

WEIGHTED CAPITATION

For DHSSPSNI Dental Branch

By

Simon Reid
Dental Officer
HSCB

This document has been compiled with the benefit of support and advice gratefully received from Donncha O'Carolan acting Chief Dental Officer for Northern Ireland, Michael Donaldson Consultant in Dental Public Health HSCB and Penny Murray Deputy Principal Statistician DHSSPSNI.

WEIGHTED CAPITATION

CONTENTS

- 1. EXECUTIVE SUMMARY**
- 2. A4 HEADLINE SUMMARY**
- 3. INTRODUCTION**
- 4. CONTEXT**
- 5. DEVELOPMENTAL AIMS FOR THE SYSTEMS AND PROCESSES WITHIN THE NEW CONTRACT**
- 6. BACKGROUND TO THE DEVELOPMENT OF THE WEIGHTED CAPITATION APPROACH**
- 7. THE DEVELOPMENT PROCESS**
- 8. CONCLUSIONS & RECOMMENDATIONS**
- 9. ABBREVIATIONS**
- 10. GLOSSARY OF TERMS**
- 11. APPENDICES**
- 12. REFERENCES**

1. EXECUTIVE SUMMARY

A very important piece of work has been completed on the development of a 'Weighted Capitation Formula'. The basic premise of this formula is to more accurately calculate the enhanced capitation fee that will be known as the **Patient Care Payment (PCP)**.

This monthly fee per patient will now cover examination, radiographs ('x rays'), preventive care and simple periodontal care (cleaning). It will also include an element of prospective treatment needs with item of service payments being paid as top-up payments as and when defined treatments are actually provided. The PCP thus facilitates an increasing proportion of dentists' earnings to be paid as a regular block payment, improving practice cash flow and moving away from the historical treadmill effect.

At the moment capitation fees ('Capitation' and 'Continuing Care', under the current General Dental Services GDS contract) are calculated 'just' on the basis of five broad age bands, a rough weighting of questionable accuracy for the electoral wards with higher dmf ratings and an enhanced fee for those meeting special needs criteria. Under the Weighted Capitation Formula the Patient Care Payment will now be calculated from the following measurable criteria:

- Patient age,
- Gender,
- Patient post-code data
- List turnover as measured by new patient registrations

There will also be an enhanced fee premium for those with special needs that meet specified criteria.

The post-code of residence is being used because dental decay (as a proxy for oral health) is strongly correlated to deprivation and deprivation in turn is associated with specific postcode areas. This weighted system will therefore

more fairly reward dentists who register patients from deprived backgrounds who therefore have higher treatment needs. Our approach is similar to the model used in the allocation process for other health and social care budgets including General Medical Services (GMS), General Practitioner (GP) prescribing and the Regional Capitation Formula for allocating resources for health, community and personal social services.

The GMS system is the closest comparable model to the GDS system and therefore it would seem appropriate to therefore use the weighted capitation approach within the new contract.

Three adjustments have been made to reflect the workload from the different demographics of registered patients. These are:

(1) Age/Gender Adjustment

This was developed to recognise the fact that patients of different ages and genders have different treatment needs and attendance patterns. Age/Gender weightings are usually based on activity data. An analysis of the previous claim history for the total population from all dentists was carried out over a three-year period of data for common Statement Dental Remuneration (SDR) items (reflecting routine treatment activity) to establish baseline data. This data was developed as 'Historic Costs' data and it gave a clear indication of different treatment needs depending on age.

Looking first at the effect of age on treatment needs, there were natural break points, which indicated that ten age bands should be used. The effect of this has been an increase from two to seven in the number of age bands for adults (i.e. > 18 years old).

Next the effect of gender on treatment need was considered and again the 'Historic Costs' were analysed. This analysis showed that male patient treatment claims cost more than those for females and males had

a higher volume of treatment items. This was found to be the case for each of the ten defined age bands.

To check that there were no anomalous scores for historic costs (for example skewed by large number of small cost items or small numbers of high cost items) the results were triangulated with the number of treatment items claimed. The findings and curves were similar, so validating the cost curve analysis.

The effects of age and gender were then combined into a formula. The formula uses the cost curve calculations to determine the specific cost weightings for the different age/gender groups and is applied at the practice level.

(2) Additional-Needs Adjustment

We next need to recognise that patients of similar ages and genders can have significantly different treatment **needs** and therefore these can impact differently on dentists' workloads. This is invariably because of the way that lifestyle choices can affect health, both oral and general. Oral health, like many other lifestyle related conditions, is strongly correlated with socio-economic deprivation, which in turn is associated with certain postcodes. Therefore in order to identify need, postcode is used as the indicator.

Practices in different locations can therefore have different workloads for patient lists that are broadly similar in terms of gender and age bands. Therefore patient need has to be factored in, as this will affect the workload for dentists.

An analysis was undertaken on previous uptake of dental services (treatment item claims) at the practice level. The treatment items claimed by all dental practices were mapped against postcodes of patients who attended each practice. This produced 'Historic Costs' data for each practice and this data was further analysed to calculate the adjustment for need.

Specifically, a dental practice index was calculated which reflects the profile of the demographics of a practice's patient list. In this way the modelling is at a dental practice level (compared to the age/gender adjustment which is at the patient level). All of the practice indexes are then combined and a practice-weighted population is produced. Each practice then receives their relative share of the overall allocation pot. This is the 'Fair Shares' system, as used in other areas of healthcare funding in N. Ireland (e.g. GMS global sum, pharmaceutical prescribing and the Hospital Community & Social Services budget).

(3) List Turnover Adjustment

It is recognized that there are different statuses of patient registrations i.e. current registrations, new registrations and drop-offs. Also there will be times when individual patients change registration status and therefore the registered list is always changing. An analysis of all registered patients was therefore carried out for a 15-month period to identify changes in patient registration status. The results from the analysis of the registration data allows for a turnover adjustment factor to be calculated for use in the weighted capitation formula.

The analysis of patient movement showed that 4% of patients move from registration status each month. Over the 15-month period this results in 40% of registered patients changing status.

The other factor to take into consideration is the potentially increased workload required for a newly registered patient compared to an existing registered patient.

Therefore the next piece of work was to determine whether new registrations required more treatment and consequently had a higher claim cost than continuing registrations. Again this analysis was carried out on an individual patient basis over a financial year and showed that new patients undergo 48% more items of treatment than a continuing registration patient and this leads to a 68% higher cost in treating a new patient compared to a continuing registration patient. Therefore the uplift

factor, the 'List Turnover Adjustment' for a newly registered patient should be x 1.68 to recognise this increased treatment need.

The weighted capitation formula was further adjusted to take account of the effect of list turnover and the consequential workload demands from new patients. These adjustments will be applied simultaneously to the patient list at the practice level to produce a patient list index, which is appropriately weighted. For administration purposes at the Business Services Organisation (BSO), this will be done at the practitioner/practice level. The analysis of the data has shown that this has the same effect as carrying out the weighting process at individual patient level and then aggregating them to practice level.

It is proposed that the list weightings are calculated at a quarterly basis, as is the case with the GMS patient capitation formula. Logistically the BSO would be unable to carry out these complex calculations on a monthly basis. However payment could be made on a monthly basis (using the quarterly calculation rate).

It is further proposed that remodelling of the three adjustments, which is a very major exercise, would only be carried out on a three yearly basis when the weighted capitation formula is reviewed and recalculated if necessary.

Patient Weighted Capitation Formula

The final piece of work was to generate a formula, which incorporates the adjustments caused by the effects of:

1. Age
2. Gender
3. Oral Health Need
4. List turnover in terms of greater workload from new patient registrations

All these factors have been combined into a formula called **the Weighted Capitation Formula** which will permit the BSO to pay out, on a monthly basis, an individual patient care payment which is weighted for the factors above. The practice weighted population (i.e list of registered patients) will be re-

calculated on a quarterly basis thus reflecting the actual registrations and care provided under the new contract arrangements.

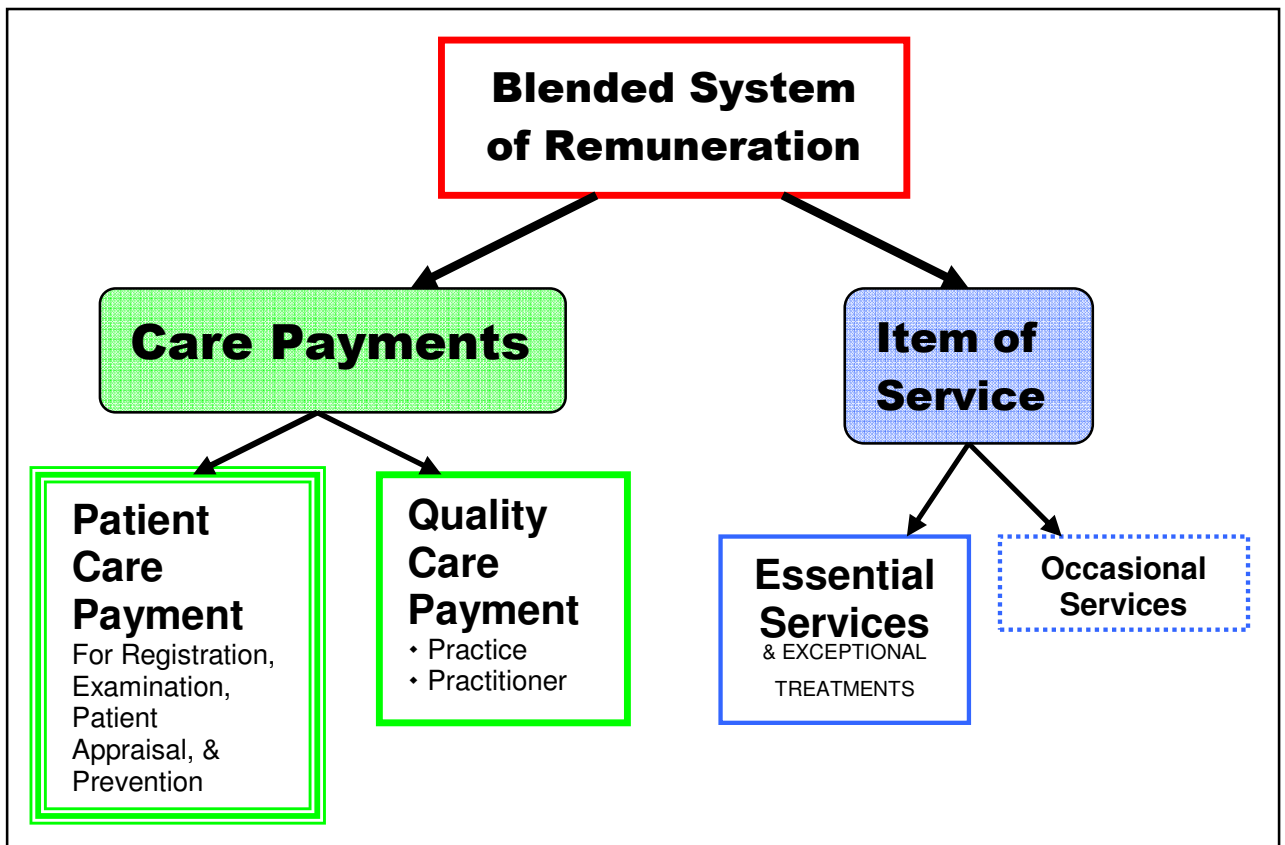


Diagram representing the PDCC Blended System of Remuneration

2. A4 HEADLINE SUMMARY

Dentists will be paid a 'Patient Care Payment' (PCP) for each registered patient as one part of the blended payment system in the new Primary Dental Care Contract (PDCC). This will cover initial patient care by, examination, investigation, diagnosis and simple tooth cleaning and will also include an element of prospective treatment needs. Importantly it will allow preventive care to reduce the risk of oral disease. Therefore an increasing proportion of dentist's remuneration will be a regular block payment, so improving practice cash flow and pace of work.

Dentists traditionally care for a list of registered patients and these individual patients experience different risks, have different needs and consequently will have different patterns of attendance. However, the present capitation system under the GDS contract has only a limited ability to differentiate between individuals by placing them in certain broad categories. Detailed analysis of actual treatment claims across our population shows significant differences in treatment need in terms of age, gender, socio-economic deprivation and whether patients are regular attendees or have just joined a dentist's list. From this data it has been possible to weight or compare the different needs of these different types of patients and to classify them as groups with similar circumstances. These groups have a range of needs, risks and attendances from low to high and therefore can be weighted, in terms of relative workload for the dentist, when compared against each other.

Using this information we have developed a weighted patient capitation formula, which is adjusted for age, gender, postcode, list turnover and new patient registration to generate PCPs. This will allow dentists to be fairly paid for the ongoing care of the different types of patients on their registration lists. As such it is one of a number of novel features in the new contract that aims to enable more patients to access care, reward dentists for providing preventive care and permit the HSCB to address the recommendations of the 2006 Primary Dental Care Strategy (PDCS).

3. INTRODUCTION

Much work has been carried out for more than three years to develop the bespoke N. Ireland Primary Dental Care Contract (PDCC). The main driver for change on the modernisation of Health Service dentistry in N. Ireland has been the 2006 Primary Dental Care Strategy (PDCS) [1]. The aims of the PDCS have directed the development of the framework for the new contract and this is also true for the development of our weighted capitation approach. This paper will explain the development of a weighted capitation system as the key mechanism to pay practitioners the 'Patient Care Payment' (PCP) within the contract's blended system of remuneration.

The 'Patient Care Payment' remunerates practitioners for registering patients and providing all necessary treatment and care within the 'Patient Care Pathway'; and for then maintaining patient registration and access to restorative care, defined as the 'Essential Services', during a registration period up to a two year maximum. We are proposing a process whereby practitioners will be fairly remunerated by a mechanism that will reflect the patient treatment needs, depending on the demographics of their registered patient list. This also helps to achieve our aim to further reduce the current treadmill effect, where practitioners are paid mainly on the volume of treatment output. Whilst we believe that local commissioning is key to improving access we also recognise that it is important to make the contract attractive to General Dental Practitioners (GDPs), to hopefully increase practitioner commitment. This weighted capitation approach has the potential to do so by supporting practitioners providing dental care and preventive interventions in all areas but particularly those of high need. This may be seen as incentivising but as the formula will show, is based on analyses of previous treatment provision and simply recognises the existing significant workload that such practitioners already provide. This weighting will more accurately and equitably reflect the patient demographics and therefore patient healthcare needs, at a practitioner level.

This paper should be considered in conjunction with previously developed papers relating to the PDCC which are available on the Department of Health Social Services & Public Safety (DHSSPSNI) website **[2]**.

The 'Care Payment & Quality Indicator Domains' paper is especially relevant because it explains the detail of what care and treatments the 'Patient Care Payment' covers, whereas this paper concentrates on the theory behind the weighted capitation formula used to calculate that payment. However for quick reference purposes a key paragraph from the former paper summarises the treatment and care that the Patient Care Payment will enable,

"The PCP fee within this domain covers taking the patient through the PDCC Care Pathway (i.e. Histories; Examination; Risk-based Patient Appraisal; Preventive Services as per BASCD toolkit; procedures to assist diagnosis and treatment planning; and basic periodontal care) and for maintaining them as 'registered' patients (with associated obligations within the PDCC Care Pathway and the Essential Services) awaiting appropriate recall."

(Section 3.1.2 Care Payment & Quality Indicator Domains paper) **[3]**.

Finally, the weighted capitation concept may be difficult to grasp because some of the statistical and theoretical aspects used to develop our bespoke approach can be challenging to understand. Indeed, where such a radical new system is proposed there is always the potential for incomplete understanding or indeed mis-understanding which could result in a potential barrier to change. Therefore I have tried to make this paper as 'user-friendly' as possible and hopefully the summaries in 'plain English' previously listed at sections 1 & 2, may be especially useful for those who don't have direct knowledge or experience in the field of dentistry or healthcare in general.

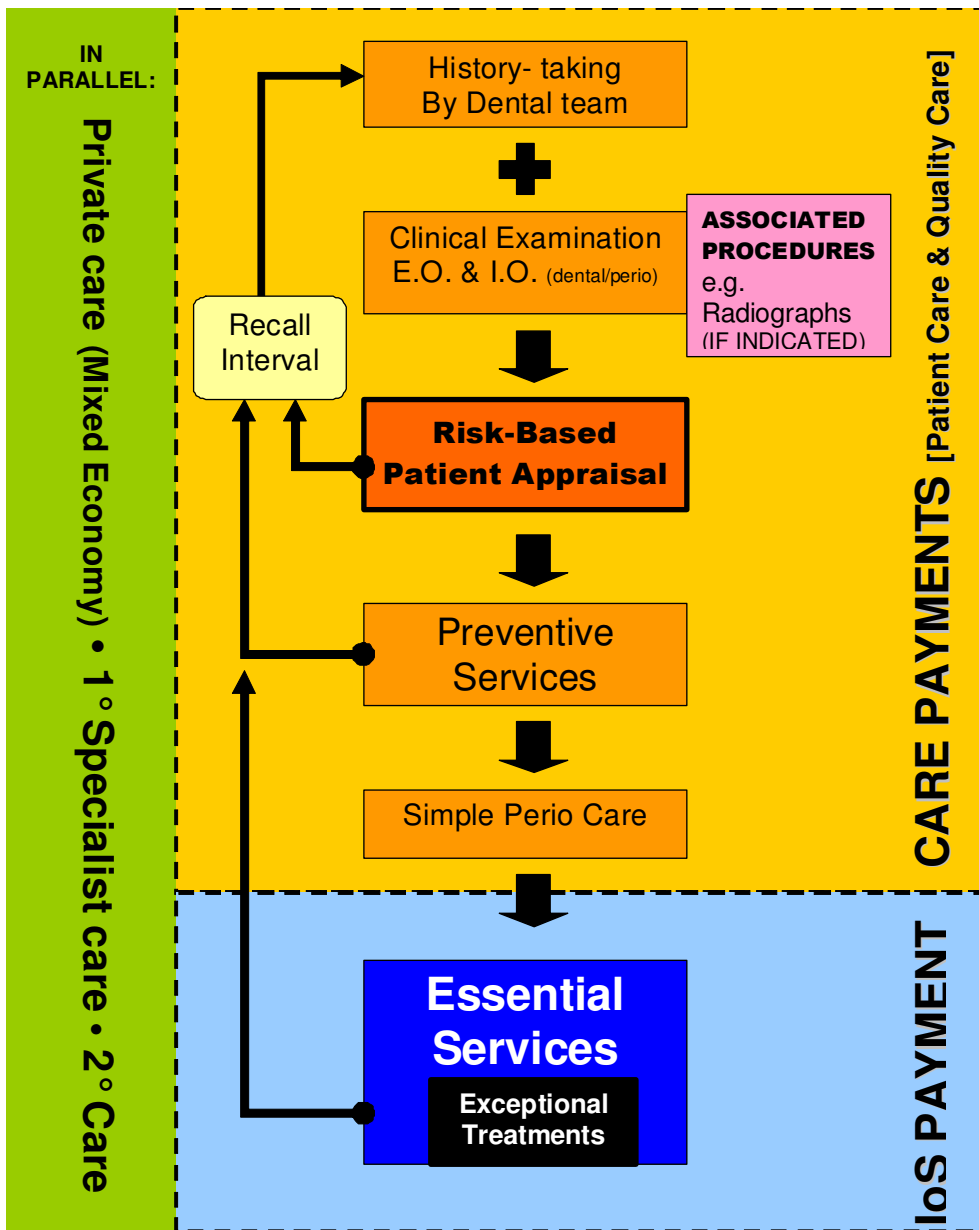


Diagram representing the Patient Care Pathway and the Contract Framework

4. CONTEXT

~ GENERAL CONTEXT

4.1 USE OF A WEIGHTED CAPITATION FORMULA IN OTHER AREAS OF HEALTHCARE

For primary health services in N. Ireland the only budgets not allocated via a capitation approach are dental, pharmaceutical services fees and optometry. These are all 'demand-led' budgets and therefore are difficult for the commissioner and contractor to control.

It would therefore make sense to move to a system that uses such a weighted capitation approach for part if not all of the allocation of the budget to enable a consistent approach and fairer allocation of resources.

A weighted capitation approach is already used in GMS, pharmaceutical prescribing and the Hospital Community & Social Services budget in N. Ireland. Such an approach is also used in other parts of the UK and weighted capitation type approaches are also used in other countries.

Given that the GMS system is the closest comparable model to the GDS system it would seem appropriate to therefore use the weighted capitation approach within the new contract.

4.2 USE FOR LCG RESOURCE MANAGEMENT

Previous work by expert advisers on developing budget allocations for Local Commissioning Groups (LCG's) has noted that the preferred option for allocating the various elements of Family Practitioner Services (FPS) funding to LCG's would be the use of a weighted capitation formula [4].

Local Commissioning Group's came about following the Review of Public Administration (RPA), which led to a change in the organisations in Health and Social Care. They are already running in shadow form, will be supported initially by the Health and Social Care Board (HSCB), but ultimately will be responsible for commissioning services at a local level.

4.3 PUBLIC HEALTH PERSPECTIVE

A key development of the PDCC is the delivery of preventive advice and interventions, which will be remunerated within the PCP. These advices and interventions will potentially be available to all registered patients and therefore enable a 'population strategy' [5] across the whole attending population rather than solely targeting high-risk individuals. Such a population strategy or public health approach to the prevention of oral disease is more effective than the isolated interventions, which do not lead to sustainable oral health improvements [6]. This public health approach therefore fits the current dominant strategy for prevention and health promotion for non-communicable diseases [7] [8]. The weighted capitation approach will allow all registered patients to access preventive care and reduce the risk to oral health in the greater population but will more fairly reward practitioners for the greater preventive needs of socio-economically targeted sub-populations. In this way it enables a 'Geographic targeting' [9] approach by recognising the capitation weighting relative to that in the background population. This is a 'directed population approach' [10], but importantly, by weighting the whole population, it means preventive care is resourced for all patients, recognising that oral disease is not just confined to subgroups in distinct geographic socially deprived areas [11] [12]. That is, there are no arbitrary natural breaks depending on where one resides for receiving preventive care or not. Patients from all areas should receive preventive care, to a greater or lesser extent. In summary, our weighted capitation system will remunerate practitioners to provide a directed population approach to preventive dental care, which is weighted, when appropriate, to enhance the background general population approach.

4.4 MORAL CONSIDERATIONS IN RESOURCE ALLOCATION

Despite the risk of it becoming a philosophical debate there are important issues to consider. The weighted capitation approach attempts to address some of the moral concerns relating to the allocation of scarce health care

resources. Whilst recognising that there are competing and conflicting moral issues this approach appears to aim to reconcile several major concerns [13]:

- Aim to allocate health care funds to meet the needs of all.
- Allocate health care funds on the basis of need.
- Enable the health care professionals to give priority to patients' needs.
- Facilitate equitable access to health care.
- Aim to maximise potential benefits from available resources.

The Weighted Capitation Formula relates to only one part of the blended system of remuneration but this system as a whole also aims to best address these same concerns.

~ DENTAL CONTRACT CONTEXT

4.5 BACKGROUND TO LEGACY DENTAL SYSTEM

A capitation system was brought in under the 1990 GDS contract that was introduced throughout the U.K. The principle of the capitation payments was to encourage registration and to enable a regular payment that was not output driven, to remunerate practitioners for providing patient access to care.

This paid a small monthly amount to the practitioner for registering and providing ongoing care for an adult patient, which was called the 'Continuing Care Payment'.

A similar payment was made for child patients, which was known as the 'Capitation' payment though other aspects of dental care were to be provided under this arrangement. There was also a system for weighted entry payments for patients presenting for registration with initial treatment requirements. This was subsequently dropped because it was believed that unnecessary claims were being made and that subsequent treatment was not always being provided. The system was modified in due course so that many treatment items could be claimed but other items such as radiographs, scaling or fluoride application remained within the Statement of Dental Remuneration

(SDR) narrative, “*care and treatment necessary to secure and maintain oral health*”. A mechanism for an enhanced payment, of double the normal fee, recognised the extra time required to treat those with a severe handicap or learning difficulties.

This system proved popular with both dentists and patients and higher than expected levels of registration were achieved. Also more treatment was carried out. As a result the fees were reduced in 1992 and the prior approval limit was reduced. The period of registration was later changed from 24 to 15 months and patients lapsed from registration, with dentists losing their capitation/continuing care payment, if the patient did not re-attend for re-registration.

A form of weighting was later introduced for patients with a home postcode in certain electoral wards that oral health surveys had found to have higher average dmf scores. This attracted a proportionately enhanced monthly fee, which for capitation patients also depended on age.

Payments are made on a monthly basis in arrears. New registrations during the month, or those leaving having registered elsewhere, are paid proportionately to prevent a double payment. However patients who lapse are paid to the end of the relevant calendar month. Cumulative payments of all Continuing Care Payments and Capitation Payments are made for all practitioner registrations and a printed report is enclosed within their posted payment schedule.

4.6 CURRENT DENTAL SYSTEM STATUS

The current system, the 2009 SDR, operates as follows:

4.6.1 CAPITATION PAYMENT

[SDR - Section X Section 41] **[14]**.

- ‘Capitation Payments’ attract a basic monthly fee determined by three age bands; 0-5 years; 6-12 years; and 13-17 years. Payments are £1.50, £3.10 and £4.55 per patient per month respectively.

- This payment is increased by 100% for those with a severe mental or physical handicap or severe learning difficulties.
- Patients living in electoral wards with the worst dmf rates, over 2.96 attract an additional weighting of 100% for ages 5 years and younger; and a 50% weighting if aged 6-17. The next group of wards, with a dmf rate of 1.63-2.95, attracts a 25% weighted payment for those aged 5 years and under.

4.6.2 CONTINUING CARE PAYMENT

[SDR - Section XI Section 45] **[14]**.

- Currently the Continuing Care payment is calculated for remuneration purposes solely on the basis of age but there are only two categories; 18-64 years of age; and 65 or over. Payments are £0.80 and £0.95 per patient per month respectively.
- Patients aged 18 years and above, living in electoral wards with the worst dmf rates, 2.96 and above, attract an additional weighting of 50%.

The current mechanism, using the electoral ward dmf scores via patient postcode to enhance the registration payment, enables a relatively simple calculation to be made at the BSO. However the theory may be sadly lacking because of doubts on the accuracy of the dmf data. It does however show that a system based on the patients' home postcode is workable.

Analysis of 2008-2009 data by the Information Unit at BSO show that capitation type fees (i.e. Capitation plus Continuing Care fees under the current contract) make up 21.9% of the gross monthly payments to GDPs. There is wide variation in the working hours, Health Service commitment and work patterns of dentists in general dental practice and as such it is difficult to consider an 'average' dentist. However it would appear to be useful, for illustrative purposes in terms of patient numbers and practitioner income, to show mean values. The same data shows at dentist level a mean Capitation list size of 332 patients and a mean Continuing Care list size of 732 patients. The corresponding mean monthly payments at a dentist level were £1437.82 for Capitation patients and £602.24 for Continuing Care patients.

In summary a capitation system is already in use for all registered patients, which is known as 'capitation' payments for children and 'continuing care' payments for adults. The only ways the cost per capita of every patient is routinely enhanced is by a limited set of basic age bands and by home address postcode mapped to areas of poor dental health at electoral ward level. (The only exception is the doubling of the capitation payment for children with severe mental or physical handicap or severe learning difficulties).

As such this system attempts to make a capitation payment more patient-specific but has not been determined by detailed analyses of patient treatment data and therefore poorly and imprecisely reflects the different treatment needs across the population.

5. DEVELOPMENTAL AIMS FOR THE SYSTEMS AND PROCESSES WITHIN THE NEW CONTRACT

Any dental contract should have the principal aims to improve oral health, prevent oral disease, match service provision with need and reduce oral health inequalities.

In the previous documentation relating to the development of the contract [2] the six main aims of the 2006 PCDS [1] have been stated:

- Local commissioning of services;
- Access to appropriate dental care for everyone who needs it;
- A clear definition of treatments available under the health service;
- A greater emphasis on disease prevention;
- Guaranteed out-of-hours services;
- A revised remuneration system, which rewards dentists fairly for operating the new arrangements.

This section looks at the developmental aims that have tailored the configuration of the system and processes that will be used to operate the new contract.

5.1 FOLLOW EXPERT HEALTH ECONOMIST ADVICE

At the start of the developmental work on the new dental contract we consulted with Professor Ciaran O'Neill a health economist formerly with Queen's University Belfast. He was asked to review the present system and consider how it might be changed in future.

He identified that none of the three basic options; Retrospective Fee for Service (Item of service); Prospective Payment System (Full capitation); nor Salaried/Sessional Services was the best solution. He reported that a

'Blended System' would be the recommended approach, maximising the advantages of these components. The current GDS system has 'developed' into somewhat of a blended system, but had led to several market failures that had to be addressed.

His advice was that there was scope to develop a blended system to address the shortcomings of the current one and improve efficiency and equity of care. As such it is proposed to retain a capitation element within the blend but to model this to more specifically reflect the needs of the different patient demographics across the population.

5.2 BE MORE SPECIFIC TO PATIENT DEMOGRAPHICS

DHSSPSNI propose an enhanced capitation payment for registration via the 'Patient Care Payment' (PCP) to cover the patient journey through the 'Patient Care Pathway'. The PCP will be more patient specific and representative of patient care needs than the current system used to calculate capitation and continuing care payments under GDS arrangements. The weighted capitation system enables the targeting of resources appropriately on health need and will increase the provision of preventive care to those living in those most socially-economically disadvantaged areas. This should therefore help to address current health inequalities in the oral health of our population.

As previously detailed at section 4.6 the current system only calculates the payment by basic age bands (three age groups for children and two age groups for adults) and only further enhances that relevant monthly fee, by a limited mechanism, for those who live in certain geographic areas or are children with special needs.

DHSSPSNI has therefore developed the weighted capitation formula to calculate a patient specific payment truly reflecting the expected workload for those with the greatest treatment needs.

5.3 REDUCE THE TREADMILL EFFECT

The blended system, including weighted capitation payments as 'Patient Care Payments', should facilitate the cultural leap away from the current, mainly 'Item of Service' contract. This should therefore reduce the 'treadmill effect' experienced by practitioners under the current GDS system, which is predominantly output driven ('Care Payment and Quality Indicator Domains (CPQID) - Section 1.2) [3]. This also reduces the 'drill & fill' ethos that has evolved from the present contract where remuneration for output potentially acts as a perverse incentive to carry out restorative treatments rather than adopt more conservative active monitoring and preventive approaches where reasonable.

5.4 INNOVATION

As described earlier the main driver for the new contract has been the 2006 PDCS [1]. The aims of the PDCS have been used to develop all aspects of this bespoke contract but it is worth highlighting three key sections that specifically relate to our approach of developing a weighted capitation system:

Vision for Primary Dental Care Services (PDCS 6.7) [1]

"The system to deliver this vision must be innovative and we must look at different ways of doing things. There will be change and for many that will be difficult. If we do not design and organise a new system now then we will have one by default and that is unlikely to be one that is accessible, equitable, improves oral health or is of high quality."

How the New System will work (PDCS 6.14) [1]

"In order to achieve our vision of accessible, high quality dental services delivering evidence-based care, changes need to be made. We believe that these changes are necessary to improve the effectiveness of oral healthcare, to allow dentists to concentrate more on prevention, to safeguard access to dental services and to ensure

that Health Service dentistry offers an attractive career to practitioners.”

Managing the Change (PDCS 7.2) [1]

“In taking forward the recommendations the Department will work with the profession in developing new remuneration arrangements that recognise the contribution dentists make to improving oral health in Northern Ireland.”

5.5 SIMPLIFICATION

Another key driver has been the common underlying principle to develop a simplified system of administration (and monitoring) (‘Essential Services’ paper - Section 5.4) [15], *“the aim is to develop a practical system that is easy to use and cost effective for both the Commissioners/Administrators and Practitioners.”* This will be achieved by developing a system with, *“fewer categories/descriptors of treatment”* and also, *“simpler administration and data returns”*.

This aspect has previously been covered in the Care Payment and Quality Indicator Domains (CPQID) paper [3] where it is proposed that the priorities of the reporting system should be:

- Not procedurally burdensome
- Simple data submission at the practice level
- Simple data extraction, analysis and remuneration by the Commissioner/Administrator
- Simple yet robust reporting
- Allow for accurate and timely remuneration
- Allow for assurance and monitoring

(‘Care Payment & Quality Indicator Domains’ paper - Section 3.1.1) [3]

5.6 ENABLE THE POSSIBILITY OF TRANSITION TO A MAINLY OR WHOLLY CAPITATION BASED SYSTEM

The trend in recent years has been for a reducing proportion of primary care dentists' GDS remuneration to come from 'Item of Service' treatment fees. The latest available figures (2008/2009) show that 58.3% of payments relate to Item of Service; 21.9% to Capitation & Continuing Care; and 19.8% to the block payment of Allowances [16]. Therefore just over 40% of payments are not related to treatment provided under 'Item of Service'.

In 2009/2010 this trend is expected to continue further as the increased commitment payment has a greater effect on the balance of GDS payments.

	2006/2007	2007/2008	2008/2009
Item of Service	65.6%	62.3%	58.3%
Capitation & Continuing Care	21.6%	21.0%	21.9%
Block Payments (Allowances)	12.7%	16.8%	19.8%

Reproduced from: CDO News Autumn-Winter 2009 [16]

The weighted capitation approach to the 'Patient Care Payment', within this proposed blended payment system, could potentially facilitate the longer-term transition to a mainly or wholly 'enhanced capitation' payment system in time (through evolutionary rather than revolutionary change). A decision on whether to change the blend will only be considered after an evaluation and

consultation with the profession. ('Care Payment & Quality Indicator Domains' paper - Section 1.2 & 1.4) **[3]**.

6. BACKGROUND TO THE DEVELOPMENT OF THE WEIGHTED CAPITATION APPROACH

The process that led to the development of the weighted capitation approach began as a progression from the work outlined in the 'Care Payment & Quality Indicator Domains' paper [3]. It is important to note that when other aspects of the contract framework were being considered this was not done in isolation. All aspects of the contract inter-relate and need to integrate, but different parts were developed and progressed at different stages. Where this was the case we tried to consider any influence or effect on the other key parts of the framework.

Work on the 'Care Payment & Quality Indicator Domains' paper [3] and consideration of aspects later included in the 'PDCC dataset' paper [17] led us to consider an individual risk scoring approach to assess oral health needs. Initial thoughts involved the use of some type of quantitative individual Oral Health Score with bands to categorise oral health need. However a number of problems with this approach were identified:

- ~ The scoring is to a greater or lesser extent subjective.
- ~ It would require much work to record and calculate the score at practice level.
- ~ Making the scoring more objective would further complicate and extend the process.
- ~ It would require more complex reporting procedures to enable remuneration.

It was recognised that clinicians routinely risk assess their patients but that these are not formal exercises and are not routinely recorded. Such informal, holistic assessments of oral health risk are used as part of the treatment planning and long-term care planning process. The National Institute for Health and Clinical Excellence (NICE) recall guidelines require a more formal risk assessment of the individual and the 'Delivering Better Oral Health Toolkit' [18] requires a risk assessment to determine if patients are at an

increased risk. Risk assessments are also recommended in the Faculty General Dental Practice (FGDP) Selection Criteria for Dental Radiography and can inform other diagnostic testing decisions. Against this background, there seemed little advantage in requiring a different formal assessment to be completed and recorded.

The decision was made to record a simple risk assessment of Low, Medium or High, which could be used to inform the processes detailed above; help with short and long term treatment planning within the Patient Care Pathway and Essential Services; and be used to inform the patient and encourage behavioural change. A 'Risk-Based Patient Appraisal' template was then developed which is available in the Appendix of the 'Care Payment & Quality Indicator Domains' paper [3]. There is still a subjective element to this, but because there are only three rating categories and the risk is more simply assessed, it is not anticipated that this will be a significant issue. It was recognised that some training or guidance material would be made available to help practitioners in this respect. There would also be an opportunity to compare for possible outliers with colleagues in the same, local or other regional practices.

Simon Reid and Donncha O'Carolan had some initial discussions on this matter and then met Michael Donaldson for some Dental Public Health advice. Accepting that some form of quantitative individual measurement of patients' oral health, as covered earlier in this section, would be more representative it was decided however that this would be more complicated and time consuming to collect. The use of socio-economic indicators had been previously used in GMS by identifying patients at a postcode level to reflect higher levels of experience of certain diseases and therefore the greater need to access healthcare services in more deprived areas. There is a wealth of evidence that oral disease is strongly correlated with socio-economic deprivation [19] [20] [21] [22] [23] [24] [25] [26] and therefore those in greatest need. Consequently it was decided to look at this as a proxy measure. Our first thought was to try to link payments to those with greatest need using postcode or 'receipt of benefits' as proxy markers. However it was noted that 'receipt of benefits' may not be a useful marker because it wouldn't apply to under 18 year olds and therefore they could not be weighted. The

use of home address postcode therefore seemed to be the best-fit proxy as per the GMS system and worthy of further consideration.

It was later considered that an advantage of such an approach is that it is not necessary to submit individual formal risk reports for each patient, which makes for easier data reporting from the practice. Furthermore there is no need to extract, analyse and remunerate such data for individual patients by the commissioner. Reported patient identifier data is used to calculate a patient specific payment. Information in relation to the risk assessment should be recorded in the patient record but would not need to be reported. The information in the records would be available for monitoring and assurance processes.

It was also considered that although there may be shortcomings where individual patients may not fit the demographics typical to their postcode (i.e. may have better or worse oral health than expected), overall at the practice level they would balance out and so the net effect would be representative.

We then sought the advice of Penny Murray (PM) Deputy Principal Statistician at DHSSPSNI to find out if there were any parallels that could be drawn from the General Medical Services (GMS) model of service care. We were aware that patient indicators had been used for GMS remuneration and also felt that the GMS model of care was similar to that for General Dental Services. We felt that it would potentially be useful to use the same markers as were used to identify deprived groups in the GMS contract. The GMS formula uses indicators (Unemployment rate, Standardised limited long-standing illness, standardised self-assessed health not good and single carer households) to calculate the 'Additional Needs Index' and reflect the increased workload for such patients.

PM's initial advice was that the indicators used in the GMS calculation reflect more on the potential for affecting General Medical Practitioner workload and that there would not necessarily be any established link between dental need and the GMS additional needs indicators. The ideal approach would be to model dental need specifically to derive dental-specific needs indicators;

these are detailed resource intensive exercises and initially it was agreed that rather than embark on such work, a commonly used general deprivation measure could be used in the interim. She advised that the Northern Ireland Statistical Research Agency (NISRA) would recommend the N. Ireland Index of Multiple Deprivation (IMD) as a good general deprivation measure. However, Noble scores cannot be used directly as indices; the Standardised Mortality Ratio (SMR) under 75 years is already in index form and is highly correlated with Noble overall and Noble Health Domain. Therefore this approach was used in the initial modelling.

Having proved the capitation approach as a workable concept with the use of the SMR under 75 as the additional needs index; it was agreed that detailed modelling would be undertaken to relate General Dental Services utilisation to the specific needs of dental registered patients. The preferred model resulting from the regression modelling contained the Noble Income Domain as the best predictor of dental utilisation. The Noble Income Domain comprises the following indicators: Income supports, Job seekers allowance, Working families tax credit and Disabled persons tax credit.

A deprivation score would be assigned to each registered dental patient according to his or her home postcode. It would be possible to model which indicators are related to oral health and how they affect the need and demand for dental services.

PM then made initial enquiries with the Central Services Agency (CSA) (now Business Services Organisation – BSO) to check if the necessary data could be extracted from the central data held on their IT system databases. Confirmation came that the data was available and accessible not simply from the dental database but across a number of databases that could be accessed.

We planned to consider the effect of age on treatment need, as this was already reflected in the current capitation system. Also it was decided to analyse the effect of gender as a weighting because anecdotally there are different attendance patterns and therefore treatment needs and women of childbearing age have different treatment patterns. Also in general terms

females live longer; are liable to hormone related diseases, which may affect oral health; and respond more positively to health promotion. These factors are likely to impact on oral health needs differently to the male population.

To enable these analyses to proceed a list of treatment activity indicators was drawn up to represent clinical activity. This list comprised those common treatment items, as listed in the SDR, regularly provided by GDPs to registered patients.

The BSO database of previous claims for these SDR items was analysed across the population for all dentists contracted to provide GDS services. This data became known as the 'Historic Costs' data that was subsequently used in the development and modelling of the three adjustments for patient demographics used to create the Weighted Capitation Formula.

The specialised statistical modelling is mentioned in the following section and is fully covered within the appendices listed at section 11.

7. THE DEVELOPMENT PROCESS

At this stage the further developmental work had been handed over to a specialist statistician, PM because it was beyond the expertise of those dentists involved in the earlier developmental process. PM also had the experience of working with other primary care systems.

Having explored the paths explained in the previous section the decision had been made in principle to use patient based measures of age, gender and socio-economic status it was now a matter for the specialists to develop and model this work.

The full detail of the development process can be found in the four documents listed as appendices at section 10 within this document.

An overview of the process has already been given in section 1, the Executive Summary.

8. CONCLUSION AND RECOMMENDATIONS

The use of the weighted capitation formula will enable a more patient-specific, calculated capitation payment to be made in the form of the 'Patient Care Payment'. This will more accurately reflect the differences across the patient demographics in a typical list of registrations.

This is therefore an improvement on the current system that does not allow much variation in the payments made for different patient types within the population. It will now more fairly reward practitioners for the differing current and ongoing care needs of those registered on their patient list. Furthermore it allows an aggregated, monthly block payment for the patient list to be made, which covers; the care of those patients through the 'Patient Care Pathway'; the ongoing provision of preventive care for them; and access for those patients to restorative treatments via the 'Essential Services'.

Practices would be able to report changes in patient registration status and the planned replacement BSO Family Practitioner Services (FPS) Dental IT payment system would be able to make the necessary calculations from the submitted patient identifiers and related data.

The recommendation therefore is that the proposed Weighted Capitation Formula is adopted and used to calculate 'Patient Care Payments' for the capitation element of the blended system of remuneration for the PDCC.

9. ABBREVIATIONS

BSO	Business Services Organisation (formerly CSA)
CPQID	'Care Payment and Quality Indicator Domains' paper (DHSSPSNI)
CSA	Central Services Agency (now BSO)
DHSSPSNI	Department of Health, Social Services & Public Safety, N. Ireland
DMF/DMFT	Decayed, Missing, Filled (Teeth) index
FGDP	Faculty of General Dental Practice (UK)
FPS	Family Practitioner Services
GDP	General Dental Practitioner
GDS	General Dental Services
GMS	General Medical Services
GP	General Practitioner. Can be used to mean General Medical Practitioner or General Dental Practitioner though usually refers to the medical variety. This document refers to 'GP prescribing' which also refers to General Medical Practitioners.
IMD	N. Ireland Index of Multiple Deprivation
NICE	National Institute for Health and Clinical Excellence
NISRA	Northern Ireland Statistical Research Agency
PDCC	Primary Dental Care Contract (N.I.)
PDCS	Primary Dental Care Strategy (N.I.) (2006)
PM	Penny Murray (Deputy Principal Statistician DHSSPSNI)
SDR	Statement of Dental Remuneration
SMR	Standardised Mortality Ratio
SOA	Super Output Area – A geographic area used for statistical analysis. In N. Ireland there are 890 such areas with an average population of 2000 in each

10. GLOSSARY OF TERMS

ADDITIONAL-NEEDS ADJUSTMENT

One of the three adjustments within the Weighted Capitation Formula that relates to different patient oral health needs associated with their lifestyle choices. Research has shown that such lifestyle related health conditions are strongly correlated with the level of socio-economic deprivation and postcode of residence can be used as a proxy measure.

AGE/GENDER ADJUSTMENT

Another one of the three adjustments within the Weighted Capitation Formula that relates to different patient oral health needs associated with their age and gender.

BLOCK PAYMENT

Regular payment made to those providing primary dental care services. Distinct from retrospective fees for service, currently known as 'Item of Service', where dentists are paid for individual treatment items carried out.

BUSINESS SERVICES ORGANISATION

The organisation that provides business support functions and specialist professional services to the N. Ireland health and social care sector. The BSO administers the dental contract and receives reports from practitioners from which payments processed.

CAPITATION

'Per Capita' or 'per head' payment, made to a healthcare practitioner to provide patient access to ongoing care and services, which may also include a payment element for the provision of treatment(s). Under the current dental contract this term is also used as the terminology for capitation fees paid to dentists for those registered patients under the age of eighteen. In this case the payment covers care and treatment with some additional fees being payable for certain specified treatments. In contrast the adult capitation system under the current dental contract, known as Continuing Care, pays

dentists for providing care but does not include a payment element for treatment.

COMMUNITY HEALTH INDEX (CHI) NUMBER

A four-digit number, used in conjunction with the date of birth, under the current dental contract to identify an individual patient from the population. It is used within the dental payment system of Family Practitioner Services at the Business Services Organisation.

CONTINUING CARE

Terminology to describe the capitation fees paid to dentists for those over the age of eighteen under the current Dental Contract. (See Capitation).

DEMAND-LED BUDGET

Funding where the budget follows the demand for services. As demand increases this continues to draw on funding resources unless the budget is capped.

DMF/DMFT

An index used for epidemiological surveys of dental health where dental disease (caries a.k.a. tooth decay) is measured as Decayed, Missing or Filled Teeth. As used in the current dental contract, for Capitation and Continuing Care payments, the specific survey measurement of primary dentitions was dmft where 't' relates to measurement by tooth (as opposed to dmfs where 's' measures by surface).

DRILL & FILL

This expression is used by some dentists to describe how the Item of Service payment system for carrying out treatment items encourages dentists to place restorations (fillings) i.e. 'drill & fill' rather than review early decay or carry out preventive advice or treatment. (See also 'treadmill effect').

ESSENTIAL SERVICES

Defined list of individual restorative treatments that will be available to registered patients under the new dental contract. This is a core range of treatments, drawn from the current list in the Statement of Dental Remuneration, primarily for health benefit as opposed to cosmetic benefit.

ITEM OF SERVICE

Retrospective fees for service, currently known as 'Item of Service', where dentists are paid for individual treatment items carried out.

FAIR SHARES SYSTEM

A process whereby a healthcare funding budget is distributed between service providers with the aim being to provide equal opportunity and equal resource for equal need.

FAMILY PRACTITIONER SERVICES

Collective name for medical, dental, pharmaceutical and ophthalmological primary care services.

GENERAL DENTAL SERVICES (GDS)

The name for the current dental contract system for the delivery of primary dental care in N. Ireland by 'high street' General Dental Practitioners, as opposed to the Community Dental Service.

GENERAL MEDICAL SERVICES (GMS)

The name for the current medical contract system for the delivery of primary medical care in N. Ireland by General Medical Practitioners, as opposed to that primary medical care provided by Trusts.

HISTORIC COSTS DATA

A data analysis, at patient level, of previous dental treatment claims carried out for the N. Ireland population over a three-year period, which was used to inform the development of the Weighted Capitation Formula.

LIST TURNOVER ADJUSTMENT

The third of the three adjustments within the Weighted Capitation Formula that relates to different patient oral health needs associated with their registration status. This recognises that those irregular patients require more care and treatment when they do attend, compared to those who attend on a more regular and frequent basis.

LOCAL COMMISSIONING GROUPS

Five local groups of healthcare representatives, commissioning staff, district councillors and representatives from the voluntary sector, responsible for the assessment, planning and commissioning of the delivery of health and social care services across specified geographic areas of N. Ireland.

NOBLE INDEX

The index developed from the N. Ireland Multiple Deprivation Measure. Also known as the Index of Multiple Deprivation or IMD.
(See N. Ireland Multiple Deprivation Measure)

N. IRELAND MULTIPLE DEPRIVATION MEASURE (IMD)

This is the official measure of spatial deprivation for Northern Ireland. This is used to produce a relative ranking of small geographic areas within Northern Ireland for the effective planning of policies and targeting resources to deprived areas. It is composed of different domains of deprivation such as; Health and Disability Domain; Income Domain; Employment Domain; and Education Domain.

NOBLE SCORES

The scores developed from the N. Ireland Multiple Deprivation Measure used to rank the geographic areas.
(See N. Ireland Multiple Deprivation Measure)

ORAL DISEASE

Diseases that affect the oral cavity i.e. mouth. Such diseases can affect the teeth, gums, tongue, mouth lining and jaws. The most commonly occurring

oral diseases are caries (a.k.a. tooth decay), which affects the teeth, and periodontal disease, which affects the gums.

ORAL HEALTH

The status, on the health-disease spectrum, of teeth, gums, tongue, mouth lining and jaws. It reflects not only the presence or absence of physical illness but also the subject's own perspective of the impact oral disease on their quality of life. Oral health is an important component of general health.

ORAL HEALTH INEQUALITIES

Commonly used to refer to disparities in oral health status observed among those in different socio-economic groups. Those from more deprived areas are found to have higher levels of oral disease.

PATIENT CARE PATHWAY

Pathway of care that patients will follow when they register for dental care and treatment under the new dental contract.

PATIENT CARE PAYMENT

The proposed ongoing monthly weighted capitation fee paid per patient to General Dental Practitioners that covers; the provision of an examination; radiographs ('x rays'); preventive care; simple periodontal care (cleaning); and includes an element of payment recognising likely prospective treatment needs. It will also cover ongoing patient care and allows patients to access the defined range of available treatments as defined in the Essential Services.

PATIENT IDENTIFIER DATA

This describes patient data used when transmitting information relating to the provision of dental care and treatment for an individual patient. This will include such information as the full name, date of birth, Community Health Index number (or similar e.g. Health and Care number), gender and address. This data will allow that patient to be identified as one specific member of the population. In this way care and treatment planned/received can be recorded and the appropriate payment processed.

PATIENT REGISTRATION

Individuals joining the list of patients, registered centrally to a healthcare provider such as a doctor or dentist, so that they are entitled to access care and treatment from a specified provider under the terms set out in the GDS contract.

PRIMARY CARE

Community based healthcare services that are usually the first point of contact for patients e.g. doctors, dentists pharmacists. In the dental context services are mainly accessed at high street dental practices. (As distinct from the Community Dental Service and hospital based secondary care).

REVIEW OF PUBLIC ADMINISTRATION

A review that has been carried out into the delivery of public services in N. Ireland relating to local government, health, education and libraries. This process commenced in 2002. For health this led in 2009 to the replacement of the four Health and Social Services Boards into a single Health and Social Care Board. The re-organisation also led to the formation of the Public Health Agency, the Patient Client Council and the Business Services Organisation.

RISK-BASED PATIENT APPRAISAL TEMPLATE

A risk appraisal template designed for the new contract to aid dentists in considering patients' chances of developing oral and general disease. This could be used to inform and record the care and treatment planning process; the provision of preventive advice and treatments; and to help plan the appropriate recall period.

SOCIO-ECONOMIC DEPRIVATION

A relative measure of social class often derived from individuals' occupational status, income data or other personal information. May be obtained from anonymised census data and then aggregated to allow local areas to be compared in relation to affluence/deprivation.

STATEMENT OF DENTAL REMUNERATION (SDR)

Regulations relating to the current General Dental Services contract in N. Ireland that incorporates a list of the individual treatment items that can be provided and payment subsequently claimed for.

TREADMILL EFFECT

This describes the perception among some dentists that the payment for providing individual treatments (i.e. the Item of Service system) drives them to carry out more of such treatments. It also reflects the situation where income is largely generated only when the dentist is carrying out these restorative treatment items i.e. output is rewarded as distinct from outcome. (See also 'drill & fill').

WEIGHTED CAPITATION FORMULA

A formula based on the size of the population within each area (i.e. capitation) with factors that seek to adjust for the relative need (i.e. weighted) for healthcare resources. Such a formula determines the share of funding for each area based on relative need but does not determine the overall size of the budget.

For the purposes of this paper it is the formula proposed to calculate specific registration payments (Patient Care Payments) to General Dental Practitioners for providing ongoing dental care and treatment to individual patients. The payment the dentist receives relates to the group profile of their list of patient registrations and is determined by the age, gender, socio-economic status and attendance pattern of each patient.

11. APPENDICES

The following four documents from Penny Murray, Deputy Principal Statistician DHSSPSNI, have been inserted as the following Appendices

- {1} Development of a Weighted Capitation Formula
- {2} Dental Additional Needs Index – For Use in a Dental Weighted Capitation Formula
- {3} Development of a Patient List Turnover Adjustment: Revised Methodology
- {4} Analysis of Dental Registrations & Patient Movements March 2008 to May 2009

APPENDIX 1

PENNY MURRAY DOCUMENT

Development of a Dental Weighted Capitation Formula (DC09/v04)

1. Introduction

- 1.1 The General Dental Services (GDS) budget is used to pay General Dental Practitioners (806 as at 1st April 2008) for providing a family dental health treatment and advice service to all patients on their lists. Dental charges are a proportion, currently 80%, of the cost of treatment up to the current maximum of £384. The net expenditure on GDS in N Ireland in 2007/08 was £66.6 million (net excludes patient charges and other deductions).

2. Rationale for Introducing a Block Contract

- 2.1 As part of the negotiations on a new Dental Contract, a new model of service delivery and remuneration has been proposed. Part of this new “blended” system will consist of patient care payments for ongoing patient care; these payments would be allocated using a capitation formula which would allocate on the basis of the dental practice population and that populations’ relative need for resources.

3. Principles of a Weighted Capitation Approach

- 3.1 This paper describes a proposed approach and methodology for a capitation-based formula for the allocation of general dental services resources to the dental practices across Northern Ireland. The principle of weighted capitation means that resources are shared out across dental practices depending on:
- The relative size of the relevant population;
 - The relative cost of each relevant age/gender group; and
 - The relative level of additional need (for example, higher levels of poor oral health are associated with higher levels of deprivation even within the same age/gender grouping).
- 3.2 It is worth noting that the formula is not concerned with the absolute level of need for dental resources in Northern Ireland, but rather the relative level across Northern Ireland. The formula is about equitably sharing out across the dental practices, the “pot” of money already allotted to the General Dental Services Budget for Northern Ireland, rather than varying its size or proposing any ideal level of overall NI dental budget.

- 3.3 In the absence of a pure measure of need for dental resources, a utilisation-based measure is used as a proxy. The weighted capitation approach is evidence-based in that it, takes account of the existing use of dental resources together with key factors such as population, age, gender and additional needs associated with deprivation, which determine the resources needed to fund general dental services. The overall aim of the formula is to ensure equal resource for equal need. This weighted capitation method is used widely in the field of resource allocation.

4. Allocations to Local Commissioning Groups (LCGs) from April 2009 onwards

- 4.1 Although this paper will refer to dental practices as the recipients of the budget; the formula could also be used to allocate GDS resources to the new Local Commissioning Groups. Current on-going work on LCG allocations has noted that in advance of a new dental contract, allocation basis would be historical spend and would assign dental practices to LCGs on the basis of their postcode, that is, the geographical location of the practice, rather than taking any account of where the practice draws its patients from.

5. Population Base for Dental Block Payments

- 5.1 As GDS budgets are intended to cover costs incurred by general dental practitioners in providing dental health treatment and an advice service to their patients, it is important that they receive an allocation for the proportion of patients registered with them. This means it is necessary to count patients registered with each dentist (and in the case of LCG allocations; assigned to the LCG in which the dental practice is located irrespective of whether the patient lives in that LCG area). The dental registrations database maintained by the Business Services Organisation (BSO) is a record of all patients registered on Northern Ireland health service dentists' lists including their age and gender. The capturing of a unique code on the registrations allows matching with the Exeter System (a record of all patients registered with a NI General Practitioner); Exeter captures the postcode of each patient; this allows us to identify LCG service users who are not resident in that LCG (10.7% of health service patients in Northern Ireland were registered with a general dental practitioner outside their own LCG area as at September 2008).

6. Age/gender Adjustment

- 6.1 After population size, the next significant consideration in a resource allocation formula is to account for needs, which arise from having a population age and/or gender structure, which is different from the

Northern Ireland average. The formula adjusts for differences in the use of dental resources based on the age/gender profile of each practice's registered populations, rather than based simply on per head of population. For example, a practice with a more middle-aged population than the Northern Ireland average will find that its dental resources will have to cater for a greater amount of oral health need and treatments than a practice with a younger population. (Table 6.1 illustrates that the Western LCG has a younger registered population whereas the Belfast LCG has a more elderly population.)

Table 6.1 Registered Age Structure of the LCGs at September 2008

Age Group	Belfast	Northern	S Eastern	Southern	Western	NI
0-5	6.08%	7.19%	7.01%	7.82%	8.22%	7.16%
6-12	11.81%	13.83%	13.27%	14.75%	17.53%	13.93%
13-17	9.02%	9.71%	9.83%	10.42%	13.12%	10.17%
18-59	56.52%	53.62%	52.70%	53.10%	50.79%	53.67%
60+	16.57%	15.66%	17.18%	13.90%	10.34%	15.08%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

6.2 Adjustment for age and gender was derived by calculating age/gender cost weights based on dental activity by men and women in a number of age groups. These cost weights were derived from age/gender specific dental activity information extracted from the treatment database in conjunction with dental registration data, both maintained by the BSO. The following steps were taken:

- A list of common activities considered to reflect treatment activity in General Dental Practice was provided by the CDO and colleagues. These treatment activity indicators covered: examination and reporting (all item 1), procedures to assist diagnosis and treatment planning (all item 2), periodontal treatment (all item 10), permanent fillings (all item 14), endodontic treatment (1501), inlays and crowns (1701-1734), bridges (1801-1808 & 1831), extractions (all items 21), oral surgery extractions (22), dentures (2731-2751) and children's restorations (4401-4404).
- Activity for the indicators listed above were compiled for 3 financial years (2005/06, 2006/07 and 2007/08). Patient registrations at September each year were compiled for 2005 to 2007.
- Where age and/or gender were omitted from the records on the activity data, the unique Health and Social Care Number was used to match records on the registrations database and allow age and/or gender to be appended. Note in each year a very small proportion of records (approx. 10 records and approx. £300 of

dental treatment each year) could not have the age or gender of the patient confirmed and where subsequently deleted from the analysis.

- After charting items and cost by single ages to examine frequencies, age groups were defined and appended to the activity records.
- The BSO provided a look-up table to denote whether each item was defined as an activity unit of either “a claim” or “a tooth”. Total items were then calculated by multiplying the item by the number of teeth treated, if this was appropriate. Here the payment claim numerator, that is, per tooth treated, reflects the clinical activity; for example, item 1421 permanent filling in 3 different teeth would be paid as 3 items. The database is structured so that these 3 items appear against one patient and one record; we needed to transform this into 3 items. Where tooth notation was irrelevant, e.g. dentures (item 2733), or the activity is already listed in the Statement of Dental Remuneration (SDR) as “per tooth” then the claim numerator that is, “per claim” reflects clinical activity and would be counted as 1 item. Note that 2 items (2121 and 1451) although denoted with units of activity as “per tooth”, were additional fees and often did not have notated teeth recorded; these were counted as 1 item each time.
- Queries were run to create the following tables:
 - (a) Total costs by age/gender group (from activity database)
 - (b) Registered population by age/gender group (from registration database – denominator will be all registered patients not just those receiving treatment)
 - (c) Costs per capita for each age/gender group
 - (d) Relative cost weights were created by making all costs per capita relative to the minimum cost per capita.

The above queries were repeated on number of items rather than total costs to create relative item weights.

- The relative weights were charted for the 3 years; the figures for both items and costs show a slight increase between 2005/06 and 2006/07 in the adult age groups; however the weights are very similar for all age groups between 2006/07 and 2007/08. There is no crossing of the age/gender weight curves and there do not appear to be any irregularities in the trends; however, a 3-year average was also calculated and is shown on the charts.
- Sampling/random error can arise when an estimate is based on a survey rather than a full census of the population. In this case although we are using full activity data, the approach still constitutes sampling as we are using selected years of data. Confidence

intervals for costs per capita based on a single year's data (2007/08) are shown at Appendix B; these small confidence intervals reassure us about the reliability of the weights. The use of a 3-year average would improve stability even more.

6.3 Figures 6.1 and 6.2 show the relative cost weights for females and males respectively over the 3 years 2005/06-2007/08 plus a 3-year average. The weights are given in Appendix A.

Figure 6.1 Female Cost Weights

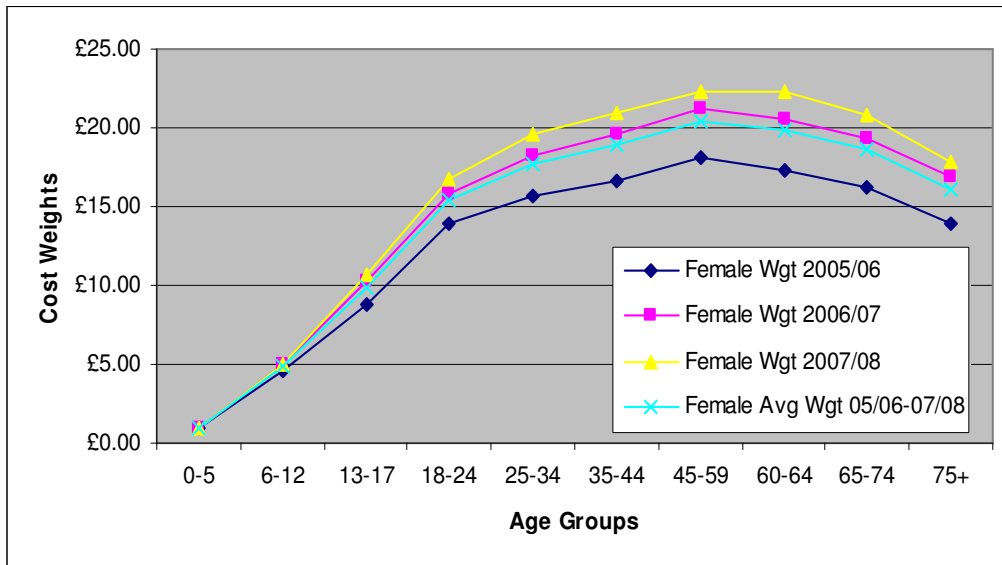
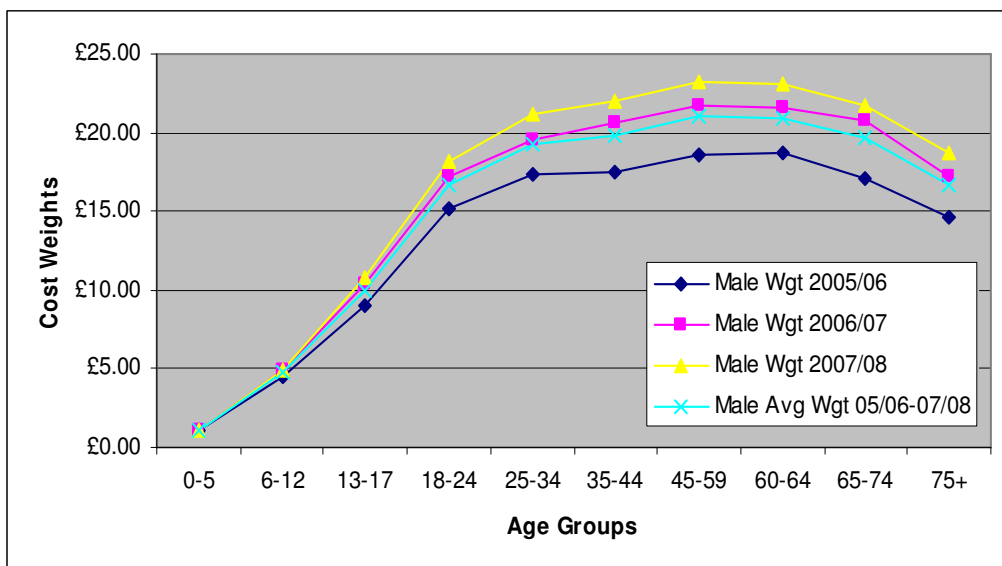


Figure 6.2 Male Cost Weights



6.4 Figures 6.3 and 6.4 show the relative item weights, again for females and males respectively for 3 years and a 3-year average. The weights are given in Appendix A.

Figure 6.3 Female Item Weights

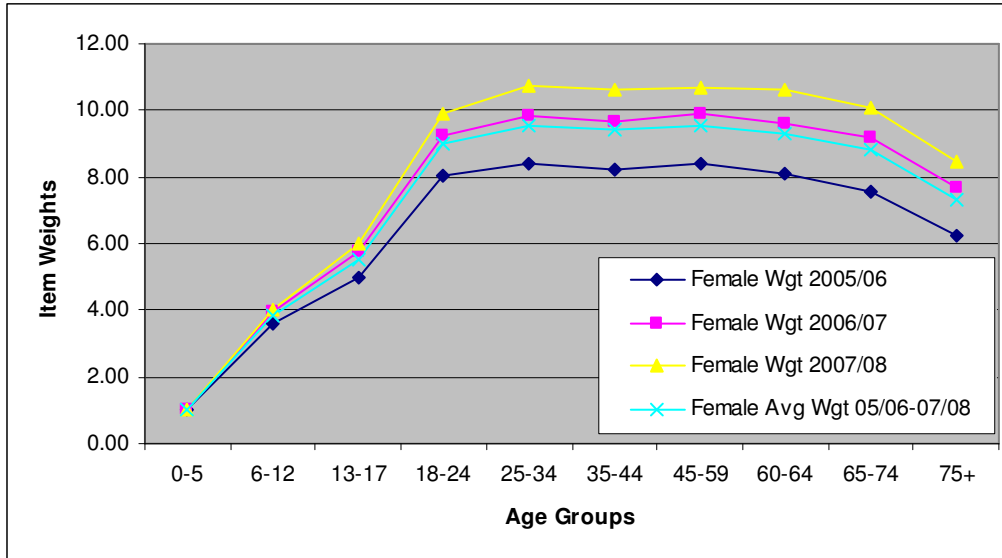
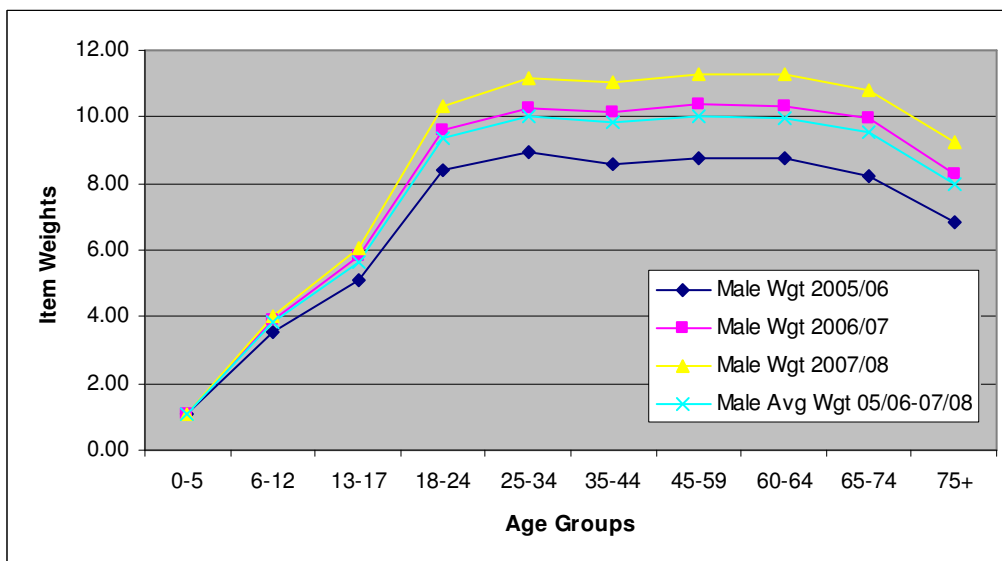


Figure 6.4 Male Item Weights



6.5 Under the current capitation and continuing care arrangements in the SDR, no distinction is made between males and females. A check of the September registrations indicates that the gender field is not completed in respect of 10,218 patients (1.2% of total registrations). Except in the case of maternity exemptions, gender would have been irrelevant. However, examination of the cost curves (see Figure 6.5) would suggest that using separate curves would be more appropriate; males cost more than females in every age group, especially in the

younger adult age groups of 18-24 and 25-34 where males cost on average £2 more than females. The volume of items is again higher for males than females in every age group (see Figure 6.6); item weights are shown for information only, the cost weights would be used in the capitation formula.

Appendix B shows the total costs and population denominators for each age/gender group, the costs per capita per age/gender group and the relative cost weights derived from these data.

Figure 6.5 Male & Female Cost Weights (3-year average)

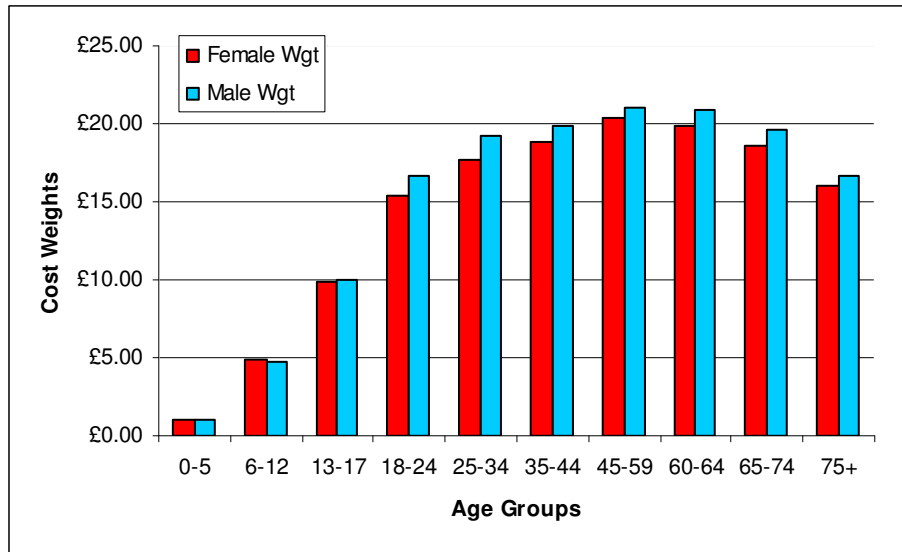
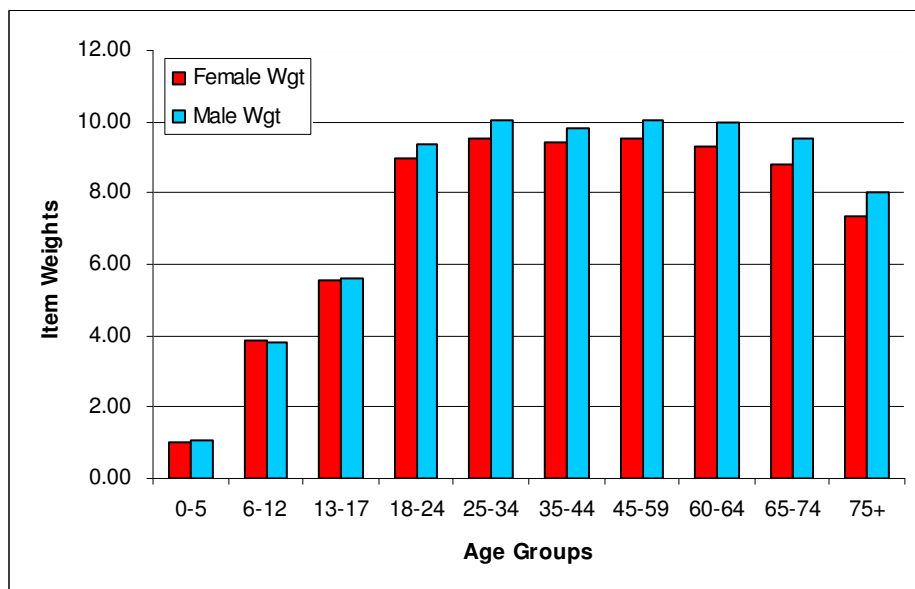


Figure 6.6 Male & Female Item Weights (3-year average)



6.6 Table 6.2 shows the LCG's relative dental resources shares resulting from applying these age/gender weightings. The weight effects are

shown as an index around 1 (NI being 1). LCGs with an index below 1 have an age/gender structure that places a less than NI average burden on dental resources due to the lower proportion of adults and elderly on their registered lists. Comparison with registered population shares shows that the Southern and Western LCG shares have decreased after adjusting for age and gender; this is consistent with Table 6.1 which showed these 2 LCGs to have the younger age structures.

Table 6.2 Age/Gender Index at LCG Level & LCG Population Shares (after age/gender adjustment)

	Belfast	Northern	S Eastern	Southern	Western
Registered Popn % Shares	23.77%	25.82%	17.34%	19.59%	13.48%
Registered Popn Age Index	1.0416	1.0033	1.0122	0.9823	0.9303
Population Shares (%) after adjusting for age & gender	24.76%	25.91%	17.55%	19.24%	12.54%

7. Additional Needs Adjustment

- 7.1 After adjusting for age and gender structure of the population, the second weighted capitation adjustment is that required to reflect the relative need for dental resources over and above those due to population size and age/gender profile. Currently within the SDR system, additional need is only taken account of with respect to capitation payments for children aged 5 and under; this equates to the dentist being paid an additional sum equal to 25% of the appropriate basic fee where the child resides in a NI electoral ward with a “decayed, missing, filled” (dmf) score of 1.63 or above.
- 7.2 In the absence of a pure measure of need for dental resources, an appropriate proxy measure is used. Usually in the field of resource allocation, a modelling exercise (regression model) would be carried out to identify the indicators of morbidity, health and socio-economic circumstances which would determine the need for dental resources. There is a strong association between deprivation and poor oral health and in the timescale available a good measure of deprivation will suffice rather than embark on a modelling exercise. As the Noble Index of Multiple Deprivation (IMD) is a relative measure of deprivation and cannot be used to determine “how much” more deprived one SOA is compared to another, the scores cannot be used directly as an index. In this case a general indicator of morbidity which is already in index form and which is highly correlated with the Noble IMD could be used; standardised mortality ratio aged under 75 is highly correlated with both Noble Overall (0.74) and Noble Health Domain (0.76).
- 7.3 The standardised mortality ratio under 75 (SMRu75) is only available on an area-basis and so to construct dental practice level indicators, it

was necessary to attribute the characteristics of the Super Output Area (SOA), from which each dental practice list was drawn, to the dental practice. This process is made possible because we know the dental practice of registration of each patient and the patient's postcode allowing us to attach the SOA of residency of each patient (note 1.2% of postcodes are missing from the dental registrations database; the attribution process takes account of these by apportioning the unknown postcode records proportionately on the basis of where the practice draws its list from based on the known postcode records). The method assumes that each individual on a dentist's list is randomly selected from the SOA in which he/she lives. See Appendix C for a diagrammatic explanation of the attribution process.

- 7.4 Table 7.1 shows the LCG's relative dental resources shares resulting from applying these additional need weightings. The weight effects are shown as an index around 1 (NI being 1). The Belfast, Southern and Western LCGs have a need for dental resources greater than the NI average when based on "additional needs" only.

Table 7.1 Additional Needs Index at LCG Level & LCG Population Shares (after additional needs adjustment)

	Belfast	Northern	S Eastern	Southern	Western
Registered Popn % Shares	23.77%	25.82%	17.34%	19.59%	13.48%
Registered Popn Need Index	1.0562	0.9347	0.9162	1.0039	1.1351
Population Shares (%) after adjusting for additional need	25.11	24.14%	15.89%	19.66%	15.30%

8. Combining the Adjustments at Dental Surgery Level

- 8.1 Each of the adjustments will generate a separate dental practice index, comparing the dental practice score on the adjustment to the NI average. The indices are then simultaneously applied to the registered practice list. This produces a practice-weighted population. The application of the indices to all practices produces a notional population, which differs from the actual registered population. Weighted populations are adjusted so as to total the registered population (a process known as normalisation). Each dental practice would then receive their relative share of the overall NI dental block payment.

[Table follows on next page]

Table 8.1 Registered Population, Indices, Weighted Populations and % Shares by LCG

	Belfast	Northern	S Eastern	Southern	Western
Registered Population	203,809	221,418	148,674	167,950	115,581
Population Shares %	23.77%	25.82%	17.34%	19.59%	13.48%
Reg Popn Age Index	1.0416	1.0033	1.0122	0.9823	0.9303
Popn % Shares	24.76%	25.91%	17.55%	19.24%	12.54%
Reg Popn Needs Index	1.0562	0.9347	0.9162	1.0039	1.1351
Popn % Shares	25.11%	24.14%	15.89%	19.66%	15.30%
Reg Popn Total Index	1.1002	0.9378	0.9274	0.9861	1.0560
Age & Need Wgt Popn	224,226	207,656	137,876	165,619	122,055
Popn % Shares	26.15%	24.22%	16.08%	19.32%	14.23%
2007/08 Net Dental Spend % Shares	27.88%	25.06%	14.65%	17.78%	14.63%

- 8.2 Note that some practices do not have a registered list of patients, e.g. orthodontists and oral surgeons. A capitation approach cannot be applied without a population base to which the indices are then applied; for this exercise dentists practising solely as orthodontists or oral surgeons were excluded. In processing claims each month, the BSO reclassify those dentists classed as an orthodontist based on number of orthodontic treatment claims, these dentists were not excluded as they have registered lists for general dental purposes but happen on some months to pass the threshold for orthodontic claims.
- 8.3 The current work on developing allocations for LCGs has noted that the preferred option for allocating the various elements of FPS money to LCGs would be a weighted capitation formula. For those services such as dental where a capitation formula is not yet in place; a solution had to be found based on historic spend so that LCG funding reflects the current reality of where services are actually delivered. The line highlighted in red in Table 8.1 shows the % shares resulting from 2007/08 historic net dental spend. The details of how these shares were calculated are contained in Appendix D. Compared to historic spend patterns, a move to fair shares would see South Eastern and Southern LCGs increasing their share of the overall pot.

9. Implementation Issues

- 9.1 The application of any capitation formula is possible at any geographical level or administrative level, in this case, practice level; however, there are a number of implementation issues that will need to be considered and addressed. The list below is a few examples, the

BSO, policy colleagues and the profession will be much better placed to advise on these issues.

- It is only possible to apply a capitation approach where there is a population base; orthodontists and oral surgeons who do not register patients for general dental treatment but accept referrals have no population base; if these types of services are to receive a block payment a different means of allocation for these practices would be required. Consideration should be given to whether a block payment is actually appropriate to these specialists where the payment can range from a few hundred pounds to a few thousand.
- The dental system at the BSO holds a wealth of data on treatments, volume and costs of activity and the number and profile of health service dentists. It is important that any move away from an item of service claim system did not result in the loss of such rich data which is vital for answering AOs, planning service delivery, probity, quality monitoring by RDOs, etc. It would be very difficult to collect data if there was no direct link to payment of the dentist; the current system is reliant on dentists requiring payment and therefore submitting the appropriate claims.
- The dental payment system is extremely limited and modifications to it would be very unlikely; calculation of a “block payment” would have to be done manually outside the system (in a similar manner to the current practice allowance). Payment would also require manual intervention, with the “nominated” dentist in each practice receiving payment. Note the implications for the BSO in terms of calculating payments – consideration needs to be given to the frequency of payment, e.g. quarterly, and the knock-on effect on BSO resources.
- The current dental payment system deals with individual contracts and sub-contracts with individual dentists; this block payment system would move away to a practice-based allocation. There would be operational issues, e.g. (i) there maybe the need to nominate one dentist to receive the block payment on behalf of each practice as the current dental payment system pays the individual DS number, rather than the practice; (ii) patients are currently registered with a dentist not a practice and patients therefore move with their dentist until registration lapses – the block payment would be based on registrations per practice but at any one time it can be difficult to track exactly the number of patients per practice and (iii) currently contract numbers are recycled and so it would be a large housekeeping task by the BSO to ensure each dentist and his/her contract or sub-contract was assigned to the correct practice for each payment calculation.

- Each patient does have a location code attached which denotes dentist and surgery using the contract and sub-contract codes; however, if e.g. the payment was to be quarterly it would still be necessary to calculate monthly populations and indices and therefore monthly weighted populations due to the turnover of patients from one month to another. Again this has resource implications for the BSO..
- As already noted in the paper, gender is missing for approx. 1.2% of registrations and it would be more accurate to apply separate age/gender curves; matching with the Exeter System may decrease the number of records with a missing gender field.
- Patient postcode is currently attached by a matching exercise with Exeter; however, there are approx. 20,000 incorrect CHI Numbers on the dental system which leads to returning either an incorrect postcode or no postcode.

10. Recommendations

- 10.1 The age gender curve has been devised using a robust approach and with accurate, up-to-date data; it would be appropriate for use it a pilot of the blended system. The method to derive the curve would also be appropriate in a full roll-out of the formula, simply being updated to reflect the most current 3-year average of activity data.
- 10.2 However, it is recommended that some further work take place around devising the additional needs index. As already mentioned in paragraph 7.2, resource allocation work usually consists of an intensive modelling exercise to identify the best predictors of need. Reliance on one needs indicator, in this case the SMRu75, is not recommended and before any such formula would be used across all practices this full modelling exercise should take place.
- 10.3 For other hospital, community and family practitioner services allocations, interim indices have been used pending research and development of indices specific to that service. Use of the SMRu75 as an interim needs indicator would be appropriate for a pilot but still requires some further testing even prior to a pilot. For example, it may be that the SMRu75 variable has a high level of spread and may be too redistributive; we could test transforming the distribution of the variable to find the more appropriate relationship between need and dental service utilisation.

Sub-Appendix A:**Cost & Item Weights for Males & Females, 2005/06 to 2007/08**

Age Group	Male Cost Weights 2005/06	Male Cost Weights 2006/07	Male Cost Weights 2007/08
0-5	£1.06	£1.10	£1.10
6-12	£4.45	£4.85	£4.91
13-17	£8.98	£10.32	£10.80
18-24	£15.11	£17.15	£18.18
25-34	£17.36	£19.58	£21.16
35-44	£17.46	£20.67	£21.97
45-59	£18.52	£21.75	£23.25
60-64	£18.69	£21.58	£23.05
65-74	£17.03	£20.73	£21.79
75+	£14.60	£17.20	£18.76

Age Group	Female Cost Weights 2005/06	Female Cost Weights 2006/07	Female Cost Weights 2007/08
0-5	£1.00	£1.00	£1.00
6-12	£4.54	£4.94	£5.00
13-17	£8.85	£10.22	£10.66
18-24	£13.94	£15.78	£16.74
25-34	£15.72	£18.26	£19.56
35-44	£16.62	£19.55	£20.98
45-59	£18.08	£21.24	£22.27
60-64	£17.29	£20.48	£22.28
65-74	£16.23	£19.35	£20.85
75+	£13.94	£16.87	£17.84

Age Group	Male Item Weights 2005/06	Male Item Weights 2006/07	Male Item Weights 2007/08
0-5	1.05	1.09	1.09
6-12	3.57	3.93	4.01
13-17	5.12	5.82	6.07
18-24	8.39	9.60	10.30
25-34	8.93	10.24	11.14
35-44	8.59	10.14	11.06
45-59	8.77	10.36	11.31
60-64	8.76	10.31	11.26
65-74	8.19	9.95	10.83
75+	6.86	8.27	9.21

[Sub-Appendix A ~ Table continues next page]

Age Group	Female Item Weights 2005/06	Female Item Weights 2006/07	Female Item Weights 2007/08
0-5	1.00	1.00	1.00
6-12	3.61	3.95	4.02
13-17	4.99	5.76	5.98
18-24	8.06	9.22	9.91
25-34	8.37	9.87	10.72
35-44	8.21	9.69	10.63
45-59	8.38	9.91	10.70
60-64	8.08	9.58	10.60
65-74	7.59	9.18	10.06
75+	6.23	7.69	8.46

Sub-Appendix B**Dental Costs & Total Registered Patients (aggregate of 2005/06 to 2007/08)**

Age Group	Dental Costs (sum of 2005/06 - 2007/08)		Registered Patients (sum of 2005/06 - 2007/08)	
	Males	Females	Males	Females
0-5	£287,699	£258,252	86,595	84,133
6-12	£2,682,698	£2,653,374	184,996	179,427
13-17	£4,041,466	£4,028,711	132,127	133,331
18-24	£5,576,555	£6,468,120	108,742	136,938
25-34	£7,861,833	£11,039,756	133,097	203,083
35-44	£10,656,673	£13,833,384	174,759	238,602
45-59	£13,979,821	£16,193,183	216,926	258,942
60-64	£3,586,236	£3,999,613	55,794	65,734
65-74	£4,569,489	£5,270,449	75,707	92,149
75+	£2,007,988	£2,955,698	39,188	59,943

Dental Costs per Capita and Relative Cost Weights (derived from 2005/06 to 2007/08 data)

Age Group	Dental Costs per Capita		Relative Cost Weights	
	Males	Females	Males	Females
0-5	£3.22	£3.07	£1.08	£1.00
6-12	£14.50	£14.79	£4.72	£4.82
13-17	£30.59	£30.22	£9.96	£9.84
18-24	£51.28	£47.23	£16.71	£15.39
25-34	£59.07	£54.36	£19.24	£17.71
35-44	£60.98	£57.98	£19.87	£18.89
45-59	£64.45	£62.54	£20.99	£20.37
60-64	£64.28	£60.85	£20.94	£19.82
65-74	£60.36	£57.19	£19.66	£18.63
75+	£51.24	£49.31	£16.69	£16.06

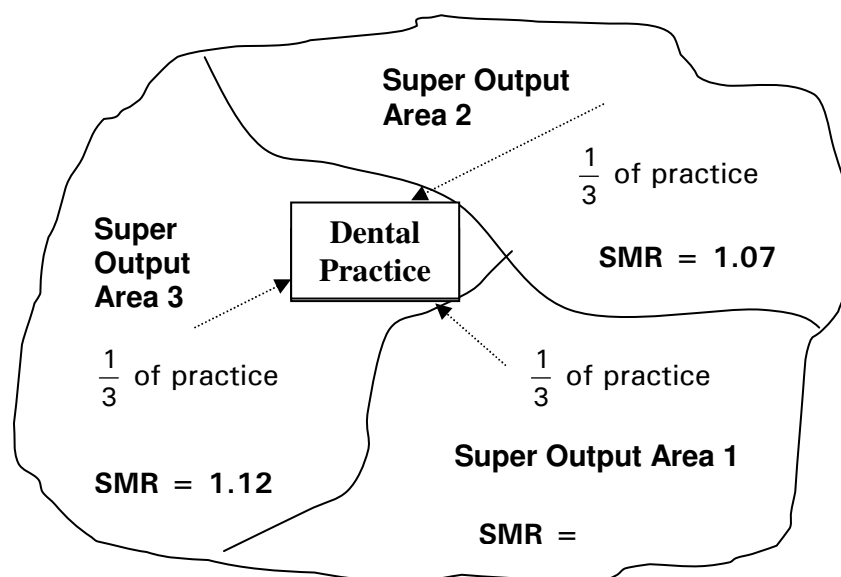
Dental Costs per Head showing 95% Confidence Intervals, 2007/08

Age Group	Males			Females		
	Lower Limit	Costs/capita	Upper Limit	Lower Limit	Costs/capita	Upper Limit
0-5	£2.77	£3.00	£3.24	£2.50	£2.74	£2.98
6-12	£13.34	£13.43	£13.51	£13.61	£13.70	£13.79
13-17	£29.39	£29.55	£29.71	£29.04	£29.18	£29.32
18-24	£49.63	£49.76	£49.90	£45.71	£45.81	£45.91
25-34	£57.78	£57.91	£58.05	£53.45	£53.55	£53.65
35-44	£60.01	£60.13	£60.25	£57.31	£57.42	£57.52
45-59	£63.53	£63.64	£63.75	£60.85	£60.96	£61.07
60-64	£62.87	£63.09	£63.31	£60.76	£60.98	£61.19
65-74	£59.45	£59.64	£59.82	£56.90	£57.08	£57.26
75+	£51.06	£51.35	£51.64	£48.57	£48.82	£49.06

Sub-Appendix C**ATTRIBUTION OF NEED TO GENERAL DENTAL PRACTICES**

The standard unit of analysis is the Super Output Area (SOA), however, it is more meaningful to analyse dental variation by General Dental Practice. Needs data such as Standardised Mortality Ratios are available by SOA but not by Dental Practice. It is therefore necessary to “attribute” SOA data to General Dental Practices. In this example, each person on the dental practice list takes on the SMRu75 for their SOA as a whole. The dental practice SMRu75 can then be computed by calculating the population-weighted average of the SOA SMRs of all the patients on each practice list.

Consider the hypothetical General Dental Practice in the diagram below:



Practice catchment: \dashrightarrow

By giving the Dental Practice the SMR under 75 for the SOA in which it is based (SOA 3) would be inaccurate as the Dental Practice draws patients from more than one SOA. It is more accurate to compute values based on the place of residence of the Practice population. In this hypothetical

example, the dental practice draws one third of its population from each of 3 SOAs.

In the example above the Dental Practice SMR u75 would be:

$$\left(\frac{1}{3} * 0.83\right) + \left(\frac{1}{3} * 1.07\right) + \left(\frac{1}{3} * 1.12\right) \cong 0.997$$

Sub-Appendix D**Work on developing LCG Allocations for Family Practitioner Services****Net Dental Costs* in 2007/08 by LCG**

LCG	2007/08 Net Dental Spend	% Shares
Belfast	£17,651,405.49	27.88%
South Eastern	£9,278,517.58	14.65%
Southern	£11,257,413.61	17.78%
Northern	£15,864,544.46	25.06%
Western	£9,266,217.00	14.63%
Total	£63,318,098.14	100.00%

* Excludes patient charge (£15m) and other deductions and levy (£2.2m).

Final CSA Assurance Letter 2007/08	£66,600,360.00
Difference	£3,282,261.86

£2.9m difference from the final accounts can be attributed to the items listed below. These items are not contained within the Dental Payment System and cannot be assigned to individual contractors or assigned to specific LCGs.

Payment to the NI Council PostGrad Medical & Dental Education	£309k
Refunds to patients	£30k
Canon Hygiene Regional Contract	£260k
Compensation Payment for Early Retirement	£97.5k
Employers' Superann Contribution	£2.2m
Total which cannot be assigned to individual contractors	£2.9m

Notes:

1. Dentists assigned to LCG according to postcode of premises, ie. Geographical location.
2. Some dentists work in more than one surgery; in some cases these dentists have separate contracts for each surgery and therefore their net pay could be assigned according to surgery postcode to the correct LCG.

However, some dentists although working in more than one surgery, choose to retain a single contract with sub-contracts. The CSA Dental Payment System operates at the contract rather than sub-contract level; where the dentist's sub-contracts were all within the same LCG the net pay for all sub-contracts could be assigned directly to the LCG. Only 3 dentists had sub-contracts working across LCGs and their net pay had to therefore be apportioned according to the ratio of item claims between surgeries - only £500k had to be apportioned in this manner. Given the small amount of money concerned, it was not deemed necessary to try to disaggregate surgery-specific spend (e.g. rates) from dentist-specific spend (e.g. CPD allowances).

Implementation:

The above % shares based on 2007/08 historic spend are one option for allocating the 2009/10 LCG dental allocations.

Note however that there are a number of issues which may require revision to these shares in the future:

- (i) A tendering process is currently underway to place additional dental services in "gap" areas by the end of this financial year. Gap areas refer to those locations where recently there has been increased difficulty in accessing Health Service dentistry.
- (ii) The knock-on effect that the tendering exercise may have on current Health Service Dentistry providers; that is, there may be an increase in Health Service dentistry from current providers in those areas where these tendered dentists are located. Note there is also potential for the overall spend in dental to increase.
- (iii) Negotiations are underway regarding a new dental contract and this is likely to include changes to the payment methods such as movement away from an item of service fee structure to a "block payment" using a weighted capitation based allocation approach. Such an approach is likely to be subject to a pilot in the first instance and so use of a weighted capitation method for allocations may be some years down the line. Note that some service exclusions, e.g. orthodontics, would likely apply to a capitation based approach.

APPENDIX 2

PENNY MURRAY DOCUMENT

Dental Additional Needs Index – For Use in a Dental Weighted Capitation Formula

1. Introduction

- 1.1 The aim of the piece of work is to develop statistical models to relate general dental services utilisation to the needs of dental registered patients. Population needs are measured using a range of deprivation and socio-economic indicators whilst dental utilisation is measured in the form of costs per capita adjusted for age and gender. Analyses were carried out at the dental practice level. Cost data relate to the financial year 2007/08.

2. Accounting for Age/Gender Effects

- 2.1 The aim of this utilisation-based modelling is to determine the need for dental resources after allowing for population size and the age/gender structure of the dental practice. To account for age and gender, 2 methods to construct the dependent variable have been tested:
- (i) The first uses cost-weighted dental activity in each practice standardised to account for the age and gender distribution of the practice. The age/gender distribution is approximated by the dental age weights (previously documented in Paper DCF_2009v2). For this paper we will call these dental units. The calculation to arrive at the dependent variable essentially compares the total item costs for each practice with the expected costs given the age/gender structure of the practice list; this ratio of actual to expected costs is then regressed on the set of needs variables. Within resource allocation work, these models are commonly termed “2-stage models”.
 - (ii) The second approach uses actual practice cost per head and regresses this directly on the needs variables together with a set of variables representing the proportion of the practice list falling within a set of defined age/gender groups. Within resource allocation work, these models are commonly termed “1-stage models”. One age group is used as a comparator (in this case females aged 45-59 as they represent the largest proportion of dental registrations) so that the coefficients and significance tests relate to differences between each particular age/gender group and females aged 45-59.

Note both methods are used across various resource allocation models, for example, the 2-stage approach is used in the current NI prescribing formula and the regional allocation formula for hospital, community and social services funding; whereas the 1-stage approach is used in the GMS rurality index.

3. Health Care/Dental Care Needs

- 3.1 A comprehensive set of needs variables was constructed at dental practice level; data on health status, morbidity and socio-economic variables were derived from the 2001 Census, measured at Super Output Area (SOA) level and attributed to practice lists. An explanation of this attribution process was provided in paper DCF_2009v2. Mortality and birth rate variables were derived from data from the Registrar General NI, again measured at SOA and attributed to practice level. Income related variables that reflect economic disadvantage were also included, sourced from live administrative systems within DSD, again measured at SOA level and attributed to practice level. Index of Multiple Deprivation (Noble) domains were also included, again measured at SOA and attributed to practice level. Definitions of the needs variables are provided at Appendix A.

4. Accounting for Health Board Effects

- 4.1 It can be reasonably assumed that HSS Boards could have operated in different ways when providing dental services to their respective populations and these may impact on utilisation patterns and/or the dental needs of the populations. Differences between areas can be controlled for in regression models through the use of dummy variables. Dummy variables were coded 0 or 1 with all dental practices being assigned to a Health Board according to postcode of practice. One HSS Board is used as a comparator; the Eastern Board was the omitted Board as it has the largest number of dental registrations.

5. Preliminary Modelling

- 5.1 Preliminary models were run and then the dataset was refined to remove highly correlated variables. The distribution of the dataset was examined using description statistics, outliers and tests for a normal distribution. The dataset was normalised by removing extreme outliers.
- 5.2 Stepwise, forward, backward and general-to-specific selection routines were tested. Both additive and multiplicative (log transformed) models were tested. Dependent variables using both methods to account for age and gender effects (as described in paragraph 2.1) were tested.
- 5.3 Throughout all analyses, each observation representative of a dental practice was weighted in percentage to the total list size of the dental practice. This ensured that, in seeking to infer a regional average model of utilisation, undue weight was not given to patterns of utilisation in smaller practices.

6. Model Testing

- 6.1 In our preliminary work to develop a dental weighted capitation formula, the SMR under 75 was used as an interim needs indicator. Use of this variable in each of the model types was also tested to establish the weight of any relationship between dental utilisation and SMRu75.

- 6.2 Seven models could be produced; all comprising only one variable. Three models result in the Index of Multiple Deprivation Employment Domain, 3 result in the Index of Multiple Deprivation Income Domain and one results in long-term unemployment. These models always have higher explanatory power than the SMR under75 when it is tested in the same models.

7. Rationale for Selecting a Preferred Model

- 7.1 The use of one of the models comprising an Index of Multiple Deprivation Domain would be recommended over the long-term unemployment variable as they comprise a number of indicators within the domain rather than reliance on a single indicator. This allows us to rule out the 2-stage multiplicative model as it results in the long-term unemployment variable.
- 7.2 Both the Income Domain and the Employment Domain are plausible measures of need. IMD_Employment comprises unemployment count, incapacity benefit, severe disablement allowance, new deal and invalid care allowance. IMD_Income comprises job seekers' allowance, income support, working families' tax credits and disabled person's tax credits. Note that these 4 indicators are all categories for exemption from paying dental service treatment charges.
- 7.3 In resource allocation fields, it is felt unrealistic that the effect of additional needs would be the same in all areas (in this case dental practices) irrespective of their level of age-related needs. The 1-stage additive model assumes that the effects of need are constant across all age groups; as we have a choice of other models which do not have this limitation we can rule out the 1-stage additive model.
- 7.4 Of the models left to choose from, within the 2-stage additive model, IMD_Income results in slightly higher explanatory power than IMD_Employment; given the indicators within IMD_Income it is more plausible as a needs measure than IMD_Employment. This still leaves us with a choice between a 1-stage multiplicative model and a 2-stage additive model; both resulted in the needs variable IMD_Income. Both models allow the effects of additional need to vary with age and both pass a specification test; so there is little to choose between them. The 1-stage multiplicative model has a slightly higher R^2 than the 2-stage additive but note the 1-stage model contains the effect of age/gender as well whereas the 2-stage model is explaining additional need over and above age effects. Isolation of the needs variable in both models indicates that the needs variable's explanatory power is actually much higher in the 2-stage additive model.
- 7.5 The 1-stage model does not use the age cost curve that we previously developed; given the robust analysis that went into developing the age cost curve it would be preferable to use the model which allows us to apply the age cost curve. This would lead us to choose the 2-stage additive model. The 2-stage additive model also benefits from having no technical issues that can arise from using a log transformed variable. The only downside to a 2-stage model is that interactions between age and need are not captured as fully as with a 1-stage model; however, this is not felt to be a major limitation and as already mentioned, such models are used to distribute other

Departmental allocations. It is therefore recommended that the 2-stage additive model be the preferred option.

- 7.6 The chosen additive model has explanatory power of $R^2 = 16.7\%$ and looks like this:

$$\text{Cost per Dental Unit} = 1.132 + (2.854 \times \text{IMD_Income})$$

Cost per Dental Unit refers to dental costs standardised for age/gender using our age cost curve derived from activity data
1.132 being the constant from the regression equation
2.854 being the un-standardised coefficient from the regression equation

- 7.7 The model was tested for any improvement in explanatory power that could be achieved from simply entering other variables into the above model that intuitively may have some association with higher dental activity. Entering other variables either led to no improvement or caused the IMD_Income variable to become not significant.
- 7.8 The preferred model was also tested in an attempt to include rurality variables; 8 rurality variables were tested including population density, distance to urban centres of various population sizes and economically active population working in agriculture. None of the variables displayed a significant coefficient when entered into the preferred model and none of the variables come through in the modelling if other selection routines are applied.

8. Application of 2-Stage Additive Model at Dental Practice Level

- 8.1 At dental surgery level the additional needs adjustment would redistribute +/- 5.71%. The index ranges from 0.77 to 1.65. At Local Commissioning Group level the index would redistribute +/- 3.39% and ranges from 0.899 to 1.137. The table below shows the LCGs' relative dental resources shares resulting from applying these additional need weightings. The weight effects are shown as an index around 1 (NI being 1). The Belfast, Southern and Western LCGs have a need for dental resources greater than the NI average when based on "additional needs" only. Table 1 is the same as Table 7.1 in paper DCF_2009v2 which detailed the additional needs adjustment based on the SMR under 75.

Table 1 Additional Needs Index at LCG Level & LCG Population Shares (after additional needs adjustment)

	Belfast	Northern	S Eastern	Southern	Western
Registered Popn % Shares	23.64%	25.68%	17.19%	19.86%	13.64%
Registered Popn Need Index	1.0584	0.9366	0.8989	1.0111	1.1369
Population Shares (%) after adjusting for additional need	25.02%	24.05%	15.45%	20.08%	15.50%

DH TRIM REF DH1-07-2187~3

- 8.2 Table 2 shows the combination of the age and need adjustments (equivalent to Table 8.1 in paper DCF_2009v2). The age index as developed and detailed in paper DCF_2009v2 has been applied simultaneously with the additional needs index based on IMD_Income, producing a practice weighted population. Weighted populations are then normalised to total the registered population. Dental practices have then been assigned to an LCG according to postcode of the premises. Note that the registered population base differs slightly from paper DCF_2009v2 due to the removal of 7 practices which had very small lists; these were removed to prevent them distorting the analysis.

Table 2 Registered Population, Indices, Weighted Populations and % Shares by LCG

	Belfast	Northern	S Eastern	Southern	Western
Registered Population	199,861	217,136	145,354	167,950	115,306
Population Shares %	23.64%	25.68%	17.19%	19.86%	13.64%
Reg Popn Age Index	1.0419	1.0032	1.0122	0.9829	0.9309
Popn % Shares	24.63%	25.76%	17.40%	19.52%	12.69%
Reg Popn Needs Index	1.0584	0.9366	0.8989	1.0111	1.1369
Popn % Shares	25.02%	24.05%	15.45%	20.08%	15.50%
Reg Popn Total Index	1.1028	0.9395	0.9099	0.9938	1.0584
Age & Need Wgt Popn	220,402	204,004	132,254	166,910	122,037
Popn % Shares	26.06%	24.13%	15.64%	19.74%	14.43%
2007/08 Net Dental Spend % Shares	27.88%	25.06%	14.65%	17.78%	14.63%

- 8.3 Note the Noble Index of Multiple Deprivation is currently being reviewed and it is likely that the Income Domain will comprise a different set of indicators in the future. However, we could revisit the modelling to test the new domain alongside the previous version and if need be the formula could move to applying the new Nobel Income Domain. Also note that, the current Noble Income Domain comprises 4 variables which are available from live administrative systems within the Department of Social development and therefore it would be possible to update the variables ourselves should the new Noble Income Domain prove less suitable for explaining dental utilisation and our preference therefore being to retain the current Income Domain.
- 8.4 Development of a list turnover adjustment was detailed in a separate paper; appendix B shows the LCGs' relative dental resources shares resulting from applying these list turnover weights (Table B.1). The weight effects are shown as an index around 1 (NI being 1). Table B.2, Appendix B shows the combination of the age, additional needs and list turnover adjustments.
- 9. Some Further Issues**
- 9.1 There are several specific factors which drive need and demand in dentistry and these are quite different from the drivers for other health services; dental

activity such as check-ups occurs throughout people's lives, not just when there is an obvious need. This will continue or may even become more reinforced as dentistry becomes more preventative focused.

- 9.2 There is also "noise" in the dental health care system from for example, patient charges which interact with patient demand for dental services. Patient charges also affect revenue and can be difficult to predict depending on volumes of activity and movements between exempt and non-exempt populations. This is important if we are increasing access by bringing charge payers back into health service dentistry that were previously accessing private dentistry.
- 9.3 The provision of private dentistry, levels of private versus health service dentistry and the supply of health service dentistry all create "noise" within the system and therefore within the modelling process. It is normal practice in resource allocation work, to relate utilisation to need while adjusting for influences of supply; this is because good accessibility can create higher levels of demand and therefore higher levels of utilisation for the same level of need. So it would be preferable to neutralise the historic levels of supply so resources are allocated equitably on the basis of need alone. Thought would need to be given to practice supply characteristics that would be appropriate to model plus data availability to produce such variables. Examples of usual supply variables (taken from a GP setting) would be number of patients per dentist, single-handed practice, training practice and proportion of private treatments.

SUB-APPENDIX A:**DEFINITIONS OF THE NEEDS INDICATORS INCLUDED IN THE REGRESSION MODEL**

Variable description
Dental Surgery Number
Census variables
Proportion of Pensioner Households
Proportion of households with 3+ children
Proportion of persons in no carer households
Proportion of persons in single carer households
Proportion of persons in two carer households
Proportion of persons in concealed households
Proportion of pensioners in no car households
Proportion of persons in single carer pensioner households
Proportion of pensioners living alone
Proportion of pensioners in no carer households
Proportion of those aged 75+ living alone
Proportion of pensioners in social rented housing
Proportion of pensioners in private rented housing
Proportion of pensioners in households w/o central heating
Proportion of pensioners in households w/o basic amenities
Proportion of households with no car
Proportion of households with two+ cars
Proportion of dependent children (0-17) in lone parent households
Proportion of working age adults with no qualifications
Proportion of working age adults with qualifications
Proportion of pensioners living in overcrowded households
Standardised limiting long-term illness ratio
Standardised limiting long-term illness ratio (aged 65&over)
Self-report not good health ratio (standardised)
Proportion of persons who provide unpaid care
Provides unpaid care for 20 hours or more
Long-term unemployment rate
Proportion of persons stating religion as Catholic
Persons 16-74 Economically active Unemployed
Persons aged 16-74 Full-time students
Persons 16-74 managerial & professional occupations
Persons 16-74 routine & manual occupations

General Registrar Birth & Death Data
<p>Standardised birth rate</p> <p>Standardised mortality ratio - under 75</p> <p>Standardised mortality ratio - 65 plus</p> <p>Percentage of births of low birth weight <2500g (Child Health System)</p>
Noble Index of Multiple Deprivation (Total & Domains)
<p>NIMD total</p> <p>NIMD income</p> <p>NIMD employment</p> <p>NIMD health and disability</p> <p>NIMD education</p> <p>NIMD proximity to services</p> <p>NIMD crime and disorder</p> <p>NIMD living environment</p> <p>NIMD physical environment</p> <p>NIMD income deprivation - children</p> <p>NIMD income deprivation - older people</p>
Social Security Data
<p>Proportion of the population in receipt of AA at August '07</p> <p>Proportion of the population in receipt of DLA at August '07</p> <p>Proportion of the population in receipt of IB at August '07</p> <p>Proportion of the population in receipt of JSA at August '07</p> <p>Proportion of the population in receipt of SDA at August '07</p> <p>Proportion of the population in receipt of IS at August '07</p> <p>Note those in receipt of Working Families/Disabled Person's Tax Credits are also exempt from dental charges; this data is owned by Her Majesty's Revenue & Customs and cannot be made available at this level for analysis.</p>
Rurality Variables
<p>Number of residents per hectare</p> <p>% of the economically active population in agriculture</p> <p>% of people living in Enumeration Districts (EDs) with density < 4 people/hect</p> <p>% of people living in EDs with density < 0.5 people/hect</p> <p>Distance (Km) to urban centre of 5,000+ people.</p> <p>Distance (Km) to urban centre of 10,000+ people.</p> <p>Distance (Km) to urban centre of 20,000+ people.</p> <p>Distance (Km) to urban centre of 50,000+ people.</p>

GMS Quality & Outcomes Framework (QOF) Variables

Prevalence per 1,000 population of CHD
Prevalence per 1,000 population of Heart Failure 1
Prevalence per 1,000 population of Heart Failure 3
Prevalence per 1,000 population of Stroke
Prevalence per 1,000 population of Hypertension
Prevalence per 1,000 population of Diabetes
Prevalence per 1,000 population of COPD
Prevalence per 1,000 population of Epilepsy
Prevalence per 1,000 population of Hyperthyroidism
Prevalence per 1,000 population of Cancer
Prevalence per 1,000 population of Mental Health
Prevalence per 1,000 population of Asthma
Prevalence per 1,000 population of Dementia
Prevalence per 1,000 population of CKD
Prevalence per 1,000 population of Atrial Fibrillation
Prevalence per 1,000 population of Learning Disability

SUB-APPENDIX B: INCLUSION OF LIST TURNOVER ADJUSTMENT

B.1 At dental surgery level the list turnover adjustment would redistribute +/- 0.701%. The index ranges from 0.9624 to 1.3065. At Local Commissioning Group level the index would redistribute +/- 0.086% and ranges from 0.9977 to 1.0030. The table below shows the LCGs' relative dental resources shares resulting from applying these list turnover weightings. The weight effects are shown as an index around 1 (NI being 1). The Belfast, Southern and Western LCGs have a need for dental resources greater than the NI average when based on turnover of patients only.

Table B.1 List Turnover Index at LCG Level & LCG Population Shares (after list turnover adjustment)

	Belfast	Northern	S Eastern	Southern	Western
Registered Popn % Shares	23.64%	25.68%	17.19%	19.86%	13.64%
List Turnover Index	1.0010	0.9977	0.9985	1.0030	1.0002
Population Shares (%) after adjusting for list turnover	23.66%	25.62%	17.16%	19.92%	13.64%

B.2 Table B.2 shows the combination of the age, need and list turnover adjustments. The age index has been applied simultaneously with the additional needs index based on IMD_Income and simultaneously with the list turnover adjustment producing a practice weighted population. Weighted populations are then normalised to total the registered population. Dental practices have then been assigned to an LCG according to postcode of the premises.

Table B.2 Registered Population, Indices, Weighted Populations and % Shares by LCG

	Belfast	Northern	S Eastern	Southern	Western
Registered Population	199,861	217,136	145,354	167,950	115,306
Population Shares %	23.64%	25.68%	17.19%	19.86%	13.64%
Reg Popn Age Index	1.0419	1.0032	1.0122	0.9829	0.9309
Popn % Shares	24.63%	25.76%	17.40%	19.52%	12.69%
Reg Popn Needs Index	1.0584	0.9366	0.8989	1.0111	1.1369
Popn % Shares	25.02%	24.05%	15.45%	20.08%	15.50%
Reg Popn Turnover Index	1.0010	0.9977	0.9985	1.0030	1.0002
Popn % Shares	23.66%	25.62%	17.16%	19.92%	13.64%
Reg Popn Total Index	1.1048	0.9367	0.9088	0.9961	1.0582
Age, Need, Turnover Wgt Popn	220,802	203,399	132,092	167,296	122,018
Popn % Shares	26.11%	24.05%	15.62%	19.78%	14.43%
2007/08 Net Dental Spend % Shares	27.88%	25.06%	14.65%	17.78%	14.63%

APPENDIX 3

PENNY MURRAY DOCUMENT

Development of a Patient List Turnover Adjustment: Revised Methodology (V2: 05/03/2010)

Introduction

1. Within the developmental work to derive a weighted capitation formula for the allocation of dental resources, it was recognised that practices with high list turnover have higher workload, as the patients initially after registration tend to require more treatment and therefore more consultations compared to other patients who have had continued registration either at the same practice or having transferred from another practice.
2. It was agreed that analysis should be carried out to identify the volume and cost of treatment for a new registration compared to an existing patient. If this analysis indicates that costs are higher for new registrations; then an uplift factor could be applied to new registrations on a quarterly basis.

Data Source

3. Initially registration and treatment data for 2008/09 at individual patient level was acquired from the BSO. Initial examination of this data highlighted that depending upon individual practice procedures there can be a delay of up to 6 months between treatment received and receipt and processing of the claim by the BSO. Therefore it was recommended that analysis of costs should be for the financial year as a whole rather than month-by-month or quarter-by-quarter. Note that even with analysis across a full financial year there will be claims paid in one year but relating to courses of treatment extending from the previous year and likewise there will be courses of treatment started in one financial year but not paid until the subsequent year.
4. Initial analysis attempted to track each individual on a month-by-month basis to establish (i) whether they were a completely new registration to the NI dental list; (ii) whether they had transferred from one practice to another; (iii) whether they had dropped off the NI list completely; or (iv) whether they had lapsed registration during the year and then re-registered either at the same practice or a different one.

Initial Data Analysis Methodology

5. This analysis turned out to be very cumbersome and resource-intensive due to the tracking of each individual month-by-month across the financial year and practice-by-practice. A “new” registration had to be defined as new to the practice’s list from one month to the next; those that retained their registration at one practice throughout the year were defined as “continuing”. Those patients with lapsed registration had to be defined as “continuing”; however, once they re-registered at the same or a new practice they would be picked up and counted as a “new” patient. The limitation with this approach was that these new registrations which were simply the result of elapsed registration would have costs which more likely reflect their “continuing” status and would have impacted on the cost of a “new” patient by dampening these “new patient” costs. Patients who transferred from one practice to another were defined as “new”; again this would have dampened the costs for “new patients” as these transfers were more likely to have costs reflective of continual registration.

6. This analysis indicated that an average “new” patient based on 2008/09 data would cost 42% more than a “continuing” patient. It was agreed that a second year of analysis based on 2007/08 data should be undertaken and this resulted in “new” patients costing 68% more than “continuing” patients. Given the difference in results, analysis of a third year of data and use of a 3-year average was recommended. **However, it came to light that a different methodology had been employed between the 2 years of analysis leading to the apparent difference rather than any real difference between the years. Both methodologies were reviewed and it agreed that the subsequent method used to analyse 2007/08 data was more appropriate and overcame some of the limitations originally noted in the 2008/09 analysis.**

Alternative Data Analysis Methodology

7. This alternative methodology although tracking at an individual patient level does not track on a practice-to-practice basis but rather at an overall NI level; the method is therefore less complicated and more appropriate in terms of costing patients transferring between practices. In this case, a “new” registration is defined as a patient new to the NI list in any one month. Patients who retained registration on the NI list from one month to the next are defined as “continuing”; this includes those transferring from one practice to another. This is the main difference in the 2 methodologies and overcomes the previous limitation in that these transfers which should reflect continual registration treatment costs no longer dampen the costs of a “new” patient. Those with lapsed registration are now only picked up when they re-register and will be counted as “new”; this will still create some

dampening of “new patient” costs but to a much lesser extent now that we have dealt with transfers.

8. Note that due to the delay of up to 6 months between treatment received and receipt and processing of the claim by the BSO, the issue of attaching all costs to each individual in any one financial year will still exist.

Results

9. The results now show a consistent trend over the 3 years of analysis (2006/07 to 2008/09). The percentage breakdown of “new” versus “continuing” patients in terms of number of registrations, volume and costs is shown in Appendix A for each of the 3 years. For each year the tables also include average cost per item, average items per patient and average cost per patient. Given that we have 3-years data, we have produced and would recommend using the 3-year average; this analysis indicates that for the 3-year average 2006/07 to 2008/09, an average new patient costs 67% more than a continuing patient. Table 1 details the 3-year average results.
10. The 67% higher cost for new registrations compared to other patients could be used to produce an uplift factor which may be applied to all new registrations at each individual practice on a quarterly basis. The resulting factor to be applied to each new registration would be 1.67. In applying the uplift factor within the allocation formula, the factor would be applied to new registrations to a practice regardless of whether the patient is new to the NI list or a transfer from another surgery. This will be easier and quicker for the BSO to administer on an ongoing basis for allocation purposes as they only need to identify patients new to a practice’s list and not be concerned about where they have come from either within or outside of the NI dental system.

**Table 1 (a) Registrations & Treatment Activity by Type of Patient
(3-year period 2006/07 to 2008/09)**

	Number Of Patients	Total Item Cost	Number Of Items
Continuing	2,401,916 (74%)	£75,329,654 (63%)	4,837,897 (66%)
New	854,835 (26%)	£44,783,598 (37%)	2,534,438 (34%)
All	3,256,751 (100%)	£120,113,252 (100%)	7,372,335 (100%)

**Table 1 (b) Average Item Cost, Average Number of Items per Patient &
Average Cost per Patient (3-year average 2006/07 to
2008/09)**

	Average Cost Per Item	Average Items Per Patient	Average Cost Per Patient
Continuing	£15.57	£2.01	£31.36
New	£17.67	£2.96	£52.39
All	£16.29	£2.26	£36.88

**Table 1 (c) Number of Items & Total Cost as % of, the Total Items &
Total Cost of Continuing Patients (3-year average 2006/07
to 2008/09)**

	Items As % Of Continuing Patient Items	Cost As % Of Continuing Patient Costs
Continuing	100%	100%
New	147%	167%

SUB-APPENDIX A**Table A1 (a) Registrations & Treatment Activity by Type of Patient
2006/07**

	Number Of Patients	Total Item Cost	Number Of Items
Continuing	828,095 (75%)	£25,971,627 (63%)	1,689,860 (66%)
New	283,192 (25%)	£14,958,705 (37%)	861,254 (34%)
All	1,111,287 (100%)	£40,930,332 (100%)	2,551,114 (100%)

**Table A1 (b) Average Item Cost, Average Number of Items per Patient &
Average Cost per Patient 2006/07**

	Average Cost Per Item	Average Items Per Patient	Average Cost Per Patient
Continuing	£15.37	2.04	£31.36
New	£17.37	3.04	£52.82
All	£16.04	2.30	£36.83

**Table A1 (c) Number of Items & Total Cost as % of, the Total Items &
Total Cost of Continuing Patients 2006/07**

	Items As % Of Continuing Patient Items	Cost As % Of Continuing Patient Costs
Continuing	100%	100%
New	149%	168%

**Table A2 (a) Registrations & Treatment Activity by Type of Patient
2007/08**

	Number Of Patients	Total Item Cost	Number Of Items
Continuing	805,289 (74%)	£24,422,775 (63%)	1,569,937 (66%)
New	284,067 (26%)	£14,453,485 (37%)	819,845 (34%)
All	1,089,356 (100%)	£38,876,261 (100%)	2,389,782 (100%)

**Table A2 (b) Average Item Cost, Average Number of Items per Patient &
Average Cost per Patient 2007/08**

	Average Cost Per Item	Average Items Per Patient	Average Cost Per Patient
Continuing	£15.56	1.95	£30.33
New	£17.63	2.89	£50.88
All	£16.27	2.19	£35.69

[Tables continue next page]

Table A2 (c) Number of Items & Total Cost as % of, the Total Items & Total Cost of Continuing Patients 2007/08

	Items As % Of Continuing Patient Items	Cost As % Of Continuing Patient Costs
Continuing	100%	100%
New	148%	168%

Table A3 (a) Registrations & Treatment Activity by Type of Patient 2008/09

	Number Of Patients	Total Item Cost	Number Of Items
Continuing	768,532 (73%)	24,935,252 (62%)	1,578,100 (65%)
New	287,576 (27%)	15,371,408 (38%)	853,339 (35%)
All	1,056,108 (100%)	40,306,660 (100%)	2,431,439 (100%)

Table A3 (b) Average Item Cost, Average Number of Items per Patient & Average Cost per Patient 2008/09

	Average Cost Per Item	Average Items Per Patient	Average Cost Per Patient
Continuing	£15.80	2.05	£32.45
New	£18.01	2.97	£53.45
All	£16.58	2.30	£38.17

Table A3 (c) Number of Items & Total Cost as % of, the Total Items & Total Cost of Continuing Patients 2008/09

	Items As % Of Continuing Patient Items	Cost As % Of Continuing Patient Costs
Continuing	100%	100%
New	145%	165%

APPENDIX 4**PENNY MURRAY DOCUMENT****Analysis of Dental Registrations & Patient Movements,
March 2008 to May 2009****1. Methodology**

- 1.1 The Business Services Organisation (formerly the Central Services Agency) supplied registrations at individual patient level for the 15 months March 2008 to May 2009. Using the patient's Central Health Index number which is unique to each individual, each patient was tracked month by month allowing us to identify the status of each patient over the period. This allowed us to identify new registrations and drop-offs on a month-by-month basis; and for existing patients, we could identify on a month-by-month basis if they became de-registered or transferred practice.

2. New registrations each month

- 2.1 The number of new registrations at each surgery has been studied over the 15 month period. New registrations after the first month have been split into two different types; those joining from another surgery and those newly registered to the NI list altogether. The breakdown of this can be seen for Northern Ireland in Table 1 below (This information can be found for each individual surgery in the new joiners by month excel file).

Table 2.1: Number of new registrations for all surgeries in Northern Ireland

Month	Number of New Registrations to the NI List	Number of People Changing Surgery	Total No. of New Registrations (New & Transfers)
April 2008	24982	4617	29599
May 2008	27068	2318	29386
June 2008	24880	1518	26398
July 2008	28564	1716	30280
August 2008	21560	2137	23697
September 2008	31344	1597	32941
October 2008	31252	2653	33905
November 2008	27612	1947	29559
December 2008	25377	2006	27383
January 2009	23905	1610	25515
February 2009	22030	1735	23765
March 2009	30852	1897	32749
April 2009	27114	3498	30612
May 2009	25127	1413	26540

- 2.2 This analysis shows that the majority of the new patients registering at surgeries over the 15 month period are new to the NI list and not transferring in from another surgery.

3. The number of people dropping off the list by month

- 3.1 The number of people who drop of the surgery lists has also been investigated; again this has been split into those who drop of the list completely and those who are moving surgery. The results can be seen in Table 2 below for all surgeries across Northern Ireland. (This information can be found by surgery in the Leavers by month excel file.)

Table 3.1: Number of people dropping of the list of all surgeries in Northern Ireland

Month	Number Dropping of the NI List	Number of People Changing Surgery	Total Number of Drop-offs (Drop-offs & Transfers)
April 2008	28155	4617	32772
May 2008	23214	2318	25532
June 2008	26967	1518	28485
July 2008	24867	1716	26583
August 2008	32383	2137	34520
September 2008	35405	1597	37002
October 2008	26713	2653	29366
November 2008	27415	1947	29362
December 2008	19481	2006	21487
January 2009	23195	1610	24805
February 2009	23677	1735	25412
March 2009	23768	1897	25665
April 2009	27921	3498	31419
May 2009	18761	1413	20174

- 3.2 Again from this table it can be seen that the majority of the turnover is due to individuals who are leaving the list completely rather than transferring to another surgery.

4. Numbers remaining registered

- 4.1 If we look at the figures for those who remain registered from one month to the next as shown in Table 3 below (the surgery level data can be found in the surgery base excel file); we can see that at Northern Ireland level there are on average each month 793,158 people who are registered with the same surgery. This is 96% of the average NI list who are stable from one month to the next, therefore on a month to month basis there is 4% turnover at NI level.

Table 4.1: Number of People Registered at the Same Surgery as in the Previous Month

Month	Total Remaining Registered
April 2008	791,084
May 2008	795,151
June 2008	796,052
July 2008	795,867
August 2008	791,627
September 2008	778,322
October 2008	781,897
November 2008	786,440
December 2008	794,512
January 2009	797,090
February 2009	797,193
March 2009	795,293
April 2009	796,623
May 2009	807,061

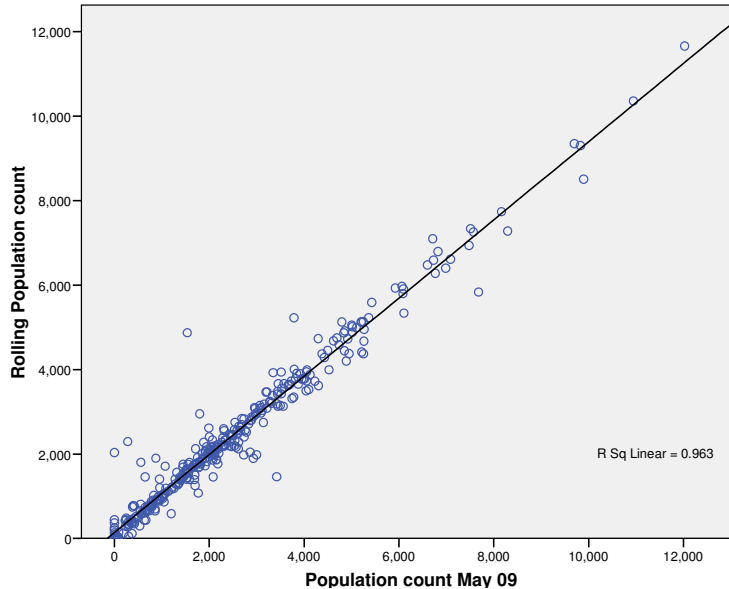
- 4.2 However, when we consider the entire 15 months, there are 496,958 people who remain registered on the list for all of the 15 months, of these 476,485 remain registered at the same surgery, and the remaining 20,473 changed their surgery of registration over this 15 month period. The average number of registrations at NI level over the 15 months is 822,026; this shows that over the 15 months 325,068 people or 40% of the list moved on or off the list.

5. Investigating method of counting the population on the list

- 5.1 A comparison of two alternative methods of counting the list population will be made here and each has advantages and disadvantages. These alternative methods are:
- (i) Using the population at a point in time
 - (ii) Using a rolling count over the 15 month period where each person is given a 1/15 weight for each of the 15 months that they are registered at a surgery.
- 5.2 A count taken from the most recent point in time will be the most up to date count possible and will be relatively easy to administer in a payment mechanism. Capitation payments would be in advance for the quarter ahead and so the static population at the start of that period will more accurately reflect the dental surgery's current list. Note as the list will be updated quarterly for payment purposes; the population base will reflect the changing population of each surgery.
- 5.3 A rolling count over the previous 15 months will have a more accurate representation of how the surgery's list population has developed and changed in the past but will not necessarily reflect the current population size and profile.

- 5.4 A plot showing these two potential population counts can be seen in the figure below. In this chart each point represents a surgery and the x-axis is the population count as of May 2009 and the y-axis is the rolling population count for the previous 15 months up to May 2009.

Figure 5.1: Comparison of May 2009 Snapshot Population versus 15 Month Rolling Population up to May 2009



- 5.5 From the figure above it appears that there is a very strong correlation between the two potential counting methods. For the vast majority of the surgeries there is little difference in the May 2009 snap-shot count and the total rolling count. The surgeries where there are significant differences in the two counts are those surgeries which have experienced large changes in the number of people registered from the start to the end of the year, either surgeries which appear to be closing down or surgeries which appear to be starting up.
- 5.6 If the population count is to be used for future allocation of resources it would appear that the rolling count of population will penalise the growing surgeries by scaling back their growth to effectively an average population over the previous 15 months. Likewise the rolling count would benefit those surgeries who have experienced larger drops in the number registered by producing there average they can appear to have drastically more people registered.
- 5.7 Additionally if we look at the total population using the two different counting methods there are 833,601 in the May 2009 count and only 822,026 in the rolling count; these almost 11,000 people are not being counted in the rolling population, thus the surgeries where they had been registered will not receive any funding for them.

- 5.8 Thus it appears that if the population count is to be used for future allocations the most recent population count would be a more reliable option.

6. Conclusion

- 6.1 There are large numbers of people both leaving and joining the dental list every month, this on average results in 4% of the people changing each month, which over the 15 months results in 40% of those on the list having changed status over the period.
- 6.2 If we accept that dental surgeries experience a high level of turnover, it could be viewed that new registrations involve higher workload than existing patients and therefore high turnover brings higher workload. Rather than manufacture a population base to capture this turnover, which would be very cumbersome to administer; a turnover adjustment could be developed which would generate a separate practice index. The age index, additional needs index and turnover index would then be applied simultaneously to the practice list, producing a practice weighted population on which to base % shares.

7. Further work

- 7.1 A further study is required to analyse whether patients registering to a new surgery are more expensive on average than those patients who have been on the surgery's list. Data has been requested from the BSO linking registration data with treatment data on an individual patient basis. This will allow us to identify the volume and cost of treatment on a monthly basis for a newly registered patient compared to an existing patient. If this analysis indicates that cost is x% higher for new registrations compared to other patients; then an uplift factor could be applied to all new registrations on a quarterly basis. This would be much easier to administer at the BSO within a weighted capitation approach.

[End of Appendices]

11. REFERENCES

- 1 "Primary Dental Care Strategy"
Dept. of Health, Social Services and Public Safety
September 2006
Ref: 84/2006
Available from
http://www.dhsspsni.gov.uk/dental_strategy_2006.pdf
[Last accessed 9/2/10]
- 2 Dental Contract Documents:
 - An introduction to the proposed new Primary Dental Care Contract
 - Essential Services Modelling
 - Block diagram of Primary Dental Care Contract
 - Block diagram of Patient Care Pathway
 - Block diagram of Blended Remuneration Plot
 - Care Payment & Quality Indicator Domains
 - PDCC Data Set. Primary Dental Care ContractAvailable from
<http://www.dhsspsni.gov.uk/index/dental/dental-pubs.htm>
[Last accessed 9/2/10]
- 3 'Care payment and quality indicator domains' paper.
Available from
http://www.dhsspsni.gov.uk/care_payment_quality_indicator_domains.pdf
[Last accessed 9/2/10]
- 4 Resource Management Programme Board
Draft Family Practitioner Services (FPS) Methodology Paper
- 5 Rose G. 'Sick individuals and sick populations'. International Journal of Epidemiology. 1985. Vol 14(1): p 32-38.
- 6 Watt R. 'Strategies and approaches in oral disease prevention and health promotion'. Bulletin of the World Health Organisation Sept. 2005; 83(9): 711-718.
- 7 'Global Strategy for the prevention and control of non-communicable diseases'. Geneva: World Health Organisation. 2000.
- 8 Petersen P E. 'The World Oral Health Report 2003. Continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme'. Community Dentistry and Oral Epidemiology 2003; 31 Supplement 1:3-24.
- 9 Burt B A. 'Concepts of risk in dental public health'. Community Dentistry and Oral Epidemiology 2005; 33: 240-247.

- 10 Sheiham A & Joffe M. 'Public dental health strategies for identifying and controlling dental caries in high and low risk populations. In: Johnson N W (editor) Risk markers for oral diseases vol 1. Dental caries: markers of high and low risk groups and individuals'. Cambridge. Cambridge University Press; 1992. p 445-481.
- 11 Batchelor P & Sheiham A. 'The limitations of a 'high-risk' approach for the prevention of dental caries'. Community Dentistry and Oral Epidemiology 2002; 30: 302-312.
- 12 Tickle M, Milsom K M, Jenner T M, Blinkhorn A S. 'The geodemographic distribution of caries experience in neighbouring fluoridated and nonfluoridated populations'. Journal of Public Health Dentistry 2003; 63(2): 92-98.
- 13 Gillon R. 'Medical Ethics: four principles plus attention to scope'. BMJ 1994; 309: 184.
- 14 Statement of Dental Remuneration 2009 No. 1.
[Health and Personal Services (Northern Ireland) Order 1972]
DHSSPSNI
- 15 'Essential Services' paper.
Available from
<http://www.dhsspsni.gov.uk/primarydentalcarecontract2.pdf>
[Last accessed 9/2/10]
- 16 CDO (Chief Dental Officer) News Autumn-Winter 2009
Available from
<http://www.dhsspsni.gov.uk/cdonewsautumnwinter2009.pdf>
[Last accessed 4/3/10]
- 17 'PDCC Data Set' paper
Available from
http://www.dhsspsni.gov.uk/pdcc_data_set.pdf
[Last accessed 9/2/10]
- 18 'Delivering better oral health: An evidence-based toolkit for prevention'. Department of Health and the British Association for the Study of Community Dentistry. 2nd Edition. 13th July 2009. Gateway Ref 12231.
Available from:
http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_102331
(Last accessed 7/2/10)
- 19 Carstairs V & Morris R. 'Deprivation and Health in Scotland'. 1991. Aberdeen. Aberdeen University Press.
- 20 Sweeney P C, McColl D, Nugent Z & Pitts N. 'Scottish Health Board dental epidemiological Programme. Addendum to the 1995/1996 report

- on 5 year olds: Deprivation and Dental caries'. 1996. University of Dundee.
- 21 Jones C, Woods K, Taylor G. 'Social Deprivation and tooth decay in Scottish schoolchildren'. Health Bulletin 1997; 55: 11-15.
- 22 Watt R & Sheiham A. 'Inequalities in oral health: a review of the evidence and recommendations for action'. BDJ 1999; 187(1): 6-12.
- 23 Tickle M, Kay E, Worthington H & Blinkhorn A. 'Predicting population dental disease experience at a small area level using census and health service data'. Journal of Public Health Medicine 2000; 22: 368-374.
- 24 Locker D. 'Deprivation and oral health: a review'. Community Dentistry and Oral Epidemiology 2002; 28(3): 161-169.
- 25 Poulton R, Caspi A, Milne B, Thompson W, Taylor A, Sears M & Moffit T. 'Association between children's experience of socioeconomic disadvantage and adult health: a life-course study'. The Lancet 2002; 360(9346): 1640-1645.
- 26 Health And Social Wellbeing: Dental Health & Deprivation Inequalities and Unfair Access Issues Emerging from the DHSSPS (2004) "Equality and Inequalities in Health and Social Care: A Statistical Overview" Report. Available from:
<http://www.dhsspsni.gov.uk/dentalhealthdeprivation.pdf>
[Last accessed 9/2/10]