CME Article #1

# Lost Productive Work Time Costs From Health Conditions in the United States: Results From the American Productivity Audit

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## Learning Objectives

- Recall the overall magnitude of lsot productive time (LPT) and its dollar cost as found in the American Productivity Audit, and the respective contributions of absenteeism and decreased producitivity at work.
- Be aware of how LPT varies with a number of demographic and workrelated factors.
- Compare the factors predisposing to LPT for personal and family-related reasons.

## Abstract

*The American Productivity Audit (APA) is a telephone survey of a random sample of 28,902 U.S. workers designed to quantify the impact of health conditions on work. Lost productive time (LPT) was measured for personal and family health reasons and expressed in hours and dollars. Health-related LPT cost employers $225.8 billion/year ($1685/employee per year); 71% is explained by reduced performance at work. Personal health LPT was 30% higher in females and twice as high in smokers (≥1 pack/day) versus nonsmokers. Workers in high-demand, low-control jobs had the lowest average LPT/week versus the highest LPT for those in low-demand, high-control jobs. Family health-related work absence accounted for 6% of all health-related LPT. Health-related LPT costs are substantial but largely invisible to employers. Costs vary significantly by worker characteristics, suggesting that intervention needs vary by specific subgroups.* (J Occup Environ Med. *2003;45:1234–1246*)

A number of studies have described the work impact of common conditions like migraine,[1–10] low back pain,[11,12] arthritis,[13,14] diabetes,[15,16] allergic rhinitis,[7,17–22] gastroesophageal reflux,[23–25] and depression.[7,12,26–30] Research on these and other individual health conditions in both population and specific workplace settings has advanced our understanding of the cost of health care relative to costs from the impact of health conditions on work. Considerably less research has focused on measuring the composite impact of all health conditions on work. Moreover, although a number of studies have assessed the impact of health conditions on absence, relatively few have estimated the cost from both absence and reduced performance or effectiveness at work. The latter could be particularly important, because evidence indicates a number of health conditions have a greater impact on reduced performance at work than on absence.[1–3,5,6,20,21,24,27,31,33,34]

To gain a broader understanding of the impact of health conditions on the U.S. workforce, we launched the American Productivity Audit (APA). The goal of the APA is to describe variation in overall absence time and reduced performance time from health conditions and to project costs to the U.S. workforce. We were specifically interested in understanding how lost productive time and the associated costs varied by key demographic variables, because these factors are strongly related to the prevalence of common health conditions

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and, as such, should influence employer expectations. In addition, the influence of selected features of work was assessed on both the amount of productive work time lost and the manner in which it was lost (ie, absence time vs. presenteeism). Finally, lost productive time was assessed by smoking status and alcohol consumption, 2 important and common habits that influence general health status.

## Methods

The APA was completed using the Work and Health Interview (WHI). The WHI is a computer-assisted telephone interview designed to quantify lost productive work time, including time absent from work and reduced performance while at work as a result of health conditions, individually or in combination.

The APA was conducted over a 1-year period to avoid bias inherent to the temporal impact of seasonal conditions (eg, common cold, flu, allergic rhinitis) on LPT. Details on the interview, sampling method, data collection, and analytic methods, including the procedures for calculating LPT and estimating the cost of LPT in the U.S. workforce are described subsequently. The study protocol and informed consent statement were approved by the Essex Institutional Review Board (Lebanon, NJ).

### Work and Health Interview

The WHI was developed, tested, and validated in 2 separate studies. Details regarding these studies are available on request.* In brief, the WHI uses a 2-week recall interval and is comprised of 8 modules. The first 3 modules obtain verbal informed consent and capture detailed data on employment status, usual work time, and the presence of 22 different health conditions, including chronic conditions (eg, diabetes, heart disease), chronic episodic conditions (eg, headache, gastrointestinal problems, depression), and acute episodes of illness (eg, common cold, influenza). A *missed workdays* module quantifies number of missed days of work and the related cause. A *job visualization* module asks about tasks and activities performed at work, the time allotted to each, and those deemed most important. It also characterizes occupation in terms of job demand and job control.[35] The intention is to ensure that respondents "visualize" work before answering questions about reduced work performance on days at work not feeling well. The module for *lost productive time on days at work* asks about reduced performance on days at work and the related cause. A *lifestyle* module captures information on health habits and the closing *demographics* module gathers additional demographic information, including annual salary.

### Household Sampling and Selection of Household Members

The APA is a national survey of the U.S. workforce. Households were selected as a random sample of residences with telephones in the continental U.S. Genesys Sampling Systems (Fort Washington, PA) provided a probability sample of residential telephone numbers in the 48 contiguous states and the District of Columbia. Households were called on different days of the week (excluding Friday and Sunday) and at different times of the day between noon and 9 PM. A minimum of 10 attempts were made to contact each household. Residents were deemed eligible if they were 18 to 65 years of age, a permanent member of the household, reported in the affirmative to the Current Population Survey (CPS)[36] question on employment status (ie, "Last week, did you do any work for either pay or profit?"), and were employed in their current job at least 14 days. In addition, 1 in 10 individuals who responded that they did not do any work was selected at random to participate if they were 18 to 65 years of age and a permanent member of the household.

The purpose of the study was described to potential respondents at the time of household contact. If more than 1 eligible adult was a member of the household, we selected the person to interview who was to have the next birthday. This procedure approximates a probability-based selection method without the need to enumerate all eligible members of the household.[37] Verbal informed consent was obtained before initiating the interview. Once an interview was completed, the interviewer requested to speak with the next eligible member of the household who would have a birthday. Up to 2 eligible members per household were interviewed to optimize the efficiency of the sampling strategy.[38]

### Data Collection and Benchmarking

Data collection for the APA began on August 1, 2001, and continued for a period of 1 year. Approximately 2500 interviews were completed each month. The sample included individuals who worked for pay or profit in the past 7 days (ie, occupation-eligible) and a 10% random sample of individuals who did not work for pay or profit in the past 7 days (ie, occupation-ineligible).

We attempted to contact a total of 300,927 telephone numbers between August 1, 2001, and July 31, 2002. Of these, 84,176 (28.0%) were nonworking numbers, 17,183 (5.8%) were fax machines, modems, or pagers, and 19,594 (6.5%) were businesses. We assumed that the remaining 179,974 telephone numbers were households and attempted to contact them all. Of these, 47,368 (26.3%) could not be reached after 10 attempts, 29,326 (16.3%) were other no-contacts (deceased, incompatible

*"Health-related lost productive time: recall interval and bias in cost estimates" and "Validation of the work and health phone interview," submitted for publication, are available by request to wfstewart@geisinger.edu.

schedule, subject not in household) and 35,520 (19.7%) refused to participate before eligibility could be established. Of the remaining 67,760 households, 38,079 (56.2%) were deemed to have no eligible resident, 25,366 (37.4%) had 1 eligible resident, and 4315 (6.4%) had 2 eligible residents. A total of 33,996 potential respondents agreed to participate in the survey (ie, gave a complete or partial interview) and 30,523 completed the full interview. Of this number, 28,902 (92.2%) were occupation-eligible. Overall participation was estimated at 66.4%.†

Although efforts were made to obtain a random sample of the U.S. workforce, selective participation is inevitable in phone surveys because of noncoverage (ie, some individuals eligible to participate in the study were not included in the survey sampling frame) or unit nonresponse (ie, no data were collected for some individuals selected for the study sample). We used a 2-step weighting method to account for selective participation. Specifically, a weight was applied to individual participants as the inverse of the number of phone lines available for incoming calls to account for the unequal probability of selecting households. Additionally, occupation-ineligible subjects comprised a 10% sample that was reflected in the composite weight. Second, a benchmarked weighting adjustment was used to account for selection bias resulting from incomplete coverage of the U.S. population and to ensure that estimates of certain sample demographic subgroup totals conformed to "known" values for these totals. The Current Populations Survey (CPS)[36] was used as the external reference database because it provided high precision estimates on a nationally representative sample of the U.S. workforce. Population weighting adjustment was achieved using a raking method that allowed for benchmarking to 4 variables common to both the APA and CPS. Raking used an iterative proportional fitting procedure to ensure that the weights assigned to individual respondents led to marginal distributions on auxiliary variables that were equivalent in the APA and the CPS.[39] The 5 auxiliary variables included age group (≤ 24, 25–34, 35–44, 45–54, 55–64, ≥65 years of age), gender (male or female), region of residence (northeast, south, midwest, west), worked in last week for pay or profit (yes or no), and number of hours missed from work in last week (0, 1–7, 8–15, ≥16 hours). Wesvar© version 4 statistical software (Westat, Rockville, MD) was used to perform the raking adjustments.

## Analysis

Analysis was restricted to the 28,902 occupation-eligible respondents who completed the interview. Analyses were first completed to describe variation in health-related LPT among workers by selected characteristics. The method for estimating LPT from WHI data is described in detail elsewhere (Stewart et al., unpublished data). In brief, LPT for personal health and family health reasons were quantified separately and differentiated in this analysis. LPT for a personal health reason was the sum of hours per week absent from work for a health-related reason ("*absenteeism*") and the hour-equivalent of health-related reduced performance on days at work ("*presenteeism*"). *Absenteeism* included *missed workdays* and *reduced work hours* on days at work during the recall period. *Presenteeism* was quantified based on responses to 6 questions. Five questions focused on frequency of behaviors (*all of the time, most of the time, half of the time, some of the time,* and *none of the time*) associated with reduced work performance on days at work not feeling well in the previous 2 weeks. These behaviors included losing concentration, repeating a job, working more slowly than usual, feeling fatigued at work, and doing nothing at work. The sixth question focused on the average amount of time it took to start working after arriving at work. LPT for a family health reason was the sum of hours per week absent from work for a health-related reason in which only hours associated with missed full days of work were measured.

Lost labor costs were estimated by translating hours of lost productive time into lost dollars using self-reported annual salary or wage information (ie, hourly wage was calculated as annual income divided by the reported average number of hours worked per week × 52 weeks). Lost dollars were calculated by multiplying lost hours × the hourly wage.

Variation in LPT was evaluated in relation to 3 groups of factors: demographics, occupational and employment characteristics, and health habits. Demographic variables are known to be strongly associated with common health conditions that affect work. If work loss varies by demographic factors, then information on the relationship can be used to estimate expected work loss given the demographic profile of a workforce. Demographic variables included gender, age group (18–29, 30–39, 40–49, 50–65 years), race or ethnicity (white, black, Asian, Hispanic, and other), and highest level of formal education (no high school diploma, GED or high school diploma, some college or associate degree, college degree, graduate degree). Occupational variables are likely to be related to an individual's motivation to work and work role demands, thereby influencing the amount of productive time lost from health conditions and how it is lost (ie, absence time vs. reduced performance at work). Occupational variables in-

†A total of 38,497 individuals refused participation before eligibility could be established. Among individuals who did not refuse, 55.5% (42,340/[114,833–38,497]) were not eligible. Assuming that 55.5% of those who refused were ineligible (ie, 21,366), we estimated that 63,706 individuals (42,340 + 21,366) were not eligible. Overall participation was estimated at 66.4% (ie, 33,966/(114,833–63,706).

cluded annual wage or salary (<$10,000, $10,000–19,999, $20,000–29,999, $30,000–39,999, $40,000–49,999, $50,000+), occupation classified according to "major group" as defined by the 1998 Standard Occupational Classification System (Bureau of Labor Statistics, US Department of Labor), and a combined job demand and job control category (high demand–high control, high demand–low control, low demand–high control, low demand–low control) based on Karasek et al.[35] We also included geographic region (northeast, south, midwest, west) as a broad-based surrogate for possible sociocultural differences in views on work. Finally, LPT was assessed by smoking status (never smoked, exsmoker, currently smokes <1 pack/day, currently smokes 1+ pack/day) and current alcohol consumption (does not drink, <1 drink/week, 1–6 drinks/week, 7+ drinks/week) because these are 2 of the most common personal habits that affect health and are easily and reliably measured.

Data were summarized for total LPT and its components (ie, absence time for personal health reasons, reduced performance time while at work for personal health reasons, and absence time for family health reasons). Values for LPT per week were skewed to high values, with 55% of respondents reporting no lost productive time. For this reason, we summarized data as means and as the percent of workers with 2 or more hours of LPT in the previous week. We selected 2 hours as a meaningful threshold for LPT in a 1-week period.

Benchmarked LPT estimates stratified by demographic, occupational, and employment characteristics, and health habits were adjusted for other covariates using linear regression (PROC GLM, SAS version 8.2; SAS Institute Inc., Cary, NC). In previous work, we demonstrated that inference regarding variation in estimates by demographic and other factors using linear regression was very similar to that obtained using Poisson regression. We used linear regression because coefficients were more easily interpreted.

A small percent of values for the benchmarking and weighting variables (gender, age, region, worked in the previous week, number of respondents and number of telephone lines in the household) was missing (ie, 0.9%). Missing values for categorical variables were imputed using the age- and gender-specific mode. Missing values for continuous variables were imputed using the age- and gender-specific median. If 1 of the 5 variables used in the calculation of presenteeism was missing, the mean value of the remaining 4 variables was substituted, reducing the proportion with missing presenteeism estimates from 4.5% to 3.3%. Salary information was missing for 18.7% of all respondents. Regression modeling, which included gender, age, race, education, region of residence, job code, and duration in job, was used to estimate hourly salary for these subjects. SAS version 8.2 was used for all analysis.

## Results

A profile of the benchmarked sample compared with the participation sample is summarized in Table 1. Among participants, women comprised 56.1% of the sample and respondents were equally distributed across the 4 age groups. A majority of respondents were white (77.0%), formally educated beyond high school (66.6%), and working more than 30 hours per week (82.9%) with an annual income less than $40,000 per year (51.3%). The most common occupational category was "office or administrative support," (16.4%) followed in order by sales (9.3%) and the education/training/library occupational category (7.6%). Benchmarking (ie, reweighting in reference to the CPS) resulted in several significant distributional changes. Compared with the participation sample, reweighting primarily influenced percent distribution by gender, age (ie, more adults 18–29 years of age and fewer adults 40–49 years of age), and geographic region. For the latter, weighting was increased for underrepresentation in the west and decreased for overrepresentation in the south.

### Variation in Lost Productive Time

During the 2-week recall period, 10% of workers were absent from work for a personal health reason and another 2% were absent for a family health reason; 38.3% reported unproductive time as a result of personal health on at least 1 workday during the recall period (Table 2). However, approximately half of these individuals lost fewer than 2 hours per week. Overall, workers lost an average of 2 hours per week of productive work time for either a personal or family health reason (Table 2). Reduced performance at work as a result of personal health accounted for 66% (1.32 hours per week) of the lost time, followed in order by work absence for personal health (0.54 hours per week) and work absence for family health (0.12 hours per week) (Table 2). These mean estimates, however, are based on substantial interindividual variation in LPT.

Variation in estimates of LPT for personal health reasons is summarized in Table 3. For each covariate, crude estimates of LPT did not substantially differ from the adjusted estimates. As such, we focus specifically on the adjusted estimates and summarize, in order of presentation, variation by demographic factors, occupational features, and personal habits.

On average, women reported 30% more LPT than men ($P < 0.001$). There was a statistically significant gradient in LPT by age ($P < 0.001$); 50 to 65 year olds reported only two thirds of the LPT compared with those less than 30 years of age. On average, Asians reported a substantially lower LPT than all racial/ethnic groups ($P < 0.001$). Workers

**TABLE 1**
Percent Distribution of Occupation Eligible APA Survey Participants by Demographic Characteristics and Reweighted Percent Distributions

| Characteristic | Category | Unadjusted | | Reweighted |
|---|---|---|---|---|
| | | No. | Percent | (%) |
| Gender | Male | 12,701 | 43.95 | 53.03 |
| | Female | 16,201 | 56.05 | 46.97 |
| Age | 18–29 | 6,453 | 22.33 | 25.25 |
| | 30–39 | 7,043 | 24.37 | 24.26 |
| | 40–49 | 8,416 | 29.12 | 26.18 |
| | 50–65 | 6,990 | 24.19 | 24.30 |
| Race/ethnicity | White | 22,246 | 76.97 | 76.34 |
| | Black | 2,579 | 8.92 | 8.58 |
| | Native American | 282 | 0.98 | 0.99 |
| | Asian | 441 | 1.53 | 1.77 |
| | Hispanic | 1,371 | 4.74 | 5.32 |
| | Other | 626 | 2.17 | 2.31 |
| | Missing | 1,357 | 4.70 | 4.68 |
| Education | No high school diploma | 1,517 | 5.25 | 5.40 |
| | GED or high school diploma | 8,134 | 28.14 | 28.87 |
| | Some college or associate degree | 8,561 | 29.62 | 29.42 |
| | College degree | 6,439 | 22.28 | 21.93 |
| | Graduate degree | 3,139 | 10.86 | 10.57 |
| | Missing | 1,112 | 3.85 | 3.82 |
| Hours worked per work | Works > 30 hours/week | 23,955 | 82.88 | 83.42 |
| | Works 20–30 hours/week | 3,170 | 10.97 | 10.41 |
| | Works < 20 hours/week | 1,777 | 6.15 | 6.17 |
| Standard occupation classification | Management (11) | 1,348 | 4.66 | 4.55 |
| | Business/financial (13) | 1,253 | 4.34 | 4.11 |
| | Computer/math (15) | 611 | 2.11 | 2.16 |
| | Architecture/engineering (17) | 529 | 1.83 | 2.05 |
| | Life/physical/social science (19) | 361 | 1.25 | 1.31 |
| | Community/social service (21) | 618 | 2.14 | 2.02 |
| | Legal (23) | 258 | 0.89 | 0.81 |
| | Education/training/library (25) | 2,200 | 7.61 | 7.03 |
| | Arts/sports/media (27) | 707 | 2.45 | 2.41 |
| | Healthcare practitioners (29) | 1,911 | 6.61 | 5.97 |
| | Healthcare support (31) | 736 | 2.55 | 2.34 |
| | Protective services (33) | 564 | 1.95 | 2.19 |
| | Food prep/serving (35) | 1,467 | 5.08 | 5.23 |
| | Building/grounds maintenance (37) | 776 | 2.68 | 2.70 |
| | Personal care/service (39) | 1,096 | 3.79 | 3.63 |
| | Sales (41) | 2,699 | 9.34 | 9.43 |
| | Office/administrative support (43) | 4,742 | 16.41 | 14.81 |
| | Farming/fishing/forestry (45) | 385 | 1.33 | 1.49 |
| | Construction/extraction (47) | 1,459 | 5.05 | 5.87 |
| | Installation/maintenance/repair (49) | 1,217 | 4.21 | 4.89 |
| | Production (51) | 1,968 | 6.81 | 7.15 |
| | Transportation/moving (53) | 1,400 | 4.84 | 5.55 |
| | Military (55) | 208 | 0.72 | 0.87 |
| | Missing | 389 | 1.35 | 1.45 |
| Annual salary | Less than $10,000 | 2,234 | 7.73 | 7.65 |
| | $10,000–19,999 | 3,694 | 12.78 | 12.46 |
| | $20,000–29,999 | 4,654 | 16.10 | 15.93 |
| | $30,000–39,999 | 4,242 | 14.68 | 14.73 |
| | $40,000–49,999 | 2,928 | 10.13 | 10.30 |
| | $50,000 or more | 5,756 | 19.92 | 20.32 |
| | Missing | 5,394 | 18.66 | 18.61 |
| Geographic region | Northeast | 5,438 | 18.82 | 18.79 |
| | South | 4,435 | 26.76 | 23.97 |
| | Midwest | 10,544 | 36.48 | 35.10 |
| | West | 5,181 | 17.94 | 22.13 |

APA, American Productivity Audit.

**TABLE 2**
Estimates of Lost Productive Time per Week for Personal or Family Health Reasons in the APA Sample, Benchmarked to the U.S. Workforce

| Component of LPT | Indicator | Health-Related Reason for LPT | | |
|---|---|---|---|---|
| | | Personal Health | Family Health* | Any Health† |
| Absence time | Mean (SE) in hours/worker/week | 0.54(0.01) | 0.12(0.01) | 0.67(0.02) |
| | Percent with > 0 hours/week | 10.03 | 2.02 | 11.70 |
| | Percent with ≥ 2 hours/week | 8.10 | 2.00 | 9.84 |
| Reduced performance time equivalent | Mean (SE) in hours/worker/week | 1.32(0.02) | — | 1.32(0.02) |
| | Percent with > 0 hours/week | 38.30 | — | 38.30 |
| | Percent with ≥ 2 hours/week | 18.90 | — | 18.90 |
| Total LPT‡ | Mean (SE) in hours/worker/week | 1.86(0.03) | 0.12(0.01) | 1.99(0.03) |
| | Percent with > 0 hours/week | 39.93 | 2.02 | 40.76 |
| | Percent with ≥ 2 hours/week | 23.56 | 2.00 | 24.78 |

* Reduced performance as a result of a family health reason was not assessed.
† Includes personal or family health reasons.
‡ Includes absence time and time equivalent of reduced performance. APA, American Productivity Audit; LPT, lost productive time; SE, standard error.

with a college degree or higher reported less LPT than workers with less education ($P < 0.001$), and those earning less than $10,000 or more than $50,000 per year reported less LPT than workers with intermediate incomes ($P < 0.001$). Workers residing in the northeast or south reported significantly less LPT than workers in the midwest or west ($P < 0.001$).

LPT varied substantially by occupation (data not shown). Workers in architecture and engineering occupations reported the lowest mean LPT (1.35 hours per week). In contrast, those in personal care or service, building grounds maintenance, and installations and repair reported hours of LPT per week that were more than 70% higher than those in occupations with the lowest LPT. Even after adjusting for occupation, there was substantial variation in LPT by job demand–control. Workers in high demand–low control occupations reported the lowest LPT (1.81 hours per week) and those in low demand–high control occupations reported the most (3.32 hours per week) and levels that were significantly ($P < 0.001$) higher than the other 3 groups.

LPT also varied significantly by personal habits (Table 3). LPT increased in relation to amount smoked. The adjusted LPT estimate among those smoking 1 or more packs per day was almost twice as high as that observed for nonsmokers ($P < 0.001$) and significantly ($P < 0.001$) greater than that observed for exsmokers. A somewhat different pattern was observed for alcohol consumption. Workers consuming 1 to 6 alcoholic drinks per week reported the least LPT (1.56 hours per week; $P < 0.001$), with higher mean levels of LPT among both nondrinkers and those consuming 7 or more drinks per week.

A separate analysis was completed to understand variation in absence time for family health reasons (Table 4). Overall, the mean estimates of LPT per week are lower compared with those observed for personal health reasons. The adjusted mean LPT for a family health reason was 78% higher in females than males, significantly ($P < 0.001$) higher in younger (less than 40 years of age) than older workers (≥40 years of age), and lower in those with a college degree ($P < 0.001$) than less formal education. Modest variation was observed by annual salary, although those reporting $50,000 or more had the lowest mean value ($P < 0.001$). Adjusted LPT for family health reasons was higher in the midwest and west than in the northeast or south ($P < 0.001$). LPT for family health was highest for those with low demand–high control jobs ($P < 0.001$), a pattern that mirrors LPT for personal health reasons. Finally, LPT for family health reasons also varied significantly by personal habits (Table 4). LPT increased in relation to amount smoked. The adjusted LPT estimate among those smoking 1 or more packs per day was approximately 75% higher than that observed for nonsmokers and exsmokers ($P < 0.001$). A somewhat different pattern was observed for alcohol consumption. Workers consuming ≥7 alcoholic drinks per week reported the least LPT for a family health reason (0.06 hours per week; $P < 0.001$), with the highest mean levels of family-related LPT among both nondrinkers and those consuming <1 drink per week ($P < 0.001$).

*Cost of Lost Productive Time in the U.S. Workforce.* Using APA data, we estimated the cost of total health-related LPT in the U.S. workforce. These estimates are limited to workers actively engaged in work and amount to $225.8 billion per year. The percent distribution of both LPT and costs are summarized in Table 5 by demographic factors. Differences between the distributions of LPT expressed in hours and in dollars are

**TABLE 3**
Lost Productive Time per Week for a Personal Health Reason in the APA Sample, Benchmarked to the U.S. Workforce

| | | Total LPT | | |
|---|---|---|---|---|
| Characteristic | Category | Crude Mean* (SE) | Adjusted Mean† (SE) | Percent With ≥ 2 LPT hours |
| Gender | Male | 1.65 (0.04)‖ | 1.64 (0.04)‖ | 20.71** |
| | Female | 2.16 (0.04) | 2.14 (0.04) | 26.79 |
| Age | 18–29 | 2.22 (0.06)‖ | 2.21 (0.05)‖ | 29.02** |
| | 30–39 | 2.05 (0.05) | 2.03 (0.05) | 26.16 |
| | 40–49 | 1.81 (0.05) | 1.77 (0.05) | 21.58 |
| | 50–65 | 1.48 (0.05) | 1.48 (0.05) | 17.33 |
| Race/ethnicity | White | 1.82 (0.03)‖ | 1.83 (0.03)‖ | 22.77** |
| | Black | 2.25 (0.10) | 2.26 (0.09) | 27.73 |
| | Native American | 2.39 (0.29) | 2.42 (0.26) | 27.98 |
| | Asian | 1.01 (0.15) | 1.00 (0.20) | 14.83 |
| | Hispanic | 1.98 (0.12) | 2.01 (0.11) | 26.41 |
| | Other | 2.03 (0.22) | 2.06 (0.17) | 25.08 |
| | Missing | 2.46 (0.16) | — | 27.69 |
| Education | No high school diploma | 2.56 (0.13)‖ | 2.57 (0.11)‖ | 29.17** |
| | High school graduate/GED | 1.95 (0.06) | 1.96 (0.05) | 23.59 |
| | Some college/associate degree | 2.01 (0.06) | 2.02 (0.05) | 25.26 |
| | College degree | 1.60 (0.05) | 1.60 (0.06) | 21.21 |
| | Graduate degree | 1.46 (0.10) | 1.48 (0.08) | 19.22 |
| | Missing | 2.57 (0.18) | — | 28.66 |
| Annual salary | Less than $10,000 | 1.76 (0.09)‖ | 1.77 (0.10)‖ | 22.39** |
| | $10,000–19,999 | 2.27 (0.08) | 2.27 (0.07) | 27.83 |
| | $20,000–29,999 | 2.21 (0.06) | 2.21 (0.06) | 27.84 |
| | $30,000–39,999 | 2.09 (0.07) | 2.10 (0.07) | 25.85 |
| | $40,000–49,999 | 1.91 (0.07) | 1.93 (0.08) | 24.84 |
| | $50,000 or more | 1.61 (0.07) | 1.62 (0.06) | 19.92 |
| | Missing | 1.56 (0.07) | 1.32 (0.07) | 18.82 |
| Geographic region | Northeast | 1.74 (0.06)‖ | 1.73 (0.06)‖ | 22.35** |
| | South | 1.76 (0.05) | 1.75 (0.05) | 21.85 |
| | Midwest | 1.96 (0.04) | 1.96 (0.04) | 24.38 |
| | West | 2.05 (0.06) | 2.02 (0.06) | 25.16 |
| Job demand and control | High demand–high control | 2.74 (0.06)‖ | 2.71 (0.05)‖ | 33.24** |
| | High demand–low control | 1.81 (0.04) | 1.81 (0.05) | 23.51 |
| | Low demand–high control | 3.35 (0.12) | 3.31 (0.09) | 40.41 |
| | Low demand–low control | 2.05 (0.09) | 2.06 (0.10) | 27.60 |
| | Missing | 0.01 (0.01) | 0.01 (0.06) | 0.06 |
| Cigarette use | Never smoked | 1.43 (0.05)‖ | 1.45 (0.05)‖ | 17.36** |
| | Exsmoker | 1.72 (0.06) | 1.74 (0.07) | 20.48 |
| | Smokes < 1 pack/day | 2.32 (0.11) | 2.34 (0.09) | 27.41 |
| | Smokes 1 + pack/day | 2.86 (0.13) | 2.85 (0.09) | 29.66 |
| | Missing | 2.02 (0.04) | 1.96 (0.04) | 27.28 |
| Alcohol consumption | Does not drink | 1.87 (0.07)‖ | 1.92 (0.06)‖ | 21.03** |
| | < 1 drink/week | 1.87 (0.07) | 1.87 (0.06) | 22.36 |
| | 1–6 drinks/week | 1.56 (0.06) | 1.56 (0.07) | 19.49 |
| | 7+ drinks/week | 2.13 (0.21) | 2.14 (0.11) | 21.46 |
| | Missing | 2.01 (0.04) | 1.95 (0.04) | 27.19 |

* Benchmarked to the US workforce.
† Adjusted for all other covariates included in Table 3.
‡ $P < 0.05$; § $P < 0.01$; ‖ $P < 0.001$; $F$ test.
¶ $P < 0.05$; # $P < 0.01$; ** $P < 0.001$; "not stated" category excluded from calculation of chi-squared statistic. APA, American Productivity Audit; LPT, lost productive time; SE, Standard error.

explained by variation in the average hourly cost of labor by various subgroups. For example, workers earning $50,000 per year account for 17% of the LPT but 34% of the LPT costs.

## Discussion

Among U.S. workers, we observed that LPT for a personal or family health reason cost U.S. employers at least $226 billion per year in 2002. Relatively few studies have quantified LPT as a result of work absence and reduced performance while at work. Among those that have, lost labor time cost estimates for specific health conditions were substantial.

**TABLE 4**
Lost Productive Time per Week for a Family Health Reason in APA Sample, Benchmarked to the U.S. Workforce*

| Characteristic | Category | Total LPT | | |
|---|---|---|---|---|
| | | Crude Mean† (SE) | Adjusted Mean‡ (SE) | Percent With ≥ 2 LPT hours |
| Gender | Male | 0.09 (0.01)¶ | 0.09 (0.01)¶ | 1.37‡ |
| | Female | 0.16 (0.01) | 0.16 (0.01) | 2.72 |
| Age | 18–29 | 0.15 (0.02)¶ | 0.14 (0.01)¶ | 2.31‡ |
| | 30–39 | 0.17 (0.02) | 0.17 (0.01) | 2.70 |
| | 40–49 | 0.11 (0.01) | 0.11 (0.01) | 1.96 |
| | 50–65 | 0.07 (0.01) | 0.07 (0.02) | 1.02 |
| Race/ethnicity | White | 0.11 (0.01)¶ | 0.11 (0.01)¶ | 1.81‡ |
| | Black | 0.16 (0.03) | 0.16 (0.02) | 2.82 |
| | Native American | 0.21 (0.08) | 0.21 (0.07) | 3.63 |
| | Asian | 0.08 (0.04) | 0.08 (0.05) | 0.92 |
| | Hispanic | 0.20 (0.05) | 0.20 (0.03) | 2.22 |
| | Other | 0.26 (0.11) | 0.27 (0.05) | 2.53 |
| | Missing | 0.19 (0.04) | — | 3.11 |
| Education | No high school diploma | 0.12 (0.02)§ | 0.12 (0.03)¶ | 1.96‡ |
| | High school graduate/GED | 0.15 (0.02) | 0.15 (0.01) | 2.16 |
| | Some college/associate degree | 0.13 (0.01) | 0.13 (0.01) | 2.22 |
| | College degree | 0.09 (0.01) | 0.09 (0.02) | 1.50 |
| | Graduate degree | 0.09 (0.01) | 0.09 (0.02) | 1.56 |
| | Missing | 0.21 (0.04) | — | 3.24 |
| Annual salary | Less than $10,000 | 0.12 (0.02) | 0.12 (0.03)¶ | 2.30‡ |
| | $10,000–19,999 | 0.13 (0.01) | 0.13 (0.02) | 2.44 |
| | $20,000–29,999 | 0.16 (0.02) | 0.16 (0.02) | 2.36 |
| | $30,000–39,999 | 0.14 (0.02) | 0.14 (0.02) | 1.89 |
| | $40,000–49,999 | 0.15 (0.04) | 0.15 (0.02) | 2.29 |
| | $50,000 or more | 0.10 (0.02) | 0.10 (0.02) | 1.46 |
| | Missing | 0.10 (0.01) | 0.08 (0.02) | 1.78 |
| Geographic region | Northeast | 0.10 (0.01) | 0.10 (0.02)¶ | 1.76‡ |
| | South | 0.11 (0.01) | 0.10 (0.02) | 1.94 |
| | Midwest | 0.14 (0.01) | 0.13 (0.01) | 2.11 |
| | West | 0.15 (0.02) | 0.15 (0.02) | 2.09 |
| Job demand and control | High demand–high control | 0.16 (0.02)¶ | 0.16 (0.01)¶ | 2.61‡ |
| | High demand–low control | 0.15 (0.01) | 0.14 (0.01) | 2.33 |
| | Low demand–high control | 0.21 (0.03) | 0.21 (0.02) | 3.15 |
| | Low demand–low control | 0.12 (0.02) | 0.12 (0.03) | 2.13 |
| | Missing | 0.00 (0.01) | 0.00 (0.02) | 0.04 |
| Cigarette use | Never smoked | 0.09 (0.01)¶ | 0.09 (0.01)¶ | 1.50‡ |
| | Ex smoker | 0.08 (0.01) | 0.08 (0.02) | 1.46 |
| | Smokes < 1 pack/day | 0.13 (0.03) | 0.13 (0.03) | 1.96 |
| | Smokes 1+ pack/day | 0.14 (0.02) | 0.14 (0.03) | 1.96 |
| | Missing | 0.17 (0.02) | 0.16 (0.01) | 2.59 |
| Alcohol consumption | Does not drink | 0.10 (0.01)¶ | 0.11 (0.02)¶ | 1.69‡ |
| | < 1 drink/week | 0.11 (0.01) | 0.11 (0.02) | 1.88 |
| | 1–6 drinks/week | 0.09 (0.02) | 0.09 (0.02) | 1.35 |
| | 7+ drinks/week | 0.06 (0.02) | 0.06 (0.03) | 1.05 |
| | Missing | 0.17 (0.02) | 0.16 (0.01) | 2.58 |

* Absence time only; reduced performance as a result of a family health reason was not assessed.
† Benchmarked to the US workforce.
‡ Adjusted for all other covariates included in Table 4.
§ $P < 0.05$; ‖$P < 0.01$; ¶$P < 0.001$; $F$ test.
# $P < 0.05$; **$P < 0.01$; ‡$P < 0.001$; "not stated" category excluded from calculation of chi-squared statistic. APA, American Productivity Audit; LPT, lost productive time; SE, standard error.

Previous studies indicated that the most costly conditions tended to be common ones such as allergic rhinitis at a cost of $7.7 billion per year,[20,21] migraine at a cost of $13 billion per year,[6] and depression at a cost of $44.0 billion per year.[30]

Based on APA data, we estimated that employers lose an average of $1685 or more per employee per year because of health-related LPT. By comparison, in 2001, employers spent approximately $2606 per year on health insurance premiums for the average employee (ie, not including

**TABLE 5**
Estimates of Total Annual Health-Related Lost Productive Time and Concomitant Costs in the U.S. Workforce

| | | Lost Productive Time (millions of hours per week) | | Cost equivalent of lost productive time (billions of dollars per year) | |
|---|---|---|---|---|---|
| **Characteristic** | **Category** | **Hours** | **Percent** | **Dollars** | **Percent** |
| Gender | Male | 120.32 | 46.14 | 117.22 | 51.92 |
| | Female | 140.47 | 53.86 | 108.53 | 48.07 |
| Age | 18–29 | 78.28 | 30.01 | 52.34 | 23.19 |
| | 30–39 | 69.81 | 26.77 | 61.89 | 27.42 |
| | 40–49 | 64.28 | 24.65 | 62.73 | 27.79 |
| | 50–65 | 48.43 | 18.57 | 48.78 | 21.61 |
| Race/ethnicity | White | 192.43 | 73.79 | 161.60 | 71.58 |
| | Black | 26.66 | 10.22 | 18.86 | 8.36 |
| | Native American | 3.36 | 1.29 | 2.08 | 0.92 |
| | Asian | 2.52 | 0.97 | 2.42 | 1.07 |
| | Hispanic | 15.02 | 5.76 | 11.08 | 4.91 |
| | Other | 6.51 | 2.49 | 6.69 | 2.96 |
| | Missing | 14.30 | 5.48 | 23.02 | 10.20 |
| Education | No high school diploma | 18.30 | 7.02 | 9.82 | 4.35 |
| | High school graduate | 78.44 | 30.08 | 51.94 | 23.01 |
| | Some college or associate degree | 81.94 | 31.42 | 63.45 | 28.11 |
| | College degree | 48.56 | 18.62 | 52.37 | 23.20 |
| | Graduate degree | 21.50 | 8.24 | 27.20 | 12.05 |
| | Missing | 12.05 | 4.62 | 20.97 | 9.29 |
| Annual salary | Less than $10,000 | 18.34 | 7.03 | 3.37 | 1.49 |
| | $10,000–19,999 | 39.19 | 15.03 | 14.99 | 6.64 |
| | $20,000–29,999 | 49.41 | 18.95 | 27.57 | 12.21 |
| | $30,000–39,999 | 42.93 | 16.46 | 31.57 | 13.98 |
| | $40,000–49,999 | 27.79 | 10.66 | 26.38 | 11.69 |
| | $50,000 or more | 45.50 | 17.45 | 77.23 | 34.21 |
| | Missing | 37.64 | 14.43 | 44.63 | 19.77 |
| Geographic region | Northeast | 44.79 | 17.17 | 41.67 | 18.46 |
| | South | 58.19 | 22.31 | 47.82 | 21.18 |
| | Midwest | 94.99 | 36.43 | 76.53 | 33.90 |
| | West | 62.82 | 24.09 | 59.72 | 26.45 |
| Standard occupation classification | Management (11) | 11.12 | 4.27 | 14.70 | 6.51 |
| | Business/financial (13) | 10.82 | 4.15 | 13.62 | 6.03 |
| | Computer/math (15) | 5.65 | 2.17 | 7.53 | 3.33 |
| | Architecture/engineering (17) | 3.68 | 1.41 | 4.83 | 2.14 |
| | Life/physical/social science (19) | 2.40 | 0.92 | 2.54 | 1.12 |
| | Community/social service (21) | 6.22 | 2.38 | 6.30 | 2.79 |
| | Legal (23) | 2.61 | 1.00 | 3.85 | 1.71 |
| | Education/training/library (25) | 13.83 | 5.30 | 12.90 | 5.71 |
| | Arts/sports/media (27) | 6.37 | 2.44 | 5.58 | 2.47 |
| | Healthcare practitioners (29) | 13.95 | 5.35 | 12.95 | 5.74 |
| | Healthcare support (31) | 6.95 | 2.66 | 4.77 | 2.11 |
| | Protective services (33) | 4.55 | 1.74 | 4.04 | 1.79 |
| | Food prep/serving (35) | 14.74 | 5.65 | 7.98 | 3.53 |
| | Building/grounds maintenance (37) | 8.06 | 3.09 | 5.76 | 2.55 |
| | Personal care/service (39) | 11.27 | 4.32 | 6.07 | 2.69 |
| | Sales (41) | 24.98 | 9.58 | 20.14 | 8.92 |
| | Office/administrative support (43) | 44.12 | 16.92 | 33.06 | 14.64 |
| | Farming/fishing/forestry (45) | 3.71 | 1.42 | 2.65 | 1.17 |
| | Construction/extraction (47) | 14.81 | 5.68 | 13.71 | 6.07 |
| | Installation/maintenance/repair (49) | 14.13 | 5.42 | 12.41 | 5.50 |
| | Production (51) | 18.74 | 7.19 | 15.26 | 6.76 |
| | Transportation/moving (53) | 14.22 | 5.45 | 11.97 | 5.30 |
| | Military (55) | 2.54 | 0.97 | 2.03 | 0.90 |
| | Missing | 1.33 | 0.51 | 1.10 | 0.49 |

Continued

**TABLE 5 CONTINUED**
Estimates of Total Annual Health-Related Lost Productive Time and Concomitant Costs in the U.S. Workforce

| | | Lost Productive Time (millions of hours per week) | | Cost equivalent of lost productive time (billions of dollars per year) | |
|---|---|---|---|---|---|
| Characteristic | Category | Hours | Percent | Dollars | Percent |
| Job demand and control | High demand–high control | 125.88 | 48.27 | 116.66 | 51.68 |
| | High demand–low control | 72.23 | 27.70 | 63.39 | 28.08 |
| | Low demand–high control | 41.75 | 16.01 | 31.63 | 14.01 |
| | Low demand–low control | 20.70 | 7.94 | 13.85 | 6.13 |
| | Missing | 0.24 | 0.09 | 0.22 | 0.10 |
| Smoking status | Never smoked | 55.76 | 21.38 | 49.32 | 21.85 |
| | Exsmoker | 37.90 | 14.53 | 33.14 | 14.68 |
| | Smokes < 1 pack/day | 25.15 | 9.64 | 17.37 | 7.70 |
| | Smokes 1 + pack/day | 30.10 | 11.54 | 22.64 | 10.03 |
| | Missing | 111.88 | 42.90 | 103.27 | 45.74 |
| Alcohol consumption | Does not drink | 47.18 | 18.09 | 34.20 | 15.15 |
| | < 1 drink/week | 53.97 | 20.69 | 43.47 | 19.26 |
| | 1–6 drinks/week | 32.53 | 12.47 | 29.92 | 13.25 |
| | 7+ drinks/week | 15.21 | 5.83 | 14.64 | 6.49 |
| | Missing | 111.91 | 42.91 | 103.50 | 45.85 |
| Total | | 260.79 | 100.00 | 225.75 | 100.00 |

* $P < 0.05$; † $P < 0.01$; ‡ $P < 0.001$; "not stated" category excluded from calculation of chi-squared statistic.

dependents).[40,41] A major share of the latter was attributable to chronic conditions in older workers, in whom the cost per individual can be substantial. In contrast, an increasing number of studies indicate that common acute or chronic episodic health conditions account for a majority of health-related LPT costs in the workplace. This pattern is consistent with our results. We found that common self-reported health conditions including pain (eg, from headache, low back pain, or arthritis), the flu or common cold, symptoms suggestive of a depressive disorder (eg, sad and blue, fatigue), allergic rhinitis, and gastrointestinal complaints were the most costly in terms of LPT during the previous 2 weeks (data not shown). Although the LPT costs resulting from these conditions at the individual level are modest, population-level costs are substantial because prevalence is relatively high.

Our results indicate that reduced performance at work was the dominant source of health-related LPT in the U.S. workforce. On average, 71% of all health-related LPT was the result of reduced performance. The ratio of reduced performance LPT to work absence LPT was 2.4, with only modest variation among demographic subgroups (eg, 2.1 for workers 50–65 years of age, 2.7 for workers with a college degree). This dominant role of reduced performance LPT is supported by previous research on specific health conditions. For a variety of common conditions, a substantial share of LPT was explained by reduced performance, not work absence.[1–3,5,6,20,21,24,27,31,33,34]

Employers routinely document the time that employees are absent from work because it is tangible and has a known cost even though many cannot determine the reason for the absence. Few employers document health-related LPT while at work, making it largely invisible. Moreover, because reduced performance is not as tangible as an observed work absence, employers could question whether reduced performance LPT is, in fact, dominant. This finding, however, is consistent with other data. Specifically, our data indicate that on any given day, relatively few workers are absent from work. Also, we found that 78.5% of APA respondents reported at least 1 health condition in the 2 weeks before being interviewed. Given that health conditions are highly prevalent in the workforce and that work performance is impaired in a substantial proportion of workers with common conditions, it is not surprising that a majority of the health-related LPT we observed results from reduced performance while at work.

LPT and LPT costs varied substantially in the workforce. The greatest variability was observed by tobacco use, job demand and control, and gender. Cigarette smoking is the most widely studied health risk factor and a dominant cause of morbidity and mortality. Previous cost estimates of lost productivity resulting from smoking focused on years of productive life lost. In particular, between 1995 and 1999, the average annual cost of mortality-related productivity losses attributable to smoking for adults in the U.S. population was $81.9 billion.[42] Although an important societal cost, mortality-related productivity losses do not inform employers about the costs of smoking in their active workforce. We found that workers who reported

smoking ≥1 pack of cigarettes per day had approximately 2 times more LPT per week than workers who reported never smoking. This difference in LPT translates into a substantial excess LPT cost for heavy and even moderate smokers and indicates that more aggressive investment in smoking cessation programs could offer employers a considerable return on investment when the combined savings in LPT and direct medical costs are considered.

Previous studies have shown that job characteristics, including demand and control, have a long-term effect on the risk of cardiovascular disease (CVD).[43] Workers in high-demand, low-control jobs (ie, considered to be highly stressful) were observed to have the highest risk of CVD.[44] A different relationship, however, was observed between job demand–control and LPT. High-demand, low-control jobs were associated with the lowest average LPT per week; low-demand, high-control jobs were associated with the highest average LPT per week. This pattern suggests that higher levels of worker control can lead to higher levels of LPT (mean LPT was also elevated for workers in high-demand, high-control jobs) because workers in these types of jobs can more easily adjust their work pace to correspond to how well they feel. We empirically tested this hypothesis by calculating the LPT ratio of reduced performance to work absence in the 4 job demand–control groups. As expected, the observed ratios were higher for high-control jobs (ie, low-demand, high-control ratio = 2.78; high-demand, high-control ratio = 2.64) than low-control jobs (ie, high-demand, low-control ratio = 2.03; low-demand, low-control ratio = 2.24) indicating that workers with high-control jobs lose a disproportionate share of LPT while at work compared with workers with low-control jobs. Note that workers in high-control jobs also miss more hours of work, on average, than workers in low-control jobs. One possible explanation for this finding is that individuals in high-control jobs could go to work when not feeling well which, in turn, delays their recovery from acute conditions.

We also observed that LPT for females was approximately 30% higher than for males. Four factors are likely to explain part of the gender difference. First, common health conditions that can cause LPT (eg, depression, anxiety, migraine headache, and gastrointestinal disorders) are more common in females than males.[6,27,30,32,45–47] Among these, depression and migraine headache are the most costly.[6,27,48] Second, more often than not, females assume the role of primary caregiver in the family. Our data clearly indicate that women incur a disproportionate share of family health-related LPT. As a result, women could be exposed more frequently to highly transmissible agents that can lead to the cold, flu, and other infections. In fact, we found that the prevalence of self-reported cold or flu in the previous 2 weeks was significantly higher in women than in men 18 to 45 years of age (ie, 19.4% vs. 16.5%; $P < 0.001$). Third, menstrual pain can lead to periodic short-term reduced work performance. Finally, compared with men, women are more likely to seek outpatient medical care for a health condition,[49] potentially leading to more time absent from work.

Time absent from work for a family health reason accounted for 6% of all health-related LPT (ie, personal and family health). However, it is likely that we underestimated total LPT for a family health reason because we did not capture reduced performance while at work for a family health reason (eg, time spent in scheduling doctor visits, lost concentration, and so on). Nonetheless, although the population impact of family health on LPT is modest, the individual impact is substantial. Most of the absence time occurs in women between 18 and 45 years of age, and based on self-reported information, a majority of this time was devoted to caring for a child, not a parent. Among those who lose time for a family health reason, the average LPT is 6.99 hours per week. This finding is particularly relevant for employers with workforces comprised predominantly of younger females. Depending on how the health benefit is structured, employers can incur an overall cost benefit by engaging support systems for their employees designed to minimize the time required to manage pediatric health conditions.

Our estimate of $226 billion in health-related LPT does not include costs from 3 other causes. First, we do not account for disability that leads to continuous absence of 1 week or more. Second, the WHI was designed to focus only on estimating work loss incurred by the individual workers who reported a health condition during the recall period. We viewed this source of work loss as the primary driver of employers' costs associated with lost productive work time. We recognize that health-related LPT estimates could be refined by considering other factors such as the hiring and training of replacement workers or the institutional effect among coworkers.[50] Taking these other factors into consideration could increase, decrease, or have no net effect on health-related LPT cost estimates. Third, estimating current LPT as a result of longstanding chronic conditions like diabetes is challenging because workers can adjust their performance expectations over time and as a condition progresses. This perceptual accommodation makes it difficult to accurately ascertain the impact of a chronic condition on work in the recent past through self-report. An accurate estimate of work impact would require that an individual compare their recent work performance to that before the onset of the chronic condition. Analyses are underway using other data (ie, quality of life, changes in work performance since onset of a chronic illness) to

examine the potential underestimation of LPT linked to accommodation from chronic progressive conditions.

Workers also lose productive work time for non-health related reasons.[51] Broadly speaking, these include work life issues such as problems with childcare and continuing education. Although the first year of APA data collection focused on quantifying health-related LPT, we expanded the focus of the WHI in year 2 to also capture data on nonhealth-related LPT. This broader focus will allow us to estimate the relative LPT costs from health conditions versus other causes and provide employers with evidence on the relative benefits of providing workers with support systems that minimize LPT.

In closing, to fully understand workforce LPT resulting from illnesses and a course of action, employers need information on the illnesses that are most common in their workforce, the LPT costs associated with these illnesses, and the quality of health care that is provided to manage these illnesses. The first 2 issues can be addressed indirectly using the APA database. We have been working with employers to project their annual health-related LPT costs using data from the APA. We model an employer's LPT using a direct adjustment procedure that derives stratum- and condition-specific estimates of prevalence and mean LPT per week from the APA, and applies them to the age and gender distribution of the employer's workforce. LPT (in hours) is translated to dollars using age- and gender-specific wage data from the employer. Other employer-specific covariates such as hours worked per week are also used, if available, to refine the estimates. This is a first step to provide employers with a more concrete understanding of the costs they face from health conditions in their workforce and to begin to consider how healthcare dollars can be more effectively targeted to population specific needs.

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