A Controlled Substances (CS) score: is it related to healthcare utilization and total cost of care?

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Background

- More than half of drug overdose deaths involve prescription drugs with the majority being opioid painkillers. The risk of overdose increases as daily morphine equivalent dose increases, notably above 100 mg per day.[1]
- There is data demonstrating an association with increased annual direct health care costs and increased rates of emergency room (ER) visits among opioid abusers compared to non-abusers.[2]
- Opioid abusers frequently use other controlled substances (CS) concomitantly increasing their risk of overdose and death.[3]
- One pharmacy benefit manager's care management program (GuidedHealth® [GH]) CS retrospective Drug Utilization Review (DUR) identifies members who may be misusing or abusing CS. Using the CS score, members with a score 12 or higher are identified and their prescribers are notified in an effort to prevent CS related adverse events and reduce costs.
- Identifying members with a high CS score of 12 or more and mailing prescriber(s) a letter has been shown to be associated with a reduction in CS score of 1 to 1.4 points in two studies at six months after the intervention compared to a concurrent control group.[4,5] Furthermore, the reduction in CS claims resulted in a net CS claims savings of $210,566 or $0.06 PMPM across more than 1 million commercially insured lives and prescribers found the program valuable, 88% said useful/very useful, 84% said data was accurate.[5]
- However, as noted in an editorial,[6] the CS score has not been validated and it is unknown if the CS score is associated with healthcare utilization and/or costs.

Objective & Purpose

- To determine if the CS score is associated with healthcare utilization (i.e., hospitalizations or emergency room visits) and total cost of care, defined as all medical and pharmacy health insurer costs.
- If an association exists between the CS score, healthcare utilization, and costs, then quantify what a one point change in the CS score equates to in hospitalizations, emergency room visits, and total cost of care.

Methods

- The study included commercial members from 11 health plans across the US.
- Members were required to be continuously enrolled (no gap) in all of 2012 and 2013 and 18 years of age or older as of 12/31/12.
- Prime Therapeutics care management program, GuidedHealth, identifies members with controlled substances claims in the past 90 days and calculates a CS score.
- CS score is calculated using a count of CS claims, unique pharmacies, unique prescribers and increasing monthly CS utilization (Table 1).
- Using the GuidedHealth rules for the CS score, all members in the analysis were assigned a score based on CS utilization in the 4Q2012. Members with a score of zero were included in preliminary analyses, however, they were later removed, limiting the population to those members with a score greater than zero.
- The pre-period was defined as all of 2012 and the post period was defined as all of 2013.
- We queried medical claims back 455 days from 10/1/12 for cancer, 140.xx through 209.xx excluding 173.xx for non melanoma skin cancer, and flaged these members for identification.
- Pre-period (2012) measurements included:
  - age
  - gender
  - education, income, and race at a ZIP-code level, derived from Census Bureau information
  - Optum pharmacy risk group score, which measures disease burden
  - Charlson Comorbidity Index score
  - total allowed amounts for all pharmacy and medical claims
  - ER visits using revenue codes found on medical claims
  - hospitalizations using revenue codes found on medical claims
  - region of the country – midwest or south
  - presence of cancer diagnosis
- Post period (2013) measures included:
  - total allowed amounts for all pharmacy and medical claims (health insurer + member paid)
  - ER visits using revenue codes found on medical claims
  - hospitalizations using revenue codes found on medical claims
  - total controlled substance drug costs (health insurer + member paid)
- A logistic regression model was used to measure the association between CS score and adverse event in the post-period (hospitalization and ER visit), with adjustment for: age, gender, Charlson Comorbidity Index score, and ZIP code derived: race, education and income; pre-period hospitalization or ER visit, Pharmacy Risk Group score, cancer medical claim ICD9 code found in 455 days prior to 4Q2012, region of the country (midwest or south) and total costs of care in the pre-period. The logistic regression fit was assessed using the C-statistic.
- Cost analyses were performed using a generalized linear model with Gamma distribution and adjusted for the same covariates listed above.
- A park statistical test was run to ensure the CS drug cost data and total cost of care data met the assumptions of the Gamma model.
- To describe what a one point change in the CS score means for healthcare utilization and costs (total costs and CS drug costs), we used the adjusted cost for each CS score group, with 23 different CS score groups. From the Gamma model a trend line was fit to generate a linear regression equation (e.g., y = mx + b) where coefficient *m* indicates that for every additional one point change in CS score you can expect costs to increase by an average of $m.
- Members with a score of 21 or higher were excluded because they are outliers and represented only 2,384 (0.24%) of 999,852 members. Therefore, the trend lines were only fit to data from members with a score between 2.5 and 20.5.
- The intercept b is a prediction for the response value when all predictors equal zero. However, our study did not collect data in this all-zero range, so the value of the constant is not interpretable.

Results

- Approximately 11 million members across 11 health plans were eligible in December 2012 (Figure 1 flow diagram).
  - 5,922,175 (54%) were continuously enrolled in all of 2012 and all of 2013
  - 4,922,323 (83.1%) members did not have any CS claims in the 4Q2012
  - 999,852 (16.9%) members with at least one CS claim which equates to a CS score of 2.5 or higher were the analyzable population. Their average age was 47 years and 43% were male.
- Just under half (47%) had a CS score = 2.5, indicating a single CS claim during the 4Q2012, half of the members (51%) had a score between 3 and less than 12. The remaining 2% (20,858 members) had a score of 12 or more (Figure 2).
- A CS score of 12 or more was found in 20,858 (0.35%) of the total 5,922,175 commercially insured 18 years of age or older and continuously enrolled members analyzed.
- Almost half of the members had a claim for an opioid (48.3%), 39.7% had a claim for a hypnotic/anxiolytic, 10.9% had a claim for a stimulant and less than 5% had a claim for either an anabolic steroid or other drug (e.g., migraine medications, sodium oxybate, pregabalin).
- The 2013 unadjusted total cost of care by CS score is shown in Figure 2. The median 2013 total cost of care for members with a CS score of 2.5 was $2,486 and increases to $17,709 for members with a score of 20 to less than 21.

Controlled Substance Score association with health care utilization and costs

- We found a statistically significant and consistently increasing association between the 4Q2012 CS score groups and hospitalizations, ER visits, controlled substance drug costs, and total costs of care, in 2013, after multivariate model adjustment.
- Fitting a trendline to the adjusted model results, we found what a 1 point change in CS score was associated with: (Figures 3 and 4).
  - $1,488 total cost of care
  - $235 CS drug cost
  - 0.9% hospitalization rate
  - 1.5% ER visit rate
- For a 10,000 life group, based on a 0.2% member identification rate with a CS score of 12 or more for intervention, 20 members' CS score could be reduced by 1 point. Previous published research[4] demonstrated a CS score reduction of 1.36 points compared to a concurrent control group. Taking the 1.36 points x $1,488 = $2,024, then multiplied by 20 members = $40,480, and dividing by (10,000 x 12 [1 year]) = $0.34 per member per month potential cost avoidance.

Conclusions

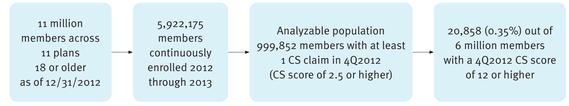
- In 4Q2012, at least one CS claim was found for 17 of 100 commercially insured members 18 and older and continuously enrolled for 2 years. For 99.7% of these members, their CS score ranged from 2.5 to less than 21.
- The results of this analysis validate a linear association between increasing CS score and increasing healthcare utilization, defined as hospitalizations and ER visits, as well as CS drug costs and total health care costs. No specific CS score break point was found to be associated with substantially higher healthcare utilization or costs.
- The linear relationship between CS score, healthcare utilization, and total cost of care, allowed for the conclusion that for every one point increase in CS there was an associated annual $1,488 increase in total cost of care, $235 increase in CS costs, 0.9% increase in hospitalizations, and 1.5% increase in ER visits.
- Previous research demonstrated a prescriber letter intervention, using the CS score 12 or higher and 12 or more CS claims over 90 days as the intervention threshold, was able to reduce the CS score an additional 1.36 points compared to a control group.[4,5] Findings from this study allow for the translation of the 1.36 point reduction in CS score for a 10,000 life group to potential cost avoidance of $40,480 annually or $0.34 per member per month.
- Health insurers should be actively identifying members who either are at risk for CS misuse/abuse or who appear to be over utilizing CS drugs and engage prescribers.
- Future research will examine the drug related outcomes of hospitalization and ER visits for a subset of members using opioids.

Table 1. Controlled Substance Score Components[4]

Source of information	Weight
Volume of controlled substance claims	Assign half a point to the individual for each of their first 8 claims for a controlled substance; assign 1 point for each additional controlled substance claim thereafter.
Number of unique pharmacies and prescribers	Based on the combined total of unique pharmacies and prescribers, assign 1 point for the first two unique entities; assign 1.5 points for each unique entity thereafter.
Rate of utilization of controlled substances	Assign 1 point if the number of claims for controlled substances in the 3rd month of the 90-day pre-intervention is two or more than the number of claims in the 2nd month of the pre-intervention period.

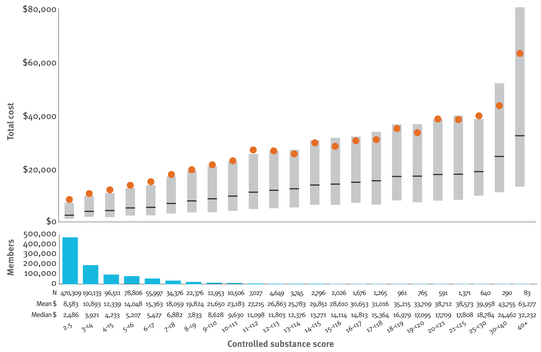
NOTE: minimum score = 2.5 (1 CS claim = 0.5 + 1 unique pharmacy +1 unique prescriber + 0 for no increased utilization)

Figure 1. Flow of members in the analysis



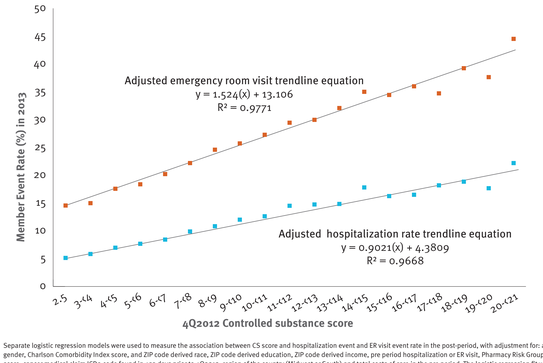
CS = controlled substance

Figure 2. Distribution of Member Total Cost of Care in 2013 by Controlled Substance Score



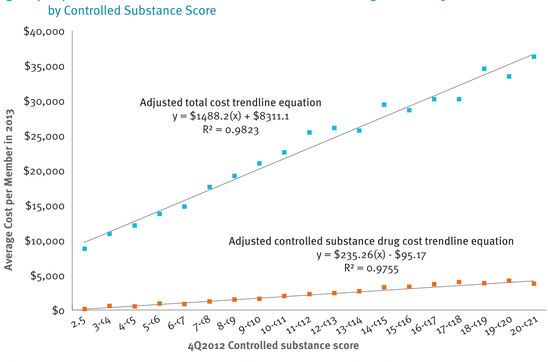
Authors' analysis of medical and pharmacy administrative claims data for eleven million commercially insured members in eleven health plans around the United States in the period 2012–2013. Members were placed into one of twenty three controlled substance score ranges according to their 4Q2012 CS score. Orange dots represent the mean 2013 total costs of care for members within that CS score range, bars represent the interquartile ranges and the line within the bars represents the median 2013 total costs of care for members within that CS score range. A member's 2013 total cost of care was determined by summing all medical and pharmacy claims allowable amounts during 2013. The lower bar graph represents the number of members in each CS score range.

Figure 3. Adjusted Hospitalization and Emergency Room Visit Rate in 2013 by Controlled Substance Score



Separate logistic regression models were used to measure the association between CS score and hospitalization event and ER visit event rate in the post-period, with adjustment for: age, gender, Charlson Comorbidity Index score, and ZIP code derived race, ZIP code derived education, ZIP code derived income, pre period hospitalization or ER visit, Pharmacy Risk Group score, cancer medical claim ICD9 code found in 455 days prior to 4Q2012, region of the country (Midwest or South) and total costs of care in the pre period. The logistic regression fit was assessed using the C-statistic. C-statistic for hospitalizations was 0.727 and 0.694 for ER visits. The adjusted costs from the logistic regression model were used to fit a trend line to and generate a linear regression equation (e.g., y = mx + b) where coefficient m indicates that for every additional CS score one point change you can expect costs to increase by an average of $m. Members with a CS score of 21 or higher were excluded because they were cost outliers and represented only 2,384 (0.24%) of 999,852 members.

Figure 4. Adjusted Total Cost of Care and Controlled Substances Drug Cost in 2013 by Controlled Substance Score



Cost analyses were performed using the generalized linear model with Gamma distribution and adjusted for age, gender, Charlson Comorbidity Index score, and ZIP code derived race, ZIP code derived education, ZIP code derived income, pre period hospitalization or ER, Pharmacy Risk Group score, cancer medical claim ICD9 code found in 455 days prior to 4Q2012, region of the country (midwest or south) and total costs of care in the pre period. A member's 2013 total cost of care was determined by summing all medical and pharmacy claims allowable amounts during 2013. A member's 2013 CS drug cost was determined by summing all CS drug claims allowable amounts during 2013. A park test was run to ensure the CS drug cost data and total cost of care data met the assumptions of the Gamma model. The adjusted costs from the Gamma model were used to fit a trend line to and generate a linear regression equation (e.g., y = mx + b) where coefficient m indicates that for every additional one-point change in CS score you can expect costs to increase by an average of $m. Members with a CS score of 21 or higher were excluded because they were cost outliers and represented only 2,384 (0.24%) of 999,852 members.

Limitations

- Members with high risk CS use patterns may be missed when using the CS score as the only method to identify members for intervention.
- Pharmacy claims data include assumptions of members' drug utilization and medication taking behaviors.
- Cash paid CS prescriptions will generally not have been submitted to the PBM and would not be included in the member's CS score.
- The data used in this study is limited to commercial populations, primarily in the central and southern regions of the United States, and therefore may not be generalizable to Medicare and Medicaid or to commercially insured individuals residing in other regions of the US.
- The CS score has not been correlated to hospitalizations or emergency department visits associated with CS abuse or misuse such as opioid overdose.
- Although this analysis adjusted for the 10 year risk of mortality using the Charlson Comorbidity index and the Pharmacy Risk Score as a proxy for severity of illness, the study is subject to unmeasured confounding potentially influencing the results.

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