USC Schaeffer
Leonard D. Schaeffer Center
for Health Policy & Economics

# Quantifying the Life-course Benefits of Prevention

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# Microsimulation is useful to study the lifetime returns to health and social investment

Since 2004, we have answered **salient policy questions** about social investments using two microsimulation models:

- **Future Elderly Model** (FEM)
- **Future Adult Model** (FAM)

Supported by the National Institute on Aging, our research studies the determinants of health and health spending and translates these findings for policymakers. These models have been used to study:

- Aging
- Early childhood education
- Adverse childhood events
- Serious mental illness
- Obesity
- Tobacco
- Alzheimer's disease
- Medical innovation
- Cardiovascular risk factors
- Pharmaceutical price controls
- Medicare reform
- Progressivity of government programs

**Forecasts** long-term population health in:

- United States
- California
- Los Angeles County
- 20+ other countries

**Contributions featured by:**

National Academies of Sciences, Engineering, and Medicine

MacArthur Foundation

Congressional Budget Office

Department of Labor

Social Security Administration

World Economic Forum

Economic Report of the President

LA County Department of Public Health

California Institute for Regenerative Medicine

# FEM and FAM track the complex interaction between health, mortality, and economic outcomes

- Our models are estimated using nationally-representative panel data
  - Health and Retirement Study data for the over-50 population (FEM)
  - Panel Study of Income Dynamics for the 25+ population (FAM)
- We simulate individuals' risk factors, chronic illnesses, loss of function, and death using clinically-informed statistical models
- Our projections also track health-related economic outcomes such as work, earnings, wealth, medical expenditures, and government program participation/benefits
- We simulate actual survey respondents, allowing for substantial heterogeneity

# Transition models update health and economic characteristics

| | | |
|---|---|---|
| Health | Chronic conditions | ADRD, cancers, congestive heart failure, diabetes, heart attack, heart disease, hypertension, COPD, stroke, pain |
| | Functional limitations | Activities of daily living, instrumental activities of daily living |
| | Mental health | Depressive symptoms, mental distress, sleep issues |
| | Mortality | Death |
| | Risk factors | BMI, exercise, smoking |
| Life events | | Widowhood, nursing home entry |
| Economic | Employment status | Working for pay |
| | Health insurance | Health insurance type |
| | Income and assets | Capital income, earnings, wealth |
| | Public program participation | OASI, DI, SSI, other transfers |

# … plus contemporaneous outcomes of interest

| | | |
|---|---|---|
| Medical cost and use | Individual | Drug $, out of pocket $ |
| | Medicaid | Eligibility, $ |
| | Medicare | Total $, Parts A/B/C/D |
| | Total expenditures | $ |
| | Utilization | Doctors visits, hospital encounters, hospital nights |
| | Informal care | Spousal care hours, non-spousal care hours |
| Taxes paid | | Federal, state, property |
| Subjective well-being | | Life satisfaction, quality-adjusted life years (EQ5D, HUI3), self-reported health |
| Government transfers | | OASI benefits, SSDI benefits, SSI benefits, others government transfers |

# We use counterfactual scenarios to quantify value

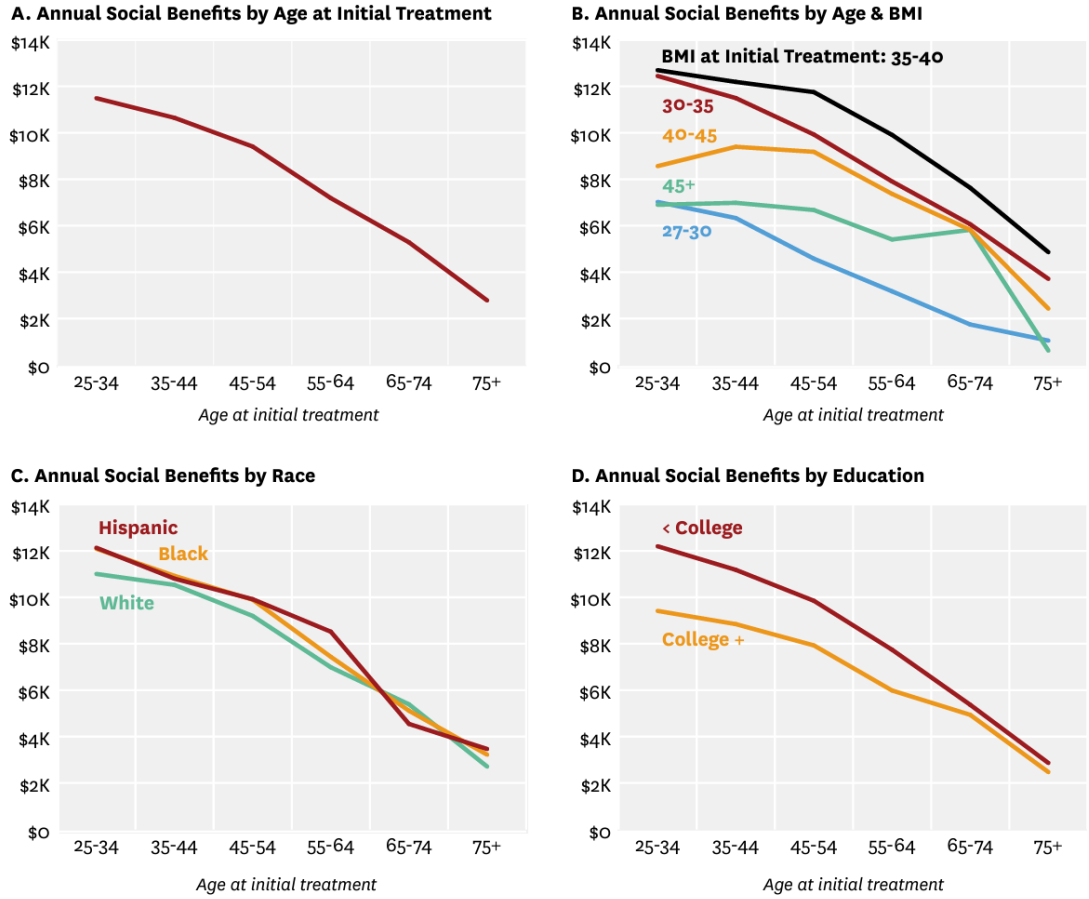
- **Intervene on transitions**
  - Decrease likelihood of developing a disease
  - Delay onset of a disease
  - Slow the progression of a disease
  - Mitigate the impacts of a disease
- **Alter initial characteristics of simulated individuals**
  - Decrease risk factors
  - Remove prevalent disease

# Our work often estimates the burden of disease, the value of treatment, and the value of prevention

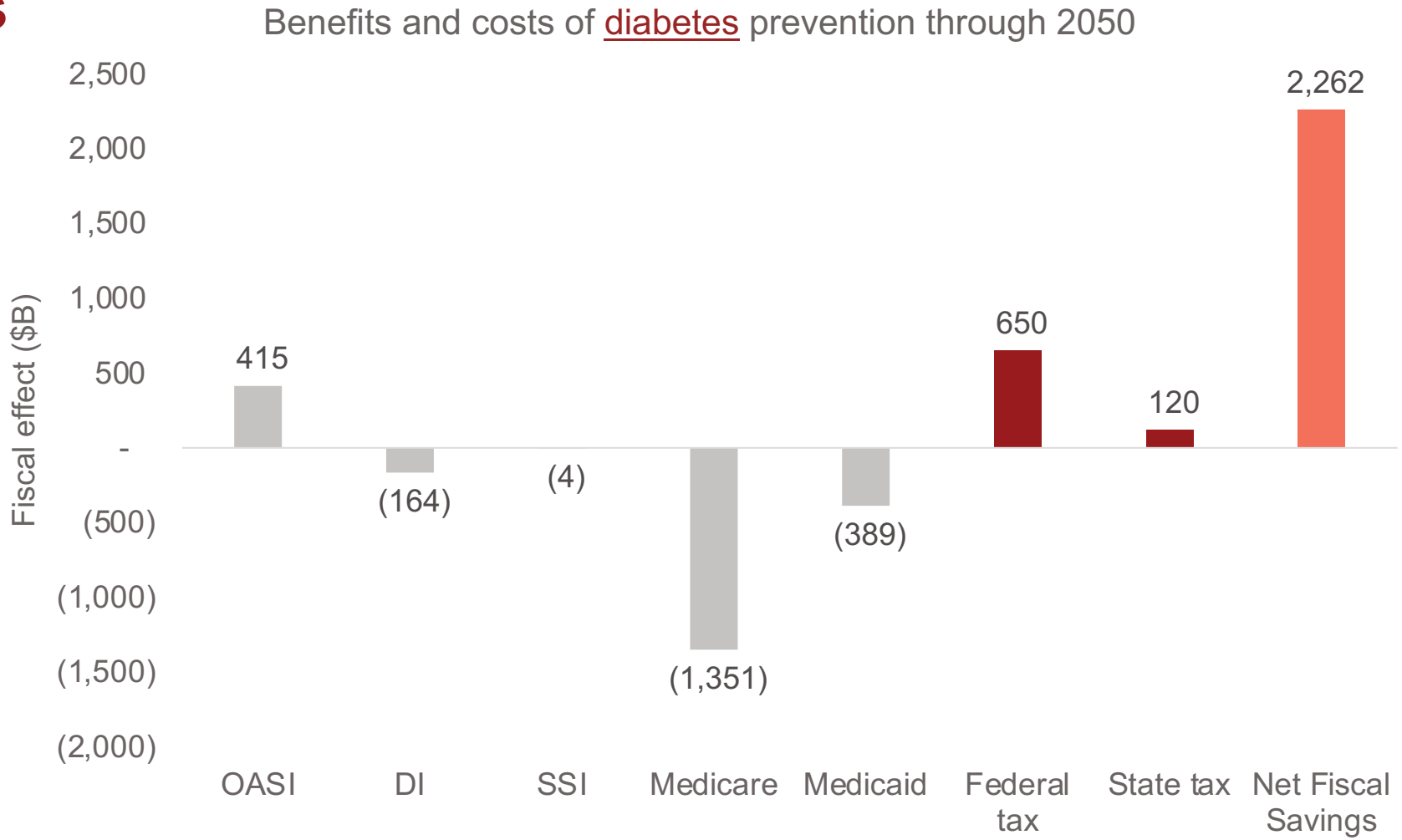
- **Different studies take different perspectives on value**
  - **Individual – quantity and quality of life, earnings, costs/benefits**
  - **Societal – aggregate quantity and quality of life, cost offsets for fiscal spending**

# BMI reduction shows potential for sizable social benefit

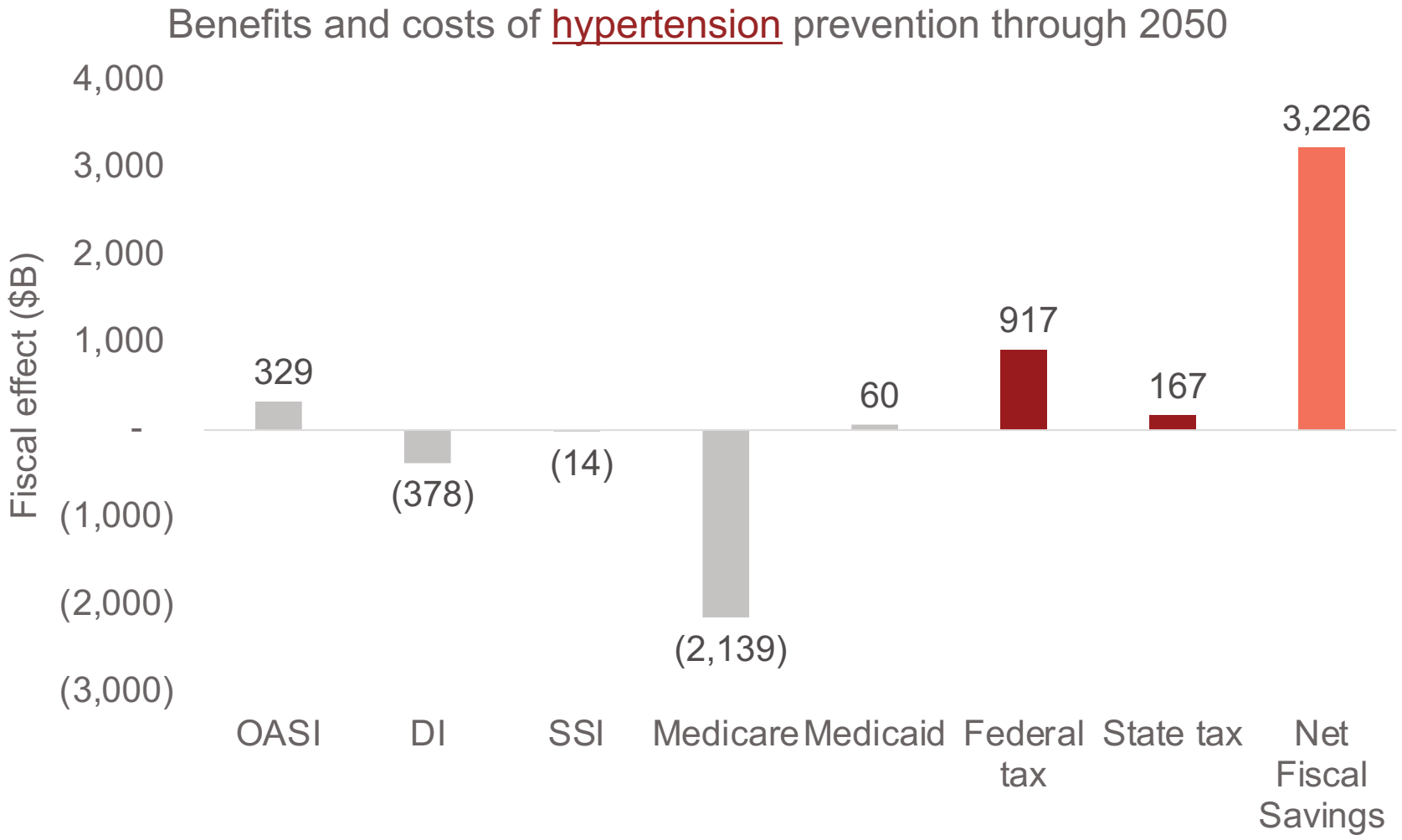

***Figure 2. Annual Social Benefit From Treating Obesity***



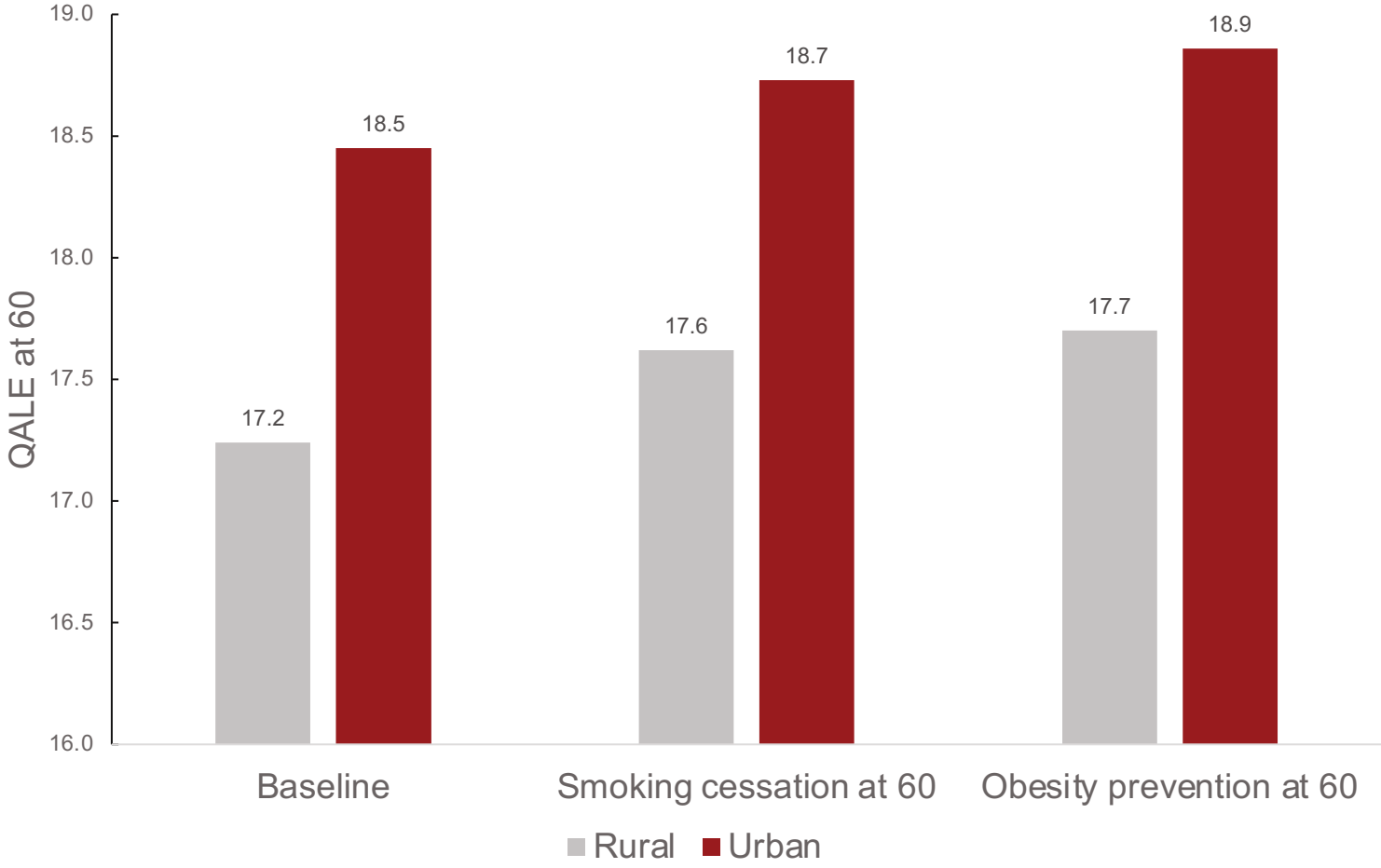
# Population prevention of diabetes could yield significant fiscal benefits



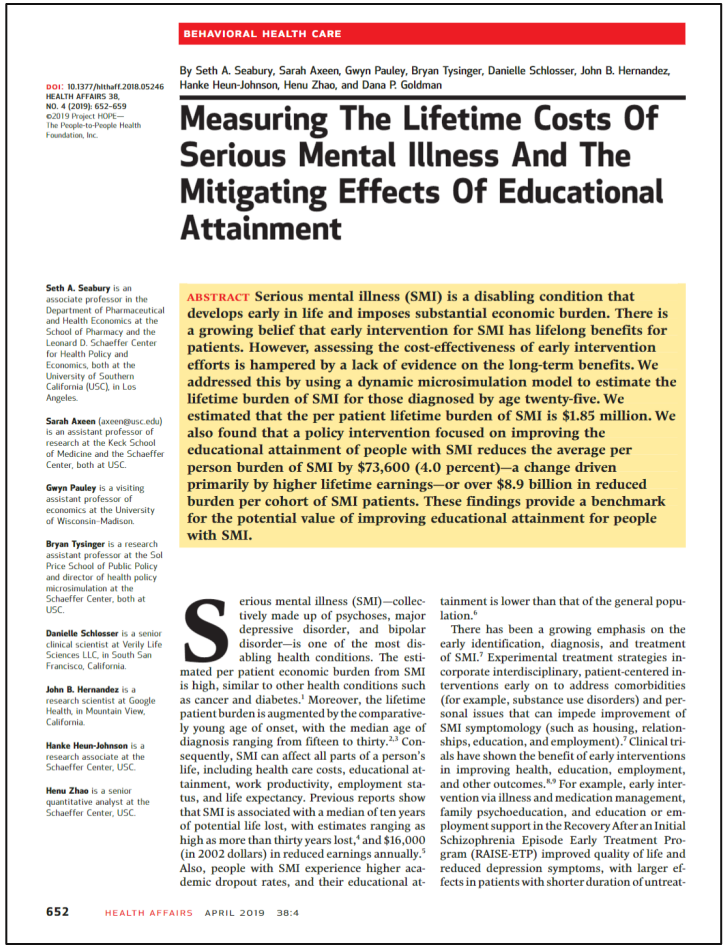
# … as could mitigating the effects of hypertension



# Decrease the urban-rural health gap by targeting modifiable risk factors in older adults



# Decreasing Serious Mental Illness Burden through Education



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By Seth A. Seabury, Sarah Axeen, Gwyn Pauley, Bryan Tysinger, Danielle Schlosser, John B. Hernandez, Hanke Heun-Johnson, Henu Zhao, and Dana P. Goldman

## Measuring The Lifetime Costs Of Serious Mental Illness And The Mitigating Effects Of Educational Attainment

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ABSTRACT **Serious mental illness (SMI) is a disabling condition that develops early in life and imposes substantial economic burden. There is a growing belief that early intervention for SMI has lifelong benefits for patients. However, assessing the cost-effectiveness of early intervention efforts is hampered by a lack of evidence on the long-term benefits. We addressed this by using a dynamic microsimulation model to estimate the lifetime burden of SMI for those diagnosed by age twenty-five. We estimated that the per patient lifetime burden of SMI is $1.85 million. We also found that a policy intervention focused on improving the educational attainment of people with SMI reduces the average per person burden of SMI by $73,600 (4.0 percent)—a change driven primarily by higher lifetime earnings—or over $8.9 billion in reduced burden per cohort of SMI patients. These findings provide a benchmark for the potential value of improving educational attainment for people with SMI.**

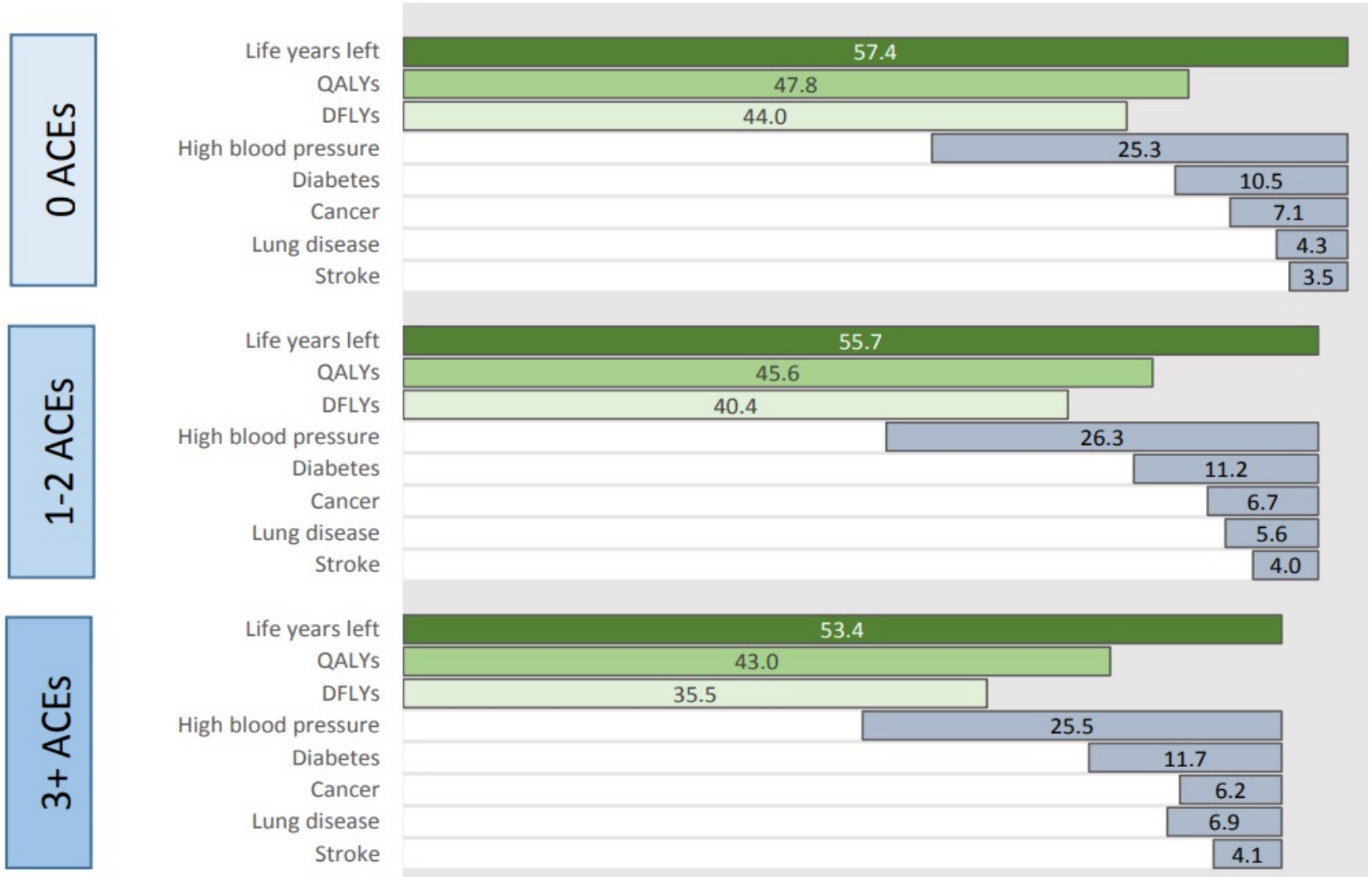
Serious mental illness (SMI)—collectively made up of psychoses, major depressive disorder, and bipolar disorder—is one of the most disabling health conditions. The estimated per patient economic burden from SMI is high, similar to other health conditions such as cancer and diabetes.[1] Moreover, the lifetime patient burden is augmented by the comparatively young age of onset, with the median age of diagnosis ranging from fifteen to thirty.[2,3] Consequently, SMI can affect all parts of a person's life, including health care costs, educational attainment, work productivity, employment status, and life expectancy. Previous reports show that SMI is associated with a median of ten years of potential life lost, with estimates ranging as high as more than thirty years lost,[4] and $16,000 (in 2002 dollars) in reduced earnings annually.[5] Also, people with SMI experience higher academic dropout rates, and their educational attainment is lower than that of the general population.[6]

There has been a growing emphasis on the early identification, diagnosis, and treatment of SMI.[7] Experimental treatment strategies incorporate interdisciplinary, patient-centered interventions early on to address comorbidities (for example, substance use disorders) and personal issues that can impede improvement of SMI symptomology (such as housing, relationships, education, and employment).[7] Clinical trials have shown the benefit of early interventions in improving health, education, employment, and other outcomes.[8,9] For example, early intervention via illness and medication management, family psychoeducation, and education or employment support in the Recovery After an Initial Schizophrenia Episode Early Treatment Program (RAISE-ETP) improved quality of life and reduced depression symptoms, with larger effects in patients with shorter duration of untreat-



| Lifetime outcomes | Non-SMI group | SMI by age 25 | *Absolute difference* | SMI education intervention |
|---|---|---|---|---|
| QALY | 47.6 | 36.0 | *-11.6* | 0.3 |
| Medical spending ($K) | 399.3 | 495.9 | *96.5* | 1.1 |
| Earnings ($K) | 1122.3 | 585.2 | *-537.1* | 40.9 |
| SSDI ($K) | 7.8 | 46.6 | *38.8* | -0.8 |
| SSI ($) | 2.5 | 22.9 | *20.3* | -3.1 |
| | | **Total lifetime burden** | ***1852.7*** | 73.6 |

# Quantifying the burden of ACEs on adults over age 25



# Eliminating ACEs effects on different pathways could yield substantial benefits

| | Health Pathway | Risk Pathway | Opportunities Pathway |
|---|---|---|---|
| **Life Years** | 84.8% | 13.1% | 0.6% |
| **Quality-Adjusted Life Years** | 84.2% | 14.2% | 0.6% |
| **Disability-Free Life Years** | 90.8% | 8.6% | 0.6% |
| **Earnings** | 35.2% | 8.1% | 55.7% |

**Health pathway** – eliminates direct ACEs effect on chronic disease risk, functional limitations, and mental distress
**Risk pathway** – eliminates direct ACEs effect on smoking, exercise, and BMI
**Opportunities pathway** – eliminates direct ACEs effect on work, earnings, and marriage

# Final thoughts

- There is enormous potential value in preventing disease or the targeting the precursors of disease
- Chronic illnesses like diabetes and hypertension weigh heavily on individuals and government programs
- A broader perspective helps to quantify the full benefits (and costs!) of prevention
- Identifying high-benefit groups ex ante helps to allocate scarce resources
- Typical challenges encountered include
  - Enrollment, adherence, program costs, monitoring costs, incentives to intervene

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