1 EXECUTIVE SUMMARY

1.1 Background

Tobacco use is the number-one cause of preventable mortality and morbidity in Oregon. This burden is not distributed equally, with the tobacco industry targeting populations facing systemic racism and other discrimination as well as lower-income populations. Many of these populations have not received adequate access to treatment or protection through public health policy interventions. Oregon Tobacco Prevention and Education Program (TPEP) has relied on the state-level CDC's Smoking-Attributable Morbidity and Mortality Economic Costs (SAMMEC, Warren et al., 2014) to communicate the burden of tobacco use in Oregon communities and advocate for prevention policies and cessation support. However, the SAMMEC does not provide county-scale estimates reflecting disparities in smoking rates and health baseline conditions among vulnerable populations and SAMMEC is no longer updated.

The objective of this project is to develop and implement a framework for generating Oregon tobacco burden estimates that:

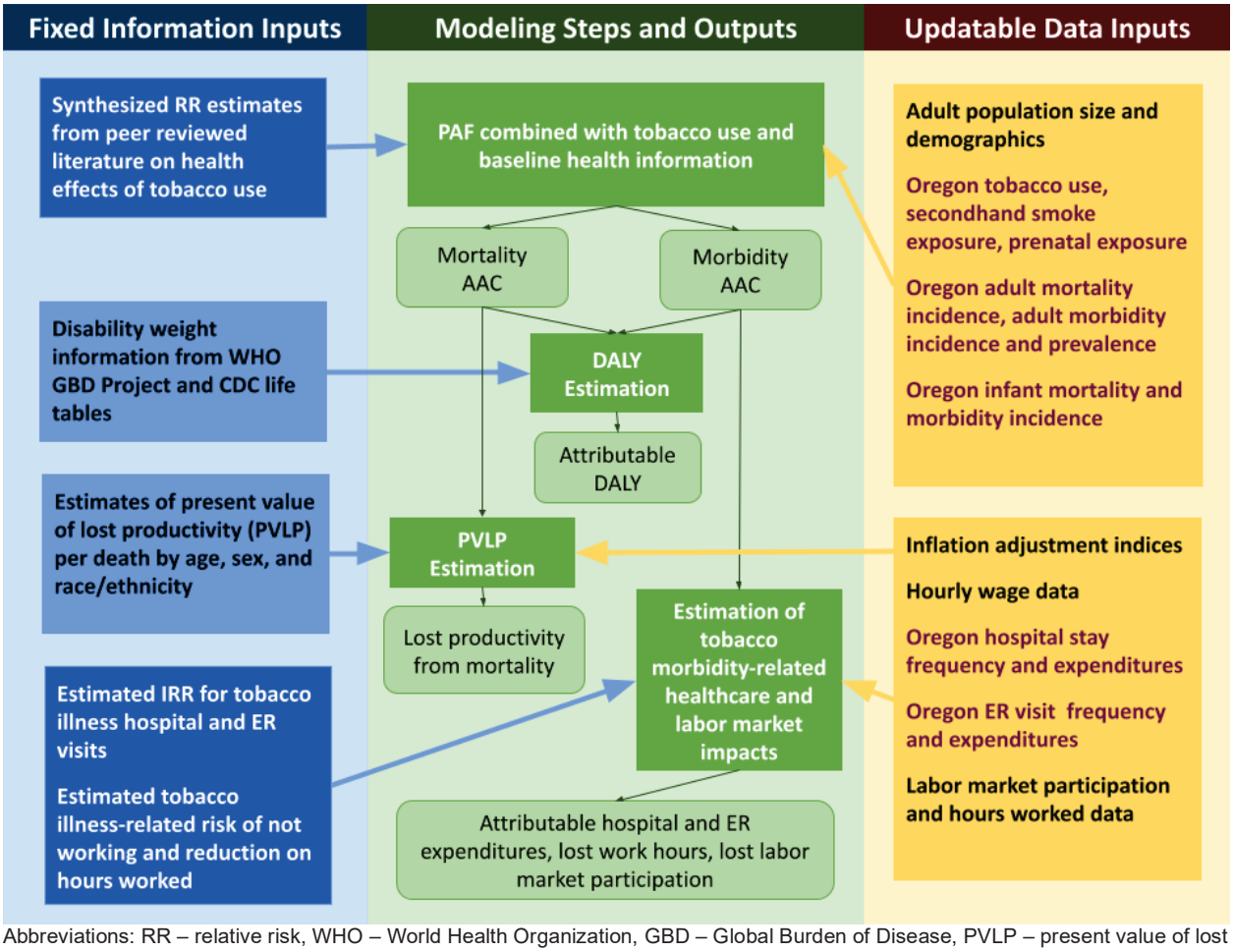
- Are comprehensive with respect to health effects, tobacco products, and economic impacts;
- Reflect population variability in smoking rates and health baseline conditions;
- Are available at county-scale;
- Can be routinely updated by Oregon TPEP using available data sources.

1.2 Methods

Figure 1 provides and overview of the framework and data underlying our estimates of Oregon public health and economic burden of tobacco use. We developed county-scale, age-, sex-, and race/ethnicity-specific population-attributable fractions using the most recent tobacco epidemiology studies for adult mortality and morbidity endpoints (including cancer, diabetes, respiratory, and cardiovascular disease) and maternal smoking-related infant mortality and morbidity. We characterized impacts for several products (cigarette, cigar, non-combustible tobacco), current/former smokers, secondhand smoke. We used Oregon Behavioral Risk Factor Surveillance System 2014-2019 data, 2016-2019 vital statistics for adult mortality data, 2013-2018 vital statistics for live births-infant mortality data, 2015-2019 vital statistics for infant mortality data, and American Community Survey 2019 5-year population data. In addition to the annual attributable cases on premature death or disease, we have characterized the public health burden in terms of Disability-Adjusted Life Years (DALY) lost using disability weights from the World Health Organization Global Burden of Disease Project and US 2017 life tables published by the Centers for Disease Control and Prevention.

Economic burden of smoking-related mortality was represented by the present value of lost productivity, where per case age-, sex-, and race/ethnicity-specific values were estimated using American Time Use Survey 2019, CDC 2017 life tables, and 2020 Oregon wage data and assuming 3% discount rate. To assess economic burden of morbidity attributable to tobacco use, we implemented a new analysis of the Medical Expenditure Panel Survey 2010-2018 data to estimate the smoking-attributable incremental rate ratios for hospital visits and emergency room visits, along with the relative risk of exiting the labor market and a percent reduction in hours worked due to smoking-related illness. Economic burden of morbidity was assessed by combining these estimates with Oregon 2016-2020 hospital discharge data, Oregon 2018-2019 emergency room data, and American Community Survey 2018 5-year labor market data.

Figure 1 Overview of Framework and Data Underlying Oregon Public Health and Economic Tobacco Use Burden Estimates



Abbreviations: RR – relative risk, WHO – World Health Organization, GBD – Global Burden of Disease, PVLP – present value of lost productivity, ER – emergency room, AAC – annual attributable cases, PAF – population-attributable fraction, DALY – disability-adjusted life years lost, CDC Centers for Disease Control and Prevention

Notes:

- **Fixed information inputs** region (blue) shows inputs that were developed to support the framework calculations; they are not expected to be frequently updated. *Rectangles in dark blue indicate de novo estimates developed for this framework*.
- **Modeling steps and outputs** region (green) shows implemented computational steps (rectangles in dark green) and types of estimates generated (rectangles in light green). *Arrows indicate data flows*.
- **Updatable data inputs** region (yellow) shows the input data types that are expected to have routine new releases and can be used to generate annual tobacco burden estimates in future years. *Text in red should Oregon-specific data sources*.

1.3 Results

Table 1 shows a summary of the key results from this analysis, including our core estimates of nearly 8,000 premature deaths, 162,000 disability-adjusted life years (DALY) lost, 4,800 hospital stays, 7,300 emergency room visits, and $5.7 billion (2020 USD) in medical costs and lost productivity annually in Oregon. We note that the estimated 8,000 tobacco deaths align with 7,500 tobacco deaths estimated from direct Oregon reporting. Other notable patterns discussed on the report are as follows: (1) largest per capita tobacco burden is observed among Native Americans, followed by non-Hispanic Blacks and non-Hispanic Whites; (2) tobacco death count per capita is two times higher in rural counties compared to urban counties; (3) the largest population-attributable fractions are observed for respiratory disease and cancers.

Table 1. Summary of Annual Oregon Public Health and Economic Tobacco Use Burden in Modeled Year 2020

Burden Type	Annual Tobacco Use-Attributable Effects	Annual DALY Lost	Percent of Annual Baseline	Economic Burden (millions 2020 USD, 3% discount rate)
Adult mortality	8,294.41	100,147.80	23	$3,405.62
Adult morbidity	NAp	62,012.95	NAp	NA
Infant mortality - SIDS	4.71	520.09	13	$12.49
Infant mortality - preterm	1.94		4	
Infant morbidity - LBW	296.01	NA	10	NA
Hospital visits	4,775.05	NAp	7	$181.86
ER visits	7,364.24	NAp	11	$56.61
Reduction in hours worked by labor market participants	32,748.59	NAp	2	$1,159.47
Persons not in labor market for health reasons	15,583.15	NAp	1	$875.65

Abbreviations: NA – not available, NAp – not applicable, DALY – disability-adjusted life years, USD – United States dollars, SIDS – sudden infant death syndrome, LBW – low birth weight, ER – emergency room.

1.4 Conclusions

Development and implementation of the Oregon-focused tobacco burden framework has produced the following insights:

- It is feasible to comprehensive community-scale annual tobacco burden estimates that rely on data readily accessible by Oregon Health Authority. Because all key data sources receive periodic updates, routine updates to tobacco burden estimates are also possible. This framework can be implemented by other states if they have access to information similar to that provided by Oregon for this effort.
- Implementation of this framework required a considerable initial resource commitment to analyze the extensive tobacco impacts literature in epidemiology, health and labor economics domains. Therefore, major updates to the framework (e.g., adding new endpoints or new types of economic impact) is expected to be infrequent. We recommend periodic literature analysis to determine whether the framework reflects the most recent state of science.
- It was not possible to quantify several types of impacts identified in the literature (e.g., effects of particular tobacco products, other healthcare utilization) because suitable Oregon input data were not available, implying that our overall estimate of tobacco burden is underestimated. Further, sparsity of available data has prevented exploration of the tobacco burden by race and ethnicity at the county scale.

The results of this work will help target Oregon Tobacco Prevention and Education Program's outreach and planning efforts via identification of Oregon communities that bear the largest burden of tobacco use will help direct communication, prevention and cessation support policies thereby promoting healthier environments in communities that need these interventions the most.