

Health Care Resource Use and Costs Associated With Side Effects of High Oral Corticosteroid Use in Asthma: A Claims-Based Analysis

Allan Luskin,¹ Evgeniya Antonova,² Michael S. Broder,³ Eunice Chang,³ Dennis Ledford⁴

¹HealthyAirways, Madison, WI, USA; ²Partnership for Health Analytic Research, LLC, Beverly Hills, CA, USA; ³Genentech, Inc., South San Francisco, CA, USA; ⁴Division of Allergy and Immunology, Department of Medicine, Morsani College of Medicine, University of South Florida and the James A. Haley Veterans' Hospital, Tampa, FL, USA

INTRODUCTION

- Oral corticosteroids (OCS) are used in the management of asthma exacerbations and severe persistent asthma.¹
 - OCS are associated with debilitating dose- and duration-dependent adverse events,² such as bone fractures, diabetes mellitus, infections, hypertension, and cataracts.
- Estimates of medical spending attributed to the treatment of possible side effects are limited.

OBJECTIVE

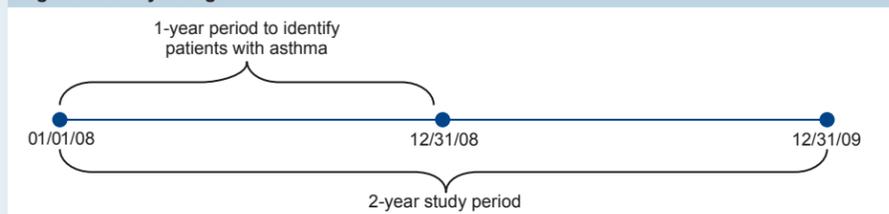
- To estimate all-cause health care resource use and health care costs that could be attributed to side effects of high OCS use in patients with asthma.

METHODS

Study Design

- Cross-sectional retrospective study of adult patients with continuous enrollment in a 2008 and 2009 commercial administrative claims database.
- Patients ≥ 18 years of age were included if they had:
 - ≥ 2 claims with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code for asthma (493.x) in 2008; and
 - Evidence of ≥ 2 filled prescriptions for asthma medications in 2008 (Figure 1).

Figure 1. Study Design



Cohorts

- Patients with high OCS use versus no OCS use were matched (1:1) on age, sex, geographic region, and chronic obstructive pulmonary disease (COPD) status.
- High OCS use was defined as ≥ 30 OCS days in both 2008 and 2009.
 - Previous research demonstrated an increased risk of possible side effects in asthma after 30 days of cumulative OCS exposure.³
- The high OCS use cohort was further divided into 2 subcohorts:
 - Those with diagnoses indicating possible OCS side effects
 - Identified by ICD-9-CM and Current Procedural Technology codes.
 - Those without diagnoses suggestive of possible OCS side effects.
- Possible side effect diagnoses: bone-related conditions, pneumonia, opportunistic infections, diabetes mellitus, hypertension, lipid disorders, glaucoma, obesity, cataracts, and ulcer disease.

Outcome Variables

- Overall and asthma-specific cumulative health care costs and resource use in the 2-year study period.
 - Health care resource use: office visits, emergency department (ED) visits, and inpatient admissions.
 - Asthma-related claims: claims for asthma medications or with asthma listed as the primary ICD-9-CM code.
 - Costs comprised medication and medical claims.

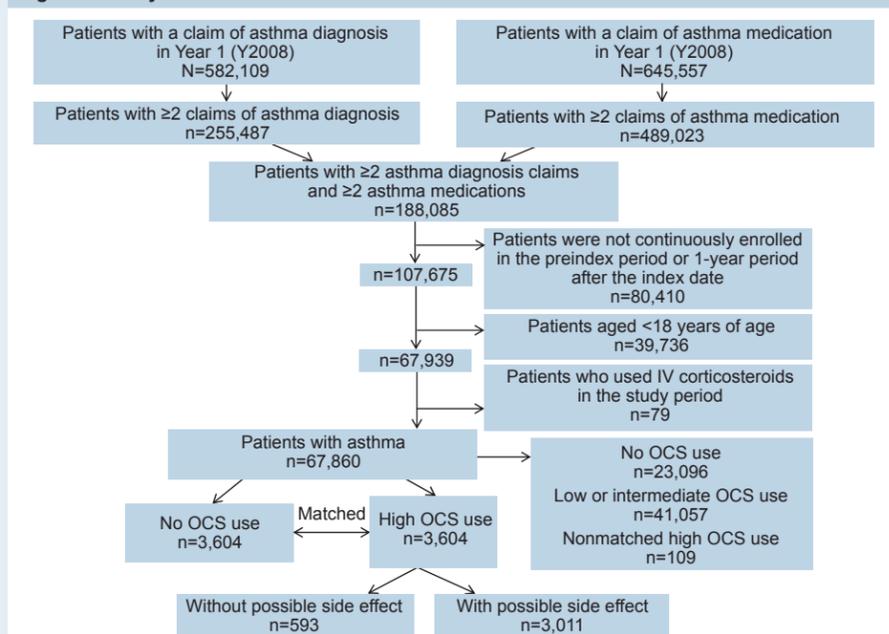
Analyses

- Comparison of total all-cause and asthma-related annualized health care costs and health care resource use between matched cohorts (high OCS use vs no OCS use), univariate analysis.
- Comparison of total all-cause and asthma-related annualized health care costs and health care resource use in the high OCS use cohort with and without possible OCS-related side effects:
 - Unadjusted univariate analysis; and
 - Adjusted for: age, sex, geographic region, COPD status, linear regression (costs, number of office visits), and negative binomial regression models (number of hospitalizations, ED visits).

RESULTS

- Matched groups included 3,604 high OCS use and 3,604 no OCS use patients with asthma (Figure 2).
 - Mean (SD) age: 54.4 (12.7) years; 68.1% female; 44.9% with COPD.
 - High OCS use was associated with higher rates of any possible OCS-related side effect (83.5% vs 78.1%, respectively; $P < 0.001$) and higher mean (SD) annual health care costs (\$24,627 [\$29,116] vs \$12,479 [\$15,597], respectively; $P < 0.001$) than no OCS use.

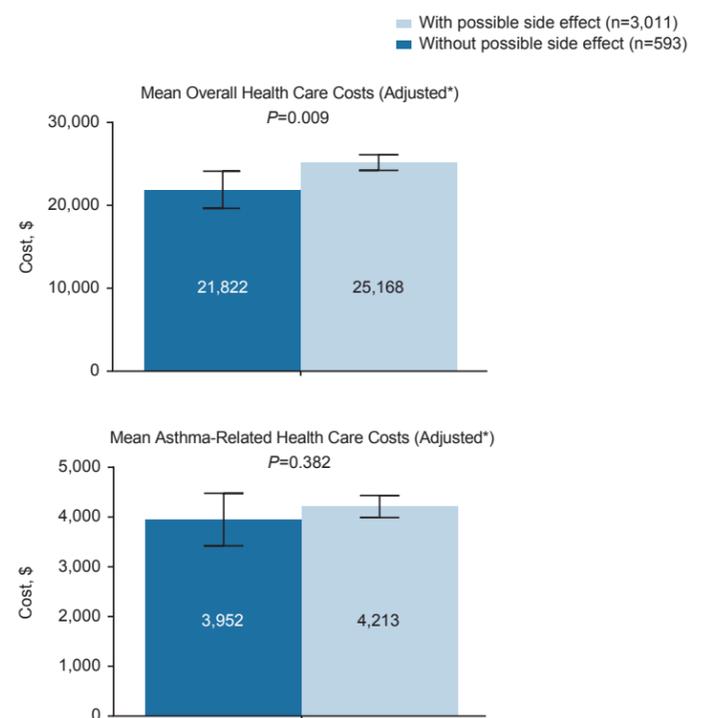
Figure 2. Study Cohort Selection



IV, intravenous; OCS, oral corticosteroid.

- Possible side effects versus no possible side effects among high OCS users:
 - Unadjusted
 - Patients with possible side effects were older (56.0 [12.1] vs 45.8 [12.2] years, respectively; $P < 0.001$) and sicker (mean [SD] Charlson Comorbidity Index score, 3.4 [2.7] vs 1.8 [1.4], respectively; $P < 0.001$; concomitant COPD, 49.9% vs 19.4%, respectively; $P < 0.001$) than those without possible side effects.
 - In unadjusted comparisons, mean (SD) annualized all-cause health care claims totaled \$26,355 (\$30,536) in patients with possible side effects versus \$15,851 (\$18,061) in patients without possible side effects ($P < 0.001$).
 - The increase in overall costs was driven by increased office visits (23.4 [15.5] vs 17.6 [14.7]; $P < 0.001$) and hospitalizations (0.60 [0.94] vs 0.19 [0.49]; $P < 0.001$) in patients with versus without possible side effects, respectively.
 - Asthma-related hospitalizations also were higher among patients with versus without possible side effects, respectively (0.11 [0.36] vs 0.04 [0.17]; $P < 0.001$).
 - Adjusted
 - Overall health care costs, but not asthma-related costs, were higher in patients with possible side effects (Figure 3).

Figure 3. Adjusted Health Care Costs



*Adjusted by age, sex, geographic region, Charlson Comorbidity Index score, and chronic obstructive pulmonary disease status.

- Overall (SE) costs for patients with versus without possible side effects were driven by an increase in office visits (23.0 [0.3] vs 19.6 [0.6], respectively; $P < 0.001$) and hospitalizations ($P < 0.001$; Table).
- The number of asthma-related hospitalizations were greater in patients with versus without possible side effects (0.07 [0.006] vs 0.03 [0.007], respectively; $P < 0.001$).

Table. High OCS Use With and Without Possible Side Effects: Adjusted* Annualized Health Care Resource Use

Health Care Resource	Adjusted Mean* (95% CI)		P Value
	Without Possible Side Effect n=593	With Possible Side Effect n=3,011	
All-cause			
No. of office visits	19.6 (18.3–20.9)	23.0 (22.5–23.6)	<0.001
No. of inpatient hospitalizations/year	0.22 (0.18–0.27)	0.44 (0.41–0.46)	<0.001
No. of ED visits/year	0.66 (0.50–0.88)	0.73 (0.64–0.82)	0.549
Asthma-related			
No. of asthma-related office visits	2.9 (2.5–3.3)	3.2 (3.0–3.4)	0.205
No. of asthma-related inpatient hospitalizations/year	0.03 (0.02–0.05)	0.07 (0.06–0.09)	<0.001
No. of asthma-related ED visits/year	0.01 (0.01–0.03)	0.02 (0.01–0.02)	0.451

ED, emergency department; OCS, oral corticosteroid. *Adjusted by age, sex, geographic region, Charlson Comorbidity Index score, and chronic obstructive pulmonary disease status.

LIMITATIONS

- Our study had the possibility for unmeasured confounders.
- Study was focused on high OCS use (≥ 30 days).
- Dose-dependent nature of OCS effect on possible side effects was not addressed.

CONCLUSIONS

- High OCS use was associated with significantly higher costs than no OCS use.
- In the high OCS use cohort, patients with possible side effects were more likely to use health care services than those without possible side effects.
- Given the potential for side effects and increased costs, health care providers and payers should consider direct efforts to minimize side effects before the latter affect quality of life and health care costs.

REFERENCES

- National Heart, Lung, and Blood Institute Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma - Summary Report 2007. <http://www.nhlbi.nih.gov/guidelines/asthma/asthsumm.htm>. Accessed September 15, 2015.
- Liu D, et al. *Allergy Asthma Clin Immunol*. 2013;9:30.
- Raimundo K, et al. *Am J Respir Crit Care Med*. 2014;189(meeting abstracts):A1337.

ACKNOWLEDGMENTS

Medical writing support for this poster was provided by Charlotte Kenreigh of Excel Scientific Solutions and funded by Genentech, Inc. and Novartis Pharmaceuticals Corporation.



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