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Estimating a Rural-Urban PCP Workload Disparity: Caring for Smokers

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Background

Smokers are concentrated in rural America. CDC reports 28.5% of rural Americans smoke versus 25.1% of urban Americans[1]. The workload impact of those additional smokers in a rural primary care practice has not been investigated. We hypothesize that workload difference associated with caring for rural smokers will be greater than the 3.4% suggested by the smoking rate difference. We will calculate primary care physician workload differences based on estimated number of rural versus urban smokers in a practice and their estimated comorbidity rates derived from Cerner Health Facts ® EHR data. Defining physician workload by number of comorbidities being managed is novel. Given that payers are associating chronic disease management metrics to payment[2], calculating primary care workload by comorbidities managed is salient[3] and illuminates real-world primary care workload differences[4].

Methods

Cerner Data Description: We used Cerner Health Facts® EHR data warehouse (Cerner Corporation, Kansas City, MO, USA) as our data source. Health Facts® contains clinical data contributed voluntarily from over 200 hospital systems (accounting for over 800 hospitals) using Cerner EHR systems across the U.S. spanning the past two decades. Cerner Corporation collects and integrates the data with its internally established procedures in compliance with Health Insurance Portability and Accountability Act (HIPAA) laws, thus all data are de-identified. The data in Health Facts® are mostly time-stamped and cover a variety of aspects of patients' hospital records including encounters, diagnoses, procedures, medications, vital signs, laboratory results, etc. Since Health Facts® has been completely de-identified according to HIPAA regulations, the Institutional Review Boards (IRB) at Oklahoma State University (OSU) exempted the study from review.

Patient Extraction: The smoking patients were identified and extracted from Health Facts® using the following ICD-9/10 diagnosis codes.

- ICD-10 Codes:
  - F17.200: Nicotine dependence, unspecified, uncomplicated
  - F17.201: Nicotine dependence, unspecified, in remission
  - F17.203: Nicotine dependence, unspecified, with withdrawal
  - F17.208: Nicotine dependence, unspecified, with other nicotine-induced disorders
  - F17.209: Nicotine dependence, unspecified, with unspecified nicotine-induced disorders
  - F17.210: Nicotine dependence, cigarettes, uncomplicated
  - F17.211: Nicotine dependence, cigarettes, in remission
  - F17.213: Nicotine dependence, cigarettes, with withdrawal
  - F17.218: Nicotine dependence, cigarettes, with other nicotine-induced disorders
  - F17.219: Nicotine dependence, cigarettes, with unspecified nicotine-induced disorders
  - Z87.891: Personal history of nicotine dependence
  - Z72.0: Tobacco Use – Each code is often used with modifier(s) to specifically define the type of tobacco use
- ICD-9 Codes:
  - 305.1: Tobacco use disorder

Methods Continued

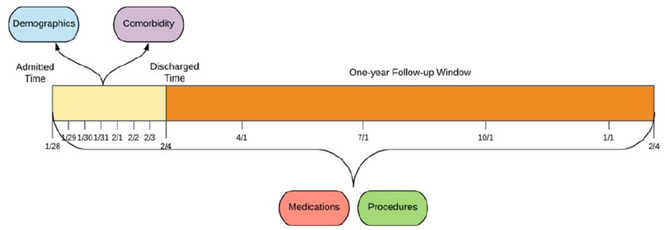
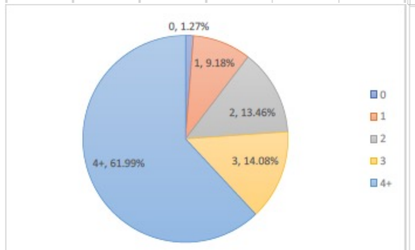


Figure 1. Index, follow-up encounters and data associated for Smoking.

Comorbidity Counting: Because the ICD-9/10 codes used in Health Facts® can be overly specific to express comorbid disease states in the usual sense. We used the Clinical Classifications Software (CCS)[5] to aggregate ICD-9/10 codes into relatively high-level disease states. For example, CCS combines malignant neoplasms at different locations of esophagus together as the "cancer of esophagus". These disease states were then used to identify and count comorbidities of patients.

Urban		
comorb_dis	N	P
0	81,826	1.27%
1	589,622	9.18%
2	864,493	13.46%
3	904,330	14.08%
4+	3,980,255	61.99%
mean	5.90	NA
sd	4.72	NA

Rural		
comorb_dis	N	P
0	5,776	0.45%
1	102,067	7.93%
2	176,800	13.73%
3	189,646	14.73%
4+	813,134	63.16%
mean	5.93	NA
sd	4.82	NA



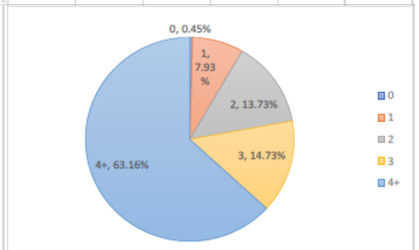


Figure 2. Rural and Urban comorbidity distribution.*

*Patients with more than 4 comorbidities were aggregated to the 4 condition. Even if they had more comorbidities, only 4 were calculated per patient. Therefore, comorbidity rate differences may be somewhat greater or less than reported.

Estimation: We hold constant the number of patients in a typical primary care panel (2500)[6] then apply the CDC published rural/urban smoking rates[1] to estimate the volume of smokers in a rural practice (28.5% of 2500 = 712.5) and in an urban practice (25.1% of 2500 = 627.5). We use the Cerner Health Facts Data Base to determine rates of comorbidities among patients designated as smokers from 1/1/2010 to 9/18/2017 (total n = 7,757,949; rural = 1,337,423, urban = 6,420,526). We estimate smoker-related comorbidities in rural and urban panels using the rates of rural and urban patients with 1, 2, 3 or 4+* comorbidities and multipling the rate by rural/urban smoker volume. For example, of the 712.5 patients in a rural practice 14.73% of them have 3 comorbidities, resulting in 314.85 comorbidities (712.5 * 0.1473 * 3 = 314.85). We total all estimated number of comorbidities for rural and urban and compare them.

Results

Using 2500 patients in a patient panel, we estimate that rural primary care physicians care for 85 more smokers than urban counterparts. Due to higher comorbidity rates of those smokers, it is estimated that rural primary care physicians manage 319.54 more comorbidities (2,367.07 rural smoker comorbidities, 2,047.53 urban smoker comorbidities), constituting a 15.6% (319.54/2047.53) comorbidity management workload increase associated with caring for smokers.

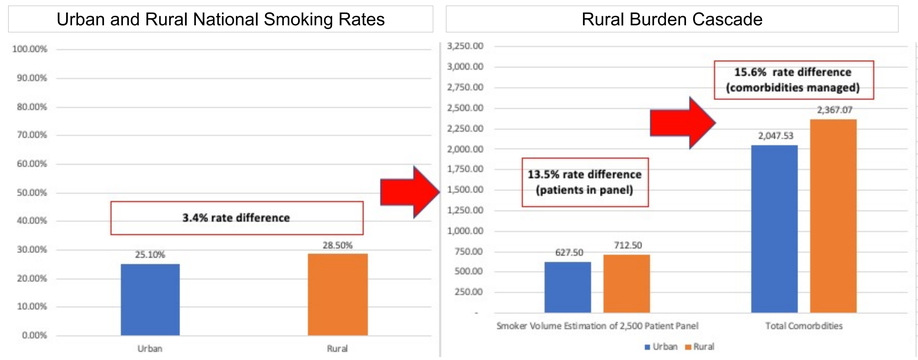


Figure 3. Rural Burden Cascade. In an estimation of a 2500 patient panel, rural smoker care burden grows by the compounding factors of more smokers in a panel who have higher rates of comorbidities.

Conclusion

The 3.5% rural-urban smoking rate difference falls short of telling the story of how smokers likely impact physician workload differently in rural and urban practices. We estimate that the smoker-associated physician workload (comorbidity management) in a rural primary care practice is ~16% greater than urban practice. This demonstrates a sizeable workload disparity between rural and urban primary care physicians. We encourage the review of other patient populations to better understand rural primary care workload inflation.

A limitation of the study is that the patients themselves are not designated as rural or urban in the data, but rather the health care setting is designated rural or urban. However, given that the physicians are rural or urban located, we found the use of the setting designation in the data to be valid in its application to rural/urban primary care physician workload comparison.

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