# Estimating Productivity Loss from a Societal Perspective: A Practical Framework Using U.S. Public-Use Data

Lu Shi[1], PhD; Hanxuan Yu[2], MS; Meng Li, PhD[1]
[1]Center for the Evaluation of Value and Risk in Health, Tufts Medical Center, Boston, MA, USA
[2]Center for Health Decision Sciences, Harvard University T.H. Chan School of Public Health, Boston, MA

Poster Code: EE310

## BACKGROUND

Productivity estimates are a key component in cost-effectiveness analyses from a societal perspective. However, existing approaches to estimating productivity losses vary in assumptions, data sources, measurement methods, and lead to inconsistent results.

## OBJECTIVE

We propose a coherent conceptual framework and practical approach using public data to estimate productivity impact of various disease areas in the US.

## METHODS

Figure 1. Framework for estimating annual and lifetime productivity loss

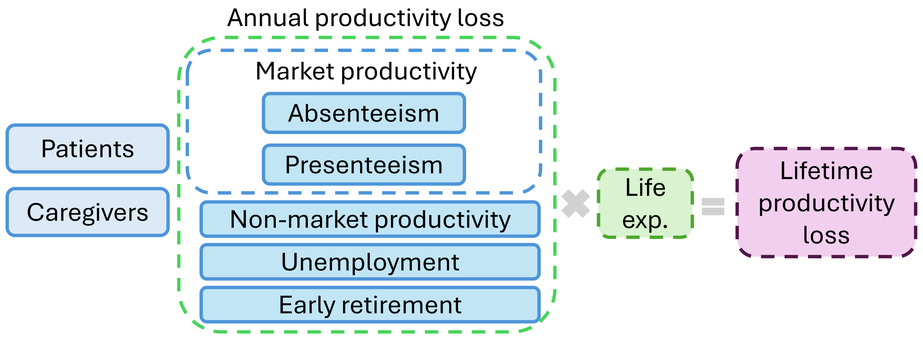



Table 1. Data sources and variables for productivity loss estimation

| Data source | Variables |
|---|---|
| Medical Expenditure Panel Survey (MESP), 2016–2023 | Disease related absenteeism, probability of unemployment |
| American Time Use Survey (ATUS), 2016–2023 | Market productivity, non-market productivity |
| U.S. Census Bureau, 2016 | U.S. population |
| National Vital Statistics System (NVSS), 2016 | Life expectancy |
| U.S. Bureau of Economic Analysis, 2016–2023 | Benefits to wages ratio |
| Health and Retirement Study (HRS), 2016–2022 | Probability of early retirement |
| Literature search | Presenteeism |

## RESULTS

Table 2. Annual market productivity loss by ICD-10-CM disease categories, all ages and sex (3 examples): MEPS, 2016–2023

| ICD-10-CM | Category description | Absenteeism | | Presenteeism[1] | | Total |
|---|---|---|---|---|---|---|
| | | Days per year[2] | Cost per year | Days per year | Cost per year | |
| C00-D49 | Neoplasms | 1.4 | 181.4 | 0.9 | 32.7 | 214.1 |
| H00-H59 | Diseases of the eye and adnexa | 1.3 | 166.7 | 1.7 | 64.6 | 231.3 |
| All | Total population | 3.9 | 514.9 | 1.7 | 64.4 | 579.3 |

Notes:
[1] Allen et al., 2018 (DOI: 10.1186/s12960-018-0321-9)
[2] Adults with the disease were matched to individuals from the general population using propensity scores generated based on age and sex. Estimates were weighted for the complex multi-stage sampling design of MEPS.

## RESULTS

Figure 2. Population market and non-market productivity daily mean values, by sex and age: ATUS and U.S. Bureau of Economic Analysis, 2016–2023

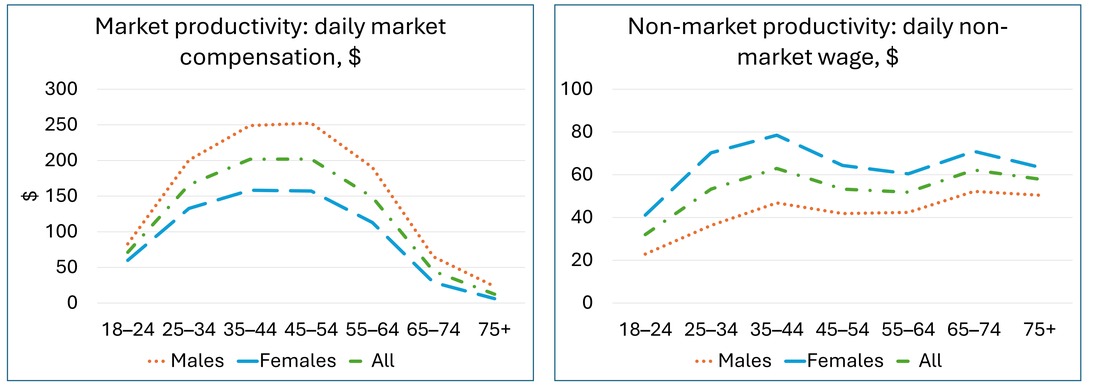



Figure 3. Life expectancy by disease category and age groups, all ages and sex (3 examples): NVSS, 2016

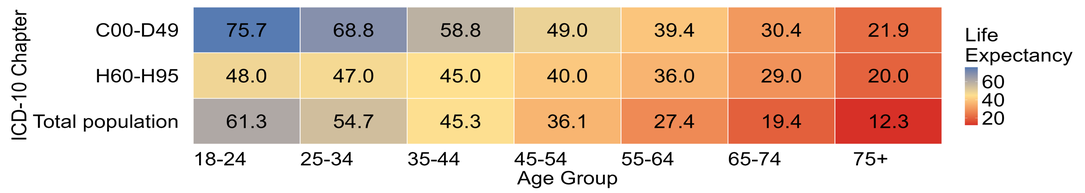
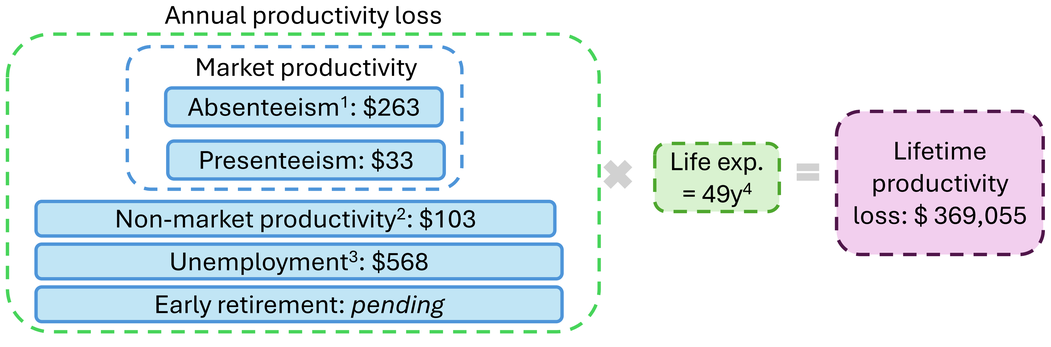



Table 3. Probability of disease related unemployed by ICD-10-CM disease categories, all ages and sexes (3 examples): MEPS, 2016–2023

| ICD-10-CM | Category description | Probability |
|---|---|---|
| C00-D49 | Neoplasms | 0.77% |
| H00-H59 | Diseases of the eye and adnexa | -0.27% |
| All | Total population | -1.04% |

Figure 3. Evaluation of life-time productivity loss for a patient diagnosed with C00–D49 neoplasms at age 50




Notes:
[1] Disease-related absenteeism: Daily market compensation for individuals of all sexes aged 45–54 was multiplied by disease-related absenteeism days: $202.05×1.3=$262.67.
[2] Non-market productivity: Non-market productivity was calculated as market productivity multiplied by the non-market-to-market value ratio: ($263+$33)×($51.85/$148.53)=$103.33
[3] Unemployment-related productivity loss: The probability of unemployment for a male patient with neoplasms was 0.77%. Annual productivity loss due to unemployment was calculated as: $73,736.68×0.77%=$567.77.
[4] Life expectancy at age 49 was assumed to comprise 15 years of employment and 34 years in retirement. ($262.67+$33+$103.33+$567.77) ×15y+($44.78+$12.36)/2*365 × 34y= $ 369,055.25.

## DISCUSSION

- Several variables could not be estimated because of limited data availability, including: (1) disease-related probabilities of full-time employment (2) disease-related probabilities part-time employment; (3) disease severity; (4) disease duration; (5) disease progression.
- Other potential variables were available but were not included in the current analysis or require further evaluation or estimation, including: (1) disease-related early retirement; (2) inpatient length of stay and emergency room visits/days; and (3) paid sick leave.
- Caregiver-related estimates have not yet been completed.
- Discounted future earnings, reported in 2023 U.S. dollars, were not included in the current estimation.
- Self-employed individuals were not considered from this analysis.

## CONCLUSION

This study established a framework for estimating both market and non-market productivity losses applicable across diverse disease contexts.

## FUNDING SUPPORT

NA

## CONTACT

Lu Shi
(lu.shi@tuftsmedicine.org)