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EDITORIAL

More than a year has elapsed since the issue of No.2, a period which has seen the usual pattern (for Uganda) of wild swings of fortune. In November 1971, Mr.Golbey had just arrived. He finally left in December 1972. Dr.Dale served as Visiting Lecturer from February to June 1972. Dr.Applegarth came in June to work as Visiting Professor, but found it necessary to leave again in October. Miss Thakrar went on leave to India in August, and did not return.

The picture is not entirely black, however. Three newly qualified B.Sc. holders have been selected for Clinical Biochemistry training and service. All have honours degrees in Biochemistry and Zoology. They are:-

Mr.J.P.Latigo (Ministry of Health)
Mr.G.B.A.Mbahinzireki (University)
Mr.T.R.Andreonzi

All will be treated alike, just as occurs with University and Government staff in other departments of Mulago. With the imminent departure of the Head of Biochemistry Dept., their training period will be awkward, but it is hoped to get over the worst difficulties before this happens. For the same reason, it has been decided that Dr.R.W.Ddungu should complete his training period for the M.Med.(Path.) (Chemical Pathology) overseas - and he has in fact already left to spend a year in Hammersmith Hospital as a Registrar in the Clinical Biochemistry Department (Prof I.D.P.Wootton.)

All these losses of senior supervisory staff would seem very alarming, were they not occurring this time against a background of similar changes in all departments of Mulago Hospital and were it not for the now very strong middle level of staff and the strong tradition of good, accurate work. The quality control report below will emphasise that standards have not declined in the past 6 months - rather they are improving steadily. The chief effect of the staff losses will be in fact to delay development and extension of services, rather than to cause a regression. The long promised and long overdue Quality Control report appears in this issue.

Editor.

QUALITY CONTROL

REPORT FOR THE PERIOD UP TO 28th FEBRUARY 1973

Quality control procedures were discussed in Vol I No.1. Introduction of effective systems has been much slower than was then envisaged, and the system now in operation differs somewhat from what was then proposed. A most valuable addition has been participation in an international scheme operated by Wellcome Reagents Ltd of Beckenham, Kent, U.K. For an outlay of £100 per annum we are enabled to compare our performance with over 200 laboratories in U.K.

There now follows a summary description which should enable the attentive reader to understand both what is done and the significance of the 2 different kinds of assessment reported below.

1) Internal system, using artificial reference materials giving estimates related to both accuracy and precision.

For each test a solution is made up containing the material to be assayed, in known concentration. This is a stock solution, somewhat more concentrated than the highest value of interest for the test concerned. Each day a different dilution is made of the stock and this is given to the analyst to be handled in the same manner as a normal sample. Of course, the analyst is not told what dilution was used. The dilutions used are such as to give final solutions covering the range from somewhat below the lower limit of normal to somewhat above the upper limit - that is, the range required for most critical clinical decisions.

Thus for each assay, each day, we have an expected result and an assay result. The difference is called by us the, "divergence" (d). We calculate over aperiod the "mean divergence", $=\sum d/n$, and the "standard divergence" $=\sum (d^2/n)^{\frac{1}{2}}$ The second a measure of the precision of the method, the first of its accuracy, i.e. any systematic tendency towards high or low results.

This is an unconventional approach, believed in fact to be wholly original. Advantages claimed are:-

a) Accuracy and precision may be tested over a wide range of concentrations. b) There is no ambiguity or doubt as to the reference or "true" value. c) Bias appearing in the mean divergence is definitely attributable to matters connected with assay and reading procedures.

Obvious disadvantages are:

A) The analyst knows he is being tested and on which solution, thus the result is not necessarily a good measure of typical performance. B) Use of artificial solutions prevents assessment of factors connected with the nature of actual analytical samples. C) Some analyses, including enzymes, cannot yet be handled by the approach. D) The "standard divergence" does not relate closely to the true standard deviation unless the mean divergence is zero. If this is not the case, it gives an unduly unfavourable impression. As there is no suggestion that this should be the only programme used and as no other offers the advantages listed above, we feel this should be employed in any case, and that others should be added to it.

2. Wellcome Quality Control Scheme, using "natural" material

The company provides freeze-dried serum samples, identified by number only, to be assayed at fortnightly intervals over a 6 months period. They are not all different, but we do not know which numbers represent the same original sample. The materials are made up by adding the correct amount of water, and handed to the analysts to be treated just like any normal sample. The result is transmitted to the company, who carry out statistical analyses. Every 2 weeks we get back from them a computer print-out showing how our results compare with other laboratories. At the end of 6 months we get an assessment covering the entire period and showing both our "bias" in relation to other laboratories and our precision, measured from our blind replications. This is an estimate of the true standard deviation of the test, unlike programme 1 in which an analytical result is never compared with another run on the same sample. (Nevertheless, the two figures ought to be much the same, given that mean divergence is small, c.f. 1 D above). In addition, the laboratory's overall performance is assessed in relation to other participating laboratories, assuming certain ideal relationships of precision and bias. This is a largely arbitrary business.

Advantages are: a) Tests are run on natural material b) Estimates of true standard deviation available. c) Comparisions are available with other laboratories, helping in the translation of clinical meaning from one hospital to another d) Bias results require careful and individual assessment but fill out and reinforce information gained from programme 1.

Disadvantages are:A) As for programme 1. B) There is no imperative reason to believe that the mean result obtained by the 200 laboratories is the "correct" result. In fact in some cases it definitely is not - see below for glucose - and in general it all depends on the method employed. C) so far, only a limited range of serum constituents can be covered.

We hope shortly to add the following :-

3) Blind testing of precision, using ordinary analytical samples.

Samples already run will be repeated during another batch later the same day or on the following day. Elaborate precautions will be taken to make sure the analyst does not know which samples will be re-tested, or which samples in a given batch have been tested before. Advantages: A) Measures true precision, result may be held applicable to any ordinary specimen assayed in the normal way. Disadvantages: A) Applicable to stable materials only. B) Measures precision only.

4) As Programme 1, but using commercial quality control Materials.

Advantages: a) Extends programme to analyses not accessible to testing by artificial solutions. b) Uses "natural" material.

c) Provided that the reference value stated by the manufacturers is correct, it will allow assessment of factors in the sample modifying bias (c.f. 1.c). Disadvantages are: A) Reliance on manufacturers stated value (This is not an idle quibble - it has often been found that the manufactures assays are unsatisfactory. B) Expense will reduce frequency of use below what would be desirable.

BIAS AND PRECISION

Period April - September 1972

Material WELLCOME FREEZE-DRIED SERUM

Results are those computed by the Centre

Constituent	Units	Bias	Precision (Standard Deviation)	Ranking of Laboratory
Sodium	mM	-3	2.6	154/224
Potassium	mM	-0.18	0.13	128/224
Protein	g%	-0.11	0.39	200/219
Glucose	mg%	-5.1	8.1	157/225
	mM	0.28	0.45	
Urea	mg%	+0.19	8.5	212/228
	mM	0.03	1.4	
GOT	IU/l(25°)	-4.6	1.9	28/197
Alkaline phosphatase	IU/l(37°)	-13	4.9	62/212
Overall Ranking				137/231

Comment

1) Glucose bias is in relation to mean for all methods (including the non-specific Cu reduction techniques). In general, bias is relative to all methods - not only those chemically similar to our own.

2) Our bad scatter on protein, glucose and urea pulled us down. Excellent results for enzyme assays redress balance overall. Mr.T.Mpanga must be given full credit here.

3) Sodium and potassium results show distinct low bias and unacceptable scatter. This must be put right.

4) Performance is not considered a matter for self-congratulation, but is better than clinical staff opinion would admit. Results are generally sufficiently precise for ordinary clinical purposes.

MEAN AND STANDARD DIVERGENCE

Period December 1972
Material AQUEOUS SOLUTION

Constituent	n	Units	Mean Divergence	Standard Divergence
Sodium	31	mM	-1.4	3.8
Potassium	24	mM	+0.17	0.58
Chloride	31	mM	-0.7	2.4
Glucose	31	mg%	-0.3	6.4
			0.044	0.36
Urea	42	mg%	-0.3	6.8
		mM	0.05	1.1
Calcium	8	mg%	-0.01	0.30
		mM	-0.002	0.08
Uric Acid	10	mg%	-0.5	0.9
		mM	29.75	53.6

MEAN AND STANDARD DIVERGENCE

Period JANUARY 1973
Material AQUEOUS SOLUTION

Constituent	n	Units	Mean Divergence	Standard Divergence
Sodium	32	mM	+0.3	3.2
Potassium	38	mM	+0.003	0.14
Chloride	27	mM	+0.3	4.0
Glucose	38	mg%	-1.4	5.0
		mM	-0.08	0.28
Urea	45	mg%	-0.4	6.4
		mM	0.067	1.07
Calcium	16	mg%	-0.15	0.33
		mM	-0.04	0.08
Uric Acid	12	mg%	-0.3	0.84
		µM	17.85	49.98

MEAN AND STANDARD DIVERGENCE

Period FEBRUARY 1973

Material AQUEOUS SOLUTION

Constituent	n	Units	Mean Divergence	Standard Divergence
Sodium	43	mM	-0.2	3.5
Potassium	37	mM	+0.02	0.23
Chloride	45	mM	-0.8	2.8
Glucose	41	mg%	-0.7	5.7
		mM	0.04	0.32
Urea	42	mg%	-0.7	3.7
		mM	0.12	0.62
Calcium	20	mg%	-0.2	0.43
		mM	-0.05	0.11
Uric Acid	13	mg%	-0.7	0.93
		mM	41.7	55.3