

Structured Smoking Exposure Variability in the Electronic Health Record Hurts Lung Cancer Screening Practices

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Introduction

Annual low dose computed tomography (LDCT) screening has been shown to reduce lung cancer deaths in high-risk patients¹. Electronic health records (EHRs) can help facilitate the screening process by identifying eligible patients. However, data in EHRs can be missing, incomplete, and less reliable than data directly extracted from free-text notes²⁻⁴.

In our EHR, smoking exposure is contained in the patient's "Social History", which includes the EHR-calculated pack-year derived from manually entered amount and duration of tobacco use. Only the most recent value is displayed in this area. When entered, the data are not subject to validation and can be updated by anyone with access to the EHR, facilitating inaccuracies in the smoking history. As a result, providers are not able to accurately and reliably determine patients' eligibilities for LDCT screening. Previously, we have shown that a patient's documented smoking exposure at time of presentation is correlated with the likelihood of having an LDCT screen ordered at that visit⁵.

We aimed to explore the specific causes of the inaccuracies of EHR-documented smoking exposure, especially with regard to improperly decreasing pack-year values.

Methods

Study Design and Setting

This was a retrospective cohort study performed in an urban, safety-net medical system (including over a dozen ambulatory centers) in Cuyahoga county of northeast Ohio.

Data Collection

We reviewed records of all outpatient encounters between August 1, 2013 and June 21, 2017. Encounters were included if the patients met the criteria for the United States Preventative Services Task Force (USPSTF) lung cancer screening guidelines: age 55-80 years old (at time of encounter) and smoking exposure documentation of at least 30 pack-years within 15 years prior to the encounter⁶. Encounters were not included after an LDCT was ordered for the patient or if the provider had not ordered any LDCTs during the study period.

Statistical Analysis

Analysis was performed using the RStudio software package version 1.0.143 (RStudio Team, Boston, MA) and R version 3.4.0 (R Foundation for Statistical Computing, Vienna, Austria).

Population

The data set included 53,407 encounters for 8,185 patients (Table 1).

Characteristics	All Patients No.	%
Sex		
Female	4125	50
Male	4060	50
Race/ethnicity of patient		
White	5002	61
Black	2566	31
Hispanic	369	5
Other	228	3
Preferred language of patient		
English	7824	96
Spanish	195	2
Other	166	2

Table 1 – Demographics of study patients. Other demographics (e.g. insurance, age, etc.) were not included in this table because they can fluctuate over different encounters for the same patient.

Results

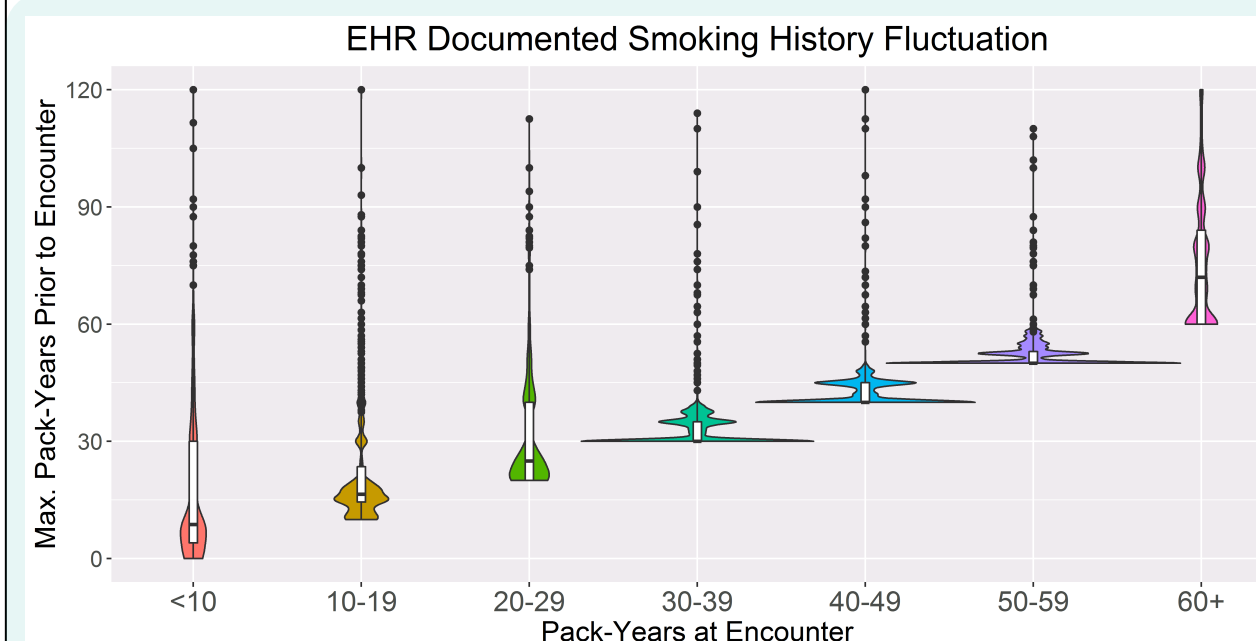


Figure 1 – This violin plot shows the wide variation in pack-year documentation. Contrary to what is expected, patients' "current" smoking exposures are not their lifetime maximums. The variation is actually more extreme than depicted, because the y-axis was limited at a maximum of 120 for display purposes; however, there were many points above this limit. The largest documented pack-year value in our system is over 1000.

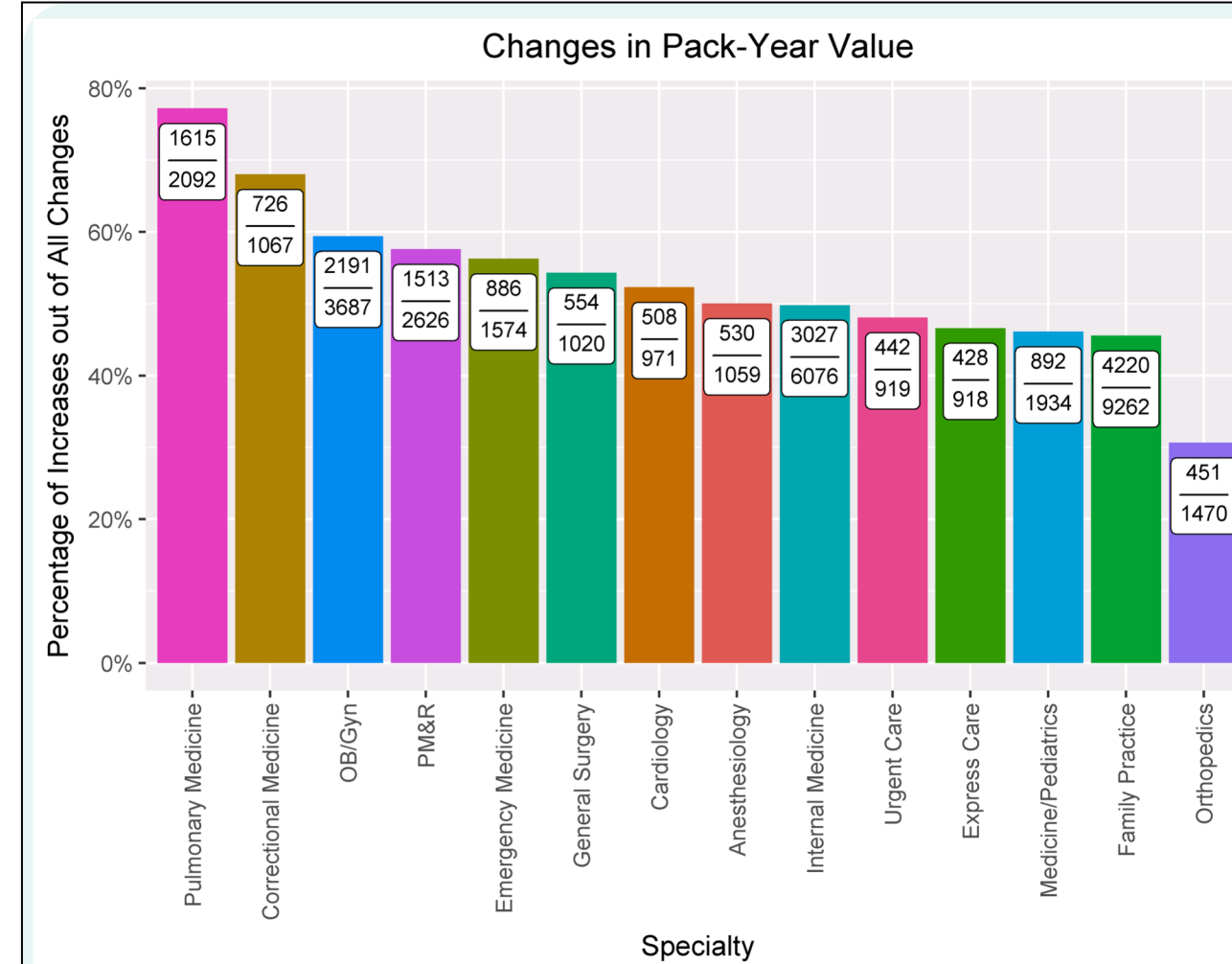


Figure 2 – While smoking exposure should never decrease, there was a wide variety in how well different specialties followed this principle in practice.

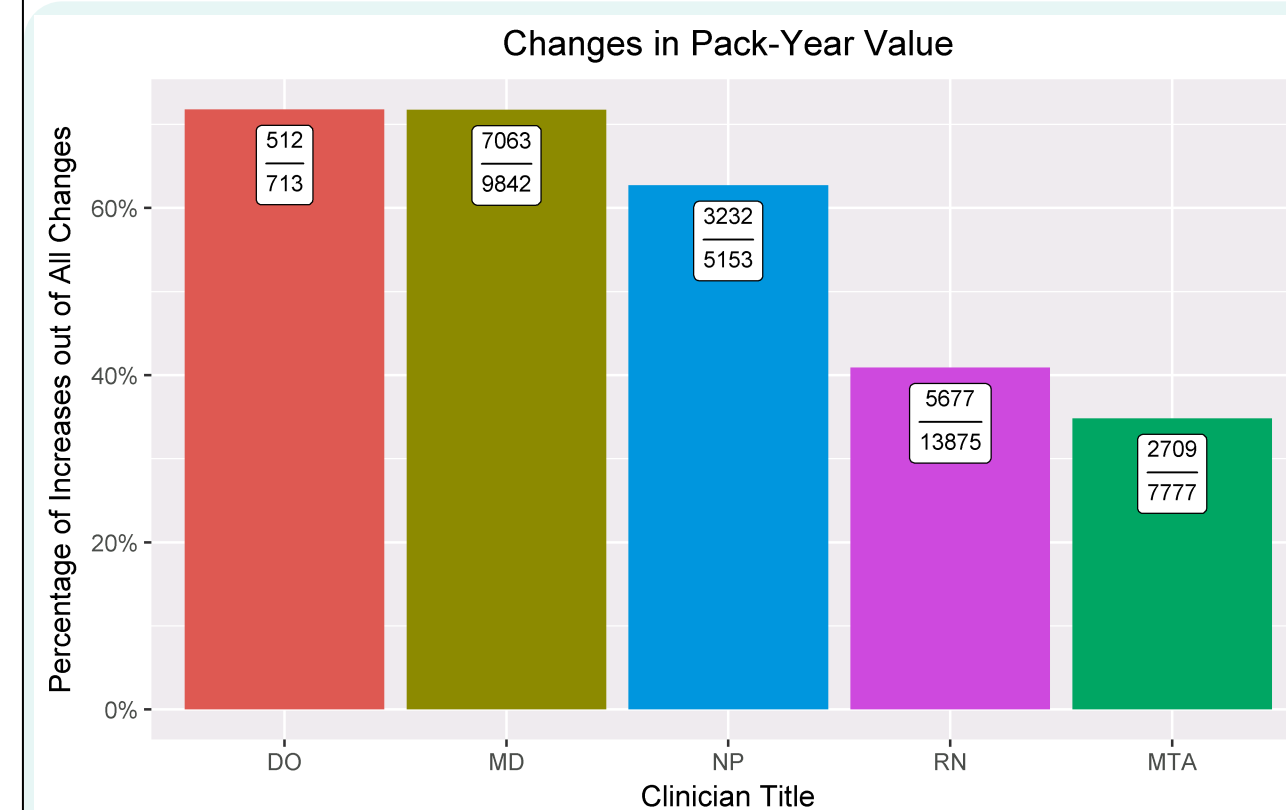


Figure 3 – Similar to Figure 2, there was wide variation in the success of different types of clinicians with respect to increasing, rather than decreasing, smoking exposure.

Discussion

Ideally, patients' documented smoking exposures should never decrease (the USPSTF guidelines allow exposure to be discounted after 15 years of abstinence, but our EHR is younger than 15 years old, so this does not apply to our data). Unfortunately, as Figure 1 shows, this was not the case in our population. Patients frequently

present with a documented smoking exposure lower than their lifetime maximum.

Not surprisingly, pulmonary healthcare workers had the best proportion of increasing changes to total changes of smoking exposure (Figure 2). Interestingly, DOs and MDs seemed to show better data stewardship than RNs and MTAs (Figure 3).

The reasons behind these trends are not clear, but it is obvious that safeguards must be put in place to prevent improper decreases in smoking history documentation. As we have previously shown, documented smoking history at presentation is a strong determinant of whether a patient is ordered an LDCT by their PCP⁵.

EHR can be used as a tool to facilitate better data stewardship, either displaying a patient's maximum recorded smoking exposure beside their current one or by discouraging the inappropriate lowering of smoking exposure.

Future Directions

- Would targeted education improve data stewardship?
- Would better data stewardship increase LDCT ordering?
 - If so, would the number of positive screens increase?
- Would alternative metrics (e.g. lifetime maximum pack-year) increase LDCT ordering in a meaningful way?

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