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The impact of salary payment on GP working practices

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WORK IN PROGRESS - PLEASE DO NOT QUOTE OR CITE

5.1 Summary

GPs' decisions about the allocation of their time mediate the relationship between workload and the quality of care they provide. In this paper we present work-in-progress from a three-year evaluation of salaried GP contracts currently being 'tested' within Personal Medical Services (PMS) pilot sites in England. We develop a simple theoretical model to predict the influence of salaried GP contracts on the choice of surgery hours, and the number and length of consultations. We predict that salaried GPs would prefer to see fewer patients for longer consultations compared with GPs paid by a mix of fee-for-service (FFS), target payment, allowances and capitation payment. We test these predictions using workload data collected on a sample of salaried GPs in ten PMS pilot sites and ten practices of standard contract GPs. Controlling for doctor, patient and practice characteristics our results suggest that salaried GPs work similar numbers of surgery hours, and have similar numbers and lengths of consultations compared with standard contract GPs. Further work on both the theoretical and empirical components of this paper are outlined.

5.2 Introduction

Demand as well as supply-side factors determine GP (General Practitioner) workload. On the demand side the number of patients registered with the GP and the characteristics of that sub-population are important influences on GP workload.[1-3] On the supply-side significant amounts of the variation in GP workload are explained by the characteristics of GPs and their practices.[4-6] GP decisions to allocate their time between work and leisure, direct patient care and administration, and longer or shorter consultations mediates the relationship between GP workload and the quality of care they provide. We argue in this paper that the type of remuneration system influences these decisions.

Most GPs in the UK are independent contractors and provide general medical services (GMS) under the standard GP contract. Broadly speaking this contract relates income to workload. The average GP earns most of their income (53 per cent[7]) from capitation payments with allowances (19 per cent), sessional fees (6 per cent), item of service (15 per cent), and target payments (7 per cent) making up the remainder. Therefore, the more patients a GP has on their list, and the more of some types of services they provide the greater their income. However, large list sizes and large numbers of consultations have negative effects on the length of the consultation[8] which reduces the scope for health education/prevention[9] and detection of psycho-social problems.[10] Salaried contracts for GPs, currently being 'piloted' within the UK, remove the link between pay, productivity and list size, and therefore may not only affect the recruitment and retention of GPs but their working practices as well.

The NHS (Primary Care) Act 1997 allows Personal Medical Services (PMS) pilots to replace the standard contract between the GP and Secretary of State for Health with a locally negotiated (PMS or pilot) contract, and GPs can also opt to become salaried.[11] GP practices, NHS trusts and employees can apply to become a PMS pilot. Applicants can choose to provide only personal medical services under a PMS contract equivalent to General Medical Services (GMS) provided by standard contract GPs or additional services such as drug rehabilitation under a PMS plus contract. As with GP fundholding PMS pilots are launched in "waves" with the first wave consisting of 87 pilots, of which 46 planned to employ GPs on salaried contracts.

There has been no empirical work comparing GPs' working practices under salaried and mixed capitation payment in the UK and very little from other countries.[12,13] Wolinsky and Marder published two analyses of a study of over 2000 primary care physicians paid by salary, fee-for-service (FFS) or capitation.[14,15] Using regression analysis to control for doctor and area characteristics only they found that salaried payment was associated with longer consultations compared with either FFS or capitation. Catlin compared patient encounters amongst salaried doctors in 29 staff model HMOs and capitation doctors in network HMOs.[16] The study reported that salaried payment was associated with fewer patient visits per patient per year compared with capitation, but the results were not adjusted for patient, doctor or organisational characteristics.

In summary, the international evidence is inconclusive. There is some support for the prediction that salaried payment results in fewer but longer consultations, but we have reservations about the quality of the analyses and the generalisability of the findings. Therefore, it seems timely to carry out a study of these issues in the UK.

In this paper we report the results of a study of GP workload in ten salaried GP practices and ten standard contract GP practices nine months after the first wave of PMS pilots went live. We develop a simple theoretical model to derive predictions of the impact of salaried status on the number and length of consultations. We then test these hypotheses using workload data collected from the two groups of practices at two time points.

5.3 Theoretical model

Most of the theoretical models in the payment systems literature that consider the effect of salary payment compare it with pure FFS or capitation systems.[17-19] Iversen and Luras use an income-leisure framework to predict that the optimal number of referrals to specialists and patients would be higher in a mixed capitation compared with a mixed salaried system.[20] Hutten models a number of aspects of GP working practices under salaried and mixed capitation systems and arrives at similar predictions to us.[21]

We assume that GPs care about income:

$$y = y(N, L) = y_o + y_f(N) + y_c(L) \quad (1)$$

where y_o is a lump sum (salary component) of income, N is the number of consultations, L is the number of patients on list. Under a salary scheme the last two parts of income are zero. We also assume GPs care about their leisure:

$$T - tN \quad (2)$$

where T is total time endowment, and t is length of consultations. Lastly, GPs care about the health gain of their patients:

$$\mathrm{H(N,}t\mathrm{)},\ H_N > 0,\ H_t > 0 \quad (3)$$

where H is the increase in health resulting from the GP. For simplicity we assume that GPs do not care about the average health gain over all patients on their list, only in the total (absolute) effect on patient health.

The GP utility function is

$$u(y,v,H) = u(y_o + y_f(N) + y_c(L), T - tN, H(N,t)) = W(L,t,N) \quad (4)$$

which is increasing in income (y), leisure (v) and health (H) and concave. The GP can control the length of consultation t, list size L and the number of consultations N by demand management. GPs can reduce the size of their list by closing it and movements off the list will cause it to fall. Alternatively GPs can attract new patients to their list or prevent patients from leaving it by providing, for example, well-decorated waiting rooms or short waiting times for appointments. To keep the model simple we also assume that the GP's demand management activities have no direct effect on their utility. We shall also assume one type of GP treating one type of patient. We are concerned with the GP's choice of workload variables and how this choice is influenced by economic incentives.

The first order conditions are

$$W_L = \frac{du}{dL} = u_y y_{cL}(L) = 0 \tag{5}$$

$$W_t = \frac{du}{dt} = -u_v N + u_H H_t = 0 \tag{6}$$

$$W_N = \frac{du}{dN} = u_y y_{fN} - u_v t + u_H H_N = 0 \tag{7}$$

where y_{cL}, y_{fN} are the marginal effects of additional patients and of additional consultations on income from capitation and from fee per item or targets. u_y, u_v, u_H, are marginal utilities from income, leisure and health.

We assume that salaried GPs get a fixed list so that the salaried GP's decisions on N and t are found by solving the last two first order conditions. The GMS GP's decision is found by solving the three first order conditions. But note that the first order condition on the list is equivalent, since $u_y > 0$ always, to $y_{cL}(L) = 0$. Thus if the GP can control list size they choose it to maximise their income. If there are any costs to changing the list size we assume they are purely financial so that y_c is net income from the list. The GMS GP's optimal list size is separable from their decision on consultation length and number and would also be unaffected by any changes in their other income.

5.3.1 Comparing salaried and GMS GPs decisions

We can get some intuition from the first order conditions on N and t. Rearrange each of them to solve for u_H/u_v and then substitute one of the expressions for u_H/u_v into the other. Rearrange the resulting expression again to get

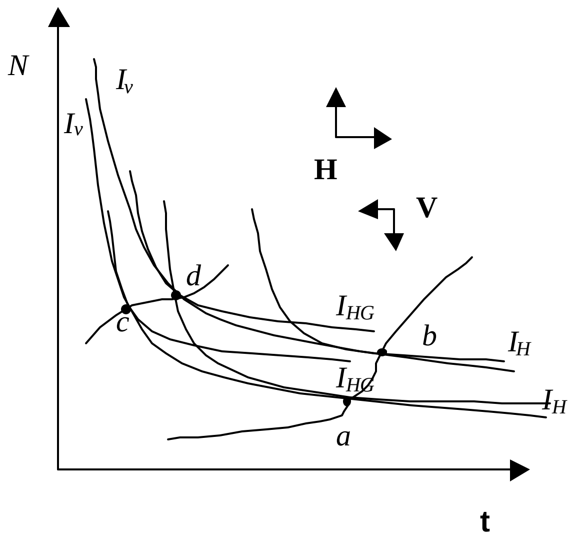
$$\frac{N}{t} = \frac{H_t}{H_N} + \frac{H_t u_y y_{fN}}{t u_v} \qquad (8)$$

The second term on the right hand side is positive for GMS GPs and zero for salaried GPs. This suggests (but does not prove) that the ratio of N to t is greater for GMS GPs: they prefer to see more patients for shorter consultations because of the effect on their income. The figure illustrates the possibilities. Given their fixed income a salaried GP cares only about the effects of t and N on their leisure and the health of their patients. Increases in t, N reduce their leisure and the right angled hyperbola indifference curves I_v show combinations of t, N which give the same leisure. They prefers other things equal to be on lower leisure indifference curves. The slope of the leisure indifference curves is $-N/t$ which is the left-hand side of (8).

The curves I_H are health isoquants: they show combinations of t, N which yield the same health. The salaried GP will choose a combination like a or b where their leisure indifference curves and patient health indifference curves are tangent.[1] In terms of (8) the second term on the right hand side is zero: they do not have to take account of the effect of N on their income because they have a fixed salary. The point chosen along the "expansion path" through ab depends on the GPs' willingness to trade off leisure for patient health.

[1] To ensure the model is well behaved we must place restrictions on the curvature of the patient health indifference curves relative to the leisure indifference curve to ensure they are tangent from above. If tangent from below the model has no solution.

Now consider the GMS GP. They take account of the effect of consultations on their fee income, as well as on leisure and patient health. Hence the second term in (8) is positive. The implication is that, to achieve a given amount of leisure (fixed tN) they prefer to have more *N* and smaller *t* than a salaried GP. Hence they will choose points like *c*, *d* for given leisure, rather than *a*,*b*. Again the point chosen on their expansion path through



cd depends on their willingness to give up leisure to produce more patient health *and* to get additional income.

The constant leisure "substitution effect" comparisons are clear. A salaried GP will see fewer patients and have longer consultations than a GMS GP if they have the same leisure: compare *a* and *c* or *b* and *d*. However, suppose the GMS GP is initially at *d*. Suppose the salaried contract offered the GP the same income as they would earn given the number of fee generating consultations they choose as a GMS GP. If they choose the same *t*, *N* as at *d* they will get the same leisure. But they will do better by changing *t*, *N*. With leisure constant they will do better to move to *b* where they are better off because more patient health is generated with leisure unchanged. This is the "leisure substitution effect". Alternatively they can move along the constant health isoquant through *d* down to a. Again they are better off since patient health is unchanged but leisure is increased. The "health substitution effect" is also clear: they choose longer but fewer consultations.

Although we can predict they will move to the salary "expansion path" (where they maximise patient health for given leisure) we cannot predict where on it they will choose to lie. Pla usibly they will choose a point between *a* and *b* where they produce more patient health and enjoy more leisure. Note that if they have at least as much leisure as they had under GMS and produce at least as much patient health they must be between *a* and *b* and have fewer N and longer t. If they place a high value on leisure relative to patient health they may move back down ab beyond a and have fewer and shorter consultations because they now no longer have to take account of the loss of income from fewer consultations.

5.3.2 Comparative statics

In this section we examine the effect of a change in the function $y_f(N)$ linking the number of consultations to income from fees and targets which increases the marginal income from consultations. Salaried GPs have y_{fN} = 0 by definition, whereas $y_{fN} > 0$ for GMS GPs. Hence the effect of an increase in the marginal income from consultations gives us information about the difference between salaried GPs and GMS GPs. If the increase always leads a GMS GP to increase N and reduce t say then we predict that salaried GPs have smaller N and longer t. Since changes in the fee parameter will alter income as well as behaviour we attempt to decompose the overall effect of the parameter change into income and substitution effects.

Because the decision on L is unaffected by the GMS GP's income, leisure and patient health, changes in the parameter affecting fee income have no effect on L and we can concentrate on the effect of the parameter on the first order conditions on N and t. Let the income from fees be $y_f(N,k)$ where $y_{fk} > 0$, $y_{fNk} > 0$ so that increasing the parameter k increases income from fees and increases the marginal income from consultations. We can derive the comparative static results in the usual way by totally differentiating the two first order conditions on t and N with respect to the fee income parameter k:

$$\begin{bmatrix} W_{tt} & W_{tN} \\ W_{Nt} & W_{NN} \end{bmatrix} \begin{bmatrix} t_k \\ N_k \end{bmatrix} = \begin{bmatrix} 0 \\ -u_{yy} y_{fk} - u_y y_{fNk} \end{bmatrix}$$

and solving for

$$t_k = W_{tN} (u_{yy} y_{fk} + u_y y_{fNk}) \qquad (9)$$

$$N_k = -W_{tt} (u_{yy} y_{fk} + u_y y_{fNk}) \qquad (10)$$

Even though the second order conditions imply that $W_{tt} < 0$ both expressions are ambiguous since $u_{yy}y_{fk}$ is negative if marginal utility of income is diminishing in income. Even though more consultations have become more valuable the GP may prefer fewer of them because additional income is less valuable than the additional leisure. However if marginal utility does not decline rapidly with income then the term $(u_{yy}y_{fk} + u_y y_{fNk})$ is positive and the effect of the parameter change is positive: the GMS GP responds by increasing the number of consultations.

The effect of the fee change on the length of consultations is ambiguous even if $(u_{yy}y_{fk} + u_y y_{fNk})$ is positive. The first term in (9) is

$$W_{tN} = -u_v + u_{vv}Nt + u_{HH}H_t H_N + u_H H_{tn} \qquad (11)$$

The first three terms are negative if utility is concave. The last term however is likely to be positive since u_H is positive and the marginal gain in health from an additional consultation is increased if the consultation is longer. Thus in general the effect of making consultations more valuable financially on the length of consultations is ambiguous.

In summary, if salaried GPs work the same number of surgery hours as standard contract GPs they will see fewer patients for longer. However, it is also plausible that salaried GPs will choose more leisure and patient health as well as longer but fewer consultations. But the comparative statics show this result is not robust once we consider changes in the FFS element of GP income.

5.4 *Methods*

5.4.1 Study design

We adopted a prospective case control design to investigate the impact of salaried status on GP workload. A randomised controlled trial design was not appropriate, as participation in PMS sites is voluntary, and there was insufficient time to start prospective data collection prior to the launch of the initiative.

5.4.2 Participants

We selected PMS pilot practices from the first wave of pilots in England on the basis that the salaried GPs had switched from the standard GP contract to a salaried contract whilst remaining in the same practice. We chose to sample this type of practice rather than those where salaried GPs were being employed in addition to existing GPs to maximise the number of salaried GPs in the study. Salaried GP practices were matched with control standard contract GP practices for partnership size, number of whole time equivalent (WTE) GPs and the deprivation band within which most patients attracting such payments were grouped.

We selected practices that contained predominately standard contract GPs as our controls. We recruited these practices from six randomly selected health authorities, geographically spread across England. Sample size calculations, taking into account within and between practice variation, indicated that ten practices in each study group would be sufficient to detect a difference in consultation lengths of 30 seconds.

5.4.3 Data collection

Data were collected for each matched study and control practice at the same point in time during two six month periods (December 1998 - June 1999; December 1999 - June 2000). The first data collection period started approximately nine months after the GPs in the study practices became salaried. Data on a number of aspects of GP working practices were collected in three ways. First, information on the patient (age, gender, condition) and the outcome of the consultation (prescription given, for example) were recorded for each consultation (including those outside surgery hours) by every GP in each practice for a one week period using a diary. Time spent on non-clinical tasks such as practice administration or clinical audit was recorded in the diaries at the end of each day. The start and finish time of surgeries were recorded so that average consultation lengths could be estimated for those days that a researcher was not present at the practice.

This diary was developed with advice from the Royal College of General Practitioner's Research Unit in Birmingham and piloted in two busy practices in Manchester and Liverpool. A researcher explained the use of the diary to GPs on the first day of the week and remained in the practice to answer any questions. The researcher then returned seven days later to collect the diary and to follow up missing data.

Secondly, on the first day that the diary was given to GPs and when the researcher returned to collect the completed diaries, consultation lengths were measured by direct observation.

Thirdly, since the practice and GP characteristics are predictors of GP workload[8] information was obtained from practice managers on the second visit to the practice using a questionnaire. Information on the practice included number of GPs, training status, whether previously a fundholding practice, list size, out of hours arrangements, weekly surgery and reception hours, the number and working hours of the primary health care team, appointment systems, and clinics provided. GP characteristics measured included: age, gender, outside activities, years in practice, whole time equivalent, and income band.

5.4.4 Estimation

We have repeated measures (at time points 1 and 2) of both surgery hours worked per week and consultation lengths within GPs. Failure to take this clustering of data into account leads to under-estimates of standard errors.[22] We therefore estimate random-effects models using the generalised least squares (GLS) estimator with observations clustered within GPs. We model GP working practices as a system of two equations. First, GPs choose the number of surgery hours to work (tNi for GP i) which we model as:

$$tN_{ij} = \beta_1 X_{ij} + u_{1i} + e_{1ij} \qquad (j\ (time)=(1,2)) \qquad (12)$$

Where X is a vector of exogenous personal and practice characteristics for GP i, β_1 is an unknown parameter vector. Since we have observations within GPs we need to take this into account by estimating u_1, which is the GP-specific residual whereas e_1 is the overall error component.

Second, the GP chooses the length of consultation to manage the number of patients they see. This decision depends on the endogenous choice of working hours thus:

$$t_{ij} = \beta_2 X_{ij} + \gamma_2 tN_{ij} + u_{2i} + e_{2ij} \qquad (13)$$

where tN_{ij} represents the choice of surgery hours.

The exogenous variables for the surgery hours consultations were GP age, gender, whole time equivalent (WTE), deprivation index, age and sex of patients seen during research week, remuneration system, and the predicted income of the GP. We relax the assumption made in the theoretical model about GPs seeing one type of patient by including patient characteristics variables in the empirical model. We also assume list size is fixed for both types of GPs and therefore exogenous. Remuneration system is a binary variable with GPs on fixed income or salary-type payments (GP registrars, salaried assistants, GPs on the retainer scheme, and PMS salaried GPs) as one group and GPs with income likely to vary with numbers of consultations (standard contract and locum GPs) as the other.

We predict the lump sum component of GP income (y_o) so that the resulting variable would not reflect the effect of surgery hours on income for GMS GPs through $yf(N)$, and therefore exogenous. We estimate two separate income models for salaried and standard contract GPs using interval regression with income bands as the dependent variable and a set of GP personal characteristics and list size as the independent variables. We calculate y_0 by subtracting the list size component of income (the product of the coefficient for list size and list size) from the predicted value.

We estimate two models for consultation length. The first model (model "a") uses the average consultation length for each surgery collected using the diary (usually for research days 1 to 7). The second (model "b") uses the times measured by a researcher during the first day the diary was given to GPs and a week later when the researcher was in the practice to collect the diaries (usually research days 1 and 8). Therefore, the two models use data measured using *different* methods although they both include (*different)* data for the *same* (first) research day. In model "b" patient age and sex data were not available for observations on the eighth research day so instead the average age and sex of patients seen during the whole research week were imputed for all observations.

All models were estimated using Statistics Data Analysis (STATA) version 6.0.

5.5 *Results*

Ten salaried GP PMS pilot practices were identified as suitable cases but one practice refused to take part so a replacement PMS pilot site was recruited. Twenty-nine GMS practices were identified as possible matches and were invited to participate in the study. Seventeen practices declined to take part so ten were selected from the remaining twelve.

Table 1 shows descriptive statistics for the study sample averaged over the two data collection periods. The characteristics of the GPs and the practices are broadly similar to those nationally. List size per WTE GP in the sample was slightly lower than the national average of 1979.[23] However, list size per WTE GP was higher in standard contract GP practices (2,187) compared with in the salaried GP group (1,699), which is consistent with the prediction of our model. We were unable to find national estimates of GP-to-medical staff ratios but we did obtain a national average for 1998 for the ratio of unrestricted GP principals to practice staff in England of 0.25, which compares with 0.19 for the study sample.[23] The deprivation index[24] provides a ward-level score that ranges from 1.16 for the least deprived wards to 83.77 for the most. These scores were attached according to the ward of the practice rather than the wards of the registered populations.

The two main groups of GPs in the study practices were PMS salaried GPs (37 per cent) and standard contract GPs (42 per cent). The average WTE of GPs in our sample was 0.77. Compared with Department of Health figures[25] there were fewer full-time (one WTE) GPs in the sample (60 per cent) compared with 83.8 per cent nationally. The sample contained more female GPs than the national average of 31.1 per cent. Our sample tended to have more GPs aged between 30 and 34 compared with 11 per cent nationally. A third of the GPs had net incomes above the intended average net income (IANI) for standard contract GPs of £47,510 in 1998/9.[26] GPs in our sample had been in post for an average of 7 years and 37 per cent had outside interests, but we could not obtain national estimates on these characteristics.

Average length of surgery consultations nationally has been estimated at 8.4 minutes [27] and this compares with other studies of GP workload.[28,29] The average consultation length in our sample varied across models "a" and "b", with the estimate from model "b" similar to published estimates. The average number of surgery hours worked by GPs was estimated to be 14.2 hours in the 1992-3 GMSC/Department of Health survey but again other estimates of surgery hours vary between 16[28] and 20 hours.[1] GPs in our sample practices worked on average 15 hours per week in surgery.

Table 2 shows two estimated models for GP income. The sign and size of the coefficients in each model are similar. Income was higher for male salaried GPs compared with females, and intuitively whole time equivalent GPs earned more than those who worked part-time (neither of these were significant in the standard contract model). GP age had a negative effect on income but this was not statistically significant in either model. As predicted by our theoretical model list size was positively associated with higher income in the standard contract GP model whereas the association was negative for salaried GPs, but in neither model were the coefficients significant. The number of years a GP had been in the practice and whether they had outside interests was positively associated with higher income, but again neither was significant in either model.

Table 3 shows the estimated model for surgery hours worked per week. GPs working in deprived practices with small list sizes and seeing older patients worked fewer hours per week. GPs who saw high proportions of male patients worked longer surgery hours but this variable was not significant. In terms of supply variables the only statistically significant variable was GP whole time equivalent, which was positively associated with surgery hours. Salaried GPs worked 2.3 fewer surgery hours per week compared with standard contract GPs but the coefficient did not reach statistical significance in our model. Older GPs tended to work fewer surgery hours and female GPs worked 2.1 fewer surgery hours per week, but neither of these variables were statistically significant. The fixed component of GP income had an insignificant effect on surgery hours.

The Breusch-Pagan test rejects the hypothesis that the variation of the GP level error term is zero, and the Hausman test suggests that the random effects specification was appropriate (i.e. the random effects u_{1i} and regressors are not correlated). The RESET results also suggest the model is correctly specified. The Rho statistic indicates that 45 per cent of the total variation in the dependent variable is due to variation within GPs. Overall, the explanatory variables explained 57 per cent of the variation in surgery hours.

Model "a" predicts average consultation length per surgery and shows that none of the "demand" variables were statistically significant. The remuneration system did not have a statistically significant effect on predicted consultation length, although the positive sign of the coefficient is consistent with the prediction of our model. Given surgery hours (which has a weak negative association with consultation length) salaried GPs provided similar length consultations compared with standard contract GPs. Therefore, this is inconsistent with the prediction of our model that salaried GPs would choose longer consultations but implies that if t is uncorrelated with Nt (surgery hours), then N must increase proportionately with Nt. Training status and the greater availability of other medical staff within the practice are associated with longer average consultations per surgery.

Using more detailed consultation length data model "b" shows that only GP sex was a significant predictor of consultation length. Our estimates indicate that female GPs provide consultations that are 2.33 minutes longer than those provided by male GPs. Remuneration system was not statistically significant but as in model "a" the sign of the coefficient was as expected.

RESET results indicate that only model "b" is correctly specified, but the Hausman and Breusch-Pagan test statistics show that the random effects specification was appropriate in both models. The amount of variation in consultation length explained by the explanatory variables is greater in model "a" at 10 per cent. The percentage of variation in consultation length explained by variation within GPs is similar in both models at 14 per cent.

5.6 Discussion

Our results suggest that after controlling for demand and supply factors GPs working within salaried GP PMS sites work a similar number of surgery hours per week compared with GMS GPs and have similar length consultations. This result implies that salaried GPs see similar numbers of patients during the week, which is not consistent with the predictions of our model and with the limited (and probably unreliable) international evidence available.[16] Our findings suggest that either salaried GPs do not react to the incentives we have discussed and/or the FFS component of standard contract GP income does not have a strong influence on *N*. Interestingly, our estimates of income (for a one WTE GP) indicate that salaried GPs are being paid more compared with standard contract GPs in our sample for seeing the same number of patients and working the same surgery hours. However, the finding that salaried GP consultation lengths are not longer suggests that there might be other factors that we have not taken into account in either the theoretical or empirical model.

This study has a number of strengths and limitations that need to be taken into account when interpreting the results. This study is the first evaluation of salaried contracts in the UK, and one of the few in the field of doctor payment systems that uses consultation-level data. We estimated surgery hours and consultation lengths (model "a" only) using self-report data, which is regarded as less accurate compared with objective sources. However, it is unlikely that this method of data collection gave rise to any systematic bias within the study since any measurement error will be common to both study groups. Indeed, our estimate of surgery hours falls within the range of published estimates. Consultation lengths measured by direct observation (model "b") are similar to published estimates, but those obtained from the diary (model "a") are slightly higher.

GPs are not randomly allocated to either salaried or standard contracts but self-select. Therefore, GPs preferences for salaried status may be related to their working practices. For example, salaried GPs may place a higher value on leisure compared with standard contract GPs and therefore choose a salaried contract because it offers fewer working hours. This selection bias may distort our estimate of the effect on working practices. The next stage in this work is to use instrumental variables techniques to adjust the estimates for unobservable GP characteristics.

There might also be an endogeneity problem with GP whole time equivalent in the empirical models as this variable might depend upon list size. In addition, earlier work shows that just under half of the salaried contracts being used within the first wave of PMS pilots stipulated total *working* hours.[30] Therefore, another consideration is whether we are modelling salaried contractual arrangements rather than any behavioural response to being salaried.

We presented a simple theoretical model in this paper but several assumptions need further development. For example, the assumption that the GP's choice of list size is separable to choice of N and t is questionable since larger list sizes would increase the number of consultations (via the effect on patient demand), increasing working hours and reducing leisure. However, list size becomes endogenous and another estimation strategy is needed. Another area for development includes the influence of the different components of income on each other. We would expect GPs to respond less to FFS income if they have a large capitation income component.

To conclude, this paper reports preliminary findings from a three-year study of salaried contracts for GPs. We have found that salaried GPs within PMS practices have similar working practices as standard contract GPs. Further work needs to be done to confirm that there are no differences in other aspects of working practice before conclusions can be made about the cost effectiveness of salaried contracts.

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Table 1: Descriptive statistics

	Observations	Mean	Standard deviation
Practice characteristics			
List	40	4469	2728.22
List size per WTE GP	40	1943.07	521.32
Dr-to-medical staff ratio	40	0.42	0.25
Deprivation index[1]	40	33.29	19.66
Training practice (%)	40	0.13	0.33
GP characteristics [2]			
Contract type (%):			
- Salaried (PMS)	131	0.37	0.48
- Salaried assistant	131	0.03	0.17
- Retainer scheme	131	0.03	0.17
- Registrar	131	0.02	0.15
- Standard contract	131	0.42	0.50
- Locum	131	0.13	0.34
WTE	131	0.77	0.32
Age	130	41.48	8.43
Male (%)	164	0.62	0.49
GP net income bands (%):	106		
<£20,000		0.066	0.25
£20,000 - £30,000		0.066	0.25
£30,000 - £40,000		0.18	0.39
£40,000 - £50,000		0.21	0.41
£50,000 - £60,000		0.33	0.47
£60,000 - £70,000		0.13	0.34
£70,000 - £80,000		0.02	0.14
Outside interests (%)	110	0.37	0.49
Years in current practice	114	7.02	6.62
Patient characteristics[3]			
Age	10425	39.57	22.89
Male (%)	10331	0.40	0.49
Workload			
Surgery hours worked per week	114	15.33	5.92
Consultation length (model a)	777	10.65	4.13
Consultation length (model b)	4228	8.08	4.90

Note:

1. The higher the scores in each domain the more deprived the area.
2. Information presented relates to those GPs who were in practice at time of research, and not necessarily those who collected data.
3. Estimated for those patients consulting during the research week only.

Table 2: Interval regression results for GP income

Dependent variable: income band	Salaried GPs (PMS and other[1])		Standard contract GPs and GPs paid by session[2]	
Independent variables:	Coefficient	P value	Coefficient	P value
Constant	28459.27	0.005	31087.08	0.048
GP sex (0=female; 1=male)	9979.66	0.007	2665.13	0.542
GP age	-343.71	0.106	-287.22	0.398
WTE	28790.15	0.000	22560.88	0.071
Outside interests (0=no; 1=yes)	3070.59	0.368	1822.483	0.704
Years in practice	443.36	0.121	273.65	0.522
List size	-0.36	0.633	0.68	0.240
Number of observations	54		47	
LR χ^2_6	40.19	0.0000	10.19	0.1168

Notes:

1. Includes GPs earning 'fixed incomes': GP assistants, retainers and registrars
2. Includes GP locums

Table 3: Regression results

Dependent variable	Surgery hours worked per week		Consultation length (model a)		Consultation length (model b)	
	Coefficient	P value	Coefficient	P value	Coefficient	P value
Fixed effects:						
Constant	4.6535	0.417	9.9714	0.149	2.7230	0.598
Demand variables						
Deprivation index	-0.0468	0.032	-0.0158	0.247	0.0134	0.302
List per WTE	0.0025	0.014	0.0002	0.785	-0.0009	0.072
Patient age	-0.1691	0.036	-0.0252	0.107	-0.0003	0.993
Male patients	5.8230	0.174	-1.5988	0.122	1.3237	0.435
Supply variables						
Remuneration system (0=standard (FFS); 1=salary)	-2.3010	0.095	0.5142	0.527	0.2297	0.738
GP age	-0.0026	0.967	0.0118	0.737	-0.0004	0.991
GP sex (0=female; 1=male)	-2.1453	0.139	-1.4842	0.036	-2.3327	0.001
GP WTE	12.0473	0.009				
GP income (y_0)	0.0001	0.445	0.0002	0.479	0.0004	0.073
GP income squared (y_0^2)			-2.55e-09	0.467	-4.14e-09	0.095
Dr-to-medical staff ratio			-2.6706	0.023	-0.9991	0.312
Training practice (0=no; 1=yes)			2.5948	0.002	0.5061	0.416
Surgery hours worked per week			-0.0547	0.357	-0.0627	0.072
Random effects:						
σ_u	2.5292		1.4292		1.8379	
σ_e	2.8235		3.4749		4.4507	
ρ	0.4452		0.1447		0.1457	
Number of observations	104		546		3822	
Number of groups (GPs)	60		56		57	
Wald statistic	χ^2_9=94.55	0.0000	χ^2_{12}=35.15	0.0004	χ^2_{12}=30.59	0.0023
R-sq:						
Within	0.0945		0.0231		0.0017	
Between	0.6399		0.3504		0.3319	
Overall	0.5703		0.1000		0.0446	
Hausman test	χ^2_5=9.02	0.1082	χ^2_{11}=16.73	0.1160	χ^2_{11}=17.06	0.1062
Breusch/Pagan Lagrangian multiplier test for random effects (χ^2_1)	6.14	0.0132	93.26	0.0000	1471.20	0.0000
Reset test (χ^2_3)	6.13	0.1054	19.20	0.0002	1.61	0.6567