Long-term evaluation of qualitative EQA results

United Kingdom National External Quality Assessment Service for Microbiology

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Qualitative Data

- Categorical measurement expressed by means of a natural language description
  - Nominal e.g. organism name/identity, genotype, presence/absence, positive/negative
  - Ordinal e.g. 1+, 2+, 3+ (can be ordered)

- ‘There is no such thing as qualitative data. Everything is either 1 or 0’
  - Fred Kerlinger, Quantitative researcher, Miles and Huberman 1994; Qualitative Data Analysis
Ways of handling qualitative data

- Use of surrogates
  - Number of participants
  - % laboratories making the correct identity
- Identify significant patterns
  - Changes in practice
- Compare categories
  - Changes in categories
- Apply a numerical score
Review of the Parasitology schemes: 15 years

- Faecal and blood parasitology schemes introduced in 1986
- Identification of parasites and stage as ova, cysts, larvae
- Comparison of reported result with the assigned value/identity
- % of participants reporting the correct result
Faecal parasitology: examining for helminths

Kettelhut et al. Journal of Clinical Pathology 2003
Faecal parasitology: overall performance UK participants subscribing since start of scheme

![Histogram showing participants' scores expressed as a percentage, comparing 1986-88 with 1999-2001 with a statistical significance of p < 0.0001.](image)
Blood parasitology: comparison of participant performance

[Bar chart showing percentage of participants achieving correct results for different parasitic infections over the years 1987, 1992, 1998, and 2000/01. Each infection is represented with bars for each year, with p-values indicating statistical significance.]

EQALM 2010
Blood parasitology: overall performance of UK participants subscribing since start of scheme

![Graph showing participants' scores expressed as a percentage with bars for 1986-88 and 1999-2001. The y-axis represents the number of participants, and the x-axis represents participants' scores expressed as a percentage. The graph shows a significant improvement from 1986-88 to 1999-2001 with p < 0.0001.]
Blood parasitology: overall performance all UK participants
Review of mycobacterium culture scheme

- Introduced in 1993
- Participants report on the culture results and identify to genus or species level
- Range of different culture media used
- UK standard method recommends culture for 12 weeks to have confidence in correct report of a negative result
- Time to identification of culture positive dependant on
  - Species
  - Strain
  - Bacterial load
  - Method
10 year review

- % participants reporting correct results
- Centre for Disease Control recommendation
  - Time to reporting

Walton et al. Clinical Microbiology and Infection 2005
Mean percentage of laboratories correctly reporting *Mycobacterium tuberculosis*

Walton *et al.* Clinical Microbiology and Infection 2005

EQALM 2010
Time to positive reporting

Cumulative %

- 1995
- 1998
- 2002

Time to positive report

- 14
- 21
- 28
- >28

EQALM 2010
Mycobacterium culture scheme

Summary

- % participants reporting positive result by 21 days rose from 55% in 1995 to 83% in 2002 and 87% in 2009/10
- Increasingly liquid culture systems have been used
- Proportion of non-UK laboratories has increased from 20% in 1995 to 44% in 2002 and 58% in 2009/10
Susceptibility to Rubella

- Historically immunity to rubella was set at the limit of detection of the diagnostic assays.
- Changes in practice from Radial Haemolysis through to Reverse Passive Haemagglutination to ELISA resulted in the introduction of a low level positive category where initially clarity about protection from infection was not clear.
- In 2001 10 IU/mL cut off set.
- Comparison of kits made.
  - Implications to management of rash in pregnancy.
## Low level positive rubella reporting

<table>
<thead>
<tr>
<th>Spec no.</th>
<th>No. &gt;10 IU/mL</th>
<th>% pos</th>
<th>No. &lt;10 IU/mL</th>
<th>No. numerical data sets</th>
<th>Range</th>
<th>Median for all kits</th>
<th>5% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>6357</td>
<td>363</td>
<td>97.6</td>
<td>9</td>
<td>329</td>
<td>0-70</td>
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<td>29</td>
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<td>6359</td>
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<td>332</td>
<td>0-147</td>
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<td>344</td>
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<td>18</td>
<td>12</td>
<td>33</td>
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<td>348</td>
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<td>12</td>
<td>7</td>
<td>18</td>
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<td>402</td>
<td>0-500</td>
<td>10</td>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

Fagan et al 2006
Rubella IgG serology

Method medians for methods with ≥10 users
Rubella IgG serology

- 56.2% to 98.7% of participants reported a positive (>10 IU/mL) result
- Linear regression, taking DiaSorin as the baseline (due to its fairly low mean and large-enough frequency of usage), showed that Bayer produced the highest results (2.1 fold > DiaSorin, 95% CI (2.0-2.3)).
- Overall Roche followed by Diamedix and DiaSorin produced the lowest results.
- However a more recent analysis (3 low level samples) has shown that Roche now gives high results, Bayer (now Siemens) now gives lower results, DiaSorin remains consistently low.
Monitoring performance
**General Bacteriology report: Page 1 formats**

**UK National External Quality Assessment Service for Microbiology**

<table>
<thead>
<tr>
<th>Intended Result</th>
<th>Your Report</th>
<th>Your Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen 8366</td>
<td><em>Bacillus cereus</em></td>
<td>2</td>
</tr>
<tr>
<td>Specimen 8367</td>
<td><em>Neisseria meningitidis</em> serogroup B</td>
<td>0</td>
</tr>
<tr>
<td>Specimen 8368</td>
<td><em>Shigella flexneri</em> serotype 1b</td>
<td>2</td>
</tr>
</tbody>
</table>

**Cumulative score information**

Total number of specimens sent to you for UK NEQAS for General bacteriology over the last 6 distributions is 18.
Specimen numbers 8170 8171 8172 8206 8207 8208 8244 8245 8287 8288 8289 8333 8334 8335 8366 8367 8368 have been analysed and scored.

Number of reports returned and scored 17.
Number of specimens reported as not examined (not scored) 1.
Number of specimens received too late for analysis (not scored) 0.
Number of specimens for which no report was received (scored as 0) 0.
Your cumulative score for these specimens was 23 out of a possible total of 32.

The mean score calculated from the reports returned by ALL laboratories was 28.54 (with a standard error of 3.13).
Cumulative scores may change if participants' results are amended.
Your performance rating for UK NEQAS for General bacteriology (i.e. the number of standard errors by which your cumulative score lies above or below the mean for) ALL laboratories is -1.77.
A performance rating of more than -1.96 standard errors below the mean indicates possible poor performance.

**Cumulative score is less than mean score**

**PR** — a form of ranking

Compares other labs examining the same specimens

Country specific if over 10 labs
Performance graphs

Your performance rating over the past 12 distributions (annual cycle)
Your current performance rating is 0.38
Performance Governance

A brief summary of the relevant analysis is given below and a print-out of the details of your results for the relevant specimens is attached.

<table>
<thead>
<tr>
<th>Antimicrobial susceptibility</th>
<th>Your total score</th>
<th>Total possible score</th>
<th>Average Score</th>
<th>Your performance rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>221</td>
<td>230</td>
<td>227.64</td>
<td>-2.50</td>
</tr>
</tbody>
</table>

I realise that Quality Assessment results may not reflect the total performance of a laboratory but they are designed to help the head of the laboratory to assess the accuracy of the procedures carried out by his or her staff.
Summary

- Raw descriptive data can be categorised and comparison made between the categories
- Comparisons can be interpreted
- Changes to the categories can be monitored over time
- Applying a numeric score allows ‘hard’ statistical analysis
Thanks

UK NEQAS for Microbiology team

National Quality Assurance Advisory Panel

Monika Manser and Peter Chiodini

Scheme participants