The value of vaccination in prevention of respiratory syncytial virus disease in older adults. A modelling analysis for Greece.

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Introduction

•Respiratory syncytial virus (RSV) is one of the leading causes of respiratory illness in older adults (1).
•The clinical burden can be severe for adults who are hospitalized with an RSV infection. Among hospitalized adults with RSV infection, severe outcomes occurred in 19.1% of patients including intensive care unit admissions, mechanical ventilation, and/or death (2).
•Apart from the humanistic/clinical burden, RSV infection is a global health problem that exerts a significant economic burden on healthcare systems (3).
•In August of 2023, the European Commission granted marketing authorization to a bivalent stabilized prefusion F subunit vaccine (RSVpreF) for the prevention of lower respiratory tract disease (LRTD) caused by RSV in adults aged 60 years and older (4).

Objective

The aim of present study was to evaluate the health benefits, costs and cost-effectiveness of vaccination with RSVpreF, for the prevention of LRTD caused by RSV in Greek adults 60 years of age and older.

Methods

Model overview

- A Markov model was locally adapted to simulate lifetime risk of health and economic outcomes of RSV as well as the expected impact of vaccination against RSV, over lifetime horizon among a population of Greek adults 60 years of age and older.
- Model population characterized by age (60-64, 65-74, 75-84, and 85-99y) and comorbidity profile (CP) (with vs. without chronic or immunocompromising medical conditions [CMC+ vs. CMC-])
- Health outcomes and economic costs projected monthly, from model entry through end of modelling horizon, including:
  - Health outcomes: medically attended RSV-LRTD by care setting (hospital [RSV-H], emergency department [RSV-ED] outpatient visit[RSV-VO]), and RSV-related deaths.
  - Economic costs: direct medical costs of treatment for RSV are generated based on event rates and unit costs in relation to the setting of care (hospital, ED and OV), age, and CP and costs of vaccination.

Estimation of Model Inputs

- Data on population by age and CP were obtained from the official European Union website (Eurostat) and a published study.
- The annual rate of RSV cases requiring hospitalization was obtained from local experts, while age-specific rates of RSV- requiring outpatient care (such as ED and OV) were sourced from published studies (5-6) and validated by local experts (Table 1).
- RSV rates were allocated across calendar months based on the insights of local experts and this distribution by calendar month was assumed to be invariant by care setting.
- Case-fatality rates (CFR) due to RSV-H were obtained from literature (7), while CFR assumed to be 0 for RSV requiring outpatient care only.
- Vaccine efficacy was derived using full season 1 and full season 2 results and post hoc analyses from the RENOIR trial (4).
- Vaccine coverage was assumed to vary by age and CP based on data from a Greek observational study (8) (Table 1).
- Utility and disutilities values were informed by published studies (10-11).

Table 1: Model inputs for the comorbidity profile, vaccine coverage, annual Incidence rates of RSV by care setting, age/comorbidity profile & direct medical costs

Age group/CP	CP distribution	Vaccine coverage by age and CP	Annual Incidence rates of RSV (per 100,000) by care setting, age and CP			RSV-attributable direct medical costs by care setting age and CP		
60-64			Hospital	Emergency Department	OV	Hospital	Emergency Department	OV
CMC-	47%	20%	19	80	1,496	€1,714	€243	€163
CMC+	53%	40%	373	201	2,591	€2,923	€311	€231
65-74								
CMC-	30%	40%	59	92	1,505	€2,919	€319	€239
CMC+	70%	50%	558	261	2,894	€3,881	€388	€308
75-84								
CMC-	16%	50%	150	101	1,511	€5,111	€319	€239
CMC+	84%	60%	740	310	3,143	€7,083	€388	€308
85-99								
CMC-	7%	55%	190	111	1,517	€7,087	€319	€239
CMC+	93%	60%	977	365	3,420	€8,983	€388	€308

Methods

- As for age/CP-specific direct medical costs associated with RSV hospitalization were obtained from the Diagnosis-Related Group (Table 1).
- The cost of ED and OV cases were estimated by combining the resources consumed, as provided by local experts, with the corresponding unit costs obtained from official sources(12) (Table 1).
- The unit cost per dose of bivalent RSVpreF was estimated at 205.98, as stated by the price bulletin issued by the Greek Ministry of Health(12).

Analysis

- Incremental cost-effectiveness ratios are calculated by comparing vaccination strategy and no vaccination and calculating the additional cost per additional health benefit in terms of cost per QALY gained, cost per LY gained and cost per hospitalization avoided.
- Deterministic sensitivity analyses (DSA) and probabilistic sensitivity analyses (PSA) evaluated impact of changes in key model parameters and assumptions.
- The perspective of the analysis was that of a Greek public payer (EOPYY) and an annual discounting of 3.5% was applied for future health outcomes and costs which is commonly used in similar studies in Greece.

Results

- Over lifetime horizon the model projected that there would be 258,170 hospitalizations, 112,248 ED encounters, 1,201,604 outpatient visits and 25,463 deaths related to RSV among Greek adults aged ≥60 years resulting in direct medical costs of circa €1.6 billion without vaccination (Table 2).
- Based on the RSV vaccination coverage considered in the analysis, the model indicates that 18,118 hospitalizations, 7,874 ED encounters, 48,079 outpatient visits and 1,706 deaths could be prevented over the modelled time horizon (Table 2).
- The health benefits associated with RSVpreF vaccination contributed to incremental gain of 10,976 LYs and 7,230 QALYs compared with no vaccination strategy (Table 2).
- The incremental analysis showed that RSVpreF was estimated to be a cost-effective vaccination strategy resulted in ICERs of €12,991 per LY gained, €19,723 per QALY gained and €7,870 per RSV hospitalized case avoided compared to no vaccination strategy
- The results of DSA indicated that the base case model results are robust.
- The PSA confirmed the base case results, the mean ICER on the PSA was €19,641 of vaccination with RSVpreF compared to no vaccination strategy.

Table 2:Base case model results of RSVpreF vaccination strategy versus no vaccination strategy

Parameters	RSVpreF vaccination strategy	No vaccination strategy	Incremental Results of RSVpreF vs No vaccination
Health Outcomes			
No. of cases			
Hospital	240,052	258,170	-18,118
Emergency department	104,374	112,248	-7,874
Outpatient visit	1,153,525	1,201,604	-48,079
Total	1,497,951	1,572,022	-74,071
No. of RSV-related deaths	23,757	25,463	-1,706
Total QALYs	22,132,094	22,124,864	7,230
Total LYs	32,449,292	32,438,315	10,976
Economic Outcomes (in millions)			
Direct cost of vaccine (€)	274,22	-	274,22
Direct RSV medical care cost (€)	1,421,65	1,553,27	-131,63
Total cost (€)	1,695,87	1,553,27	142,59
Cost-effectiveness analysis (RSVpreF vs No vaccination)			
ICER per QALY gained (€)			**19,723**
ICER per LY gained (€)			**12,991**
ICER per RSV hospitalized case avoided (€)			**7,870**

Conclusion

- **Vaccination with RSVpreF was estimated to be a cost-effective strategy for the prevention of RSV disease in Greek adults aged over 60 years.**
- **The availability of RSV vaccination improves public health outcomes by averting additional RSV cases and deaths and has the potential to fulfill an unmet medical need.**

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