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Impact of budesonide/glycopyrronium/ formoterol Initiation on Healthcare Resource Utilization and Carbon Emissions in Patients with COPD in Spain. Insights from the ORESTES Study.

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1 OBJECTIVES

- To evaluate the impact of initiating treatment with budesonide/glycopyrronium/ formoterol (BGF) in patients with chronic obstructive pulmonary disease (COPD) in Spain on:
  - healthcare resource utilization (HCRU)
  - carbon footprint, and
  - associated costs

2 METHODS

- **ORESTES** was a retrospective, observational study, conducted in 20 Spanish hospitals, including 718 adults aged ≥40 years with COPD who initiated BGF (between 2022 and 2023).
- **HCRU**: The analysis included data on hospitalizations, emergency room (ER) admissions, primary care (PC), and specialist visits, as well as rescue treatment use, across two time periods: 12 months before and 12 months after BGF initiation (Table 1).
- **Carbon footprint:** Greenhouse gas (GHG) emission factors per HCRU and use of the main reliever, short-acting beta agonist (SABA), were applied to estimate environmental impact. GHG emissions from maintenance therapies were excluded, as a regulatory application for BGF with a next-generation, near-zero global warming potential propellant, which makes the device have a carbon footprint similar to a dry powder inhaler, has been recently approved in Europe in July 2025.
- **Costs and emissions** were based on relevant published literature from the Spanish National Health System perspective (Table 2a and Table 2b) and results are extrapolated to 1,000 patients.

3 RESULTS

- **After initiating BGF treatment**, there was an **overall decrease in the use of HCRU**(see Table 1, Table 2a and Table 2b). **SABA** use **decreased by 25.2%.**

Table 1. Pre- and post-BGF HCRU per patient

	Pre-BGF*	Post-BGF*	Difference, % (95% CI)
Hospitalizations			
nº hospitalizations/year	0.53	0.47	-12.9% (-14.5;-11.4)
nº days hospitalized/year	4.47	4.06	-9.2% (-13.3; -5.1)
ER admissions			
nº visits/year	0.71	0.62	-12.0%(-13.7-10.2)
Primary care			
nº visits/year	1.89	1.80	-4.95 (-7.4; -2.4)
Specialists†			
nº visits/year	1.28	1.51	17.5% (15.6; 19.4)
SABA			
nº prescriptions year	1.19	0.89	-25.5% (-26.9;-24.0)

*Defined as 12-month period pre-BGF (baseline) or post-BGF (follow-up).
For post-BGF, annualized rates are provided.
† Pulmonologist, Internist, others
CI: confidence interval

Table 2a. HCRU unitary costs

Variable	Unitary cost‡	Cost source
Hospitalization day	508.45 €	Alcázar-Navarrete B, Jamart L, Sánchez-Covisa J, Juárez M, Graefenhain R, Sicras-Mainar A. Clinical Characteristics, Treatment Persistence, and Outcomes Among Patients With COPD Treated With Single- or Multiple-Inhaler Triple Therapy: A Retrospective Analysis in Spain. Chest. 2022;162(5):1017-1029.
ER admission	141.98 €	
Primary Care visit	28.01 €	
Specialist visit	111.14 €	

‡Updated to €2025

Table 2b. HCRU unitary emissions

Variable	Emissions ($kgCO_2$)	Emission source
Hospitalization day	44.20	Garcia Sanchez JJ, Barraclough KA, Cases A, et al. Using Chronic Kidney Disease as a Model Framework to Estimate Healthcare-Related Environmental Impact. Adv Ther. 2025;42(1):348-361.
ER admission	23.00	
Primary Care visit	7.50	
Specialist visit	36.90	
SABA prescriptions	24.87	Villar Álvarez F. Medicamentos y cambio climático. Fundación Ecología y Desarrollo (ECODES). Nov 2022

- After initiating BGF treatment, **costs and CO_2 emissions decreased** as a result of lower HCRU(see Table 3 and Table 4).

Table 3. Pre- and post-BGF costs per 1,000 patients

Variable¥	Pre-BGF	Post-BGF	Difference
Hospitalizations	2,271,933 €	2,063,926 €	-208,007 €
ER admission	100,325 €	88,338 €	-11,987 €
Primary Care visit	52,920 €	50,341 €	-2,578 €
Specialist visit	142,414 €	167,325 €	24,911 €
Total cost	2,567,591 €	2,369,930 €	**-197,661 €**

¥ SABA costs not included as it is negligible

Table 4. Pre- and post-BGF emissions ($kgCO_2eq$) per 1,000 patients

Variable	Pre-BGF	Post-BGF	Difference
Hospitalizations	197,501	179,419	-18,082
ER admission	16,252	14,311	-1,942
Primary Care visit	14,168	13,478	-690
Specialist visit	47,285	55,556	8,271
SABA prescriptions	29,594	22,133	-7,461
Total emissions	304,800	284,896	**-19,904**

Healthcare costs

↓ 7.7% reduction in total healthcare costs was observed

↓

Mainly driven by reduction in hospitalization days

Annual savings

€197,661 per 1,000 patients

€198 per patient

Greenhouse gases

↓ 19,904 kg CO_2eq

emissions reduction per 1,000 patients

equivalent to **110,455**[&] car kilometers

[&] 0.29 kg CO_2 per mile = 0,18 kg CO_2 per kilometer. 19,904 kg CO2 / 0,18 = 110,455 car kilometers
https://northeast.devonformularyguidance.nhs.uk/formulary/chapters/3-respiratory/the-environmental-impact-of-inhalers

4 CONCLUSIONS

Reductions in hospitalizations, costs, and carbon emissions were observed after BGF initiation, suggesting that better disease control can drive both better clinical outcomes and greater environmental sustainability.

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