Economic Value of RSV Maternal Vaccination to Prevent Infant Disease in Ecuador

EE409

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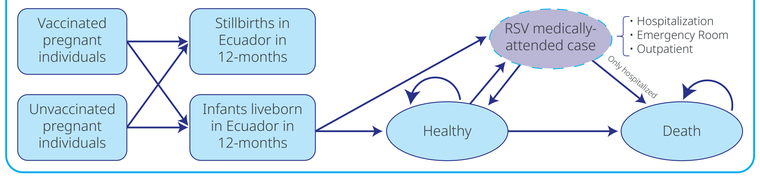
OBJECTIVE

- This study aimed to estimate the cost–utility of RSVpreF maternal vaccination for preventing RSV-related illness in Ecuadorian infants.

METHODS

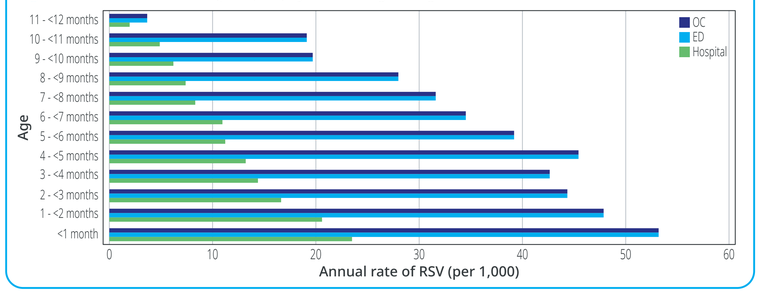
- A population-based Markov model was used to project RSV-related clinical and economic outcomes among infants aged <1 year and compare the impact of maternal bivalent RSVpreF vaccination against no vaccination [1–3]. Clinical outcomes and direct medical costs were evaluated over infants' first 12 months of life. A lifetime model time horizon was used to capture infant premature death from RSV hospitalization and the analysis was conducted from the Ecuadorian health system perspective[4,5].
- Health outcomes: Quality-adjusted life years (QALY), number of cases of medically-attended RSV cases by care setting (hospital [H], emergency department care encounters [ED], outpatient clinic encounters [OC]), and attributable deaths.
- The model included mutually exclusive health states: healthy, RSV-LRTI medically-attended cases (comprising outpatient care, ED, and hospitalization), and an absorbing state of death related to RSV hospitalizations (**Figure 1**).

Figure 1. Model schematic



- The model population includes all pregnant individuals in Ecuador during a 1-year period (n= 213,367) and all births (n= 215,714) for the reference period. Infants were grouped by their gestational age at birth: full term (at least 37 weeks), late preterm (32 to 36 weeks), early preterm (28 to 31 weeks), and extreme preterm (27 weeks or earlier). Data were taken from the Ecuadorian Statistics National Institute for 2024[6].
- The incidence rates were extracted from the microdata of the Statistical Record of Hospital Beds and Discharges for 2023 and 2024[7] and the Healthcare Production Dashboard of the Ecuadorian Social Security Institute[8] using the ICD-10 codes J210, J219, J121, J205, B974. These rates were expected to differ according to term status[9], calendar month[7], and age[7]. In addition they were adjusted considering an underreporting factor of 1.32, based on Bierrenbach & Ranzani[10] and Tran et al.[11]. These rates were included in the model as shown in **Figure 2**.

Figure 2. Annual rates of RSV (per 1,000) by care setting and age



- General mortality rates and case-fatality due to RSV were extracted from the Ecuadorian Statistics National Institute[6,7] and for the latter it was assumed to occur only at inpatient services (< 3 months: 0.6%, 3 - <6 months 1.5% and 6- <12 months 0.3%)[7].
- Vaccine effectiveness (VE) for full-term and late preterm infants was based on data from the MATISSE efficacy study[12], and a decline in VE was projected to wane linearly to 0% by age 9 to <10 months. In addition, a 0% VE was assumed for early and extreme preterms[12].
- Utility for infants without RSV assumed to be 1; annual QALY loss associated with RSV-RTD was 0.0157 for inpatient infants and 0.0061 for outpatient cases[13].
- The intervention costs are limited to vaccine acquisition and administration expenses. For the former the cost was extracted from the PAHO Revolving Fund[14] and for the latter a cost of 4 USD per dose administered was assumed.
- Direct costs per episode were based on Ecuadorian administrative data[8], using the average cost of 2023 and 2024 for the J121 and J210 ICD-10 codes for cases under 1 year. A cost of 3,346.08 USD per hospitalization and 331.36 USD both per emergency department and outpatient clinic encounter was included. Although the list of health services and procedures prices in Ecuador hasn't been updated since 2014[15], they are still in force and no consumer price index or any other price adjustment was conducted.
- Key assumptions included a 5% annual discount rate, applied to both costs and outcomes following local guidelines[5]. A year-round RSVpreF uptake of 50% was modelled considering that WHO/UNICEF estimates for the country in 2025 was 51%[16].
- According to national guidelines, while cost-effectiveness thresholds are generally determined with reference to GDP, there are currently no established estimates for Ecuador[4,5]. Consequently, it was decided to apply the upper limit threshold recommended by neighboring countries[17]. The cost-effectiveness threshold was based on Ecuadorian 3xGDP per capita for 2025 (USD 21,596, 1xGDP= 7.198,6)[18]. Deterministic (-25%/+25%) analyses were conducted to evaluate the robustness of the findings.

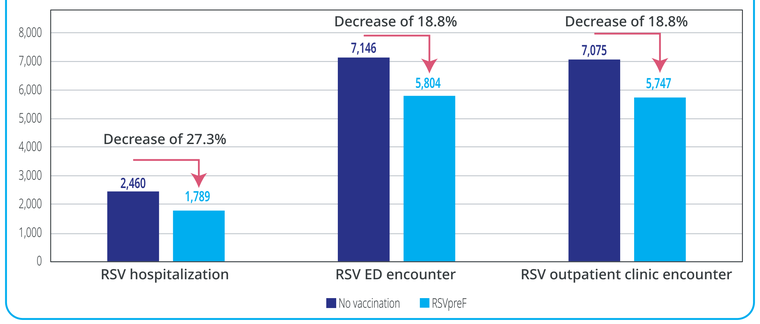
RESULTS

- Without intervention, over 16,880 RSV cases were estimated to occur annually:
  - 43% (n=7,146) ED encounters,
  - 42% (n= 7,075) OC encounters, and;
  - 15% (n= 2,460) hospitalizations.
- In this context, RSVpreF would avert 671 hospitalizations, 1,342 ED, 1,328 OC and 6 deaths, which translated into a 3 million USD decrease of direct medical costs (**Table 1**).
- This implies a decrease in the number of hospitalizations in 27.3%, 18.8% of ED encounters and 18.8% of OC encounters (**Figure 3**).

Table 1. Base case results

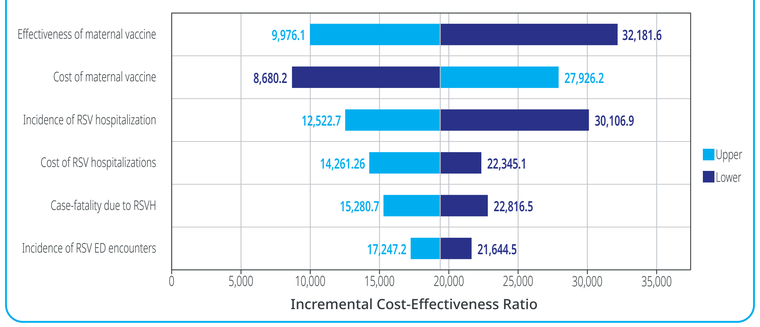
	RSVpreF	No vaccination	Incremental
Health outcomes			
RSV hospitalization	1,789	2,460	-671
RSV ED encounter	5,804	7,146	-1,342
RSV outpatient clinic encounter	5,747	7,075	-1,328
RSV-related deaths	13	19	-6
Quality-Adjusted Life Years (QALY)	4,096,172.7	4,096,040.2	133
Direct Costs (millions)			
Medical care	9.4	12.5	-3.0
Maternal vaccination	5.6	0	5.6
Total	15.0	12.5	2.6
Incremental Cost-Effectiveness Ratio (USD per QALY)			**19,380**

Figure 3. Healthcare resource utilization results, base case results



- The incremental cost-effectiveness ratio was estimated at USD 19,380 per QALY gained, indicating that RSVPreF is cost-effective for the Ecuadorian health system (**Table 1**).
- Parameters such as the incidence of RSV hospitalizations and the effectiveness of the RSVpreF vaccination were identified as the main model drivers. The cost of the maternal vaccine, the cost of RSV hospitalizations, the CFR and the incidence of ED encounters also altered the ICER (**Figure 4**). The model presented consistent results against other key parameters.

Figure 4. Tornado diagram for DSA (main drivers)



LIMITATIONS

- The results presented can be interpreted as a conservative estimation of the potential public health and economic impact of maternal RSVpreF vaccination, given that maternal benefit and RSV sequelae were not included in the analysis.
- The cost of RSV medically-attended cases by care setting derived from summarized national metrics that do not discriminate based on the age groups studied, this might underestimate the direct medical costs.
- International data was used where Ecuador-specific data was not available (e.g. utilities, relative risk of RSV by age).
- Most Ecuadorian data come from administrative records, which although provide a snapshot, also is subject to the limitations typical of these sources of information, such as inaccuracy or misclassification of ICD-10 codes and billing codes, missing data, and clerical errors[19], and therefore a underreporting of events might be present, considering estimations made by other authors[20].

CONCLUSION

- Maternal RSVpreF vaccination represents a cost-effective strategy for Ecuador. Integrating this intervention into the national immunization schedule could substantially reduce RSV-related morbidity, hospitalizations, and associated healthcare expenditures, ultimately improving infant health outcomes.

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