Tobacco use and comorbid mental health conditions: a modeling challenge

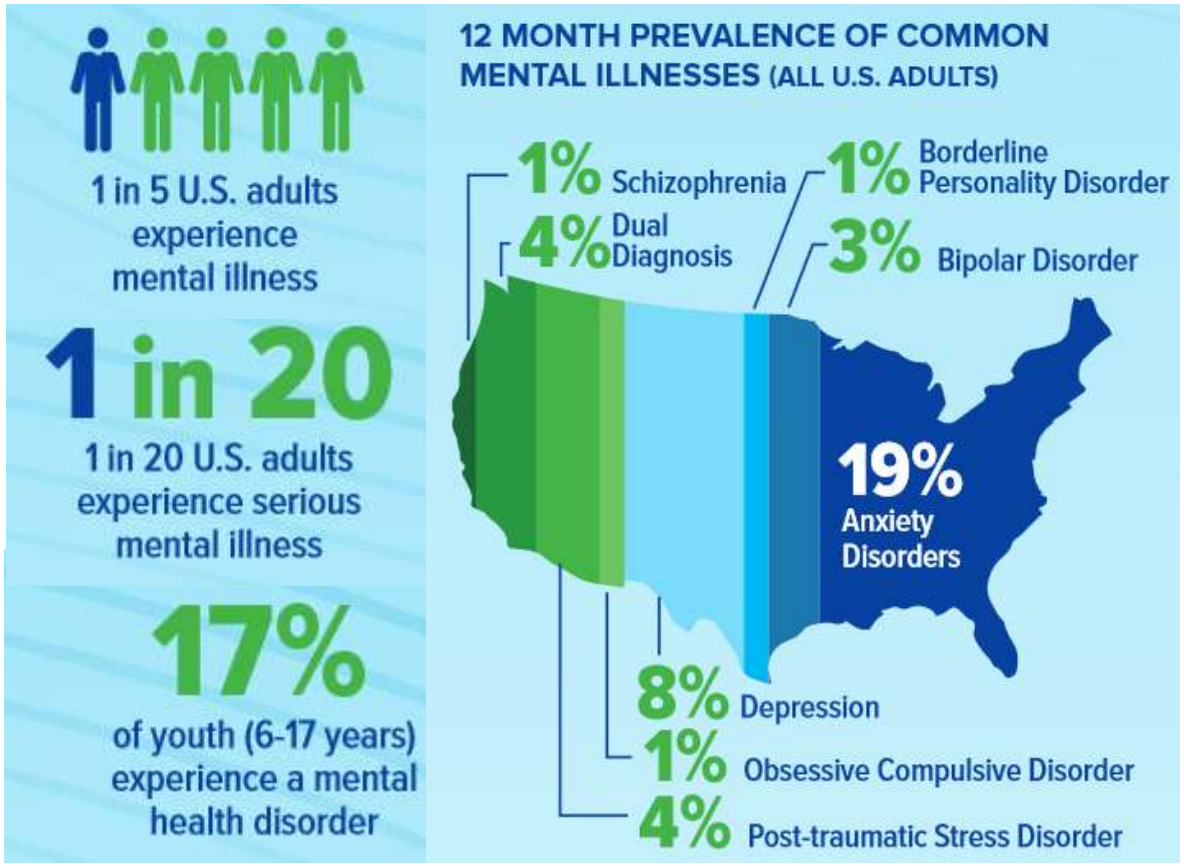
CAsToR Symposium
June 7th, 2021

Jamie Tam, MPH, PhD
Assistant Professor
Department of Health Policy and Management
jamie.tam@yale.edu

(ACS, 2018)

Yale SCHOOL OF PUBLIC HEALTH

Mental health conditions in the US



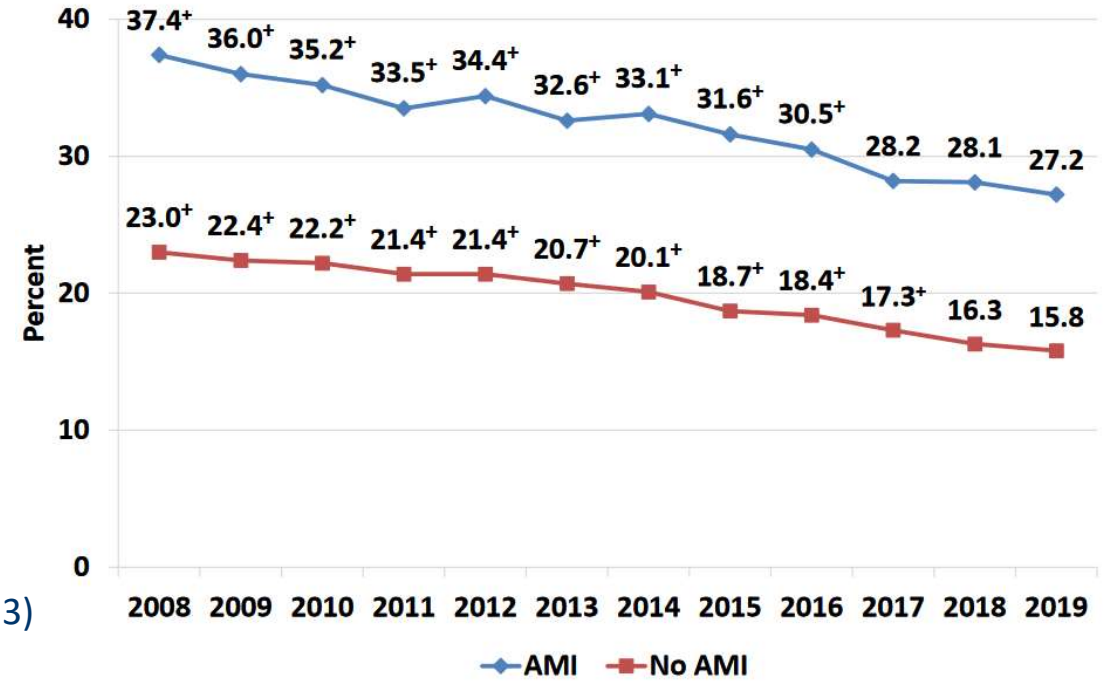
(NAMI, 2020; NSDUH 2019)

Persistent tobacco use disparity by mental health status

- Higher mortality risk; differences in life expectancy primarily due to smoking.
- Higher likelihood of smoking initiation, increased smoking intensity, lower likelihood of quitting
- Priority population identified as tobacco disparity group

(Tam, 2016; Williams, 2013)

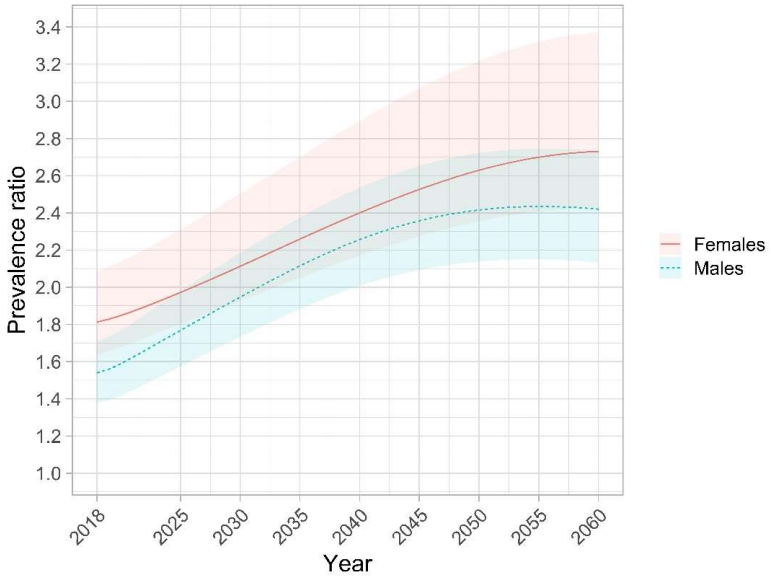
Current Smoking among Adults with AMI, NSDUH 2008-2019



Why model tobacco use and mental health?

- Complexity and population heterogeneity are realities
- More recent cohorts of smokers have disproportionately high psychiatric vulnerability
- Priority population that has not experienced comparable declines in smoking
- Disparities may be widening
- Knowing underlying dynamics can identify opportunities for optimal intervention

Smoking prevalence ratio between adults with current and never major depression, 2018-2060



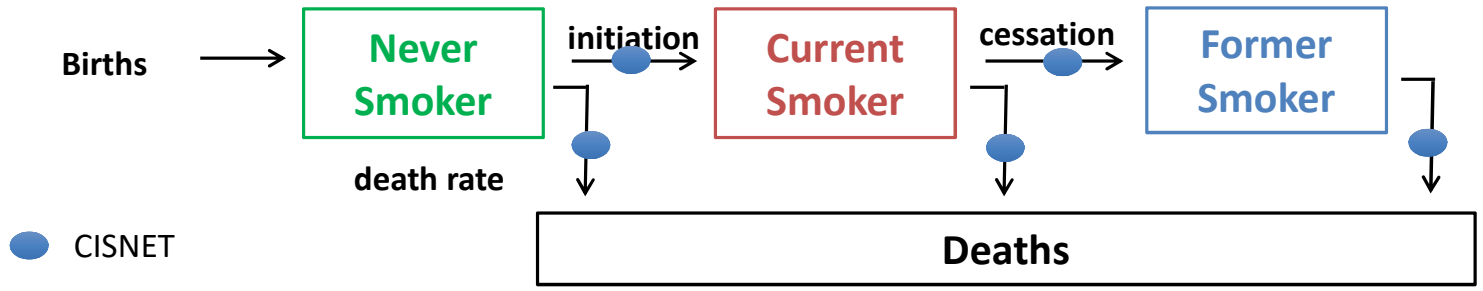
(Talati, 2016; Cook, 2014; Tam, 2020)

Challenge #1: Data and definitions

National surveys that include smoking AND mental health

Survey	Mental health measures	Assessments
NSDUH	Major Depressive Episodes (MDE), SPD, SMI, AMI, depression/anxiety diagnosis, suicidality	Annual cross-sectional
NHIS	SPD, depression/anxiety rotating core 2019-forward	Annual cross-sectional
BRFSS	SPD, MDE, Anxiety/depression for some states	Annual cross-sectional, state-based
PATH	Self-perceived mental health, schizophrenia/psychosis diagnosis	Wave 1 (2013-14), Wave 2 (2014-15), Wave 3 (201516), Wave 4 (2016-18)
NESARC	DSM diagnostic criteria for mental disorders	Wave 1 (2001-2002), Wave 2 (2004-2005), NESARC-III (2012-2013)
NCS	DSM mental disorders, MDE, suicidality, SMI, AMI	NCS-I (1990-1992), NCS-2/Replication (2001-2003), NCS-Adolescent (2001-2004)

Smoking data and definitions



- Calibrate a smoking-only model to NSDUH data on smoking
- Model inputs for smoking initiation and cessation are from the Cancer Intervention and Surveillance Modeling Network, which relies on NHIS data

Aligning across data sources

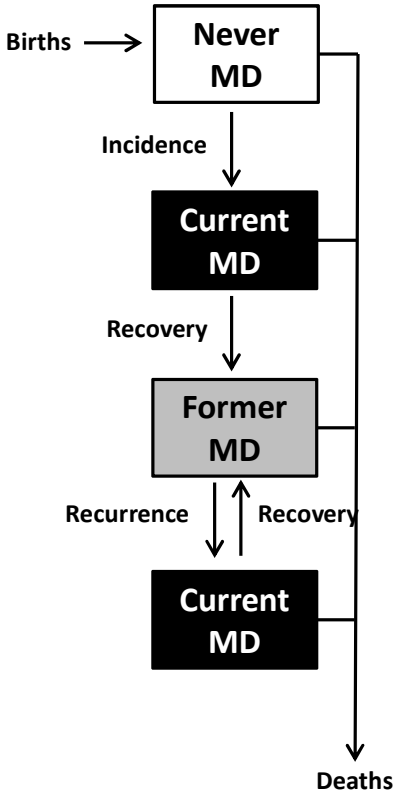
	Current smoker	Former smoker	Never smoker
NHIS	Currently smokes every or some days & smoked ≥100 cigarettes in lifetime	Smoked ≥100 cigarettes in lifetime & does not currently smoke	Smoked <100 cigarettes in lifetime
NSDUH	Smoked in past 30 days	Ever smoked but not in past 30 days	Has never smoked a cigarette
Cancer Intervention and Surveillance Modeling Network (CISNET) lung consortium	Smoked ≥100 cigarettes in lifetime & smoked within the past 2 years	Smoked ≥100 cigarettes in lifetime & last smoked ≥2 years ago	Smoked <100 cigarettes in lifetime
Modified definition used by model	**Smoked ≥100 cigarettes in their lifetime & smoked in past year**	**Smoked ≥100 cigarettes in lifetime but not in past year**	**Smoked <100 cigarettes in lifetime**

Screening for Major Depression

- Major Depressive Episode:
- 2 week+ period during which the respondent reports experiencing at least 5 of the following 9 symptoms (DSM-IV/5):
  1. depressed mood most of the day,
  2. markedly diminished interest or pleasure in activities most of the day,
  3. significant changes in weight or appetite,
  4. insomnia or hypersomnia,
  5. psychomotor agitation or retardation,
  6. fatigue,
  7. feelings of worthlessness,
  8. diminished ability to think or concentrate, and
  9. recurrent thoughts of death or suicide ideation.
- No exclusions due to illness, mourning, and substance use disorders, or other psychiatric disorder

Challenge #2: Model structure

Version 1.0



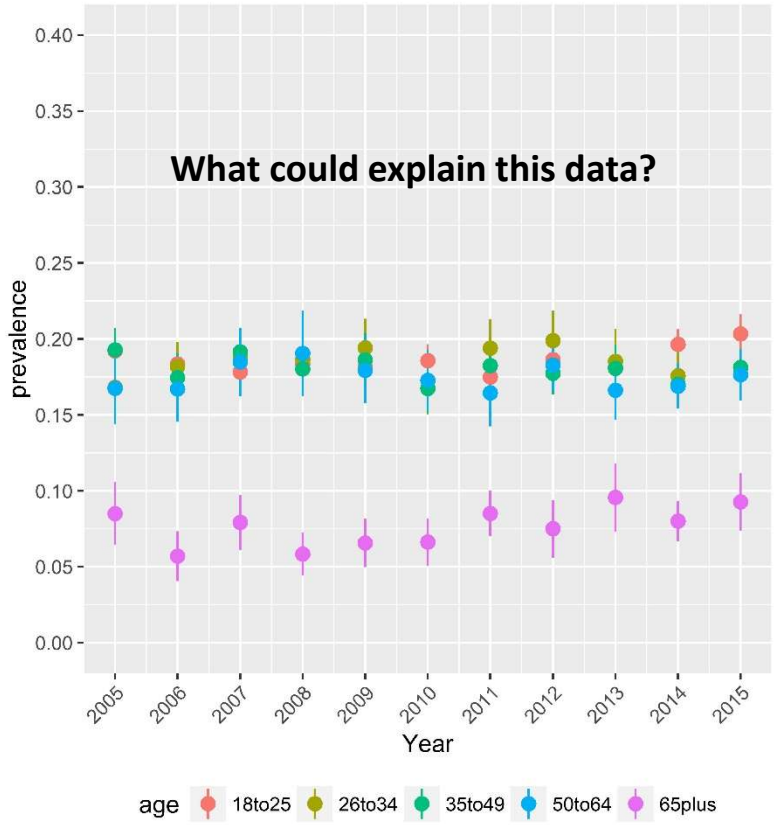
- Never MD
  - No lifetime history of MD episode
- Current MD
  - Past year Major Depressive Episode
  - Includes 1st MD episodes and subsequent recurring episodes
- Former MD
  - No MD episode in the past year, but lifetime history of at least one episode

What is the appropriate model structure?

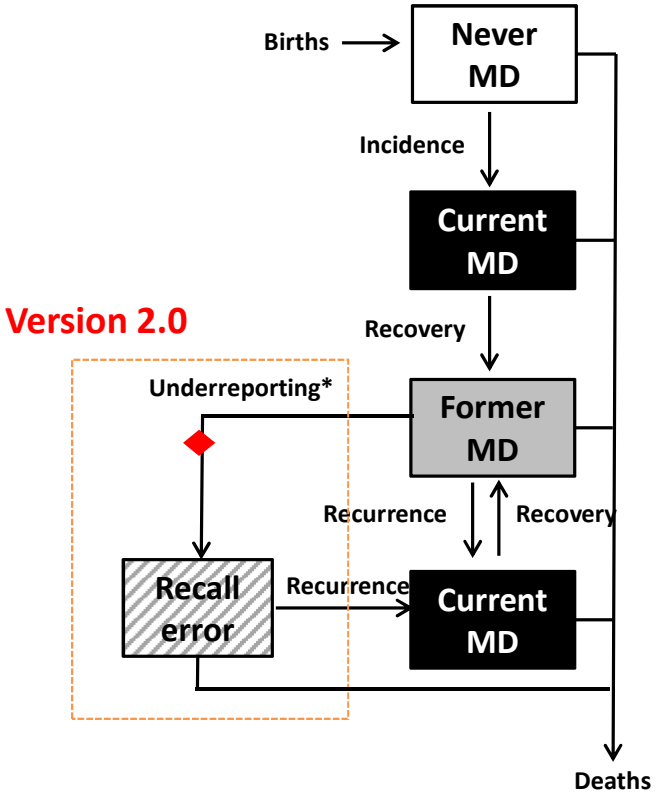
Implausible survey data

- Lifetime MD prevalence, NSDUH 2005-2015
  - Lifetime prevalence of depression drops dramatically for ages 65+
  - No change from ages 18-64
- Surveys that screen for depression symptoms are subject to high levels of recall error
  - Lifetime depression is much higher in cumulative vs. retrospective survey evaluations
  - 13.1% vs. 4.5% (Takayanagi, 2014)

Women with Lifetime MD, NSDUH



Building recall error into the model structure

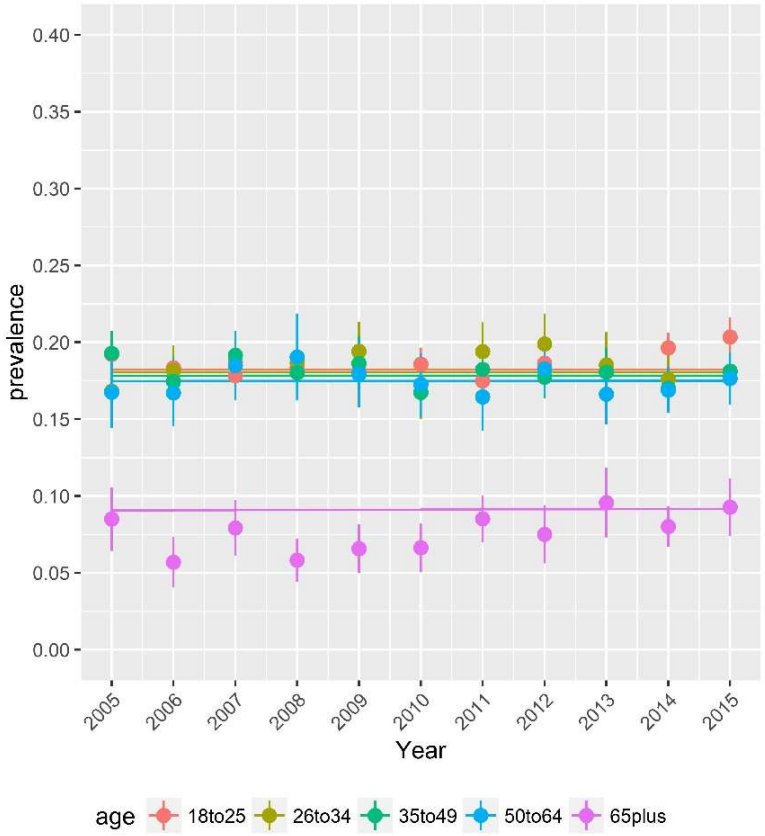


- Never MD
  - No lifetime history of MD episode
- Current MD
  - Past year Major Depressive Episode
  - Includes 1st MD episodes and subsequent recurring episodes
- Former MD
  - No MD episode in the past year, but lifetime history of at least one episode
- Recall error
  - Report no lifetime history of MD episode
  - But modeled as former MD

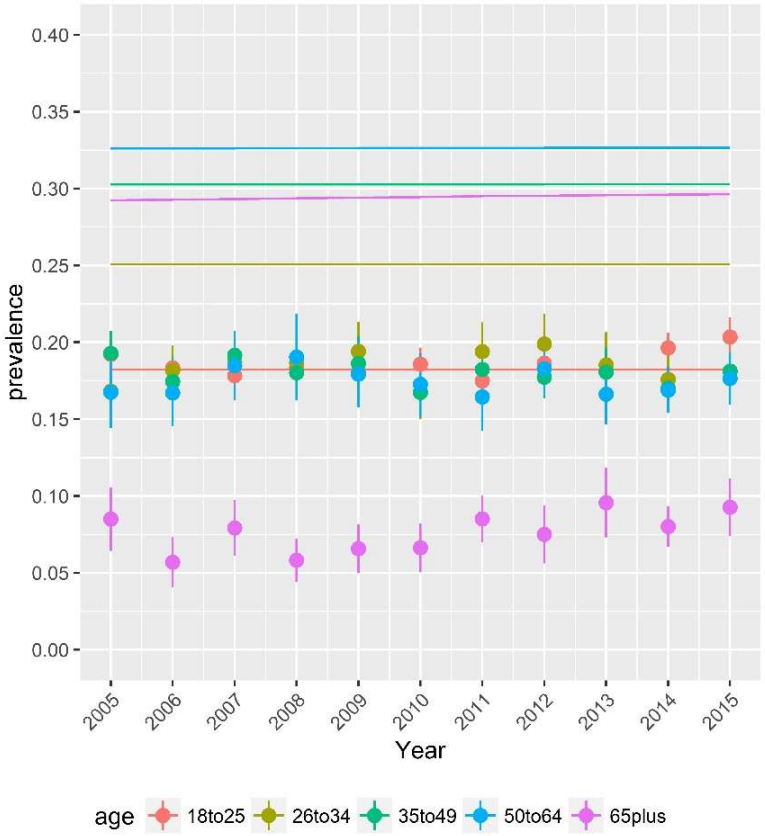
(Tam, 2020)

Lifetime MD prevalence, adjusted for recall error

Recall error = Never MD



Recall error = Former MD

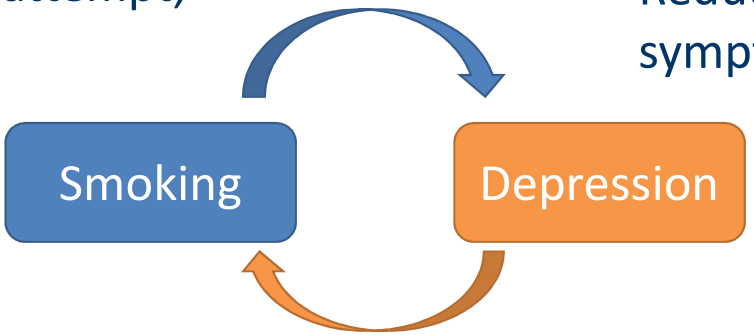


(Tam, 2020)

Challenge #3: Smoking and mental health interactions

Smoking increases risk for:
- Depression symptoms
- Suicide ideation, attempt, completion

Smoking cessation:
- Alleviates mood
- Reduces depression symptoms



Shared underlying genetic, neurobiological, environmental factors

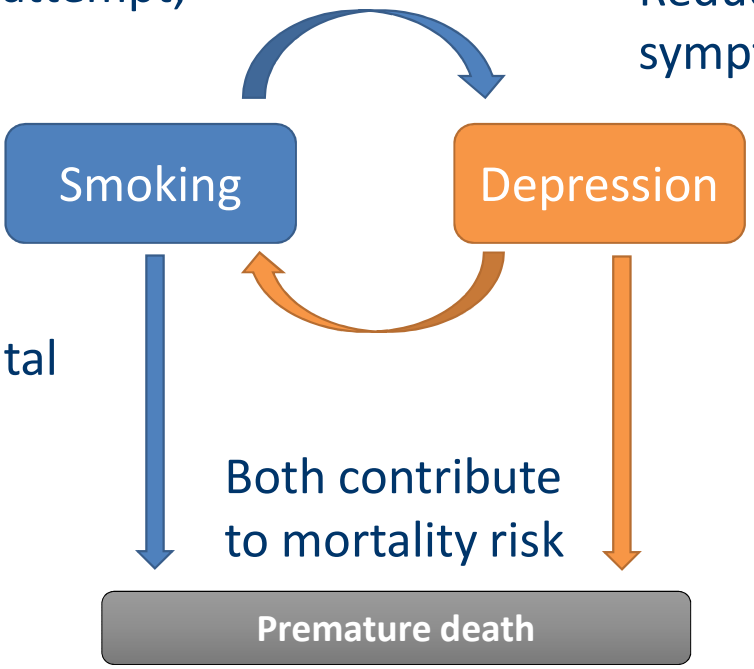
Depression:
- Increases risk for smoking initiation
- Reduces odds of successful quitting

(Fluharty, 2017)

Potential for feedback effects

Smoking increases risk for:
- Depression symptoms
- Suicide ideation, attempt, completion

Smoking cessation:
- Alleviates mood
- Reduces depression symptoms

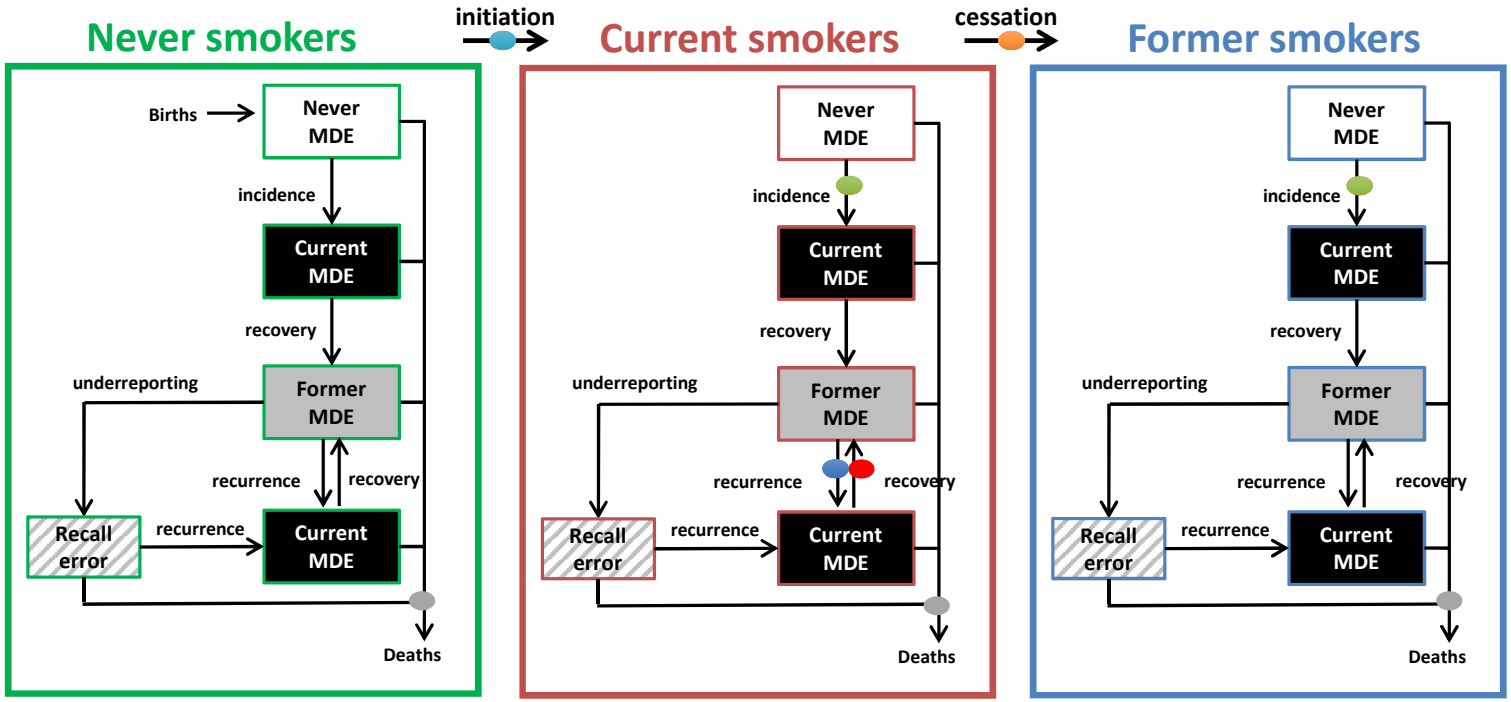


Shared underlying genetic, neurobiological, environmental factors

Depression:
- Increases risk for smoking initiation
- Reduces odds of successful quitting

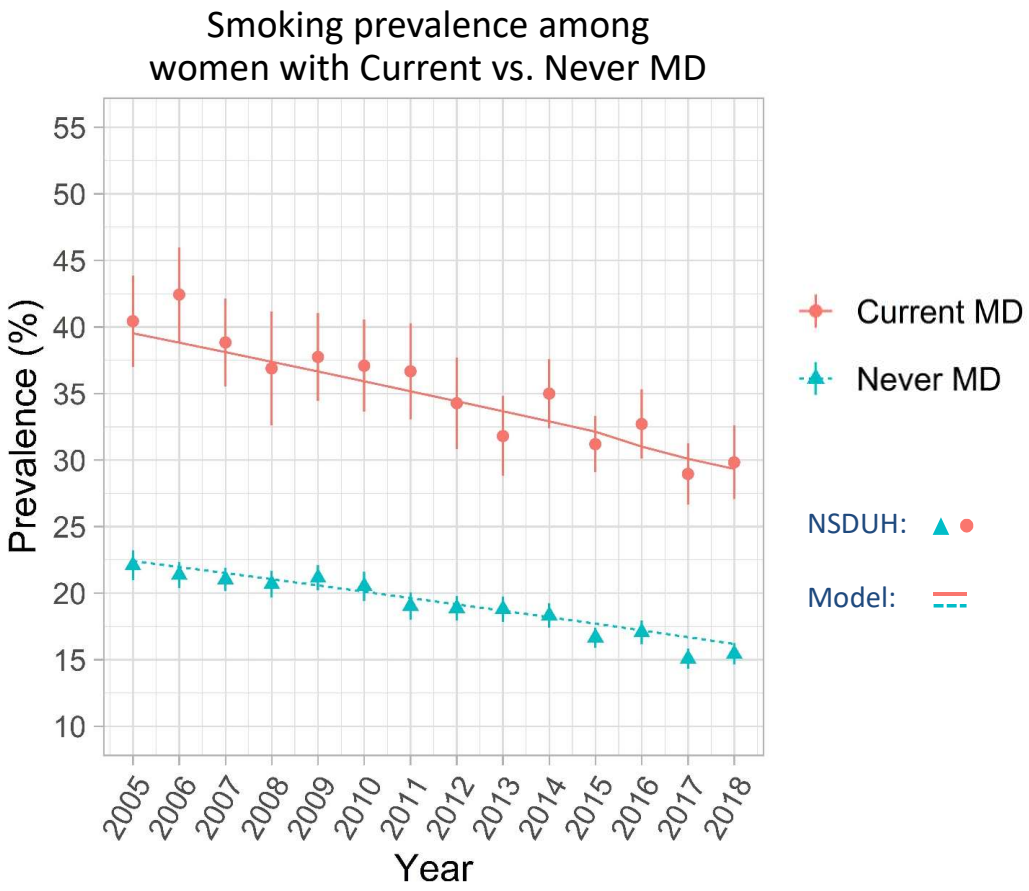
(Fluharty, 2017)

Smoking and depression parameters depend on each other



 (Hitsman, 2012; Cavazos-Rehg, 2014; van Gool, 2006; Swendsen, 2010; Walker, 2015; Klungsøyr, 2006)

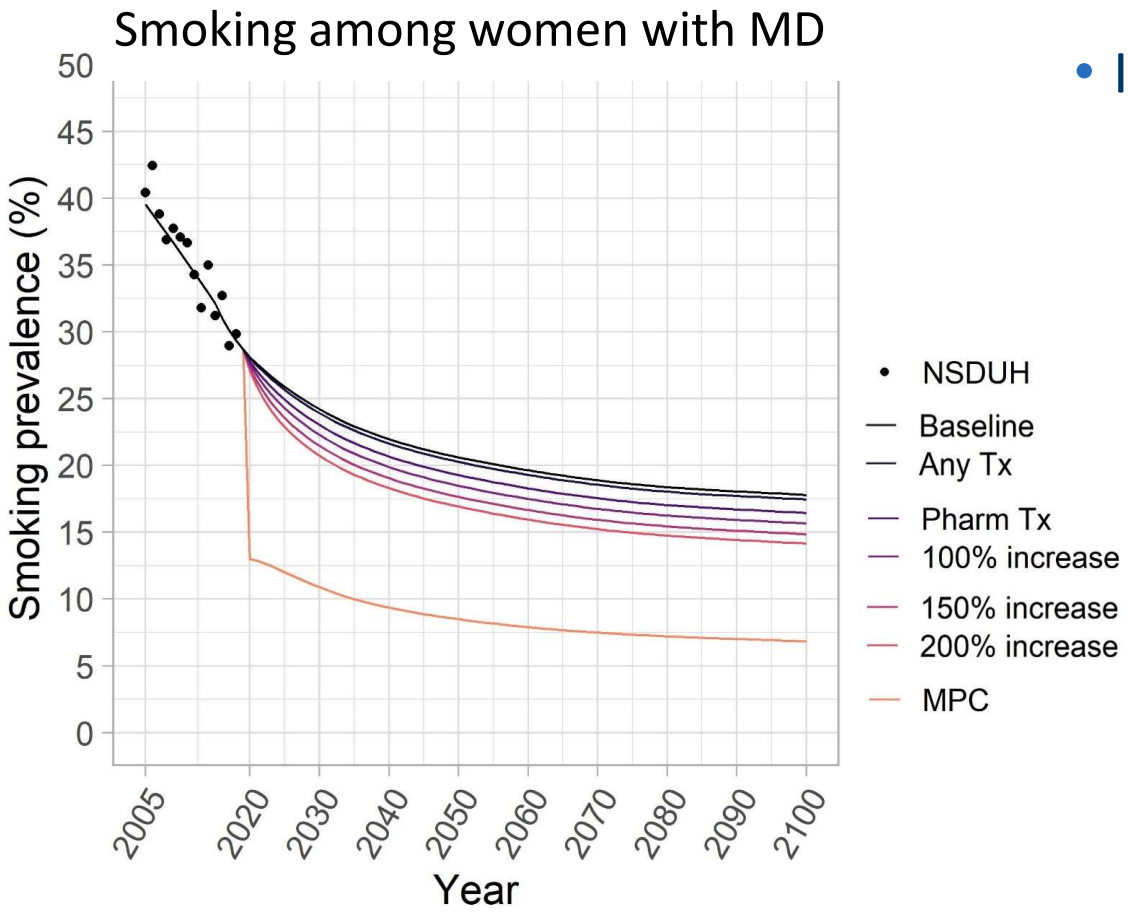
Calibrating the model



Parameter	Description	Initial estimate	Calibrated estimate (Women)
$RRcs\_dep1$	Klungsoyr, 2006	1.70	1.37
$RRfs\_dep1$	Klungsoyr, 2006	1.48	1.00
$ORhdep\_quit$	Hitsman, 2012	0.81	0.96
Efs_depr	N/A	N/A	1.00
Ecs_depr	van Gool, 2007	1.37	1.00
$Edepr\_smkinit$	Swendsen, 2010	1.40	5.19
$deprecovSF\_fs$	N/A	N/A	1.00
$deprecovSF\_cs$	N/A	N/A	0.70
$RRmd$	Walker, 2015	1.71	5.68

(Tam, 2020)

The Major Depression and Smoking (MDS) Model



- Insights:
  - Tobacco disparity expected to persist without bold action
  - Focus on cessation treatment alone leads to modest population health gains
  - Need for prevention, initiation lens
  - Integrate smoking in mental health and vice versa

(Tam, 2021 In Press)

Challenge #4: Non-cigarette tobacco products

- Lack of non-cigarette tobacco data for comorbid populations
- Product use transitions may differ from general population
- Potential for state explosion

(CDC, 2021)

Next challenges

- E-cigarettes
- Impact of tobacco regulations
- Co-occurring substance use
- Depression increases among young adults
- COVID-19 impact on mental health and substance use

Questions?
jamie.tam@yale.edu

Model R code:
https://github.com/jamietam

Thank you!

National Institute on Drug Abuse

References

American Cancer Society and Vital Strategies. (2018). "The Tobacco Atlas: Comorbidites." Retrieved May 10, 2018, from https://tobaccoatlas.org/topic/comorbidities/.

Cook, B. L., G. F. Wayne, E. N. Kafali, Z. Liu, C. Shu and M. Flores (2014). "Trends in smoking among adults with mental illness and association between mental health treatment and smoking cessation." JAMA **311**(2): 172-182.

Fluharty, M., A. E. Taylor, M. Grabski and M. R. Munafò (2016). "The Association of Cigarette Smoking With Depression and Anxiety: A Systematic Review." Nicotine Tob Res **19**(1): 3-13.

Takayanagi, Y., A. P. Spira, K. B. Roth, J. J. Gallo, W. W. Eaton and R. Mojtabai (2014). "Accuracy of reports of lifetime mental and physical disorders: results from the Baltimore Epidemiological Catchment Area study." JAMA Psychiatry **71**(3): 273-280.

Talati, A., K. Keyes and D. Hasin (2016). "Changing relationships between smoking and psychiatric disorders across twentieth century birth cohorts: clinical and research implications." Molecular psychiatry **21**(4): 464.

Tam, J., B. Mezuk, K. Zivin and R. Meza (2020). "U.S. Simulation of Lifetime Major Depressive Episode Prevalence and Recall Error." American Journal of Preventive Medicine **59**(2): e39-e47.

Tam, J., G. M. J. Taylor, K. Zivin, K. E. Warner and R. Meza (2020). "Modeling smoking-attributable mortality among adults with major depression in the United States." Prev Med: 106241.

Tam, J., K. E. Warner, K. Zivin, G. M. J. Taylor and R. Meza (2021). "The Potential Impact of Widespread Cessation Treatment for Smokers With Depression." American Journal of Preventive Medicine **(In Press)**.

Williams, J. M., M. L. Steinberg, K. G. Griffiths and N. Cooperman (2013). "Smokers With Behavioral Health Comorbidity Should Be Designated a Tobacco Use Disparity Group." Am J Public Health **103**(9): 1549-1555.

Wootton, R.E., Richmond, R.C., Stuijfzand, B.G., et al., 2019. Evidence for causal effects of lifetime smoking on risk for depression and schizophrenia: a Mendelian randomisation study. Psychol. Med. 1–9.