

## BACKGROUND

- Acromegaly, a chronic and debilitating disorder caused by excessive growth hormone secretion, results in considerable comorbidities, declines in quality of life and increased mortality.<sup>1,2</sup>
- Many acromegaly patients are not effectively treated and suffer from slowly progressive disease complications.<sup>2</sup>
- The economic burden of these comorbidities has not been well characterized.

## OBJECTIVE

- To describe healthcare utilization and costs associated with acromegaly in the U.S.

## METHODS

### Study Design and Data Source

This was a retrospective cohort study combining 2 commercial, HIPAA-compliant U.S. claims databases, Thomson Reuters MarketScan and IMS Health PharMetrics. Data covered 1/1/2002-12/31/2008 for PharMetrics and 1/1/2002-12/31/2009 for MarketScan.

### Study Population and Study Timeframe

Each acromegaly patient was followed for one calendar year following the first observed acromegaly diagnosis (See diagram).

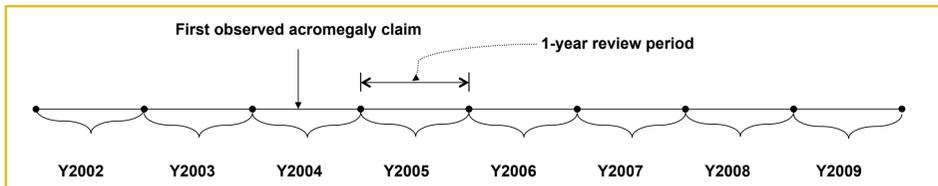
#### Inclusion Criteria:

- 1 medical claim with acromegaly diagnosis (ICD-9-CM code 253.0) in any diagnosis field at any time in 1/1/2002-12/31/2007 (PharMetrics) or 1/1/2002-12/31/2008 (MarketScan), and
  - either an additional claim with acromegaly diagnosis (criteria 1), or
  - evidence of treatment (criteria 2) for acromegaly (surgery, radiation, or medications) during the review period.

#### Exclusion Criteria:

- Patients who were not continuously enrolled in the review period.

### Patients Diagnosed with Acromegaly



## Measures

Pharmacy and medical claims in the review period were used to determine the following measures:

**Baseline Measures:** patient demographics (age, gender, region), usual care physician specialty, number of chronic conditions, Charlson comorbidity index,<sup>3</sup> and acromegaly-related complications (neoplasms including colon polyps and colon cancer, musculoskeletal complications, cardiovascular disease, sleep apnea, reproductive system abnormalities, hypopituitarism), and cardiovascular risk factors.

### Outcome Measures:

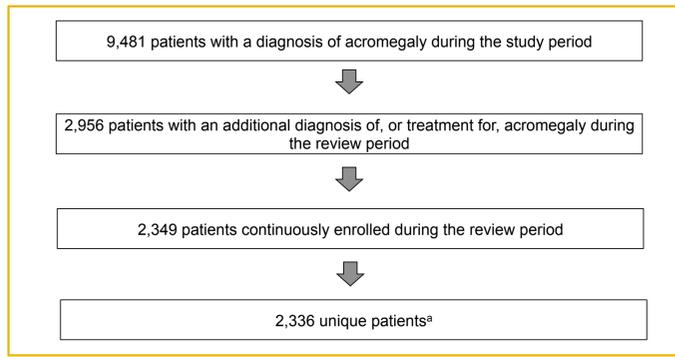
- Healthcare costs measured included pharmacy cost, non-pharmacy cost, and total healthcare cost.
- Healthcare utilization measured included number of physician office visits, number of emergency department (ED) visits, and number of inpatient hospitalizations.

### Statistical Analyses

- Descriptive statistics, including mean, median, standard deviation, and percentage, were reported for all study measures, as applicable.
- Regression models used estimate incremental increase in overall healthcare cost, risk of inpatient hospitalization, and risk of ED visit associated with each of 6 categories of complications, adjusted for baseline variables.
- OLS regression was used cost outcomes; logistic regression for others.
- Data transformations and statistical analyses were done with SAS<sup>®</sup> version 9.2.

## RESULTS

### Cohort Identification



<sup>a</sup>13 patients were assumed to be identified from both databases, and were randomly removed from one of the databases (7 removed from PharMetrics and 6 removed from MarketScan).

- Among 2,336 identified acromegaly patients, 2,045 (87.5%) had  $\geq 2$  claims with acromegaly diagnosis (criteria 1), 1,019 (43.6%) had  $\geq 1$  claims with acromegaly diagnosis and evidence of acromegaly treatment (criteria 2), and 728 (31.2%) met both criteria in the review period.

### Demographic and Clinical Characteristics

- Mean age was 45.3 years (standard deviation [SD]: 15.7), 50.9% were female.
- 27.7% were from the Midwest, 18.0% were from the Northeast, 40.8% were from the South, and 13.5% were from the West.
- Usual care physician specialty was primary care in 34.5% of patients, endocrinology in 22.7%, cardiology in 3%, and other/unknown in 39.8%.
- Patients had a mean of 3.2 chronic conditions (SD: 1.8) and mean Charlson comorbidity index of 1.0 (SD: 1.8).

### Healthcare Utilization and Costs<sup>a</sup>

	All Patients N=2,336
<b>No. of inpatient hospitalizations, no. (%)</b>	
0	1,948 (83.4)
1	308 (13.2)
2	49 (2.1)
3+	31 (1.3)
<b>No. of emergency department visits, no. (%)</b>	
0	1,813 (77.6)
1	328 (14.0)
2	114 (4.9)
3+	81 (3.5)
<b>No. of office visits, mean (SD)</b>	15.6 (14.5)
<b>Total healthcare cost, mean (SD)</b>	\$24,284 (\$33,341)
<b>Medical cost, mean (SD)</b>	\$16,995 (\$30,047)
Inpatient hospitalizations cost	\$4,904 (\$18,019)
ED visits cost	\$237 (\$988)
Non-ED outpatient services cost	\$11,854 (\$20,743)
<b>Pharmacy cost, mean (SD)</b>	\$7,289 (\$14,157)

<sup>a</sup>All costs from before 2009 were adjusted to 2009 dollars using the medical care component of the Consumer Price Index.

- Inpatient hospitalization was observed in 16.6% of patients and emergency department visits in 22.4%.
- Patients had a mean of 15.6 office visits/year.
- Total healthcare costs were \$24,284 (SD: \$33,341)/per patient-year (PPY).
- Of this total, \$16,995 (SD: \$30,047) was from medical costs and \$7,289 (SD: \$14,157) from pharmacy costs.

### Adjusted Incremental Healthcare Costs

	Linear Regression		
	Coefficient (\$)	(SE)	P Value
<b>Cardiovascular risk factor</b>			
Diabetes	10,903	(1,816)	*
Hypertension	4,634	(1,621)	0.004
Hypertriglyceridemia	54	(1,730)	0.975
<b>Acromegaly-related complication</b>			
Neoplasm <sup>a</sup>	9,697	(2,751)	*
Musculoskeletal <sup>b</sup>	6,916	(1,570)	*
Cardiovascular disease <sup>c</sup>	13,573	(2,324)	*
Sleep apnea	10,160	(2,155)	*
Reproductive system abnormality <sup>d</sup>	-2,549	(2,200)	0.247
Hypopituitarism	7,166	(1,865)	*

\*P<.001

<sup>a</sup>Colon polyp or colon cancer.

<sup>b</sup>Osteoarthritis, arthropathy/arthralgia/synovitis, carpal tunnel syndrome, or hyperhidrosis.

<sup>c</sup>Cardiomyopathy, cardiac hypertrophy, heart failure, or cardiac dysrhythmia/arrhythmia.

<sup>d</sup>Galactorrhea, menstrual abnormality, impaired libido/impotence, or infertility.

- After adjusting for age, gender, region and risk factors, the presence of all complications except reproductive abnormalities was associated with increased costs (P<0.01)
- The range of increase varied from \$6,916 for musculoskeletal abnormalities to \$13,573 for cardiovascular abnormalities.

### Adjusted Risk of Inpatient Hospitalization and Risk of ED Visit

	Risk of Inpatient Hospitalization <sup>a</sup>			Risk of ED Visit <sup>a</sup>		
	OR	(95% CI)	P Value	OR	(95% CI)	P Value
<b>Cardiovascular risk factor</b>						
Diabetes	1.68	(1.27 - 2.22)	*	1.18	(0.90 - 1.55)	0.222
Hypertension	1.51	(1.16 - 1.97)	0.002	1.82	(1.42 - 2.32)	*
Hypertriglyceridemia	1.47	(1.12 - 1.93)	0.006	1.06	(0.81 - 1.38)	0.675
<b>Acromegaly-related complication</b>						
Neoplasm	1.17	(0.77 - 1.80)	0.462	1.06	(0.71 - 1.60)	0.765
Musculoskeletal	1.60	(1.24 - 2.06)	*	1.81	(1.44 - 2.28)	*
Cardiovascular disease	2.87	(2.08 - 3.94)	*	2.42	(1.77 - 3.30)	*
Sleep apnea	1.52	(1.10 - 2.10)	0.011	1.08	(0.79 - 1.49)	0.621
Reproductive system abnormality	1.12	(0.77 - 1.63)	0.555	0.89	(0.63 - 1.24)	0.480
Hypopituitarism	1.33	(0.99 - 1.80)	0.058	1.19	(0.90 - 1.57)	0.227

\*P<.001; Abbreviations: OR, odds ratio; CI, confidence interval.

- Odds of hospitalizations and odds of emergency department visits increased in the presence of cardiovascular risk factors and cardiovascular disease, musculoskeletal abnormalities, and sleep apnea.

## LIMITATIONS

- This study provided an initial evaluation of a possible case-finding algorithm for acromegaly using a large merged claims database (MarketScan and PharMetrics). Further review and analyses of this algorithm are needed, followed by validation in medical charts.
- Some of the patients in this study may not have required acromegaly-related treatment if they had a surgical cure or entered remission prior to the observation period of this study.
- Claims are collected for payment and not research, which may limit the degree to which claims data can accurately capture an individual's medical history
- The study included commercially insured patients and may not be generalizable to other populations.
- The cost and utilization increases described are associated with complications but cannot be causally linked to those complications using claims.

## CONCLUSIONS

- Although acromegaly is rare, annual costs are high (\$24,284/pt.), and patients are frequently seen in the outpatient setting (15.6 visits) and in the hospital (16.6% admitted) in a given year.
- Acromegaly complications are associated with an increase in both utilization and cost.
- After adjustment for confounding, costs were between \$6,916 and \$13,573 higher in those with disease complications than in those without (with the exception of reproductive abnormalities, which were not associated with higher cost).
- Risk of hospitalization was more than 50% higher in patients with either sleep apnea or musculoskeletal complications than in those without, and nearly three times as high among those with cardiovascular disease as in those without.
- Appropriate attention to these complications along with adequate therapy and monitoring are critical in the approach to this disease.
- Since many complications occur slowly over time, earlier and more intensive treatment might reduce them.
- Future studies should estimate the long-term effect of treatment on costs.

## References

- Ben-Shlomo *Pituitary* 2011.
- Melmed *N Engl J Med* 2006.
- Charlson *J Chronic Dis* 1987.

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