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Economic Evaluation of Omalizumab in the Treatment of Severe Allergic Asthma in Adult Patients in Greece: A Cost Effectiveness Analysis of Clinical Trial and Real-Life Data

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Abstract

Background: Severe asthma is a major cause of morbidity and mortality around the world, associated with a heavy societal burden.

The aim of this study was to evaluate the economic value of omalizumab in the treatment of adult patients with severe asthma in Greece, from a societal perspective, based on both data collected via a clinical trial and data from a prospective observational study with real-world evidence (RWE) using a simulation model.

Method: A Markov cohort model was developed in Microsoft Excel to compare the costs and outcomes of omalizumab plus standard therapy (ST) versus ST alone. The time horizon was that of a lifetime. Costs and health outcomes were discounted annually at 3.5%. A primary analysis was based on clinical data from the INNOVATE trial, and a secondary analysis, was based on recently published real-world evidence on effectiveness of omalizumab. Both direct and indirect costs were incorporated. Unit costs were taken from publically available sources, Productivity losses were calculated based on published data, while utility values were taken from the INNOVATE study. Deterministic and probabilistic sensitivity analyses were undertaken to test the robustness of the model results.

Results: The addition of omalizumab to ST led to an incremental cost of €27,888 and € 27,255 per QALY gained in the primary and secondary analyses, respectively. The model appeared to be most sensitive to changes in the time horizon and the age of retirement. The results of the probabilistic sensitivity analysis showed that the probability of omalizumab being cost effective was 58% and 84%, at a threshold of €30,000 and € 40,000 (willingness to pay for one QALY), respectively.

Conclusion: Omalizumab appears to be a cost-effective treatment option for patients with severe asthma compared to ST in Greece, and this result is confirmed both with trial and real-world data.

Keywords: Asthma; Modeling; Real-world evidence; Cost-effectiveness; Omalizumab; Greece

Introduction

Asthma is a chronic inflammatory disorder of the airways that causes recurrent episodes of wheezing, breathlessness, chest tightness and coughing [1]. Severe asthma requires the highest level of recommended treatment to maintain adequate control, while often good control is not achieved despite the maximum recommended treatment [2].

The epidemiology of severe asthma is difficult to define due to the various definitions of severity across studies. In a French study the estimated prevalence of severe asthma ranged between 1 and 3% of the general population, both in children and adults [3].

Asthma is a major cause of morbidity and mortality around the world and it adversely affects patients' quality of life (QoL) [4–8]. The resource use and costs associated with the management of asthma are significant [9–14], and it is widely accepted that the societal costs associated with asthma are likely to be much higher than direct costs [15]. The cost of the disease depends on the degree of severity and is highly associated with disease control [16]. Patients with severe persistent allergic asthma who are inadequately controlled despite Step 4 therapy, are a challenging population with significant unmet medical need [17].

Omalizumab is a monoclonal antibody for use in IgE-mediated allergic diseases, which was approved by the European Medicines Agency (EMA) in November 2005 as an add-on therapy to improve asthma control in patients with severe persistent allergic asthma [18]. Results of the INNOVATE randomized, placebo-controlled trial have shown that omalizumab reduced the overall clinically significant exacerbation rate, the rate of severe clinically significant exacerbations and improved patients' quality of life [17].

Recent real-world evidence has shown that omalizumab is at least as effective in real-life practice as in clinical trials. Study results by Molimard and colleagues strongly suggest that omalizumab in the first patients treated in real-life setting provided a similar benefit to

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that observed in clinical trials [19]. A more recent study performed in Greece and Cyprus by Tzortzaki et al. showed that omalizumab is even more effective in real life practice compared to what was observed in clinical trials [20].

The aim of this study was to evaluate the economic value of omalizumab in the treatment of adult patients with severe asthma in Greece, based on both clinical data from the INNOVATE trial and on real-world effectiveness data.

Methodology

Two analyses were carried out using a simulation model: a primary analysis, which was based on clinical trial data from the INNOVATE study [17], and a secondary analysis, which was based on real-world data from the Tzortzaki et al. study [20].

Model design

A Markov cohort model was developed in Microsoft Excel to compare the costs and outcomes of omalizumab plus standard therapy (ST) versus ST alone, from the societal perspective in Greece. ST included inhaled corticosteroids (ICS) plus long-acting beta-agonists (LABA) plus rescue medication (oral corticosteroids –OCS- and short-acting beta-agonists -SABA). This model has been extensively published (Brown 2007; Dewilde 2006; van Nooten 2013) previously. Markov model was chosen as it is a flexible tool that allows changes between health states over time and calculates the costs and outcomes associated with each state. This is particularly important for asthma in which patients move among different health states repeatedly.

The model had five Markov states: daily symptoms (including symptom-free periods as well as non-significant asthma exacerbations), clinically significant non-severe (CSNS) exacerbations, clinically significant severe (CSS) exacerbations, severe exacerbation-related death and all cause death. The model structure is presented in Figure 1 and is described in detail elsewhere [21].

The study time horizon was that of a lifetime with cycle length of 3 months. Costs and health outcomes were discounted annually at 3.5%. Since payers might be interested in shorter time horizon, the model was run for time horizon of 10 years and 20 years as part of sensitivity analysis.

Model inputs

Clinical data: Primary analysis incorporated data on clinical effectiveness from the INNOVATE study (Table 1).

In the secondary analysis, exacerbation rates associated with ST and effectiveness data for omalizumab (Table 2) were based on the recent real-world evidence (RWE) study conducted by Tzortzaki and colleagues [20]. This prospective observational study was conducted in Crete and Cyprus and used data from medical registries in order to investigate the RWE on omalizumab's effectiveness in the management of severe allergic asthma. An important feature of this study was the long-term (4 years) efficacy evaluation of omalizumab therapy in severe asthma patients, while previous omalizumab "real-life" studies evaluated patients for a much shorter time period ranging from 5 months to 1 year [20].

Other clinical inputs, which were the same across primary and secondary analyses, are presented in (Table 3). Since mortality associated with CSS exacerbations is based on single study, it was tested in sensitivity analysis using its 95% confidence interval limit.

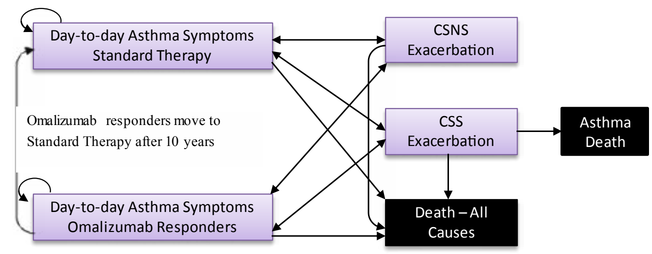

Figure 1: Markov model structure.

Parameter	Value
Age	54
ST exacerbation rate per patient per year	1.69
Omalizumab responders relative risk of exacerbation Vs. ST	0.37
ICS usage reduction due to omalizumab	0%
Omalizumab response* at 16 weeks	0.57

ST: Standard Therapy; ICS: Inhaled Corticosteroids
* Response as defined by GETE (Global Evaluation of Treatment Effects)
Source: INNOVATE trial data published in Norman et al. 2013 [21]

Table 1: Clinical effectiveness data based on the INNOVATE trial.

Parameter	Value
Mean age of omalizumab treatment initiation	54
ST exacerbation rate per patient per year	2.30
Omalizumab relative risk of exacerbation	0.35
ICS usage reduction due to omalizumab	12%
Omalizumab response at 16 weeks	0.77

Source: Tzortzaki et al., 2012 [20]; ST: standard therapy; ICS: inhaled corticosteroids

Table 2: Clinical effectiveness data based on RWE.

Parameter	Value	Source
Mortality rate associated with CSS exacerbations	2.478%	Watson et al., 2007 [22]
Age related mortality	Life table	Greek life tables
Proportion of CSS out of total exacerbation for omalizumab responders	0.350	INNOVATE trial data published in Norman et al. 2013 [21]
Proportion of CSS out of total exacerbations for ST	0.524	INNOVATE trial data published in Norman et al. 2013 [21]

CSS: Clinically Significant Severe; ST: Standard Therapy

Table 3: Other clinical inputs used both in primary and secondary analyses.

CSS: Clinically Significant Severe; ST: Standard Therapy

Dosing schedule for omalizumab was based on the dosing table presented in the Hochhaus et al. study [22,23], which is dependent on the baseline IgE levels and patients' weight. The distributions of baseline IgE levels and patients' weight were taken from the Tzortzaki study [20] and were simulated using Monte Carlo Simulation. The dosing table was subsequently used to calculate the dosage for each of the 1000 simulated patients and obtain the patient distribution across different dosing levels (Table 4).

For ICS dosage, the model used the treatment distribution found in INNOVATE including a daily ICS dose of 2330 μg and 200 μg LABA, plus 22% of patients receiving oral corticosteroids, 35% anti-leukotriene and 30% theophylline [17].

Cost data: Both direct and indirect costs were incorporated in the

	375 mg 2x/month	300 mg 2x/month	225 mg 2x/month	300 mg 1x/month	225 mg 1x/month	150 mg 1x/month	75 mg 1x/month
Primary analysis (patient distribution based on INNOVATE trial data)	8.00%	15.00%	20.00%	26.00%	0%	31.00%	0%
Secondary analysis (simulation from data published in Tzortzaki et al. [20])	7.25%	28.60%	46.75%	14.80%	0%	2.60%	0%

Table 4: Patient distribution in different dosing schemes for the primary and secondary analysis.

study. Pharmaceutical costs for treatment with omalizumab were based on the dosing schedule presented in (Table 4). Duration of treatment with omalizumab was set at 10 years based on omalizumab's NICE submission (Norman 2013). Alternate values of treatment duration have been tested in the sensitivity analysis. The costing of omalizumab was based on the costs for 75 mg and 150 mg (Table 5).

To calculate annual pharmaceutical costs, generic drugs have been used where possible, prices were taken from the official Drug Price Bulletin published by the Ministry of Health [24] and the costing assumed that patients were fully compliant. The cost base year was 2013 (Table 6)

ICS: inhaled corticosteroids; LABA: long-acting beta agonists; SABA: short-acting beta agonists, OCS: oral corticosteroids

Resource use data were taken from the literature [5] and were validated by local experts in order to reflect the Greek clinical practice. The components taken into consideration were general practitioner visits at surgery or home, hospital outpatient visits, emergency room visits and the hospital length of stay either in general ward or intensive care unit.

Unit cost data for medical and hospitalization costs were taken from officially published sources (Table 7).

The cost to the Greek National Health Service (NHS) of a CSNS exacerbation was set at €84.35, both for the primary and secondary analysis, based on the exacerbation rate from trial data and on unit costs from the study by Geitona et al. [25]. The cost to the NHS of a CSS exacerbation was set at €123 and €2,084 (average value across all GOLD classes of COPD patients from a 2006 study adjusted to 2013 prices), for the primary and secondary analysis respectively, based on clinical trial data and the results of the Geitona et al study [25]. The ICU costs were used to calculate the cost of an exacerbation based on the observed incidents of exacerbations for which patients got admitted into ICU. Estimates of productivity losses and indirect costs associated with asthma in Greece were also based on the published literature [26] and were included both in primary and secondary analysis (Table 8).

Utility data: Utility values for the 'day to day asthma state' were collected during the 28 weeks of INNOVATE with the use of the asthma quality of life questionnaire (AQLQ) [5]. The AQLQ values were then mapped onto the EQ-5D to derive utilities using a published mapping function (Tsuchiya 2002). Utilities for the CSNS and CSS states came from a study conducted in the UK [27]. All utility values are presented in (Table 9).

Model outputs

Model outcomes include the number of clinically significant exacerbations, the years of life gained, quality-adjusted life years (QALYs), direct and indirect costs. The incremental cost-effectiveness ratio (ICER) is calculated as the difference in total costs between the two treatment arms, over the difference in total QALYs.

Sensitivity analyses: The robustness of the model results was tested in a series of one-way deterministic sensitivity analyses. The parameters varied in the deterministic sensitivity analysis were: i) the mortality rate associated with a CSS exacerbation, which was ranged between the lower and upper limit of its 95% confidence interval, ii) the discounting rates, which were varied between 0-5% for both costs and outcomes, iii) the duration of treatment with omalizumab, which was ranged between 5-15 years, iv) the model's time horizon, which was tested at 10 and 20 years, v) the age of retirement, which was allowed to take values between 55 and 60 years, since there is no unified retirement age across all Social Insurance Funds in Greece, and vi) the daily wage rate, which was varied between €79 and €85.84, based on the trimester data for the cost of employment by the National Statistical Service of Greece.

In addition to the deterministic sensitivity analysis, a probabilistic sensitivity analysis (PSA) was also conducted in order to understand the uncertainty around the estimated ICER value. The PSA was conducted by using a Monte Carlo Simulation to generate the parameter values for 1000 simulations in which all model inputs were varied simultaneously as per pre-defined distributions. For instance, cost was varied using gamma distribution and relative risk was assumed to follow lognormal distribution. Detailed PSA inputs can be seen in Appendix. Both the deterministic and the PSA were conducted in the primary analysis model.

Results

Primary analysis results

The primary analysis showed that total costs in the ST arm were €58,076, whereas total costs in the omalizumab arm were €89,969, leading to an incremental cost of €31,893 (Table 10). Omalizumab resulted in 0.94 additional life years and 1.14 additional QALYs. The incremental cost-effectiveness ratio was estimated at €27,888 per QALY gained. The addition of omalizumab also resulted in 214 less Note: The ICER reported in Table 10 is based on the model calculations –deviation from calculations based on the numbers in Table 10 (incremental cost over incremental QALYs) are due to rounding.

Secondary analysis results

The secondary analysis showed that total costs with ST were €96,097, whereas total costs with omalizumab were €144,694. In the omalizumab arm, direct costs accounted for 83% of total costs, whereas in the comparator arm, direct costs accounted for 52%. Treatment with omalizumab resulted in an additional 1.61 life years and 1.78 QALYs, while the number of CSNS and CSS exacerbations avoided was estimated at 1.04 and 3.31, respectively. Productivity losses were also reduced with omalizumab treatment, resulting in 385 less work-loss days (Table 11).

Note: The ICER reported in Table 11 is based on the model calculations –deviation from calculations based on the numbers in Table 11 (incremental cost over incremental QALYs) are due to

Omalizumab cost per 75 mg pre-filled syringe	€ 152.35
Omalizumab cost per 150 mg vial or pre-filled syringe	€ 283.30

Table 5: Cost of omalizumab.

Drug	Cost	# doses/pack	mg/dose	Dose/day	Daily cost
ICS	€ 28.97	200	250	2330	€ 1.35
LABA (generic)	€ 28.35	120	25	200	€ 1.89
SABA (generic)	€ 4.96	200	100	605	€ 0.15
OCS (generic)	€ 1.78	28	5	20	€ 0.25
antileukotrine	€ 22.40	28	10	10	€ 0.80
theophylines	€ 1.65	60	175	700	€ 0.11

ICS: Inhaled Corticosteroids; LABA: Long-Acting Beta Agonists; SABA: Short-Acting Beta Agonists, OCS: Oral Corticosteroids

Table 6: Daily cost per drug.

Health care resource	Unit costs (€)
GP office visit	20.0
GP home visit	30.0
Day hospitalization	75.0
ER visit	97.7
Hospital (general ward) per stay	832
Hospital (ICU) per stay	2,393.6

GP: General Practitioner; ER: Emergency Room; ICU: Intensive Care Unit
Source: Ministerial Decision (FEK B' 3054/18-11-2012, 49976/05-12-2012, 3100/2011)

Table 7: Unit cost data.

Parameter	Value	Source
Number of days of lost productivity due to CSNS exacerbation (days per exacerbation)	5	Matsaganis et al. [26]
Number of days of lost productivity due to CSS exacerbation (days per exacerbation)	10	Matsaganis et al. [26]
Daily wage rate (calculated as annual income divided by 260 days (5 working days per week * 52 weeks per year)	€82.86	Mean annual income per employee for 2012 was €21,738, based on cost of employment per month published by the National Statistical Service of Greece (www.statistics.gr). This figure was subsequently inflated to reflect 2013 prices.
Retirement age in Greece	65	
Productivity loss period associated with mortality (in years)	Till age of retirement	

CSNS: Clinically Significant Non-Severe; CSS: Clinically Significant Severe.

Table 8: Indirect costs: productivity losses.

Health State	Utility value
Day to day asthma symptoms – Standard therapy	0.669
Day to day asthma symptoms –Omalizumab	0.779
Clinically significant non-severe exacerbation	0.572
Clinically significant and severe exacerbation	0.326

Source: Dewilde et al. 2006 [5]

Table 9: Utility values for the Markov model health states.

Outcome	**ST**	**Omalizumab plus ST**	**Incremental difference**
Total costs	€58,076	€89,969	€31,893
Direct costs	€21,536	€65,406	€43,870
Indirect costs	€36,540	€24,563	-€11,977
Total QALYs	8.79	9.93	1.14
Total Lys	13.40	14.34	0.94
ICER (Incremental costs per QALY gained)			**€ 27,888**
Number of CSNS exacerbations	16.40	15.64	-0.76
Number of CSS exacerbations	17.57	15.47	-2.11
Work-loss days	662	447	-214

CSNS: Clinically Significant Non-Severe; CSS: Clinically Significant Severe
Note: The ICER reported in Table 10 is based on the model calculations –deviation from calculations based on the numbers in Table 10 (incremental cost over incremental QALYs) are due to rounding.

Table 10: Model outcomes per patient in the primary analysis.

Outcome	ST	Omalizumab plus ST	Incremental difference
Total costs	€96,097	€144,694	€48,597
Direct costs	€49,833	€119,976	€70,143
Indirect costs	€46,264	€24,718	-€21,545
Total QALYs	8.02	9.81	1.78
Total Lys	12.33	13.94	1.61
ICER			**€ 27,255**
Number of CSNS exacerbations	20.11	19.07	-1.04
Number of CSS exacerbations	21.55	18.24	-3.31
Work-loss days	836	450	-385

CSNS: Clinically Significant Non-Severe; CSS: Clinically Significant Severe
Note: The ICER reported in Table 11 is based on the model calculations –deviation from calculations based on the numbers in Table 11 (incremental cost over incremental QALYs) are due to rounding.

Table 11: Model outcomes per patient in the secondary analysis.

rounding.

Based on the results of both the primary and secondary analyses, the incremental cost effectiveness ratio of omalizumab is estimated to a maximum of €28,000 per QALY gained, which is lower than the commonly accepted threshold of €30,000 per QALY gained.

Results of sensitivity analyses

One-way sensitivity analysis: For the primary analysis, one way sensitivity analyses were run for the key parameters. Results of the deterministic sensitivity analysis are presented in Table 12. The model appeared to be most sensitive to changes in the time horizon and the age of retirement. For a time horizon of 10 years, the ICER was approximately €41,000 per QALY gained, while for a retirement age limit of 55 years, the ICER was approximately €38,000. When all the other parameters were allowed to vary, they did not increase the ICER beyond the €30,000 threshold.

Probabilistic sensitivity analysis: The results of the PSA showed that, in 98.8% of the simulations, omalizumab plus ST resulted in more costs and more QALYs, while in 58% of the cases, the ICER fell below the €30,000 threshold (Figure 2).

In order to understand the relationship between the willingness

Scenario	Treatment	Total Costs	Total Life years	Total QALYs	ICER
Base case	ST	€58,076	13.40	8.79	
	Omalizumab+ST	€89,969	14.34	9.93	€27,888
Mortality rate associated with CSS exacerbations=2.865%	ST	€60,578	12.92	8.47	
	Omalizumab+ST	€91,143	13.96	9.68	€25,226
Mortality rate associated with CSS exacerbations=2.129%	ST	€55,798	13.86	9.09	
	Omalizumab+ST	€88,911	14.69	10.17	€30,738
No discounting	ST	€74,217	20.32	13.33	
	Omalizumab+ST	€112,987	21.92	14.99	€23,243
Discount rate of 5% for both costs and outcomes	ST	€53,303	11.57	7.59	
	Omalizumab+ST	€82,865	12.34	8.59	€29,575
Treatment time for omalizumab: 5 years	ST	€58,076	13.40	8.79	
	Omalizumab+ST	€74,665	13.95	9.44	€25,398
Treatment time for omalizumab: 15 years	ST	€58,076	13.40	8.79	
	Omalizumab+ST	€104,352	14.61	10.29	€30,759
Time horizon: 10 years	ST	€47,967	7.45	4.89	
	Omalizumab+ST	€78,830	7.78	5.63	€41,358
Time horizon: 20 years	ST	€54,697	11.30	7.41	
	Omalizumab+ST	€86,246	12.02	8.41	€31,448
Retirement age: 55 years	ST	€22,517	13.40	8.79	
	Omalizumab+ST	€66,019	14.34	9.93	€38,039
Retirement age: 60 years	ST	€34,957	13.40	8.79	
	Omalizumab+ST	€74,086	14.34	9.93	€34,215
Productivity loss per day: 79.5	ST	€56,594	13.40	8.79	
	Omalizumab+ST	€88,973	14.34	9.93	€28,313
Productivity loss per day: 85.84	ST	€59,588	13.40	8.79	
	Omalizumab+ST	€90,985	14.34	9.93	€27,455

Table 12: Results of one way sensitivity analysis (primary analysis model).

to pay (WTP) threshold and the probability of being cost effective at a given threshold, a cost effectiveness acceptability curve was constructed based on the simulations that were run. At a threshold of €30,000, the probability of omalizumab being cost effective was 58%, while at a threshold of € 40,000 the probability was 84%. Therefore, the PSA results indicate that omalizumab is expected to be cost effective in the commonly accepted WTP threshold range of € 30,000 to € 50,000 (Figure 3).

Discussion

The increasing prevalence of asthma has severe implications in terms of costs and burden of the disease, as the resource use associated with its management is high. In 2010, the number of visits of asthma patients to physician offices in the US was estimated at 14.2 million, the number of visits to hospital outpatient departments was 1.3 million, and the visits to emergency departments was 1.8 million [9–11]. In the UK, it is estimated that annual direct costs to the NHS for treating and caring for asthma patients are at least £750 million [12].

The cost of treating asthma depends on the degree of severity of the disease [16]. It has been shown that severe and difficult to treat asthma accounts for about half of asthma expenditure [28]. Estimates also suggest that about 35–50% of overall spending on asthma is for acute exacerbations [13] and that around three quarters of these episodes represent treatment failure [14]. Costs are also highly associated with disease control. Poor asthma control is associated with a substantial degree of impairment and therefore indirect costs [29]. Therefore, although direct costs are substantial, it is widely accepted that the societal costs associated with asthma are likely to be much higher [15].

Given the increased prevalence and associated costs of severe asthma, it is obvious that health care policy makers would be seeking cost-effective treatments to control patients with asthma.

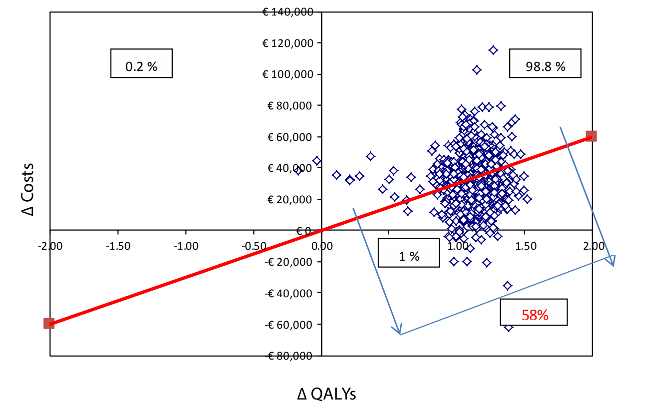

Figure 2: PSA scatter plot.

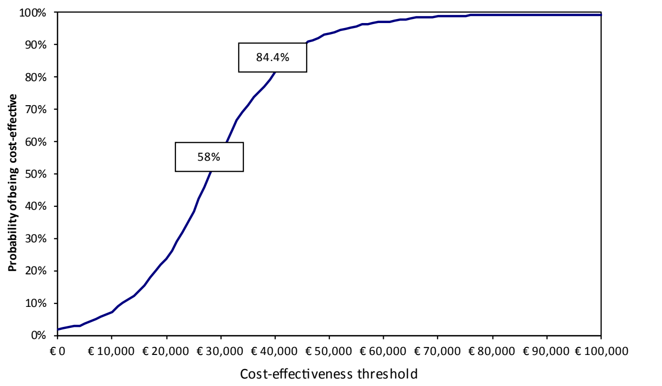

Figure 3: Cost effectiveness acceptability curve.

To the best of our knowledge, this is the first study to incorporate both clinical trial data and real-world evidence in the economic evaluation of omalizumab in the Greek health care setting. RWE is becoming increasingly important in reimbursement decisions and health care decision makers are developing policies that integrate data from different sources, recognizing the importance of evidence that goes beyond information collected within the framework of clinical trials [30].

The present study showed that omalizumab has a very high probability of being cost-effective in the Greek health care setting. The ICER of the primary analysis was €27,888 per QALY gained, which is below the commonly accepted €30,000 cost-effectiveness threshold. This finding is supported by the results of the secondary analysis, where real world effectiveness data for omalizumab were incorporated. The respective incremental cost of omalizumab compared to ST was €27,255 per QALY gained. Both deterministic and probabilistic sensitivity analyses confirmed the robustness of the results.

It is important to note that the threshold used to discuss cost-effectiveness is a threshold used in studies conducted from the NHS/ health care utilization perspective [31], while this study was conducted from the societal perspective, in order to incorporate indirect costs too. Productivity losses constitute a major component of total costs of asthma. In the UK, up to 1.1 million working days were lost due to breathing or lung problems in 2008/09 [8]. In the present study, the cost of work loss days due to asthma in the ST arm accounted for 63% and 48% of total costs in the primary and secondary analyses, respectively, while the respective figures in the omalizumab arm were 27% and 17%. The high percentage of indirect costs in the comparator arm indicates that with ST alone exacerbation control is low, and therefore, productivity losses are much higher.

A potential limitation of the study is that adverse events have not been incorporated in the analysis. However, based on trial results, omalizumab is well tolerated [17] and adverse events in both treatment arms are not statistically significantly different and do not lead to increased discontinuation. Thus it has been assumed that no incremental difference appears in the two patient groups.

Another limitation of the study is using utility mapping function developed using UK weights. Ideally utility value for asthma control state should have been estimated using Greek weights. But in absence of such data, UK based utility values have been used and this matches well with utility of exacerbations, which are also based on UK data. The impact of using UK utilities in terms of incremental QALYs is not expected to be much because both treatment arms are affected.

Several studies on the cost-effectiveness of omalizumab have been published in the international literature. The incremental cost per QALY gained has been estimated at €56,091 in Sweden [5], €31,209 in Canada [32] and €26,000 in Italy [33]. In the UK, the National Institute for Health and Care Excellence (NICE) has recently recommended omalizumab for the treatment of severe persistent allergic asthma, under an agreed patient access scheme. The ICER that the NICE Committee accepted as most plausible was £23,200 per QALY gained [34]. In the US the ICER for omalizumab has been estimated to range between $287,200 [35] and $821,000 [36].

All the above studies evaluated the cost-effectiveness of omalizumab against ST from a health-care or payer perspective; however, the definition of the comparator (ST) depended on the patient population, which differed across studies, reflecting the different marketing authorization in the US compared with Europe. This explains the significant difference in the ICER estimation between the European and the US studies. Thus, our results should only be compared against results of studies that have been conducted in a population consistent with an EU marketing authorization; based on this, it appears that our results are consistent with the findings of other European studies, confirming the external validity of our model.

Conclusion

Omalizumab appears to be a cost-effective treatment option for adult patients with severe persistent allergic asthma compared to standard therapy in Greece, and this result is confirmed both with trial clinical data and real-world evidence. Economic evaluation studies that incorporate real world evidence are of major importance and provide added value to the evidence considered by decision makers, as these reflect the effectiveness of pharmaceutical products in real-life and illustrate how the latter translates into the drug's economic value for patients' lives.

Conflict of Interest

VS, MC, EP are Novartis employees and MB was working in Novartis at the time of the study. MG and NS have no conflict of interest.

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