Does adjustment for patient mix affect the results of the BHIVA National Audit 2015?

Margaret May, University of Bristol, on behalf of the BHIVA Audit and Standards Sub-Committee
• Monitoring of quality of HIV care, feedback and improvement is important virtuous circle
• BHIVA audits are an important mechanism
• UK CHIC data also used for monitoring
• We looked at NHS indicators in CHIC
  • Eg % virally suppressed at 1 year after ART start
    ⇒ Important to account for clinic size and patient mix
• Should audit data be adjusted for case-mix?
• What is the best way of presenting audit data back to the clinics?
BHIVA 2015 audit

Audit adherence to 2011 BHIVA guidelines for routine investigation and monitoring of adult HIV-1-infected individuals and, where relevant, immunisation guidelines.

Case-note review of adults (>16) who attended for specialist HIV care during 2014 and/or 2015:

- 50-100 patients per HIV service
- Self-audit spreadsheet tool used
- Data collected during June-August 2015

Accompanying brief survey of clinic practice/policy
Outcomes: for the analyses that follow we looked at the 15 outcomes collected during the BHIVA 2015 audit.

- **HIV**
  - resistance test done/sample stored
  - VL measured within past 6 months, **not applicable if not on ART**
  - adherence assessed within past year, **not applicable if not on ART**
  - all medication recorded within past year, **not applicable if not on ART**

- **Hep**
  - vaccinated/immune to hepatitis A
  - hepatitis B surface antigen status is known
  - hepatitis C antibody status is known

- **CVD**
  - CVD risk assessed, **within past 3 years if on ART, ever if not on ART**
  - smoking status recorded within past two years
Outcomes: for the analyses that follow we looked at the 15 outcomes collected during the BHIVA 2015 audit.

**VAX**
- flu vaccination recorded as done, or recorded as advised to obtain from GP, within past year
- vaccinated against pneumococcus, CD4 <200 only

**screening**
- sexual health screen offered within past year
- cervical cytology recorded as done, or recorded as advised to obtain elsewhere, within past year, females only

**Risk assessment**
- bone mineral density measured, age >70 and on ART only
- fracture risk assessed within past 3 years, age >50 only
Participation

- 123 services submitted patient data
  - 112 completed the survey
- Sites requested to provide a sample of 50-100 patients.
- Excluded sites with sample size < 40 patients.
  - No. sites reduced from 123 to 106.
- Table shows the distribution of sample sizes for the total of the 123 sites.

<table>
<thead>
<tr>
<th>Site sample size</th>
<th>Frequency</th>
<th>Percent</th>
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<tbody>
<tr>
<td>&lt;40</td>
<td>17</td>
<td>13.82</td>
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<tr>
<td>40-74</td>
<td>57</td>
<td>46.34</td>
</tr>
<tr>
<td>75-99</td>
<td>10</td>
<td>8.13</td>
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<td>100</td>
<td>39</td>
<td>31.71</td>
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<td>Total</td>
<td>123</td>
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### Summary statistics for the 15 outcomes by centre

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td>Resistance test done</td>
<td>106</td>
<td>81%</td>
<td>0.12</td>
<td>42%</td>
<td>100%</td>
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<tr>
<td>VL measured last 6m</td>
<td>106</td>
<td>90%</td>
<td>0.10</td>
<td>33%</td>
<td>100%</td>
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<tr>
<td>Adherence measured past year</td>
<td>106</td>
<td>94%</td>
<td>0.09</td>
<td>46%</td>
<td>100%</td>
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<td>Medications recorded past year</td>
<td>106</td>
<td>89%</td>
<td>0.12</td>
<td>45%</td>
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<td>Hep A vaccination/immune</td>
<td>106</td>
<td>60%</td>
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<td>0%</td>
<td>100%</td>
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<td>Hep B surface antigen status known</td>
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<td>93%</td>
<td>0.16</td>
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<td>Hep C antibody status known</td>
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<td>96%</td>
<td>0.06</td>
<td>52%</td>
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Summary statistics for the 15 outcomes by centre

<table>
<thead>
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<th>Outcome</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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<tr>
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<tr>
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<td>100%</td>
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<tr>
<td>Sexual health screen offered in last year</td>
<td>106</td>
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<td>98%</td>
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<tr>
<td>Cervical cytology done (females only)</td>
<td>106</td>
<td>75%</td>
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<tr>
<td>BMD measured (age&gt;70, on ART)</td>
<td>70</td>
<td>17%</td>
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<tr>
<td>Fracture risk assessed last 3 yrs (age&gt;50)</td>
<td>106</td>
<td>18%</td>
<td>0.24</td>
<td>0%</td>
<td>94%</td>
</tr>
<tr>
<td>Vaccinated against Pneumococcus (CD4&lt;200)</td>
<td>106</td>
<td>25%</td>
<td>0.31</td>
<td>0%</td>
<td>100%</td>
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</tbody>
</table>
Variability of 12 outcomes across clinics

Vertical line = median, box = 25th to 75th percentiles, whiskers = 95% of distribution, individual points are outliers.
Is adjustment by patient mix required?

- The first goal is to study whether outcomes are affected by the patient mix of the sites.
- First, we look at the scores for the outcomes by age, sex, ethnicity, risk group and the combined variable of sex/ethnicity/risk.
- Graphs are shown only for 4 outcomes
  - resistance, VL, hep A, and sexual health screen
    - considered to be representative for the 12 outcomes
      - according to factor analysis discussed later
Proportion of patients with resistance test done

**Age by ResistSummary**

- 16-29
- 30-49
- 50-69
- >70

**Sex by ResistSummary**

- M
- F

**Ethnicity by ResistSummary**

- BA Black African
- W White
- O Other
- U Unknown

**Exposure by ResistSummary**

- HS
- MSM
- O/U

**Risk group**

**Sex/ethnicity/risk**

*Resistance tests Patterned by age*

- Younger patients more likely to have test
Proportion of patients with VL test done in last 6m

All overlap or are above 90%
Proportion of patients with Hep A vaccination/immune

Note levels much lower – around 60%
Proportion of patients offered sexual health screen

More likely to be offered to:
Younger patients
Males
White
MSM
Adjusting for patient mix

We fitted a logistic regression models for all patients for each outcome
Included age, sex/ethnicity/risk group

Using the model, we predicted the probability of the outcome for each patient

We calculated the expected proportion of patients with the outcome for each centre
Graph of observed: expected proportion
Resistance test done

Little difference between unadjusted and adjusted positions
Similarly for other outcomes e.g.
- VL measured
- Hep A status
  – no substantial difference

**VL measured**

**Hep A status**
Does audit data need to be adjusted for case-mix?

No

Why were we so bothered about this?
The importance of adjusting for patient characteristics and clinic size when comparing measures of treatment outcome across clinics: the UK CHIC study

- Studies have shown the importance of timely diagnosis, retention in care and maintaining a low viral load (VL) to reduce HIV transmission.

- Two important measures are:
  - % patients with CD4 > 200 cells/mL at registration
  - % patients with undetectable VL 1 year after starting ART.

- We compared these indicators in UK centres accounting for centre size and case mix
Funnel Plot Structure

Better than average

Worse than average

Number of patients per centre
Unadjusted & Adjusted funnel plots for CD4 >200 cells/mL at registration

Unadjusted

Adjusted

Number of eligible patients per centre (2006-2013)
Unadjusted & Adjusted funnel plots for VL<200 copies/mL at 1 year

Unadjusted

Adjusted

Number of eligible patients per centre (2008-2012)
Unadjusted ratio  

Adjusted ratio  

**AUDIT**  

Adjustment for patient mix makes **no** difference  

**UK CHIC**  

Adjustment for patient mix **does** make a difference
Do comparisons of indicators using CHIC data need to be adjusted for case-mix?

Yes

Why is the answer different?
Both are summarising individual patient data at the clinic level.
# Audit vs. patient outcomes

<table>
<thead>
<tr>
<th>BHIVA audit</th>
<th>UK CHIC</th>
</tr>
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<tbody>
<tr>
<td>• Outcomes are actually whether services have been <strong>offered/done</strong></td>
<td>• CD4 at clinic presentation depends on <strong>community profile</strong> and <strong>testing strategy</strong> where clinic is situated (London or not? MSM or not?)</td>
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<tr>
<td>• <strong>Processes</strong> in place in clinic</td>
<td>• VS at 1 year depends on <strong>patient</strong> adherence to ART</td>
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<tr>
<td>• <strong>Guidelines</strong> being followed?</td>
<td>• <strong>Patient</strong> outcomes</td>
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<tr>
<td>• <strong>Not</strong> patient outcomes</td>
<td>• Funnel plot appropriate</td>
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<tr>
<td>• Cannot use funnel plot as sampling 50-100 patients</td>
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</table>
Part 2: Performance charts

The second goal of this study is to propose some performance charts where each site will be able to compare its results with the mean of other sites.
Meaningful feedback of audit data

Bad
Ranking – league tables

Better
Benchmarking against the average
toleration SD? +/- 10%
Benchmarking against standards
 90:90:90

Useful
Identifying problematic outliers
Identifying very good practice
Identifying deviations/trends in own clinic
Boxplots for outcomes: median (95% CI)

Results for Site 1

Outcome

- Resistance done
- VL measured
- Adherence assessed
- Meds recorded
- Hep A immune
- HBsAg known
- HCV tested
- CVD risk assessed
- Smoking assessed
- Flu vax managed
- SH screen offered
- Cerv. cyt. managed

Proportion

Δ Site 1 score  95% confidence interval
Boxplots for outcomes: median (95% CI)

Results for Site 17

Outcome

- Resistance done
- VL measured
- Adherence assessed
- Meds recorded
- Hep A immune
- HBsAg known
- HCV tested
- CVD risk assessed
- Smoking assessed
- Flu vax managed
- SH screen offered
- Cerv. cyt. managed

Proportion

△ Site 17 score  —  95% confidence interval
Dashboards using the overall mean

- Mean of overall: <80%
- Mean of overall: <90%
- Mean of overall: 95% CI for site: ±10%
- Mean of overall: >110%

Outcome

0.2 0.4 0.6 0.8 1

Proportion

<80% of overall mean
<90% of overall mean
95% CI for site
Site score
Overall mean

>110% overall mean
Resistance done
VL measured
Adherence assessed
Meds recorded
Hep A immune
HBsAg known
HCV tested
CVD risk assessed
Smoking assessed
Flu vax managed
SH screen offered
Cerv. cyt. managed

Results for Site 1

Comparison with overall mean:
- Much worse
- Worse
- As expected
- Better
- Overall mean
- Site rate

95% CI for site rate

Proportion
Resistance done
VL measured
Adherence assessed
Meds recorded
Hep A immune
HBsAg known
HCV tested
CVD risk assessed
Smoking assessed
Flu vax managed
SH screen offered
Cerv. cyt. managed

Results for Site 17

Comparison with overall mean:
- Much worse
- Worse
- As expected
- Better

Overall mean
Site rate
95% CI for site rate

Proportion

Comparison with overall mean:
- Much worse
- Worse
- As expected
- Better

Overall mean
Site rate
95% CI for site rate

Proportion
# Correlations

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</table>

**Medications with adherence**

**Hepatitis A and B with C**

**CVD risk with smoking assessment**
Factor analysis

• Reduces the number of variables by exploiting correlation between variables
• 4 factors
  1. Resistance measured
  2. VL, adherence, medications recorded (“HIV care”) 
  3. Hepatitis A, B and C
  4. CVD, smoking, flu, sexual health, cervical cytology (“screening”)
Simplified dashboard

Based on average of components

Results for Site 1

Factor

Resistance done

HIV Care

Hep A,B,C

Other Screening

Comparison with overall mean:
- Much worse
- Worse
- As expected
- Better

Site rate

95% CI for site rate

Proportion
Results for Site 17

Factor

Resistance done

HIV Care

Hep A,B,C

Other Screening

Comparison with overall mean:
- Much worse
- Worse
- As expected
- Better

Site rate

95% CI for site rate

Proportion

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Summary

• Feedback to the clinics of audit data is key to improving services “virtuous circle”

• 2015 BHIVA audit focussed on processes
  • These are largely independent of patient mix
    ⇒ No need to adjust

• Monitoring progress towards treatment outcomes
  • Eg 90:90:90 using CHIC data
    ⇒ Requires adjustment for patient mix

• Dashboards benchmarking against the UK average may be useful for clinic feedback
Acknowledgements

Analyses: Skevi Michael
Interpretation: Mark Gompels, Caroline Sabin, Hilary Curtis

The BHIVA Audit and Standards Sub-Committee:

- A Freedman (chair), B Angus, D Asboe, G Brough, F Burns, D Chadwick, D Churchill, V Delpech, K Doerholt, Y Gilleece, P Gupta, A Molloy, J Musonda, C Okoli, O Olarinde, E Ong, S Raffe, M Rayment, C Sabin, A Sullivan

HIV clinical services who submitted audit data

UK CHIC
Open forum on how best to present site-level audit results

13:30-14:30 Friday (tomorrow)
In Exchange Room 6/7

To take part, please contact Hilary Curtis in person or by text giving your name and affiliation to 07984 239 556.

Please get your lunch in the Exhibition Hall before going up to the meeting room.