# Overnight Stay Elective Admissions in Thames Valley

## Higher volumes at particular Trust sites after adjusting for population characteristics and day case rates

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## Aims

- To demonstrate that overnight stay elective admissions are higher in particular locations due to different thresholds for GP referral and addition to a waiting list at the receiving acute site

- To calculate the volume of overnight stay elective admissions in particular locations that should arise due to population charactistics, I.e. excluding GP referral and site admission thresholds.

- To provide PCT commissioning and PBC leads with an insight into the PBR implications of variations in volumes of overnight stay elective admissions.

- To determine which locations are bearing a higher PbR cost due to these activities.

- To alert PCTs to which HRG chapters are most susceptible to repeat elective overnight admissions for the same patient, i.e. particular HRG which may be best placed in a wider non-PBC risk pool.

## Executive Summary

This work analyses the results from 2.13 million head of population with144, 000 overnight stay elective admissions per annum. Analysis is at lower super output area level (LSOA)[1] covering all extremes of age profile, deprivation, ethnic composition (Asian & Black) using data for the three years 2003/04, 2004/05 and 2005/06 with volumes normalised to 2005/06 out-turn. Data is analysed at Health Resource Group (HRG) chapter level where each chapter corresponds to a body system, i.e. Nervous System, Vascular System, etc.

A unique relationship between deprivation and increased overnight stay elective admission is confirmed for each individual HRG Chapter. Ethnicity has a variable effect depending on the specific HRG chapter and ethnic type. Students are confirmed to have generally lower elective rates of admission except for Mental Health[2].

The key finding of this work is that the volume of excess overnight elective admission is the outcome of GP referral rates and thresholds to admission at the receiving acute site. Adjustment for differential day case rates at the various acute sites makes only a limited effect on the results of the analysis.

Elective overnight admissions show no relationship with distance to the nearest acute site. Excess admissions are therefore exclusively related to GP referral rates and to thresholds for elective intervention at the receiving acute site.

In this study the 12 acute hospital sites (both within and outside of TV) providing care to the residents of TV is used to define 12 hospital elective catchment areas[3]. Each output area was allocated to a catchment using straight line distance[4]. Each acute site at the centre of a catchment area does not provide a full range of services, i.e. spinal surgery, plastic surgery, etc; however, it is illustrative to see how relative rates of elective overnight admission vary between different catchment areas. The implications to PbR are discussed. HRG chapter benchmarks and estimates of excess activity have been calculated for each Local Authority, PCT and Acute site.

[1] Each LSOA contains around 1,000 to 3,000 head of population. LSOA nest together into electoral wards and can be further nested into PCT or Local Authority boundaries.
[2] Full time students aged 16 and over.
[3] The 12 acute sites are as follows: Basingstoke, Frimley Park, Heatherwood, Hemel Hempstead, Hillingdon, Horton, Milton Keynes, Oxford Radcliff, Royal Berkshire, Stoke Mandeville, Swindon, Wexham Park, and Wycombe.
[4] This method assumes that the bulk of the population would normally go to the nearest acute site for elective care. Around 5% of elective admissions are to out-of-area hospitals; however for the purpose of establishing good correlations the approximation is fit for purpose.

## Key Points

### Effect of the Healthcare System

- System factors and not the population characteristics are responsible for the bulk of excess 'admissions'
- System factors include GP referral thresholds and thresholds for acute intervention at the receiving acute site

### Implications to PbR

- The Aylesbury Vale and Milton Keynes Local Authority areas account for 22% of the total TV excess elective overnight admissions
- Both of these LA's have a high excess of GP referrals relative to their population characteristics
- Excess cost for these two LA's is around £2.3M with a total excess cost of £10M across the whole of TV

### Effect of Population Characteristics

- Rates increase with the Index of Multiple Deprivation (IMD)[5], i.e. areas of highest deprivation have highest levels of elective overnight admission.
- Some HRG chapters show slightly increased levels of admission due to ethnic populations.
- In general 'students' show significantly lower levels of elective overnight admission than their non-student counterparts. The only exception is in Chapter T (Mental Health) where students have higher rates of elective admission.

### High Cost Individuals

- Particular HRG Chapters (T - Mental Health, P - Diseases of Childhood, R – Spinal Conditions) are more susceptible to the impact of individual patients with multiple elective procedures.
- It is suggested that the causative HRG be excluded from PBC and are included in a wider inter-PCT risk pool.
- The effect of these multiple admissions was corrected for in the analysis of population characteristics.

## Introduction

Over recent years the volume of overnight stay elective admission has been decreasing across Thames Valley as more and more procedures are dealt with as a day case.

## Method of Analysis

Refer to the companion reports covering emergency admissions for a full description of the analytical methods.

The effect of distance to the nearest acute site was found to have no effect on the volume of elective admissions. A similar effect was found for zero day elective admissions.

During the process of analysis it was noted that the variation between LSOA was higher than expected in particular HRG Chapters.

**Table One: Analysis of variation**

| Chapter | Index of Variation |
|---|---|
| P - Childhood | 3.7 |
| S – Haematology & others | 2.2 |
| T - Mental Health | 1.6 |
| L - Urinary Tract | 1.6 |
| B - Eyes | 1.5 |
| H - Musculoskeletal | 1.5 |
| A - Nervous System | 1.5 |
| D - Respiratory | 1.3 |
| C - Head, Neck & Ears | 1.3 |
| F - Digestive | 1.3 |
| E - Cardiac | 1.3 |
| M - Female Reproductive | 1.1 |
| J – Skin, Breast, Burns | 1.1 |
| R - Spinal | 1.1 |
| Q - Vascular | 1.0 |
| G – Biliary Tract | 1.0 |
| K - Endocrine | 1.0 |

Table One presents a summary of the variation between LSOA seen across Thames Valley. In this analysis a value around 1 indicates that the variation is mainly due to statistical randomness.

Higher levels of variation can arise from two sources:

1. Variable thresholds for GP referral and admission at the receiving acute site
2. Some HRG chapters will contain HRG which are more susceptible to repeat admissions for the same individual

Chapter N (obstetric & neonatal) was excluded from the analysis on the basis that the events in this chapter are mainly ‘unplanned’ admissions.

Table Two explores the source of variation due to individuals with multiple admissions by looking at the ratio of actual to national average admissions in each LSOA.

**Table Two: HRG chapters where particular LSOA have very high volumes of admission**

| Chapter | Maximum Ratio | Cap | LSOA Effected |
|---|---|---|---|
| T | 472% | 100% | 98 |
| P | 1080% | 100% | 60 |
| R | 408% | 200% | 32 |
| K | 336% | 193% | 9 |
| A | 265% | 134% | 6 |
| S | 217% | 96% | 5 |
| D | 343% | 201% | 3 |
| G | 296% | 210% | 3 |

The cap was calculated as the mode (middle of ranked values) plus three times the square root of the mode. This is an approximation to the effect of statistical randomness. All other chapters have a maximum ratio less than the calculated cap.

Hence in Chapter T it is possible that just 98 individuals with up to 10 admissions per annum spread across TV accounted for the 'out of range' instances of much higher than expected admission.

Chapter P is a good example of particular conditions where a single individual could be expected to attend many times with separate HRG covering developmental disorders, behavioural disorders, blood cell disorders, renal disease, neoplasm's & chemotherapy.

## Population Factors Influencing Admission

Refer to the companion report for specific comments regarding the role of the Index of Multiple Deprivation (IMD) and ethnicity on the relative volume of admissions.

Coefficients in the model covering these fundamental population characteristics are given in Appendix One. The level of 'excess' overnight admissions is calculated for each HRG Chapter after adjusting for the fundamental population characteristics of age profile, IMD, ethnicity (Asian or black) and students.

At this point it is relevant to compare the relative sensitivity of each HRG chapter to the effect of IMD for elective and emergency admission. This is given in Table Three.

**Table Three: Relative increase in Elective and Emergency overnight admissions for a 10 unit increase in IMD.**

| HRG Chapter | Emergency | Elective |
|---|---|---|
| A | 20% | 2% |
| B | 6% | 1% |
| C | 13% | 4% |
| D | 33% | 4% |
| E | 19% | 2% |
| F | 19% | 1% |
| G | 30% | 9% |
| H | 13% | 4% |
| J | 26% | 1% |
| K | 32% | 1% |
| L | 23% | 2% |
| M | 14% | 4% |
| P | 13% | 1% |
| Q | 28% | 8% |
| R | 19% | 4% |
| S | 21% | 1% |
| T | 32% | 8% |

As can be seen elective admission is relatively insensitive to the effect of increasing IMD. The highest IMD for any LSOA in TV is around 50 units and this would only account for 45% higher elective admissions in Chapter G and only 5% higher in Chapters B, F, J, K, P and S. The bulk of all LSOA in TV have an IMD less than 20 units and so it is obvious that the major factor determining the level of elective overnight admission is the age profile of each LSOA.

**Table Four: Site thresholds influencing the relative rates for overnight elective admission.**

Data at HRG Chapter level is averaged over three years and adjusted to 05/06 out-turn. This acts to adjust for the progressive reduction in volumes of overnight admissions due to increasing day case rates over the passage of time.

| Site | A | B | C | D | E | F | G | H | J | K | L | M | P | Q | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORH/NOC | 118% | 96% | 93% | 151% | 63% | 87% | 111% | 82% | 96% | 110% | 105% | 99% | 129% | 92% | 126% | 79% | Low |
| RBBH | 101% | 80% | 93% | 67% | 95% | 96% | 80% | 109% | 96% | 95% | 91% | 84% | 136% | 105% | 123% | 127% | 150% |
| MKGH | 95% | 197% | 105% | 119% | 96% | 137% | 134% | 92% | 102% | 99% | 84% | 114% | 65% | 106% | 79% | 124% | Low |
| Wexham Park | 46% | 30% | 105% | 56% | 134% | 92% | 75% | 108% | 88% | 83% | 110% | 108% | 122% | 92% | 56% | 101% | Low |
| Wycombe | 84% | 91% | 109% | 90% | 125% | 96% | 100% | 86% | 96% | 103% | 97% | 98% | 102% | 93% | 62% | 84% | 164% |
| Stoke Mandeville | 98% | 195% | 106% | 145% | 126% | 108% | 101% | 97% | 142% | 109% | 108% | 100% | 43% | 94% | 104% | 63% | 380% |
| Heatherwood | 113% | 36% | 96% | 40% | 123% | 97% | 89% | 114% | 100% | 86% | 116% | 91% | 136% | 133% | 70% | 99% | 248% |
| NDH | 106% | 83% | 108% | 60% | 113% | 112% | 108% | 117% | 88% | 109% | 97% | 107% | 60% | 107% | 119% | 119% | Low |
| Horton | 118% | 77% | 88% | 121% | 77% | 106% | 107% | 129% | 95% | 100% | 87% | 118% | Low | 88% | 156% | 86% | Low |
| Swindon | 93% | 149% | 94% | 165% | 92% | 99% | 147% | 138% | 155% | 122% | 111% | 102% | 72% | 131% | 143% | 90% | Low |
| Hemell Hempstead | 229% | 100% | 107% | 91% | 94% | 91% | 90% | 97% | 96% | 60% | 106% | 100% | 56% | 101% | 79% | 115% | 280% |
| FPH | 98% | 65% | 100% | 80% | 77% | 73% | 67% | 111% | 93% | 121% | 140% | 125% | Low | 85% | 134% | 132% | 358% |

Sites with the highest volume of overnight admissions are highlighted in red. Commissioners should investigate which specific HRG account for the excess admissions at sites with a high propensity to admit.

PBC leads are advised that a referral to the Swindon acute site is likely to lead to higher costs across most HRG chapters.

Put another way, elective rates of admission should be roughly at the age adjusted national average for all PCTs across the UK. This is in total contrast to the current form of the capitation formula which assumes that emergency and elective admissions have the same sensitivity to 'deprivation', i.e. the capitation formula cannot be used as a basis for comparing elective admission rates between PCTs.

## Effect of Acute Thresholds

The fact that there is large variation in acute healthcare structure & practice is widely known and implies that thresholds to overnight elective admission should be different at different sites.

The usual approach to identify a healthcare system is to use a PCT or local authority boundary, however, such boundaries do not reflect the usual flows of patients to the nearest acute hospital site. In this study each LSOA has been assigned to sit in the catchment area of the nearest acute hospital site.

In this study a 100% relative rate of admission represents the TV average while a relative admission rate of 120% implies 20% more elective admissions than the TV average after adjusting for the effects of age, IMD, ethnicity and distance.

Table Four demonstrates that certain hospital sites have far higher rates of admission, i.e. have a lower threshold to 'admitting' a patient as an overnight once the patient has presented at the hospital.

The 'admission threshold' must not be seen as a general threshold but is most probably condition specific. Hence one site will 'admit' a higher proportion of say diabetic cases (Chapter K) while another will deal with these via outreach type services. This understanding then opens up the way for changes in disease management pathways.

## Volume of 'Excess' Admissions

The volume of excess overnight elective admissions has been determined relative to the Thames Valley average. The actual volume in each LSOA was compared to the expected volume using the age profile, IMD, ethnic mix and students applicable to the LSOA.

The difference between actual and expected was then summed across all LSOA falling into a Trust or PCT catchment area and this total reflects the contribution of the non-population characteristics upon the count of overnights. Data is given in Tables Five and Six. Several comments are necessary to the correct interpretation of these tables.

Firstly, the tables are all resident based and so give the relative rates of admission experienced by different blocks of people. The elective overnight volumes are largely determined by where the patient attends for their first outpatient visit. Hence while there is no elective overnight activity at NDH, per se, the patient attends at this site for outpatient first and follow-up visits. The overnight admission will occur at the RBBH, ORH or NOC. The excess of admissions is therefore determined by the relative referral rates of the nearby GPs and then by the threshold to admission set by the consultant teams running the outpatient clinics held at NDH.

**Table Five: Calculated excess overnight elective admissions for Thames Valley Residents lying in the catchment area of various acute sites.**

| Acute Site | A | B | C | D | E | F | G | H | J | K | L | M | P | Q | R | S | T | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RBBH | 72 | | | | 28 | 6 | | 250 | 22 | 12 | | | 93 | 41 | 77 | 337 | 86 | 1,025 |
| ORH/NOC | | | | 187 | | | 43 | | | 44 | 200 | 40 | 262 | | 7 | 58 | | 841 |
| Stoke Mandeville | 57 | | 45 | 82 | 74 | 65 | 9 | 86 | 97 | 10 | 44 | 28 | 82 | 7 | 19 | 5 | 83 | 792 |
| Wexham Park | | | 58 | | 173 | 44 | | 142 | | | 90 | | 59 | 18 | | 62 | | 645 |
| MKGH | 16 | | 70 | 63 | 9 | 192 | 6 | | 28 | 9 | | | 30 | 37 | | 112 | | 571 |
| Heatherwood | 24 | | 12 | | 76 | 49 | | 98 | 22 | 7 | 81 | | 29 | 35 | | 39 | 44 | 516 |
| Wycombe | 38 | | 70 | | 100 | | 15 | | | 32 | | 34 | 35 | 13 | | 13 | 37 | 387 |
| NDH | 16 | | 29 | | 22 | 50 | 15 | 93 | | 11 | | 18 | 34 | 22 | 16 | 27 | 23 | 377 |
| Horton | 26 | | | 33 | | 19 | 10 | 144 | 10 | | | 46 | | | 33 | 6 | | 326 |
| **TV Acute** | **249** | **0** | **284** | **364** | **484** | **425** | **98** | **814** | **178** | **124** | **414** | **166** | **625** | **172** | **152** | **658** | **274** | **5,480** |
| Swindon | | 21 | | 24 | | | 18 | 43 | 29 | 6 | 28 | | 22 | 6 | 10 | | | 207 |
| Hemell Hempstead | 22 | 16 | | 5 | 7 | | | 7 | 6 | | 14 | | 6 | | | 9 | 10 | 100 |
| FPH | | | 21 | | | | | | | | 28 | | | | 4 | 26 | 18 | 97 |
| Hillingdon | | | 12 | | | 26 | | 6 | | 5 | | | 6 | 4 | | 10 | | 68 |
| **Non-TV Acute** | **22** | **37** | **33** | **29** | **7** | **26** | **18** | **56** | **35** | **11** | **70** | **0** | **35** | **10** | **14** | **44** | **27** | **473** |
| **All Acute Providers** | **271** | **37** | **317** | **393** | **490** | **451** | **117** | **869** | **213** | **135** | **484** | **166** | **659** | **182** | **166** | **702** | **301** | **5,952** |

**Table Six: Calculated excess overnight elective admissions for Thames Valley residents living within different local authorities and hence PCTs. This is the cumulative outcome of all acute sites servicing these LAs and PCTs.**

| Local Authority | A | B | C | D | E | F | G | H | J | K | L | M | P | Q | R | S | T | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aylesbury Vale | 52 | | 30 | 79 | 62 | 81 | 32 | 85 | 109 | 10 | 28 | 33 | 117 | | 16 | 42 | 90 | 866 |
| Wokingham | 46 | | | | 53 | 35 | | 155 | 15 | 18 | 48 | | 26 | 14 | 27 | 114 | 46 | 598 |
| West Berkshire | 24 | | 32 | | 33 | 58 | 9 | 152 | | 12 | | 9 | 52 | 27 | 28 | 63 | 30 | 529 |
| Bracknell Forest | | | 43 | | 38 | 52 | | 117 | 12 | 9 | 109 | 25 | | 15 | | 17 | 43 | 480 |
| Cherwell | 6 | | | 63 | | 47 | 41 | 103 | 11 | 8 | 31 | 54 | 19 | | 18 | 25 | | 426 |
| Windsor and Maidenhead | | | 40 | | 76 | | | 58 | | | 32 | | 26 | 35 | | 100 | 18 | 385 |
| South Oxfordshire | 7 | | | 47 | | | | | 11 | 7 | 67 | | 41 | | 35 | 156 | | 370 |
| Milton Keynes | | | | 55 | | 180 | | | | 6 | | | 21 | 43 | | 55 | | 361 |
| Reading | 18 | | | | 10 | | | 76 | | | | | 27 | 22 | 26 | 76 | 42 | 297 |
| Vale of White Horse | 11 | | | 39 | | | 11 | | | 6 | 70 | 28 | 72 | 7 | 25 | 26 | | 295 |
| Wycombe | 30 | | 67 | | 57 | | | | | 22 | 13 | 21 | 31 | 15 | | | 27 | 283 |
| Slough | | | | | 78 | | | 71 | | | 51 | | 24 | | | | | 225 |
| Oxford | 12 | | | 15 | | | | | | 23 | 16 | | 121 | | | | | 187 |
| South Bucks | | | | | 38 | 29 | | 19 | | 10 | | | 14 | 7 | | 25 | 11 | 153 |
| West Oxfordshire | | | 30 | | | | | | 28 | 5 | | 22 | 53 | | | | | 138 |
| Chiltern | 47 | | | | 45 | | | | | | | | 8 | | | 12 | 20 | 132 |
| **TV Total** | **253** | **0** | **242** | **299** | **491** | **480** | **93** | **837** | **186** | **136** | **464** | **192** | **653** | **186** | **175** | **711** | **326** | **5,723** |

Secondly, the calculated excess in these tables includes higher than expected volumes wherever there is an individual with multiple admissions, i.e. use the table as a maximum indication of likely reductions in elective admission due to bringing all acute site and GP thresholds to the TV average. Chapters T (Mental Health), P (Diseases of Childhood) and to a much lesser extent R (Spinal Conditions) experience the most multiple admissions. For Chapter T such multiple admissions account for around 100 of the calculated 300 'excess' and occurred mainly in Berkshire West and Buckinghamshire. For Chapter P multiple admissions account for around 350 of the calculated 650 excess (of which 40% occur at the ORH) while for Chapter R they account for 60 of the calculated 170 excess. Commissioners are therefore advised to run standard reports which list multiple elective admissions for a single individual.

Lastly all numbers in the two tables have been adjusted for the effect of lower day case rates in each HRG chapter at particular sites and hence in particular PCTs. This adjustment is explained below.

Note that some 8% of the 'excess' admissions occur at acute sites which are outside of TV. Commissioners are less likely to have direct influence over acute site admission thresholds but may be able to influence the relative volume of GP referrals and also to re-direct the flow of patients to sites with lower relative levels of admission.

## Correcting for Day Case Rates

Acute sites with a lower than expected day case rates will have higher than expected volumes of overnight elective admissions. This can be corrected for by calculating the volume of excess overnight stays at each site or PCT due to day case rates and then adjusting the observed 'excess' to account for this factor.

Actual and expected day case rates were obtained from the Performance Investigator data reporting tool. The analysis was restricted to TV residents seen at various acute sites or to TV PCTs. The expected day case rate was adjusted for age, sex and case mix. The resulting number of higher than expected overnight stays was then calculated for each acute site or PCT.

All numbers in Tables Five and Six have been adjusted for these effects. It must be pointed out that these adjustments are case mix sensitive will become increasingly inaccurate if very high volumes of a single HRG dominate the chapter. These inaccuracies account for the mismatch in total 'excess' seen between the two tables. Numbers in each table are indicative only and are meant to be the starting point for further investigation as to which HRG make up the excess.

Recall that the 'excess' is relative to the TV average. Hence if one site has a large excess then this will have inflated the TV average.

## Appendix One: Population characteristics influencing the volume of overnight elective 'admissions'

The coefficients in this table were used to calculate the TV average volume expected due to population characteristics. The basic unit is the age adjusted national average (NA) which has been calculated for each LSOA.

Expected volume for each LSOA = NA x (Intercept + A x IMD + B x % Asian + C x % Black + D x % Student)

The volume of 'excess' admissions relative to the TV average was then calculated for each LSOA and these were then aggregated to Ward, Local Authority and PCT.

| HRG Chapter | Intercept (I) | IMD (A) | Asian (B) | Black (C) | Student (D) |
|---|---|---|---|---|---|
| A Nervous System | 0.146 | 0.002 | | | -0.003 |
| B Eyes & Periorbita | 0.101 | 0.001 | 0.002 | 0.004 | |
| C Mouth, Nose & Ears | 0.209 | 0.004 | 0.001 | 0.004 | -0.003 |
| D Respiratory | 0.296 | 0.004 | | | |
| E Cardiac | 0.335 | 0.002 | 0.004 | | -0.001 |
| F Digestive | 0.113 | 0.001 | | | -0.002 |
| G Hepato-biliary & Pancreatic | 0.358 | 0.009 | 0.005 | 0.010 | -0.015 |
| H Musculoskeletal | 0.383 | 0.004 | | | -0.006 |
| J Skin, Breast & Burns | 0.182 | 0.001 | | | -0.002 |
| K Endocrine & Metabolic | 0.260 | 0.001 | 0.003 | 0.006 | 0.002 |
| L Urinary Tract & Male Reproductive | 0.122 | 0.002 | | | -0.002 |
| M Female Reproductive | 0.224 | 0.004 | | | -0.004 |
| P Childhood | 0.058 | 0.001 | 0.001 | 0.002 | -0.001 |
| Q Vascular | 0.324 | 0.008 | | | -0.007 |
| R Spinal | 0.565 | 0.004 | | | -0.009 |
| S Haematology, Poisoning & Non-specific groups | 0.085 | 0.001 | | | -0.002 |
| T Mental Health | 0.013 | 0.008 | 0.003 | 0.008 | 0.003 |

The value of the intercept is effectively the TV expected proportion of national average (ON + DC) for a hypothetical LSOA where IMD, %Asian, %Black and %Student are all zero. Very high values for the intercept tend to indicate that overall access rates in TV may be unduly high (as per Chapters R and H) while very low values of the intercept tend to indicate far higher levels of events counted as 'elective' admission outside of TV (as per Chapters T & P).

Note that in most cases the values of the coefficients relating to the population are very low indicating that for elective overnight admission it is the age profile which on the whole drives the rates of admission.