patients needing specialist medical advice and treatment are most likely to have their first contact as an outpatient, or at an Accident & Emergency [A&E] Department. In the case of outpatients, referral is the norm: usually by the patient’s general medical practitioner [GP], though referral may be by another specialist. Outpatients are invariably offered an appointment. Patients seen are either discharged, or asked to return as an outpatient, as an inpatient (involving an overnight stay at the hospital) or as a day case (not involving an overnight stay at the hospital).

Missed appointments are variously known as ‘no shows’, ‘DNA’ [Did Not Attend], and ‘FTA’ [Failed To Attend]. DNA is common parlance in the United Kingdom NHS, and is the term used for the rest of this paper. Information on non-attendance has been collected centrally for all new appointments in Scotland in recent years. There has been little change in recent years, although a peaking in 2003 and its subsequent decline are discernable (ISD Scotland of NHS National Services Scotland, 2006a). Overall, some one-in-ten new appointments in Scotland had been missed.

Cell phone ownership and SMS use

Information on ownership and text message – short message service [SMS] – use in the United Kingdom is given in table 1. Ownership and use are common, and both tend to fall with age. SMS use has continued to increase, most recently among those older. The data suggest very many patients could be reached by SMS messages, though those at greatest risk for health care, the elderly, are the least likely.

[Insert table 1]

Administrative innovation: booking appointments

The traditional arrangement

We begin by describing the booking arrangements that preceded the administrative innovation. On receipt of the referral letter from, say, the GP, the consultant decides its priority. In the past new patients were notified, there and then by letter, of the booked appointment: its date, time and place. All patients are given an appointment, but categorised in decreasing order of importance as: ‘urgent’, ‘soon’ and ‘routine’. Waiting time targets have been set for ‘urgent’, ‘soon’ and ‘routine’ patients. In Dumfries & Galloway [D&G] the target for ‘urgent’ cases has been 2-4 weeks, depending on the specialty, and for ‘soon’ patients it has been 6-12 weeks, again depending on the specialty. ‘Routine’ patients have been given the next available appointment. Some ‘routine’ patients have had such long waits that the various United Kingdom Health Departments set waiting time targets. In Scotland the waiting time target for all outpatients for the period studied was six months. In June 2005 the target set for the end of 2007 was reduced to 18 weeks (ISD Scotland of NHS National Services Scotland, 2006b).

Return patients were booked at the preceding clinic. No waiting time targets have been set. Instead, the patient’s wait is based on his or her clinical circumstances.

Patient focussed booking [PFB]

Patient focussed booking was introduced in 1999 in England on an experimental basis under the name ‘partial booking’ (Department of Health, 2002, Annex B). It was introduced into Scotland in 2003, and has been adopted by D&G and a number of Scottish hospitals. We focus on three features of PFB that changed the way bookings are made (Department of Health, 2002; and CCI, NHSScotland, 2006).

First, bookings are no longer made far in advance of the appointment date. In D&G the threshold has been five to seven weeks, depending where the clinic has been held. To that extent ‘urgent’ patients have been unaffected by the introduction of PFB. New patients expected to wait longer are sent a letter of acknowledgement indicating the Scottish target of 26 weeks, together with the expected waiting time locally for that specialty. They are told they will be contacted approximately six weeks prior to the appointment. Return patients are given a review appointment at the clinic if it is within six weeks; those who must wait longer are told they will be contacted shortly before their next appointment to fix a date, time and place.

Tied in with the five to seven week thresholds has been the requirement that consultants plan their annual leave at least six weeks in advance, or else be responsible for finding a replacement: a policy enforced by senior management at D&G (NHS Dumfries & Galloway, Unpublished report, 2005). Cancelled *clinics* inconvenience patients who had booked appointments, adding to their waiting time, and putting them out-of-order – i.e. *not* first-come-first-served - in relation to their date of referral (Audit Scotland, 2003, pp 13-4).

Second, patients with longer waits are now invited, by letter, to make an appointment. They are asked to phone the hospital - charged at the local rate in D&G - and book an appointment. Calls are to be made between 8 am to 12 noon and 2 pm to 6 pm, Monday to Friday, and expected to last no more than two minutes on average. Patients who do phone are sent a further letter confirming the date, time and place of their appointment. Those who do not, within two weeks, are sent a reminder 'invitation' letter, and warned the hospital will assume the appointment is no longer needed if they fail to respond within a further two weeks of the reminder 'invitation' letter. In the case of new appointments this is exactly what happens, and the patient's GP is told to re-refer the patient if this is clinically appropriate. Practice in D&G varies in the case of return appointments: for some specialties patients are 'discharged'; for others an appointment is made without consulting the patient.

And third, patients are given more choice of date, time and place for their appointment.

To summarise: the booking arrangements under PFB made no difference to the traditional arrangements for 'urgent' new patients or for return patients with successive appointments no more than five to seven weeks apart. For the others, it did. Appointments are booked closer to the date they are held, for some patients very much closer. Patients have to opt in to have an appointment, whereas previously all were assigned one. And finally, patients are now given some choice of where and when the appointment is held, whereas previously the choice was made by the hospital.

PFB was introduced in D&G in July 2004 on a specialty-by-specialty basis, and applied simultaneously to new and return appointments in any given specialty. Most specialties in the health board were covered by July 2005. Notable exceptions were obstetrics, psychiatry, clinical oncology and palliative care for clinical or practical reasons, and ophthalmology because of the additional resources required. D&G introduced a variant of PFB whereby some patients with longer waits were *assigned* a date, time and place for their appointment six weeks in advance, denoted by PFBpart. This is exactly the same as the traditional system, except the booking was nearer to the date of the appointment. The national model was used for other patients: they had to contact D&G to book an appointment, and are denoted by PFBfull. The dichotomy, PFBpart and PFBfull, proves a useful research tool, and frequent reference will be made to it below. Information on the proportion of new and return appointments over the thirteen-month period of study, August 2004 to September 2005, at D&G is shown in figure 1. There was an early growth in the proportion of patients covered by PFB, to one-third by the end, of whom rather more than half these conformed to the national model.

[Insert figure 1]

The introduction of PFBpart incurred no additional resource costs, as its only difference from traditional booking has been when the appointment letter was sent. The introduction of PFBfull, on the other hand, incurred significant additional costs: upgrading the patient administrative system software, installing and operating the call centre, and extra correspondence. The setting up costs to D&G for some 1650 appointments a month was £700 in 2005 prices; the running costs were more than £257 per 100 appointments.

Technological innovation: appointment reminders

NHS practice in respect of sending appointment reminders has varied. In the past, those patients who were sent reminders received a phone call, or a letter or card. In D&G no reminders were sent until August 2004, when it experimented with sending SMS and E-mail messages. This innovation was built upon its centralised patient administrative system that holds each patient's personal data, such as address and main phone number, in electronic form. The experiment required the adaptation of the patient administrative system to accept cell phone numbers and E-mail addresses, and its use to send messages with the appropriate information. There was a one-off cost to D&G, of from £700 to £1000, in staff time at April 2005 prices

Contact details must also be collected, and the introduction of reminders to coincide with PFB at D&G was deliberate. The requirement for patients to phone back to book an appointment gave hospital staff the opportunity to explain why, and to ask for contact details. The willingness of patients to provide these details has been taken as implied consent for their use this way. The subsequent letter containing – and for PFB patients confirming - details of the date, time and place of the appointment also draws explicit attention to the last minute reminder: particularly useful for those not covered by the national model, PFBfull, who otherwise might have been unaware that reminders were available. The resource implications of collecting contact details were thus minimal.

The content of these SMS and E-mail messages has been the same, being:

“You have an NHS appointment on [date] at [time]. Please contact 0845
..... [D&G patient focussed booking phone number] if you cannot attend.
[Case reference number]”

The reminders were sent two days in advance of the appointment. D&G made use of the NHS network, NHSmail, and so incurred no delivery charges from sending SMS and E-mail messages.

Information on the implementation of reminders over the thirteen-month period, August 2004 to September 2005, at D&G is shown in figure 2. It rose from 2% to 7% of the health board population of non-psychiatric outpatients. On the face of it, the proportion was very low, bearing in mind the extent of cell phone ownership and SMS use. Part of the explanation is the way appointments were booked. Patients booked the traditional way and those *assigned* appointments under PFB, PFBpart, did not have to confirm their appointment, and the hospital's booking staff therefore missed

the opportunity to collect contact details when the booking was made. This contrasts with the PFBfull patients who had to confirm they wanted an appointment. Figure 2 also shows trends in reminders for patients booked under the three arrangements: traditional, PFBpart and PFBfull. There is little to choose between the traditional and PFBpart groups: only very small proportions were sent a reminder, gradually rising from some 2% to 4%. The proportion for PFBfull, on the other hand, was consistently much higher, ranging from 10% to 18%. Reminders were sent in all specialties, except psychiatry.

[Insert figure 2]

Modelling non-attendance

A common explanation given by those who missed their appointment is that they forgot to attend. See, for example, Gilhooly *et al.* (1994) and Stone *et al.* (1999). It provides a rationale, but not the only one, why both innovations might reduce non-attendance.

We start with the administrative innovation, comparing patient focussed booking with the traditional arrangement. First, patient focussed booking only comes into effect for patients whose wait is in excess of five to seven weeks. If patients were more likely to forget the earlier appointments are booked, then DNA rates would fall with PFB. This is common to both variants, PFBpart and PFBfull.

There are two further differences associated with PFBfull that make it likely non-attendance will be lower: first, patients now have had some choice of date, time and place for the appointment; and second, patients have to opt in to qualify for an appointment. This distinction between PFBpart and PFBfull allows the contribution of their different features to non-attendance to be separated.

The technological innovation, using SMS and E-mail messages as reminders, is also expected to reduce non-attendance. D&G experimented with three media combinations: SMS only, E-mail only, and Both. We also test the subsidiary null hypothesis that the three media combinations each had the same impact; and replace them by a single variable, REMINDER, if the evidence is consistent with this null hypothesis.

We suggested above that patient focussed booking would reduce non-attendance if patients were more likely to forget appointments booked far in advance than those nearer the appointment. This is the rationale given for PFBpart reducing non-attendance. This behavioural assumption is tested by a second subsidiary hypothesis: that last minute reminders would have a larger impact the further in advance appointments were booked. Under the traditional booking arrangements the period from booking the appointment to the appointment date is approximated by WAIT. WAIT is calculated from the date the referral is received: not necessarily the same as when the booking is made. The hypothesis is formed in terms of the interaction term, REMINDER*WAIT, whose expected sign is negative.

Other studies have found a positive association between WAIT and non-attendance (Beauchant and Jones, 1997); but this could have explanations other than

forgetfulness increasing, as WAIT gets longer. One such is that the patient's health improved sufficiently for an appointment to be no longer thought necessarily, but the patient failed to cancel it. We test for non-linearity by expressing WAIT as a cubic function, i.e. WAIT, WAIT² and WAIT³. Information on WAIT is only available for new appointments.

Also included in the model are patient specific details such as age (eighteen five year age groups, from 0-4 to 85 and over), sex, income, specialty and, in the case of new appointments, the PRIORITY given to the appointment (i.e. 'urgent', 'soon' and 'routine').

Sample

The sample studied are NHS consultant-led outpatient appointments at D&G held over the thirteen month period: from August 2004, when SMS and E-mail reminders were introduced, to September 2005, when interactive voice recording (using fixed phone lines) was introduced. Information on the distribution of appointments by media combination, new vs return and PFB is given in table 2 for the 13-month period studied.

[Insert table 2]

D&G could be described as a rural health board with a population of 174,000, covering an area of 6425 square kilometres. The consultants are based at the main general hospital in Dumfries, and hold clinics at outlying hospitals and health centres. DNA rates in D&G tended to be lower than for Scotland as a whole, before the initiatives under study (see table 3).

[Insert table 3]

Outpatient data were extracted from Form SMR00, and cover twenty-five major specialties. Psychiatry is the only major specialty not included in the data set, though this service is provided at D&G. As has already been noted, neither innovation was applied to this specialty.

Patient forgetfulness is centre stage in this analysis of the two innovations. The sample of new appointments is therefore restricted to those whose WAIT and booked days (the period between the date the booking is made and the date when the appointment is held) are positive; they number 38,215 (table 2). The sample of return appointments is restricted to those whose booked days are positive, and number 73,979.

Results

Logistic regression analysis is applied to the outcome: 'Did Not Attend'=1 vs 'Attended'=0. The results shown in table 4 are for the variables of interest.

[Insert table 4]

(a) New appointments

The main results are shown in column 1. Comparing the chi-square value, we cannot reject the null hypothesis that all three media combinations had the same impact (not shown). Further analysis was therefore restricted to REMINDER. Reminders significantly reduced non-attendance.

As expected, the two ways D&G implemented patient focussed booking had a significantly different impact on non-attendance, being greater when patients had to confirm their wish to attend the clinic and had a greater choice of its date, time and place, ie PFBfull.

The results shown in columns 2 to 6 offer additional insights, and are taken in turn. First, no information is available on PRIORITY – urgent, soon and routine – and WAIT for return appointments. The results when both sets of variables are dropped from the analysis of new appointments are shown in column 2 for comparison. The absolute magnitudes of the coefficients of the variables of interest become markedly lower: for example, -0.371 compared with -0.520 for the pair of coefficients of REMINDER. Comparing the chi-square values for the two models – columns 1 and 2 - shows a clear preference for including the two omitted variables, PRIORITY and WAIT.

Second, the interaction term REMINDER*WAIT is added to test the hypothesis that patients were more likely to forget their appointment the longer the period between the date the appointment was booked and the date it was held. To exclude the possible confounding influence of the patient focussed booking arrangements, we restrict the sample to appointments made under the traditional arrangement, that is PFB=0. The sample size drops to 28,000 whose patients had a median WAIT of 33 days and to whom 1.9% were sent a reminder. The results are shown in columns 3 and 4: column 3 with the interaction term; column 4 without it. The interaction term is non-significant, as is also REMINDER. However, if the interaction term is dropped, REMINDER once more becomes statistically significant. It seems, therefore, that there was no tendency for patients with long waits to have been more likely to forget, at least within the WAIT range studied. This result is important for some of the later interpretations of the way the two innovations influenced non-attendance.

Third, the results for the sub-set of appointments covered by patient focussed booking, PFB=1, are shown in column 5. The benchmark is now PFBpart, instead of the traditional booking arrangement. The estimate for PFBfull, therefore, shows its additional effect; and is in line with the differences in the estimates of PFBfull and PFBpart shown in columns 1 and 2. Notice also that the sets of coefficients of the three WAIT terms are very similar in all four columns 1 and 3 to 5. In other words, irrespective of the booking arrangements made and whether or not last minute reminders were sent, non-attendance was an increasing function of WAIT.

Fourth and finally, results for the sub-set of patients who met the forthcoming waiting time target of 18 weeks, being $WAIT \leq 126$ days, are shown in column 6. The coefficients for REMINDER, PFBpart and PFBfull are not significantly different from their corresponding values, shown in column 1, when no waiting time restriction is put on the sample studied. To that extent, conclusions drawn from the whole sample

might be expected to apply to the situation when the new waiting time target is in force.

(b) Return appointments

The results are also shown in table 4 and limited to column 7. Again, comparing the chi-square value we cannot reject the null hypothesis that all three media combinations had the same impact (not shown). Reminders significantly reduced non-attendance.

Again, as expected, the two ways D&G implemented patient focussed booking had a significantly different impact on non-attendance, being much greater when patients had to confirm their wish to attend the clinic and were given more choice of the date, time and place of their appointment.

The analysis of new appointments showed that omitting appointment priority and WAIT could reduce the estimated impact of the variables of interest on non-attendance. This possibility must also be borne in mind when interpreting the results for return appointments. In all, therefore, last minute reminders and patient focussed booking had a marked impact, to reduce recorded non-attendance for return appointments.

(c) The translation of log-odds values to probabilities

The estimates in table 4 refer to log odds. Data on some of the corresponding probabilities are shown in table 5, and should be interpreted as the effect on the probability of non-attendance. Thus in the case of new attendances, based on table 4 column 1, PFBpart reduced the probability of non-attendance to 0.258 of what it would have been had the traditional booking arrangement been used instead. The corresponding probability for PFBfull, 0.149, shows PFBfull had a much larger impact than PFBpart. The probability for PFBfull, taken from table 4 column 5, makes this explicit: namely, that the probability of non-attendance reduced to 0.366 with PFBfull, as compared with PFBpart being the alternative.

[Insert table 5]

If the DNA rate had been 10.0% under the traditional booking arrangement with no reminder then, with PFBfull, the DNA rate for new appointments would fall to 1.49% [=0.149*10.0%], and the full implementation of patient focussed booking would reduce the probability of non-attendance by 85.1% [=1-0.149].

The Department of Health in Scotland is keen to promote patient focussed booking, conforming to the English norm, i.e. PFBfull. In this case, reminders would be sent *in addition* to the new booking arrangements, and would reduce non-attendance of new attendances by a further 62.7% [=1-0.373]. Combined with PFBfull, the DNA rate would fall to 0.56% [=0.373*1.49%], a fall in the DNA rate of a further 0.93% points [=1.49%-0.56%].

Corresponding results for return appointments are as follows, remembering that omitting WAIT and PRIORITY may lead to biased results. PFBfull would reduce a

10.0% DNA rate to 3.11% [=0.311*10.0%]; and the addition of a reminder would reduce the DNA rate further to 0.95% [=0.308*3.11%], a fall of the DNA rate by 2.16% points.

Such large falls would not have been achieved had patients been *assigned* an appointment, as under PFBpart. Not only did PFBpart have a smaller direct impact on non-attendance but also, as was noted above, it offered less opportunity to send last minute reminders, which further reduced non-attendance.

Discussion

D&G historically has had a good record of compliance in respect of attendance at consultant-lead outpatient clinics, at least compared with the rest of Scotland. Nevertheless, two initiatives introduced in 2004 increased compliance still further. These two are the subject of this paper, being: ‘patient focussed booking’, otherwise known as ‘partial booking’ in England, and last minute reminders. We look at each in turn.

Administrative innovation: patient focussed booking

Patient focussed booking more than halved ‘recorded’ non-attendance as compared with traditional booking. The evidence of other studies is mixed (Charman and English, 2003; Department of Health, 2000; and Kelsall, 2005). Why was this so?

We start with PFBpart. On the face of it, exactly the same patients were contacted as under the traditional method. Where the two differed was how far in advance of the appointment the booking would have been made. In the case of PFB it was no more than five to seven weeks in advance of the appointment; in the case of the traditional arrangement it would have been at the time a consultation was sought, and could have been much earlier, or later. Our hypothesis was based on the behavioural assumption that the late booking under PFB gave patients less time than otherwise to forget the appointment. However, when it came to testing for the interaction effect, REMINDER*WAIT, we found no support for the hypothesis that patients with longer waits to the appointment were more likely to forget. This result is based on a sample of new appointments booked the traditional way, whose median WAIT was 33 days. Although patients covered by PFB were likely to have waited very much longer, the period between when their appointment was booked and when it was held was much the same as the median value for patients booked under the traditional arrangement.

One alternative explanation, easily overlooked, is that patients cancelled appointments they didn’t intend to keep. Our interpretation of events is as follows. When patients were contacted under PFB, some were prompted about an appointment set in motion, sometime many weeks before, but which they now found no longer necessary and/or desired. Patients contacted under PFBpart who took no action would have been recorded as DNA; but others may have been prompted to contact the hospital and cancelled the appointment. The ‘recorded’ DNA rate falls in the latter case because attendance status is only recorded for appointments not cancelled. Unfortunately, there are no data on patient cancellations to provide additional support for this hypothesis. Some support for our interpretation may be found in the robustness of WAIT for the two sub-samples: patients booked under the traditional method

(PFB=0), and patients booked under patient focussed booking (PFB=1). Not only is the impact of WAIT on non-attendance independent of last minute reminders, but also of when the appointment was booked.

The national norm for PFB, PFBfull, had a significantly greater impact on non-attendance than PFBpart. There are two possibly contributory factors: patients had to confirm their wish for an appointment, and they had more choice of its date, time and place. We have argued that setting the booking five to seven weeks in advance of the appointment may have prompted some patients to question their continuing wish to have a consultation. In the case of PFBpart, patients had to take the initiative to cancel the appointment, and we suggest some did so. In the case of PFBfull, patients also had to take the initiative, but this time to confirm the appointment: quite different in terms of incentives. It is hardly surprising, therefore, that the impact was greater for PFBfull, and no recourse to the additional possibility of greater choice is necessary as an explanation.

Explanations in terms of patient cancellations suggest a benign outcome: the patient and provider both gain, and an unnecessary appointment has been avoided. But this assumes patients are best able to judge the clinical significance of their decision about what is, after all, a referred service. It is appropriate, therefore, that safeguards are in place. At D&G, in the case of new appointments, the patient's GP is informed and has the opportunity to follow up; and in the case of return appointments, patients will already have been seen by the consultant or some other qualified person.

At D&G not all specialties were considered suitable for patient focussed booking. However, given the success of the pilot project, there are plans to extend it to ophthalmology, as more resources become available, and to child & adolescent psychiatry with the booking arrangements being handled by the patient's parents or guardians, among other specialties. D&G introduced patient focussed booking for new and return appointments, seemingly with equal success. Official guidance has tended to focus on their application in the first instance to new appointments (CCI, NHSScotland, 2006, p 20). D&G certainly found administrating patient focussed booking for return appointments much more complex. A simple example shows why. In the case of new appointments, one can pool consultants in any given specialty. However, once seen, patients generally prefer to keep to the same consultant for subsequent appointments. So instead of one queue for, say, new appointments in orthopaedics, there might be five queues – one for each consultant - for return appointments in the same specialty. At D&G the patient administrative system software was designed so that these and other complexities could be sorted out within the window of a two-minute phone call patients made to book an appointment.

In the case of PFBpart there were no additional resource implications for D&G when compared with the traditional method. PFBfull, on the other hand, has had significant additional resource implications, with an initial outlay of £700 and recurrent costs of at least £257 per 100 new appointments booked in 2005 prices. Referring to results in the previous section and given a 10% DNA rate under traditional booking without reminders then PFBpart, incurring no additional costs, would reduce the DNA rate for new appointments to 2.58%. If PFBfull were used *instead*, the DNA rate would fall to 0.94% [=0.366*2.58%], a drop of 1.64% points [=2.58%-0.94%] compared with PFBpart. Thus some sixty [$\approx 100\%/1.64\%$] appointments would be required per DNA

avoided, at a recurrent cost of at least £150. PFBfull also allows patients more choice of the date, time and place for the appointment, at a cost of more than £2.50 for each appointment kept. If PFBfull is justified on economic grounds it must be for giving patients that choice, and also the greater opportunity it gives of being sent a last minute reminder. However, there is a compelling case for booking appointments no more than five to seven weeks in advance, ie implement PFBpart for all specialties when practical.

Reminders

SMS and E-mail reminders also reduced recorded non-attendance at D&G. These results are based on only 4% of patients, taking the thirteen months as a whole. On the face of it, the proportion might seem rather unrepresentative. However, reminders were much more common among the group PFBfull, and there is no reason to believe that sub-sample of patients was unrepresentative: for example, there was no tendency for some specialties to use PFBfull and others PFBpart. Furthermore, the very large size of the sample allows some variation in reminders independent of booking arrangement. The model of non-attendance also includes a number of other variables, such as deprivation, to correct for possible confounding influences. Some weight may thus be given to the results obtained.

The three media combinations had the same impact on non-attendance, and so we focus on the results for REMINDER. The results for new and return appointments may not be directly compared, because different sets of explanatory variables are used. However, drawing on the results in table 4, the different sets of results for new appointments may be compared. Columns 4 and 5 are the two sub-samples, PFB=0 and PFB=1, drawn from the whole sample in column 1. Although the absolute magnitude of the coefficient of REMINDER is twice under patient focussed booking than under the traditional booking arrangement, the difference is not statistically significant. This provides further evidence that however far in advance a booking was made, within reason, it had little impact on the probability of it being forgotten. Last minute reminders more than halved non-attendance.

The system of reminders introduced at D&G incurred the relatively modest one-off cost of adapting the patient administrative system. However, until cell phone numbers and E-mail addresses are routinely collected, these contact details will be costly to obtain. They were avoided only because they had been an adjunct to the national norm of patient focussed booking, PFBfull; but, as an adjunct, their additional impact on reducing DNA rates was also absolutely quite small. Using figures calculated above, i.e., with a benchmark DNA rate of 10.0% with traditional booking and no reminders, then reminders reduced DNA rates for new appointments by only 1% point [$\approx 0.93\%$], and imply one hundred reminders would have to be sent to avoid one DNA. The corresponding numbers for return appointments are 2% points [$\approx 2.16\%$] and fifty reminders. The numbers of messages per DNA avoided may seem prohibitively large but the only resource cost to D&G was the one-off cost of setting up the scheme, some £700-£1000 in 2005 prices. There were no recurrent costs. Had D&G used a commercial provider to send SMS messages, recurrent costs might have been £7.60 in 2007 prices per 100 deliveries, based on an annual charge of 600 reminders per month – the rate for the last two months of the period studied

(Kapow, 2007). This works out at a delivery cost of from £3.80 to £7.60 per DNA avoided.

At best, some 18% of new and return appointments under PFBfull were sent a reminder (see PFBfull in figure 2 above) in D&G. This compares poorly with experience at Yorkhill children's hospital, another Scottish hospital based in the city of Glasgow, which had a scheme similar to D&G. A comparison based on new appointments for a common single specialty, such as medical paediatrics, finds that at D&G 10.7% in this specialty were sent reminders, whereas at Yorkhill the corresponding proportion received was 31.4% (Milne *et al.*, 2006, table 5). One is bound to conclude that patients, and their guardians, were less likely to have had cell phones in D&G, given its low population density, compared with Glasgow. However, rather than D&G abandon its experiment with cell phones and the World Wide Web, the success of reminders encouraged it to extend the service to include the use of interactive voice reproduction. The last technology is based on fixed line phones, for which ownership is more common and whose contact details are routinely collected when patients were referred. Interactive voice reproduction costs D&G; there is, therefore, a strong case for extending the routine collection of contact details at referral to cell phones and the World Wide Web.

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Figure 1 Proportion of new and return outpatient appointments using patient focussed booking (PFB), by type, D&G, August 2004 to September 2005 (%)

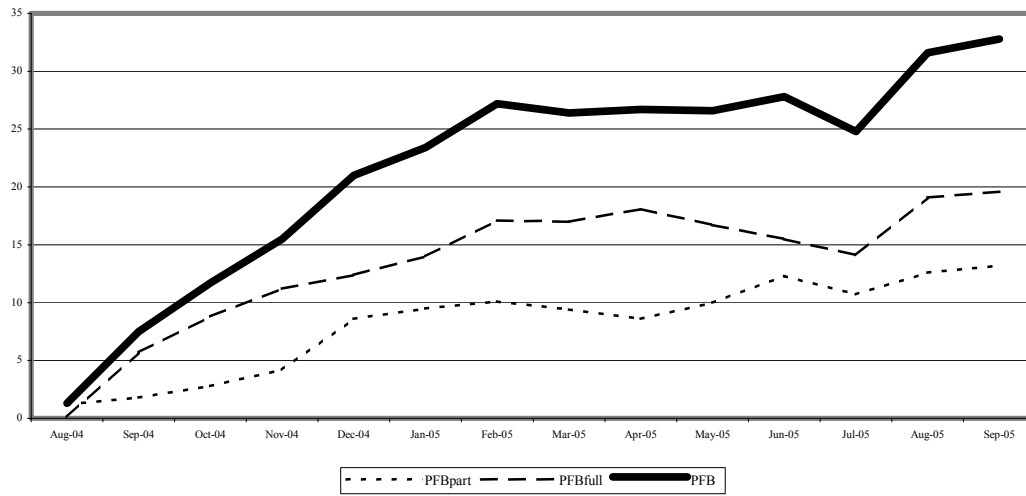


Figure 2 Proportion of new and return outpatient appointments sent reminders, by booking arrangement, D&G, August 2004 to September 2005 (%)

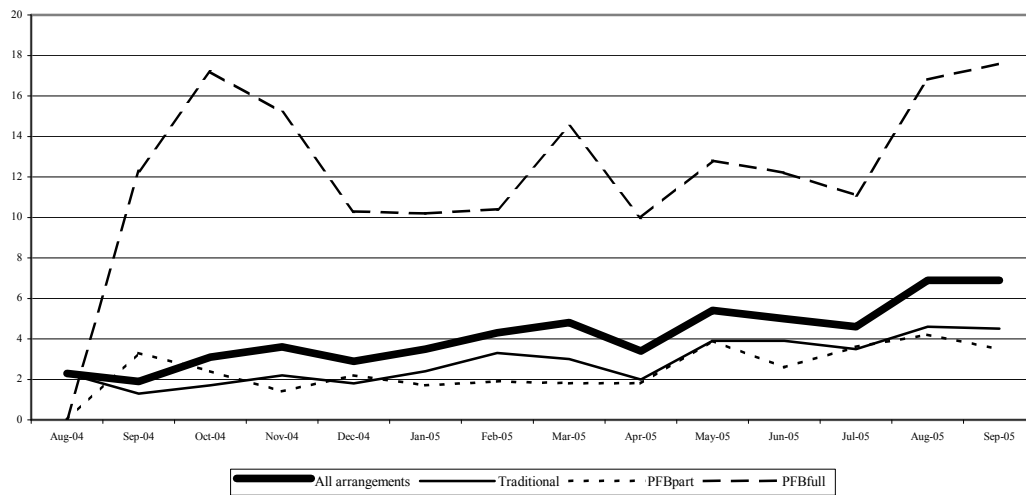


Table 1 Cell phone ownership and SMS use, United Kingdom.

Age group	Ownership (%)	SMS use (%)	
	July 2004	March-May 2005	January-March 2006
18 and over	82	76	82.5
18-24	93	97	96.4
25-34	97	94	91.7
35-44	89	82	92.7
45-54	83	75	81.4
55-64	74	59	NK
55 and over	NK	NK	65.1
65 and over	76	32	NK

Notes: Ownership based on fixed phone survey; SMS use based on those with cell phones.

Sources: Enpocket (2004) and unpublished information, reproduced with permission.

Table 2 Appointments, by media combination, booking arrangement, and type, D&G, August 2004 to September 2005.

Reminder	New ^a			Return ^b			Total
	Booking arrangement			Booking arrangement			
	Traditional	PFB	All	Traditional	PFB	All	
SMS	383	585	968	1277	1069	2346	3314
E-mail	96	98	194	311	240	551	745
Both	55	89	144	348	196	544	688
Neither	28,325	8,584	36,909	56,872	13,666	70,538	107,447
Total	28,859	9,356	38,215	58,808	15,171	73,979	112,194

Source: D&G Acute & Maternity NHS trust.

Notes: (a) Based on days waited and booked both positive.

(b) Based on days booked positive.

Table 3 DNA rates for new appointments, by specialty, D&G and Scotland, year ending 31 March 2000. (%)

Specialty	Scotland	D&G
General surgery	10.5	6.2
Orthopaedics	10.1	6.0
ENT	12.5	8.1
Ophthalmology	10.3	7.2
Urology	14.1	8.4
Paediatric medicine	11.3	13.2
Gynaecology	11.5	7.2
Mental illness	23.8	17.8
All specialties	11.4	6.7

Source: ISD Scotland Scottish Health Statistics 2000 Section M5

Table 4 Analysis of log odds of DNA

Variable	New ^a appointments						Return ^b
	Whole sample		PFB=0		PFB=1	WAIT≤126	appointments
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
REMINDER ^c	-0.520	-0.371	-0.208	-0.406	-0.850	-0.433	-0.811
	(0.160)***	(0.158)**	(0.293)	(0.185)***	(0.319)***	(0.200)**	(0.098)***
REMINDER*WAIT			-0.002				
			(0.002)				
PFBpart	-1.058	-0.545				-1.035	-0.401
	(0.085)***	(0.081)***				(0.126)***	(0.067)***
PFBfull	-1.741	-1.156			-0.549	-1.606	-0.797
	(0.111)***	(0.107)***			(0.145)***	(0.147)***	(0.062)***
WAIT	0.011		0.012	0.012	0.010	0.036	
	(0.001)***		(0.001)***	(0.001)***	(0.003)***	(0.008)***	
WAIT ²	0.000		0.000	0.000	0.000	0.000	
	(0.000)***		(0.000)***	(0.000)***	(0.000)***	(0.000)***	
WAIT ³	0.000		0.000	0.000	0.000	0.000	
	(0.000)***		(0.000)***	(0.000)***	(0.000)***	(0.000)**	
PRIORITY	√		√	√	√	√	
N	37,366	37,366	28,204	28,204	9,162	30,980	72,534
-2 Log likelihood	14,844.815	15,391.165	12,461.391	12,462.111	2,311.751	11142.840	35,111.208
Chi-square; df; p-value	1896.257; 40; <0.01	1349.907; 35; <0.01	1500.566; 39; <0.01	1,499.846; 38; <0.01	288.986; 37; <0.01	1180.709; 40; <0.01	2906.270; 35; <0.01
H-L test ^d , p-value	0.273	0.646	0.661	0.488	0.437	0.802	0.776

Notes: (a) Based on days waited and booked both positive.

(b) Based on days booked positive.

(c) SMS only + E-mail only + both.

(d) Hosmer-Lemeshow goodness-of-fit.

Standard errors in parentheses.

** , *** denotes p <0.05 and 0.01, respectively.

Table 5 Impact on probability of DNA, by type of appointment.

Variable	New ^a		Return ^b
	1	5	7
REMINDER ^c	0.373	0.299	0.308
PFBpart	0.258		0.401
PFBfull	0.149	0.366	0.311

- Notes: (a) Based on days waited and booked both positive.
 (b) Based on days booked positive.
 (c) SMS only + E-mail only + both.