

**WORK-IN-PROGRESS: PLEASE DO NOT CITE OR CIRCULATE WITHOUT  
PERMISSION**

## **The impact of the 2006 NHS dental reforms on access to dentistry.**

William Whittaker[1], Stephen Birch[1,2]

[1]

Health Economics  
Health Methodology Research Group  
Community-Based Medicine  
University of Manchester  
Contact: william.whittaker@manchester.ac.uk

[2]

McMaster University, Canada

### **Abstract**

Major reforms to NHS dentistry were introduced in 2006. These included new Courses of Treatment (CoT) cost bands, a new NHS dentist contract, and PCT-led commissioning. The cost bands were aimed at creating a simpler patient charge structure so patients would be better informed about the charges they would incur. PCT-led commissioning and the new NHS dentist contract were aimed at improving NHS dental access. In this paper we investigate how check-ups with NHS dentists has changed since the introduction of the reforms. We use British Household Panel Survey data for 1991-2007 to model changes in dental check-ups in England over time. A dynamic probit model is used with unobserved heterogeneity and transitions between NHS and private dental check-ups using a random-effects framework. We test for significant changes in the rates of NHS check-ups, and transitions between sectors following the reforms. We find that total NHS check-ups decreased following the reforms, but NHS check-ups for those with a poor dental check-up history increased, accommodated by increases in the transition to private service use among the rest of the population. The reforms had an important effect on dental check-ups in the population .

## ***Background***

In 2002 *NHS Dentistry: Options for Change* set out a number of suggested reforms to modernise NHS dentistry, these included PCT level commissioning, a simplification of patient costs, and a change in focus to prevention and education of oral disease. The overriding aim of these changes was to create a clear demarcation of private and NHS services for both clinicians and patients, and help improve access to NHS dentistry by shifting commissioning of dental services from a bottom-up system whereby dentists provided the work and charged the NHS, to a top-down system with PCTs commissioning services, this it was hoped, would stop dental-deserts where dentists have moved away from areas.

*Options for Change* was followed by *NHS Dentistry: Delivering Change* in 2004 which detailed how these reforms were to be delivered. The 2004 report set out radical changes to Courses of Treatments (CoTs) from a system of individual prices for each individual item on a list of over 400 different treatments to banded costs for courses of treatment. This new charges structure was aimed at improving clarity, affordability and equity for patients while not reducing the total yield from charges. The simplified charges would reduce administration costs for dentists and ensure charges do not create a barrier to good clinical practice and the promotion of oral health by providing a system of dentist remuneration that removed incentives to overtreat (Pg.14), while rewarding time spent advocating prevention.

The report highlighted a particular concern of inequality in oral health across England, with data from the 2003 National Survey of Child Dental Health showing that while dental decay is at the lowest level since records began, there are clear geographic inequalities with children living in some areas of the north of England having on average twice the level of dental decay as children in other parts of the country. The report also reveals how adults in the northern England are twice as likely to have no teeth (Pg.13). Along with the new charges, local (PCT) level commissioning was aimed at reducing these

inequalities in oral health status through improvements in access to dental care.

The reforms were introduced on April Fools Day 2006. PCTs became responsible for commissioning NHS dental care services, new NHS dental contracts were issued to dentists and three price bands for different CoTs were introduced. The price bands led to some treatment courses being more expensive, and others less expensive than prior to the reforms, and created a clear distinction between NHS and private dental services.

Following the reforms, the Department of Health (DH) conducted a review of the impact of these changes in 2007 (*NHS Dental Reforms: One Year On*). The key findings were an increase in the number of dentists offering NHS services, a higher level of services commissioned and, although the number of patients seeing an NHS dentist remained stable, the main benefits were in those areas that had previously suffered shortages of dentists. There was however some evidence of a reluctance of dentists to work under the new system, with 1,050 dentists who previously provided NHS dental care rejecting NHS contracts, but the DH claim these represented less than 4% of all NHS dental services.

There has been much strain on NHS dentistry due to shortages of NHS dentists in some areas and long waiting lists leading to some patients to either go without any care or to use private dental services. The House of Commons Health Committee evaluated the impact of the reforms and found a reduction in patients seen by an NHS dentist of 2.3% (900,000) from the introduction of the reform until December 2007 and concluded that “the indications are that the new arrangements have failed so far to improve patient access overall.” (pg.26).

The reforms may lead to a number of possible effects, we propose two hypotheses:

*1. NHS dental services use will increase following the reforms*

PCT-led commissioning was developed with the hope of increasing use in deprived areas, so increased commissioning should act to increase the rate of NHS dental check-ups, particularly for those in deprived areas (and possible reduction in private dental check-ups). However, this effect may be mitigated by the decline of 1,050 dentists working under the new NHS contract which could increase inequalities in access.

*2. The public-private mix in dental care provision will be affected by the reforms*

With the new banded CoTs, many expensive items of service have become less expensive (e.g., the most expensive treatment was reduced from £389 in 2005/2006 to £194 in 2007/2008). Other things equal we might expect an increase in use of these treatments and possible in-flow of patients from the private sector. However, dentists have less of an incentive to undertake complex treatment under the new contract so this may reduce supply leading to bottlenecks in the NHS. Also, those dentists refusing to work under the new contract may have encouraged their patients to pay privately for dental care.

To test these hypotheses we use nationally representative data for England from the British Household Panel Survey (BHPS) to model annual dental check-ups. Panel data allows us to model changes across individuals after the introduction of the reforms, and the detailed questionnaire enables us to control for other factors that may influence trends in dental check-ups. Of particular importance is the ability to control for unobserved heterogeneity in dental check-ups and assess check-ups among those with poor dental check-up histories. Although there is evidence of reductions in NHS patients seen (House of Commons Health Committee (HCHC), 2008), there has been no study that controls for other potential mitigating factors on dental use as we do here. Furthermore, the panel nature of the BHPS enables us to model how individuals responded to the clear demarcation of NHS and private dentistry by estimating changes in transitions between the two types of provider before and after the reforms. Understanding the trends in check-ups is important for effective service and workforce planning and future commissioning for PCTs.

## ***Methodology***

### **NHS dental check-ups**

To analyse the effects of the dental reforms we model changes in the volume and distribution of dental check-ups over the period 1991-2007 using data from the BHPS. Unfortunately the BHPS does not contain information on dental attendance so check-ups are the closest measure we can get for patients seen (which is a measure used by the DH and HCHC for dental access).

We use multivariate modelling techniques to control for factors influencing NHS dental check-ups that we can observe, and control for unobserved heterogeneity for those we do not observe; which may impact on check-up rates. Omitting these other effects will make our inference biased. In addition, dental check-ups are likely to be highly persistent, maybe because of existing relationships between patient and provider, or because some individuals may be pro-active in their attitude to dental care, to control for this we also need to model visits conditional on lagged NHS check-up status.

We follow Wooldridge (2005) in estimating a dynamic probit model with unobserved effects as represented by equation (1) below:

$$P(y_{it} = 1 | y_{i,t-1}, \dots, y_{i0}, z_i, c_i) = \Phi(z_{it}\gamma + \rho y_{i,t-1} + c_i) \quad (1)$$

Here  $y_{it}$  is a binary indicator for a check-up with an NHS dentist at year  $t$ ,  $y_{i0}$  is a binary variable indicating whether individual  $i$  had an NHS check-up in their first observation (initial condition), and  $c_i$  is an individual specific time-invariant error term.  $z_{it}$  is a vector of covariates that we think could have an effect on NHS dental check-ups, these include: health problems, gender, ethnicity, education qualifications, marital status, number of children, region of residence, job status, and Social Occupation Classification for the employed. We also include year dummies, and this is where our primary interest lies, as

years 2006 and 2007 will capture any changes in check-up rates following the reforms we include a dummy for post-reform that is one when in years 2006 and 2007.

Equation (1) relies on several assumptions, firstly, that the dynamics are correctly specified as first order having conditioned on  $z_{it}$  and  $c_i$ . Secondly that  $c_i$  is additive in the standard normal cumulative distribution function, and finally, that  $z_{it}$  is strict exogenous.

To model the unobserved effect we assume:

$$c_i | y_{i0}, z_i \sim Normal(\alpha_0 + \alpha_1 y_{i0} + z_i \alpha_2, \sigma_a^2) \quad (2)$$

and  $c_i = \alpha_0 + \alpha_1 y_{i0} + z_i \alpha_2 + a_i$  where  $a_i | (y_{i0}, z_i) \sim Normal(0, \sigma_a^2)$ .

Our model is thus:

$$y_{it} = \beta_0 + \beta_1 z_{it} + \beta_2 y_{i0} + \beta_3 z_i + a_i + u_{it} \quad (3)$$

Where  $z_i$  contains the time averages of the exogenous explanatory variables but does not include time dummies. Specifying  $c_i$  in this way means we can use standard random effects probit estimations in STATA, we just add in  $y_{i0}$  and  $z_i$  to our model and the random effects technique integrates out the unobserved effect.

To estimate whether the reforms have managed to increase use we define 'poor access' as those individuals who report having no dental check-up (either NHS and/or private) in the last two waves/years prior to interview. We follow the DH and HCHC in modelling access as use and two years was chosen as this was the recommended timeframe between dental check-ups as advocated by NICE. We generate dummies for each wave that identify those with poor access, and these are interpreted in the model as the probability that you have a dental check-up in the current wave having not had one in the last two waves.

## Substitution effects

To model any substitution effects borne from the reforms we model transitions to private dental check-ups given you have had an NHS dental check-up in the previous year with the same set of covariates,  $z_{it}$ , as the above model (as we are modelling movements from NHS check-ups we do not include dummies for poor access as by construction no-one in this group has had a dental check-up in two years). Our dependent variable is a dummy for transition from a check-up with an NHS dentist to private dentist between two waves. Any change in the probabilities of moving from NHS to private dental services after the reforms will be picked up by our post-reform dummy. A positive coefficient here could imply the reforms created an incentive for switching from NHS to private dental services. We estimate equation (3) below using random effects probit techniques in STATA. As a transition in the last wave negates the possibility of you transiting again in the proceeding wave we do not have a dynamic problem as in Equation (1).

$$P(p_{it} = 1 | n_{i,t-1} = 1) = \beta_0 + \beta_1 z_{it} + \mu_i + \xi_{it} \quad (3)$$

Here  $p_{it}$  is a binary indicator for a private dentist visit at wave  $t$ , and  $n_{i,t-1}$  is a binary indicator for an NHS dental check up at wave  $t-1$ .

## Data

We use the first seventeen (1991-2007) waves of the British Household Panel Survey (BHPS). The BHPS was designed as an annual survey of each adult (16+) member of a nationally representative sample of more than 5,000 households, making a total of approximately 10,000 individual interviews. The same individuals are re-interviewed in successive waves and, if they split-off from original households, all adult members of their new households are also interviewed. Children are interviewed once they reach the age of 16. Thus the sample should remain broadly representative of the population of Britain as the population structure changes over time (Taylor et al. 2001).

Dental check-ups are measured by responses to the questions: ‘Have you had a dental check up since September 1<sup>st</sup> last year’, and ‘Did you get this on the NHS or was it private?’

To model changes in dental check-ups following the dental reforms we use waves 16 and 17 of the BHPS. As the dental check-up question is retrospective, wave 17 covers check-ups for the period September 1<sup>st</sup> 2006 until the interview date in 2007 (usually September), while wave 16 covers the period September 1<sup>st</sup> 2005 until September 2006 and would therefore cover seven months before the reforms, and five after. Although wave 16 covers the period in which the reforms occurred, we might expect that the full effects of the reform would take some time to occur. Wave 17 covers the year from six months after the reforms were introduced and might be expected to represent a more ‘steady state’ post reform period. Nevertheless any difference in the utilisation between the two waves should be viewed as conservative since at least part of wave 16 was already under the reform period. In addition, not all respondents in the BHPS are interviewed in September, but most are interviewed by the end of December, as such wave 16 may capture 6,7 or more months of the reform period as respondents are asked ‘since September 1<sup>st</sup> last year...’ and not ‘during the period 1<sup>st</sup> September last year and 1<sup>st</sup> September this year...’.

Modelling dental check-ups is restrictive given patients can see a dentist for reasons other than a dental check-up. Table 1 gives annual rates of NHS check-ups from the BHPS and patients seen from NHS data for 1997-2006, our measure is closely representative of data from the NHS Information Centre. In addition, the average yearly rate of NHS check-ups across the sample is 48% which is in line with the 50% patients seen measure by the NHS. So while our check-up measure is not directly comparable, the rates do seem similar to the patients seen measure.

Figure 1 plots total, NHS, and private dental check-ups over the sample and shows that there has been an increase of about 10 percentage points in overall dental check-ups, this increase however is largely due to an expanding



private sector with private dental check-ups nearly doubling over the 17 years, this is in comparison to a stable if not slightly declining rate of NHS check-ups.

## **Results**

Table 2 gives the proportion of respondents with varying patterns of dental check-ups over the survey. Approximately 23% of the sample visited a dentist for a check-up in each wave they were interviewed. Table 3 reveals that 57% of these were exclusively to NHS dentists, 7% to private dentists, and 36% attended a mixture of the two over the sample.

There were approximately 16% of individuals not attending a dentist over their period surveyed, and Table 4 shows that 21% of the sample never had a check-up with an NHS dentist (59% for a private check-up).<sup>1</sup>

To model the raw effect of the dental reforms on dental check-ups Table 5 gives the rates of dental check-ups both before and after the reform where we compare waves 16 and 17 with either all previous waves. The reforms look to have increased dental check-ups, but this is the result of a reduction in NHS check-ups, and consequent increase in private dental check-ups. To omit any time trend, the second panel of Table 5 compares rates at waves 14 and 15 with rates at waves 16 and 17 and while the results tell the same story, the changes are on a lower scale (though there is a large(r) reduction in NHS check-ups). The decline in NHS check-ups is very close to the 2.3% reduction in patients seen observed by HCHC (2008) using NHS data.

Table 5 also gives check-up rates by poor access status, and reveals the different effects between the two groups. In particular, NHS dental check-ups increased after the reforms for those with poor access while those with a good access history experienced a reduction in NHS check-ups, later we control for

---

<sup>1</sup> It is important to note that the BHPS had booster samples in waves 7, 9, and 11 and new respondents can flow into the sample as children turning 16 or through newly formed relationships of original sample members – as such, the panel is unbalanced and none attendance can be indicative of a respondent observed only twice over the period during which they do not attend a dentist.

other factors that may have contributed to these changes, but these cross-tabulations given here do suggest NHS check-ups have increased after the reforms for those with poor access.

To investigate any substitution effect, Table 6 reports changes in dental service provider from 2005 to 2007. While approximately 5.2% move to NHS dentistry, 10% transfer to private dental check-ups and 85% do not change dentist type. Put another way, of those that changed dental providers, 33% are movements to NHS from private dentists, and 67% are to private dentists from NHS providers. We therefore do find a substitution of NHS services for private dental services between the two years suggesting the reforms had led to a shift towards private sector dentistry – the opposite of what the reforms had set out to do.

## **Multivariate Results**

The results from our multivariate analysis of NHS dental check-ups are given in Table 7. The model covers 1994-2007 this is because we model lagged check-ups and poor access (that requires the last two years observations). We report three sets of results, the first set is for a probit model where we do not control for unobserved heterogeneity or dynamic persistence in NHS check-ups. The second set, 'RE Probit' are the results where we control for unobserved heterogeneity (i.e. controlling for unobservable differences between individuals in their probability to have a dental check-up, e.g. attitudes to oral health), while assuming strict exogeneity of the explanatory variables with the heterogeneity (i.e. that the unobservable effects are not correlated with the covariates in the model e.g. that attitudes to oral health are the same across gender). The final set of results, 'Dynamic Probit' builds on the second by allowing the heterogeneity term to be correlated with the time averages of the covariates (i.e. where we now allow some correlation of the unobservable effect with the covariates and assume this correlation can be picked up by the time averages of the covariates). Estimates are given as marginal effects and are interpreted as the difference in probability of

attending an NHS dentist for a check-up relative to base, for example, the estimate of -0.462 for the poor access dummy in the 'Probit' model is interpreted as those with in the pre-reform period with no check-up in the last two years having a 46.2% lower probability of having an NHS dental check-up in the current wave compared to those with good access.

The heterogeneity term is significant in both the second and third models ( $p$ -values $<0.001$ ) which suggests there are significant unobservable differences in probabilities between individuals. A test of the joint significance of the time averages in the third model was not rejected, suggesting that the time averages are picking up significant differences in the probability of having a dental check-up. Given the above tests, we favour the third set of results.

We find NHS dental check-ups are highly correlated, the coefficient estimate is large and statistically significant and suggests those who had an NHS dental check-up in the last wave were 33.8% more likely to have an NHS check-up in the current wave compared to those who didn't have an NHS check-up in the last wave. The positive, significant effect of the initial condition implies a substantial correlation between the unobserved heterogeneity and the initial condition.

Turning to our prime interest of the effects of the reforms, we find a negative, statistically significant difference in NHS check-ups for the post-reform period (recall the post-reform dummy is a dummy for waves 16 and 17). The estimate of -0.061 suggests NHS check-ups in the reform period were 6.1% lower than in 2005. This is larger than the cross-tabulations in Table 5 and NHS Information Centre statistics, but recall we have controlled for any time trending effects and other factors that may have explained changes in NHS check-ups.

To assess whether rates of NHS dental check-ups have increased for those with poor access following the reforms, we separate our poor access dummy into the pre- and post-reform periods. As expected, we find a statistically significant reduced probability of NHS dental check-ups for those with poor

access, this effect is smaller in the third model than the first and second as these were picking up the effects of lagged NHS usage (recall those with poor access are defined as individuals with no dental check-up in the previous two years). Our estimate of post poor access reform is positive and significant, and suggests that while those with poor access are still less likely to have a check-up with an NHS dentist than those with good access ( $-0.096+0.090=-0.006$ ) the reforms do seem to have improved check-up rates for those with poor dental check-up histories.

Our other controls are largely intuitive. Females, and those with children are more likely to have an NHS dental check-up, this may be because females receive free dental treatment during and for a period following pregnancy, and those with children may visit the dentist more regularly because of an increased awareness of oral hygiene or because they have a check-up when their children have one. We find higher probabilities of NHS dental check-ups for those in receipt of Government benefits who are likely to attain either free or discounted NHS dental services.

The decline in overall NHS dental check-ups and improvement in check-ups for those with poor access history suggests the clientele for NHS dentistry has changed, it is interesting to assess the types of individuals who have moved out of NHS dentistry and into private dental services to determine whether there appears to be any substitution effect occurring and if this has changed after the reforms. Table 8 gives the estimates for transitions to private dental check-ups from NHS check-ups, recall we have no dynamic issue here and as the heterogeneity term is significant in the second set of results, we focus our inference on these.

We find a positive, statistically significant effect for the period after the reforms on changes to private dental check-ups. The estimate on our post reforms variable is 0.024 and is interpreted as transitions from NHS to private check-ups being 2.4% higher in the post reform period than in 2005 (and in fact this probability is higher in comparison to any wave previous). The results suggest that substitution of NHS dental services for private services increased

following the reforms, this may have not been by choice however, since the rejection of many NHS dentists to sign the new contract may have led to patients being forced into private dental services.

Our results in Table 8 also shed some light on the types of patients seeing private dentists, for example, those in the most southern regions of England (London, South East and South West) have higher probabilities of transiting, the lower rates of NHS dental check-ups found in Table 7 suggests this may be because there is a growing absence of NHS dentists in the South and East. Transiting is also higher for those in employment, and there seems to be an inverted u-shape in age which may signal a trend for younger generations to seek private dental services.

## ***Conclusion***

With regards to our initial hypotheses of the impact of the reforms we find:

### *1. NHS dental services use will increase following the reforms*

Our results suggest that NHS dental check-ups reduced following the reforms, while check-ups for those with poor access improved after the reforms were introduced (to a level close to those with good check-up histories). PCT-led commissioning may have worked in improving access in deprived areas. The simplified pricing structure may have enticed those with poor access also. The reduction in NHS check-ups could be due to those dentists refusing to sign the new NHS dental contract, which were reported to have represented 4% of total NHS dental activity (DH, 2007). In addition, there are some treatments under the new price bands that are more expensive and it makes economic sense for patients to build up problems and have them treated under the same course for one price rather than individually, this may have worked to reduce demand in overall check-ups. It was also noted in the HCHC (2008) report that the number of complex treatments has reduced dramatically following the reforms, and this may be a reflection of the price bands and dental contracts.

## *2. The public-private mix in dental care provision will be affected by the reforms*

Our data enables us to model transitions between NHS and private dental service use – something not possible with aggregate data and the lack of data available for private dentistry. We find a significant increase in the probability of movements from NHS to private dental check-ups following the reforms. This may be due to a number of reasons. First, while the CoTs price bands make some treatments cheaper, there are some treatments that are more expensive under the new price bands. Second, those dentists refusing to sign up to the new contract could have forced patients in their areas to transit to private dental services.

Our overall conclusion is that the reforms seem to have shifted some groups to different dental practitioners. There has been a movement of people out of NHS dentistry and into private dentistry, but this has been met with a (slightly lower) increase in NHS check-ups by those with poor access history.

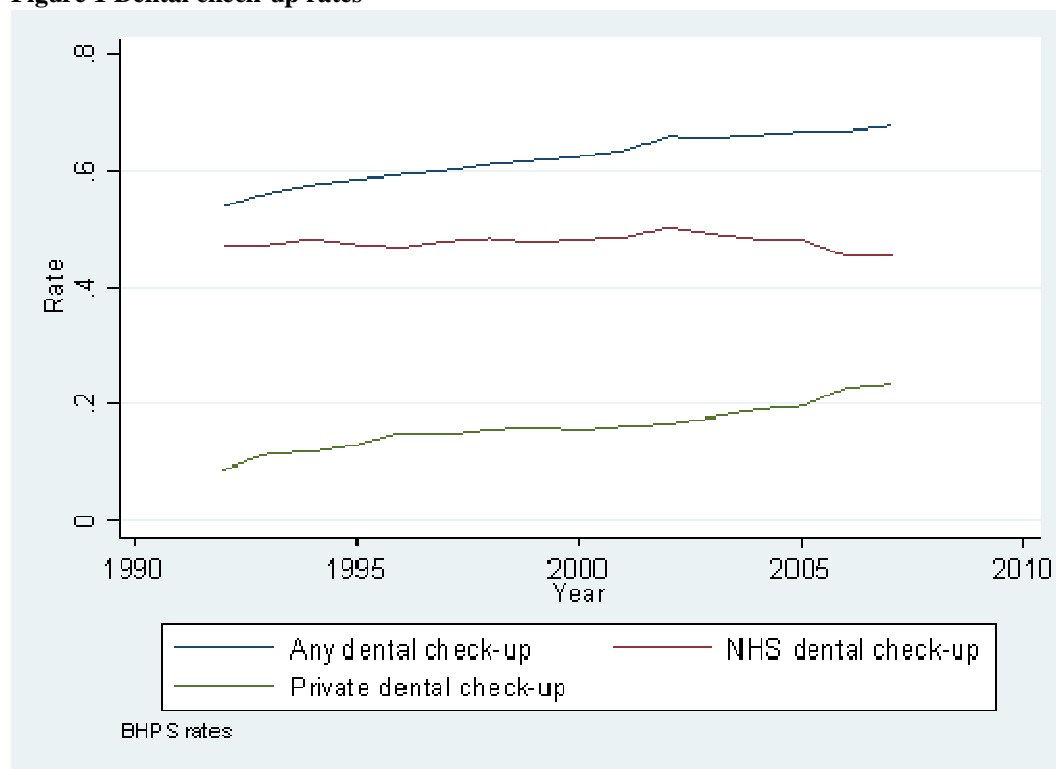
## ***Discussion***

There are a number of points for discussion:

1. The General Dental Council secured the level of NHS dentist income until April 2009 should their income under the new contract be reduced. Now this has passed, if dentists refuse to sign up to the NHS, our results suggest further patients will transfer to private dental services. What will happen to those patients who refuse to transit with their current dentist? Will this have a detrimental effect on their use? How important is it for PCT's to be able to negotiate effectively, to keep NHS dentists?
2. NICE have changed their recommendations for check-ups to whatever your dentist recommends (i.e. individual needs based). Will this be enough to help free up NHS dentists and improve access?

3. What impact do these results have on workforce planning in NHS dentistry? The changing patient base will lead to changing needs and requirements of NHS dentists. Further, PCT-led commissioning should help NHS dentistry better meet the needs of their PCT. But if this is the case, will PCT's have trained workforce planners that will have the skills to identify future skills gaps and recognise demographic and needs changes for their local area. This would be vital to commissioning services that will successfully meet future patient needs.

**Figure 1 Dental check-up rates**



**Table 1 Annual NHS dental check-up rates**

Year	BHPS NHS check-up	NHS data on patients seen
1997	46.2	52.9
1998	47.3	49.8
1999	46.6	45.6
2000	47.0	45.3
2001	46.9	45.1
2002	48.1	44.9
2003	47.1	44.0
2004	45.3	44.5
2005	45.0	44.2
2006	42.5	45.3

**Table 2 Frequency of dental check-ups**

<i>Check-up to any dentist (all waves)</i>	<i>Number of individuals</i>	<i>%</i>
Annual visits	2789	22.95
No Visits	1966	16.18
Number of individuals	12151	100.00

**Table 3 Annual dental usage by type of dentist**

<i>Annual check-up by type</i>	<i>Number of individuals</i>	<i>%</i>
NHS	1584	56.79
Private	193	6.92
Mixture	1012	36.29
All check-ups	2789	100.00

**Table 4 No check-ups over sample**

<i>No check-ups over sample</i>	<i>Number of individuals</i>	<i>%</i>
NHS	2584	21.27%
Private	7226	59.47%
No check-ups to either NHS/private	1966	16.18%
Number of individuals	12151	

**Table 5 Rates of dental check-ups pre- and post-reforms**

<i>Reform period</i>	<i>All visits (%)</i>	<i>NHS visits (%)</i>	<i>Private visits (%)</i>
<i>All sample</i>			
<i>All waves</i>			
	0	61.3	48.18
	1	67.28	45.43
Change		5.98	-2.75
<i>Waves 14/15 compared with 16/17</i>			
	0	66.5	48.32
	1	67.28	45.43
Change		0.78	-2.89
<i>Poor Access</i>			
<i>All waves</i>			
	0	18.59	14.10
	1	20.29	14.33
Change		1.69	0.23
<i>Waves 14/15 compared with 16/17</i>			
	0	18.47	12.71
	1	20.29	14.33
Change		1.81	1.61
<i>Good access</i>			
<i>All waves</i>			
	0	80.34	61.64
	1	82.58	54.81
Change		2.24	-6.83
<i>Waves 14/15 compared with 16/17</i>			
	0	82.56	59.54
	1	82.58	54.81
Change		0.02	-4.73



**Table 6 Changes in dental check-up type for attendees (2005 v 2007)**

<i>Transfer to private</i>	<i>Transfer to NHS</i>		<i>Total</i>
	0	1	
0	3,699	214	3,913
1	426	11	437
<b>Total</b>	<b>4,125</b>	<b>225</b>	<b>4,350</b>

**Table 7 NHS dental check-up estimation results**

<i>NHS dental visit</i>	<i>Probit</i>		<i>RE Probit</i>		<i>Dynamic Probit</i>	
Lag NHS check-up					0.338**	(0.005)
NHS check-up at 1 <sup>st</sup> wave					0.269**	(0.008)
Poor Access	-0.462**	(0.003)	-0.301**	(0.006)	-0.096**	(0.007)
Poor Access Post Reform	0.072**	(0.014)	0.145**	(0.016)	0.090**	(0.016)
Year/wave (base 2005):						
1994	0.050**	(0.010)	0.058**	(0.012)	0.041**	(0.015)
1995	0.033**	(0.010)	0.038**	(0.012)	0.016	(0.014)
1996	0.022**	(0.010)	0.020*	(0.012)	0.010	(0.014)
1997	0.027**	(0.010)	0.031**	(0.011)	0.024*	(0.013)
1998	0.040**	(0.010)	0.049**	(0.011)	0.037**	(0.013)
1999	0.020**	(0.010)	0.024**	(0.011)	0.008	(0.012)
2000	0.016*	(0.009)	0.025**	(0.011)	0.017	(0.012)
2001	0.023**	(0.009)	0.034**	(0.011)	0.027**	(0.012)
2002	0.033**	(0.010)	0.050**	(0.011)	0.045**	(0.012)
2003	0.009	(0.010)	0.014	(0.011)	0.004	(0.011)
2004	0.000	(0.010)	-0.000	(0.011)	-0.002	(0.011)
Post reforms (waves 16/17)	-0.046**	(0.009)	-0.078**	(0.010)	-0.061**	(0.010)
Ethnic Minority	-0.032**	(0.006)	-0.045**	(0.016)	-0.017	(0.012)
Female	0.037**	(0.004)	0.091**	(0.010)	0.038**	(0.009)
No Qualifications	-0.024**	(0.005)	-0.098**	(0.012)	0.006	(0.042)
Degree	-0.018**	(0.006)	-0.031**	(0.013)	-0.044**	(0.022)
Marital Status (base married):						
Couple	-0.017**	(0.006)	-0.028**	(0.010)	-0.007	(0.013)
Widowed	-0.097**	(0.008)	-0.133**	(0.014)	-0.025	(0.021)
Divorced	0.004	(0.008)	-0.005	(0.014)	-0.012	(0.018)
Single	-0.014**	(0.006)	-0.021**	(0.011)	-0.006	(0.014)
Children (base none):						
One	0.056**	(0.006)	0.064**	(0.008)	0.051**	(0.009)
Two	0.064**	(0.007)	0.074**	(0.010)	0.049**	(0.011)
Three or more	0.108**	(0.010)	0.114**	(0.015)	0.081**	(0.017)
Age:						
21-25	0.005	(0.012)	-0.029**	(0.014)	-0.009	(0.016)
26-30	0.035**	(0.012)	0.016	(0.016)	0.033	(0.020)
31-35	0.037**	(0.013)	0.039**	(0.017)	0.055**	(0.024)
36-40	0.014	(0.013)	0.022	(0.018)	0.034	(0.028)
41-45	0.028**	(0.013)	0.031*	(0.019)	0.031	(0.032)
46-50	0.032**	(0.013)	0.023	(0.019)	0.019	(0.036)
51-55	0.026*	(0.013)	0.001	(0.020)	0.002	(0.040)
56-60	0.019	(0.014)	-0.010	(0.021)	0.005	(0.044)
61-65	-0.000	(0.015)	-0.038*	(0.023)	-0.003	(0.048)
66+	-0.053**	(0.015)	-0.104**	(0.023)	-0.013	(0.054)
Health Problems:						
Arms or Legs	0.031**	(0.004)	0.017**	(0.007)	0.006	(0.007)
Sight	-0.022**	(0.009)	-0.011	(0.012)	-0.000	(0.013)
Hearing	0.012*	(0.007)	0.016	(0.011)	0.020	(0.013)
Skin	0.019**	(0.005)	0.006	(0.008)	-0.008	(0.009)
Chest, Breathing	-0.010*	(0.005)	-0.007	(0.009)	0.002	(0.010)
Heart and blood	0.019**	(0.005)	0.029**	(0.009)	0.027**	(0.009)
Stomach, liver, kidney	0.040**	(0.007)	0.038**	(0.010)	0.021*	(0.011)

<i>Diabetes</i>	-0.004	(0.010)	0.015	(0.018)	0.028	(0.023)
<i>Alcohol, drugs</i>	-0.013	(0.028)	-0.031	(0.039)	-0.033	(0.043)
<i>Epilepsy</i>	-0.032	(0.020)	-0.061	(0.039)	-0.123**	(0.051)
<i>Migraine</i>	0.002	(0.007)	0.005	(0.010)	0.003	(0.011)
<i>Other</i>	0.039**	(0.009)	0.037**	(0.012)	0.028**	(0.012)
Region (base London):						
<i>South East</i>	-0.009	(0.007)	-0.004	(0.015)	-0.044*	(0.025)
<i>South West</i>	0.000	(0.008)	0.007	(0.018)	-0.023	(0.035)
<i>East Anglia</i>	0.177**	(0.009)	0.218**	(0.021)	0.040	(0.041)
<i>East Midlands</i>	0.089**	(0.008)	0.095**	(0.019)	0.056	(0.038)
<i>West Midlands</i>	0.067**	(0.008)	0.101**	(0.019)	0.047	(0.041)
<i>North West</i>	0.112**	(0.008)	0.136**	(0.018)	0.036	(0.042)
<i>Yorkshire &amp; Humber</i>	0.123**	(0.008)	0.149**	(0.019)	0.061	(0.042)
<i>North East</i>	0.067**	(0.009)	0.049**	(0.022)	-0.079	(0.053)
Job status (base private sector employee):						
<i>Self Employed</i>	-0.020**	(0.007)	-0.022*	(0.012)	-0.015	(0.014)
<i>Public Sector Employee</i>	0.041**	(0.006)	0.035**	(0.009)	0.016	(0.011)
<i>Unemployed</i>	0.035**	(0.014)	0.058**	(0.019)	0.049**	(0.020)
<i>Retired</i>	0.065**	(0.012)	0.054**	(0.017)	0.025	(0.019)
<i>Maternity Leave</i>	0.154**	(0.041)	0.159**	(0.050)	0.141**	(0.051)
<i>Family Care</i>	0.042**	(0.011)	0.068**	(0.016)	0.050**	(0.018)
<i>FT Educ</i>	0.083**	(0.017)	0.129**	(0.023)	0.101**	(0.025)
<i>LT sick, Disabled</i>	0.069**	(0.014)	0.075**	(0.021)	0.043*	(0.023)
<i>Gvt. Training Scheme</i>	0.068	(0.067)	0.032	(0.080)	0.062	(0.080)
<i>Other</i>	0.139**	(0.032)	0.170**	(0.040)	0.155**	(0.042)
Social Occupation Classification (base other, no job):						
<i>Managers &amp; Administrators</i>	-0.020**	(0.010)	0.013	(0.015)	0.014	(0.016)
<i>Professional Occupations</i>	0.002	(0.011)	0.018	(0.016)	0.001	(0.017)
<i>Associate Professional &amp; Technical Occupations</i>	0.003	(0.011)	0.026*	(0.016)	0.015	(0.017)
<i>Clerical &amp; Secretarial Occupations</i>	0.045**	(0.010)	0.039**	(0.015)	0.010	(0.016)
<i>Craft &amp; Related Occupations</i>	0.010	(0.011)	0.011	(0.017)	0.004	(0.018)
<i>Personal &amp; Protective Service Occupations</i>	-0.008	(0.011)	-0.006	(0.016)	-0.015	(0.017)
<i>Sales Occupations</i>	0.031**	(0.012)	0.026	(0.018)	-0.003	(0.019)
<i>Plant &amp; Machine Operatives</i>	0.008	(0.012)	-0.003	(0.017)	-0.009	(0.019)
Observations	89716		89716		89716	
Pseudo R <sup>2</sup>	0.160					

Marginal effects; Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$

**Table 8 Transitions from NHS to private dental service use results**

<i>Transition from NHS to private check-up</i>	<i>Probit</i>		<i>RE Probit</i>	
Year/wave (base 2005):				
1992	-0.017**	(0.006)	-0.028**	(0.004)
1993	0.011	(0.008)	-0.005	(0.006)
1994	-0.003	(0.007)	-0.012**	(0.005)
1995	-0.002	(0.007)	-0.011**	(0.005)
1996	0.021**	(0.008)	0.011	(0.007)
1997	0.010	(0.008)	0.003	(0.006)
1998	0.024**	(0.008)	0.015**	(0.007)
1999	0.020**	(0.008)	0.013**	(0.007)
2000	-0.011	(0.007)	-0.012**	(0.005)
2001	-0.002	(0.007)	-0.005	(0.006)
2002	-0.017**	(0.007)	-0.018**	(0.005)
2003	0.003	(0.007)	0.000	(0.006)
2004	0.006	(0.008)	0.003	(0.006)
Post reforms (waves 16/17)	0.023**	(0.007)	0.024**	(0.006)
Ethnic Minority	0.012**	(0.004)	0.010*	(0.006)
Female	-0.010**	(0.003)	-0.009**	(0.003)
No Qualifications	-0.011**	(0.003)	-0.017**	(0.004)
Degree	0.004	(0.004)	0.006	(0.005)
Marital Status (base married):				
Couple	-0.000	(0.004)	-0.006	(0.004)
Widowed	0.025**	(0.007)	0.010	(0.008)
Divorced	-0.014**	(0.005)	-0.016**	(0.005)
Single	-0.006	(0.004)	-0.008*	(0.004)
Children (base none):				
One	-0.022**	(0.003)	-0.020**	(0.003)
Two	-0.023**	(0.004)	-0.020**	(0.003)
Three or more	-0.043**	(0.004)	-0.035**	(0.004)
Age:				
21-25	0.041**	(0.009)	0.047**	(0.010)
26-30	0.049**	(0.010)	0.060**	(0.011)
31-35	0.061**	(0.010)	0.068**	(0.011)
36-40	0.079**	(0.011)	0.089**	(0.013)
41-45	0.071**	(0.011)	0.083**	(0.013)
46-50	0.054**	(0.010)	0.068**	(0.013)
51-55	0.054**	(0.011)	0.073**	(0.014)
56-60	0.055**	(0.012)	0.079**	(0.015)
61-65	0.062**	(0.014)	0.093**	(0.018)
66+	0.042**	(0.012)	0.067**	(0.016)
Health Problems:				
Arms or Legs	-0.004	(0.003)	-0.002	(0.003)
Sight	-0.005	(0.006)	-0.009	(0.005)
Hearing	-0.003	(0.005)	-0.004	(0.005)
Skin	0.003	(0.004)	0.005	(0.004)
Chest, Breathing	-0.007*	(0.004)	-0.009**	(0.004)
Heart and blood	-0.001	(0.004)	-0.002	(0.004)
Stomach, liver, kidney	-0.005	(0.005)	-0.006	(0.004)
Diabetes	-0.009	(0.008)	-0.009	(0.008)
Alcohol, drugs	-0.028	(0.019)	-0.023	(0.016)
Epilepsy	0.010	(0.015)	0.011	(0.018)
Migraine	-0.001	(0.004)	0.001	(0.004)
Other	0.004	(0.006)	0.001	(0.005)
Region (base London):				
South East	0.009*	(0.005)	0.017**	(0.006)
South West	0.013**	(0.006)	0.025**	(0.008)
East Anglia	-0.037**	(0.005)	-0.027**	(0.006)
East Midlands	-0.042**	(0.004)	-0.032**	(0.005)

<i>West Midlands</i>	-0.005	(0.005)	0.003	(0.007)
<i>North West</i>	-0.019**	(0.005)	-0.014**	(0.005)
<i>Yorkshire &amp; Humber</i>	-0.026**	(0.005)	-0.019**	(0.005)
<i>North East</i>	-0.008	(0.006)	-0.005	(0.007)
Job status (base private sector employee):				
<i>Self Employed</i>	0.017**	(0.005)	0.012**	(0.006)
<i>Public Sector Employee</i>	-0.004	(0.004)	-0.002	(0.004)
<i>Unemployed</i>	-0.031**	(0.008)	-0.024**	(0.007)
<i>Retired</i>	0.004	(0.009)	-0.004	(0.008)
<i>Maternity Leave</i>	-0.056**	(0.018)	-0.047**	(0.010)
<i>Family Care</i>	-0.017**	(0.007)	-0.018**	(0.006)
<i>FT Educ</i>	-0.016*	(0.009)	-0.019**	(0.007)
<i>LT sick, Disabled</i>	-0.050**	(0.007)	-0.041**	(0.005)
<i>Gvt. Training Scheme</i>	-0.051*	(0.028)	-0.039**	(0.020)
<i>Other</i>	-0.049**	(0.016)	-0.036**	(0.012)
Social Occupation Classification (base other, no job):				
<i>Managers &amp; Administrators</i>	0.028**	(0.008)	0.017**	(0.008)
<i>Professional Occupations</i>	0.018**	(0.008)	0.009	(0.008)
<i>Associate Professional &amp; Technical Occupations</i>	0.019**	(0.008)	0.009	(0.008)
<i>Clerical &amp; Secretarial Occupations</i>	0.012	(0.007)	0.007	(0.007)
<i>Craft &amp; Related Occupations</i>	0.022**	(0.009)	0.016*	(0.009)
<i>Personal &amp; Protective Service Occupations</i>	0.016*	(0.008)	0.012	(0.008)
<i>Sales Occupations</i>	0.021**	(0.009)	0.014	(0.009)
<i>Plant &amp; Machine Operatives</i>	0.002	(0.009)	-0.001	(0.008)
Observations	55235		55235	
Pseudo R <sup>2</sup>	0.029			

Marginal effects; Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$

## References

Department of Health (2002) *NHS Dentistry: Options for Change*

Department of Health (2004) *NHS Dentistry: Delivering Change*

Department of Health (2007) *NHS Dental Reforms: One year on*

House of Commons Health Committee (2008) Fifth Report of Session 2007-2008, *Dental Services*, HC289-I

Taylor, Marcia Freed (ed). with John Brice, Nick Buck and Elaine Prentice-Lane (2001) *British Household Panel Survey User Manual Volume A: Introduction, Technical Report and Appendices*. Colchester: University of Essex.

Wooldridge, J. (2005) 'Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity.' *Journal of Applied Econometrics*, vol.20, pg.39-54.