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RESEARCH ARTICLE

Workplace Productivity Cost Associated With Psychological Distress in the United States

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ABSTRACT

Introduction: Psychological distress (PD) is negatively associated with workplace productivity.

Objective: To estimate the potential workplace productivity cost of PD related to absenteeism and presenteeism in the United States, and to break down this cost by broad industry sector.

Method: We used data from the 2021 National Health Interview Survey, which included questions on absenteeism and presenteeism, and applied a human capital approach to quantify absenteeism and presenteeism cost associated with PD. We measured PD using the Kessler Psychological Distress Scale (K6) and categorized the presence or severity of PD as: no (K6 = 0), mild (K6 = 1–4), moderate (K6 = 5–12), and severe (K6 ≥ 13) PD. We used workers reporting no PD as the reference group. Our regression models included sociodemographic, economic, health, and workplace covariates.

Results: In 2021, 16,356 sampled adults represented 151 million US workers. Among these workers, 3.8 million (2.5%) reported experiencing severe, 24.0 million (15.9%) moderate, and 57.4 million (38.0%) mild PD. Our regression estimates suggest that the total PD-related absenteeism and presenteeism cost that year was between United States Dollars (USD) 90.1 and 118.2 billion, excluding additional costs related to injury, turnover, disability claims, and early retirement. We also observed statistically significant differences in estimated total and per-worker cost of PD across seven broad industry sectors. Total PD-related cost was highest in the services sector (USD 53.9 billion), followed by healthcare and social assistance (USD 19.7 billion) and wholesale and retail trade (USD 12.4 billion). On a per-worker basis, we observed the highest cost in healthcare and social assistance (USD 950), services (USD 732), and wholesale and retail trade (USD 731).

Conclusion: Our findings showed large and uneven burden of PD across different industries manifested through absenteeism and presenteeism. This burden may be reduced, and productivity enhanced, through improvement in work organization, the implementation of psychosocial risk management strategies, and the expansion of mental health interventions. Investments in workplace mental health may generate returns comparable to other capital investments largely through lowering absenteeism and presenteeism costs.

1 | Introduction

Mental health conditions have become an increasing concern for employers [1–3], educational and community institutions [4], and society at large [5–7]. Even though the definitions and measurement of mental health conditions vary across studies, there is evidence of their high burden. Globally, mental disorders were associated with 418 million disability-adjusted life years and an estimated economic cost of approximately United States Dollars (USD) 5 trillion in 2019 [8]. The literature shows that mental health conditions are among the leading

contributors to workplace costs, particularly through absenteeism and presenteeism [9]. Absenteeism refers to any instance in which a worker is not working during scheduled work hours regardless of the reason, and presenteeism refers to continuing to work while ill which may affect the quality of the work performed [10]. Both are thought to lead to reduced productivity [9–11]. Moreover, the negative impact of physical health conditions on productivity is often exacerbated when these conditions co-occur with psychological distress (PD) [12]. PD, which includes depression and anxiety, is often included in national health surveys [13–16].

The COVID-19 pandemic brought renewed attention to the significance of PD [17]. The percentage of US adults reporting severe PD surged from 3.4% in 2018% to 27.7% in April 2020 [18]. Studies have also shown the distribution of PD by sex, age, and family income in 2021 [19, 20]. Poor psychosocial working conditions and suboptimal work organization have been shown to independently contribute to PD among workers [21, 22]. Specific contributing factors include limited skill utilization opportunities, low decision-making authority, high work demands, time pressures, interpersonal conflict, harassment, job insecurity, long working hours, irregular schedules, inadequate compensation or recognition, major organizational changes, and low levels of social support [10, 21–24].

Numerous reviews have identified associations between PD or the presence of mental disorders and productivity losses through both absenteeism and presenteeism, including those by de Oliveira et al. (2023) and Burton et al. (2008) [9, 25, 26]. However, de Oliveira et al. (2023) concluded that the majority of the studies examined were not causal and only measured associations, only three of the studies examined were of high quality, and only two of these found a positive but small effect [18]. Both clinical depression [27] and PD [28] have been significantly associated with self-reported absenteeism. Emotional well-being also plays a role in absentee behavior [29]. In addition, the burden of PD may be greater for blue-collar compared with white-collar workers [30]. PD has also been strongly linked to presenteeism [28, 31–33]. Workplace psychosocial hazards include aspects of work design, management practices, organizational culture, and employment conditions [34]. These hazards can increase the risk of stress, depression, burnout, and other mental health problems, including suicide [35]. They are now considered as modifiable contributors to mental health conditions and treated as such in some occupational health policies.

While a thorough literature review of the causes and associated costs of psychological distress is outside the scope of this paper, we summarize several important studies and briefly mention some of the data and methods used because the ways they assessed cost varied widely. A meta-review of 72 studies by Niedhammer et. al. [36] mainly showed significant associations between adverse psychosocial work exposures and cardiovascular disease and mental health, particularly depression. This review also found that additional workplace psychosocial factors such as job strain, job insecurity, and long working hours were also associated with health outcomes such as obesity, diabetes, anxiety and use of psychotropic medication [36]. A recent study by Keramat [15] used 2007-2021 longitudinal data from the Household Income and Labor Dynamics in Australia Survey with 70,973 person-year observations from 18,729 unique working adults to access levels of psychological distress and productivity loss as measured through sickness absence, presenteeism and underemployment. They found that moderate and high psychological distress was associated with a higher rate of sickness absence, presenteeism, and underemployment when a working adult shifted from low psychological distress, after controlling socio-demographic, health, and employment-related characteristics.

Goh et al. [37] conducted a meta-analysis, using 228 studies published during 1970–2011, to assess the impact of workplace stressors on health outcomes that included self-rated poor (physical) health, self-rated poor mental health, physician-diagnosed health conditions, and death. Among other results, they found that job insecurity increased the odds of reporting poor health by about 50%, high job demands increased the odds of having a physician-diagnosed illness by 35%, and long work hours increased mortality by almost 20%. In another related study based on this work, they estimated that in 2008 there were 120,000 excess deaths constituting 5%–8% of the total national healthcare expenditure [38]. They used workplace stressors and workplace conditions that might mitigate the negative effects of job stressors, including whether a person is employed at all. Their model focused on the US civilian labor force in 2010. They estimated health outcomes using pooled Medical Expenditure Panel Study (MEPS) data from 2004 to 2008 and computed the probability of death using CDC Vital Statistics data from 2009, adjusting upward the 2008 total health care expenditure from MEPS using data from the National Health Expenditure accounts by the Centers for Medicare and Medicaid Services. A subsequent study by Goh et al. [39] assessed the potential reduction of the burden of workplace stress on worker health by comparing US and European estimates of health care costs and mortality from workplace stress. They used total healthcare costs from workplace exposure in 2010 and estimated 17,000 preventable workplace-attributable deaths, finding that the United States would spend approximately $44 billion less on health care costs related to potentially preventable workplace stress if its workplace policies were comparable to those of a European country of similar wealth. Their results suggest that focusing policy interventions on the workplace could reduce U.S. health care costs.

Several European Union countries have adopted structured approaches—including regulations and risk assessments—to address psychosocial hazards in the workplace [40]. However, interventions have often focused more on individual-level solutions such as stress management and resilience training rather than organizational-level changes such as improving work design and management practices, possibly missing opportunities to prevent PD [41]. Backes et al. [42] conducted a systematic review and meta-analysis of occupational health interventions across health-related absenteeism and economic outcomes. They found non-significant reductions in absenteeism, however, although not directly measured, reporting improvements in presenteeism or return on investment. These interventions included mental health, physical health, nutrition or, workplace atmosphere. They recommend that future research measure presenteeism directly.

The overall economic burden of work-related psychosocial hazards—including injury, illness, disability, and productivity loss—is expected to surpass that of other occupational hazards [43]. In response, some investigators have called for greater attention to the cost of work-related psychosocial hazards [43].

The present study contributes to this effort in at least three ways. First, we estimated the workplace productivity cost of PD in the United States, using nationally representative data collected in 2021 that included information on both absenteeism and presenteeism; this was the only year that this survey included a question on presenteeism, albeit narrowly defined as related to being physically ill. Specifically, we quantified the cost associated with PD in 2021 due to absenteeism (missed workdays because of illness) and presenteeism (working while ill). Second, we disaggregated this cost by severity of PD (mild, moderate, and severe). Finally, we disaggregated cost across seven broad industry sectors as Alterman et al. [44] showed that workplace psychosocial risk factors differed by industry.

2 | Method

2.1 | Data

We used publicly available sample adult data from the 2021 National Health Interview Survey (NHIS) [45]. This activity was reviewed by CDC, deemed not human subjects research, and was conducted consistent with applicable federal law and CDC policy. NHIS collects yearly information on health status, access to healthcare services, health behaviors, sociodemographic characteristics, and employment status. Occupation and industry are asked in two out of every three years from sampled adults. In 2021, the National Institute for Occupational Safety and Health (NIOSH) sponsored additional questions on the number of days absent from work due to illness and number of days worked while ill. We considered sample adults who worked and ascertained their working status in the week before the survey using variable EMPWRKLSW1_A (see Appendix A).

2.2 | Measurement of Variables

In line with the literature in this area, we used absenteeism and presenteeism cost to estimate the workplace productivity cost associated with PD [14–16]. We measured absenteeism by the number of workdays missed due to illness, using the 2021 NHIS question "During the past 3 months, about how many days of work did you miss because you were ill or because there was a chance you had COVID-19?" We measured presenteeism by the number of days having worked while ill during the 3 months before the interview, using the question "During the past 3 months, how many days did you work while physically ill?" We derived the reduction in productivity due to presenteeism using information from the literature. See the Analytical Method section below.

We measured the independent variable – PD in the past month – using the Kessler-K6 scale [46]. We excluded participants who did not complete the scale. The appropriateness, utility, and performance of this scale has been supported by the literature [46–49]. Sampled adults answered six questions that can be used to measure PD: "During the past 30 days, how often did you feel (1) so sad that nothing could cheer you up, (2) nervous, (3) restless or fidgety, (4) hopeless, (5) everything was an effort, and (6) worthless." To score responses, we used the 5-point Likert scale provided by the NHIS that ranged from "none of the time" to "all the time." The K6 scale ranges from 0 to 24, with 0 indicating no PD, and 24 indicating the highest level of PD. Most of the studies in this area considered only severe or moderate PD [30, 49, 50]. Generally, K6 ≥ 13 is considered as severe and K6 from 5 to 12 as moderate PD [51, 52]. In this study, in addition to moderate and severe PD, we considered mild or low PD. We divided the K6 scale into four categories: no PD (K6 = 0), mild PD (K6 = 1 to 4), moderate PD (K6 = 5 to 12), and severe PD (K6 ≥ 13). Though the cut-off points may be different, four similar categories of PD have been used by other researchers. For an example, see Forman-Hoffman et al. (2014) [53]. We used workers in the no PD category as the reference group.

Sociodemographic, economic, health, and workplace factors may affect the association between PD and absenteeism and presenteeism. To control for the effect of these factors, we included the following sociodemographic covariates in our analysis: sex; age-group in years (18–24, 25–34, 35–44, 45–54, 55–64, 65–74, and 75 +); race and ethnicity (White non-Hispanic, Black non-Hispanic, Asian non-Hispanic, Hispanic, American Indian and Alaska Native (AIAN) and any other race group, and Other non-Hispanic); marital status (married or living with partner, widowed, divorced or separated, and never married); and education (less than high school diploma, high school or GED diploma, some college, associate degree, and BA/BS degree or higher). We also included family income and workplace covariates. We measured family income using the family poverty status variable (RATCAT_A, single imputed value) expressed as a ratio of family income to poverty threshold for sample adults' family, and grouped into three categories: < 100%, 100%–200%, and > 200%. The workplace variables included employment category or class of worker (private industry, government, self-employed in own business, contractor), and access to paid sick leave. With some adjustments, we also included seven industry sectors in line with the seven broad National Occupational Research Agenda (NORA)|NORA|CDC industry sectors (agriculture, forestry, fishing, and hunting (agriculture); construction; healthcare and social assistance; manufacturing; services; transportation, warehousing, and utilities; and wholesale and retail trade). Due to their small sample sizes, we excluded mining and oil and gas industries, and we included public safety in the services industry. We included the following health-related covariates: self-reported responses to a question asking whether a doctor or health professional had ever told the respondent they had coronary heart disease, asthma, any type of cancer, diabetes, or arthritis. We also included as covariates injury in the past 3 months including injuries due to repetitive strain, body mass index (normal weight, overweight, and obese), and geographical region (Northeast, Midwest, South, and West). We used the number of hours worked in the past week as an exposure variable (see the analytical method section below). In the descriptive analysis, we determined statistical significance according to non-overlapping confidence intervals.

2.3 | Analytical Method

To estimate workplace productivity cost associated with PD, we used a human capital method [54]. Based on economic theory, the human capital approach estimates the workplace cost as the product of missed or reduced productivity workdays and the worker's marginal productivity, usually approximated by wages and "fringe" or nonwage benefits [30, 55–59]. In this study, we used the following steps for analyses.

First, we estimated the number of missed workdays, and the number of days worked while ill that were associated with PD. A commonly used method to estimate these numbers is to run a count regression model using the number of workdays missed due to illness or the number of days worked while ill as outcome variables and the independent variable (in our case PD), controlling for covariates. Covariates are included to increase precision and accuracy and to control for variables that distort the true relationship between the outcome and the independent variable. In this study, we used a negative binomial regression model because both outcome variables (number of workdays missed due to illness and number of days worked while ill) were overdispersed. We used the number of hours worked per week as an exposure variable to control the likelihood that those who work full-time have more opportunity to both miss work and work while ill compared with part-time workers (see Hutchinson, 2005) [60]. Then we estimated the number of workdays missed and the number of days worked while ill in the past 3 months associated with mild, moderate, and severe PD level, controlling for variables that were likely to be correlated with workdays missed and days worked while ill. We used workers who reported not experiencing PD as the reference group. We multiplied these estimated numbers of days by four to compute the annual number of workdays missed and the number of days worked while ill that were associated with PD. Similar approaches have been used in previous studies [28, 58, 59, 61–64]. While we could not control for seasonality effects on all the variables we used, we checked the monthly variation in workdays missed and days worked while ill to assess seasonality effects on these variables.

We then estimated the percentage of productivity loss associated with presenteeism. The literature shows a minimum productivity loss of 9.3% and a maximum productivity loss of 52% for presenteeism [11, 65–68]. In this study, we used 9.3%, the minimum productivity loss for mild PD and 15% mean productivity loss for moderate PD from Goetzel et al. (2004) [69]. For severe PD, we used the 35% productivity loss associated with depression reported in a review of five studies by Lerner and Henke (2008) [70]. We next estimated the marginal productivity of labor to monetize losses due to absenteeism and presenteeism. As indicated above, previous studies have estimated the marginal productivity of labor using the median wage rate and benefits. In this study, instead of the overall median wage rate, we used the sex-, education-, and occupation-adjusted median hourly earnings computed from the 2021 Current Population Survey (CPS) data (https://www.census.gov/programs-surveys/cps.html) and added 31% of nonwage benefits on these earnings [71]. When we estimated cost by broad industry group, we computed the sex, education, and occupation-adjusted wage rates for each broad industry group.

We used the following equations to estimate the workplace absenteeism and presenteeism cost associated with PD.

$$\mathrm{CA} = (\mathrm{ADW}) \sum_{s} 4(A_{s3m} \times W_{s3m})$$

$$CP = (\mathrm{ADW}) \sum_{s} 4L_s(P_{s3m} \times W_{s3m})$$

Where:

CA is total cost of absenteeism associated with PD, s is severity of PD (mild, moderate, severe), ADW is the median daily wage rate including benefits, A_{s3m} is estimated number of days absent from work associated with s PD in the past 3 months, $W_{s3m}$is number of workers with s PD in the past 3 months,

CP is the total cost of presenteeism associated with PD, L_s is median productivity loss of s PD associated with presenteeism, and P_{s3m} is estimated number of days worked while ill associated with s PD in the past 3 months.

Total workplace absenteeism and presenteeism cost associated with PD will then be $CA + CP$.

We also conducted a sensitivity analysis using two scenarios. First, we used a mean 15% productivity loss associated with presenteeism for all groups that reported having experienced PD. Second, instead of the stratified median wage rate, we used the unadjusted median hourly earnings in 2021 and added 31% of nonwage benefits. Because the use of stratified median wages reduces the estimated cost of an illness for lower paid workers and undermines the positive effect of preventive interventions, some previous studies have also used non-stratified median earnings [72].

3 | Results

The 2021 NHIS adult file included 29,482 respondents. We excluded 12,043 respondents who replied "no" and 978 respondents who replied "don't know" to the "worked last week" question. We excluded 105 respondents who did not complete all the questions we used to compute Kessler's K6 PD scale. In the regression analyses, we excluded 1019 respondents with missing information for any of the covariates shown in Table 2. The final sample size in the absenteeism and presenteeism regressions varied slightly due to item-level nonresponse for the absenteeism and presenteeism questions. In the absenteeism regressions, we excluded 291 and in the presenteeism regression 202 respondents with missing responses. See Appendix A for the sample size and exclusion details. After applying survey weights, 16,356 included respondents represented approximately 151.0 million workers in the U.S. in 2021. Our descriptive statistipresented in Table 1 below showed that 2.5% of workers reported severe PD, representing an estimated 3.8 million working adult population. In addition, 15.9% and 38.0% reported moderate and mild PD, representing an estimated 24.0 and 57.4 million working adult population, respectively.

The distribution of PD level by sociodemographic, economic, health, and workplace characteristics is presented in Table 2. More female and never-married workers reported experiencing PD compared with males and married or widowed, divorced, or separated workers. The prevalence of reporting PD decreased with age before slightly increasing for those 74 and older. It also increased with educational attainment through some college, then decreased at the associate degree level before increasing again. Compared with government and private sector workers, self-employed workers reported lower prevalence of PD. Workers in healthcare and social assistance, services, and wholesale and retail trade reported the three highest prevalences of PD compared with workers in other sectors. Workers who reported that a healthcare professional had ever told them they had asthma, cancer, or arthritis also reported experiencing a higher prevalence of PD compared with those who did not report having been told they had these chronic

TABLE 1 | Estimated worker population and prevalence of psychological distress (PD), 2021.

Variables	Unweighted sample size	Estimated weighted working adult population (In thousands)	Estimated weighted prevalence of PD (%)
Total	16,356	151,036	
No PD (K6 = 0)	7037	65,763	43.5
Mild PD (K6 = 1 to 4)	6295	57,445	38.0
Moderate PD (K6 = 5 to 12)	2625	23,988	15.9
Severe PD (K6 > = 13)	399	3840	2.5

conditions. Workers reporting family income as a percentage of the federal poverty level above 200% reported the lowest prevalence of moderate or severe PD compared with those at other poverty levels.

In 2021, 18.3% of workers reported at least one missed workday due to illness in the past 3 months (not reported in a table). Table 3 shows that the percentage of workers reporting missing at least one workday increased with the severity of reported PD. While 37.2% and 26.7% of workers with severe and moderate PD reported at least one missed workday, respectively, 13.3% of workers with no PD reported at least one missed workday. We observe a similar relationship for presenteeism. Workers with severe (41.8%) and moderate PD (30.4%) reported working while ill in the past 3 months, compared with 11.7% of workers with no PD. There were also statistically significant differences (non-overlapping confidence intervals) between workers who reported mild and no PD in terms of the percentage reporting at least one missed workday and working while ill.

Table 3 shows the mean number of missed workdays due to illness and the mean number of days worked while ill by PD level in year 2021. The mean number of missed workdays due to illness was 15.7 for workers with severe PD and 8.2 for workers with moderate PD, and 5.4 for mild PD, compared with 4.3 for workers with no PD. We observed larger differences in the number of days worked while ill by PD level. Workers with severe and moderate PD worked while ill for 31.3 and 11.6 days compared with 6.9 for those with mild PD and 5.6 days for those with no PD. We checked the monthly variation in workdays missed and days worked while ill in 2021 to assess potential seasonality effects and found that there were no statistically significant differences in the distribution of workdays missed and days worked while ill by month in 2021 (results available by request).

Table 4 presents the estimated number of missed workdays and number of days worked while ill in 2021 associated with severe, moderate, and mild PD from our multivariable analysis, adjusting for covariates. Again, we observed statistically significant differences and an increasing number of reported days along with the increasing severity of PD. Workers with severe, moderate, and mild PD had an excess 9.6 [95% CI: 5.0–14.2], 7.0 [95% CI: 2.8–11.2], and 1.6 [95% CI: 1.3–1.19] missed workdays, respectively, compared with workers with no PD symptoms. Similarly, compared with workers reporting no PD, workers with severe (25.3), moderate (7.4), and mild PD (2.3) had excess days working while ill.

Using the total US civilian population working during the survey week, we estimated the 2021 cost for absenteeism and presenteeism that was associated with PD disaggregated by PD level, and we present the results in Table 5. Controlling for the effects of covariates, the total estimated workplace productivity cost associated with PD was USD 100.0 billion in 2021; 80.4% was associated with absenteeism and 17.6% with presenteeism. The share of total workplace productivity cost associated with PD was nonlinear with severe (19.3%), moderate (52.6%), and mild PD (28.1%) costs. While the share of severe PD in the absenteeism cost was only 12.5%, its share in the presenteeism cost was 46.6%. The mean workplace productivity cost associated with PD was USD 663 per worker in 2021 (USD 100.0 billion/151.0 million workers).

We also conducted sensitivity analyses to assess how varying key assumptions affected our cost estimates (Table 5). First, we replaced the median wage rate adjusted for sex, education, and occupation using Current Employment Survey data -reported 2021 median hourly earnings (USD 30.60 [73] and adding 31% for nonwage benefits to that). Second, we grouped workers into those with any PD (K6 > 0) vs. no PD (K6 = 0), assuming a 15% mean productivity loss for presenteeism. Under the first assumption, the total productivity cost increased to USD 118.2 billion; under the second, it decreased to USD 90.1 billion.

Figure 1 and Tables 6 and 7 present our estimates of the workplace productivity cost of PD by broad industry sector. The percentage of workers who reported any type of PD was highest in the healthcare and social assistance (60.5%), services (59.5%), and wholesale and retail trade (57.2%) sectors. See Figure 1. The percentage of workers who reported moderate PD was highest in the healthcare and social assistance (18.7%), followed by workers in the services (16.9%) and wholesale and retail trade (16.3%) sectors. The percentage of workers who reported severe PD was highest in wholesale and retail trade (3.9%), followed by healthcare and social assistance (2.7%) and services (2.5%). The overall workplace cost associated with PD was highest in services (USD 54 billion), followed by healthcare and social assistance sectors (USD 19.7 billion) (See Table 6). The mean per worker workplace cost associated with PD was highest in healthcare and social assistance (USD 950), followed by services (USD 732) and wholesale and retail trade (USD 731) (See Table 7).

4 | Discussion

The literature shows that beyond its direct association with health, PD significantly impairs workers' ability to concentrate and collaborate effectively, thereby negatively affecting workplace productivity [7, 12, 67]. Mental health conditions, and PD in particular, are among the leading contributors to workplace costs [43, 74–78]. This study adds to this literature by providing

TABLE 2 | Distribution of PD level by sociodemographic, economic, health, and workplace characteristics, 2021[a].

Variables (%, unless noted otherwise)	Total		Working adults who reported any PD		
	No PD (K6 = 0)	Any PD (K6 > 0)	Mild PD (K6 = 1 to 4)	Moderate PD (K6 = 5 to 12)	Severe PD K6 ≥ 13
Sex (%)					
Male	48.2 [46.8–49.7]	51.8 [50.3– 53.2]	37.5 [36.2–38.8]	12.8 [11.9–13.7]	1.5 [1.3–1.8]
Female	38.3 [36.9– 39. 8]	61.7 [60.2– 63.1]	38.6 [37.4– 39.9]	19.41 [18.4–20.5]	3.6 [3.2– 4.1]
Age-group (%)					
18–24	34.4 [30.9– 38.1]	65.6 [61.9– 69.1]	37.9 [34.1– 41.7]	23.0 [20.3–26.0]	4.7 [3.5–6.2]
25–34	35.1 [33.1–37.2]	64.9 [62.8–66.9]	40.3 [38.4–42.2]	21.1 [19.5–22.9]	3.5 [2.9–4.3]
35–44	42.9 [41.0– 44.8]	57.1 [55.2–59.0]	39.2 [37.4– 41.1]	15.7 [14.3–17.1]	2.3 [1.8– 2.9]
45–54	48.7 [46.6– 50.8]	51.3 [49.2– 53.4]	36.6 [34.8– 38.5]	13.0 [11.8–14.2]	1.8 [1.3– 2.3]
55–64	51.6 [49.5–53.7]	48.4 [46.3–50.5]	36.3 [34.4– 8.3]	10.4 [9.3–11.6]	1.7 [1.2– 2.3]
65–74	56.0 [52.7–59.1]	44.1 [40.9–47.3]	34.8 [31.7–38.0]	9.00 [7.0–11.0]	0.5 [0.24–1.1]
74+	54.4 [47.9–60.8]	45.6 [39.2–52.1]	38.5 [32.3–45.0]	6.83 [4.3–10.6]	0.3 [0.04–2.0]
Race/ethnicity (%)					
Non-Hispanic White	39.3 [40.0–40.6]	60.7 [59.4–62.0]	41.1 [39.9–42.3]	17 [16.2–17.9]	2.7 [2.3–3.1]
Non-Hispanic Black	53.1 [50.1–56.2]	46.9 [43.8–49.9]	29.1 [26.7–31.5]	15.72 [13.6–18.1]	2.1 [1.4–3.0]
Hispanic	50.0 [47.3–52.6]	50.1 [47.4–52.7]	34.4 [32.2–36.8]	13.13 [11.6–14.8]	2.5 [1.9–3.2]
Non-Hispanic Asian	54.3 [50.7–57.8]	45.7 [42.3–49.3]	34.7 [31.5–37.9]	10.03 [8.3–12.1]	1.1 [0.5–2.1]
AIAN and any other group	37.5 [30.4–45.2]	62.5 [54.8–69.6]	37.7 [29.4–46.8]	20.47 [13.5–29.7]	4.3 [2.1–8.7]
Non-Hispanic other	37.5 [30.9–44.7]	62.5 [55.3–69.1]	33.8 [27.7–40.4]	24.2 [18.1–31.5]	4.5 [2.3–8.8]
Marital status (%)					
Married or living with partner	46.0 [44.2–47.3]	54 [52.7–55.4]	38.7 [37.5–39.8]	13.5 [12.7–14.4]	1.9 [1.6–2.2]
Widowed/Divorced/ Separated	45.1 [43.0–47.4]	54.9 [52.6–57.1]	34.7 [32.7–36.7]	17.31 [15.6–19.2]	2.9 [2.2–3.7]
Never married	36.8 [34.8–38.9]	63.2 [61.1–65.2]	38.1 [36.0–40.2]	21.18 [19.6–22.9]	3.9 [3.2–4.7]
Education (%)					
Less than high school diploma	55.3 [51.1– 59.4]	44.7 [40.6– 48.9]	27.5 [24.3– 31.0]	13.91 [11.4–16.9]	3.3 [2.2–5.0]
High school/GED diploma	48.6 [46.5–50.8]	51.4 [49.2–53.5]	33.4 [31.4–35.4]	14.8 [13.5–16.2]	3.2 [2.5–3.9]
Some college	39.5 [37.0–42.0]	60.5 [58.0–63.0]	38.1 [35.8–40.4]	18.38 [16.5–20.4]	4.1 [3.2–5.2]
Associate degree	43.5 [41.1–46.0]	56.5 [54.1–59.0]	37.4 [35.1– 39.7]	16.75 [14.9–18.8]	2.4 [1.83–3.3]
BA/BS degree or higher	40.0 [38.6–41.4]	60 [58.6–61.4]	43.0 [41.4–44.0]	16 [14.8–16.9]	1.5 [1.2–1.8]
Employment category (%)					
Private industry	43.4 [42.1–44.7]	56.6 [55.3–57.9]	37.9 [36.8– 39.1]	16.05 [15.2–16.9]	2.7 [2.3–3.0]
Government	40.8 [38.5–43.1]	59.2 [56.9–61.5]	41.0 [38.8–43.2]	16.34 [14.7–18.1]	2.0 [1.4–2.7]
Self-employed	46.3 [43.9– 48.8]	53.7 [51.2– 56.1]	35.9 [33.7– 38.1]	15.22 [13.6–17.0]	2.6 [1.9– 3.5]
Access to paid sick leave (%)					
No	42.6 [40.7–44.5]	57.4 [55.5–59.3]	35.9 [34.3–37. 6]	18 [16.68–19.4]	3.5 [2.9–4.2]
Yes	44.0 [42.8–45.3]	56 [54.7–57.2]	39.1 [37.9–40.2]	14.84 [14.0–15.7]	2.1 [1.8–2.4]
Health conditions (%)					
Coronary heart disease					
No	43.5 [42.3–44.6]	56.5 [55.4–57.7]	38.1 [37.1–39.1]	15.9 [15.2–16.7]	2.5 [2.2–2.8]
Yes	47.8 [42.0–53.6]	52.2 [46.4– 58.0]	33.9 [28.3– 40.0]	15.6 [11.7–20.7]	2.75 [1.2– 5.9]
Asthma					
No	45.4 [44.2–46.6]	54.6 [53.4–55.8]	38.0 [36.9–39.0]	14.58 [13.8–15.4]	2.10 [1.8–2.4]
Yes	31.8 [29.5– 34.2]	68.2 [65.8– 70.5]	38.6 [36.3– 40.9]	24.4 [22.3–26.6]	5.23 [4.2–6.5]

(Continues)

TABLE 2 | (Continued)

Variables (%, unless noted otherwise)	Total		Working adults who reported any PD		
	No PD (K6 = 0)	Any PD (K6 > 0)	Mild PD (K6 = 1 to 4)	Moderate PD (K6 = 5 to 12)	Severe PD K6 ≥ 13
Any cancer					
No	43.9 [42.7–45.0]	56.1 [55.0–57.3]	37.9 [36.9–38.9]	15.8 [15.1–16.5]	2.5 [2.3–2.8]
Yes	38.6 [35.5–41.8]	61.4 [58.2–64.5]	41.2 [38.0–44.4]	17.97 [15.5–20.8]	2.3 [1.5–3.5]
Diabetes					
No	43.2 [42.0–44.4]	56.8 [55.6–58.0]	38.4 [37.4–39.4]	15.98 [15.2–16.8]	2.4 [2.2–2.7]
Yes	48.7 [45.3–52.1]	51.3 [47.9–54.7]	32.9 [29.8–36.2]	14.68 [12.1–17.6]	3.7 [2.5–5.6]
Arthritis					
No	44.6 [43.4–45.8]	55.4 [54.2–56.6]	37.8 [36.8–38.8]	15.3 [14.6–16.1]	2.3 [2.0–2.6]
Yes	36.3 [34.0–38.7]	63.7 [61.3–66.0]	39.8 [37.5–42.0]	19.9 [18.1–21.9]	4.0 [3.2–5.1]
Body Mass Index (BMI)					
Normal weight (BMI ≤ 25)	40.4 [38.6– 42.1]	59.6 [57.9– 61.4]	39.9 [38.3–41.5]	17.6 [16.4–18.9]	2.1 [1.7–2.7]
Overweight (BMI = 26-30)	46.2 [44.6–48.0]	53.8 [52.1–55.4]	38.2 [36.7–39.7]	13.74 [12.7–14.9]	1.8 [1.4–2.3]
Obese (BMI > 30)	44.0 [42.3–45.8]	56 [54.2–57.7]	36.1 [34.5–37.7]	16.5 [15.3–17.7]	3.4 [2.9–4.1]
Family income as a percentage of the federal poverty level (%)					
< 100%	43.7 [39.2–48.3]	56.3 [51.7–60.8]	28.9 [25.3–32.7]	22.3 [19.0–26.1]	5.2 [3.8–7.0]
100%-200%	45.5 [42.8–48.3]	54.5 [51.7–57.2]	32.7 [30.4–35.1]	17.5 [15.7–19.6]	4.3 [3.3–5.4]
> 200%	43.2 [42.1–44.4]	56.8 [55.6–58.0]	39.7 [38.6–40.7]	15.1 [14.4–15.9]	2.0 [1.8–2.3]
Injury including repetitive strain injuries in past 3 months (%)					
No	46.9 [45.2–47.7]	53.1 [51.9–54.3]	37.1 [36.1–38.2]	14 [13.3–14.8]	1.9 [1.7–2.2]
Yes	27.7 [25.7–29.7]	72.3 [70.3–74.2]	42.2 [40.1–44.4]	24.8 [22.9–26.7]	5.3 [4.4–6.4]
Industry sectors (%)					
Agriculture	50.7 [42.6–58.8]	49.3 [41.2–57.4]	37.3 [29.7–45.6]	9.9 [6.0–15.8]	2.1 [0.6–7.0]
Construction	53.8 [50.2–57.4]	46.2 [42.7– 49.8]	32.0 [28.8–35.3]	12.6 [10.4–15.1]	1.7 [1.0–2.8]
Healthcare and social assistance	39.5 [37.1–42.1]	60.5 [58.0–62.9]	39.1 [36.7–41.6]	18.6 [16.6–20.7]	2.8 [2.0–3.7]
Manufacturing	50.4 [47.1–53.6]	49.6 [46.4– 52.9]	36.4 [33.5–39.5]	12.1 [10.3–14.2]	1.1 [0.6–1.9]
Services	40.4 [39.0–41.8]	59.6 [58.2– 61.0]	40.0 [38.77–41.3]	16.9 [15.9–18.0]	2.6 [2.3– 3.0]
Transportation, warehousing, and utilities	47.3 [43.7–50.9]	52.7 [49.1–56.3]	34.9 [31.5–38.4]	15.9 [13.2–19.0]	2.0 [1.1–3.4]
Wholesale and retail trade	43.1 [40.3–45.9]	56.9 [54.1–59.7]	36.92 [34.4–39.6]	16.0 [14.1–18.2]	4.0 [2.9–5.3]
Region (%)					
Northeast	44.9 [42.3– 47.4]	55.1 [52.6– 57.7]	38.4 [36.2– 40.7]	15.03 [13.6–16.5]	1.7 [1.2– 2.4]
Midwest	39.6 [37.4– 41.9]	60.4 [58.1– 62.6]	40.9 [38.7– 43.0]	16.9 [15.4–18.6]	2.6 [2.1– 3.2]
South	47.0 [45.2– 48.8]	53 [51.2– 54.8]	35.1 [33.7– 36.6]	15.2 [14.0–16.5]	2.6 [2.2– 3.2]
West	41.0 [38.3– 43.7]	59 [56.4– 61.7]	39.6 [37.5– 41.8]	16.6 [15.1–18.2]	2.8 [2.3–3.4]

[a]Numbers in brackets are 95% confidence intervals.

estimates of workplace productivity cost associated with PD using nationally representative data on US workers.

Our findings indicate that in 2021, the PD-related absenteeism and presenteeism cost in US workplaces was approximately USD 100 billion. This estimate does not account for additional cost related to injury, turnover, disability benefit claims, or early retirement [79, 80]. Using different methods and data sources, Greenberg et al. (2003) [81] estimated that the US workplace cost of depression alone (in terms of absenteeism and presenteeism) was USD 81.1 billion in 2000 after we adjusted to 2021 dollars using the US consumer price index, which aligns with the magnitude of our findings.

TABLE 3 | Number of hours worked per week, days absent from work, and days worked while ill by PD level, 2021[a].

Variable	No PD (K6 = 0)	Mild PD (K6 = 1 to 4)	Moderate PD (K6 = 5 to 12)	Severe PD K6 ≥ 13
Mean hours worked per week	40.4 [40.1– 40.8]	40.0 [39.5–40.4]	39.3 [38.7–40.0]	37.9 [36.2– 39.6]
Reported at least one day absence from work due to illness in the past 3 months (%)	13.3[12.4,14.3]	19.1[17.94,20.4]	26.7 [24.69–28.75]	37.2 [31.63– 43.2]
Reported at least one day working while ill in the past 3 months (%)	11.7 [10.8–12.6]	19.6 [18.5–20.9]	30.4 [28.3–32.5]	41.8 [36.1– 47.9]
Mean number of days absent from work due to illness in 2021	4.3 [3.7–5.0]	5.4 [4.6–6.2]	8.2 [6.8–9.6]	15.7 [9.5–21.9
Mean number of days worked while ill in 2021	5.6 [4.4–6.9]	6.9 [5.9–8.1]	11.6 [9.6–13.6]	31.3 [21.0– 41.5]

[a]Numbers in brackets are 95% confidence intervals.

TABLE 4 | Estimated number of workdays missed and number of days worked while ill associated with PD[b], 2021.

	Workdays missed associated with PD (n = 15,046)		Days worked while ill associated with PD (n = 15,135)	
PD level[a]	Days	95% CI	Days	95% CI
Mild	1.6	1.3–1.9	2.3	2.0–2.5
Moderate	7.0	2.8–11.2	7.4	6.1–8.8
Severe	9.6	5.0–14.2	25.3	14.1–36.5

[a]The reference category is workers with no PD.
[b]Estimated from a negative binomial regression controlling for sex, age group, marital status, race/ethnicity, education, employment category, coronary heart disease, asthma, any cancer, diabetes, arthritis, injury including injuries due to repetitive strain, access to paid sick leave, family poverty status, body mass index, and region. Hours worked per week were used as an exposure variable.

Overall, the workplace cost associated with PD is large, based on our and others' estimates. In addition, the workplace cost associated with PD seems to be large compared with workplace costs of other heath conditions. For example, a 1995 US study found that the cost of depression to employers, particularly the cost of absenteeism was as great or greater than the cost of each of many other common medical illnesses such as heart disease, diabetes, hypertension, and back pain [82]. A study conducted in Japan also showed that the productivity loss of mental health related to presenteeism and absenteeism was seven times higher than the medical costs for mental disorders [26]. These findings underscore the importance of implementing healthy work design and expanding workplace mental health policies and programs, and ensuring health insurance and workers' compensation adequately cover mental healthcare [43, 83, 84].

We also identified statistically significant differences in both total and per-worker PD-related costs across industry sectors. Factors such as the number of workers, median wage rates (adjusted for sex, education, and occupation), PD prevalence, and the relationship between PD and productivity losses all likely contribute to these sectoral differences. Total workplace cost associated with PD was highest in services (USD 52.5 billion), healthcare and social assistance (USD 19.4 billion), and wholesale and retail trade (USD 12.3 billion). Per-worker cost was highest in healthcare and social assistance (USD 940) and wholesale and retail trade (USD 729). The cost differences by sector point to the need to further examine and use sector-specific approaches to improve worker mental health. These could focus on the different contributors to PD by sector. For example, in healthcare and social assistance, irregular hours, emotional labor, and understaffing might be the most important contributors to PD, while in retail trade, low job control and customer-facing roles may be the most important contributors to PD. In addition, further analyses could focus on whether sectors with a higher proportion of lower wage, part-time, and hourly workers may face greater presenteeism due to job insecurity which can lead to greater productivity losses.

Several NIOSH programs and initiatives focus on further understanding and addressing mental health determinants by sector. For example, the Healthy Work Design and Well-being cross-sector program (https://www.cdc.gov/niosh/research-programs/portfolio/hwd.html) and Total Worker Health® program (https://www.cdc.gov/niosh/twh/about/index.html) work together with specific sectors to address common challenges. As another example, the recent Impact Well-being campaign produced practical guides for hospital leaders and healthcare workers that focus on reducing healthcare worker burnout, sustain wellbeing, and building systems where healthcare workers thrive (https://www.cdc.gov/niosh/healthcare/impactwellbeing/index.html).

This study has several methodological strengths. First, we used a single nationally-representative dataset to estimate missed workdays and days working while ill, minimizing bias from combining multiple data sources [69]. In addition, the short 3-month recall period and large sample size (n = 16,356) likely reduced recall and other biases associated with small sample size [85, 86]. Second, unlike many studies that focus only on severe PD or depression [12, 28], we included productivity losses from mild and moderate PD, providing a more comprehensive picture of the effects of PD. The statistically significant differences we observed between workers who reported mild and no PD in terms of presenteeism and absenteeism suggest that even mild PD may be associated with elevated incidence of absenteeism and presenteeism. Third, we accounted for occupational variation by estimating absenteeism and presenteeism cost separately across seven industry sectors. Prior studies, such as the one by Laditka et al. (2023) [87], suggest that

TABLE 5 | Estimated total productivity cost associated with PD, 2021.

Parameters and costs	Main	Sensitivity analyses	
		I[b]	II[a]
Number of workers by PD level (in millions)			
Workers who reported mild PD	57.44	57.44	
Workers who reported moderate PD	24.00	24.00	
Workers who reported severe PD	3.84	3.84	
Number of workers who reported any PD (in millions)			85.28
Median daily wage rate in 2021 (USD25.89*8) + 31% nonwage benefits	271.3	320.7	271.3
Number of days absent from work associated with PD[a]			
Mild PD	1.6	1.6	
Moderate PD	7.0	7.0	
Severe PD	9.6	9.6	
Any PD			3.2
Number of days worked while ill associated with PD[a]			
Mild PD	2.3	2.3	
Moderate PD	7.4	7.4	
Severe PD	25.3	25.3	
Any PD			4.3
Mean productivity loss associated with presenteeism (%)			
Mild PD	9.3	9.3	
Moderate PD	15.0	15.0	
Severe PD	35.0	35.0	
Any PD		15.0	
Cost of absenteeism associated with PD (million USD)			
Mild PD	24,843	29,363	
Moderate PD	45,374	53,628	
Severe PD	10,032	11,857	
Total cost of absenteeism associated with PD	80,249	94,848	75,168
Cost of presenteeism associated with PD (million USD)			
Mild PD	3308	3910	
Moderate PD	7240	8557	
Serious PD	9218	10,895	
Total cost of presenteeism associated with PD	19,766	23,362	14,954
Total workplace (absenteeism + presenteeism) cost of PD (million USD)			
Mild PD	28,151	33,272	
Moderate PD	52,613	62,185	
Severe PD	19,250	22,752	
Grand Total	100,014	118,209	90,122

[a]Number of missed workdays and number of days worked while ill associated with PD were computed controlling for sex, age group, marital status, race/ethnicity, education, employment category, coronary heart disease, asthma, any cancer, diabetes, arthritis, injury, access to paid sick leave, family poverty status, BMI, and region. The number of hours worked per week was used as an exposure variable in the negative binomial regression. The reference category was workers with no PD.
[b]We replaced the median wage rate adjusted for sex, education, and occupation by the 2021 median hourly earnings from the Current Employment Survey data.
c We grouped workers into those with any PD (K6 > 0) versus those reporting no PD (K6 = 0), assuming a 15% mean productivity loss for presenteeism.

occupational characteristics may influence PD risk more than individual traits. Fourth, the NHIS dataset allowed us to control various pre-existing health conditions, including repetitive strain injuries, which could confound our estimates. Lastly, we used stratified wage rates based on sex, education, and occupation, enhancing the accuracy of our cost estimates across worker groups.

Nonetheless, our estimates should be interpreted within the context of several limitations. First, we extrapolated 3-month absenteeism and presenteeism data to annual values. While this is standard practice [28, 58, 61–63], it could misrepresent yearly totals if data were seasonally biased. However, NHIS data collection occurs year-round, which likely mitigates this issue. Second, while absenteeism cost is likely easier to measure, presenteeism cost is

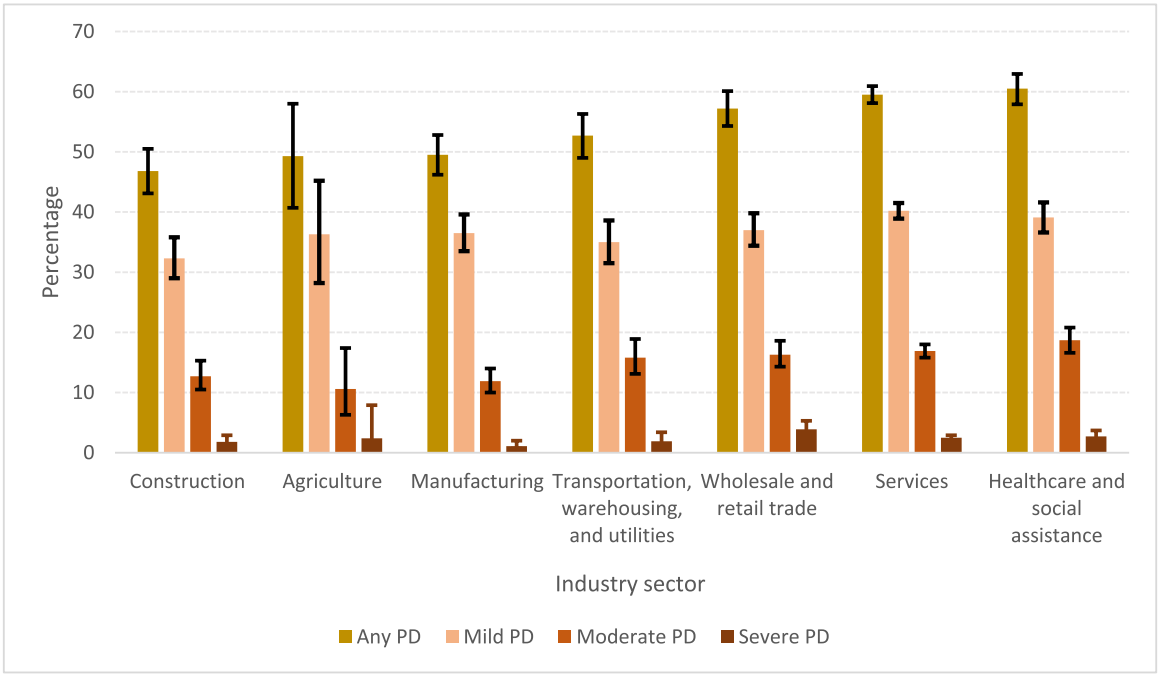

FIGURE 1 | Percentage of workers who reported any, mild, moderate, or severe PD by industry sector*, 2021. * Mining (including oil and gas extraction) is not included due to the small sample size. [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 6 | Productivity cost associated with PD by industry sector[a], 2021.

	Cost in million USD											
	Absenteeism				Presenteeism				Total (Absenteeism + Presenteeism)			Grand total[b]
Industry sector	Mild	Mod.	Severe	Total	Mild	Mod.	Severe	Total	Mild	Mod.	Severe	
Agriculture	102	118	35	255	17	26	45	89	119	144	80	343
Construction	1465	2499	470	4434	185	402	444	1031	1649	2901	914	5465
Healthcare and social assistance	4656	9766	2020	16,442	466	1250	1516	3232	5122	11,016	3536	19,675
Manufacturing	2636	3836	478	6950	256	476	348	1080	2891	4312	826	8030
Services	13,175	24,387	5263	42,825	1752	4146	5249	11,147	14,927	28,533	10,512	53,972
Transportation, warehousing, and utilities	922	1812	321	3055	157	395	411	963	1079	2207	732	4018
Wholesale and retail trade	2847	5420	1898	10,165	269	654	1343	2266	3115	6074	3241	12,430

[a]Mining (including oil and gas extraction) is not included due to the small sample size.
[b]The grand total cost is the sum of the cost when the cost of each level of PD is added together and includes both absenteeism and presenteeism.

TABLE 7 | Percentage share and mean productivity cost associated with any PD by industry sector,[a] 2021.

	Percentage share (column %)		Number of workers (millions)	Mean cost (USD)
Industry sector	Absenteeism	Presenteeism		
Agriculture	0.30	0.45	2.1	165
Construction	5.27	5.21	10.9	499
Healthcare and social assistance	19.55	16.32	20.7	950
Manufacturing	8.26	5.45	14.4	556
Services	50.91	56.28	73.7	732
Transportation, warehousing, and utilities	3.63	4.86	8.9	454
Wholesale and retail trade	12.08	11.44	17.0	731

[a]Mining and oil and gas extraction sectors are not included due to small sample size. Public safety is included in the services sector.

more complex due to factors like reduced productivity, increased errors, and spillover effects on coworkers [66, 88–90]. Estimates of productivity loss due to presenteeism vary widely in the literature and may differ by occupation and industry [68, 91, 92]. To reduce biases associated with these values, we used different productivity loss values for different PD categories. Third, we assumed that each day of absence resulted in productivity loss equivalent to a worker's wage and benefits. This may overstate losses if employers can readily replace absent workers, although unpredictable absences due to illness are often difficult to accommodate. Fourth, the NHIS question on presenteeism specifically asks about working while physically ill or because they were afraid that they had COVID. Some respondents may not consider mental health conditions as physical illness, potentially underreporting presenteeism related to PD. Additionally, the NHIS collects separate data on absences due to injuries or repetitive strain, which may have a reciprocal relationship with PD [93]. PD increases the risk of injury, while serious injuries may, in turn, lead to PD [94]. Fifth, there is a timing mismatch: NHIS measured PD experienced over the past month and employment on the week prior to the survey but it measured absenteeism and presenteeism experienced over the past 3 months. Sixth, because the NHIS data are cross-sectional, we cannot establish causality between PD and productivity losses. Longitudinal studies would be useful to identify whether reducing PD also reduces absenteeism and presenteeism. In addition, future work might incorporate additional direct and indirect costs as well as measures of decreased quality of life to give a fuller picture on the burden of PD. Seven, the timing of the survey year (2021) and the inclusion of COVID-19 as a reason for absence may not make the results of this study directly comparable to those studies that did not include pandemic years. We do not have information on the number of days worked while sick for both pre- and post-COVID years. However, the question on the number of days absent from work in the past 12 months has been asked from 2021 through 2024, the most recent year for which data are available. Analysis over 4 years (not shown but available upon request) found no significant difference in average work absences. We used data from the General Social Survey–Quality of Worklife (GSS-QWL) module to examine whether overall job satisfaction differed significantly between pre-pandemic and pandemic periods. Specifically, we analyzed data from 2018 to 2022, the most recent year available in the GSS-QWL data set. The results (available upon request) indicated no statistically significant difference in job satisfaction between these 2 years. Although we did not find statistically significant differences in the overall number of days absent from work in 2021 compared with 2022–2024 using NHIS, or in job satisfaction in 2018 compared with 2022 using GSS-QWL, 2021 may still be a nonrepresentative year. Finally, we used the human capital method to monetize costs, which has well-documented limitations [54, 95], including the assumption that wages fully reflect productivity.

5 | Conclusion

We estimated that the annual workplace cost of PD in the United States ranged between USD 90.1 billion and USD 118.2 billion in 2021. These figures do not account for additional costs such as increased employee turnover, disability benefit claims, or early retirements. Our findings may help inform employers interested in identifying, prioritizing, and implementing targeted interventions to prevent, reduce, or mitigate PD and other related mental health conditions in the workplace.

The literature highlights the importance of addressing workplace psychosocial factors—such as job demands, job control, and organizational support—to reduce illness absence and promote employee well-being [22]. Evidence also supports the expansion of mental health treatment, enhancement of supervisor support, and improvement of the psychosocial safety climate at work [75, 96]. Given the substantial potential economic burden of PD, employers and policy makers may want to use strategies such as introducing or scaling up workplace mental health programs, as well as ensuring adequate workers' compensation and health insurance coverage for mental health conditions. Investments in workplace mental health may generate returns comparable to other capital investments largely through lowering absenteeism and presenteeism costs.

Author Contributions

Abay Asfaw conceived the study and conducted the analyses. Abay Asfaw, Toni Alterman, and Regina Pana-Cryan contributed to the interpretation of the data and to drafting the manuscript or revising it critically for important intellectual content. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Disclosure

Disclaimers: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available in 2021 NHIS at https://www.cdc.gov/nchs/nhis/documentation/2021-nhis.html. These data were derived from the following resources available in the public domain: —2021 NHIS, https://www.cdc.gov/nchs/nhis/documentation/2021-nhis.html.

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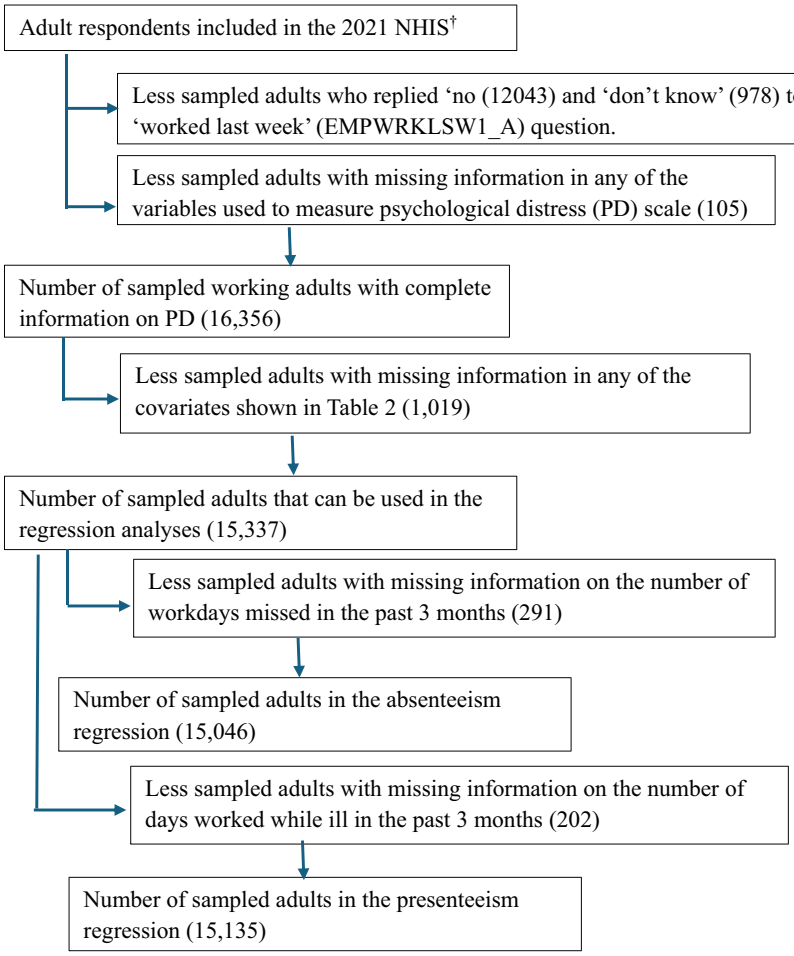
Appendix A

Number of adult respondents included and excluded in the study, NHIS Adult Sample—2021†



† For a comparison to the full number of respondents sampled in 2021, please see the NHIS Frequency Codebook.

‡ Those who were performing seasonal or contract work and worked in the past 12 months or those who were working at a job or business but not for pay are not included.