

Annexure D: Interpretation of the DIN scores applied to REF submissions

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Summary

Medical schemes submit REF Grids with age, chronic diseases (CDLs), HIV and maternity information to the Council for Medical Schemes on a quarterly basis for the purpose of the Risk Equalisation Fund shadow process. REF Grids allow schemes to present their data in a consolidated format. Seven quarters (21 months) of consolidated data has been collected since the beginning of the REF Shadow process in 2005.

After the cut-off date for a quarter's submission, DIN scores are calculated for each scheme as an aid to estimate the quality of data submitted. The scores are based on the deviations from the expected industry profile and the Statutory Returns data for the same period. The expected prevalence and count of chronic diseases, maternity and HIV cases per thousand beneficiaries are published with the REF Contribution Table on the CMS website. The CMS has created "tolerance bands" around the expected count values, and the deviation is measured between reported values and the upper or lower limits of these tolerance bands. These deviations are used in the calculation of DIN scores for total chronic diseases, multiple chronic diseases, maternity, HIV and NON-cases.

Statutory Returns data is used to measure the reasonableness of the number of beneficiaries in the below one age band, number of beneficiaries in the 85 plus age band and the total data submitted in the REF grids.

Deviational scores are calculated for each of the following eight items, while the overall score is based on a weighted average of these:

1. Degree of correlation between REF submissions and the Statutory Returns data in all the reported age bands (ScoreData)
2. Changes in number of beneficiaries in the age 85+ age category (Score85plus)
3. Changes in number of beneficiaries in the under 1 year age category (ScoreUnder1)
4. Number of maternity cases submitted (Score MAT)
5. The number of beneficiaries without any chronic diseases submitted (ScoreNON)
6. The number of HIV cases submitted (ScoreHIV)

7. Chronic diseases in line with known prevalence and age-profile information (ScoreCDL)
8. Multiple chronic diseases in relation to the expected for this age profile (ScoreCC)
9. The Overall DIN score is calculated by finding a weighted average of the above eight data quality items. The weights used are described in section 2.9.1 on page 65.

The purpose of this report is to demonstrate the progress made in improving the quality of data and to identify areas that are still lagging behind, Table 24 below displays the median scores for all schemes at the end of Q4 2005, Q1 2006 and Q2 2006. Note that, given certain limitations, high scores are indicative of data submissions with large deviations from expected values.

Table 24: DIN scores for REF submissions by quarter

<i>Test</i>	<i>Median Score⁹</i>		
	Quarter 4 2005	Quarter 1 2006	Quarter 2 2006
<i>ScoreData</i>	5,18	2,68	3,20
<i>Score85plus</i>	2,68	1,21	1,48
<i>ScoreUnder1</i>	2,13	1,37	1,67
<i>ScoreMAT</i>	1,87	1,99	1,74
<i>ScoreNON</i>	6,09	4,88	5,06
<i>ScoreHIV</i>	5,01	5,08	5,00
<i>ScoreCDL</i>	6,49	6,26	6,32
<i>ScoreCC</i>	6,25	4,99	4,77
<i>ScoreOverall</i>	4,30	3,48	3,42

Schemes will also be able to see how they compare to other schemes. Schemes are also encouraged to ascertain that the reported deviations are valid, and to communicate with the office in instances where the assigned scores is not a true reflection of the scheme's perceived data quality.

⁹ Note that Table 24 displays the median scores for all schemes, including discontinued schemes and therefore the numbers presented here differ slightly from the numbers presented in Table 6 on page 8.

1 Introduction

1.1 Purpose of DIN Scores

The purpose of automated DIN scores is to quantify the deviation of reported data from expected industry profiles and Statutory Returns data. The scores range from zero to ten; zero indicating no deviation from the upper or lower limits of the expected values, and ten indicating data with large deviations. The automated DIN scores will be useful in flagging schemes for more detailed analysis. The scores are also used as an indicator for data quality improvement.

1.2 Automated DIN scores developed

After calculating the DIN scores, these scores were checked manually for each scheme by at least two analysts to ensure that they correctly describe scheme's perceived data quality. In most instances, the scores were found to be useful and consistent with the quality of reported data. Submissions with fewer data problems were correctly assigned low scores and high scores were given to submissions with many data problems. It must however be noted that the scores reflect deviation from industry norms, or deviation from statutory returns, which may in some instances be a true reflection of a scheme's risk and is not in all instances indicative of poor data quality.

1.3 Publication of scheme specific information on the website

Scheme specific automated DIN scores will be published on the council website. The scheme with the lowest value has the best DIN scores.

The benchmark used in the calculation of these scores is available on the council website (www.medicalschemes.com, under REF Reports). To calculate DIN scores for 2005, the assumed grid count values were used as expected values around which "tolerance bands" were created published in the Contribution Table 2005 v7Feb2005, while REF Contribution Table 2006 vFinal (See Figure 23 page 52) provides the assumed count values for 2006 calculations. Note that maternity rates in the table are *annual* rates.

Figure 22: REF Contribution Table 2005 v7Feb2005

REF Contribution Table 2005											
Industry Assumptions											
the cell for the period, per 1,000 exposed											
Base Period: HIV/AIDS 2005, other diseases 2002											
used in the calculation of the REF Contribution Table is not prevalence of the disease. It is arrived at by taking the most severe disease combination. It can NOT be compared directly to prevalences in published medical literature.											
Variables in each age band in the Scheme											
Chronic Disease											
AST	BCE	BMD	CHF	CMY	COP	CRF	CSD	DBI	DM1	DM2	DY
3	4	5	6	7	8	9	10	11	12	13	14
8.7	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
22.4	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.0
25.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
18.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
11.5	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	1.1	0.1	0.0
8.7	0.0	0.9	0.1	0.0	0.0	0.1	0.2	0.0	1.6	0.3	0.0
9.8	0.0	1.3	0.1	0.1	0.1	0.1	0.3	0.1	1.7	0.7	0.0
11.1	0.0	1.2	0.2	0.1	0.1	0.2	0.3	0.1	2.2	1.7	0.0
12.4	0.0	1.3	0.5	0.3	0.3	0.3	0.3	0.1	3.2	3.8	0.0

Figure 23: REF Contribution Table 2006 vFinal

REF Contribution Table 2006											
Industry Assumptions											
in the cell for the period, per 1,000 exposed											
Base Period: HIV/AIDS expected in 2006, all other diseases from REF Grids Q3 2005											
used in the calculation of the Expected Industry REF Community Rate is not prevalence of the disease. It is arrived at by taking the most severe disease combination. It can NOT be compared directly to prevalences in published medical literature.											
Variables in each age band in the Scheme											
Chronic Disease											
AST	BCE	BMD	CHF	CMY	COP	CRF	CSD	DBI	DM1	DM2	DY
3	4	5	6	7	8	9	10	11	12	13	14
5.624	0.022	0.000	0.076	0.043	0.087	0.076	0.000	0.011	0.043	0.000	0.000
23.412	0.004	0.004	0.081	0.016	0.063	0.043	0.004	0.004	0.275	0.004	0.004
32.657	0.015	0.053	0.077	0.022	0.071	0.087	0.003	0.012	0.724	0.040	0.040
26.368	0.024	0.124	0.050	0.009	0.050	0.094	0.015	0.018	1.090	0.094	0.094
17.831	0.015	0.453	0.077	0.034	0.028	0.120	0.083	0.015	1.443	0.231	0.231
11.769	0.021	0.911	0.076	0.055	0.055	0.227	0.181	0.029	1.957	0.411	0.411
10.405	0.007	1.110	0.100	0.093	0.091	0.285	0.374	0.022	2.264	1.077	1.077
12.343	0.012	1.213	0.204	0.166	0.125	0.338	0.408	0.020	2.697	2.207	2.207
14.649	0.021	1.375	0.505	0.248	0.230	0.433	0.415	0.024	3.472	4.853	4.853

2 Description of the respective DIN scores

2.1 Degree of correlation between REF submissions and Statutory Returns data in all the reported age bands (ScoreData)

2.1.1 Definition

This DIN test measures the degree of correlation between scheme's REF submissions and the Statutory Returns data. It is expected that the ratio of beneficiaries in each age category to the total number of beneficiaries in a scheme should be the same in both the REF and Statutory Returns submissions for the same reporting period.

The ratio of beneficiaries in each age band to the total number of beneficiaries in a scheme is calculated for REF and Statutory Returns data. The REF ratio is divided by the Statutory Returns ratio and then multiplied by 100; the absolute difference between the product and 100 is calculated to find the "percentage deviation" from the expected value (Statutory Returns submission) for each age band. The ScoreData (Degree of correlation between REF submissions and Statutory Returns data in all the reported age bands) score is arrived by finding the cube root of the sum of all "percentage deviations". The score will be zero where the ratio of beneficiaries in each age band to the total number of beneficiaries in a scheme is the same. The score will be high (max 10) if there are major differences in the ratio of beneficiaries in each age band to the total number of beneficiaries between REF and Statutory Returns. The following mathematical steps are taken in the calculation of the ScoreData:

Step 1: Calculate for each age band ($i = 1, \dots, 19$) the following deviation:

$$\text{Age band Deviation} = \text{Absolute}((\text{REF Age Band } X_i) / (\text{REF Total}) / (\text{SR Age Band } X_i) / (\text{SR Total}) * 100 - 100)$$

Step 2: Calculate the sum of the deviations:

$$\text{Sum}(\text{Age band Deviation}_{\text{Under1}}, \text{Age band Deviation}_{1\text{to}4}, \dots, \text{Age band Deviation}_{85\text{plus}})$$

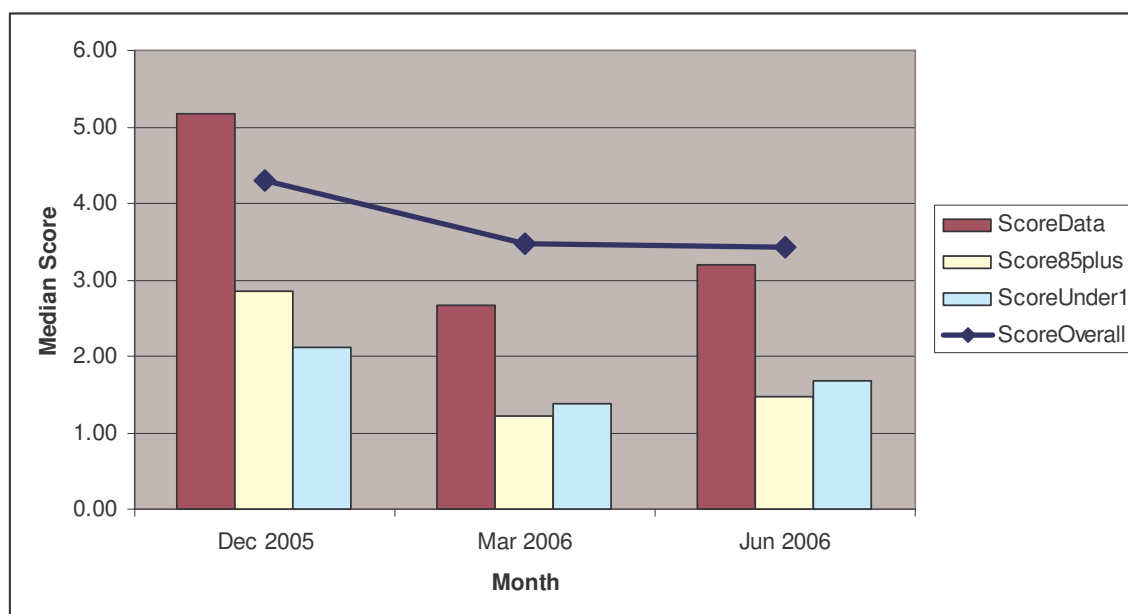
Step 3: Take the cube root of the sum of the deviations

$$\text{ScoreData} = (\text{Sum of all age bands deviations})^{1/3}$$

2.1.2 Median ScoreData by end of quarter month

The correlation between the age distributions as described in the REF returns, and the age distribution described in the statutory returns, has improved from December 2005 to June 2006 (Figure 24 below). Note that statutory returns data does not include age band breakdowns for the first two months of each quarter; in this calculation the REF submissions are compared against the statutory returns for the last month of the particular quarter only. The gap between REF and Statutory returns ratios is narrowing. Major differences of age distributions between REF and Statutory Returns data should not occur. It is expected that the two data sets should be similar because the reporting period and age-band definitions for REF and Statutory Returns are the same.

Figure 24: Median DIN scores for all schemes indicating the degree of correlation between REF Grids and Statutory Returns submission for Dec 2005, Mar 2006 and Jun 2006.



2.2 Number of beneficiaries in the 85+ Age category (Score85plus)

2.2.1 Definition

This score estimates deviations in the number of beneficiaries in the 85+ age category. It is expected that the ratio of beneficiaries in the 85+-age category to the total number of beneficiaries in a scheme should be the same in both the REF and SR submissions. A percentage of the two ratios are calculated to estimate the level of correlation. The score is obtained by finding a cube root of the percentage difference between the resulting and the expected percentage (100%). If the ratios in both the REF and SR datasets are the same, the score will be zero. The score gets worse as the difference between the ratios in the two data sets increases. This score can only be directly calculated for the last month of the each quarter, for the other months of the quarter, Statutory Returns end-of-quarter age analysis data is used.

The following mathematical steps are taken in the calculation of the Score85plus:

Step 1: Calculate the following deviation

$$\text{Age band Deviation} = \text{Absolute}((\text{REF Age Band 85plus})/(\text{REF Total})/ (\text{SR Age Band 85plus})/(\text{SR Total}) * 100 - 100)$$

Step 2: Calculate the cube root of the deviation

$$\text{Score85Plus} = (\text{Age band Deviation}_{85Plus})^{1/3}$$

2.2.2 Median Score85Plus by end of quarter month

Figure 24 on page 55 shows that the degree of correlation between number of beneficiaries in the 85plus age band for REF submissions and Statutory Returns has improved markedly from December 2005 to June 2006. The average score dropped from 2,9 in December 2005 to 1,5 in June 2006. The score for March 2006 (1,2) was the best in quarters 1, 2 and 3. The score of 1,2 for March translates to less than 2 per cent under or over reporting of REF data in the 85plus age category.

2.3 Variation in the number of beneficiaries in the under 1 year age category (ScoreUnder1)

2.3.1 Definition

This score estimates changes in the number of beneficiaries in the below 1 year age category. The ratio of beneficiaries in the below 1 year age category to the total number of beneficiaries in a scheme should be the same in both the REF and SR submissions. A percentage of the two ratios are calculated to estimate the level of correlation. The score is obtained by finding a cube root of the percentage difference between the resulting and the expected percentage (100%). If the ratios in both the REF and SR datasets are the same, the score will be zero. The score gets worse as the difference between the ratios in the two data sets increases.

The following steps are taken in the calculation of the ScoreUnder1:

Step 1: Calculate the following deviation

$$\text{Age band Deviation} = \text{Absolute}((\text{REF Age Band Under 1}) / (\text{REF Total}) / (\text{SR Age Band Under 1}) / (\text{SR Total}) * 100 - 100)$$

Step 2: Calculate the cube root of the deviation

$$\text{ScoreUnder1} = (\text{Age band Deviation}_{\text{Under 1}})^{1/3}$$

2.3.2 Median “ScoreUnder1 by end of quarter month

The degree of correlation between number of beneficiaries in the below 1 age band for REF submissions and Statutory Returns has improved to some extent from Quarter 4 2005 to Quarter 2 2006. A score of 2,1 was attained in December 2005 and 1,7 in June 2006. (Figure 24 on page 55)

2.4 Maternity cases score

2.4.1 Definition

The maternity cases score measures the reasonableness of maternity cases submitted against the expected industry profile for the scheme. The final score is obtained by finding an average of scores in a) and b) below:

- a) A percentage of total observed (REF) to the total expected maternity cases is calculated in equation 1. The score is obtained by finding a cube root of the percentage point difference between the resulting and the expected percentage (100%). If totals in both the reported and expected totals are equal, the score will be zero.

The following mathematical steps are taken in the first part of the maternity score:

$$ScoreMat1 = Absolute \left[\frac{Total\ Observed\ Mat}{Total\ Expected\ Mat} * 100 - 100 \right]^{1/3} \quad (1)$$

- b) If the reported data for each age bands is within the expected range (within “tolerance bands”), a score of zero is given. If not, the score is calculated by finding the cube root of the sum of percentage deviations from upper or lower limits (assumed deviation from expected values) of reported data for each age band. A deviation of zero given if the expected and reported cases are less than ten in an age band. A score, which is greater than zero, indicates that the reported cases are less than the lower limit or higher than the upper limit.

The following mathematical steps are taken in the calculation of the second and final part of the maternity score:

Step 1: Calculate the upper or lower deviations per age band

$$MAT\ Age\ band\ Deviation\ Age\ X_i =$$

$$Absolute\ ((REF\ MAT\ Age\ X_i) / (Upper\ Exp.\ MAT\ Age\ X_i) * 100 - 100)$$

OR

$$Absolute\ ((REF\ MAT\ Age\ X_i) / (Lower\ Exp.\ MAT\ Age\ X_i) * 100 - 100)$$

Step 2: Calculate the sum of the deviations

$$Sum(MAT\ Deviation_{Under1}, MAT\ Deviation_{1to4}, \dots, MAT\ Deviation_{85plus})$$

Step 3: Calculate the cube root of the sum of the deviations

$$ScoreMAT2 = (Sum\ of\ all\ age\ bands\ deviation)^{1/3}$$

Step 4: Calculate the average of the two scores

$$ScoreMAT = (ScoreMAT1 + ScoreMAT2)/2$$

2.4.2 Median ScoreMAT by month

The median maternity score has remained under two from October 2005 to June 2006 showing little or no improvement (Figure 25: Average score for the number of maternity cases submitted).

Table 25 below shows that there has been a decrease in the number of schemes that report maternity data with scores of zero (perfect maternity data) and scores of two or under. There has been a slight increase in the number of schemes that have scores of four or more, indicative of an increased deviation from the industry norm over the period.

Figure 25: Average score for the number of maternity cases submitted

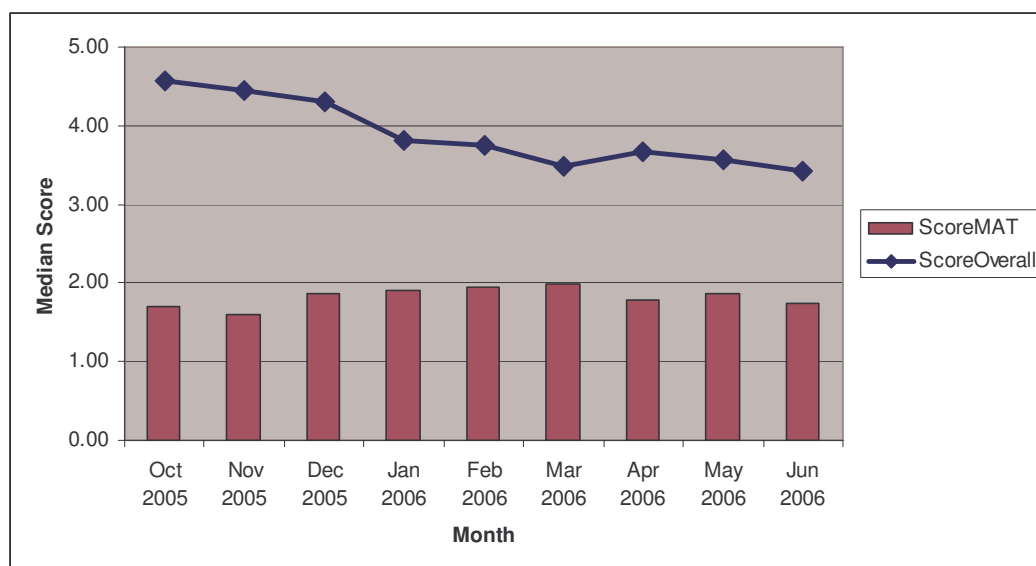


Table 25: Distribution of maternity scores for period October 2005 to June 2006

ScoreMAT	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06
0	20,0%	20,0%	20,8%	20,3%	21,9%	17,2%	16,5%	18,1%	17,3%
>0 – 2	43,1%	48,5%	39,2%	33,6%	30,5%	35,9%	37,0%	37,8%	38,6%
>2 – 4	8,5%	8,5%	7,7%	11,7%	10,9%	11,7%	8,7%	14,2%	9,4%
>4 – 6	8,5%	8,5%	7,7%	11,7%	10,9%	11,7%	8,7%	14,2%	9,4%
More than 6	3,1%	3,8%	5,4%	6,3%	5,5%	6,3%	5,5%	5,5%	4,7%

2.5 NON cases submitted

2.5.1 Definition

The NON-cases score measures the reasonableness of number of beneficiaries without any chronic diseases submitted against the expected industry profile for the scheme. The final score is obtained by finding an average of scores in a) and b) below:

- a) A percentage of the total reported to the total expected NON-cases is calculated.
The score is obtained by finding a cube root of the percentage point difference

between the resulting and the expected percentage (100%). If totals in both the reported and expected totals are equal, the score will be zero.

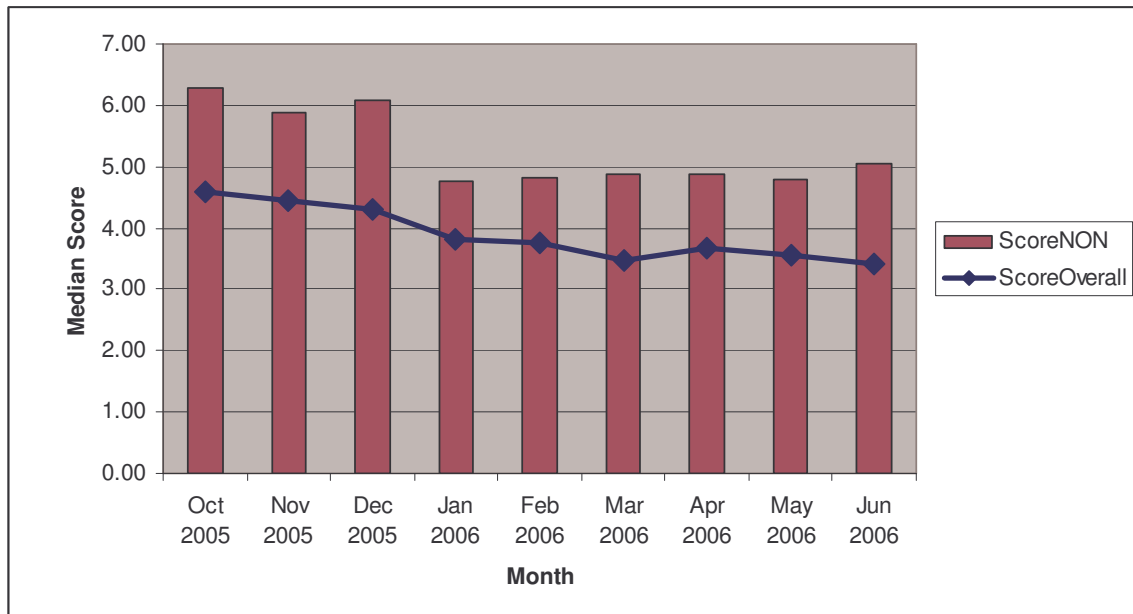
- b) If the reported data for each age bands is within the expected range, a score of zero is given. If not, the score is calculated by finding the cube root of the sum of percentage deviations from upper or lower limits (assumed deviation from expected values) of reported data for each age band. A deviation of zero given if the expected and reported cases are less than ten in an age band. A score, which is greater than zero, indicates that the reported cases are less than the lower limit or higher than the upper limit.

The calculation is the same as for maternity.

2.5.2 Median ScoreNON by month

The median DIN score for the number of NON-cases submitted has significantly decreased from 6,2 in December 2005 to 5,0 in June 2006.

Figure 26: Average score for the number of beneficiaries without any chronic condition



2.6 HIV cases submitted

2.6.1 Definition

The HIV cases score measures the reasonableness of HIV cases submitted against the expected industry profile for the scheme. The final score is obtained by finding an average of scores in a) and b) below:

- a) A percentage of the total reported to the total expected HIV cases is calculated. The score is obtained by finding a cube root of the percentage point difference between the resulting and the expected percentage (100%). If totals in both the reported and expected totals are equal, the score will be zero.
- b) If the reported data for each age bands is within the expected range, a score of zero is given. If not, the score is calculated by finding the cube root of the sum of

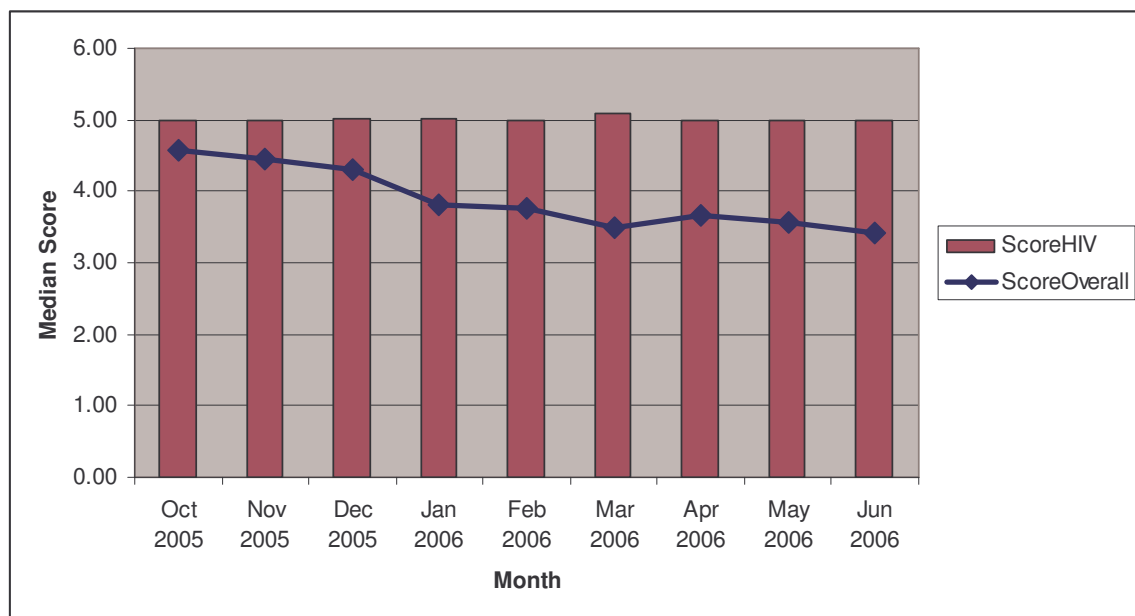
percentage deviations from upper or lower limits (assumed deviation from expected values) of reported data for each age band. A deviation of zero given if the expected and reported cases are less than ten in an age band. A score that is greater than zero indicates that the reported cases are less than the lower limit or higher than the upper limit.

The calculation is the same as for Maternity.

2.6.2 Median DIN scores for HIV

The median score for the number of HIV cases submitted has remained high (median score of +5) and stable over the three quarters.

Figure 27: Median score for the number of HIV cases submitted



2.7 Total CDL count

2.7.1 Definition

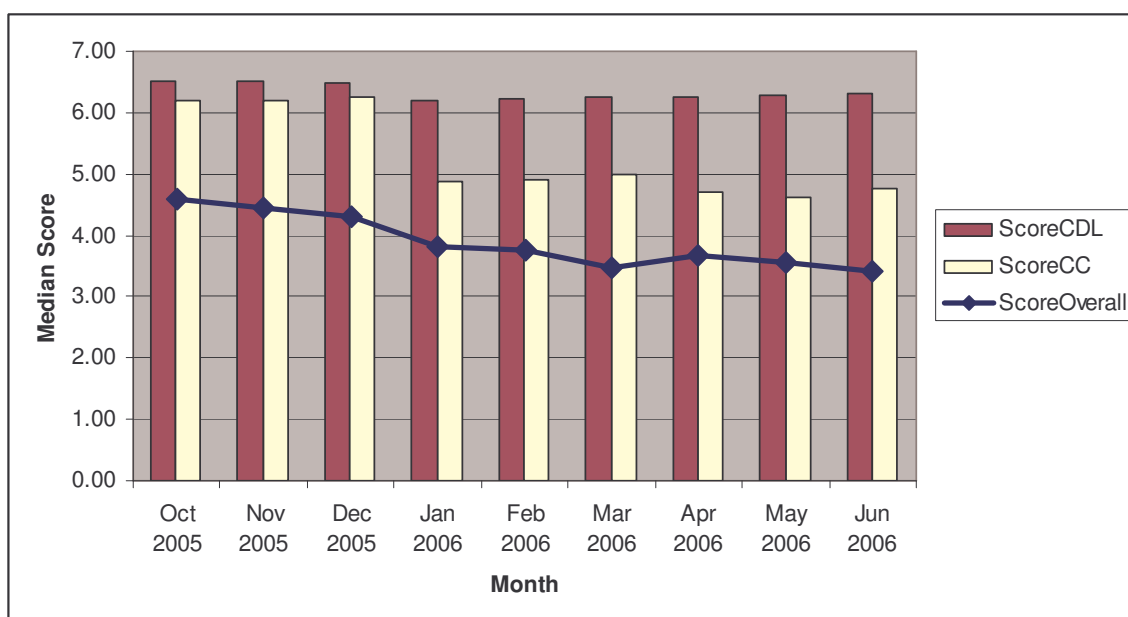
The Total CDL cases score measures the reasonableness of the total chronic diseases against the known prevalence and age-profile information. The final score is obtained by finding an average of scores in a) and b) below:

- a) A percentage of the total reported to the total expected CDL cases is calculated. The score is obtained by finding a cube root of the percentage point difference between the resulting and the expected percentage (100%). If totals in both the reported and expected totals are equal, the score will be zero.
- b) If the reported data for each age bands for each CDL is within the expected range, a score of zero is given. If not, the score is calculated by finding the cube root of the sum of percentage deviations from upper or lower limits (assumed deviation from expected values) of reported data for each age band. The total deviation is calculated by finding the sum of all CDLs deviations. A deviation of zero given if the expected and reported cases are less than ten in an age band. A score, which is greater than zero, indicates that the reported cases are less than the lower limit or higher than the upper limit.

2.7.2 Median ScoreCDL by month

The median score for the number of CDL cases submitted has decreased slightly from 6,5 in December 2006 to 6,3 in June 2006 (Figure 28, page 63). The decrease can be attributed to the fact that schemes have started using the entry and verification criteria in quarter 1 2006 data submissions.

Figure 28: Median score for the total number of CDL cases submitted



2.8 Multiple CDL count

2.8.1 Definition

The multiple CDL count score measures the reasonableness of the total multiple chronic diseases against the known prevalence and age-profile information. The final score is obtained by finding an average of scores in a) and b) below:

- a) A percentage of total reported to the total expected multiple CDL cases is calculated. The score is obtained by finding a cube root of the percentage point difference between the resulting and the expected percentage (100%). If totals in both the reported and expected totals are equal, the score will be zero.
- b) If the reported data for each age bands for each multiple CDL is within the expected range, a score of zero is given. If not, the score is calculated by finding the cube root of the sum of percentage deviations from upper or lower limits (assumed deviation from expected values) of reported data for each age band. . The total deviation is calculated by finding the sum of CC2, CC3 and CC4 deviations. A deviation of zero given if the expected and reported cases are less than ten in an age band. A score, which is greater than zero, indicates that the reported cases are less than the lower limit or higher than the upper limit.

2.8.2 Median ScoreCC by month

Figure 28 on page 63 shows that the median score for the number of multiple CDL cases submitted has significantly decreased from 6,2 in December 2005 to 4,7 in June 2006. The decrease is indicative of the application of the entry and verification criteria by some of the schemes in quarter 1 2006 submissions.

2.9 Overall DIN score (ScoreOverall)

2.9.1 Definition

ScoreOverall is the weighted average of all computed scores. The following weights were used:

- ScoreData (20)
- Score85Plus (10)
- ScoreUnder1 (10)
- ScoreMAT (20)
- ScoreNON (15)
- ScoreHIV (5)
- ScoreCDL (10)
- ScoreCC (10)

The score ranges from zero to 10. A score of zero indicates a perfect data set, and a score of 10 indicates a data set with many problems.

2.9.2 Median ScoreOverall by month

The median ScoreOverall improved from 4,6 in October 2005 to 3,4 in June 2006. The decrease in the overall score is mainly driven by the improvement in the CDL and multiple CDL data. (Figure 28, page 63)