Economic Evaluation of Infant Feeding Modalities for Mothers in Canada Living with HIV

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Disclosures

• None
BACKGROUND: HIV & PREGNANCIES

- Globally, 36.7 million\(^1\) people with HIV
- In Canada, 75,500\(^2\) with HIV; 22.4% female (n=16,880)
- Improvements in health and life expectancy\(^3\)
- Increasing trend in pregnancies\(^2\)
- FF/BF dilemma:
  - Eliminate the risk of HIV transmission vs. immunological protection & ideal nutrition to the infant

FF = formula feeding; BF = breastfeeding; MIP = Mother-infant-pairs

35% of MIP were identified in Ontario, 17% in Québec, 18% in Alberta, 8% in Saskatchewan, 11% in BC and 8% in Manitoba.  

Regional distribution of MIP

Sources: 1UNAIDS Nov 2016; 2PHAC Nov 2015; 3May et al. JAIDS July 2016
WHO Recommendation August 1 2016

• Era of new information on the impact of ART in preventing HIV transmission risk via breastmilk
• Community wishes for informed individual decision-making

Vs.

Regional Policies

• High-income countries: typically exclusive FF recommended; allowing BF in rare circumstances
• Often take into account the care provider perspectives

1. Given the dilemma between BF/FF in the context of HIV, how do we **maximize child survival** and **quality of life**, while **minimizing overall costs** that may result as result of infant feeding modality.

2. No **health economic evaluations** on exclusive BF (EBF) and exclusive FF (EFF) for mothers living with HIV (MLWH) in high-income countries.
Determine which of the two infant feeding modalities, (exclusive formula feeding vs. exclusive breast feeding) is the more cost-effective approach.
METHODOLOGY
# DEVISING THE MODEL: OVERVIEW

<table>
<thead>
<tr>
<th>Framework</th>
<th>Health Economics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Cost-Effectiveness Markov micro-simulation</td>
</tr>
<tr>
<td>Intervention</td>
<td>EFF for first 6mo of life versus EBF ... cont. to 12 months</td>
</tr>
<tr>
<td>Target Population</td>
<td>Infants in Ontario, Canada born to women living with HIV</td>
</tr>
<tr>
<td>Cost Perspective</td>
<td>Ontario Ministry of Health and Long-Term Care</td>
</tr>
<tr>
<td>Effects</td>
<td>Quality-Adjusted Life Years (QALYs)</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>3% per year for costs and clinical effects</td>
</tr>
<tr>
<td>Outcome Measures</td>
<td>Incremental Cost per QALY gained</td>
</tr>
<tr>
<td>Cycle Length &amp; Timeframe</td>
<td>1- year cycles; lifetime (0-82 years)</td>
</tr>
<tr>
<td>Data Sources</td>
<td>Published literature</td>
</tr>
<tr>
<td>Sensitivity Analysis</td>
<td>One-way and probabilistic</td>
</tr>
</tbody>
</table>
MODEL INPUTS: HEALTH STATES

Systematic Review – Health State from EBF

- HIV$_4,10$

Agency for Healthcare Research and Quality (AHRQ) – Health States from EFF

- Acute Otitis Media; Atopic Dermatitis; Nonspecific gastroenteritis; Severe Lower Respiratory Tract Infections; Asthma; Obesity; Type 1 and 2 Diabetes; Childhood Leukemia; Sudden Infant Death Syndrome$_{11,12}$

- (Cognitive development, cardiovascular diseases, infant mortality)

<table>
<thead>
<tr>
<th>Health Condition</th>
<th>Prob. if EFF vs. EBF</th>
<th>Prob. Of Recovery</th>
<th>Relative Risk of Mortality</th>
<th>Cost</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Otitis Media</td>
<td>0.61 vs. 0.49</td>
<td>1.00</td>
<td>-</td>
<td>$73.00</td>
<td>0.9667</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.06 vs. 0.03</td>
<td>0.00</td>
<td>1.281</td>
<td>$893.92</td>
<td>0.7292</td>
</tr>
<tr>
<td>Atopic Dermatitis</td>
<td>0.06 vs. 0.05</td>
<td>0.761</td>
<td>-</td>
<td>$179.13</td>
<td>0.8159</td>
</tr>
<tr>
<td>Gastroenteritis</td>
<td>0.61 vs. 0.19</td>
<td>1.00</td>
<td>-</td>
<td>$1,368.78</td>
<td>0.7319</td>
</tr>
<tr>
<td>L. Respiratory Infection</td>
<td>0.27 vs. 0.14</td>
<td>1.00</td>
<td>-</td>
<td>$1,172.02</td>
<td>0.7701</td>
</tr>
<tr>
<td>Obesity</td>
<td>0.02 vs. 0.01</td>
<td>0.00641</td>
<td>1.159</td>
<td>$3,323.00</td>
<td>0.8975</td>
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<tr>
<td>Diabetes</td>
<td>0.01 vs. 0.00</td>
<td>0.00</td>
<td>1.579</td>
<td>$6,015</td>
<td>0.7465</td>
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<tr>
<td>HIV</td>
<td>0.00 vs. 0.05</td>
<td>0.00</td>
<td>5.285</td>
<td>$19,954.16</td>
<td>0.8225</td>
</tr>
</tbody>
</table>

Cost of FF = $1,635.68
Probabilities
• Risks modified based on clinical history
• Based on expert opinion/literature review → potential associations
• Systematic review to quantify

Costs
• Annual costs of the two individual health states were added together

Utility Effects
• Used ‘minimum’

<table>
<thead>
<tr>
<th>Joint Health State</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV → Asthma</td>
<td>1.0</td>
</tr>
<tr>
<td>HIV → Obese</td>
<td>1.0</td>
</tr>
<tr>
<td>HIV → Diabetes</td>
<td>1.11</td>
</tr>
<tr>
<td>Asthma → Atopic Derm.</td>
<td>1.294</td>
</tr>
<tr>
<td>Atopic Derm. → Asthma</td>
<td>1.6</td>
</tr>
<tr>
<td>Obesity → Asthma</td>
<td>1.605</td>
</tr>
<tr>
<td>Obesity → Diabetes</td>
<td>9.44</td>
</tr>
</tbody>
</table>
FINDINGS
COST-EFFECTIVENESS RESULTS

EBF
- Cumulative cost = $47,972
- Cumulative effect = 57.9 QALYs

EFF
- Cumulative cost = $72,808
- Cumulative effect = 56.475 QALYs

ICER = \(-$17,918\) per QALY \((24,827/-1.386)\)

Therefore, EBF dominated EFF
Cost and effect discount rates
• Standard base estimate = 3%
• Sensitivity analysis = 0% and 7%

Cost of Formula milk
• Base estimate = $1635.68
• Sensitivity analysis = $817.84 and $3271.36

HIV Transmission Risk
• Base estimate = 0.05 if EBF
• Net Benefit Approach to determine threshold
ONE-WAY SENSITIVITY ANALYSIS RESULTS

Sensitivity Analysis with WTP Value of $10,000/QALY

Net Monetary Benefit

Probability of HIV Transmission

23.4%
95% CONFIDENCE ELLIPSE USING PROBABILISTIC SENSITIVITY ANALYSIS
DISCUSSION
Limitations

- Data was based primarily on observational studies
- External benefits/costs (e.g. spread of infection)
- Potential of antiretroviral toxicity or resistance
- Clinical complexities of the problem at hand
- Account for differences in sub-populations

Strengths

- Question that has not been answered before
- Health and cost outcomes over the lifetime horizon
In comparison to EFF, EBF was the more cost-effective approach. Cost/Benefit trade-off between EBF and EFF via a health economic evaluation → Maximize child survival → Maximize quality of life → Reduce healthcare costs
THANK YOU

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