Utilisation of pathology procedures in the South African private pathology sector between 2003 and 2005

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Objective. To analyse the patterns of pathology procedures performed in the private pathology sector in South Africa. To determine what the differences between the individual practices are and to attempt to explain any differences.

Design. A retrospective analysis of claims from pathology laboratories submitted by electronic interface to a medical aid administrator between January 2003 up to December 2005 were analysed. The data were sorted according to the practice number of the pathology laboratory and referring doctor, account number, laboratory number, beneficiary number and the origin of the claim (in hospital or out of hospital). The number of claims for every procedure was compared across different laboratories.

Results. Sufficient data were available on 5.4 million claim lines over the 3-year period (92% of the total lines submitted over the period). The total amount claimed increased by 2.5% and 9.9%, the number of test procedures increased by 1.4% and 17.7%, and the number of accounts increased by 4.8% and 0.9% in 2004 and 2005 respectively. These increases occurred despite a decrease in active beneficiaries of 1.6% and 4.0% in 2004 and 2005. The average cost per active beneficiary per month varied between R494 and R611 in 2005. A relatively few common test procedures (30) contributed disproportionately to the total number of procedures (67.8%) and cost (56.9%) of laboratory testing. The utilisation of individual procedures varied between laboratories with large differences in the performance of common tests such as erythrocyte sedimentation rate, reticulocyte count, protein electrophoresis and creatinine.

Conclusion. The differences in the cost of pathology claims between individual laboratories were larger than expected. There was evidence of inappropriate test utilisation. Part of the differences between laboratories under control of the laboratories and are a result of request form design, test profile content and reflexing of tests.

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Private health care in South Africa is largely funded by medical schemes that derive their funds from contributions by members of the public and/or their employers. In 2004 contributions to medical schemes amounted to R51.3 billion.[1] Medical specialists accounted for 16% (R8.21 billion) of the annual distribution of this sum and pathology laboratories were estimated to account for 28% of payments to medical specialists (R2.30 billion or 4.5% of total contributions).

In the search for better management of health care expenditure it is not surprising that health care administrators are also focusing on laboratory expenditure. This focus is not unique to South Africa and concern over inappropriate laboratory test utilisation has been expressed elsewhere.[2,3] The magnitude of excessive test utilisation has been estimated by some authors[4,5] to range between 20% and 95% of tests ordered, with a pathologist in one article[6] estimating that 26.5% of tests were excessive. Apart from the economic impact on patients and medical schemes, there is legitimate concern about the detrimental clinical impact of over-investigation resulting in the Ulysses syndrome.[7]

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A review of the literature failed to reveal any published articles on the utilisation of laboratory procedures in South Africa. This study was undertaken to assess the patterns of test utilisation in the private health care sector where a fee-for-service reimbursement model is in place.

Methods

Accounts submitted with electronic data interface from pathology laboratories to a medical scheme for payment, were collected for a 3-year period between January 2003 and December 2005. Each line represented a claim for a procedure (laboratory test) as defined in the National Health Reference Price List (NHRPL) as published by the Board of Healthcare Funders and subsequently the Council for Medical Schemes. Each line contained information on the beneficiary (unique number only), referring medical practitioner (practice number), pathology laboratory (practice number), service date, account number, laboratory number, NHRPL code, description of the procedure, price of the procedure and location of the patient (in hospital v. out of hospital).

Duplicate claims and claims where information was incomplete were excluded from further analysis. Pathology laboratories that were not in operation for at least 90% of the duration of the study were excluded as well as a number of small laboratories (less than 1% market share individually) or laboratories that did not provide a service in all the disciplines

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of clinical pathology (histopathology- or cytology-only laboratories).

Descriptive statistics were calculated for each individual laboratory to express the cost per episode. An episode was defined as all the procedures on an account and could consist of multiple laboratory numbers (specimens) over a period of time. An alternative definition of an episode is all the procedures on a beneficiary (patient) in a calendar month. These beneficiaries are subsequently called 'active beneficiaries' in this document. The frequency of individual test procedure utilisation was established on the data from 2005 as nonspecific technology-related codes were commonly utilised for C-reactive protein and haemoglobin A1c before 2005. The most common test procedures were identified and utilisation patterns for the individual laboratories for these specific procedures were further analysed.

Results

Sufficient data were available on 5 434 709 claim lines over the 3-year period (92% of the total number of lines submitted over the period). This represented 826 811 accounts and 580 277 active beneficiaries. The data originated from 6 pathology laboratories as identified by the unique practice numbers on the accounts. The laboratories are identified as A - F in the text, tables and figures.

The total amount claimed by the laboratories increased by 2.5% and 9.9% over the preceding year in 2004 and 2005 respectively. Over the same period the number of test procedures increased by 1.4% and 17.7% respectively, while the number of accounts increased by 4.8% and 0.9% respectively. These increases occurred despite a decrease in the number of active beneficiaries of 1.6% and 4.0% in 2004 and 2005.

The cost and number of test procedures per episode are given in Table I and Fig. 1. Between 2004 and 2005 the average cost of a test procedure declined by 6.6%, but the number of test procedures per active beneficiary increased by 22.7%, with the result that the cost per active beneficiary increased by 14.5%.

Laboratories C, D and E followed a pattern of decreased average cost per test procedure, but with more test procedures per active beneficiary (and per account) resulting in an increased cost per active beneficiary. Laboratories A and B revealed a contrary trend, with an increased average cost per test procedure and a small increase (laboratory A) or decrease (laboratory B) in the number of test procedures but with a similar trend in the average cost per active beneficiary. Laboratory F was the only laboratory that showed a decrease in average cost per active beneficiary in 2005. Laboratory F stopped trading as a separate entity towards the end of 2005. The range of the average cost per test procedure increased from R6.39 in 2003 to R28.67 in 2005. This increase in range reflects the opposing trends of decreasing and increasing average test costs. From Fig. 1 it is apparent that in laboratories E and F this

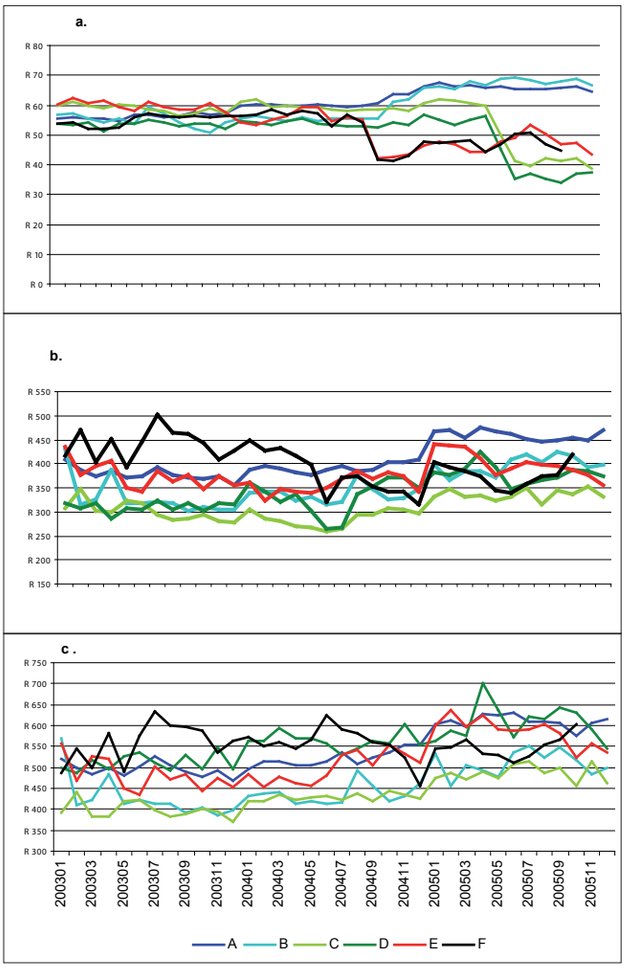

Fig. 1. Comparison between laboratories with regard to: (a) average cost of test procedures; (b) average cost of accounts; and (c) average cost per beneficiary who underwent pathology procedures in a calendar month.

occurred abruptly in September 2004, while in laboratories C and D a change occurred in June 2005.

The cost per active beneficiary per month ranged between R494.21 and R611.55 in 2005, with a difference of R117.34. The maximum difference in 2004 was R139.54, while in 2003 it was R112.40. Laboratory C consistently provided the lowest cost per active beneficiary over the period.

The relative frequency with which individual procedures were performed is represented in Table II. A total of 643 NHRPL procedure codes are potentially available for billing pathology procedures. The 10 most frequently requested tests represented 36.3% of all tests and contributed to 27.4% of all pathology expenditure. The corresponding figures for the top 30 tests are 67.8% and 56.8% respectively. The top 50 tests represented 81.5% of all procedures and 73.6% of pathology expenditure (data not shown). The tests represented in Table II are common, low-complexity procedures that are performed in bulk, mostly on automated laboratory instruments.

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Table I. Cost and activity parameters for laboratories in 2003, 2004 and 2005 (%2004 indicates the percentage difference with 2003 as a baseline, %2005 indicates the percentage difference with 2004 as a baseline)

	2003	2004	2005	%2004	%2005
Average cost/test					
Lab A	R56.18	R60.53	R63.41	7.7	4.8
Lab B	R55.13	R56.41	R70.36	2.3	24.7
Lab C	R58.86	R59.21	R46.59	0.6	-21.3
Lab D	R53.51	R53.84	R41.69	0.6	-22.6
Lab E	R59.90	R52.29	R45.72	-12.7	-12.6
Lab F	R54.87	R52.02	R45.40	-5.2	-12.7
Combined	R56.62	R57.22	R53.43	1.1	-6.6
Average cost/account					
Lab A	R378.91	R391.68	R426.88	3.4	9.0
Lab B	R330.19	R336.68	R399.19	2.0	18.6
Lab C	R300.78	R285.72	R321.36	-5.0	12.5
Lab D	R310.11	R328.32	R360.29	5.9	9.7
Lab E	R397.94	R355.16	R383.46	-10.8	8.0
Lab F	R440.32	R373.66	R348.29	-15.1	-6.8
Combined	R360.19	R352.31	R383.90	-3.3	8.5
Average number of tests/account					
Lab A	6.7	6.5	6.7	-4.1	4.0
Lab B	6.0	6.0	5.7	-0.4	-4.9
Lab C	5.1	4.8	6.9	-5.6	42.9
Lab D	5.8	6.1	8.6	5.2	41.7
Lab E	6.6	6.8	8.4	2.2	23.5
Lab F	8.0	7.2	7.7	-10.5	6.8
Combined	6.4	6.2	7.2	-2.2	19.0
Average cost/active beneficiary/month					
Lab A	R495.68	R521.17	R611.55	5.1	17.3
Lab B	R428.01	R438.48	R523.46	2.4	19.4
Lab C	R398.24	R429.47	R494.21	7.8	15.1
Lab D	R510.64	R569.01	R608.32	11.4	6.9
Lab E	R508.16	R491.74	R591.30	-3.2	20.2
Lab F	R558.11	R560.03	R549.47	0.3	-1.9
Combined	R480.97	R500.93	R573.79	4.1	14.5
Average number of tests/active beneficiary/month					
Lab A	8.82	8.61	9.64	-2.4	12.0
Lab B	7.76	7.77	7.44	0.1	-4.2
Lab C	6.77	7.25	10.61	7.1	46.3
Lab D	9.54	10.57	14.59	10.8	38.0
Lab E	8.48	9.4	12.93	10.8	37.6
Lab F	10.17	10.77	12.10	5.9	12.3
Combined	8.50	8.75	10.74	2.9	22.7

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Table II. The 30 most frequently performed pathology procedures in 2005

NHRPL code*	Procedure description	Cumulative frequency of the procedures (%)	Cumulative monetary value of the procedures (%)
3797	Platelet count	5.56	1.42
3755	Full blood count	11.00	7.91
4032	Creatinine	15.85	9.90
4171	Sodium + potassium + chloride + CO_2 + urea	20.32	17.96
4057	Glucose: quantitative	24.57	19.70
3805	Prothrombin index	27.14	21.45
3743	Erythrocyte sedimentation rate	29.65	22.30
3999	Albumin	32.04	23.61
3947	C-reactive protein	34.18	26.19
4130	Aspartate aminotransferase (AST)	36.30	27.49
4050	Glucose strip-test with photometric reading	38.38	27.91
4131	Alanine aminotransferase (ALT)	40.38	29.14
4134	Gamma glutamyl transferase (GGT)	42.35	30.35
4001	Alkaline phosphatase	44.22	31.45
4133	Lactate dehydrogenase (LD)	46.09	32.60
4117	Protein: total	47.77	33.19
4009	Bilirubin: total	49.42	34.09
3867	Miscellaneous microscopy (body fluids, urine, etc.)	51.07	35.01
4076	Blood gas and ancillary tests – max 6/patient/day	52.71	38.59
4025	Cholesterol/HDL/LDL/triglycerides	54.33	43.56
4010	Bilirubin: conjugated	55.94	44.22
4507	Thyrotropin (TSH)	57.38	47.43
3893	Bacteriological culture: miscellaneous	58.73	48.40
3806	Therapeutic drug level: dosage	60.04	49.07
3762	Haemoglobin estimation	61.29	49.33
4113	Potassium	62.54	49.84
4519	Prostate-specific antigen	63.70	51.76
4094	Magnesium: spectrophotometric	64.78	52.20
4017	Calcium: spectrophotometric	65.85	52.63
4484	Thyrotropin (TSH) + free thyroxine (FT_4)	67.81	56.87

*NHRPL code is the code allocated to the procedure in the National Health Reference Price List.
HDL = high-density lipoprotein; LDL = low-density lipoprotein.

The utilisation of individual procedures and the relative frequency of certain procedures varied between laboratories. The details of selected test procedures are presented here.

1. Erythrocyte sedimentation rate (ESR) is a common laboratory procedure used as a nonspecific marker of an inflammatory response. Laboratory D performed relatively more ESR procedures relative to full blood counts (FBCs) than any other laboratory by a considerable margin (Fig. 2a). Even if laboratory D is ignored, the range of ESR to FBC in all patients varied between laboratories by 33 - 51.8%. All laboratories except laboratory D had a higher ratio of ESR/FBC in outpatients than in hospitalised patients. Laboratory D performed ESR on 73.7% of FBCs on hospitalised patients, while laboratories C and E performed the procedure in 22.5% and 22.7% of cases respectively.

2. Reticulocyte count is a useful procedure to assess bone marrow response in anaemic patients. On average laboratory C consistently performed a reticulocyte count in 0.4% of FBCs (Fig. 2b). Laboratory E performed this procedure in 7.9% of FBCs. Laboratory F increased the frequency of this procedure abruptly in July 2004. Laboratory D reduced the frequency of this procedure in a similar fashion in August 2004.

3. Protein electrophoresis is regarded in some circles in South Africa as part of a 'liver function profile'. As liver function tests (LFTs) are not identifiable with a unique NHRPL code, gamma glutamyl transferase (GGT) is used as a surrogate marker of LFT. Other components of a LFT include albumin, total protein, aspartate transaminase, alanine transaminase, lactate dehydrogenase, alkaline phosphatase, total and conjugated bilirubin (all of which are in the top 30 tests). Serum protein electrophoresis is an invaluable tool in diagnosing and monitoring of monoclonal bands in myeloproliferative diseases and as such is a test that can be expected to occur mainly in people older than 50 years. However routine screening for monoclonal bands with protein electrophoresis is not recommended and routine testing in young people has no place.

On average laboratories A, C, D and F performed protein electrophoresis in 8.7% of all cases where a GGT (LFT) was performed (Fig. 3a). On average laboratories B and

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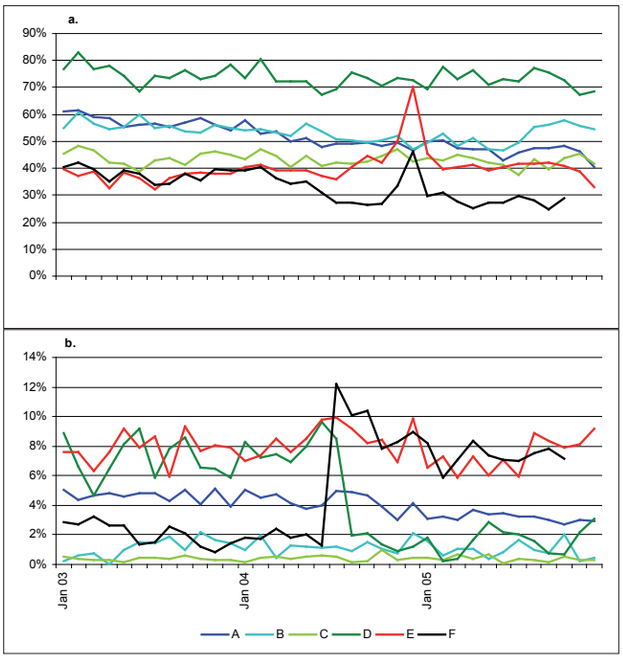

Fig. 2. Comparison of tests related to full blood counts: (a) erythrocyte sedimentation rate (or viscosity) ratio to full blood counts; and (b) reticulocyte ratio to full blood counts.

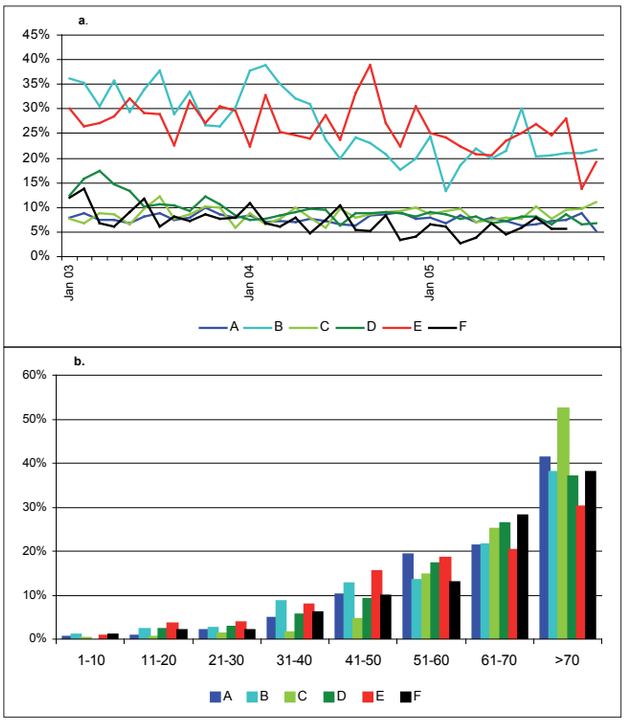

Fig. 3. Variation in the performance of protein electrophoresis: (a) comparison between laboratories with regard to the ratio of serum protein electrophoresis to gamma glutamyl transferase; (b) comparison between laboratories of serum protein electrophoresis per age band of patients in years.

E performed the same procedure in 26.8% and 26.5% of instances. In hospitalised patients, laboratory B performed protein electrophoresis in 55.9% of instances where a GGT was performed during 2003 and this was reduced to 27.9% in 2005 (data not shown).

The laboratories with the highest incidence of protein electrophoresis (B and E) had the lowest percentage of patients older than 50 years (68.9% and 74.8% respectively, Fig. 3b). Conversely the laboratory with the lowest incidence (7.6%) of protein electrophoresis per GGT (laboratory C) had the highest percentage of patients over 50 years (92.8%).

4. Urea and electrolytes is a profile identifiable by a single NHRPL code and is one of the few instances where the cost of the profile is less than the sum of the components. Creatinine may be more valuable than urea as a marker of renal function. Creatinine was performed with a urea and electrolyte profile in 98.8% of all laboratories except laboratory D which performed this combination in approximately 74.9% of instances.

5. Laboratory A maintained a constant percentage of approximately 50% glucose tests compared with cholesterol tests in hospitalised patients for the entire period (Fig. 4). Laboratory C exhibited a dramatic increase during 2003, which continued unabated in 2004 (3.4-fold from the baseline), and ended 2005 with a 4.5-fold increase over the baseline of early 2003.

Discussion

A potential limitation of this study is that the claims received by the medical scheme administrator may not be a representative sample of the total medical aid industry in South Africa. Differences in pathology claims to medical schemes may arise from a number of factors such as geographical distribution, demographic profile, socio-economic profile, disease exposure of members and benefit design of a medical scheme. Despite this limitation we are of the opinion that the results merit consideration and that the results are an indication of the practice of pathology laboratories in South Africa. As no published results on the topic of laboratory test

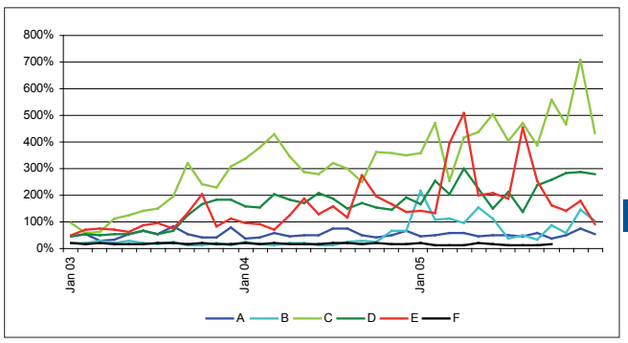

Fig. 4. Comparison between laboratories with regard to the ratio of glucose procedures to serum cholesterol in hospitalised patients.

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utilisation in South Africa are available, this article may serve as a departure point for discussion and future research.

Part of the difficulty in a study such as this one is to decide what performance parameters to use. A submitted claim line represents a single test procedure with a specific NHRPL code and the average cost per procedure could in theory provide a means of comparing different laboratories. When the mixture of tests performed by a laboratory changes abruptly, as with the increase in glucose tests discussed above, this parameter is useful in identifying these events provided that the cost of the procedure is different from the average and the volumes are sufficient to influence the average. In the medical scheme environment it is customary to express events or costs as the average for the total number of members (insured families) or total number of beneficiaries. In comparing the performance of laboratories this would only make sense if market share were equally distributed among service providers.

Cost per account provides an alternative way of comparing the performance of pathology laboratories. Differences in the way specimens are handled (laboratory numbers allocated to each department, separate laboratory numbers at branches, etc.) and the period that an account remains active can influence the composition of an account. Monitoring at account level is especially valid within a laboratory over time, but less so across laboratories. The same argument holds for the number of lines (tests) per account as a measure of testing activity. From the data in Table I and Fig. 1 it appears that laboratories C and D had the lowest cost per line and cost per account, but despite this laboratory D had the second highest cost per active beneficiary in 2005. The cost per active beneficiary cannot be predicted from line or account level comparisons in this instance. Measuring costs and events at the level of an active beneficiary is preferred and it is recommended that this parameter be used for future studies. This allows comparison between laboratories by measuring performance on actual patient referrals. By specifying the period as a calendar month it is inevitable that some active members will be counted twice in consecutive months if the event occurs over a month end and beginning. However this would affect all laboratories equally and would allow monitoring during a calendar year.

The 9.9% increase in monetary value for claims received for 2005 was surprising taking into consideration that the number of active beneficiaries decreased by 4.0% over the period. The resultant 14.5% increase in cost per active beneficiary per month cannot be explained by the general NHRPL tariff increase of 5.2% that was granted for 2005. The only alternative explanation for the increases is an increase in test utilisation, and this is confirmed by the increase in average number of tests per account and active beneficiary.

The lower-cost laboratories B and C are located in coastal regions, while laboratories A and D are located in the interior. Variation in laboratory practice can be geographical and may represent differences in disease incidence, teaching habits and local custom. However there is not a convincing scientific rationale for the geographical differences observed in this study.

The 30 most commonly requested tests represent 4.7% of available NHRPL codes but 67.8% of procedures and 56.9% of pathology expenditure. Efforts to address laboratory utilisation should focus firstly on these common tests and for this reason the variation of selected tests from the top 30 list was further investigated. The very high incidence of ESR per FBC and almost universal creatinine with 'urea and electrolytes' is a cause of concern, and efforts to decrease excessive and inappropriate utilisation of these specific tests have been described elsewhere in the literature.[8] The fact that laboratory D consistently performed creatinine in only 74.9% of cases compared with all other laboratories that performed these procedures in combination in more than 98% of cases would suggest that significant over- or under-utilisation occurs. The same can be said for the high ESR incidence at laboratory D compared with the other laboratories. The reason for the differences can be attributed at least in part to the design of the pathology request form, with most laboratories except laboratory D not offering the option to order a 'urea and electrolytes' without creatinine. On examining a sample of request forms it would appear almost impossible to order the individual components of 'electrolytes'.

On average, laboratory C performed reticulocyte counts with 0.4% of FBCs. When compared with the almost 20-fold higher percentage (7.9%) of laboratory E, there is no ready explanation. The sudden increase in reticulocyte performance by laboratory F occurred in the same time period as the acquisition by laboratory E. The drop in reticulocyte performance a month later by laboratory D followed a meeting with the management of the laboratory where this specific issue was discussed. Reticulocyte performance is under control of the laboratory as the test is reflexed based on a haemoglobin value, often without consultation or consent of the referring clinician.

The high incidence of serum protein electrophoresis in laboratories E and B contrasts sharply with laboratory C. The age distribution of patients who had a serum protein electrophoresis by the individual laboratories is compatible with an appropriate utilisation of this procedure by laboratory C. The marked increases in glucose utilisation can be attributed to the implementation of a point-of-care testing device in a hospital group that was reported to own a stake in the particular laboratories.

The variations observed can be at least partly explained by factors under control of the individual laboratories such as the design of the pathology request form, the expanding content of profiles and the reflexing of tests such as reticulocyte

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counts. Other contributing factors may include the existence of business opportunities that arise from a corporate shareholder, as seen with the selective increase in glucose performance above.

There is therefore clear evidence that differences in the utilisation of laboratory tests occur in the South African private health care sector. In the absence of scientifically defendable differences in disease distribution the differences are likely to be secondary to inappropriate test utilisation. Inappropriate test utilisation can be due to over- or underutilisation of laboratory tests. The magnitude of this inappropriate utilisation was impossible to estimate with any degree of accuracy in this study as clinical information to judge clinical appropriateness of laboratory tests was not available. The compulsory submission of International Classification of Diseases (ICD10) codes as envisaged by the Council for Medical Schemes will be an invaluable tool for the rational assessment and management of laboratory test utilisation in future.

By arbitrarily assuming that the lowest utilisation in each parameter examined above represents ideal utilisation, a potentially large amount of expenditure could be avoided. If the lowest-cost laboratory is accepted as ideal behaviour, a cost saving of 15% is potentially achievable. It is debatable whether the lowest utilisation in this sample represents ideal or acceptable test utilisation.

The most effective way to improve test utilisation is to control the design of the pathology request form.[2,3,8,9] It has been shown conclusively that the absence of 'tick boxes', limited profile content and individual requesting of tests reduces pathology expenditure without compromising patient care. From another perspective it can be said that if the intention was to increase pathology test utilisation, it would be difficult to 'improve' the current pathology request forms. The current situation can be rectified by applying the requirements applicable to pharmaceutical scripts to pathology request forms, i.e. unambiguous requesting of a single test by the referring doctor, with the requisition verified by his/her signature, on a form that does not contain a suggestion list with multiple 'tick boxes' and exotic test profiles. This would bring South Africa in line with other countries such as Australia[10] that have already resolved these issues.

Consideration should be given to re-designing the format of the NHRPL pricing structure to eliminate incentives for overutilisation of laboratory tests. Currently each NHRPL tariff contains an element that can be described as an 'episode fee'. This component contains elements such as the cost of consumables, the cost of the phlebotomist, couriers, and administrative and accounting services associated with performing the test, and is based on an assumption of the average number of test procedures per account. Table I shows that the trend is to increase the number of tests per account. Secondly, there is wide variation in the number of tests per account between different laboratories, with the consequence that laboratories with a high test per account ratio benefit relatively more. By removing the episode fee component from each individual NHRPL item and substituting it with a single new NHRPL code for an episode fee, the temptation to increase the number of tests per event will be reduced.

An additional change to the NHRPL that should be considered is to limit the content of profiles and to expand the concept of billing decay to all cases where multiple tests are performed on a single analyser platform.

Conclusion

Considerable variation exists in the billing practices of South African pathology laboratories that can be attributed to factors not related to patient care. The extent of the excessive laboratory utilisation cannot be estimated accurately at present but is probably significant. Practical measures exist, that have been validated elsewhere, to improve laboratory test utilisation. The most important aspect to attend to is regulations to control pathology request forms and the content of test profiles.

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