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Chronic Conditions, Workplace Safety, And Job Demands Contribute To Absenteeism And Job Performance

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ABSTRACT An aging workforce, increased prevalence of chronic health conditions, and the potential for longer working lives have both societal and economic implications. We analyzed the combined impact of workplace safety, employee health, and job demands (work task difficulty) on worker absence and job performance. The study sample consisted of 16,926 employees who participated in a worksite wellness program offered by a workers' compensation insurer to their employers—314 large, midsize, and small businesses in Colorado across multiple industries. We found that both workplace safety and employees' chronic health conditions contributed to absenteeism and job performance, but their impact was influenced by the physical and cognitive difficulty of the job. If employers want to reduce health-related productivity losses, they should take an integrated approach to mitigate job-related injuries, promote employee health, and improve the fit between a worker's duties and abilities.

The trends of an aging workforce, longer working lives, and increased work demands and the increased prevalence of chronic health conditions have both societal and economic implications. Key stakeholders in the United States and other industrialized nations are exploring ways to support healthier, longer, and more productive working lives.¹ Employers are particularly interested in supporting a healthy, high-performing, fully employed workforce and in mitigating temporary or permanent work disability. However, they face two interconnected challenges. First, high rates of work-related injuries and fatalities persist, which contribute to the economic burden of work-related injury in society.^{2,3} Second, chronic health conditions in the workforce are increasing. Both factors have been associated with workplace productivity and performance.^{4–7} Previous research suggests that the relationship between these two health-related issues and productivity is com-

plex. Chronic health conditions have been linked to an increased risk of workplace accidents,^{8,9} more serious complications after an accident, prolonged recovery times, and decreased productivity.^{10–12}

Understanding the interplay of personal health, job safety, and job demands (work task difficulty) and the impact of this interplay on productivity has been difficult to study. All four components—personal health, job safety, job demands, and productivity—must be measured at the employee level in relative time sequence to assess the impact of the first three components on productivity. Measuring these components, analyzing their relative impact on productivity, and applying that knowledge to improve business practice presents a major challenge for employers.

We discuss measuring employee productivity first. Of course, absenteeism—when employees are unable to come to work because of injury or other health reasons—is a major component of

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overall productivity and tends to be the easiest component to measure.¹³ However, there is good reason to believe that presenteeism—when employees come to work but perform at lower levels than usual because of health reasons—often accounts for more lost productivity than absenteeism.¹⁴

We next turn to measuring employee health. Employers have historically relied on analyses of the association between sick days and health care claims data, but these analyses fail to consider the full range of physical and mental health conditions associated with decreased levels of productivity.¹⁵ Relying solely on such administrative data limits an employer's ability to determine the prevalence of chronic illness and injuries resulting from underdiagnosis, undertreatment, and underreporting.¹⁶ In fact, analyses that include additional information such as self-reported health risks and health conditions often present a very different picture of what drives health costs and lost productivity. Such analyses suggest that the emphasis should shift from treatment to prevention through workplace health promotion and health protection policies and programs.¹⁷

Even if employers are able to measure health, safety, and productivity, there are likely to be other factors to consider if employers and employees want to reduce health-related productivity loss. We hypothesized that the physical and cognitive job demands must be taken into account in evaluating health-related productivity loss. This study offers empirical evidence on the relationships between the physical and cognitive types of job demands and the occurrence of absenteeism and presenteeism. Understanding these relationships has practical implications, given that the employer has some influence over the organization of work, including job demands and work assignments, and over the investment in and commitment to employee safety and health.

The specific study questions were: Does previous workplace safety predict absenteeism and presenteeism? Do workers' chronic health conditions predict them? Are job demands associated with absenteeism and presenteeism, and, more specifically, does it matter if those demands are physical or cognitive? Do workplace safety and job demands interact to predict absenteeism and presenteeism? Do employee health and job demands interact to predict them?

Study Data And Methods

DATA SOURCE AND STUDY POPULATION Our study used data for the period May 1, 2010–December 31, 2014, from employers and their employ-

ees who participated in a worksite wellness program offered by Pinnacol Assurance. Pinnacol Assurance was founded as a state agency with the passage of the Colorado Workers Compensation Act in 1915 and became a quasi-public authority in 1987. Twenty-four other states also have state-based workers' compensation insurers. They and Pinnacol Assurance are the assured carriers of that insurance for their states and are required to accept all applicant businesses in their states. Pinnacol Assurance covers more than 60 percent of the market of workers' compensation insurance in Colorado, representing approximately 56,000 companies and 900,000 covered workers in all regions of the state. The majority of companies it insures are small and midsize enterprises.

Pinnacol Assurance supported an external evaluation of its worksite wellness program by partnering with several academic institutions in a variety of research areas.^{18–20} The evaluation is called the Pinnacol Assurance health risk management study; the research presented here is part of this research partnership.

Our study population consisted of 16,926 employees who took a baseline health risk assessment during the study period. Only baseline assessments were included in our analysis, and they were matched with three-year historical workers' compensation claims data. Because of Pinnacol's large market share, its covered worker population mirrors the state's overall workforce, with some exceptions. In Colorado, 54.3 percent of the workforce is male, whereas 60.0 percent of our study population was male. Whites make up 90 percent of the Colorado workforce but 84 percent of our study population. And the education level of the study population was higher than that of the general Colorado workforce.²¹

The health risk assessment included questions that measured self-reported chronic health conditions (employee health), work-related task difficulty (job demands), and sickness-related absence and job performance (productivity). All questions came from a validated instrument²² called the Health and Work Performance Questionnaire (HPQ)²³ and a modified version of that questionnaire called the HPQ Select.²⁴ Workers' compensation claims data were supplied by Pinnacol Assurance and matched to the survey data at the employee level.

All data were matched and retained using procedures and systems that were in compliance with the Health Insurance Portability and Accountability Act (HIPAA) of 1996. The Colorado Multiple Institutional Review Board considered this study to be exempt from review. Additional details about our methods and measurement are

Job performance could be enhanced if the employer better fits the job to the worker.

available in the online Appendix.²⁵

OUTCOMES Productivity at work was our outcome of interest, and we chose to measure it in terms of absenteeism and presenteeism. *Absenteeism* was defined as any time off for health-related reasons in the past four weeks, measured in numbers of sick hours. *Presenteeism* was defined as poor job performance in the past four weeks, measured on a performance scale of 0 (best) to 10 (worst). For purposes of our final presentation, we also converted absenteeism and presenteeism from their raw metrics—hours and scale values, respectively—into annual absenteeism and presenteeism costs, as described in the Appendix.²⁵

EMPLOYEE HEALTH, WORKPLACE SAFETY, AND JOB DEMANDS We categorized workers' job demands based on the physical and cognitive challenges reported by participants in the worksite wellness program. *Physical task difficulty* was defined as having difficulty performing minor physical activities at work, such as walking, lifting, sitting, and doing repetitive motions in the past four weeks. *Cognitive difficulty performing work tasks* was defined as having difficulty concentrating or being careful in performing work tasks in the past four weeks. For purposes of analysis, we categorized each employee's job in one of four ways: it had no work task difficulty, physical difficulty only, cognitive difficulty only, or both physical and cognitive difficulty.

Employee health status was measured in terms of having any of the self-reported chronic health conditions measured in the health risk assessment. We used the number of a participant's chronic health conditions (for example, diabetes, hypertension, and depression) to create a continuous variable.

Finally, employee health risk assessment data were linked with the 1,267 employees' compensable workers' compensation claims from the three years before their first assessment. We used these claims as our measure of workplace safety. The claims included both lost time claims (defined as a worker's having missed at least three shifts or twenty-four hours of work) and other claims. The retroactive period before a person is

paid workers' compensation for the first three days was fourteen days, which is similar to other workers' compensation plans in the United States. A *history of workers' compensation claims* was defined as having at least one nonzero-cost claim in the past three years—that is, a claim whose costs included medical or indemnity payments greater than \$0. In Colorado 77.1 percent of workers' compensation claims are for medical expenses only, compared to 75.2 percent nationally.²⁶

STATISTICAL ANALYSES To understand the relationship between our predictors (job demands, employee health, and workplace safety) and outcomes of interest (absenteeism and presenteeism), we ran a series of multivariate linear regression models. We controlled for workers' age, sex, race/ethnicity, income, educational status, occupation, and employment status (full time versus part time and paid by salary versus hourly wages), as well as for their employer's industry and business size (number of employees). All analyses were conducted with Stata, version 14.0. While the data had a hierarchical structure—with employees nested in employers—intraclass correlations revealed that less than 2 percent of the outcome variation was associated with the employer. For a more extensive description of our measurement and modeling procedures, see the supplemental material in the Appendix.²⁵

Study Results

CHARACTERISTICS OF THE STUDY POPULATION

The study population was predominantly male (60 percent) and white (84 percent), with an average age of forty-two (Exhibit 1). Most employees had some college education (82 percent) and worked full time (91 percent), and the numbers of hourly and salaried employees were approximately equal. Fifty-one percent worked in the service sector. Another third of the study population was equally divided among mining/construction, retail trade, and public administration (10–11 percent each). The three most common occupations of the study population were professional workers (36 percent), clerical and administrative support staff (15 percent), and executives (14 percent). Only 12 percent of the employees made more than \$75,000 per year, with 57 percent earning \$25,000–\$74,999 annually. Thirty-five percent of the workers' employers had fewer than 100 employees, while 23 percent had 500 or more.

Fifty-five percent of the employees experienced physical or cognitive difficulty, or both, in performing work tasks. On average, participants reported having 3.5 chronic health condi-

EXHIBIT 1

Selected characteristics of 16,926 employees in Colorado who participated in a worksite wellness program offered by a workers' compensation insurer, 2010-14

	Percent or mean
Percent male	60%
Average age (years)	41.7 ^a
Percent white	84%
Education	
At least a four-year college degree	51%
Some college or a two-year college degree	31
Employed full time	91%
Payment	
Hourly wage	51%
Salary	47
Industry type	
Services	51%
Mining or construction	11
Public administration	10
Retail trade	10
Occupation	
Executive	14%
Professional	36
Clerical and administrative support	15
Annual income	
\$25,000-\$34,999	11%
\$35,000-\$49,000	26
\$50,000-\$74,999	20
\$75,000 or more	12
Company size (number of employees)	
Fewer than 100	35%
100-499	41
500 or more	23
Workers' compensation claims	
Claim 1 year ago	4%
Claim more than 1 year ago but less than 2 years ago	2
Claim more than 2 years ago but less than 3 years ago	2
Difficulty performing work tasks	
No physical or cognitive difficulty	45%
Physical difficulty only	43
Cognitive difficulty only	3
Physical and cognitive difficulty	8
Average number of chronic health conditions	3.5 ^b

SOURCE Authors' analysis of data from the Pinnacle Assurance health risk management study, May 1, 2010, to December 31, 2014. **NOTES** The data are from employees' baseline health risk assessments. The insurer was Pinnacle Assurance. Percentages may not sum to 100 because this exhibit displays only selected characteristics of the study population. For a listing of all measured characteristics, see the Appendix (see Note 25 in text). ^aStandard deviation (SD): 12.5. ^bSD: 3.2.

tions. Eight percent had filed a workers' compensation claim within the past three years.

VARIABLES THAT PREDICT ABSENTEEISM AND PRESENTEEISM We investigated whether selected variables in the models of absenteeism and presenteeism worsened, improved, or had no influence on absenteeism and presenteeism (Exhibit 2). For full statistical results, see the Appendix.²⁵ As workers' number of chronic health conditions increased, so did the level of both absenteeism and presenteeism.

Workplace safety alone, measured by the occurrence of workers' compensation claims, was associated with lower reported presenteeism, compared to having no claims in the past year.

Notably, workers whose jobs were both physically and cognitively difficult and who had filed at least one workers' compensation claim were more likely to report higher levels of absenteeism and presenteeism, compared to workers with no work task difficulty and no workers' compensation claim history. Employees who had physically demanding jobs and had filed a claim in the past year showed an increase in both absenteeism and presenteeism. This suggests that if a worker is injured and must return to a physically challenging job, he or she may remain out of work longer and, after returning to work, may be unable to perform at full capacity. For employees with physically demanding jobs who filed a claim in the past two to three years, only presenteeism worsened—there was no measurable influence on absenteeism—which suggests that the effects of a claim on presenteeism may last longer than its effects on absenteeism.

LOST PRODUCTIVITY COSTS OF ABSENTEEISM AND PRESENTEEISM Employees who reported having no chronic health conditions, had filed no workers' compensation claims in the past year, and reported no job task difficulty had lower combined absenteeism and presenteeism costs, compared to employees reporting any type of job task difficulty (Exhibit 3). In general, we observed a pattern of the presence of chronic health conditions indicating greater productivity losses, among both employees who had and those who had not filed a workers' compensation claim within the past year.

This aggregate analysis of productivity costs would seem to highlight the impact of chronic conditions. However, when we examined absenteeism and presenteeism separately, a pattern emerged that highlights the greater impact of a workers' compensation claim, especially for those who have physically demanding jobs. Absenteeism costs were highest among employees who reported having only physical job difficulty.

This was especially apparent among employees who had filed a workers' compensation claim in the past year. Compared to other employees who reported only physical job difficulty and had neither chronic health conditions nor a claim in the past year, employees with both conditions and a claim had \$764 more in absenteeism costs. While the presence of chronic conditions had a significant effect on absenteeism, the effect of filing a workers' compensation claim among employees who reported only physical job difficulty accounted for a \$615 difference in absenteeism costs for those without chronic conditions and a

EXHIBIT 2

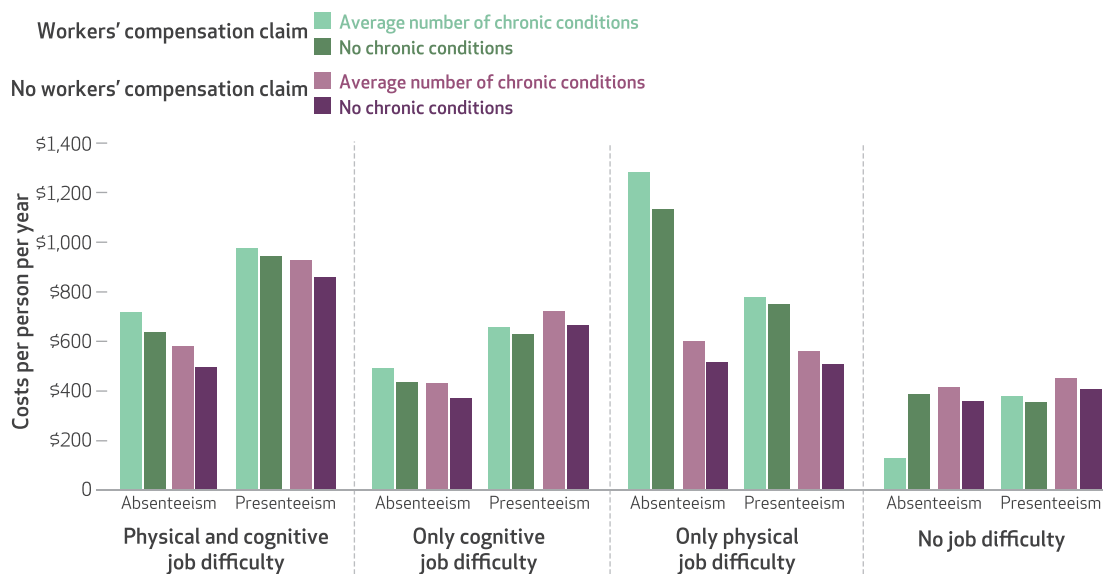
Directional effects of selected variables on employees' absenteeism and presenteeism

	ABSENTEEISM			PRESENTEEISM		
	Worsens	No influence	Improves	Worsens	No influence	Improves
Job demands^a						
Physical difficulty only	X**			X**		
Cognitive difficulty only	X**			X**		
Cognitive and physical difficulty	X**			X**		
Any workers' compensation claim 1 year ago^b		X				X*
Job demands and workers' compensation claims^c						
Physical difficulty only, at least 1 claim 1 year ago	X**			X**		
Physical difficulty only, at least 1 claim 2–3 years ago		X		X**		
Cognitive difficulty only, at least 1 claim 1 year ago	X*				X	
Cognitive and physical difficulty, at least 1 claim 1 year ago	X*			X*		
Number of chronic health conditions	X**			X**		

SOURCE Authors' analysis of data from the Pinnacle Assurance health risk management study, May 1, 2010, to December 31, 2014. ^aRef: neither physical nor cognitive difficulty. ^bRef: no workers' compensation claim in the past three years. ^cRef: neither physical nor cognitive difficulty and no workers' compensation claim in the past three years. For full statistical results, see the Appendix (see Note 25 in text). * $p < 0.10$ ** $p < 0.05$

EXHIBIT 3

Predicted costs of absenteeism and presenteeism per person per year, by job difficulty and presence of chronic conditions



SOURCE Authors' analysis of data from Pinnacle Assurance's health risk management study, May 1, 2010, to December 31, 2014. **NOTES** Chronic conditions were self-reported by employees as part of the insurer's health risk assessment. The average number of chronic conditions was 3.5 per worker. References to workers' compensation claims are those filed in the prior year.

\$677 difference for those with the average number of chronic conditions.

Presenteeism costs, in contrast, were greatest among employees who reported having both physical and cognitive job demands at work.

TOTAL LOST PRODUCTIVITY COSTS We can add absenteeism and presenteeism costs together to produce total lost productivity costs. So, for example, if we imagine a company with 5,000 full-time employees, we can use the descriptive values from Exhibit 1 to assume that 2,700 (54 percent) of the workers have some level of difficulty performing physical or cognitive tasks or both. For those employees the total health-related lost productivity costs resulting from working in a less safe workplace (indicated by the presence of workers' compensation claims) plus having the average level of chronic conditions is estimated to be \$556,000. For details on how this estimate was derived, see the Appendix.²⁵ If the company paid attention to the prevention and treatment of those chronic health conditions, implemented a strong safety culture, and made more appropriate task assignments, it might be able to recover a portion of that \$556,000. Note that this calculation is likely a conservative estimate, since it considers wage value only and does not include direct or indirect costs due to production delays or the use of replacement staff or the overtime and extra work of other employees that is needed when a coworker is absent or underperforming while ill.²⁷

Discussion

Our results show that chronic health conditions, workplace safety, and job demands have a meaningful impact on productivity. We found that absenteeism is highly related to physical job demands, whereas presenteeism is highest when jobs are both physically and cognitively demanding. These findings suggest two important points. First, it is important to combine all available relevant information on employee health and related outcomes to fully understand and manage the effects of illness and injury in the workplace and ensure a present and high-functioning workforce. Second, an effective health and safety management strategy requires a focus on both injury prevention and return-to-work practices that match the physical and cognitive requirements of a job with a worker's ability to come to work and perform well.

These findings also suggest that employers need a better appreciation of work hazards that lead to injuries resulting in workers' compensation claims and the chronic health conditions of employees, to put this information into the context of the demands of their employees' jobs. Our

Previous history of filing a workers' compensation claim is an important predictor of absenteeism.

data make a compelling case for taking an integrated approach to the design of policies and programs that address both workplace health protection and health promotion. Our estimates of possible productivity cost savings suggest that the savings from new policies and programs should be reinvested to help prevent future chronic health conditions and work-related injuries.

INTEGRATED DATA Our findings support the business case for integrating information on the health status of the workforce, sources of work-related injuries, and job demands. Medical claims data, health risk assessments, occupational and nonoccupational injury and illness claims, and records of absence because of sickness are often available to the employer either directly, with the use of appropriate firewalls and HIPAA-compliant protocols, or from third-party suppliers that provide data compilation and reporting. However, these data are rarely combined, analyzed, and used to prevent illness, injury, and work loss. If used appropriately, such information could result in improved health and related productivity by allowing the employer to address worker health and workplace safety priorities during the design of work tasks and when making benefits investment decisions.

For example, businesses with numerous safety hazards in a physically demanding workplace should make safety an investment priority. In contrast, those with no workplace hazards, no job injuries, and few physical demands on employees might choose to make worksite wellness a relatively greater investment priority.

JOB FIT Our findings suggest that job performance could be enhanced if the employer better fits the job to the worker. Employers have an opportunity to align the often divergent interests of human resource practitioners, safety officers, and the occupational health providers who make work fitness determinations. Prevention through design principles permit employers to integrate task difficulty and work-related outcomes such as attendance and performance.²⁸

Increased support for research on how employers can contribute to the promotion of a safe and healthy workforce is essential.

Job design principles could take into account not only how to perform work safely but also how to create a workplace that supports workers' goals for improving their health, well-being, and performance.

We also found that a previous history of filing a workers' compensation claim, particularly within the past year, is an important predictor of absenteeism and, to a lesser degree, presenteeism. Occupational injury data suggest that 30–40 percent of work injuries happen in the first six months of employment.²⁹

Furthermore, once a worker has filed one workers' compensation claim, the odds of his or her filing additional claims increases significantly.³⁰ This suggests the importance of examining the root cause of job injuries so that workers are not reinjured and other workers are not exposed to the same hazard. It also suggests the need to provide appropriate job accommodation. Indeed, greater attention to work fitness and accommodation in return-to-work job placements could help reduce the effects of previous workers' compensation claims on future absenteeism.

Thus, our results demonstrate that job demands—specifically, task difficulty—should be a primary consideration when employers are making accommodation decisions. The nature of the job itself and the difficulty that an individual may have with his or her assigned tasks after an injury and when suffering from certain health conditions may affect his or her level of work functioning, attendance, job performance, and risk of future injury.

HEALTH MANAGEMENT Finally, and not surprisingly, we found that the number of chronic illnesses an employee had was proportionally related to that person's absenteeism and presenteeism, even after we took into account factors such as age, sex, and the other worker characteristics in our models. Employers, and society more generally, must address the implications of the aging workforce and the rise in the number of chronic conditions in the overall population for workforce productivity and gainful employment, including for aging workers. Given the prevalence of chronic health conditions, employers should understand that hiring people with chronic conditions is unavoidable. And given the persistently high rates of work-related injuries, illnesses, and fatalities, employers should redouble their efforts to provide a safe workplace. Our data suggest that employers will increasingly need to consider and address these factors when designing work processes, assigning job duties, and deciding on benefits that support workers' well-being and productivity.

Conclusion

An integrated health, wellness, and safety investment strategy may have both short- and long-term payoffs for employers and employees. Physical and cognitive job demands need to be considered not only at the time of hire, but also when employees are assigned new tasks and when workers return from injuries or episodes of illness and as employees develop chronic health conditions. A concerted approach that eradicates the causes of workplace injuries, facilitates employees' ability to maintain good health through worksite wellness programs and wage and benefits design, and does a better job of fitting the job to the worker will reduce absenteeism and presenteeism and improve workers' health and related productivity.

Conclusion

Such investments can also enhance the lives of employees through improved health and continued employment. Employees who become chronically ill and experience extended periods of work disability or who prematurely leave the workforce stand to lose an array of economic and psychosocial benefits associated with paid employment. Human capital theory strongly supports the notion that investing in employees' health and well-being will have dividends for both the employer and the employee in terms of the amount and the quality of work that individuals are able to do. It is important to remember that in many cases, work-related injuries and chronic illnesses are preventable. Increased support for research on how employers can contribute to the promotion of a safe and healthy workforce is essential.³¹ ■

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