**Background**

Strategies for monitoring antiretroviral therapy (ART) include clinical assessment, CD4 testing, and viral load (VL) testing. Although benefits of VL monitoring have been established, it is considered too expensive to implement in low-income settings. Several studies have found varying levels of cost-effectiveness (CE) of VL monitoring. We reviewed the studies and evaluated their quality to identify gaps in evidence of potential CE of VL testing in low-income settings.

**Methods**

**Study Type:** Systematic review  
**Search Criteria:** Medline search from 1980-2012 with keywords 'cost', 'economic', 'viral load', and 'HIV'.

**Quality Measures:** Validated Quality of Health Economic Scales (QHES) questionnaire and the Drummond criteria.

**Results**

Studies identified and included: Eight (Table 1)  
QHES scores: 44 to 83 (on a scale of 0-100)  
Strategies Evaluated: Three studies evaluated a VL only strategy and seven evaluated both VL and CD4 testing.

**Model Structure:** Two studies used Markov models and others used simulation models.

**Data Inputs:**
- Seven studies used data from sub-Saharan African adults, and one used data from a study of Thai children.
- One study used a societal perspective (Vijayaghavan et al. et al.).
- All included costs of testing and first and second line drugs (Table 2), though costs varied.
- Seven studies included various costs of clinical care (except Hamers et al.).
- Five studies included quality of life measures (Table 3).
- Three studies used high quality cohort data (Bendavid et al., Vijayaghavan et al., Hamers et al.).
- One study used a clinical trial and may not be generalizable (Kahn et al.).

**Incremental CE Ratios:**
- Range: $86/life-year to $68,698/quality-adjusted life-year (Figure 1).
- Sensitivity: highest to cost of VL test kits, followed by treatment failure rates and utilities.
- Two studies found VL testing to be CE (<3 times gross domestic product (GDP)/capita), and three found it to be highly CE (<1 times GDP/capita).
- One study included a societal perspective, and found VL monitoring to be cost saving.

**Table 1:** Models included by study population and year of publication

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year of Publication</th>
<th>Sample Size</th>
<th>Strategies (Testing Intervals)</th>
<th>Time Horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bishai, C., Others</td>
<td>2007</td>
<td>7,000</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Vijayaghavan, E.</td>
<td>2007</td>
<td>6,000</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Bendavid, Y.</td>
<td>2007</td>
<td>10,000</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Phillips, P.</td>
<td>2008</td>
<td>10,000</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Kimmel, W.</td>
<td>2010</td>
<td>6,600</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Kahn, N.</td>
<td>2011</td>
<td>600</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Schneider, P.</td>
<td>2011</td>
<td>600</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
<tr>
<td>Hamers, S.</td>
<td>2012</td>
<td>600</td>
<td>CD4 (6 months)</td>
<td>10 years</td>
</tr>
</tbody>
</table>

**Table 2:** Key model cost inputs for drugs and testing including variation for sensitivity analyses

**Table 3:** Key model utility inputs including variation for sensitivity analyses

**Figure 1:** Incremental costs, outcomes, and cost effectiveness ratio (CEER) of control VL monitoring strategy for each study compared to control strategy, and gross domestic product (GDP) for the country or region of the study.

**Conclusions**

- VL testing may be CE in low-income settings.
- Three of eight studies had significant validity or quality concerns including varying time intervals, lack of appropriate comparison strategy, or inappropriate source data.
- Five studies that were methodologically strong and utilized high quality data found VL monitoring to be CE or highly CE.
- As models were most sensitive to testing costs, reduced costs of VL test kits may further enhance CE. New VL test kits are in the pipeline and will start to become available in the next 5 years.
- Future studies are needed to address methodological and data quality issues.
- The single study using a societal perspective, which is important in HIV, found VL testing to be cost saving, and demonstrates the needs for models with a wider perspective.