

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 RRD).
- 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 |
|---|--|
| <ul style="list-style-type: none"> 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) |
| <ul style="list-style-type: none"> Bipolar Disorder GERD | 12 months following their first medical claim with the disorder |
| <ul style="list-style-type: none"> 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

| N | DISEASE | VARIABLE | QUINTILE | | | | |
|--------|----------------------|----------|----------|---------|----------|----------|-----------|
| | | | 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

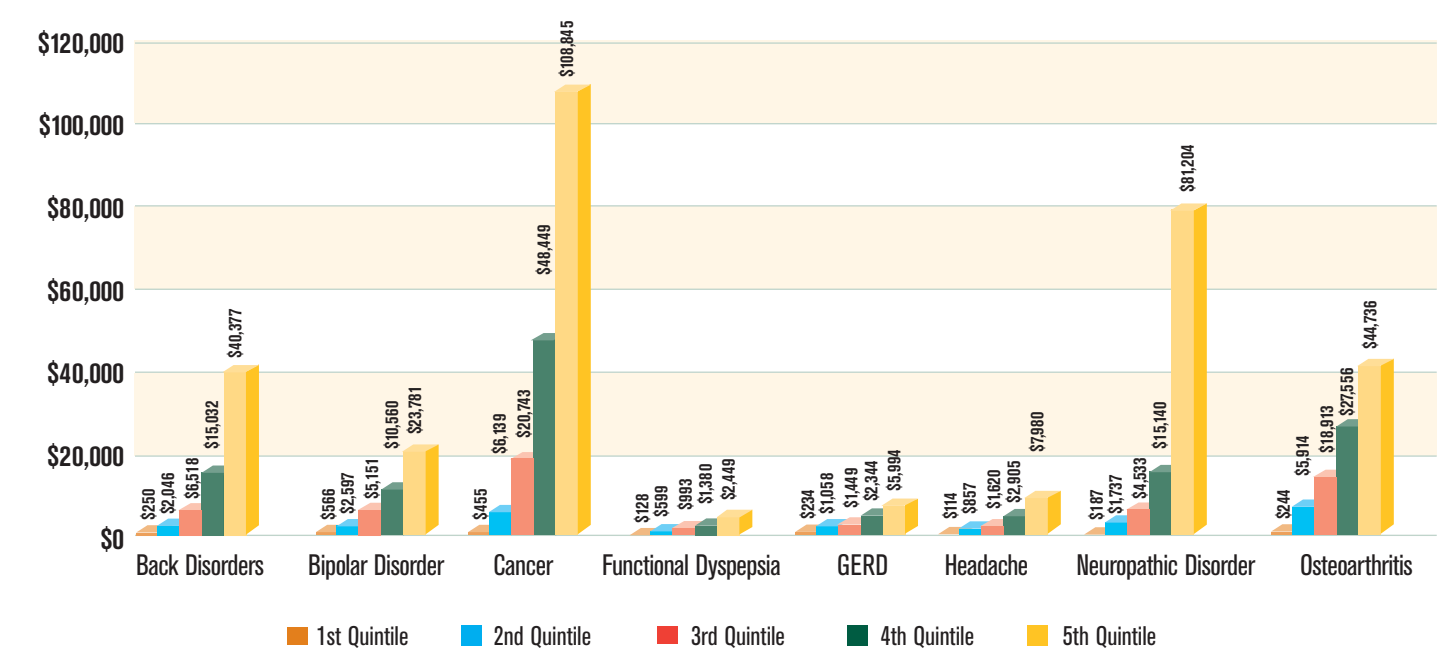


TABLE 4: PERCENTAGE OF COHORTS ASSIGNED TO QUINTILES BY DISEASE

| DISEASE | N | QUINTILE | | | | |
|-----------------------|--------|---------------------|------------------|------------------|------------------|----------------------|
| | | 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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