FAST TRACK ARTICLE

The Burden of Pain on Employee Health and Productivity at a Major Provider of Business Services

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Objective: *The objective of this study was to examine the burden of pain on employee health and productivity at a Fortune 100 company headquartered in the northeastern United States to prioritize target areas for reducing this burden.* ***Methods:*** *An electronic survey was conducted in late 2004, which produced a reasonably representative national sample of 1039 active employee respondents.* ***Results:*** *A total of 28.6% of respondents met the study definition for pain. Pain was linked to: 1) drops of more than 45% and 23%, respectively, in Overall Physical and Mental Health; 2) a fivefold increase in health-induced limitations in work performance; and 3) nearly three and two thirds workdays lost to presenteeism and absenteeism over a 4-week period. Afflicted workers displayed considerable room for improvement in their capacity for pain control and management.* ***Conclusions:*** *The prevalence of pain and its impact on those with the condition combine to make it an area of much opportunity for improving workforce health and productivity. Musculoskeletal diseases offer a promising initial target for corporate intervention.* (J Occup Environ Med. *2005;47: 658–670*)

Pain is either the primary feature or a prominent comorbidity of a number of medical diagnoses. It is a major driver of utilization of group health, workers' compensation, and disability services and often challenges efforts at medical and patient management in ways that utterly defy being ignored. As a medical condition, it is also a significant contributor to productivity loss—both impaired performance while at work (presenteeism) and time away from work (absenteeism)—striking many employees with a per-person impact that is substantial. Four common pain conditions (headaches, arthritis, back pain, and other musculoskeletal problems) alone have recently been estimated to cause productivity loss among nearly 13% of the U.S. workforce at a total cost of $62.1 billion per year.[1]

Such characteristics are leading pain to become a growing priority for employers as they look for new ways to enhance employee health and productivity. By way of context, for much of the private sector, the improvement of existing worker productivity has emerged as key to surviving and thriving in the marketplace. This development has been reinforced by such trends as the relentless march toward greater globalization, the aging of babyboomer workers, and the changing character of work itself, which is making a growing proportion of the workforce no longer interchangeable.[2]

Employers, in turn, have increasingly been drawn to a more proactive

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The authors gratefully acknowledge the sponsorship of the Institute for Health & Productivity Management (IHPM) and the financial support of a nonrestricted educational grant to IHPM by Purdue Pharma, Stamford, Connecticut.

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DOI: 10.1097/01.jom.0000171054.57677.4c

stance toward worker health. Investments in conventional routes toward productivity enhancement like education and training have by and large been optimized. By comparison, beyond paying benefits, health has for the most part been ignored, and the prospects associated with taking on such stewardship functions as health promotion, disease prevention, the restoration of function, and return to work have gained an aura of much promise.[3]

The field has responded with employer-sponsored studies on the impact of health on work performance that date back to the late 1990s.[4,5] Until recently, the focus has been on a variety of medical conditions, but rarely on pain per se. Examples include studies of the impact of musculoskeletal disorders on the work of banktellers, of irritable bowel syndrome at a hotel resort chain, of allergies on the performance of a heavy manufacturing workforce, and of 19 diseases on productivity at nine Tampa employers.[6–9]

Two developments are now spearheading the increasing private sector focus on pain and productivity: 1) the recent resurgence in per-capita spending for services by private health insurance, which has outstripped increases in average hourly earnings of U.S. workers by 39% to 14% during the 1999–2003 period[10]; 2) analyses of claims data that have amply documented pain's role as a leading contributor to this trend.[11,12] This article reports on a first-of-its kind company survey undertaken to broaden this focus by examining the burden of pain on the health and productivity of employees. Although claims analyses suggest that this impact is likely to be substantial, the self-report method mounted by the survey offers unique data for describing the burden of pain and for characterizing its magnitude. The survey medium in effect provides employees with a systematic way to convey how their quality of life and work performance are affected in ways that speak to the corporate bottom line. In so doing, it can generate information to guide corporate decision-making. Should a concerted effort be made to mount a disease management initiative to reduce the burden of this condition? The results here offer a case study that addresses this issue.

Materials and Methods

Sample

To participate, respondents (Rs) needed to be active employees of the company residing in the United States with electronic access to the Internet either at work or at home. Recruitment took place through several modalities within the company's communications framework, which were tapped to introduce the project and convey invitations to participate. The principal modalities included electronic messages transmitted in mass (ie, no personal addresses) format through the company's WebMD web site and hard copy invitations issued at the company's "Huddle" calendar meetings (ie, meetings that occur the first of the month at sites for which electronic access is not available).

A total of 1039 employees responded with completed surveys. The response rate could be at best only approximated given the information available. Company management estimates that 40% of the workforce had Internet access through the worksite at the time of the survey (the percent with Internet access through home or some other means is unknown and still an issue of vigorous debate within the company). Of those with Internet access, a further estimate is that roughly 25% had signed up for the company's WebMD program and was receiving electronic messages through the program's server at the time of the survey (the percent of employees reached through other means who also had Internet access was not known). These figures yield a response rate estimate of 43.3% [1039/(24,000*.40)*.25)].

This figure could well be at the high end of the plausible range of possible response rates given that the unknown variables described here may have had the net effect of increasing the denominator. Yet, irrespective of the level of response, the obtained sample proved reasonably representative of the target population. The obtained sample's average age was virtually equivalent to that of the target population, and its percentage male was a modest seven points below that of the latter (Table 1). Accordingly, this sample offered a viable basis for generalizing to the population targeted by the survey.

Data Collection

Employees opting to participate had to hyperlink to a URL listed in these invitations, which routed them to a web site on which they, in turn, were able to take and complete the survey. Rs had the option of accessing this URL while on breaks at work or at home (or some other nonwork-related venue). The survey took some 7 to 15 minutes to complete. Rs could do it all in one sitting, or alternatively take breaks and return to their (the same) computer within the same 24-hour period to finish it. The data collection period extended from early November through mid-December 2004.

Incentives and Confidentiality

To incentivize participation, the first 1000 Rs were awarded $10 Amazon.com gift certificates. To receive these certificates, Rs had to include their names and e-mail addresses both obtained in a manner that was decoupled from the survey

TABLE 1
Study Target Population and Obtained Sample: A Comparison of Demographic Characteristics

	Target	Obtained
Age (average in years)	40.2	40.4
Percent male	52%	45%

responses provided. To meet the company's confidentiality requirements, no other personal identifiers were elicited at any point in the process. As a result, all survey response data are and will remain deidentified to all parties, including the survey administrator.

Survey

Survey design served several objectives: 1) mount a general population approach that is relevant to all active employees regardless of health or clinical status and can identify employees meeting study criteria for pain; 2) enable the identification of a healthy benchmark sample for normative purposes; 3) focus on both description of the pain experience and quantification of the burden of pain on health and productivity; and 4) ask about ways affected employees are coping with the condition.

To achieve these objectives, the survey examined a well-used set of concepts for measuring the burden and management of disease, all tailored, when appropriate, for the assessment of pain: health status, chronic disease, presenteeism, absenteeism, medication use, condition management/coping, health risk behaviors, job characteristics, and demographics. As a set, these concepts—and their sequence of presentation in the context of a single instrument—have seen substantial use in recent work.[8,9] In most cases, the items used to assess them have a proven (ie, validated) track record by virtue of prior studies. Appendix 1 lists these concepts and the sources of the items used to measure each, and comments on the rationale for inclusion.

Pain Definition

The definition used to identify the pain sample relied on a blending of two approaches whose capacity for detecting patients with pain have been well documented in previous work. One drew from the SF-36 Health Status survey to field the item assessing the extent of bodily pain over the previous 4 weeks[13]; the other was adapted from the Brief Pain Inventory to measure the presence or absence of pain (other than everyday kinds of pain) the day of the survey.[14]

Rs had to report the experience of pain on both items to meet the study definition. In so doing, they exhibited being impacted by pain in a manner that could be considered both sensitive and specific from an epidemiologic perspective. By reporting the presence of out-of-the-ordinary pain the day of the survey, employees conveyed that their pain was immediate and compelling in nature, thereby augmenting the sensitivity of the definition. By reporting that pain had been experienced over the prior 4 weeks, they also related that their pain was also one of duration, not simply a passing phenomenon, thereby augmenting the definition's specificity. Together, the two indications made for a conservative yet robust combination for empiric study.

The two approaches were further combined to stratify employees with pain by severity. The item used for the "bodily pain over 4 weeks" approach had six response options, five of which rated the intensity of pain ranging from mild to very severe. The "non-everyday pain today" approach followed the "presence/absence today" item with a series of four items, asking Rs to rate their pain at its worst, its least, on average, and right now on 0- to 10-point scales.

This second set of items was first averaged, then transposed into a 0- to 100-point scale. Rs with scores ranging from 0 to less than 15.0 were classified as lowest-severity-pain patients; Rs with scores from 15.0 to less than 42.5 were classified as medium-severity-pain patients; whereas Rs with scores ranging from 42.5 to 100 were scored with highest severity.

Next, the 4-week item was transposed to a 0- to 100-point scale. Those scoring from 0 to 20 were classified as lowest severity; those scoring from 21 to 60 were classified as medium severity; whereas those scoring from 61 to 100 were classified as highest severity.

In the analyses reported next, we treated severity in some cases as a single overall measure and in others as a set of three modified dummy variables for lowest, medium, and highest severity. In each case, these scores were calculated by taking the average of the "bodily pain over 4 weeks" severity measure and the corresponding "non-everyday pain today" severity measure. For the modified dummy variable for each severity level, Rs received a score of 0 if they reported no experience of pain on either the corresponding "pain over 4 weeks" or the "non-everyday pain today" measure for that severity level. They received a score of 0.5 if they reported the severity level in question on one severity measure but not the other (eg, they received a 0.5 score on the lowest-severity dummy variable if they reported lowest severity on the "bodily pain over 4 weeks" severity measure but not on the "non-everyday pain today" severity measure). They were scored 1.0 if they reported the severity level on both measures.

Study Groups

As shown in Table 2 and Figure 1, 297 of the 1039 Rs, or 28.6%, met both pain criteria. Fully almost one in three employee respondents met this study's conservative definition for pain.

The severity stratification of this group yielded a bell-shaped distribution, with the majority of affected respondents falling in the medium group. The modified variable scoring strategy meant that each pain respondent could be designated a certain severity level on one severity measure and another severity level on the other severity measure. The right panel of Figure 1 conveys the result of this scoring by differentiating those who scored a certain severity level on one but not both measures

TABLE 2
Study Definition for Pain
Blending Two Validated Approaches
Brief Pain Inventory (Cleeland & Ryan, 1994)
Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains and toothaches). Have you had pain other than these everyday kinds of pain today?
SF-36 Health Status Survey (Ware, 1993)
How much bodily pain have you had during the past 4 weeks?

	BPI: Has Pain Now		
SF-36: Amt of pain last 4 wks	**No**	**Yes**	**Total**
None	229	18	247
Very Mild to Very Severe	495	**297**	792
Total	724	315	1039

from those who scored the severity level on both severity measures. It can be noted that this procedure resulted in the total number of "hits" across each of the three severity levels exceeding the total sample size of the pain group (ie, 297).

Figure 1 also shows the prevalence of a second group, the healthy benchmark, which functioned as a key norm in the analyses discussed subsequently. To be eligible, Rs needed to report none of 24 diseases on the survey's chronic condition checklist *and* above average health status on both of the study's two summary health measures: overall physical health and overall mental health (see subsequently for a description). This definition allowed employees with colds, the flu, and so on, but otherwise good health to be classified as healthy, thereby providing a realistic benchmark for comparison.

A total of 102 or 9.8% of the sample met these criteria. This percentage is a little lower than the 15% to 20% levels we have typically seen in previous work with other employers. A major reason for this was the high number of employees reporting one condition in particular: allergies. At 52%, this figure nearly doubled the levels observed in our past work.[8]

Study Measures

The criteria used to compare these groups spanned three categories: health, productivity, and pain management. Table 3 lists these measures and their descriptive statistics.

Health. The survey's nine items taken from the Short-form 36 Health Status Survey—each assessing either physical functioning, vitality, mental health, general health, or bodily pain—were combined to form two orthogonal measures of health: overall physical health and overall mental health, also known as the Physical Component Summary (PCS) and Mental Component Summary (MCS).

The PCS and MCS used here derive from the version of the PCS and MCS originally developed from the SF-12, itself a subset of the SF-36 Health Status Survey.[16] These scales were imputed through a modified regression estimate technique—the same methodology used to derive the SF-12 PCS and MCS with an additional errors-in-variables correction.[17] These imputations used as norms for the calculations a series of measures taken from an in-house active employee database developed in previous survey work with a group of similar employers (ie, the Xerox, Digital Equipment, and GTE Corporations[18]).

In addition, a disease count was computed from all "yes" reports given in response to a chronic condition checklist adapted from the Medical Outcomes Study[19] and a depression measure developed from the three items taken from a new screener for major depression and dysthymia.[20] Rs reporting no chronic conditions and scores greater than 50 on both the PCS and MCS measures comprised the healthy benchmark group.

Productivity loss. The study's measures of productivity loss covered three conceptual distinctions: workdays lost resulting from health, limitation in performance on specified job dimensions resulting from physical or mental health problems, and limitation in overall effectiveness at work resulting from physical or mental health problems.

The workdays lost distinction was comprised of: 1) the absenteeism or "time away from work resulting from health" developed by Kessler et al[21] and 2) the days less than 100% resulting from health measure first

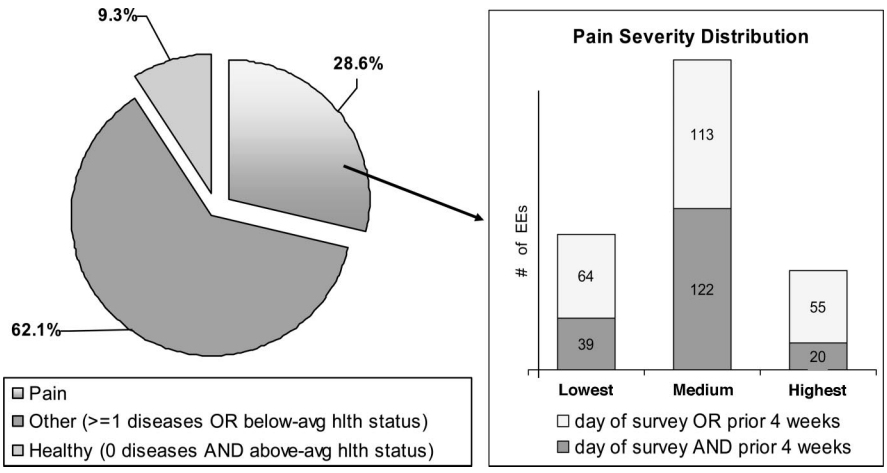

Fig. 1. Key study groups.

used by Allen and Bunn in the International Truck and Engine Allergy project.[15]

The "limitation on job dimensions" distinction was operationalized by 12 items taken from the Work Limitations Questionnaire.[22] These items assessed capacity to meet performance requirements on one of four dimensions as a function of health: time demands, physical demands, mental/interpersonal demands, and output demands. Eight of these items (two for each dimension), comprising the WLQ short form, were combined to form a summary WLQ scale.[23]

The third distinction, overall effectiveness at work, was captured by the single-item index first deployed by Allen and colleagues in the Tampa Healthy People Survey.[9] Both this item and the WLQ items were each transposed to the 0- to 100-point continuum, with high limitation scored high.

Pain management. Three measures comprised this final category. Two were three-item scales focusing on satisfaction with treatment for pain and on coping with life in general. The other measure was a single-item scale asking Rs to rate the degree of completeness of their pain control. All three measures were drawn from the recently validated Treatment Outcomes of Pain Survey developed by Rogers et al.[24]

Analyses

The Stata software program was used to implement an analytic strategy that consisted primarily of the estimation of direct effect models using ordinary least-squares regression.[25] All multivariate analyses were controlled for age and gender.

Results

Table 3 also reports certain findings that help to provide context. With re-

TABLE 3
Study Measures

Health	No. of items	Range	Mean	S.D.	Meaning of high score
Health Status					
General health	1	0–100	69.1	19.5	Excellent health
Physical functioning scale	4	0–100	90.9	16.6	No physical limitation
Vitality—energy level	1	0–100	60.6	24.1	A lot of energy all the time
Mental health—down in dumps	1	0–100	81.6	21.3	None of the time
Physical component summary	9	0–100	52.0	8.2	Excellent physical health
Mental component summary	9	0–100	47.8	11.3	Excellent mental health
Depression screener	3	0–100	25.2	43.4	At risk for major depression and/or dysthymia
Diseases: count (out of 24)	24	0–24	2.7	2.5	Many diseases
Pain					
Pain Severity	2	0–100	37.2	16.8	High severity
Low	2	0–100	23.9	35.8	High proportion
Moderate	2	0–100	60.1	38.1	High proportion
High	2	0–100	16.0	29.7	High proportion
Health Risk behaviors					
% Smoking	1	0–100	17.1	37.7	% smoking ≥1 cig/day
% Overweight	1	0–100	29.8	45.8	% BMI ≥ 30.0
% Drinking	1	0–100	10.2	30.3	% ≥1 drink/day
% Sedentary lifestyle	1	0–100	30.3	46.0	% exercising < once/wk
Productivity					
Days Lost—Last 4 wks					
Days absent	1	0–28	.47	1.78	More days
Days at work <100% due to health	1	0–28	1.91	4.32	More days
Presenteeism: —Last 4 wks					
Time demands	2	0–100	27.9	34.6	Health severely limits
Physical demands	2	0–100	16.2	23.4	Health severely limits
Mental/interpersonal demands	2	0–100	12.2	17.4	Health severely limits
Output demands	2	0–100	11.1	24.2	Health severely limits
WLQ scale	8	0–100	16.9	16.6	Health severely limits
Overall work effectiveness	1	0–100	9.7	17.1	Health severely limits
Self-reported Accidents—Last yr					
% reporting 1+ accidents	1	0–100	4.9	.22	More accidents at work
Pain Management					
Satisfaction w/Treatment	3	0–100	60.7	24.7	Highly satisfied
Pain control	1	0–100	66.3	27.7	Complete control
Coping: past week	3	0–100	74.1	22.5	Completely able to cope

spect to health, the sample exhibited better-than-average physical health but lower-than-average mental health (ie, its mean scores of 52.0 for PCS and 47.8 for MCS were, respectively, 2 points above and 2.2 points below the corresponding norms in our in-house database). Roughly one fourth of the sample indicated through the depression screener that they were at risk for major depression and/or dysthymia. Some 30% gave responses indicating that they were at risk for being overweight and having a sedentary lifestyle.

As for productivity loss, less than 5% of the sample recorded at least one accident or injury on the job over the last year—a rate that compares favorably with rates observed for other employers in our in-house database. In contrast, of the performance dimensions, time demands stood out with an average score that was strikingly high, both with respect to the other work dimensions observed for this company and with respect to the time demand scores we have observed for other employers in past studies. Time pressures and related job stresses would appear to be a cardinal feature of this company's work environment for many employees irrespective of the burden of disease.

Pain Burden

Marked by a linear pattern that increased with severity on all nine productivity measures examined, the burden exacted by pain on productivity loss was substantial (Table 4). The healthy benchmark posted negligible loss scores on virtually all of these measures. In each case, the added loss resulting from the presence of pain—whether expressed in either average number of days, percent reporting one or more accidents, or the average extent of limitation—was statistically dramatic. This loss, indexed by comparing the pain group overall with the healthy benchmark, registered highly significant ($P < 0.0001$) increases on eight of the measures and a significant increase (0.02) on the ninth (accidents). Figure 2 shows these relationships for days absent and days less than 100% during the previous 4 weeks. As can be seen, the two combined totaled to an average of just over one third of a day for healthy employees; the corresponding figure for those with pain was approximately 4 days, leaving the difference (three and two thirds days) directly attributable to the impact of pain.

The stepwise nature of this increase was evident with tests comparing the severity and healthy groups (Table 4). On five of the nine measures, the lowest severity group posted a significant jump in loss relative to the healthy group. On eight measures, the burden of pain for the medium-severity group was a significant jump relative to the lowest severity group, whereas for all nine measures, the highest severity group's increment relative to the medium group was highly significant.

Figure 3 summarizes this pattern by showing the results for the four WLQ demand scales.

Particularly revealing was the results for time demands. Reflecting an evidently time-pressured environment, the healthy group's score registered a not inconsequential burden at 16.8 on the 0–100 limitation scale. Yet, even here, the burden associated with highest severity pain almost tripled this limitation score to 46.1.

This pattern replicated on the health measures (Table 5). The health status measures—each scored in the opposite direction to link high

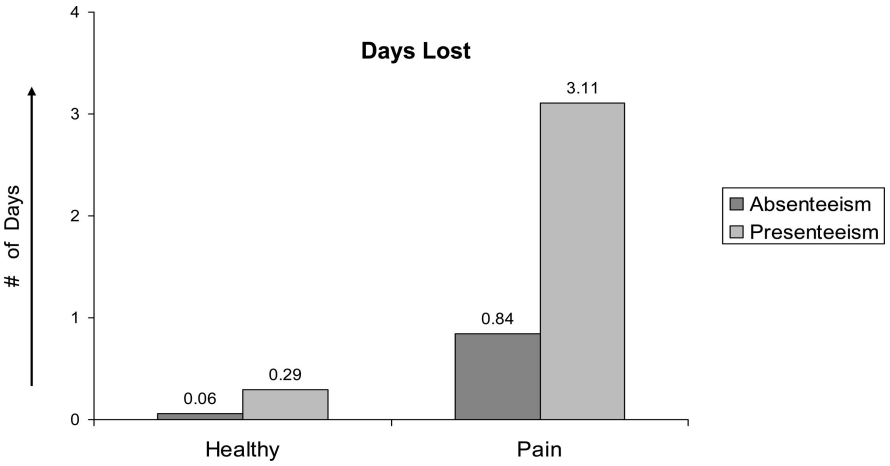

Fig. 2. Pain and workdays lost to health problems (last 4 weeks).

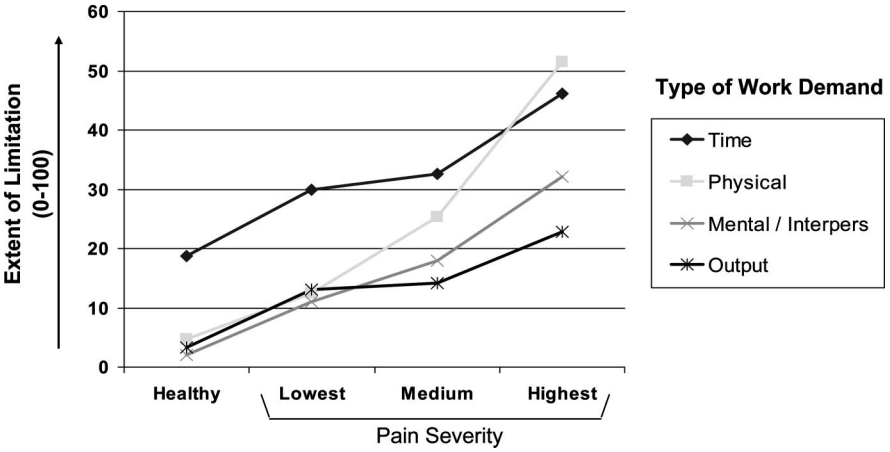

Fig. 3. Burden of pain on performance at work (difficulty/ability to meet job demands).

TABLE 4
Productivity by Pain Status

	Pain Severity Level				Healthy vs. All Severity Levels		
	Healthy	Lowest	Medium	Highest	Test	df	*P*
Days Lost—last 4 wks							
Days absent	0.03	0.33	0.86*†	1.67*†	F = 15.5	1,1032	<0.0001
Days at work <100% due to health	0.12	1.73*†	3.2*†	5.8*†	F = 40.1	1,1032	<0.0001
Self-reported accidents—Last yr							
% reporting 1+ accidents	2.6	5.1	7.5	26.6*†	X^2 = 5.2	1	0.02
Limitations while at work: performance dimensions—last 4 wks							
Time Demands[2]	16.8	30.2*	32.6*	46.1*†	F = 19.0	1,997	<0.0001
Physical Demands[2]	6.2	12.8*	25.4*†	51.5*†	F = 70.1	1,1011	<0.0001
Mental/Interpersonal Demands[2]	2.1	11.3*	18.2*†	32.2*†	F = 75.8	1,1022	<0.0001
Output Demands	3.1	13.2*	14.3*	22.9*	F = 19.3	1,1021	<0.0001
WLQ Scale[2]	7.1	17.0	22.2*†	38.5*†	F = 87.0	1,1030	<0.0001
Limitations while at work: Performance Overall—Last 4 wks							
Overall Effectiveness[2]	0.49	6.6*	16.2*†	32.4*†	F = 74.8	1,1032	<0.0001

[1] Row entries are least squares (or logistic) regression estimates adjusted for age and gender.
[2] Range: 0 = no limitation; 100 = severely limited.
* Score significantly different ($P < .05$) from score for Healthy group. No asterisk indicates that this difference is not significant.
† Score significantly different ($P < .05$) from cell to immediate left. No † indicates that this difference is not significant.

TABLE 5
Health by Pain Status

	Pain Severity Level				Healthy vs. All Severity Levels		
	Healthy	Lowest	Medium	Highest	Test	df	*P*
Health Status							
General health[2]	83.0	67.5*	61.5*†	50.4*†	F = 94.3	1,1032	<0.0001
Physical functioning scale[2]	98.9	93.4*	87.1*†	72.0*†	F = 50.2	1,1032	<0.0001
Vitality—energy level[2]	80.5	63.0*	51.6*†	45.3*	F = 86.1	1,1032	<0.0001
Mental health—down in dumps[2]	98.3	83.0*	73.3*†	67.8*†	F = 83.1	1,1032	<0.0001
Physical component summary	57.9	53.4*	46.0*†	31.7*†	F = 334.8	1,1032	<0.0001
Mental component summary	57.0	48.6*	43.2*†	43.7*	F = 76.1	1,1032	<0.0001
Health Risk behaviors							
% Smoking	8.9	15.5	18.5*	35.6*†	X^2 = 6.7	1	0.01
% Overweight	12.5	31.0*†	40.7*†	50.4	X^2 = 21.5	1	0.00
% Drinking	5.5	17.5*	9.9	16.8*†	X^2 = 5.3	1	0.02
% Sedentary lifestyle	13.1	32.3*	41.2*	48.8	X^2 = 20.8	1	0.00
Diseases							
# of conditions (out of 24)	0	2.6*	4.3*†	6.3*†	F = 330.3	1,1032	<0.0001

[1] Row entries are least squares (or logistic) regression estimates adjusted for age and gender.
[2] Range: 0 = poor health; 100 = excellent health.
* Score significantly different ($P < .05$) from score for Healthy group. No asterisk indicates that this difference is not significant.
† Score significantly different ($P < .05$) from cell to immediate left. No † indicates that this difference is not significant.

scores with better health—yielded the mirror reverse, with the healthy group scoring high and each severity group registering successively lower scores. Figure 4 shows this pattern by displaying the results for the summary PCS and MCS measures. Overall physical health fell sharply with pain severity, progressively worsening with each level of severity. Overall mental health also fell sharply, with the full effect of pain achieved at medium pain severity with average scores equivalent to a clinical depression diagnosis (ie, a score of 43 on the MCS scale).

The disease count measure likewise posted stepwise increments, from zero diseases for the healthy benchmark (reflecting the group's definition) to an average of more than six diseases for the highest severity pain group. With respect to the health risk behavior measures, in contrast, these groups did not display quite the linear pattern. For example, for employees in the me-

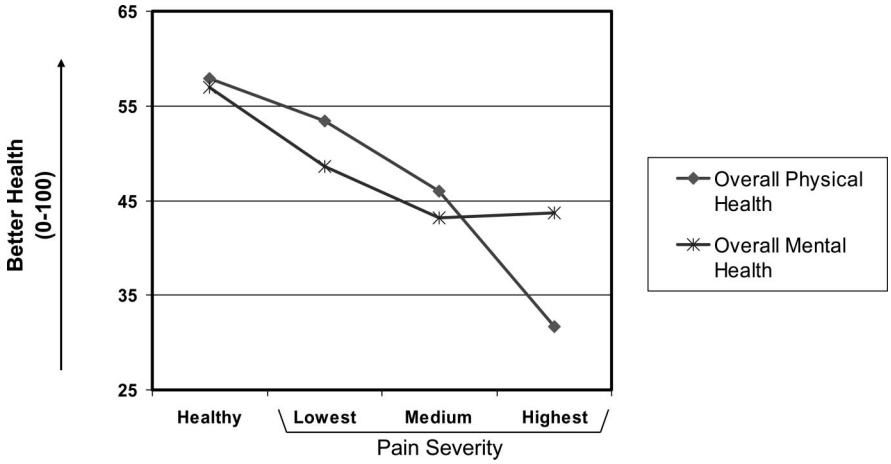

Fig. 4. Burden of pain on health status (overall physical and mental health).

dium-severity group, pain had no greater risk prevalence than the lowest severity pain on smoking, drinking, or sedentary lifestyle risks. Yet, even here, the pain group as a whole was more at risk than the healthy benchmark on each of the four health risk behavior measures assessed. Those in the pain group were significantly more likely than healthy employees to be at risk for being overweight, as well as for smoking, drinking, and a sedentary lifestyle.

Pain Management

The survey uncovered a number of ways that employees with pain reported they are explicitly using to manage the condition. These methods fall into four categories: medication use, complementary methods, healthcare utilization, and health-related behaviors.

Of the 297 employees in the study pain sample, 81% indicated that they had taken at least one medication (from the survey's list of 30+ medications) for pain over the previous year (Table 6). The majority (ie, more than three in five) reported that they had taken Advil, Motrin, aspirin, and/or Tylenol either for headache pain and/or others kind of pain. Slightly more than 10% reported taking one or more of the following prescriptions: Celebrex, Vicodin, or Naprosyn/Naproxen. (All other medications recorded less than 10% use.)

The second most frequently used category, at 59%, consisted of various forms of healthcare utilization. Some 55% reported at least one outpatient visit to a medical clinician for pain over the previous year, whereas 15% reported at least one emergency room visit and 6% at least one hospital inpatient night explicitly for pain. In addition, 5% of the sample reported that they had had at least one psychiatric/psychologic visit for pain.

The third most often reported category was health-related behaviors (28%). Some 17% of employees in the pain sample reported that they were exercising to alleviate pain, whereas 12% said they had changed their diet. Some 10% reported drinking at least one alcoholic beverage per day for pain relief. At 25%, various options for use of complementary medicine comprised the final category. Some 16% reported use of herbal medicine, whereas just over 10% reported use of acupressure and a chiropractor.

Use of these methods was not mutually exclusive, either within or across categories. However, regardless of the combination, the pain sample gave much reason to infer that—at least from the employee perspective—there was considerable room for improvement in how their pain was being managed. As shown in Table 7 and Figure 5, those in the medium-severe category indicated that their pain in the last week was on average less than two thirds (ie, 65.1%) completely controlled. Those in the highest severity group reported that their pain on average was less than 40% completely controlled.

These pain control scores were reflected in the extent of satisfaction with their treatment program for pain. The average employee with medium severe pain was less than somewhat satisfied with his or her treatment; the average employee

TABLE 6
Methods Used to Manage Pain

Pain Sample (n = 297)							
Medication 81%		**Complementary 25%**		**Utilization 59%**		**Health Behaviors 28%**	
Advil/Motrin	62%	Herbal	16%	Inpatient admission	6%	Exercise	17%
Aspirin/Tylenol	61%	Acupressure	13%	ER visit	15%	Changes in diet	12%
Celebrex	12%	Chiropractic	11%	Outpatient Psych visit	5%	Drinking alcohol	10%
Vicodin	12%	3 others: each	<10%	Outpatient Medical visit	55%		
Naprosyn/Naproxen	11%						
26 other meds: each	<10%						

TABLE 7
Outcomes of Pain Management

	Pain Severity		
	Lowest	Medium	Highest
Satisfaction w/Treatment*	80.3	58.6	39.3
Pain Control†	89.4	65.1	36.0
Coping†	83.1	74.2	60.0

* Range: 0 = completely dissatisfied; 100 = completely satisfied.
† Range: 0 = none; 100 = complete.

with highest severe pain was in fact somewhat *dis*satisfied with his or her program. Those in the lowest severity were more positive, giving an average score of very satisfied. Yet, this average still fell short of completely satisfied; even this group expressed room for improvement in their program.

The extent of success realized by these treatment programs in controlling pain evidently had broader ramifications for the capacity of affected employees to cope with life challenges. The study's coping measure addressed the extent of perceived control employees felt they had over their life more generally, their capacity to handle problems, and their capacity to cope with stressful situations. Pain severity showed a strong relationship on this measure as well. The lowest severity group reported an average coping score, suggesting that their capacity in this regard was roughly four fifths what it could be, whereas the highest severity group's score suggested an average capacity level that was not even three fourths of that for the lowest severity group.

Reducing Pain Burden

With the evidence for pain burden—and room for improvement in reducing this burden—so substantial, what did the data have to say about where to start in this regard? The survey offered one way for identifying and prioritizing the opportunities from a clinical/epidemiologic perspective: ranking pain burden by disease. Given that the resources available for such an initiative would likely in any case to be limited, this analysis was predicated on the assumption that tackling those conditions exerting the greatest burden first would provide the best chances for getting the "biggest bang for the buck."

To operationalize this notion of pain burden, survey data were used to calculate two factors for each disease in the pain sample: its prevalence and its average pain severity. Table 8 provides these calculations and reports rankings by individual disease and by disease groupings. As shown, allergies—fueled primarily by its high prevalence—ranked first among individual diseases. When diseases were grouped, however, the highest ranking belonged to the musculoskeletal group. All things considered, if the decision is made to act and resources are limited, the combined prevalence of arthritis, back pain, and neck and shoulder problems, together with their respective per-patient impacts, would appear to make this disease grouping the most fertile starting point for intervention.

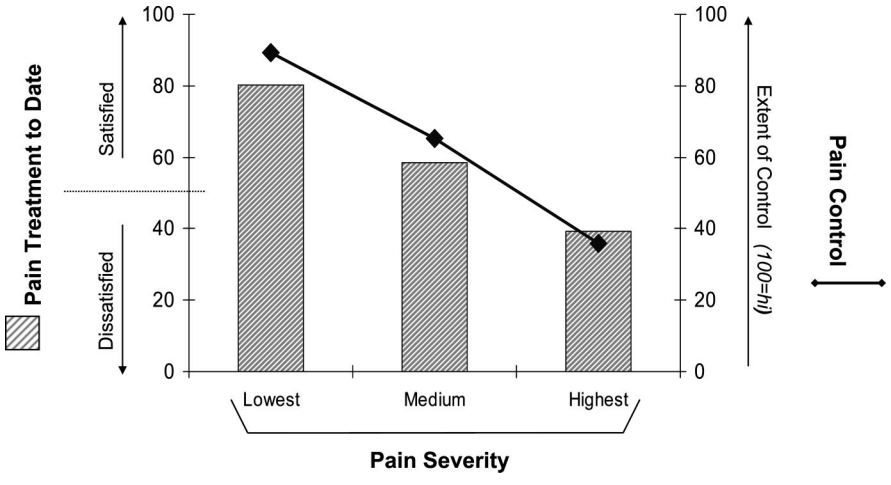

Fig. 5. Management of pain (outcomes).

Discussion

This study makes a compelling case for steps to reduce the burden of pain on employee health and productivity at this company. It also provides pointers as to where to start in this regard. First, the company's workforce and its work environment sport a profile that is ripe for susceptibility to pain. Although employee physical health is better than average (relative to employee populations elsewhere), employee overall mental health would appear to be worse than average. Just over one fourth of employees exhibit risk for depression, a frequent comorbidity of pain.[26] This company's employees also average more than two and a half medical conditions per employee, and almost one third are at risk for overweight and another third are at risk for a sedentary lifestyle—all characteristics heavily implicated in the pain experience. Moreover, the company workplace is one whose time demands many employees evidently find to be considerable and conducive to acerbating the condition.

Second are the epidemiologic findings. Nearly one in three employees is affected by pain—a less conservative definition than that used here would have found an even greater proportion. Moreover, the burden of pain on employee health

TABLE 8
Ranking Pain Burden by Disease: Pain Sample

Disease	Individual Disease: Prevalence (Pain Sample)	Pain Severity (0–100)	Prevalence × Pain Severity	Disease Rank
Allergy	58.2%	38.0	22.1	1
Neck/spine	42.8%	43.2	18.4	2
Low back	38.1%	45.3	17.2	3
Depression	38.1%	41.2	15.7	4
Arthritis/rheumatism	33.3%	43.4	14.5	5
Sleeping problems	27.6%	42.9	11.9	6
Migraine	27.9%	41.9	11.7	7
Heartburn	25.6%	42.8	10.9	8
Hypertension	21.5%	39.3	8.5	9
Irritable bowel syndrome	13.5%	44.5	6.0	10
Deafness	12.5%	43.1	5.4	11
Limitations	9.1%	52.5	4.8	12
Dermatitis	10.8%	42.7	4.6	13
Chronic lung disease	8.8%	44.0	3.9	14
Urinary	8.4%	43.4	3.7	15
Blindness	7.4%	41.4	3.1	16
Anemia	6.7%	41.6	2.8	17
Diabetes	5.7%	42.5	2.4	18
Ulcer	3.4%	53	1.8	19
Cancer	3.4%	52.5	1.8	20
Heart disease	4.7%	34.3	1.6	21
Skin cancer	2.4%	36.1	.85	22
Seizures	1.0%	38.8	.39	23
Kidney disease	1.0%	29.6	.30	24

Disease Grouping	Disease Grouping: Diseases (indexed by above ranking)	Combined Prevalence × Pain Severity	Disease Group Ranking
Musculoskeletal	2,3,5	50.1	1
Mental & nervous	4,6,7	39.3	2
Respiratory	1,14	26.0	3
Gastrointestinal	8,10,14,15,19,24	22.7	4
Cardiovascular	9,18,21	12.5	5
Cancer	20,22	2.65	6
All other measured conditions	11,12,13,16,17,23	21.09	—

and work productivity is considerable. For employees in the highest severity group (relative to the healthy benchmark), pain is associated with: 1) drops of more than 45% and 23%, respectively, in overall physical and mental health (as exhibited by the summary WLQ scale); 2) a fivefold increase in health-induced limitations in performance while on the job; and 3) the addition of nearly three and two thirds workdays lost to presenteeism and absenteeism over a 4-week period.

Third, although a variety of methods are being used to manage pain, many employees with the condition rate their current treatment approach as far short of optimal. Those with medium- and highest severity pain, in particular, indicate that there is much room for improvement, both in their capacity for pain control as well as in their treatment(s) for managing the condition. Nowhere is the opportunity for improvement more evident than among those employees with pain attributable to musculoskeletal diseases. Comparisons of pain burden by disease—generated by examining the combined prevalence and per person impact of 24 individual conditions—found that musculoskeletal diseases offered the greatest "bang for the buck" potential of all groupings studied.

Empiric studies are rarely without their possible limitations, and this undertaking is no exception. A first question concerns sample representativeness. The age/sex controls in the analyses adjusted for the fact that female employees, who are somewhat more likely to report pain (and a major comorbidity, depression), were slightly overrepresented in the data. Yet, the extent to which our sample was representative of all company employees with electronic access, or for that matter the extent to which employees with electronic access are representative of all of the company's active employees, remains

unknown. Further work clarifying this issue is needed before estimates of pain burden can be finalized in this employee population.

Second, pain detection relied exclusively on survey self-report. The validity of self-report has been the subject of considerable past work by the first author and others.[27] Although pain is inherently a subjective phenomenon that arguably is systematically best examined by this method, it remains the case that confirming diagnostic data from administrative sources (eg, group health) would have bolstered the credibility of the pain designations.

Third, the pain severity classification used here differed in two main respects from what has been reported in the literature and could be questioned in light of previous research. First was the classification's combination of the pain severity item drawn from the SF-36 survey with the severity measure developed from the four BPI severity items—a synthesis that to our knowledge was used for the first time in this context. Second were the cut points used for the BPI component of the severity measure. These cut points were an approximation of the cut points first advocated by Serlin et al.[28] and were a departure from a number of other studies that have systematically explored other cut point combinations.[29–31]

For the SF-36 component of the overall severity measure, it can be noted the severity classification was based on a straightforward designation of the labels employees could choose from when answering the SF-36 item. For example, those respondents who answered by saying their pain was severe or very severe (the two options at the most severe end of the six-point response scheme) were here assigned to the highest severity group. For the BPI component, the severity classification was based largely on distributional characteristics. Here we endeavored to balance the need to have at least a reasonable minimum number of respondents in each group with the desire to have an overall distribution of group percentages that was a reasonable approximation of the corresponding group percentages for the SF-36 component.

Additional tests that reran analyses reported here using an adaptation of the cut points for the BPI severity measure advocated by one of the most recent studies in this area, Zelman et al[32] (3.0/6.0 on the average of the "worst" and "average" BPI severity items) found no substantive differences. The means for each severity group stayed virtually the same, the pattern of significant differences between groups stayed intact, and the overall interpretation and conclusions remained unchanged. Yet, to avoid any unintended connotations, it was ultimately deemed best to couch the severity designations in terms that emphasized the distributional relationships (lowest, medium, and highest) and to leave the substantiation of designations rooted in clinical terms (mild, moderate, severe) for future research.

Fourth, for many readers, converting into dollars the productivity losses attributable to pain would likely strengthen the burden analyses. Those not familiar with survey techniques tend to relate more readily to estimates conveyed in "dollarized" metrics than to those used here (eg, percent-limited).

These possible limitations withstanding, it would appear that a systematic effort to target and reduce the burden of pain offers this company a significant opportunity to create a new "win–win"—nurturing a better quality of life for many of employees while at the same time promoting a more productive workforce. What steps could be taken to better equip this company for determining whether to pursue this opportunity? We close with three suggestions that pertain, not only to this company, but to other employers as well, which may be contemplating taking action to measure and/or reduce the burden of disease on workforce health and productivity.

First, an exhaustive effort should be made to tap the available databases to refine the information for shaping and guiding strategy development. In this case, a more expansive picture of the combinations of methods that affected employees are using to manage pain could be generated from the existing database that would help to intervention developers to better anticipate what treatment methods and approaches need be attended to and perhaps changed. Explicit comparisons of the relationships that these method combinations have with the various management outcome measures could be used to better characterize the combinations and to prioritize them in terms of effectiveness. Teasing apart some exploratory results (not reported here) that have provocatively linked job characteristics measured in the survey (ie, job demands vs. job control[33]) with productivity loss could similarly help inform strategy development.

Second, identifying the alternative intervention programs available and conducting analyses that compare the return-on-investment (ROI) for these options would provide company management with the framework needed to make what is essentially a business decision. One promising mechanism for conducting this kind of exercise is the Economic Valuation Tool, which the Institute for Health and Productivity Management is distributing to targeted members free of charge.[34] The implementation costs associated with the program alternatives for intervention would need to be identified. These costs would need to be compared against projected savings in terms of recouped productivity loss, reduced claims costs, and so on, to generate the ROI ratios that would help to guide the decision.

A final consideration concerns balancing employee confidentiality sensitivities on one hand with the prerequisites for effective and efficient study design and intervention implementation on the other. In general, the use of personal identifiers greatly facilitates—indeed is critical to—the accuracy of any analysis of pre–post change as well as the capacity of any intervention to make the

kind of connections with employees/patients who have any hope of achieving real behavioral change. Yet, in this engagement, the decision was made upfront to forego any procurement of personal identifiers during data collection in a manner that permitted linkage of these identifiers with survey responses.

Corporate concerns over employee sensitivities in this area drove this determination, and it could well have been the best decision to make at the time given the company's culture and circumstances. Yet, if an intervention and its evaluation are ever elected in the future, at some point, personal identifiers will need to be obtained and another round of "pre" data collected. In this regard, it is of note that the maintenance of participant confidentiality, while implementing and evaluating interventions, is now an established precedent in the field (as one example, see Allen et al[35]). For those intent on taking the next step, a number of "how to" Health Information Portability and Accountability Act (HIPAA)-compliance guides are now surfacing that can be drawn on for reference purposes to help direct future work in this area.[37]

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APPENDIX 1

The Survey: Content, Sources and Rationale

Concept	Survey Source	Notes/Comments
Health status: past 4 weeks	SF-36 Health Status[13]	Enabled two health status scales—Physical Health & Mental Health—to be formed and normed via multiple other databases. Items on bodily pain served as the "4 week" component of the pain screen and enabled stratification of EEs with pain by severity
Physical health items re: upper extremities	Treatment Outcomes of Pain[24]	Added discrimination where SF-36 has been shown to fall short re: pain patients
Pain status: today	Brief Pain Inventory[14]	Served as the "today" component of the pain screen and will add to capacity to enable stratify by severity
Co-morbidity checklist	Medical Outcomes Study[19]	Yielded count and itemized listing of co-morbid medication conditions
Screener for major depression disorder and dysthymia	Primary Care Screener for Affective Disorders[20]	Screened for DSM-IV diagnosis of MDD and dysthymia
Absenteeism (4 wks)	Health & Work Performance Questionnaire[21]	Allowed calculation of EE health-induced time away from work in days and hours
Presenteeism (attribute-specific—4 wks)	Work Limitations Questionnaire[22]	Allowed 4 job attribute-specific scales—time demands, physical demands, etc.—to be computed and normed via other databases.
Presenteeism (overall)	ITEC Allergy Survey[8]	Allowed overall assessment of impairment at work
Health care utilization (overall and pain specifically)	—	Obtained conventional utilization info (needed as no administrative data were available)
Work place injuries	ITEC Allergy Survey[8]	Gave a self-report of injuries and a read on injury severity (by asking about doctor visits)
Disability support via workers compensation	Treatment Outcomes of Pain[24]	Obtained disability support info (needed as no administrative data were available)
Medications for pain	Healthy People Survey[9]	Asked only of those who meet criteria for pain sample
Alternative treatments/remedies for pain	Healthy People Survey[9]	Asked only of those who meet criteria for pain sample
Treatment: outcomes and control over pain	Treatment Outcomes of Pain[24]	Assessed how well the overall management program now in place is working
Job description: demand vs. control	Job Content Questionnaire[33]	Enabled description of EE's job position in terms of EE's views of demand vs. control
Demographics	—	Elicited demographic chars known to be associated with health and productivity
Health risk behaviors	Behavioral Risk Factor Surveillance System[36]	Elicited reads on health risks that are implicated in the diagnosis of chronic pain