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Cost-effectiveness of respiratory syncytial virus (RSV) prevention interventions in children: a model comparison study

RESCEU
REspiratory Syncytial virus Consortium in EUrope

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Background

- New RSV interventions result in high interest in RSV cost-effectiveness analyses
- Static and dynamic modelling approaches have been used [1]
- Challenging to assess if different results are due to different data, assumptions, model structures, analytical concepts or country contexts

Objectives

1) To characterise and compare cost-effectiveness models
2) To examine drivers for different model outcomes

Methods

3 static and 2 dynamic models using common input data sets and scenarios

Table 1: overview of the model characteristics

	Antwerp University (UA)	Novavax (NV)	Sanofi Pasteur (SPS)	Sanofi Pasteur (SPD)	LSHTM Dynamic model
Model type	Static	Static	Static	Dynamic	Dynamic
Reference model	Li and Bilcke *et al.* [2]	Herring *et al.*# [3]	Kieffer *et al.* [4]	Voirin *et al.* [5]	Hodgson *et al.* [6]
Country of the original model	Norway	United States	United States	United States	England and Wales
Time horizon	1 year	1 year	1 year	10 years	10 years
Model type and population structure	Stochastic, multi-cohort	Deterministic, decision tree	Deterministic, multi-cohort	Deterministic, compartmental, population	Deterministic, compartmental, population
Target population					
Infants	√	√	√	√	√
Children 1-5 years	√	X	X	√	√
*Adults **	X	X	X	√	√
RSV cases					
Medically-attended (MA) cases	√	√	√	√	√
Symptomatic non-MA cases	X	X	X	√	√
Asymptomatic cases	X	X	X	√	√

* Including adults, but did not evaluate older adult vaccine program; # NV model is unpublished but is structurally similar to a published model for RSV vaccination in older adults; LHSTM: London School of Hygiene & Tropical Medicine

Strategies considered:

- **No intervention**
- **Year-round** programmes of maternal vaccine (MV) and monoclonal antibody (mAb)
- **Seasonal** programmes of MV and mAb, protecting infants from birth during October to April
- **Seasonal mAb plus catch-up** programmes in October for infants <6 months

Model input:

- Standardised input parameter set sourced from European countries
- Dynamic models required additional data with bespoke fitting and calibration methods

Table 2: Interventions' characteristics

	Maternal vaccine		Monoclonal antibody	
Base case	Phase 3 trial [7]		Phase 2b trial [8]	
Efficacy (hospitalisation) Efficacy (primary care case)	44% 39%		78% 70%	
Duration of protection	3 months		5 month	
Intervention cost (per dose)	€37.50		€50.00	
	Year-round	Seasonal	Year-round	Seasonal
Delivery cost (per dose)	€5.00	€ 11.36	€8.32	€ 11.36
Fixed implementation cost	€200,000	€100,000	€200,000	€100,000
Coverage	67%	44%	94%	94%

Health economic framework:

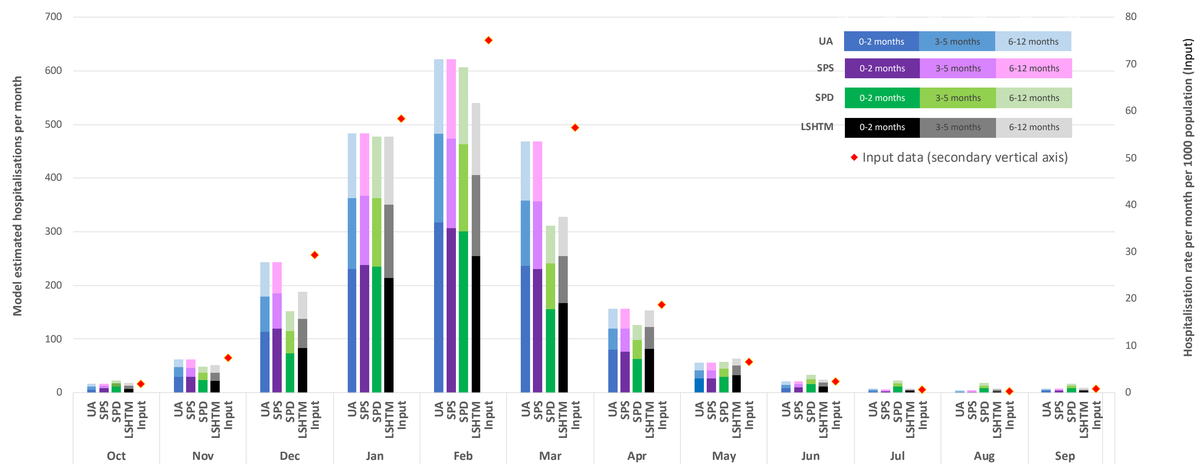
- Perspective: healthcare payer and societal
- Annual discount rate: 3% (both cost and health outcomes)
- Extensive sensitivity analyses

Results

Model-comparison of the disease burden without intervention

- Dynamic and static models provided similar results in January and February (Figure 1)
- Both dynamic models underestimated the pre- and post-peak RSV hospitalisations (i.e., >20% lower in December, >30% lower in March)

Figure 1: RSV hospitalisations (non-ICU) by calendar month

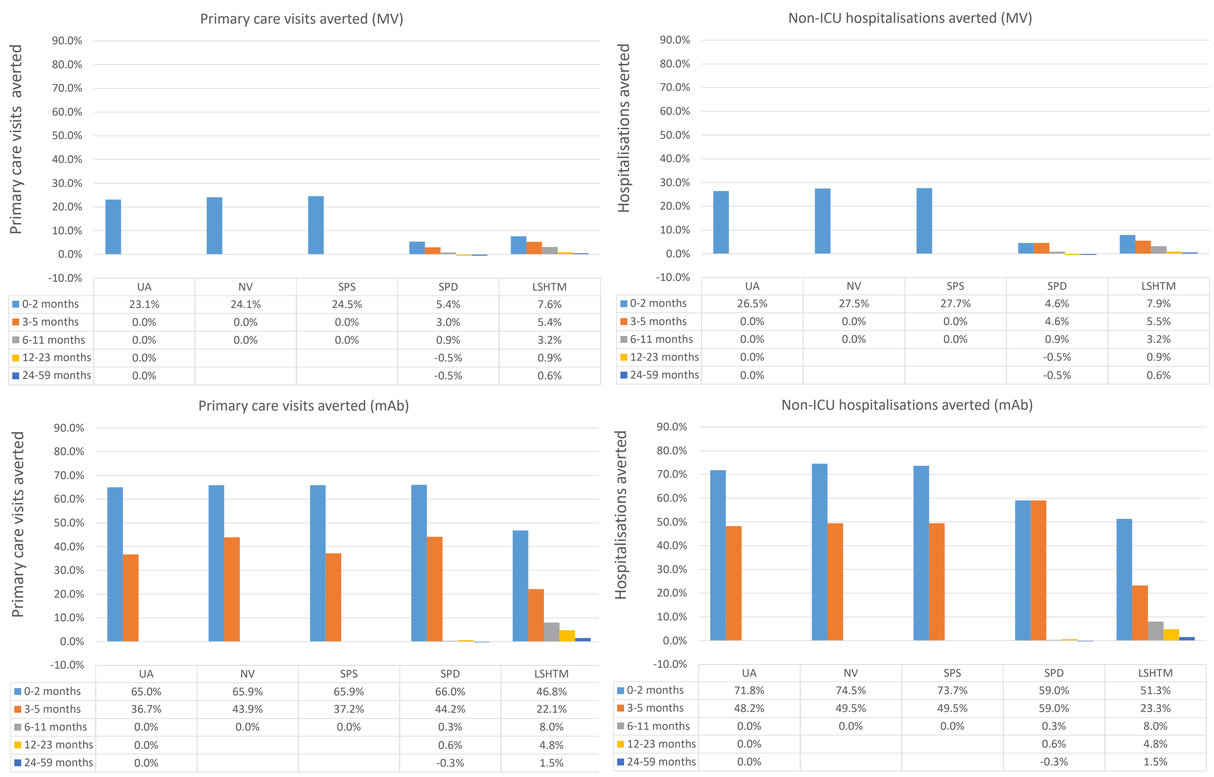


NV model output is not presented, as the model outputs could not be extracted by calendar month

For year-round programmes (Figure 2)

- Three static models estimated similar nominal and relative reductions of medically-attended cases averted
- Important differences between the dynamic models were observed for mAb, due to different waning assumptions
- Dynamic models also show differential impact in age groups (>1 year), with/without herd immunity, age shift (SPD model) and impact of waning (LSHTM model)

Figure 2: year-round programmes: primary care visits (left column) and non-ICU hospitalisations (right column) averted by MV (top row) and mAb (bottom row) as a percentage of the disease burden estimates without any intervention



Across models, cost-effectiveness was most sensitive to:

- The intervention attributes (efficacy, duration of protection and cost per dose) and the severity of the season
- QALY losses per RSV episode, especially for MV
- Length of hospital stay, especially for mAb

Conclusions

- The static and dynamic models produced similar results in terms of hospitalisations and deaths, but there were important differences
- Non-medically attended cases' QALYs and waning effectiveness of mAB and MV are influential and uncertain, and should be explored in economic evaluations of RSV interventions.

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