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VALUING REDUCTIONS IN ON-THE-JOB ILLNESS: 'PRESENTEEISM' FROM MANAGERIAL AND ECONOMIC PERSPECTIVES

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SUMMARY

This paper reports on a study of manager perceptions of the cost to employers of on-the-job employee illness, sometimes termed 'presenteeism,' for various types of jobs. Using methods developed previously, the authors analyzed data from a survey of more than 800 US managers to determine the characteristics of various jobs and the relationship of those characteristics to the manager's view of the cost to the firm of absenteeism and presenteeism. Jobs with characteristics that suggest unusually high cost (relative to wages) were similar in terms of their 'absenteeism multipliers' and their 'presenteeism multipliers.' Jobs with high values of team production, high requirements for timely output, and high difficulties of substitution for absent or impaired workers had significantly higher indicators of cost for both absenteeism and presenteeism, although substitution was somewhat less important for presenteeism. Copyright © 2007 John Wiley & Sons, Ltd.

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INTRODUCTION

Even in competitive market economies, employers do not base a worker's payment only on that worker's measured productivity. Instead, if worker productivity is reduced because the onset or exacerbation of illness causes absenteeism, or reduced productivity when the worker is at work, the worker will often continue to receive the same agreed-upon money compensation. Paying workers during an illness can be a rational, profit-increasing strategy for the firm if there is a high worker value for implicit insurance against fluctuating income, if there are positive labor morale effects, or if there is a high administrative burden of accurately measuring the productivity of each worker. However, when there are medical interventions that might reduce the burden of worker illness, valuing the resulting improved productivity should be of interest to firms. This is especially true in the United States, where employers provide and control the great bulk of health insurance for workers. Since such increased

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productivity may more than offset the cost of the medical interventions, and, therefore, may lead to a favorable 'business case' for employer payment for care, one would expect employers to be interested in accurate measurement of any such effects. In addition, the improved health and the increased output are potentially of value to workers, to the economy, and to the public sector whose tax revenues are often tied to worker productivity.

While there is, therefore, in principle a case for employer spending on costly but effective programs that improve worker health, the nature, size, and variability of illness effects on worker productivity are not well defined or measured. The goal of this paper is to provide an empirical contribution to that measurement question. One distinction that is potentially useful if obvious is the distinction between illnesses that cause the worker to fail to arrive at work – absenteeism – and illnesses that affect worker productivity even when the worker is present – that we will term 'impaired presenteeism.' (In the literature, this effect is usually just labeled 'presenteeism' (Prasad *et al*., 2004; Goetzel *et al*., 2004; Lofland *et al*., 2004).) While in both cases wages usually are paid at the same rate even though productive inputs are reduced, this distinction may be important, since existing empirical estimates of the cost of illness to firms have consistently found that the measured costs of impaired presenteeism are much larger than those for absenteeism (Burton *et al*., 2005).

The empirical research to date on impaired presenteeism is descriptive and does not rely on any formal model of the production process, much less on a complete model of firm and labor market equilibrium. We will not provide a complete model here but only a simple model of the production process to motivate our empirical work.

Almost all empirical estimates to date of the cost of impaired presenteeism are based on information collected from workers on the frequency of worker-perceived on-the-job illness and worker estimation of the impact of such illness on productivity (Collins *et al*., 2005; Stewart, 2003a,b). The typical study usually then values reduced productivity by multiplying the estimated reduced hours equivalent by the hourly wage rate to get an estimate of the cost of impaired presenteeism. Based on such calculations, it appears that the magnitude of such effects on firms in modern market economies can be quite high. However, while employers have shown some interest in reducing illnesses that lead to impaired presenteeism, such calculations have thus far failed to be universally persuasive to top management of many firms (Parry, 2002). By measuring impaired presenteeism from the manager's perspective and by estimating its costs to firms based on an economic model of production, this paper aims to provide estimates of the impact of impaired presenteeism that are relevant to managers and the decisions that they make, and may shed light on the question of why managers find past presenteeism research less than compelling.

This paper reports on a study of the impact of impaired presenteeism based on responses of 804 middle-level US managers to questions about the consequences of illness that occur or have manifestations while workers are present at work. Our study is based on manager perceptions of productivity impacts because the consequences of absenteeism on productivity are essentially and intrinsically known by the manager and not the worker; the worker does not fully know what happened when he or she was absent, or the effect on other workers when he or she was present but sick. We do not argue that the manager necessarily (or even usually) has a more accurate estimate than the worker, only that manager decisions are likely to be affected more by manager perceptions than by worker perceptions. Thus, there is an *a priori* case for using manager responses, especially if results for absenteeism and impaired presenteeism are to be compared.

The second distinct feature of this study is that it investigates whether a given illness that results in impaired presenteeism might have different impacts on productivity or output depending on the type of job and/or the organization of production. Our earlier work on the productivity effects of absenteeism strongly confirmed the hypothesis that a health-related impact on productivity, measured relative to the average daily paid wage of a worker, can be several multiples of that wage in some jobs but not in

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others, depending on job characteristics (Nicholson *et al.*, 2006). This 'multiplier' was found to be greater in jobs involving the combination of team production (TP), availability of perfect substitutes (AS), and time-sensitivity of output (TS).

In what follows, we show results on cross-job variations in illness-related productivity effects from both absenteeism and presenteeism that are largely consistent with our previous work: many jobs have multipliers greater than one, and the multipliers tend to be larger in jobs with higher values of the characteristics just mentioned. Indeed, the absenteeism measures from this sample of data are highly consistent with those from our earlier study, suggesting high reliability. However, there are some differences between absenteeism and presenteeism in the relationship of multipliers to availability of substitutes, probably reflecting the fact that it is more difficult to 'substitute around' an ill worker who is still present, compared to one who is totally absent.

This kind of information about productivity effects of absenteeism and impaired presenteeism is a necessary part of a more general behavioral model of firm decision-making and market equilibrium. As noted above, that more complete model, which we discussed in our earlier (2002) paper, will not be presented or tested here. While we do assume a relationship between firm decisions and market wages drawn from our earlier work to motivate our empirical work in this paper, we necessarily ignore many other key ingredients previously discussed in the economic literature than might be included in a full and formal model of labor market effects of illness, such as possible effects of different job risks on health, considerations of multi-period health effects (in a firm or worker-specific model of human capital formation), employer determination of what health-improving coverage interventions to adopt, and worker values for protection against illness-related income fluctuations along with any moral hazard effects that would flow from such protection (Acemoglu and Pischke, 1999; Sandy and Elliott, 2005).

PRODUCTION AND VALUATION MODEL

Here, we briefly outline the simple model of illness effects on productivity from our earlier work and modify it for the case of impaired presenteeism. We assume a competitive labor market in which workers contract for payment in advance of output based on time spent at work. However, as is customary in such models, the wage paid per unit time will depend on manager perceived output per unit time. Different firms produce different outputs in different ways. To simplify, we will assume that labor is supplied for different activities or tasks that are labeled as different jobs. Thus, the relationship of otherwise-similar labor to output can differ in job i from what it is in job j. (We do not develop an efficiency wage model or explore the relationship between absenteeism or presenteeism and different employer strategies to adjust money wages; for such a more complex model see our earlier work and Chatterji and Tilley (2002).)

Labor is combined to produce different outputs, and the relationship of labor to output depends on the type of output or job. Thus, job i may involve a higher level of TP than job j. We represent TP simply as a production function $Q(L, K)$ such that $Q = 0$ if $L < L'$. For example, if output requires a quartet of workers, output at a firm is zero if $L < 4$.

Suppose jobs differ in terms of L'. In jobs where $L' = 1$, the wage will equal the marginal value product of labor in a single person job, or $W(1)$. In jobs involving TP with $L' > 1$ workers, arbitrage requires that the wage equal $W(1)$, but the marginal product of labor is $Q(L', K)$, since reducing L by one worker below L' reduces output to zero. It, therefore, follows that, if substitution is impossible if the L labor input is not available, the value to the firm of avoiding that input reduction is the whole team's marginal product. If substitution is possible but imperfect (say, because of team-specific knowledge), the value is the difference between team output with all 'regular' members present and the lower output with a substitute.

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Finally, we can express the idea of time sensitivity (TS) by assuming that the price (or revenue) from output is highest if production is not delayed, and, therefore, the value of output falls if labor is not available in amount L' in the current time period because of worker illness, so that production must be postponed to a later time period. The marginal effect of 'timeliness' is the difference in the value of output in the two settings.

In all three situations, we assume that there are actions employers can take to mitigate the effect of impaired functioning of a team member on team productivity. We assume, as before, that the incidence of illness is exogenous (conditional on the prevailing health benefits structure, taken as given), and that worker decisions to go to or be absent from work are exogenous, given the incidence of illness and the firm's policy for paying wages when workers are ill. Specifically, we assume that firms provide full sick leave benefits and pay wages at the average daily rate whether the worker is present and unimpaired, present and impaired, or absent. (We do not ask about optimal or equilibrium sick leave policies.) We assume that a worker who becomes sick comes to work if severity is below a certain exogenously determined level, and otherwise is absent. We do assume that manager responses to impacts of impaired presenteeism on other workers take into account the full range of externalities as managers perceive it: the direct physical productivity effects, but also impacts on co-worker personal interaction, co-worker efforts to avoid contact with someone with a contagious disease, and reallocation of tasks among team members.

The firm could spend resources on training co-workers to assume some tasks or on accumulating inventory to smooth out periods of down time. Or it might pay some workers more for working harder when one team member is restricted. As long as the cost of any of these activities is less than the value of additional output it permits, a profit-seeking firm should invest in them. After these protection costs are incurred, the realized costs in terms of lost productivity from an actual event of impaired presenteeism might be substantially reduced. However, the total cost of illness is the sum of the prior mitigation costs and the actual lost productivity in the event.

As in our previous work, we assume that some jobs have higher values for the three multiplier-related characteristics than others. How is the model affected if impaired presenteeism can occur?

We need to determine two things: how does impaired presenteeism affect the benchmark market wage $W(1)$, and how does it affect the across-job multipliers? The benchmark wage, as noted, is the marginal value product of labor in the 'isolated' job. If such workers sometimes come to work with their input affected by illness, they will presumably produce somewhat less output. The impact of impaired presenteeism will be to depress the money wage per time period by the average amount of impaired presenteeism per worker. For example, if workers suffer from impaired presenteeism that reduces output by 20% on 5 days of a 20-day month, the wage per day or the salary per month (compared to the wage if there were no impaired presenteeism) will be 2.5% lower. Note that, in competitive labor markets, the market-wide average incidence of impaired presenteeism will fall entirely on workers. This will be so even if employers do not specifically reduce the wages of those who experience such health effects, or even if employers do not know which specific workers are ill.

A firm whose workers have conditions that cause them to experience more than the average amount of impaired presenteeism will generally bear that additional cost in the ways described above unless, as noted in our earlier papers, all employers can detect or measure the health status of worker applicants. However, because an individual employer can increase profits by implementing a program to reduce impaired presenteeism when the cost of the program is less than the value of the increased productivity, it will pay employers to enact such programs.

The estimation of multipliers in the case of impaired presenteeism requires definition and measurement of the impact of impairment on labor input *and* the subsequent impact of that reduction in effective input on final outputs. This impact surely varies by the type of medical conditions as well. Such variation with illness type is in contrast to the case of absenteeism, where the reduction in input can be observed directly ('one day') and where the precise type of illness that caused the absence is

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reasonably assumed to have no relationship to the effect of the day's absence on productivity. (This is not necessarily true in the more complex cases reported by managers in which sick workers might be expected to work at home.)

The predominant method in the literature for measuring the amount of impaired presenteeism is to ask workers a question like this: 'On a day when you are suffering from or experiencing the effects [of a particular illness], by what percentage amount X is your productivity reduced?' Alternatively, 'productivity' is sometimes replaced by 'ability to work.' It would seem challenging for a worker to know the effect on productivity, most especially in a team setting. We suspect that, regardless of the wording, the worker rather thinks of something like 'input of my effort.' That is, the worker's response will tend to reflect the reduction in subjective input, and not necessarily the reduction in output (assuming, as is always the case in economics, that there is a distinction between inputs and outputs). It may also be that the worker's response relates to how he or she felt when working while sick; if I feel considerable discomfort even though objectively I do my duty to my employer, I may write down that I was less able to work.

Another source of ambiguity here occurs if a workday does not involve homogenous effort, but rather a variety of tasks. This is not true for all jobs; the barista or the telephone answerer may have only one thing to do. But in many jobs we might expect the worker who is not feeling well to implement some type of priority setting, making sure the most important tasks are done and postponing or passing the others.

So there is ambiguity in using the proportion X that constitutes the usual survey response. If the worker who works an 8-hour day says '25%,' but sets priorities so that the least-valuable quartile of his or her tasks are skipped, it would not be correct to say that, with the illness, the worker is providing 6 hours and the employer is losing 2 hours of homogeneous work or input. A conceptual question for our study, therefore, is what a manager is likely to be telling us when we ask the manager the equivalent question: 'Compared to a worker who is perfectly healthy, how many fewer productive hours per 8-hour shift does a [type of worker] provide if he/she has such a condition?' The manager may be thinking of output, not input, and may be in a better position to judge productivity than the worker.

EMPIRICAL METHODS

Wage multipliers for absences

For comparison purposes, we estimated both absenteeism and presenteeism multipliers. An absenteeism multiplier is defined as $1 + c$, where c is the total cost to the firm of an absence excluding the wage (w) of the absent worker, and is measured as a proportion of the worker's daily wage. If an equally productive substitute worker could be hired at wage w to replace the absent worker, c would be zero and the multiplier would be 1.0; the firm loses the payment of the sick leave benefit or, equivalently, the output the paid worker would have produced had the worker come to work. The multiplier could be greater than 1.0 if no perfect substitute is available at wage w and at least one of the following occurs: the absence causes the worker's teammates to be idle, the firm pays overtime for another worker to replace the absent worker, or the firm loses sales due to the absence. Absence multipliers have a minimum value of 1.0 because we assume labor markets are competitive: wages are set equal to the value of workers' productivity.[1] That is, when a worker is absent, the cost to the firm is at least the worker's marginal revenue product for that day. To obtain the cost of an absence including any effect on sales, labor costs, and/or the productivity of teammates, one would multiply the worker's daily wage by the multiplier.

[1] If one believes instead that the lower limit of the productivity costs of an absence is less than the wage, which could occur if workers' wages exceed the value of their productivity, then the multipliers are still relevant but should be applied to a lower starting value.

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We first describe the method used to derive absence multipliers because the same method is used for presenteeism multipliers.

To derive an absence multiplier empirically, we need to estimate the cost to the firm of an absence by a particular type of worker. The methodology described in Nicholson *et al.* (2006) is reviewed here because we will use a similar approach to estimate presenteeism multipliers. Specifically, we asked managers to assess how an unexpected 3-day absence would affect the output of the worker's teammates or department using a 1–5 categorical scale (see question 6 in the Appendix). Managers were also asked to assess the presence of three job characteristics – AS, TP, or TS – using a 5-point scale for each characteristic. (See questions 2–4 in the Appendix for the phrasing of this measure.)

We hypothesize that c is a latent variable whose value is a function of the three key job characteristics: AS, TP, TS. Using an ordered probit, we regress managers' categorical responses to questions about the extent to which absences by a particular type of worker affect the department's output on a set of indicator variables that characterize managers' assessments of the workers' job characteristics:

$$\mathscr{L}^* = \beta_1 \mathrm{AS} + \beta_2 \mathrm{TP} + \beta_3 \mathrm{TS} \tag{1}$$

$\mathscr{L}^*$ is a latent, continuous variable. What we actually observe is that $\mathscr{L} = 1$ (i.e. a manager reports that an absence has no impact on his department's output) if $\mathscr{L}^* \leq \mu_1$; $\mathscr{L} = 2$ if $\mu_1 < \mathscr{L}^* \leq \mu_2$, and so forth. The cutoff values (μ_1, μ_2, and μ_3) are estimated along with the coefficients, β.

We use the coefficients from this regression to get the mean predicted latent value $\mathscr{L}$ for each job in the survey with a minimum of 10 manager responses. This latent value measures the incremental cost of an absence for a particular job *relative to* the cost of absences for other jobs. To convert this latent value, or index, to a measure of the actual incremental cost, c, we need to scale the index. We do so by using the quantitative value from a question directed at ascertaining a manager's estimate of the monetary cost to the firm of an absence for this job (see question 8 in the Appendix). For example, if a job has a mean predicted value at the 50th percentile of the $\mathscr{L}^*$ distribution, we assign it the monetary cost of an absence at the 50th percentile of the latter distribution. Managers were explicitly told not to include the wage of the absent worker when assessing the cost of the absence, so their response is supposed to capture incremental costs above and beyond the lost marginal revenue product of the absent worker.

We chose to use an 'indirect' regression approach for estimating c rather than using the managers' direct quantitative response to a question about worker illness because we expected (and observed) that the quantitative question would be noisier than the categorical response regarding the impact of an absence on the manager's department. That is, the categorical responses used to construct the index had greater reliability.

Deriving presenteeism multipliers

We made a few important changes to the methodology outlined above when estimating presenteeism multipliers. We estimate the ordered probit in (1) separately for a presenteeism episode associated with an acute health condition, such as a severe head cold or flu, and for a chronic health condition such as depression, seasonal allergy, or arthritis. In each case, the dependent variable is a manager's categorical response to a question regarding the impact on a worker's teammates or other members of the department if he/she is present for work but suffering from a health condition (see question 7 in the Appendix). Because it may be easier for managers to substitute for an absent worker than one who is at work but sick, we asked managers to assess the ease of substitution separately for absenteeism and presenteeism (see questions 1 and 2 in the Appendix). We did not ask separate questions for extent of team production and timeliness of output.

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We do not have a direct measure of the reduction in labor input because of impaired presenteeism. Instead, we ask the manager to provide his or her estimate of how much, as a percentage of the daily total, on-the-job illness reduces the typical worker's input, effort, or ability to work. Call this estimated reduction in input X. We associate this measure with the latent variable, but then we need to scale the latent variable so that it measures the impact on productivity or output. Let Y be a measure of the total cost to the firm of the reduction in input where (as noted earlier) the total cost should include both the short run actual reduction in output and the impacts on the outputs of other team members, as well as the cost of actions the firm took to make that productivity impact smaller than it would have been without such actions. If the manager includes in his estimate of the cost to the firm the value of the worker's lost productivity, the value of Y (measured as a percentage of the daily wage) should always be at least as large as X (measured as a percentage of hours of work per day). The presenteeism multiplier is then Y/X, and has a minimum value of 1.0. The firm will spend on precautions up to the point at which the cost of preventing the lost output from an unproductive unit of work time just equals the wage per unit of work time – so the marginal value of avoiding an hour of lost work time at a minimum equals the hourly wage.

A major difficulty arose in asking managers about Y, for conceptual reasons suggested earlier involving the distinctions between inputs and outputs, and short run and long run. We had thought about phrasing the presenteeism question in the same way as the absenteeism question in our prior work, asking the respondent to separate out and quantify effects on fellow workers *in excess* of the worker's lost productivity and only reporting those. However, (as may be obvious) we found it very difficult to compose such a question for the setting in which the worker was still present on the job. It was also difficult to ask about prior costs incurred to cushion the effect of impaired presenteeism. So, we chose to ask a simple question that was meaningful to respondents, inquiring about 'the cost the firm incurs' when the person comes to work with impaired presenteeism, recognizing that the quantitative answer may not capture all of the costs to the firm.

Specifically, we obtained X by asking managers to estimate how many fewer productive hours a worker can provide if he or she is present but with an acute or chronic health condition (see question 5 in the Appendix). Managers were also asked to estimate Y: how much (as a percentage of the daily wage) it costs the firm when a person comes to work with a health condition for one day relative to a situation when the person is not sick. We explicitly instructed the managers to include the value of the sick worker's lost productivity, costs of covering for the sick worker, spillover effects of the illness on the productivity of other workers, sales lost, and expenses to accommodate the worker's condition (see question 9 in the Appendix). This allows us to examine whether managers believe the financial impact of a presenteeism episode on output is greater than or less than its impact on productive inputs.

The simplest approach would be to divide the mean value of X by the mean value of Y for each job. However, because we believe managers can estimate the impact of a presenteeism episode with a categorical variable more precisely than with a quantitative response, we pursue the same indirect approach outlined above. Specifically, we use an ordered probit to estimate the relationship between the categorical impact of a presenteeism episode on a department's productivity and characteristics of each job, generate a predicted latent value $\mathscr{L}^*$ for each job, and link the latent value to the quantitative monetary cost of a presenteeism episode at the corresponding point in the two distributions.

A possibility is that the manager may be thinking of what might be called the 'average short run' impact of impairment after the firm has taken steps to cushion that impact. Firms may engage in cross training, stock inventories, or compensate workers for filling in for each other. If they pursue these strategies optimally, at the margin the amount spent on mitigating the effect of a lost work hour should equal the wage per hour, so the long run marginal cost of impaired presenteeism should be at least as great as the reduction in output. But managers may be thinking of the short run average cost reduction. That is, they may be thinking of the average net cost to the firm when the mitigation costs for a lost hour

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(which should at first be less than the wage per lost hour) are taken into account. Or they may ignore the mitigation costs altogether and only think of the short run costs in terms of lost productivity.

So, although we explicitly informed managers that their estimate of the monetary cost of a presenteeism episode should include the value of the sick worker's lost productivity (the direct costs) and the indirect costs borne by others, it is likely that managers reported only part of the (marginal) costs. We, therefore, present a set of presenteeism multipliers based on 'adjusted' values of Y that assume the cost to the firm of the lost inputs of the affected worker is at least equal to their wage for that affected period.

THE SAMPLE AND THE SURVEY

We identified 12 industries, described in Table I, that have different production characteristics (e.g. team versus individual production, service versus manufacturing, easy versus difficult to substitute for an absent worker). Harris Interactive, a survey research firm, created a random sample of establishments within these industries stratified by the number of employees in the establishment. Harris Interactive contacted managers at these firms who supervised one of the 57 targeted job types and had sufficient experience to be able to describe what happens when a worker is absent or present but affected by a health condition.

A total of 790 managers provided information on the structure of their department and firm (e.g. number of employees of the relevant job type) and average wage. They were also asked about the extent to which each of the four characteristics (teamwork, ease of substitution when worker is absent, ease of substitution when a worker is present but affected by a health condition, and TS) was embodied in a given job. The wording of the four key questions is presented in the Appendix. Managers were asked to indicate on a 1–5 scale how easily they could find a replacement of equal quality or productivity if a worker was absent unexpectedly for 3 days or was present but ill. A '1' indicates it is easy to find such a replacement and a '5' that it is impossible. Using the same scale, managers reported the extent to which a specific type of worker functions as a part of a team and the degree of TS of their output.

The mean responses to the job characteristics questions are reported in Table I. There is considerable variation in the job characteristics. For example, 10% of the managers indicated it was easy to postpone an employee's work (a '1'), 30% indicated there are penalties if the work is postponed (a '5'), while the other 40% of managers gave an intermediate response. We designed three questions to elicit from managers categorical answers (using a '1'–'5' scale) about the consequences of an unexpected 3-day absence, an acute presenteeism episode, and a chronic presenteeism episode on the productivity of a worker's teammates or other members of the department. The precise wording of these questions is reported in the Appendix (questions 6 and 7). A '1' indicates that the absence or presenteeism episode has no effect and a '5' indicates the team or department essentially shuts down. Presenteeism is not as harmful to productivity per affected day as is absenteeism, but it is much more common.

We report managers' responses to these two types of questions in Table I. Forty-one percent of the managers indicated that a 3-day absence would have at least a moderate effect on the team's or department's output (a value of three, four, or five), versus 24 and 26% for acute and chronic presenteeism episodes, respectively. Since few managers responded with a '5' to these three questions, we combine the values of four and five when running the ordered probit regressions.

One of our goals is to separately measure the effect of a presenteeism episode on a worker's effective inputs and the outputs of his/her team or department. Question 5 in the Appendix addresses the former objective; managers were asked how many fewer 'equivalent' hours over an 8-hour shift a worker could provide when he/she was experiencing a presenteeism episode relative to a perfectly healthy person. Managers indicated that acute and chronic presenteeism episodes reduced a worker's effective inputs by 29 and 27%, respectively (Table I). Finally, managers were asked three quantitative questions regarding

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Table I. Sample statistics

Percentage of observations by industry ($n = 790$)	
Retail sales, department stores (%)	8.6
Legal services	8.5
Motor vehicle dealers (new and used)	8.5
Hotels and motels	8.5
Trucking and courier	8.3
Hospitals	8.5
Motor vehicle and equipment manufacturing	8.5
Air transportation, scheduled and courier	8.0
Construction, non-residential	8.5
Aircraft parts and manufacturing	7.3
Physicians' offices	8.6
Eating and drinking establishments	8.5
Job characteristics ($n = 790$)	
Ease of substitution – presenteeism	
1 Easy to replace worker (%)	27.6
2 Relatively easy to replace worker	17.7
3 Moderately easy to replace worker	25.2
4 Relatively difficult to replace	18.5
5 Impossible to replace worker	11.0
	100.0%
Ease of substitution – absences	
1 Easy to replace worker (%)	25.9
2 Relatively easy to replace worker	20.3
3 Moderately easy to replace worker	26.1
4 Relatively difficult to replace	17.3
5 Impossible to replace worker	10.4
	100.0%
Time sensitivity	
1 Job has no time sensitivity (%)	9.9
2 Job has low time sensitivity	11.5
3 Moderate time sensitivity	23.5
4 High time sensitivity	24.7
5 Extreme time sensitivity	30.4
	100.0%
Team work	
1 Worker works alone (%)	24.4
2 Worker somewhat important to team	27.9
3 Moderately important to team	28.1
4 Highly important to team	13.2
5 Worker critical to team	6.4
	100.0%

Effect of a Worker's absence/presenteeism episode on his/her team members or other workers in the department ($n = 790$)

	3-day absence	Acute presenteeism episode	Chronic presenteeism episode
1 No effect at all (%)	24.2	38.3	39.5
2 Minor effect	34.5	37.3	34.9
3 Moderate effect	32.3	19.4	21.1
4/5 Total shutdown of department	9.2	5.0	4.5
	100.0%	100.0%	100.0%
Continuous variables ($n = 790$)	Mean (%)	Standard deviation (%)	Median (%)
percentage fewer hours a worker provides if he/she has a temporary acute condition	28.9	26.1	25.0
Percentage fewer hours a worker provides if he/she has a chronic condition	26.7	25.5	25.0
Overall cost of an absence (as a percent of worker's wage)	93.4	120	50.0
Overall cost of an acute presenteeism episode (as percent of worker's wage)	60.7	102	20.0
Overall cost of a chronic presenteeism episode (as percent of worker's wage)	60.8	97.3	20.0

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the overall daily cost of absences and presenteeism episodes (questions 8 and 9 in the Appendix), as a percentage of the worker's daily wage. The mean values are reported at the bottom of Table I. Managers believe that the additional team-related cost of an unexpected absence, not including any payments made to the absent worker, is 93% of the worker's daily wage. The overall cost of both types of presenteeism episodes is about 61%, and here managers were asked to include the productivity loss of the affected worker, as well as any costs to team efforts. Thus, a day of absenteeism costs more than a day of impaired presenteeism, as one would expect – but there may be many more days of impaired presenteeism.

There is considerable variation in managers' assessment of the quantitative cost of absences and presenteeism, as is evident from the large standard deviations. The median values are 50, 20, and 20% for absences, acute presenteeism episodes, and chronic presenteeism episodes, respectively. To reduce the skewness of the three quantitative variables, we top coded the values at the 95th percentile of the distributions.

MULTIPLIERS

We first show the absenteeism multipliers estimated from the data using the same technique as in our earlier work. These results help to establish the generality of the methods and set a benchmark to which the presenteeism multipliers can be compared.

The results in Table II are very similar to those in our earlier work. While there are some wage multipliers close to unity, many are between one and two. The significance levels and magnitudes of the regression coefficients, and the resulting multipliers, are all very similar to those from our earlier work for a given job, when they can be compared. This pattern helps to establish the reliability of the method. The job types with relatively high multipliers in this analysis (such as paralegals) are the same job types with high multipliers in the earlier work based on data gathered from an entirely different sample of managers. This second study thus validates our earlier results.

Table III reports the results of the three ordered probit regressions to predict separately the effect of an absence, a presenteeism episode due to an acute health condition, and a presenteeism episode due to a chronic health condition on the output of the affected worker's team mates or the department as a whole. The categorical-dependent variable takes on the value '1' if a manager reports that the absence or presenteeism episode has no effect on output, '2' for a minor effect, '3' for a moderate effect, and '4' for a total shutdown of the team/department. In Table III we report marginal effects for the probability an episode has no effect on output (i.e. the probability the dependent variable is one), and the probability an episode totally shuts down the team's or department's output (i.e. the probability the dependent variable is four).[2]

The marginal effects generally display both statistical significance and increasing magnitudes for the three job characteristics. The three omitted job characteristics are jobs where workers are easy to replace, jobs with no TS, and jobs where workers work alone. The impact of an absence or a presenteeism episode on output is generally an increasing function of how difficult it is to substitute for the worker, the TS of the job, and the extent to which workers function as teams. The anomalous behavior for the infrequently observed 'worst' job characteristic (i.e. impossible to replace, extreme TS, critical to the team) was also noted in Nicholson *et al.* (2006). Relative to a situation where it is easy to substitute for an absent worker, the job has no TS, and the worker works alone, the probability that an absence will have no effect on output is 28.6% points lower (fifth row of column two) if it is relatively difficult to substitute for an absent worker. Relative to this same baseline job, the probability that an

[2] Probabilities are reported as percentages. Marginal effects for the other two outcomes (minor effect on output and moderate effect on output) are available from the authors upon request.

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Table II. Estimated absence multipliers

Job type	Observations	Absence multipliers
Auto service technicians	19	1.05
Hotel maids	22	1.05
Customer service reps	15	1.10
Receptionists – MD office	16	1.10
Waiters/waitresses	29	1.10
Automobile sales	37	1.10
MD office receptionists	16	1.10
Cashiers	26	1.15
Medical assistants	11	1.20
Team assemblers	14	1.25
Hotel desk clerks	18	1.25
Legal secretaries	20	1.27
Construction workers	21	1.35
Cooks	19	1.36
Truck drivers	41	1.50
RNs	49	1.52
LPNs	17	1.52
Retail sales – department store	15	1.60
Office clerks – auto or department store	27	1.89
Paralegals	16	2.00
Carpenters	11	2.00
Engineers	25	2.04

acute presenteeism episode will effectively shut down a department is 3.5% points higher (second to last row of column five) if a worker is highly important to his/her team.

The major difference between the absenteeism and presenteeism regressions is with the marginal effects on ease of substitution, with the progression observed for absenteeism not apparent for presenteeism. This result is plausible because it probably is more difficult for managers to delegate tasks to co-workers when a worker is present than when they are absent, so that differences in the ease of substitution for presenteeism are not as meaningful as for absenteeism. For the other two characteristics – team production and TS – the patterns of the marginal effects are quite similar. Managers are indicating that both absences and impaired presenteeism pose much more severe problems in jobs with high values of teamwork and TS. In summary, jobs with higher adverse effects when impaired presenteeism occurs are jobs with the same or similar characteristics as those which were generally reported as having higher effects when absenteeism occurs. The exception is for the 'ease of substitution' characteristic.

The last step in turning these results into multipliers is to scale the latent variables. The scaling questions asked about X (percentage reduction in effective inputs per episode in a given job because of illness) and Y (cost to the firm of an illness-related impaired presenteeism episode). The first two columns of Table IV show the values of X for different jobs for the two different kinds of medical conditions. Mean percentage reductions range from 18 to 43%, with medians across the job types of 31 and 27% for acute and chronic conditions, respectively. When we explored whether these reported reductions in effort because of illness were themselves related to the job characteristics that predict the effect of inputs on outputs, we found a moderately strong relationship.[3]

The next four columns of Table IV show the values of the cost variable Y, both as means and, rescaled, as proportion of observations where reported Y is less than reported X. The results suggest

[3] For example, managers of jobs that involve team production reported relatively large effects of an acute condition on a worker's inputs, whereas managers of jobs that have considerable time sensitivity reported relatively small effects of an acute condition on a worker's inputs.

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Table III. Ordered probit marginal effects. Effect of a worker's absence/presenteeism episode on output of the affected worker's team/department

	Absences		Presenteeism			
			Acute condition		Chronic condition	
	No effect	Total shutdown	No effect	Total shutdown	No effect	Total shutdown
Baseline probability	63.5	0.4	78.6	0.1	78.6	0.2
Easy to replace worker						
Relatively easy to replace	−11.3**	0.5	−10.7**	0.2	−14.3**	0.4
Moderately easy to replace	−22.7**	1.4**	−19.0**	0.6*	−14.5**	0.5
Relatively difficult to replace	−28.6**	2.2**	−15.0**	0.4	−7.9*	0.2
Impossible to replace worker	−19.5**	1.1*	−5.1	0.1	−11.5**	0.3
Job has no time sensitivity						
Job has low time sensitivity	−10.7	0.4	−2.8	0.1	−14.4**	0.4
Moderate time sensitivity	−13.1**	0.6*	−7.1	0.1	−10.2*	0.3
High time sensitivity	−18.4**	1.0**	−12.3**	0.3	−19.2**	0.7**
Extreme time sensitivity	−11.1*	0.5	−9.1	0.2	−9.9*	0.3
Worker works alone						
Somewhat important to team	−14.6**	0.7*	−21.0**	0.7*	−13.1**	0.4
Moderately important	−22.6**	1.4**	−25.7**	1.0*	−20.8**	0.8*
Highly important	−41.3**	5.3**	−44.5**	3.5**	−37.6**	2.6**
Critical to team	−26.1**	1.8*	−35.6**	2.0*	−26.0**	1.2

Notes: The dependent variable of the ordered probit regressions is a manager's estimate of the impact that an absence or presenteeism episode (separately for an acute health condition and a chronic health condition) has on the output of the affected worker's team mates, or the other people in the department if the affected worker works alone. The categorical dependent variable takes on the value '1' if the episode has no effect on output, '2' for a minor effect, '3' for a moderate effect, and '4' for a total shutdown of the team/department. We report marginal effects for the probability an episode has no effect on output, and the probability an episode totally shuts down the team's or department's output. Probabilities are reported as percentages. Marginal effects for the other two outcomes (minor effect on output and moderate effect on output) are available from the authors upon request. The three omitted job characteristics are workers who are easy to replace, jobs with no time sensitivity, and workers who work alone. There are a total of 790 observations (manager responses) in the regressions. The baseline probabilities for the two outcomes of interest are evaluated for a job with the least restrictive characteristics: easy to replace, no time sensitivity, and workers who work alone.

*Significantly different from zero at the 10% level.

**Significantly different from zero at the 5% level.

some difficult issues in the scaling of Y. About one-third of the managers reported a value of Y less than X: the overall cost of a presenteeism episode (Y), measured as a percentage of the affected worker's wage, is less than the percentage reduction in that worker's effective hours (X). Even so, the mean of Y substantially exceeds the mean of X in most jobs because other managers report very large values of Y. That is, the distribution of Y is skewed to the right. Therefore, in addition to using the actual reported value of Y, we also rescale Y in two ways: by setting each manager's Y value equal to X if reported Y is less than X, and by adding the 90th percentile value of $(X - Y)$ to Y.

Table V reports the presenteeism multipliers for each job type implied by these three approaches. The unadjusted presenteeism multipliers tend to be correlated with the absenteeism multipliers for the same jobs. However, for reasons discussed earlier, we regard the adjusted or rescaled values as more useful as multipliers.

The final step calculates a presenteeism cost per day for each job (as a percent of the wage) based both on the multiplier for each job and the degree of impairment of effort associated with an illness of either type. Results are shown in Table VI using the rescaled multipliers (the second set of multipliers reported in Table V). These results strongly imply that consideration of impairment of effort does matter. For

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Table IV. Presenteeism incidence and cost

Job type	Percent reduction productive hours (X)		Mean cost of presenteeism episode (Y)		Percent of observations with $Y < X$	
	Acute (%)	Chronic (%)	Acute (%)	Chronic (%)	Acute (%)	Chronic (%)
Auto service technicians	25.7	24.3	115.6	140.6	15.8	15.8
Hotel maids	25.6	25.6	37.9	40.4	36.4	36.4
Customer service reps	37.2	24.1	78.6	68.2	53.3	40.0
Receptionists – MD office	32.0	25.8	41.5	51.4	25.0	37.5
Waiters/waitresses	23.3	27.2	54.9	51.5	34.5	34.5
Automobile sales	27.4	30.1	139.3	126.9	37.8	40.5
Cashiers	39.9	33.2	28.2	27.5	69.2	53.8
Medical assistants	29.5	28.4	35.8	82.0	27.3	27.3
Team assemblers	31.3	26.8	85.0	116.1	57.1	35.7
Hotel desk clerks	27.8	29.2	38.1	22.3	33.3	44.4
Legal secretaries	33.1	33.1	35.8	42.4	55.0	45.0
Construction workers	26.2	17.9	47.5	43.1	23.8	28.6
Cooks	42.8	29.4	48.6	34.2	36.8	26.3
Truck drivers	28.7	22.6	43.6	41.3	46.3	24.4
RNs	31.9	27.0	29.7	43.2	65.3	44.9
LPNs	36.8	33.1	70.0	35.1	35.3	58.8
Retail sales – department store	39.2	29.2	106.8	117.9	33.3	20.0
Office clerks – auto or department store	30.6	27.8	51.0	53.4	44.4	33.3
Paralegals	31.3	28.9	121.4	85.6	18.8	25.0
Carpenters	23.9	25.0	50.3	91.4	36.4	18.2
Engineers	31.5	25.0	92.3	81.6	40.0	32.0
Mean	31.2	27.3	64.4	66.5	39.3	34.4
Median	31.3	27.2	50.3	51.5	36.4	34.5

Table V. Presenteeism multipliers

	Unadjusted Y		Y rescaled: $Y \geq X$		Y rescaled w/90th percentile of $(X - Y)$	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Auto service technicians	0.04	0.00	1.00	1.00	1.46	1.54
Hotel maids	0.00	0.00	1.00	1.00	1.47	1.47
Customer service reps	0.13	0.21	1.00	1.00	1.14	1.76
Receptionists – MD office	0.25	0.31	1.00	1.00	1.33	1.75
Waiters/waitresses	0.21	0.18	1.00	1.00	1.83	1.57
Automobile sales	0.18	0.07	1.00	1.00	1.55	1.31
Cashiers	0.13	0.06	1.00	1.00	1.07	1.16
Medical assistants	0.34	0.28	1.00	1.00	1.61	1.59
Team assemblers	0.61	0.86	1.00	1.00	1.80	2.33
Hotel desk clerks	0.36	0.34	1.00	1.00	1.71	1.63
Legal secretaries	0.30	0.60	1.00	1.02	1.43	1.74
Construction workers	0.38	0.73	1.00	1.00	1.81	2.66
Cooks	0.35	0.34	1.00	1.00	1.23	1.62
Truck drivers	0.35	0.44	1.00	1.00	1.66	2.11
RNs	0.63	0.74	1.00	1.05	1.80	2.13
LPNs	0.52	0.60	1.00	1.00	1.44	1.74
Retail sales – department store	0.51	0.79	1.00	1.20	1.47	2.06
Office clerks – department store	0.98	1.08	1.49	1.67	2.21	2.43
Paralegals	1.02	1.73	1.60	2.42	2.24	3.03
Carpenters	1.26	1.40	1.49	1.73	2.83	2.83
Engineers	1.59	2.00	2.00	2.42	2.78	3.50
Mean	0.48	0.61	1.12	1.21	1.71	2.00
Median	0.35	0.44	1.00	1.00	1.61	1.75
Correlation w/absence multiplier	0.94	0.93	0.83	0.85	0.81	0.85

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Table VI. Presenteeism cost per day (as a percent of the worker's wage)

Job type	Acute (%)	Chronic (%)
Auto service technicians	12.5	12.5
Hotel maids	12.5	12.5
Customer service reps	25.0	15.8
Receptionists – MD office	25.0	25.0
Waiters/waitresses	25.0	20.1
Automobile sales	16.1	12.5
Cashiers	20.0	12.5
Medical assistants	25.0	25.0
Team assemblers	30.0	38.8
Hotel desk clerks	25.0	25.0
Legal secretaries	25.0	35.7
Construction workers	25.0	25.0
Cooks	25.0	25.0
Truck drivers	25.0	25.0
RNs	37.5	37.5
LPNs	28.9	31.7
Retail sales – department store	37.5	37.5
Office clerks – auto or department store	50.0	50.0
Paralegals	56.4	75.0
Carpenters	50.0	55.1
Engineers	75.0	75.0
Mean	31.0	32.0
Median	25.0	25.0

example, cashiers have a relatively high presenteeism cost even with a low multiplier because illness reduces their productive effort more, while carpenters have a relatively low cost even with a high multiplier because illness has less effect on their ability to work.

DISCUSSION AND CONCLUSIONS

Research conducted over the last several years has attempted to quantify the impact of health conditions on worker productivity. While employers have actively managed the impact of absenteeism on worker productivity – and have responded with various staffing strategies, benefit designs (e.g. workers compensation), and return-to-work programs – they have generally not actively managed health-related impairment of productivity while at work.

To a large extent, this reflects the fact that 'you can only manage what you can measure.' Since presenteeism measurement cannot be readily implemented, presenteeism cannot be managed. A number of worker self-reported presenteeism measures have been developed and validated, and the impact of various health conditions on the workforce has been measured. While these studies have suggested that the cost of presenteeism may substantially exceed the costs of either absenteeism or direct medical costs, this has not spurred further attempts to measure presenteeism, nor has it provoked much action by employers to enhance employee access to health promotion, disease management, or case management services that might affect presenteeism; the latter are still generally provided as part of a portfolio of uniform health benefits to employees and are not sized according to their potential differential impact on productivity in different firms or in different jobs within a firm.

Exploring manager perceptions of the consequences of on-the-job illness shows that managers are aware that such illnesses affect how well workers can work. This implies that they would be willing to invest in cost-effective treatments that might prevent or mitigate these illnesses. They are also aware that

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such adverse effects are more consequential for some jobs and for some firms than for others, which implies that interventions that are cost effective in certain situations may not be cost effective in others.

They also apparently feel that substitution for an impaired worker is less effective in the case of impaired presenteeism than in the case of absenteeism. This observation strengthens the argument that firms should be more willing to be permissive in allowing workers who are not feeling well to remain at home, precisely because it will be difficult to make up for their impairments if they are present at work. While it will still often be true, in the short run, that it is better to obtain some productivity by requiring presence at work, even if reduced, from a day's work that the firm is paying for, in the longer run a more permissive policy may allow the firm to attract and retain better quality workers and thus reduce quality-adjusted labor costs. A 'go home' strategy makes more sense for jobs with small multipliers than those with large ones.

However, some managers appear not to be clear on the total cost to the firm of adverse effects from presenteeism. If they underestimate such impacts, they will also undervalue programs intended to reduce impaired presenteeism. They might think that on the job illness does little harm to productivity, or they might think that impairing conditions are less common than they really are. Managers need to be educated if they are truly underestimating. If instead we accept manager perceptions of the cost to the firm as truth, this implies that the process by which employers and workers adapt to on-the-job illness is, at a minimum, much more complex than conventionally thought.

The somewhat greater imprecision in estimates of the impact of presenteeism can be contrasted with the precision and consistency of the results on absenteeism, which validate our earlier work both in concept and even in empirical magnitude. Estimates of absenteeism multipliers seem quite stable across samples. For presenteeism, the current analysis does provide some useful results. Presenteeism does have effects on manager perceived costs that are correlated with the job characteristics that yield high absenteeism multipliers. The last five jobs listed in Table V do have presenteeism multipliers that are greater than one, by any of the scaling techniques, while the jobs at the top of the list have multipliers close to one. But at present, we cannot be as precise about multipliers for the jobs in the center of the list, precisely because the concept of presenteeism seems confusing to managers.

There are some reasons to think that some of these manager perceptions are in error, and our approach and our results do show how to correct to some extent for probable misperception in order to produce results closer to accurate ones. But further exploration of the interaction between impairment and output across a variety of jobs would add credibility to the measurement of this potentially important influence on productivity.

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APPENDIX A: DEFINITION OF KEY VARIABLES

A.1. Characteristics of the jobs

(1) Ease of substitution for presenteeism: 'On a scale of 1 to 5, how easy is it to have a co-worker or an outside temp worker pick up the most important responsibilities of the worker who is at work but sick, where '1' is 'easy to pick up the responsibilities with similar quality' and '5' is 'impossible to pick up the

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responsibilities'?' Interviewer's prompt, if necessary: 'A '1' means there is a pool of workers you can access whenever you want and these workers can take on the key tasks of the sick worker and perform them just as the sick worker would have if he/she had been healthy; a '5' means there is nobody else you could possibly find who could take on the key tasks from the sick worker and do them just as well.'

(2) Ease of substitution for absences: 'If instead a worker were absent for the entire day because of illness, how easy is it to have a co-worker or outside temp worker pick up the most important responsibilities of the sick worker on a scale of 1 to 5? Let '1' represent 'very easy' and '5' represent 'not at all easy'.'

(3) Time sensitivity: 'On a scale of 1 to 5, how time sensitive is this worker's output, where '1' refers to work that can be 'postponed easily' and '5' refers to situations where the 'work cannot be postponed without severe consequences'?' Interviewer's prompt, if necessary: 'For example, a '1' means that the worker can complete his or her work the following day and no sales are lost and no important deadlines are missed; a '5' refers to a situation where sales would be lost and/or important deadlines missed if a worker were absent or present for work but sick.'

(4) Teamwork: 'On a scale of 1 to 5, how important is this worker to the function of his/her team, where '1' refers to 'the team can function as usual when the worker is absent or present but sick' and '5' refers to situations where 'the team cannot function when the worker is absent or present for work but sick'?' Interviewer's prompt, if necessary: 'For example, a '1' might be appropriate for a person who picks crops in a field all by himself; and a '5' might be appropriate for the conductor of an orchestra where the orchestra can't play without the conductor and the conductor is useless without the orchestra.'

A.2. Managers' estimates of the impact of a presenteeism episode on the affected worker's inputs

(5) 'Compared to a worker who is perfectly healthy, on average, how many fewer productive hours per 8-hour shift does a [type of worker] provide if he/she has such a temporary acute [or chronic] condition?'

A.3. Managers' categorical estimates of the impact of an absence or a presenteeism episode on output

(6) Impact of a 3-day absence: 'Consider a situation where a [type of worker] becomes unexpectedly ill and misses 3 days of work. On a scale of 1 to 5, what impact would this 3-day absence have on the output or work of the absent worker's team [or the other people the manager supervises if the absent worker does not work in a team]? Let '1' represent 'no effect at all' and '5' represent 'total shutdown'.'

(7) Impact of a presenteeism episode (separately asked for an acute and a chronic health condition): 'Now think about what happens to the overall productivity of the ill worker's team [or the other people the manager supervises if the ill worker does not work in a team] when one of the workers is at work with a temporary acute [or chronic] condition. What impact would the presence of this sick worker have on the output or work of the sick worker's team [or the other people the manager supervises if the absent worker does not work in a team]? Please use a scale of 1 to 5, where '1' is 'no effect at all' and '5' is 'total shutdown'.'

A.4. Scaling questions

(8) Absences: 'Overall, how much do you think an absence by this worker costs the firm, in terms of additional costs the firm incurs or sales lost due to the absence? Do not include any payments made to the absent worker. Earlier you said that these workers are paid about $____per day. Please try to estimate, as best as you can, how much an absence of this type of worker costs the firm in terms of their daily wage.' [The answer could be given as a percentage of the worker's daily wage or a specific dollar amount.]

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(9) Presenteeism episode (asked separately for an acute and a chronic health condition): 'Earlier you said that these workers are paid about $___per day. Overall, how much do you think it costs the firm when a person comes to work with a temporary acute condition [or a chronic condition] for one day, compared to the situation when the person is not sick? Costs include the value of the lost productivity, covering for the sick worker, any negative impact the illness has on the productivity of other workers you supervise, any sales lost due to reduced productivity, and any expenses to accommodate the worker's condition.' [The answer could be given as a percentage of the worker's daily wage or a specific dollar amount.]

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