Cost-Effectiveness of Strategies to Prevent Respiratory Syncytial Virus Illness Among Infants in Ireland

EE277

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INTRODUCTION

- Respiratory syncytial virus (RSV) is common in Ireland, with nearly all children infected with RSV by the age of two[1]
- Most RSV symptoms are mild, but serious cases of RSV manifesting as lower respiratory tract disease (LRTD; RSV-LRTD) are especially common among young infants or those with a weakened immune system[1]
- The National Immunisation Advisory Committee (NIAC) recommended passive immunization with nirsevimab for newborn infants born during RSV season (Sep-Feb) and infants who are younger than 6 months of age at the onset of the season[2]
- Bivalent stabilised prefusion F subunit vaccine (RSVpreF) is also licensed in Europe for use among pregnant women to protect infants against RSV immediately from birth, but it is not currently recommended in Ireland[3,4]

OBJECTIVE

To evaluate the cost-effectiveness of alternative infant RSV-LRTD prevention strategies in Ireland

METHODS

Model Overview

- Population-based cohort model was employed to evaluate clinical and economic outcomes associated with RSV-LRTD among infants aged <1 year and the expected impact of prevention strategies comprising RSVpreF and/or nirsevimab:
  - Clinical outcomes included cases of medically attended RSV-LRTD characterized by care setting (hospital [RSV-H], general practitioner office [RSV-GP]) and attributable deaths
  - Economic costs included direct costs related to medical care and interventions, as well as indirect costs related to caregiver work loss and future lost earnings associated with premature RSV-LRTD-related death
- Model population was characterised by age in months, calendar month of birth, and term status defined by gestational age in weeks (wGA) at birth (full-term [FT], ≥37 wGA; late preterm [LP], 32-36 wGA; early preterm [EP], 28-31 wGA; extreme preterm [ExP], ≤27 wGA)
- Model inputs are reported in Table 1 with details in Supplementary material

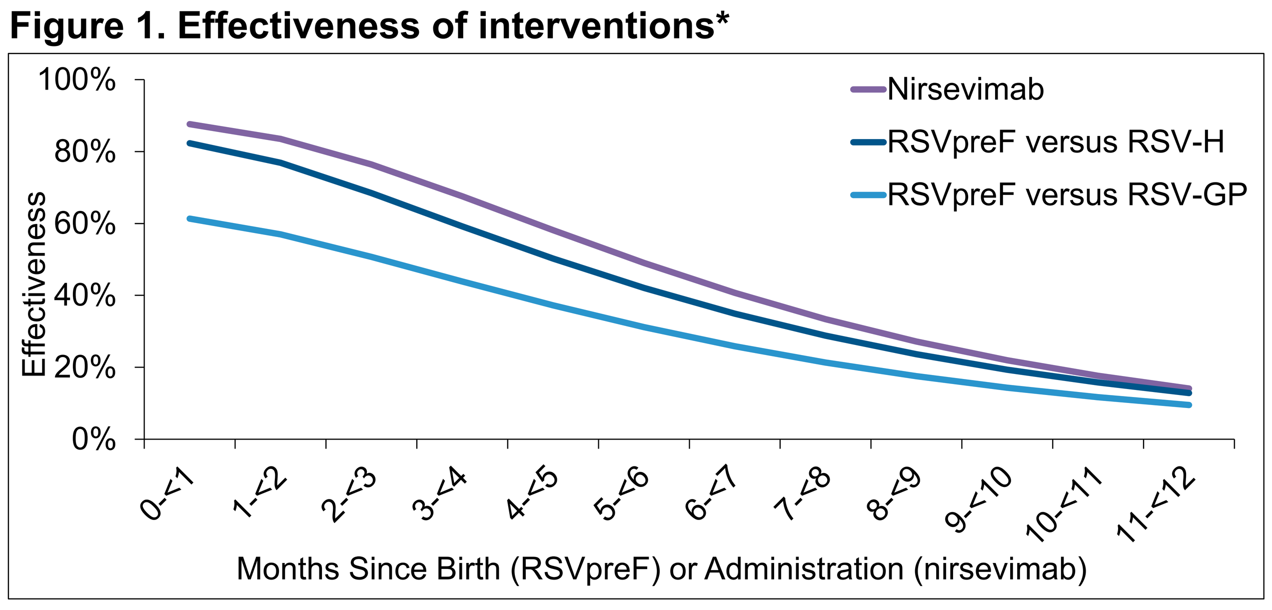
Table 1. Model Inputs

Parameter	Value	Reference
Infant population	62,700	5
Distribution of live births	FT: 93.1%; LP: 5.9%; EP: 0.6%; ExP: 0.4%	5
Incidence rates	*See Table 2*	6-8
Case-fatality rate (per 100)	<6 months: 0.057; 6 - <12 months: 0.132	9
General population mortality	*See Supplementary Material (Table S1)*	10-12
Vaccine effectiveness	*See Figure 1*	13-15
Intervention costs	RSVpreF: €202.95; nirsevimab: €370.38	6
Administration costs	RSVpreF: €25.49; nirsevimab: €10.01	6
Medical care costs	RSV-H: €9,930; RSV-GP: €184	6, 16
Cost of caregiver productivity loss	RSV-H: €302; RSV-GP: €239	17-20
Cost of RSV-related mortality	€299,503	21-23
Infant QALY loss	RSV-H: 0.0157; RSV-GP: 0.0061	24
Caregiver QALY loss	RSV-H: 0.0066; RSV-GP: 0.0041	25

Table 2. RSV-LRTD incidence rates (per 1,000)

	Month of Age											
	<1	1-<2	2-<3	3-<4	4-<5	5-<6	6-<7	7-<8	8-<9	9-<10	10-<11	11-<12
RSV-H												
FT	41	97	74	51	44	36	30	25	20	17	13	11
LP	71	168	128	125	109	90	51	42	34	29	22	18
EP/ExP	19	46	35	121	104	86	203	167	136	115	87	74
RSV-GP												
FT	3	7	8	8	9	10	9	7	9	7	8	8
LP	5	11	14	19	22	23	15	12	16	13	14	15
EP/ExP	1	3	4	18	21	23	59	47	62	51	54	58

Figure 1. Effectiveness of interventions*



*RSVpreF effectiveness assumed to be 0% for infants born <2 weeks after vaccine was administered and early/extreme preterm infants

Analyses

- Base case analyses evaluated the cost-effectiveness of RSVpreF with complementary nirsevimab (for infants not protected via RSVpreF) versus nirsevimab alone to prevent RSV-LRTD among infants aged <1 year in Ireland
- RSVpreF was administered seasonally (targeting infants with expected delivery date from Sep-Feb) to pregnant women between 24-36 weeks gestation; uptake was assumed to be 62% based on observed influenza vaccination coverage among pregnant women in Ireland[6]
- Nirsevimab uptake was assumed to be 83% among eligible infants based on early data from the nirsevimab 2024-2025 pathfinder program, a pilot program which offered nirsevimab to infants born September-February as well as high-risk infants born in the preceding months[26]:
  - Infants were only eligible for nirsevimab if they were not protected via RSVpreF
  - All nirsevimab administration was assumed to occur prior to discharge from birth hospitalization (for infants born during RSV season [Sep-Feb]) or in September (for infants born outside RSV season [March-August])
- Scenario analyses were conducted in which RSVpreF uptake was varied from base case assumption
- Probabilistic sensitivity analyses (PSA; 1,000 simulations) accounted for uncertainty surrounding key parameters
- Costs are reported in 2024 €; future costs and QALYs were discounted 4% annually

RESULTS

BASE CASE ANALYSES

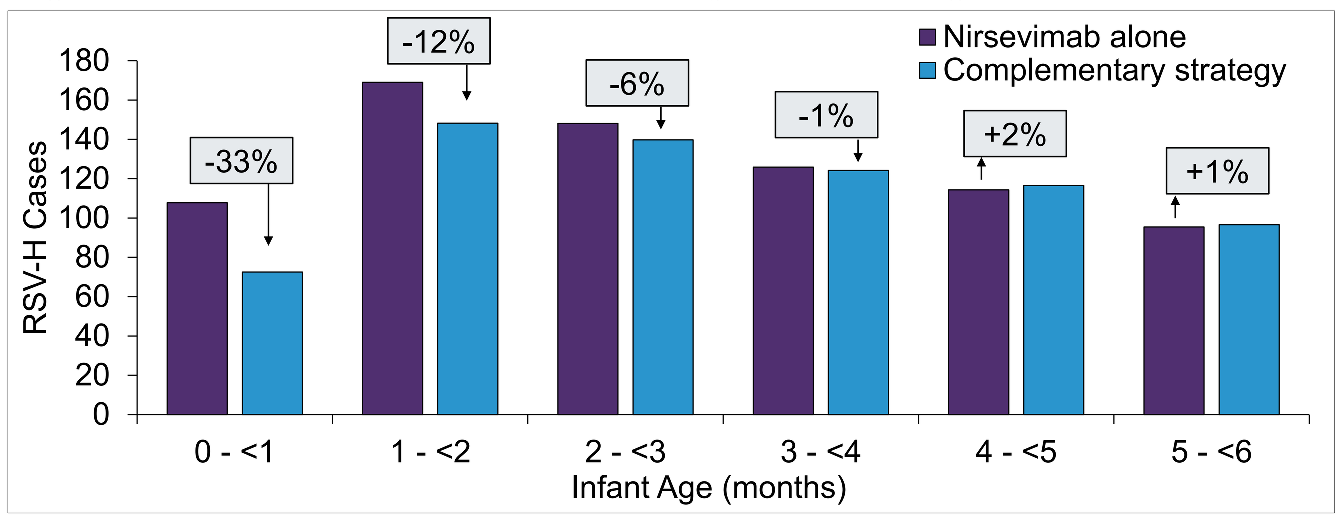
- Complementary strategy would protect 6% more infants than nirsevimab alone, yielding a 4% case reduction (Table 3):
  - By protecting infants immediately from birth via RSVpreF, complementary strategy would yield a 33% reduction in RSV-H among infants aged <1 month and a 15% reduction among infants aged <3 months, compared to nirsevimab alone (Figure 2)
- With lower intervention costs and reduced burden of severe disease, the complementary strategy would reduce total costs by 8% (Figure 3)
- Complementary strategy was thus found to be cost-saving (compared with nirsevimab alone), while yielding a similar clinical impact

Table 3. Clinical and economic outcomes with complementary strategy vs. nirsevimab alone

	Complementary strategy	Nirsevimab alone	Difference
Use of interventions			
No. women receiving RSVpreF	18,855	---	18,855
No. infants protected by RSVpreF	19,100	---	19,100
No. infants receiving nirsevimab	36,076	51,928	-15,852
Clinical outcomes			
No. of cases			
RSV-H	1,032	1,094	-63
RSV-GP	271	256	14
No. of RSV-related deaths	1	1	0.0
Life years	1,540,292	1,540,292	0.9
QALYs*	1,438,640	1,438,638	2.0
Economic outcomes (millions)			
Direct costs			
Medical care	€10.0	€10.6	-€0.6
RSVpreF	€4.3	€0.0	€4.3
Nirsevimab	€13.3	€19.3	-€6.0
Indirect costs (non-medical)	€0.6	€0.6	€0.0
Total costs (direct + indirect)	€28.2	€30.5	-€2.3
Cost-effectiveness (cost per QALY gained)			
Healthcare system perspective			Dominant
Societal perspective			Dominant

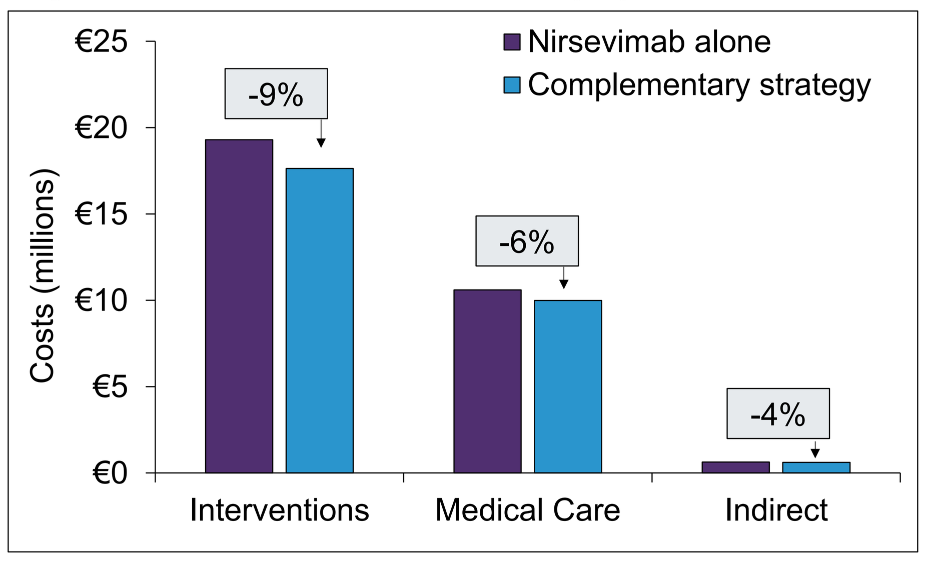
*Includes infant QALYs minus caregiver QALY loss

Figure 2. Difference in RSV-H cases by month of age*



*Percentages calculated as relative increase/decrease in hospitalizations with the complementary strategy vs. nirsevimab alone. Slight increase in months 4-<6 is due to delayed nirsevimab administration; infants aged ≥6 months had no difference.

Figure 3. Difference in costs by type*

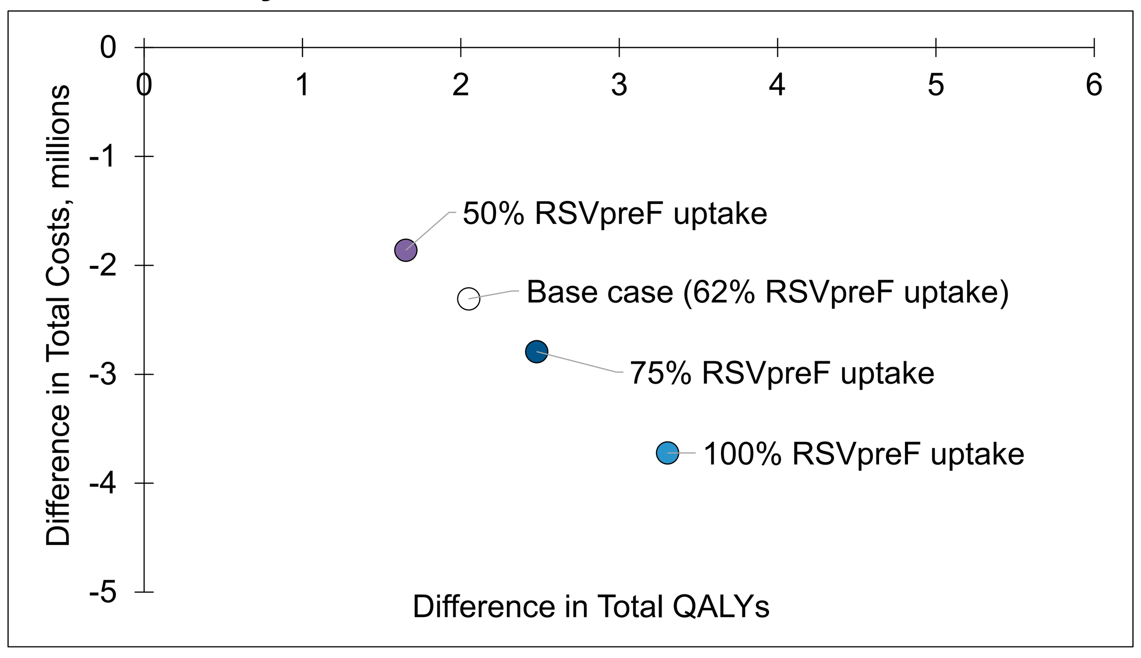


*Percentages calculated as relative decrease in costs with complementary strategy vs. nirsevimab alone

SENSITIVITY AND SCENARIO ANALYSES

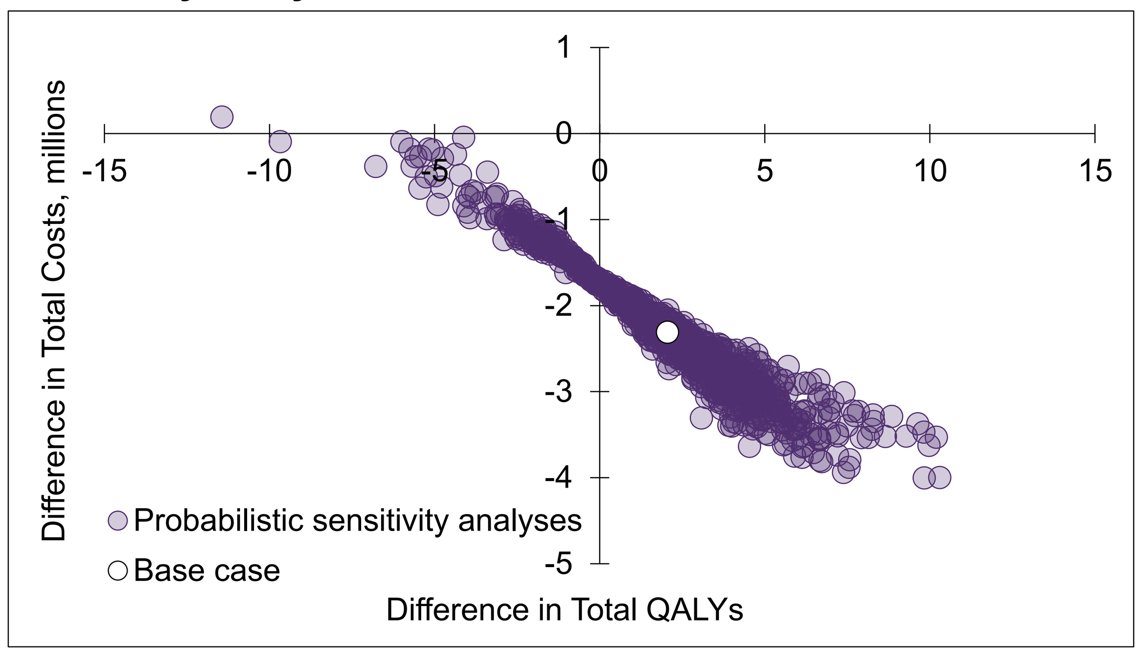
- Scenario analyses demonstrated that increasing RSVpreF coverage within the complementary strategy would further increase the clinical and economic benefit (Figure 4)
- In PSA, 783 (78.3%) simulations yielded dominance for complementary strategy; in 215 of the 216 remaining simulations, the complementary strategy reduced costs, but yielded fewer QALYs than nirsevimab alone (Figure 5)

Figure 4. Cost-effectiveness results of base case and scenario analyses*



*Reflects difference with complementary strategy vs. nirsevimab alone

Figure 5. Cost-effectiveness results of probabilistic sensitivity analyses*



*Reflects difference with complementary strategy vs. nirsevimab alone

LIMITATIONS

- The clinical burden of RSV-LRTD among infants in Ireland treated outside of the hospital setting is largely unknown due to lack of diagnostic testing; we estimated RSV-GP incidence based on outcomes reported by HIQA, but expect the burden to be underestimated[6]
- Because intervention effectiveness estimates from Hodgson et al.[13] were employed, endpoints may not perfectly align with model outcomes; data limitations also required that nirsevimab effectiveness be assumed invariant by infant age at administration and disease severity
- Ireland-specific data were employed where possible; for several model parameters (e.g., relative risk of incidence by term status, CFR, QALY loss), data from comparable country settings was required
- Several benefits of immunisation were not captured by the model, including benefits of RSVpreF for pregnant women, indirect impact of interventions on other populations, and potential prevention of non-medically attended disease, upper respiratory tract infections, and long-term sequelae of RSV-LRTD

CONCLUSIONS

Results suggest that administering RSVpreF maternal vaccine with complementary nirsevimab would be a more efficient use of resources than the current NIAC recommendation in Ireland

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