DEFINING AND EXPLORING THE EXCESSIVE HEALTHCARE BURDEN OF ADRENAL INSUFFICIENCY

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INTRODUCTION

Clinical studies of patients with adrenal insufficiency (AI) have shown increased mortality, reduced cardiovascular and skeletal health and compromised quality of life, but the impact of this on healthcare burden is unknown.

AIM

The objective of this study was to understand the clinical care pathway of patients with AI. This research utilized real-world evidence to compare comorbidities, healthcare utilization and expenditures in patients with AI.

METHODS

- United States administrative health claims data from Truven Health MarketScan® Commercial and Medicare databases (January 2006 to June 2011, including 108,271,287 records) were used.
- Patients were classified into three cohorts based on type of adrenal disorder: secondary AI (PIT) due to pituitary disorder (n=1,529), primary AI (PAI) (n=705), and congenital adrenal hyperplasia (CAH) (n=242). (Figure 1)
- **Inclusion criteria:** 1) within each cohort, patients had to have a minimum of two diagnosis codes on different days (see Figure 1 for coding algorithm) and 2) continuous health and pharmacy coverage starting at least 6 months before and for at least 12 months after diagnosis.
- **Exclusion criteria:** For all three AI cohorts, patients with less than 50% adherence were excluded from this analysis. Note: glucocorticoid drug usage was converted to a hydrocortisone equivalent (in mg) and adherence is measured from 6-12 months after first diagnosis.

Analysis

Matched Control: Each patient meeting inclusion and exclusion criteria within each AI cohort [PAI, CAH and PIT] were matched using the greedy algorithm 1:1 on age (within 5 years), gender, insurance type, and region to a general population control group in the same insurance database (matched control).

Probability of Comorbidities: Separate logistic regression models were used to estimate the probability of having each comorbid condition [Diabetes, Depression, Anxiety, Hyperlipidemia, Hypertension] for each AI cohort [PAI, CAH, and PIT] compared with their matched control. For these models covariates included: year of index and patient demographics.

Healthcare Expenditures: A multivariable regression model was generated to estimate the annual healthcare expenditures for each AI cohort [PAI, CAH, and PIT] compared to their matched control. For this model covariates included: year of index, patient demographics and patient comorbidities.

Inpatient Admissions: A multivariable regression model was generated to estimate the total number of annual inpatient admissions for each AI cohort [PAI, CAH, and PIT] compared to their matched control. For this model covariates included: year of index, patient demographics and patient comorbidities.

- Inpatient admissions were further classified by those admissions where the primary diagnosis was infection. Kaplan Meier curves were then generated to show time to inpatient admission for infection (PAI and PIT cohorts vs their matched controls). CAH cohort admissions were too few for comparison.

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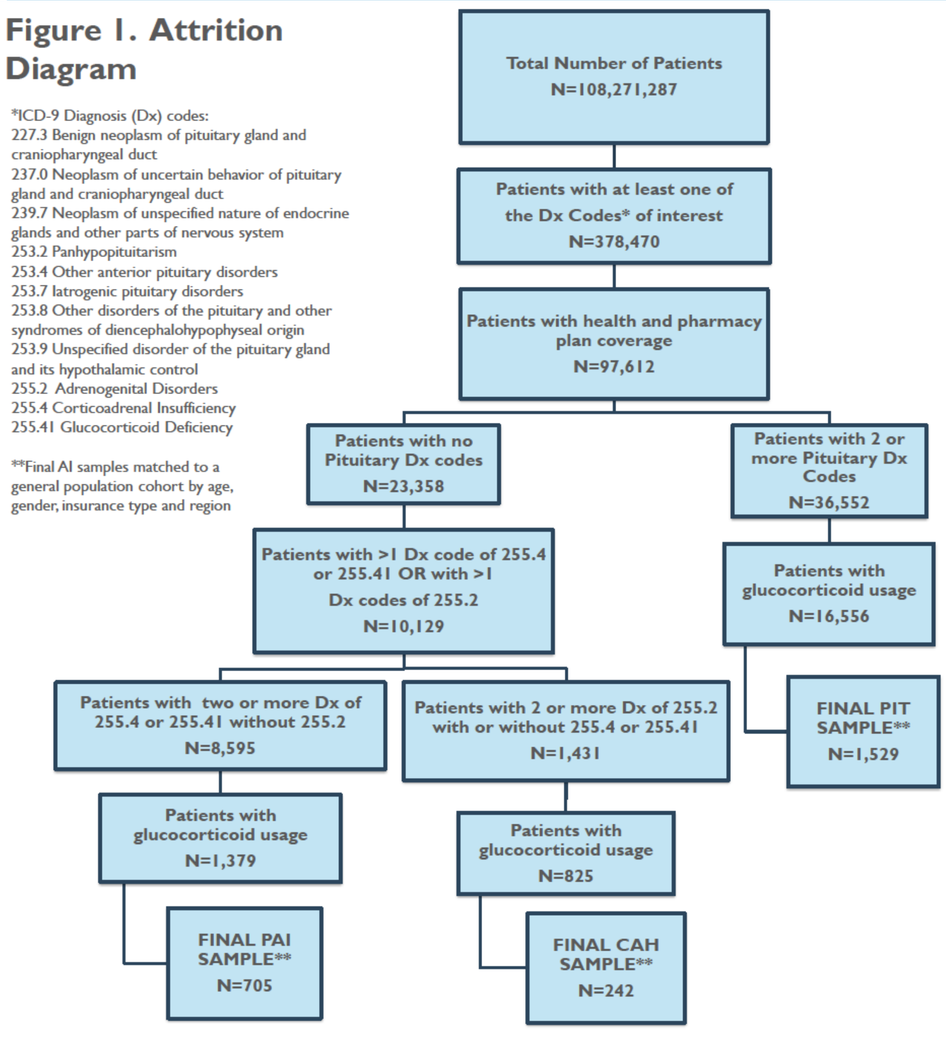
RESULTS

Figure 1. Attrition Diagram



*ICD-9 Diagnosis (Dx) codes:
227.3 Benign neoplasm of pituitary gland and craniopharyngeal duct
237.0 Neoplasm of uncertain behavior of pituitary gland and craniopharyngeal duct
239.7 Neoplasm of unspecified nature of endocrine glands and other parts of nervous system
253.2 Panhypopituitarism
253.4 Other anterior pituitary disorders
253.7 Iatrogenic pituitary disorders
253.8 Other disorders of the pituitary and other syndromes of diencephalohypophyseal origin
253.9 Unspecified disorder of the pituitary gland and its hypothalamic control
255.2 Adrenogenital Disorders
255.4 Corticoadrenal Insufficiency
255.41 Glucocorticoid Deficiency

**Final AI samples matched to a general population cohort by age, gender, insurance type and region

- All results are based on matched AI and general population cohorts.
- Each of the three AI cohorts had mean hydrocortisone equivalent of close to 31 mg/day.
- PAI, CAH and PIT showed higher odds ratios of diabetes, anxiety, and hypertension compared to the matched cohort. (Table 1)
- PAI and PIT showed higher odds ratios of depression and hyperlipidemia compared to the matched cohort. (Table 1)
- For every 1 inpatient admission for the matched cohort there were an estimated 5 inpatient admissions for the PAI cohort. (Table 2)
- For every 1 inpatient admission for the matched cohort there were an estimated 4 inpatient admission for the PIT cohort. (Table 2)
- Estimated total 12 month expenditures for each AI cohort compared to their matched cohort (Figure 2) were: PAI=$13,563 versus Control=$4,332; CAH=$6,813 versus Control=$3,739; PIT=$29,932 versus Control=$7,275.
- PAI and PIT have a greater probability of inpatient admission with infection compared to their matched cohorts. (Figure 3)

Table 1. Odds Ratios of Comorbid Conditions in AI Cohorts Compared to Matched Controls

	Comparison	Odds Ratio (CI)	P-Value
Diabetes*	PAI vs Controls	**1.79 (1.32, 2.43)**	**0.0002**
	CAH vs Controls	**3.15 (1.54, 6.45)**	**0.0017**
	PIT vs Controls	**1.73 (1.43, 2.08)**	**<.0001**
Depression	PAI vs Controls	**1.72 (1.37, 2.17)**	**<.0001**
	CAH vs Controls	1.25 (0.77, 2.02)	0.3664
	PIT vs Controls	**1.90 (1.62, 2.24)**	**<.0001**
Anxiety	PAI vs Controls	**2.27 (1.72, 2.99)**	**<.0001**
	CAH vs Controls	**2.48 (1.24, 4.99)**	**0.0105**
	PIT vs Controls	**2.11 (1.74, 2.56)**	**<.0001**
Hyperlipidemia	PAI vs Controls	**1.51 (1.18, 1.92)**	**0.0009**
	CAH vs Controls	1.50 (0.72, 3.11)	0.2757
	PIT vs Controls	**2.09 (1.77, 2.47)**	**<.0001**
Hypertension	PAI vs Controls	**1.34 (1.04, 1.72)**	**0.0231**
	CAH vs Controls	**2.39 (1.36, 4.22)**	**0.0026**
	PIT vs Controls	**1.69 (1.43, 1.98)**	**<.0001**

*Diabetes includes Type I or Type II

Figure 2. Annual Expenditures in AI Cohorts Compared to Matched Controls

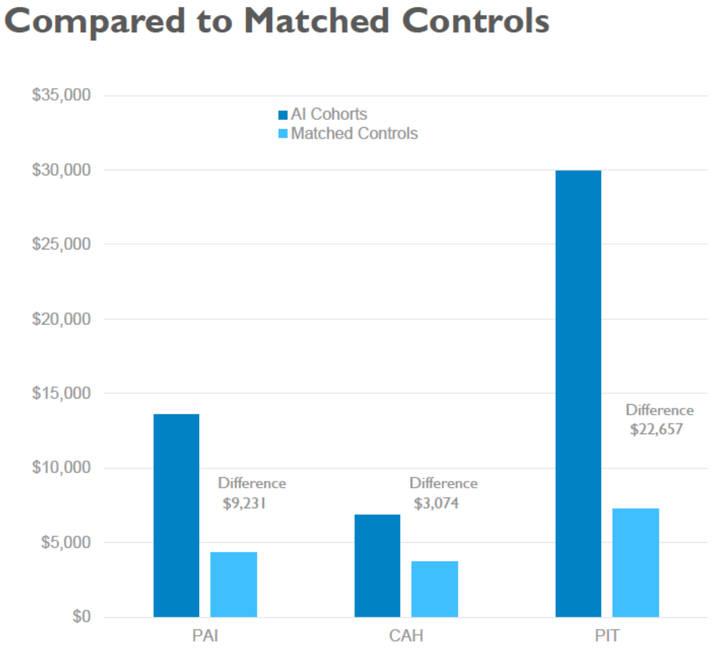


Table 2. Inpatient Admissions for AI Cohorts Compared to Matched Controls

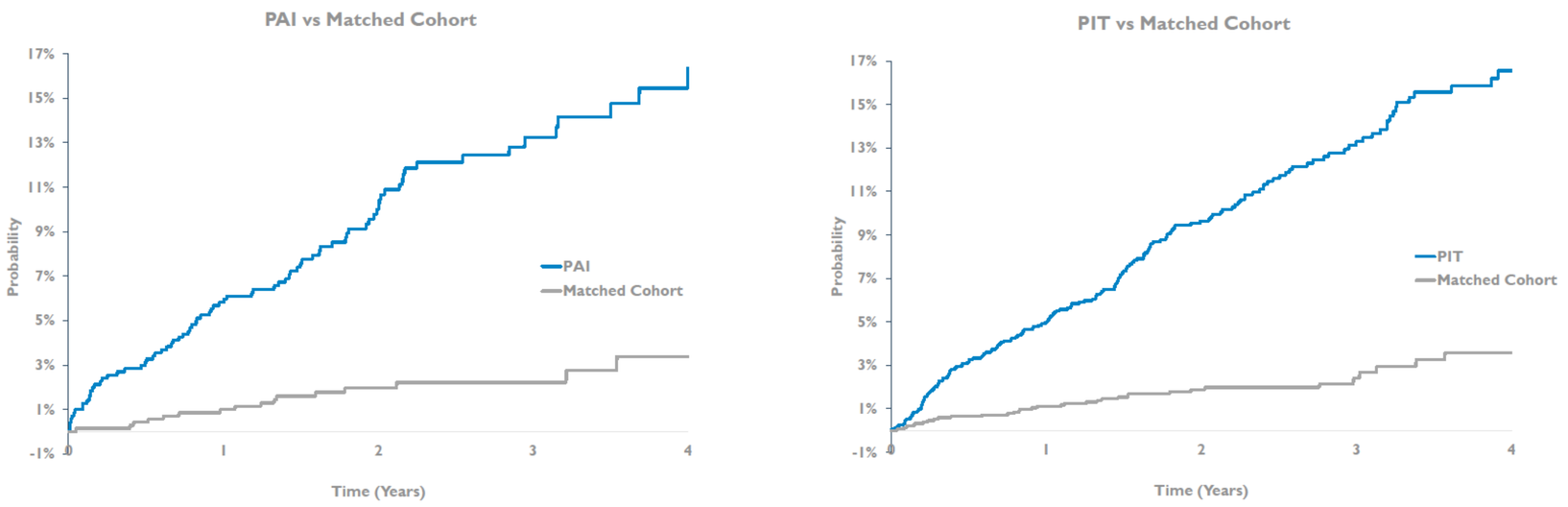
Comparison	AI Estimate	Matched Control Estimate	Ratio
PAI vs Controls*	0.64	0.13	~5:1
CAH vs Controls	0.00	0.00	
PIT vs Controls*	0.60	0.14	~4:1

* p-value <0.0001

CONCLUSION

Patients with AI carry a significant healthcare burden with higher risk of comorbidities, hospital admissions and healthcare expenditures compared to the general population.

Figure 3. Probability of an Inpatient Admission with Infection for PAI and PIT Cohorts



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