HBV in the UK: economic aspects

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Outline

• Review epidemiology

• Universal options
  - Economic model
  - Parameterisation
  - Results & sensitivity analyses

• Alternative options

• Discussion
Incidence is low in England & Wales
- ~670 laboratory reports / yr
- ~3,800 infections / yr
- ~280 chronic carriers / yr
Most cases occur in risk groups
Most (~95%) carriers living in UK acquired infection abroad
- ~6,500 new carriers immigrate
Implications
- Vaccination of risk groups may be more cost-effective
- Universal vaccination will not lead to a significant reduction in resource use
Cohort model from Fenn et al. 1996, & Anderson, unpublished

- Cohort of individuals followed from birth (either vaccinated or not)
  - Susceptible
  - Acute infection
  - Acute (fulminant) liver failure
  - Chronic carrier
  - Cirrhosis
  - Decompensated cirrhosis
  - HCC
  - Immune
  - Death

- Costs and benefits (life-years lost) compared in two cohorts
- Vaccination occurs in infancy (3 doses) or adolescence (2 doses)
- Males and females treated separately (incidence & progression differs)
- Transmission ignored (benefits underestimated)
Cohort model
epidemiological & demographic parameters

- Incidence taken from Hahne et al. (assume stable through time)
- Also used South Asian estimates as part of sensitivity analysis
- Background mortality from ONS
- Most transition probabilities taken from literature
- E.g. Cirrhosis to decomp cirrhosis and HCC from Fattovich et al. 1993
Cohort model
epidemiological & demographic parameters

• Little data on key progression (carrier to cirrhosis)
  • Estimates of 0.6 – 2.1% per yr
  • Progression rates chosen to give ~25% developing HCC over lifetime
    – Do not fit observed data on time-course of progression (data from Taiwan and US)
• Estimated transition probabilities by fitting model to (male) data
  • Taiwanese (higher) estimates
  • US (lower) estimates
  • Estimated rates for younger & older adults & when progression rates change
• Estimated lower progression rates for females
  • Based on difference in HBV mortality (HCC & cirrhosis) observed in The Gambia
  • Rates 5 times lower than for men
Cohort model 
other assumptions (base-case)

• Vaccine coverage = 90%
  • Both infant and adolescent
• Vaccine efficacy = 90%
  • Both infant and adolescent
• Life-long immunity
• Adolescent vaccination given at 12 years of age

• Future costs and health benefits are discounted at 3.5% per annum (as recommended by NICE)
Cohort model
cost parameters

- NHS perspective

- Base-case cost per vaccine course
  - Infant = £15 (3 doses @ £5)
  - Adolescent = £15 (2 doses plus £5 administration)

- Treatment costs taken from literature & standard sources
  - often HCV
  - Inflated to £2003

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Cost (£)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute HBV (no transplant)</td>
<td>Episode</td>
<td>1,747</td>
<td>Struve &amp; Giesecke (1993)</td>
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<tr>
<td>Compensated cirrhosis</td>
<td>Year</td>
<td>1,674</td>
<td>Grieve &amp; Roberts (2002)</td>
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<tr>
<td>Decompensated cirrhosis</td>
<td>Year</td>
<td>10,114</td>
<td>Grieve &amp; Roberts (2002)</td>
</tr>
<tr>
<td>HCC</td>
<td>Year</td>
<td>9,729</td>
<td>Grieve &amp; Roberts (2002)</td>
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<tr>
<td>Liver transplant</td>
<td>Episode</td>
<td>50,518</td>
<td>Grieve &amp; Roberts (2002)</td>
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Base-case results: universal infant vaccination

Estimated number of HBV associated deaths and acute morbidity in cohort with and without universal infant vaccination

~80 % reduction in HBV associated deaths
Base-case results:
universal adolescent vaccination

Estimated number of HBV associated deaths and acute morbidity in cohort with and without universal adolescent vaccination

~60 % reduction in HBV associated chronic deaths
## Cost-effectiveness

### Base-case results

Cost (£) per discounted life year gained of vaccination compared with current strategy

<table>
<thead>
<tr>
<th></th>
<th>Infant</th>
<th>Adolescent</th>
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<tbody>
<tr>
<td><strong>Taiwan (high progression)</strong></td>
<td>41,000</td>
<td>30,000</td>
</tr>
<tr>
<td><strong>USA (lower progression)</strong></td>
<td>106,000</td>
<td>73,000</td>
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</table>
Cost-effectiveness
Sensitivity to discount rate

Cost (£) per discounted life year gained of vaccination compared with current strategy. No discounting of benefits

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<thead>
<tr>
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<th>Infant</th>
<th>Adolescent</th>
</tr>
</thead>
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<tr>
<td><strong>Taiwan (high progression)</strong></td>
<td>41,000</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>5,700</td>
<td>6,400</td>
</tr>
<tr>
<td><strong>USA (lower progression)</strong></td>
<td>106,000</td>
<td>73,000</td>
</tr>
</tbody>
</table>
Cost-effectiveness
Sensitivity to cost per course

- Infant (Taiwan)
- Infant (USA)
- Adolescent (Taiwan)
- Adolescent (USA)
Cost-effectiveness: Sensitivity to incidence

Cost per life-year gained of infant vaccination compared with current strategy for UK population and South Asians.
Cost-effectiveness: Length of immunity

Cost per life-year gained of infant vaccination compared with current strategy for UK population and South Asians
• **Adolescent vaccination less effective, but more cost-effective**
  • As vaccine given closer to age at which risk is highest
  • Assumes costs per course for infant & adolescent are the same
    - At £33 per course (Wallace et al.)
    - cost per LYG ~ £70,000 (base-case, Taiwan)
• **South Asian incidence is higher than overall UK population**
  • More cost-effective to vaccinate South Asians (& other ethnic groups)
  • If 40% of population with higher incidence (assumed = South Asians)
  • Cost per LYG (infant) = 30,000 (Taiwanese progression rates)
  • May be cost-effective to target populations with high ethnic minority population
Alternative (selective strategies)
Prison vaccination (A Sutton)

• IDUs are major risk group for HBV
• More likely to be imprisoned than others
• HBV vaccination is being offered on reception to prisons in England & Wales
  – 3 dose programme (0, 7, 21 days)
• Model developed to assess
  – Coverage expected in IDUs over time
  – Impact on HBV transmission over time
Parameterising the models

- **Characteristics of IDUs**
  - UA survey
- **Imprisonment rates**
  - Routine data, UA, Prison Survey
- **Vaccine coverage**
  - Scenario & routine surveillance
- **Force of infection**
  - UA survey
Model results

- Estimated % IDUs vaccinated through prison programme
- Estimated impact on acute HBV
Discussion

• Low incidence of HBV in the UK
• Vaccination will have little impact on burden of HBV associated chronic disease
• Universal Infant / adolescent vaccination unlikely to be cost-effective
• Vaccination by risk group more likely to be cost effective (perhaps geographically selective?)
• Improving selective programme (e.g. through prisons) has potential to reduce transmission
• Will adversely affect C/E of universal programmes