THE USE OF QUINTILE ANALYSIS AS A MEASURE OF DISEASE SEVERITY: A COMPARISON WITHIN AND ACROSS DISEASES

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INTRODUCTION:

- Analyses of administrative claims data are often criticized for lacking adjustments for severity.
- We explored whether disease-specific cost (DSC) quintiles may be indicative of disease severity in an examination of several diseases.
- Vilfredo Pareto was an economist who is credited with establishing what is now widely known as the Pareto Principle or 80/20 rule. In general, the Pareto Principle predicts that costs or resources will be maldistributed within a population.
  - In this case, we wanted to test what percent of the population incurred the top 20% of disease-specific costs.

METHODOLOGY:

- The employees included in this research project came from the Human Capital Management Services Research Reference Database (HCMS RRDb).
- Data for these employees come from multiple large employers that are widely dispersed throughout the United States and represent the retail, service, manufacturing, and financial industries.
- The results presented are taken from several different studies of different diseases.
- Persons were considered to have a disease if they had a health insurance claim for a disease with an ICD-9-CM code presented in Table 1.
- The annual period of analysis for each disease state is described in Table 2.
- Annual Disease-Specific Costs (DSC) were calculated as the sum of the:
  - Disease-Specific Medical Costs (DSMC) for services associated with the disease-specific ICD-9-CM codes, and the
  - Disease-Specific Prescription Cost (DSRxC) for outpatient medicines.
- Employees in each disease state were rank ordered into 5 cost quintiles based on DSC (20% of DSC in each) ranging from lowest to highest cost quintile.
- Across diseases, pairwise differences in the quintile distributions were assessed using Chi-squared tests.

RESULTS:

- The Disease-Specific Costs (DSCs) by Quintile Group are presented in Figure 1.
- The Disease-Specific Medical Costs (DSMC) and Disease-Specific Prescription Costs (DSRxC) by Quintile Group are shown in Table 3.
- The percentages of employees within each disease state assigned to each quintile are shown in Table 4.
- All pairwise comparisons of distributions in Table 4 were significant (for FD and GERD P=0.0468, and for the remaining comparisons $P \leq 0.01$).

TABLE 1: ICD-9-CM CODES FOR STUDY COHORTS

DISEASE	ICD-9-CM CODES
Back Disorders	720.xx, 721.2x-721.9x, 722.1x-722.3x, 722.5x, 722.6x, 722.7, 722.70, 722.72, 722.73, 722.8, 722.80, 722.82, 722.83, 722.9x, 724.xx
Bipolar Disorder	Manic Disorders: 296.0x, 296.1x Bipolar Affective Disorders: 296.4x, 296.5x, 296.6x, 296.7x Manic-depressive psychosis, other, and unspecified: 296.8x
Cancer	140.xx – 239.xx
Functional Dyspepsia	536.8x
Gastroesophageal Reflux Disease (GERD)	Hypersecretory condition: 251.5 Esophagitis: 530.10, 530.1, 530.11, 530.12, 530.19 Esophageal reflux: 530.81, Heartburn: 787.1; Dysphagia – Complete: 787.2
Headache	346.xx, 349.0x, 784.0x, 307.81
Neuropathic Disorders	Face: 350.1x, 350.2x, 351.0x, 351.8x, 351.9x; Spinal Cord: 336.9x, 952.00, 952.06, 952.08, 952.09, 952.10, 952.11, 952.16, 952.2x, 952.9x; Nerve Lesions: 354.1x, 354.2x, 354.3x, 355.0x, 355.2x, 355.6x; Mononeuritis: 354.5x, 354.8x, 354.9x, 355.8x, 355.9x; Neuropathy: 337.1x, 356.8x, 356.9x, 357.0x, 357.5x, 357.81, 357.82, 357.9x Pain Complex Regional Syndrome: 337.20, 337.21, 337.22, 337.29; Miscellaneous: 353.0x, 353.1x, 353.3x, 353.6x, 353.8x, 729.2x, 951.4x, 953.4x, 955.5x, 955.6x, 955.7x, 344.61, 336.0x, 336.8x, 340.xx, 341.9x, 342.11, 342.12, 342.81, 342.91, 342.92, 343.8x, 343.9x, 344.00, 344.01, 344.03, 344.04, 344.1x, 344.60, 344.89, 344.9x, 355.1x, 355.71, 358.00, 728.86, 726.31, 726.32, 710.1x, 726.31, 726.32
Osteoarthritis	715.xx

CONCLUSIONS:

- Disease-Specific Costs are extremely maldistributed.
  - In all diseases explored, 3.5% of subjects or fewer consume the highest 20% of costs.
- These cost-comparison results may suggest that cost quintiles are indicative of severity in all disease states.
- Further investigation is warranted over an extended period of time using clinical severity data to confirm this relationship.

TABLE 2: ANNUAL PERIOD DEFINITIONS FOR STUDY COHORTS

DISEASE	12 MONTH PERIOD
• Back Disorders • Cancer • Headache • Neuropathic Disorders • Osteoarthritis	Calendar Year 2004 (1/1/2004 – 12/31/2004) If subjects were ineligible in 2004, then the protocol explored eligibility for Calendar Year 2002 (1/1/2002 – 12/31/2002)
• Bipolar Disorder • GERD	12 months following their first medical claim with the disorder
• Functional Dyspepsia	3 months before to 9 months following their first medical claim with the disorder

TABLE 3: MEAN PER-PATIENT DISEASE-SPECIFIC MEDICAL AND PRESCRIPTION COSTS BY QUINTILE

			QUINTILE				
N	DISEASE	VARIABLE	LOWEST	2ND	3RD	4TH	HIGHEST
27,311	Back Disorders	DSMC	$233	$2,243	$6,162	$14,279	$39,807
	Back Disorders	DSRxC	$17	$163	$356	$753	$570
761	Bipolar Disorder	DSMC	$266	$1,174	$2,968	$8,357	$21,427
	Bipolar Disorder	DSRxC	$300	$1,423	$2,183	$2,203	$2,354
30,745	Cancer	DSMC	$444	$6,068	$20,536	$48,289	$108,678
	Cancer	DSRxC	$11	$71	$207	$160	$167
1,669	Functional Dyspepsia	DSMC	$67	$199	$229	$449	$1,171
	Functional Dyspepsia	DSRxC	$61	$400	$764	$931	$1,278
11,653	GERD	DSMC	$105	$290	$512	$1,175	$4,886
	GERD	DSRxC	$129	$768	$987	$1,169	$1,108
15,305	Headache	DSMC	$104	$792	$1,511	$2,648	$6,846
	Headache	DSRxC	$10	$65	$109	$257	$1,134
7,522	Neuropathic Disorder	DSMC	$169	$1,556	$4,130	$12,700	$80,463
	Neuropathic Disorder	DSRxC	$18	$181	$403	$2,440	$741
7,596	Osteoarthritis	DSMC	$211	$5,366	$18,390	$27,428	$44,677
	Osteoarthritis	DSRxC	$33	$548	$523	$128	$59

DSMC =Disease-Specific Medical Costs
DSRxC=Disease-specific Rx Costs

FIGURE 1: MEAN PER PATIENT DISEASE-SPECIFIC COSTS BY QUINTILE AND DISEASE

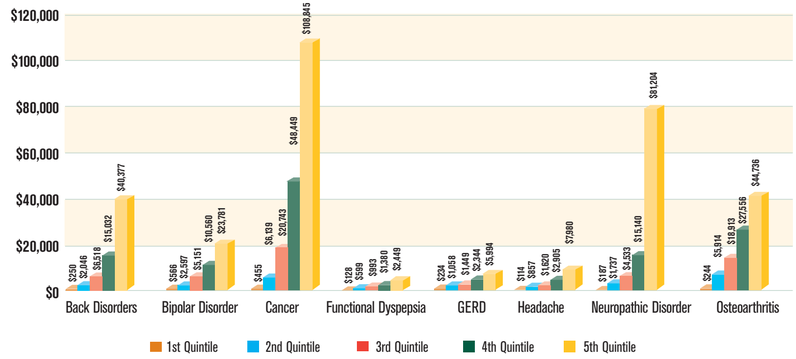

TABLE 4: PERCENTAGE OF COHORTS ASSIGNED TO QUINTILES BY DISEASE

		QUINTILE				
DISEASE	N	1ST QUINTILE LOWEST	2ND QUINTILE 2ND	3RD QUINTILE 3RD	4TH QUINTILE 4TH	5TH QUINTILE HIGHEST
Back Disorders	27,311	85.86%	8.90%	3.28%	1.42%	0.53%
Bipolar Disorder	761	71.22%	15.37%	7.88%	3.81%	1.71%
Cancer	30,745	90.13%	6.67%	1.97%	0.85%	0.38%
Functional Dyspepsia	1,669	67.29%	14.32%	8.63%	6.23%	3.54%
GERD	11,653	66.00%	14.57%	10.28%	6.57%	2.57%
Headache	15,305	79.43%	10.66%	5.63%	3.14%	1.14%
Neuropathic Disorders	7,522	85.89%	9.29%	3.55%	1.06%	0.20%
Osteoarthritis	7,596	93.60%	3.84%	1.21%	0.83%	0.51%

P-values (Chi-squared) for pairwise distribution comparisons:

- Functional Dyspepsia vs. GERD: P=0.0468
- Bipolar vs. FD: P=0.0095
- Bipolar vs. GERD: P=0.0013
- Back Pain vs. Neuropathic Pain: P=0.0002
- The other 24 pairwise comparisons: P<0.0001

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