

# A budget impact analysis of a novel diagnostic test to differentiate viral/bacterial etiology for Community-Acquired Pneumonia patients presenting to the Emergency Departments in Italy

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## Objective

Community-Acquired Pneumonia (CAP) is a major cause of mortality worldwide.

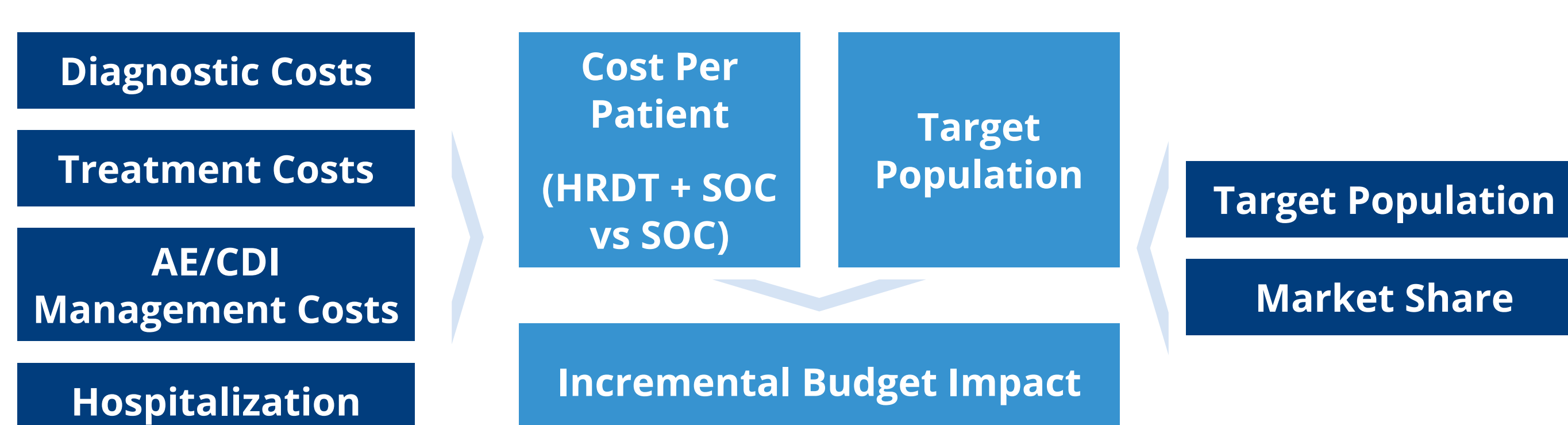
The objective of this analysis is to estimate the potential budget impact of a novel Host-Response Diagnostic Test (HRDT), able to reliably differentiate bacterial and viral infections in patients with CAP presenting to the Emergency Departments (ED) in Italy.

Appropriate and early antimicrobial therapy is important in treating patients with CAP. In a world where antimicrobial resistance (AMR) poses a significant global threat, drug-resistant infections contribute to nearly 5 million deaths every year [1]. CAP patients suffer from inappropriate antibiotics prescription, due to the complexity in differentiating bacterial and viral pathogens, and this contributes to the rise of AMR and health expenditure.

## Methods

A Budget Impact model was developed to evaluate the 1-year budgetary impact of HRDT uptake in Italy, considering all costs associated with treatment guided by the Standard of Care (SOC) and treatment guided by SOC + HRDT together, for adult CAP patients presenting to ED (Fig. 1).

Figure 1. Model structure



Savings were considered from the third-party payer and hospital perspectives.

Epidemiological data were elaborated from a real-life evidence database. HRDT uptake rate was estimated at 5% in the year of analysis.

Stratifying the target population by Pneumonia Severity index (PSI), clinical outcomes, including resource consumption, were simulated according to a literature-based cost-impact model [2]. Average number of days of antibiotic (AB) treatment and length of stay (LOS) in Italy were pulled from published literature [3-4].

Cost categories included were: diagnostic testing and ED visit, antibiotic administration, adverse events/Clostridium difficile infections (CDI) management and hospitalization. Costs were estimated by multiplying resource use, obtained from the model, by the unit cost of each resource, collected from published literature [4-6] and institutional Italian data [7,8].

Table 1. Unit costs

Cost item	Value
<b>Diagnostic test &amp; ED visit</b>	
ED visit	€ 248,30
X-ray	€ 15,50
CBC	€ 3,20
Viral PCR	€ 118,50
<b>Antibiotic treatment cost</b>	
Cost of inpatient antibiotics per day	€ 26,30
Cost of outpatient antibiotics per day	€ 6,57
<b>Hospital cost</b>	
<b>Hospital perspective</b>	
• Hospital cost per day	€ 962,60
<b>Third-party payer perspective</b>	
• Hospital cost per episode - CAP	€ 3.198,81
• Hospital cost per episode - Inpatient CDI	€ 3.558,00
• Hospital cost per episode - Outpatient CDI	€ 5.493,00

### Hospital perspective

Hospital cost was estimated by multiplying the bed-day cost by the length of stay. The impacts of AEs and CDI were accounted for as additional hospital days.

### Third-party payer perspective

Hospitalization cost for a CAP episode was calculated weighting the Diagnosis Related Groups (DRGs) concerning pneumonia by the number of discharges in Italy. For inpatient CDI the DRG related to the most severe condition was considered. Cost of outpatient CDI was inferred applying the DRG tariff related to sepsis.

Four scenarios were considered to evaluate HRDT impact on antibiotic prescription (main analysis, scenarios 1, 2, 3), on hospital admission rates (scenarios 1, 3), length of hospital stay and DRG reallocation\* (scenarios 2, 3).

\*SOC + HRDT was assumed to decrease the portion of patients given more severe DRG classifications as a result of less severe patient cases.

## References

- Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *The Lancet* 2022; published online Jan 20. [https://doi.org/10.1016/S0140-6736\(21\)02724-0](https://doi.org/10.1016/S0140-6736(21)02724-0)
- Schneider, J. E., & Cooper, J. T. (2022). Cost impact analysis of novel host-response diagnostic for patients with community-acquired pneumonia in the emergency department. *Journal of medical economics*, 25(1), 138-151.
- Migliorati, P. L., Boccoli, E., Bracci, L. S., Sestini, P., & Melani, A. S. (2006). A survey on hospitalised community-acquired pneumonia in Italy. *Monaldi archives for chest disease = Archivio Monaldi per le malattie del torace*, 65(2), 82-88.
- Lazzaro, C., Iori, I., & Gussoni, G. (2013). FASTCAP study on the management of hospitalized patients with community-acquired pneumonia: pharmacoeconomic analysis of the prospective phase. *Italian Journal of Medicine*, 2(1), 55-66.
- Legnani, D., Paizis G., Beghi G. & Gruppo Co-operativo Italiano (1998). *Trattamento della polmonite acquisita in comunita' nell'adulto, dopo fallimento di terapia antibiotica orale domiciliare, con amoxicillina/acido clavulanico switch therapy. Esperienza italiana. Le infezioni in medicina*, 6(1), 18-24.
- AGENAS (2004). Agenzia Nazionale per i Servizi Sanitari Regionali per ricoveri, personale e spesa delle aziende ospedaliere.
- Remunerazione Prestazioni Di Assistenza Ospedaliera per Acuti, Assistenza Ospedaliera Di Riabilitazione e Di Lungodegenza Post Acuzie e Di Assistenza Specialistica Ambulatoriale. Decreto 10/2012 e pubblicato in GU Serie Generale.n.23 del 28-1-2013.
- OBI Regional Tariffs (Campania, Emilia Romagna, FVG, Lazio, Liguria, Bolzano, Veneto) weighted for resident population (ISTAT 2020).

## Results

Savings were based on the following components in an Italian setting: antibiotic patients and days saved, reduced hospital admissions, and reduced hospital length of stay (Tables 2-4). Cost of hospital stay was the main driver.

Table 2. Clinical outcome for SOC+ HRDT comparing to SOC - results per patient

Clinical outcome	Main analysis	Scenario 1	Scenario 2	Scenario 3
Antibiotic patients avoided			0,43	
Antibiotic days saved			1,11	
Hospital admissions avoided	-	0,01	-	0,01
Hospital days saved	0,03	0,08	0,3	0,35

Table 3. Savings per patient - hospital perspective

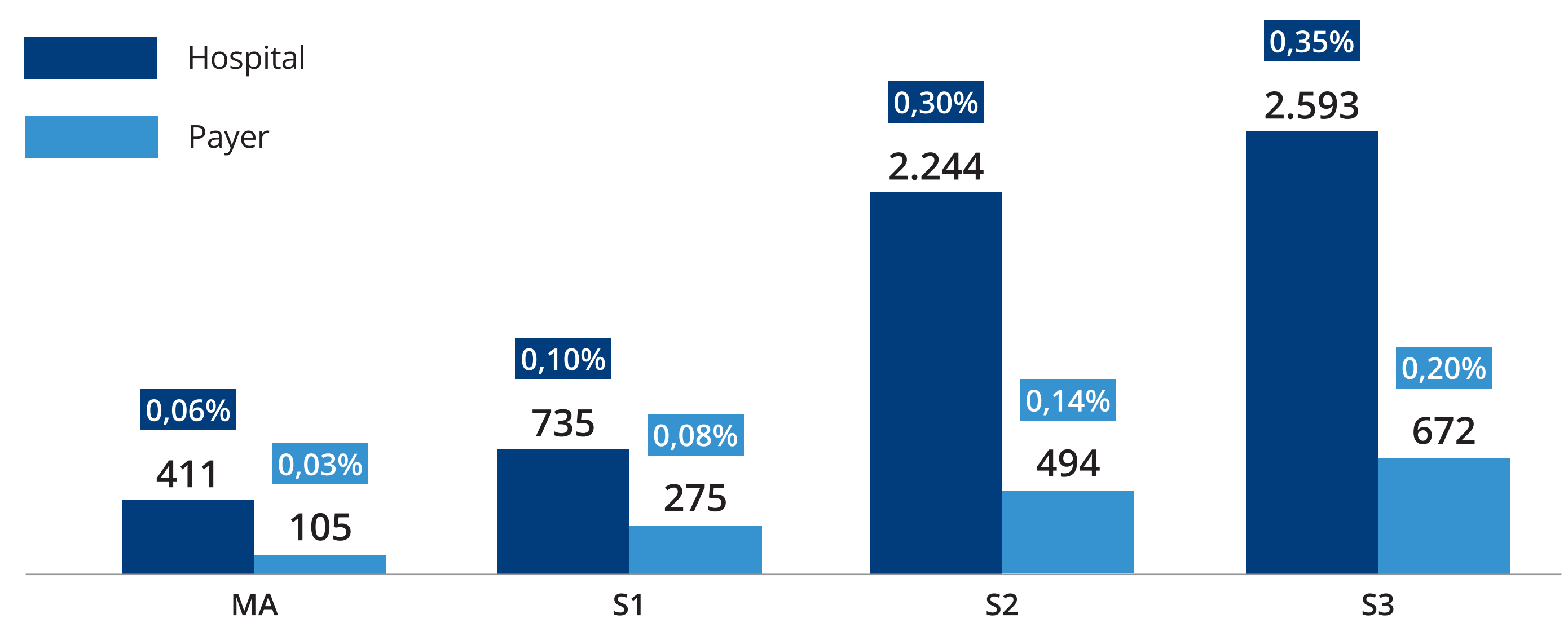
Cost drivers (€)	Main analysis	Scenario 1	Scenario 2	Scenario 3
<b>Total</b>	<b>57,26</b>	<b>102,28</b>	<b>312,34</b>	<b>360,85</b>
Diagnostic testing & ED visit	-	-	-	-
Inpatient days of AB treatment	27,02	29,97	27,02	29,97
Adverse events	1,25	1,36	1,25	1,36
Outpatient CDI	13,29	18,09	13,29	18,09
Inpatient CDI & Baseline Hospital Stay	15,7	52,86	270,77	311,43

Table 4. Savings per patient - third-party payer perspective

Cost drivers (€)	Main analysis	Scenario 1	Scenario 2	Scenario 3
<b>Total</b>	<b>14,62</b>	<b>38,28</b>	<b>68,76</b>	<b>93,57</b>
Diagnostic testing & ED visits	-	-	-	-
Outpatient days of AB treatment	0,56	-0,17	0,56	-0,17
Outpatient CDI	13,3	11,92	13,3	11,92
Inpatient CDI & Baseline Hospital Stay	0,75	26,53	54,89	81,82

Expecting 7.185 patients to be diagnosed in the ED with SOC + HRDT in the year of analysis, the adoption of HRDT (omitting its cost) would allow for savings in the range € 411.458 - € 2.592.842 for hospitals and € 105.033 - € 672.303 for payers, respectively, depending on scenarios (Fig. 2).

Figure 2. Budget Impact - Total Savings (k€)



MA (Main Analysis), S1 (first scenario), S2 (second scenario), S3 (third scenario)

## Conclusions

Combining HRDT with current SOC diagnostic process is expected to provide savings to both payers and hospitals in all scenarios.