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COST-EFFECTIVENESS OF PALIVIZUMAB PROPHYLAXIS FOR THE PREVENTION OF SEVERE RESPIRATORY SYNCYTIAL VIRUS INFECTION IN COLOMBIAN BABIES 32-35 WEEKS GESTATION USING RISK FACTORS

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Why did we perform this research?

- Respiratory syncytial virus (RSV) is the leading cause of bronchiolitis in Colombia and remains a major cause of morbidity and mortality[1]
- Palivizumab is effective in preventing RSV hospitalisation (RSVH) of premature infants born <35 weeks' gestational age (wGA),[2,3] but in Colombia its use is restricted to infants <32wGA unless there is comorbid bronchopulmonary dysplasia (BPD)[4]
- The cost-effectiveness of palivizumab in Colombia was last assessed in 2013;[5] however, since that time significant advances have occurred providing a rationale for the reassessment of palivizumab use in less premature infants:
  - The link between RSV and subsequent long-term sequelae has been strengthened[6–8]
  - The impact and importance of medically-attended RSV infections (MARI) in emergency departments and outpatients not involving hospitalisation has become increasingly well-recognised and characterised[9,10]
  - Development and publication of the International Risk Scoring Tool (IRST) has facilitated targeting palivizumab prophylaxis to those 32–35wGA infants at greatest risk of severe disease[11]

Objective: To provide an up-to-date evaluation of the cost-effectiveness of palivizumab *versus* no prophylaxis in 32–35wGA Colombian infants identified as moderate- or high-risk of RSVH by the IRST

Summary

IRST[11] for 32–35wGA infants

- Birth 3 months before to 2 months after RSV season start
- Smokers in the household and/or smoking while pregnant
- Siblings and/or day care

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Prophylaxis of moderate- and high-risk infants

IRST: International Risk Scoring Tool; RSV: respiratory syncytial virus; wGA: weeks' gestational age

Costs and QALYs

- Cost of treatment based on local palivizumab price combined with average birthweight and a growth algorithm
- Costs derived from country-specific data or local-expert validated estimates
- Utilities for RSVH/MARI and long-term respiratory morbidity (LTRM)

LTRM : long-term respiratory morbidity; MARI: medically-attended RSV infection; RSV: respiratory syncytial virus; RSVH: RSV hospitalisation

Cost-utility analysis

Base case
- Healthcare provider perspective
- Lifetime horizon
- ≤18 years of LTRM
- 5.0% discounting

▼

COP 31,204,720/QALY

COP: Colombian Peso; LTRM : long-term respiratory morbidity; QALY: quality-adjusted life year

Key takeaway

Palivizumab prophylaxis of 32–35wGA infants guided by the IRST is a cost-effective approach in Colombia

IRST: International Risk Scoring Tool; wGA: weeks' gestational age

What did we find?

Palivizumab prophylaxis of moderate- and high-risk 32–35wGA infants, as identified by the IRST, was cost-effective *versus* no intervention in the Colombian setting (Table 1)

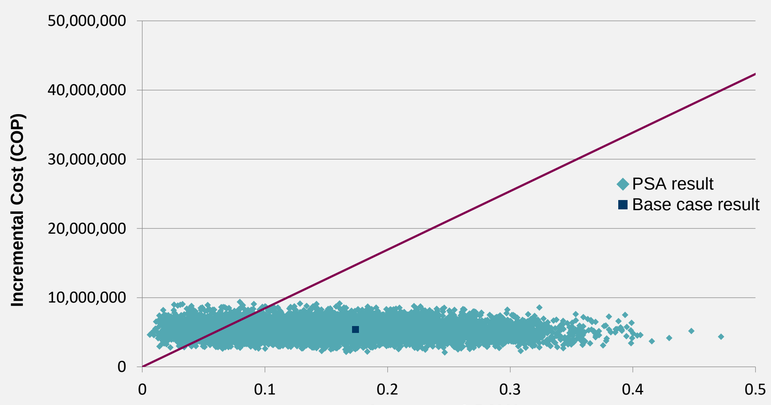
- Probabilistic sensitivity analysis (PSA) resulted in a mean incremental cost-utility ratio (ICUR) of Colombian Pesos (COP) 33,790,243 *versus* a willingness-to-pay (WTP) threshold of COP 84,659,313 (3 times the gross national product *per capita*; Figure 1)
- In deterministic sensitivity analyses the model was most sensitive to the number of injections administered, cost *per* 100mg palivizumab vial, utility scores, and palivizumab efficacy (Figure 2)
- Removing the discounting of costs and utilities improved cost-effectiveness, the cost/quality-adjusted life year (QALY) being reduced to COP 20,453,305
- Cost-effectiveness was maintained in less favourable scenarios when vial sharing was excluded and when long-term respiratory morbidity was limited to 6 years (Table 1)
  - If every infant received 5 rather than 4 palivizumab injections, the cost *per* QALY increased to COP 43,340,018, but remained below the WTP threshold

Table 1. Palivizumab prophylaxis was cost-effective in the base case and in the absence of vial sharing

	High and moderate (base case)	High and moderate (no vial sharing)
Cost difference (COP)	5,423,328	7,231,262
QALY difference	0.174	0.174
Cost (COP) *per* QALY	31,204,720	41,607,197

COP: Colombian Peso; QALY: quality-adjusted life year

Figure 1. PSA demonstrated that the probability of cost-effectiveness in the base case was 88.8% at a willingness-to-pay (WTP) threshold of COP 84,659,313

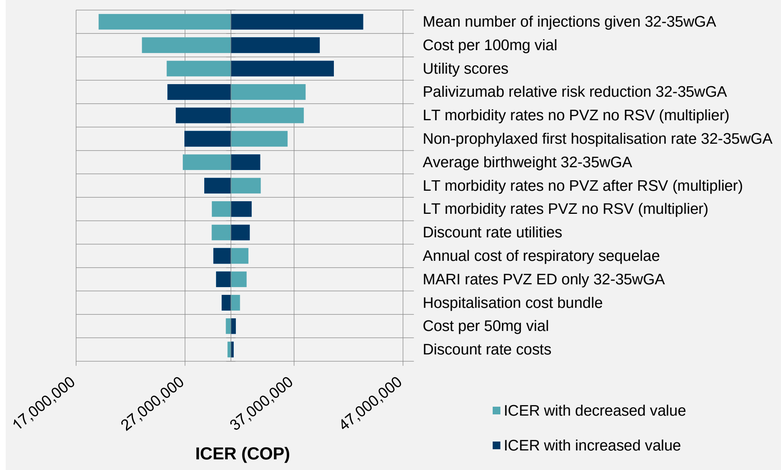


PSA: Probabilistic sensitivity analysis; QALY: quality-adjusted life year

Limitations

- Gestational age specific resource utilisation and cost data are lacking in Colombia, therefore assumptions in our model were based on estimates predicated on a broader population
- Utility data specific to 32–35wGA infants and long-term respiratory morbidity (LTRM) beyond 6 years are also lacking

Figure 2. Deterministic sensitivity analysis (15 most sensitive variables)



ED: emergency department; ICU: intensive care unit; LT: long-term; MARI: medically attended RSV not requiring hospitalisation; PVZ: palivizumab; RSV: respiratory syncytial virus; wGA: weeks' gestational age

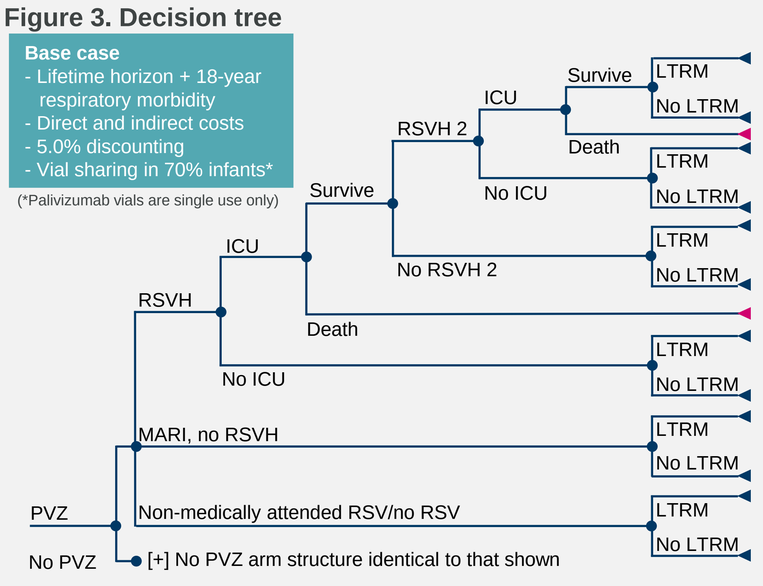
What is the significance of these data?

This cost-utility analysis demonstrates that IRST-guided RSV prophylaxis is cost-effective *versus* no prophylaxis in Colombian infants born at 32–35wGA

How did we perform this research?

- Palivizumab prophylaxis was compared to no prophylaxis in 32–35wGA infants identified as being at moderate- or high-risk of respiratory syncytial virus hospitalisation (RSVH) by the IRST[11] (score ≥20/56)
- Infants followed a new decision tree based on a systematic review of previous economic evaluations of palivizumab in 32–35wGA infants and input from global and national clinical and health economic experts (Figure 3)
  - Infants experienced RSVH, medically-attended RSV infections not requiring hospitalisation (MARI), or were uninfected/non-medically attended
  - Infants admitted to the intensive care unit (ICU) could subsequently suffer mortality; survivors could be readmitted to hospital for RSV infection
  - All surviving infants had the potential to experience long-term respiratory morbidity (LTRM)
- RSVH rates in non-prophylaxed infants were predicted using a Colombian-specific adaptation of the IRST;[12] the efficacy of palivizumab was 82.2% as *per* gestational age-group-specific data from the IMpact-RSV study[2] (Table 2)
- Palivizumab costs were calculated from Colombian birthweight statistics[13] adjusted to be specific to the 32–35wGA group using Canadian birth statistics that categorise data by week of birth,[14] combined with a growth algorithm[15] and Colombian palivizumab vial prices[16] (50mg: COP 1,357,876; 100mg: COP 2,722,324)
  - Based on available data from an ongoing prophylaxis program in Colombia, it was assumed that each infant would receive 4 doses of palivizumab[17]
  - Vial sharing was assumed to be implemented for 70% of infants, in line with current clinical practice (Note: palivizumab vials are single use only)
- Healthcare costs were drawn from Colombian studies where available[18,19] (Table 3)
- LTRM was assessed up to age 18 years across a lifetime horizon among RSVH, MARI, or uninfected/non-medically attended infants (Table 4)
  - LTRM rates were drawn from the SPRING study[20] up to 6 years of age and from Sigurs *et al.*[21–23] thereafter
  - The impact of palivizumab on LTRM was modelled based on data from three studies[24–26]
- Costs and utilities were discounted at 5% commensurate with Colombian standard
- Scenario analyses included: removal of discounting; exclusion of vial sharing; and a worst-case scenario that limited the duration of LTRM to 6 years and assumed that there was no benefit of palivizumab in preventing LTRM in infants with RSVH
- Deterministic (±20% on main variables) and probabilistic (10,000 iterations) sensitivity analyses were undertaken
- Results were expressed as an incremental cost *per* quality-adjusted life year (QALY; also called incremental cost-utility ratio [ICUR]) *versus* no prophylaxis

Figure 3. Decision tree



ICU: intensive care unit; LTRM: long-term respiratory morbidity; MARI: medically-attended RSV infection; PVZ: palivizumab; RSVH: respiratory syncytial virus hospitalisation

Table 2. Model inputs

Parameter	Palivizumab	No palivizumab
RSVH		
- Overall rate[12]	2.22%	12.45%
- ICU rate[18]	7.8%	7.8%
- Hospital ward length of stay, mean days[27]	8.6	8.6
- Utility in hospital[28,29]	0.60	0.60
- Utility post discharge, no sequelae[30]	0.88	0.88
- Utility post discharge, long-term sequelae[31]	0.79	0.79
- Mortality (ICU patients only)[1]	3.6%	3.6%
MARI		
- Rate outpatients only[2,32]	2.95%	16.57%
- Utility[30]	0.95	0.95
No RSVH/MARI		
- Utility no sequelae[30]	0.95	0.95
- Utility long-term sequelae[31]	0.79	0.79
Birth weight (g)[13,14]	1991.2	1991.2

ICU: intensive care unit; MARI: medically attended RSV infection (not requiring hospitalisation); RSV: respiratory syncytial virus; RSVH: RSV hospitalisation

Table 3. Direct costs

Parameter	Cost (COP)
Palivizumab	
- 50mg vial[16]	1,357,876
- 100mg vial[16]	2,722,324
- Administration (*per* course of palivizumab)[18,33]	71,312
RSVH *per* stay (including preadmission and intensive care unit costs)[18]	7,240,740
MARI (emergency department visit)[18]	69,663
Respiratory morbidity per annum[19]	1,817,369.97

COP: Colombia Peso; MARI: medically attended RSV infection (not requiring hospitalisation); RSV: respiratory syncytial virus; RSVH: RSV hospitalisation

Table 4. Long-term respiratory morbidity rates[20–26]

Years	Palivizumab		No palivizumab	
	RSVH	No RSVH	RSVH	No RSVH
0–1	18.43%	5.38%	41.43%	12.09%
1–2	18.43%	5.38%	41.43%	12.09%
2–3	11.05%	5.80%	29.27%	15.36%
3–4	6.12%	4.15%	18.55%	12.57%
4–5	4.39%	2.73%	15.00%	9.31%
5–6	3.25%	2.53%	12.39%	9.66%
6–7	2.93%	2.29%	12.39%	9.66%
7–13	2.33%	1.47%	17.39%	10.96%
13–18	1.79%	1.17%	22.39%	14.66%

RSVH: respiratory syncytial virus hospitalisation

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- BRG, IK & JF employers have received payment from AstraZeneca for work on various projects
- JET has nothing to declare

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