IS WORKERS' COMPENSATION COVERING UNINSURED MEDICAL COSTS? EVIDENCE FROM THE "MONDAY EFFECT"

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Steady increases in the cost of medical care, coupled with a rise in the fraction of workers who lack medical insurance, create incentives for workers who are injured off-the-job to file Workers' Compensation claims. Many analysts have interpreted the high rate of Monday injuries—especially hard-to-monitor injuries like back strains—as evidence of such claims. The analysis in this paper, however, which uses data on "first reports" of injuries filed with the Minnesota Department of Labor and Industry between 1985 and 1989, indicates that workers with low probabilities of medical coverage are no more likely to report a Monday injury than are other workers. Moreover, employers are no more likely to challenge the Monday injury claims of workers with low medical coverage rates than the claims filed by workers with high coverage rates.

Any targeted social program is vulnerable to abuse or even outright fraud in the determination of benefit eligibility. It is widely believed, for example, that a sizable fraction of Disability Insurance recipients are able to work—and are therefore technically ineligible for benefits—but claim a disability in order to receive benefits (Parsons 1980; for a dissenting view, see Bound 1989). Similar concerns are expressed about other targeted programs, including Aid to Families with Dependent Children (Wolf and Greenberg 1986), Unemployment Insurance (Burgess 1992) and Workers' Compensation. In the case of Workers' Compensation, rising costs of medical care, coupled with increases in the fraction of workers who lack medical insurance (Olson 1994), have led to growing concern that the program is paying for off-the-job illnesses and injuries. Difficulties in policing the boundary between on-the-job and off-the-job injuries have even led some analysts to propose "24-hour" medical coverage that incorporates the Workers' Compensation system into a universal

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The data used in preparation of this paper are available from the authors subject to the approval of the Minnesota Department of Labor and Industry. The programs used to analyze the data are available from David Card until December 1999.

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health care program and eliminates the special status of work-related injuries (Burton 1992; Baker and Krueger 1994).

Possibly the most striking evidence of fraudulent claim activity in the Workers' Compensation (WC) program arises from the unusual pattern of Monday accident claims. At least as early as 75 years ago, it was observed that accidents are more likely on Mondays than on other weekdays (Vernon 1921, Chapter 10). In a seminal paper, Smith (1989) showed that WC claims for strains and sprains are more likely to arise on a Monday than on other days, whereas harder-to-conceal injuries like cuts and lacerations are about equally as likely on a Monday as on other weekdays. Although circumstantial, this evidence is consistent with the view that some workers "post-date" weekend back injuries and strains in order to obtain medical coverage and indemnity benefits through WC.

In this paper we present a more direct test of the hypothesis that the "Monday effect" in WC claims arises because of higher rates of fraudulent claims on Mondays than on other weekdays. Simple models of claim-filing behavior by injured workers and claim-monitoring activity by employers suggest that employees who lack medical insurance coverage for off-the-job injuries will file more fraudulent Monday claims and employers will screen these claims more carefully. We test these predictions using administrative data on WC claims from the state of Minnesota. A major limitation of the claims data is the absence of information on medical insurance coverage. Nevertheless, insurance coverage information is available for a representative sample of workers in the March Current Population Survey (CPS). We use a two-sample estimation technique to pool the data sources and study the effect of insurance coverage on the timing of injury claims and the likelihood that employers challenge their liability for a WC claim.

The "Monday Effect" in Injury Rates: Theoretical Issues

To set the stage for our empirical analysis it is useful to consider the implications of a simple theoretical model of injury reporting and claims monitoring that incorporates the possibility of fraudulent claims.[1] For concreteness, consider injuries like muscle strains and back injuries that are not immediately life-threatening and that typically arise without the occurrence of a verifiable "accident." Employees who incur such injuries off-the-job and who lack full medical insurance coverage have a financial incentive to delay treatment and file a fraudulent WC claim the next workday. On the other hand, employers and insurance carriers have an incentive to carefully screen any questionable WC claims. In equilibrium, employees will decide which off-the-job injuries to report as having occurred at work, conditional on an expected level of claims monitoring, and employers will choose a level of monitoring activity, conditional on an expected rate of fraudulent claims.

Now consider the comparison between injury claims filed on a Monday and those filed on another weekday. Assume that the number of on-the-job injuries is constant through the week, whereas the number of off-the-job-injuries occurring prior to work is higher on Mondays.[2] We would then expect to see a greater number of total accident claims filed on Monday than on other days, a higher employer monitoring rate for Monday claims (manifested, for example, by a higher probability that the employer contests the validity of Monday injuries), and a higher fraction of Monday claims that are ultimately rejected. Of course, these predictions depend on the

[1] The model is described more formally in Card and McCall (1995).

[2] Assuming that the off-the-job injury rate is approximately constant per hour, a typical worker with an 8-to-5 Monday-to-Friday work schedule has a 420% higher probability of an off-the-job injury before the start of work on Monday morning than before the start of work on Tuesday morning. The relative rate of weekend injuries may be even larger if weekend activities (sports, home repair) are more likely to result in an injury than activities during a normal weekday evening.

maintained assumption that the on-the-job injury rate is similar on different workdays. If the true rate of on-the-job injuries is higher on Monday, then we might expect to see a higher number of WC claims reported on Mondays, but no higher rate of disputed or rejected claims.

Even if on-the-job accident rates vary across workdays, it is possible to test for the presence of fraudulent claims by comparing the relative fraction of Monday WC claims for workers with different probabilities of off-the-job insurance coverage. In particular, suppose that off-the-job and on-the-job injury rates are similar for all workers, regardless of their medical coverage, and that more off-the-job injuries occur over the weekend than overnight between two regular weekdays. Then we would expect the "Monday effect" in injury claims to be larger for uninsured workers than for insured workers. We would also expect employers to expend relatively more resources monitoring the Monday claims of uninsured workers than of insured workers, leading to a higher rate of disputed claims on Mondays for uninsured workers.

In our empirical analysis we test these predictions by comparing the relative fractions of Monday injuries among workers with different probabilities of off-the-job medical coverage, and the rates at which employers deny liability for Monday injury claims filed by employees with different probabilities of medical insurance. One potential limitation of these comparisons is the fact that WC covers 100% of medical costs, whereas many off-the-job insurance programs require co-payments or deductibles. Thus, even workers with medical insurance coverage may have some incentive to report their off-the-job injuries as WC claims. This may weaken the contrast in behavior between insured and uninsured workers.

Initial Data Description

Our analysis of the Monday effect in Workers' Compensation claims is based on a 10% random sample of the "first reports" of injury filed with the Minnesota Department of Labor and Industry between 1985 and 1989. A first report is normally posted for any serious injury, and is legally required for all injuries that result in more than three days of lost work time.[3] Our data set thus excludes minor injuries that only required medical treatment or up to three days of lost work time (or both). Some 50,000 first reports were filed annually in the mid-1980s in Minnesota, resulting in a total of 25,563 injuries in our sample.

The first column of Table 1 presents descriptive statistics for the overall sample of claims, including roughly 10% of claims for which no wage data are available. The other columns of the table show the characteristics of the subsample of injuries with a valid pre-injury wage, classified by the day of the week on which the injury occurred. The level of wages is a key predictor of the likelihood of medical coverage. Hence, for most of our analysis we concentrate on injuries records with valid wage information.

The first report forms classify injury claims by type of injury (for example, burn, fracture, or strain), body part (for example, upper back), and cause (for example, struck by falling object). The most likely injury is a back strain caused by a slip or fall. Interestingly, back injuries and strains, as well as other injuries caused by a slip or fall, are all more prevalent on Mondays than on other weekdays.

The average employer and employee characteristics in our injury claim sample differ somewhat from the average characteristics of the Minnesota work force, reflecting the non-random incidence of injuries across workers and jobs. Construction and manufacturing jobs, for example, are over-represented in the claims sample relative to their shares of total employment in Minnesota, whereas trade and services are under-represented. By the same token,

[3]Because of a waiting period for disability benefits, injuries that result in no more than 3 days of lost work time (including the day of the injury) do not generate an indemnity claim and do not require a first report of injury.

Table 1. Characteristics of Injuries by Availability of Wage Data and Day of Injury.

		Injuries with Valid Wage Data:			
Distribution of Selected Characteristics	*All Injuries*	*All*	*Monday*	*Tuesday–Friday*	*Weekend*
Injury Characteristics:					
1. Percent Back Injuries	29.8	31.3	34.3	30.2	33.1
2. Percent Burns & Cuts	13.4	13.2	12.0	13.6	13.4
3. Percent Fractures	5.6	5.9	5.2	6.2	5.6
4. Percent Strains	43.0	45.0	46.4	44.4	47.0
Employer Characteristics:					
5. Percent Self-Insured	20.3	20.6	21.1	20.3	21.4
6. Percent Construction	11.3	11.9	12.6	12.6	5.0
7. Percent Manufacturing	29.7	31.5	33.6	32.7	19.1
8. Percent Trade	18.9	19.2	18.3	18.3	27.3
9. Percent Services	22.9	22.8	21.7	21.5	33.8
Employee Characteristics:					
10. Percent Female	31.1	31.0	29.3	29.9	42.2
11. Average Age	35.1	35.2	35.4	35.3	33.6
12. Percent White-Collar	35.4	35.4	32.0	33.1	58.7
13. Average Weekly Wage	$358	358	367	362	312
Claim Characteristics:					
14. Percent with Indemnity	71.2	75.8	76.8	75.6	76.1
15. Mean Indemnity Amount (for positive claims)	$6,488	6,336	6,667	6,429	4,998
16. Percent with Temporary Total (TT) Benefits	65.9	71.4	72.9	71.2	71.3
17. Mean Duration of TT Benefits (weeks)	10.8	10.7	10.7	10.9	9.2
18. Sample Size	26,563	23,747	4,892	16,422	2,360

Source: Sample consists of 10% sample of injuries reported to Minnesota Department of Labor and Industry between 1985 and 1989.

female and white-collar workers are substantially under-represented in the sample of WC claims. The average weekly wage of injured workers ($358) is slightly below the average for all Minnesota workers ($382 per week in March 1987). Virtually all of this differential is explicable by a small set of demographic, industry, and occupation controls (see below).

Rows 14–17 of Table 1 show the percentage of injury claims with positive indemnity payments (including temporary total and temporary partial benefits paid to workers during their recovery period, permanent partial benefits paid as lump sums or continuing benefits post-recovery, and other lump sum payments), the mean payment conditional on positive payments, the percentage of claims with temporary total benefits, and the mean duration of temporary total disability. The subsample of injuries with a valid wage observation includes a higher fraction of cases with temporary total benefits (71.4% versus 65.9% overall). This differential reflects the fact that the temporary total benefit rate is a direct function of the pre-injury wage: the administrative files are therefore more likely to include the injured worker's wage rate in cases where temporary total benefits were paid.

Mean indemnity payments and the duration of benefits are very similar for injuries that occur on Mondays and other weekdays.[4] Weekend injuries, by comparison,

[4]A t-test for a difference in the mean indemnity payment between Monday and Tuesday–Friday injuries has a value of 0.66. A t-test for a difference in the corresponding durations of temporary total benefits has a value of 0.39.

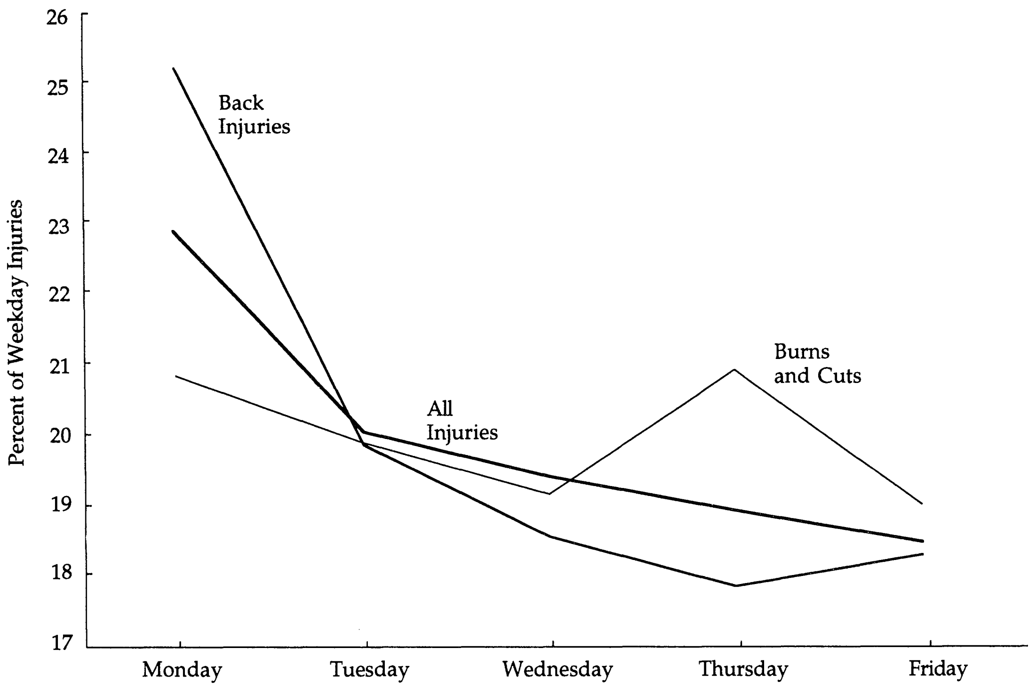

Figure 1. Distribution of Weekday Injuries.

have significantly lower mean indemnity payments and significantly shorter benefit periods.[5] In part, these differences reflect the higher concentration of weekend injuries among retail trade and service workers, and the lower average severity of injuries in these industries. Even controlling for industry, however, weekend injuries are more likely to involve female workers, white-collar workers, and lower-wage employees who tend to have lower-cost claims. In view of the distinctive character of weekend workers and weekend injuries, we focus exclusively on weekday (that is, Monday–Friday) injuries in the remainder of this paper.

Across all types of weekday injuries, 22.95% occur on a Monday. If work hours were evenly distributed across weekdays (see below), one would expect exactly 20% of weekday injuries to arise on Mondays. On this assumption, the "excess fraction" of Monday injuries is 2.95% (with a t-ratio of 10.8) and is significantly different from zero at any conventional significance level. By comparison, the fraction of weekday injury claims on Tuesday, Wednesday, and Thursday is relatively stable, ranging from 19.0% to 20.1%. The distribution of weekday injury claims is illustrated in Figure 1 for three classes of injuries: all injuries; burns and cuts; and back injuries. As noted by Smith (1989), the magnitude of the Monday effect ranges by injury type, with a negligible Monday effect for burns and cuts, and a much larger (5%) excess fraction of back injuries reported on Monday. The pattern in Figure 1 is suggestive: easy-to-conceal injuries (like back injuries) are more likely to occur on Monday, whereas highly visible or immediately threatening

[5]A t-test for a difference in the mean indemnity payment between weekend and Tuesday–Friday injuries has a value of 3.78. A t-test for a difference in the corresponding durations of temporary total benefits has a value of 2.86.

injuries (like burns and cuts) are very evenly distributed across the work week. Although not shown in the figure, claims for work-related occupational diseases (such as carpal tunnel syndrome) are also significantly more likely to be filed on Mondays than on other weekdays. We hypothesize that this pattern is driven by the arbitrary nature of the injury date for an occupational disease and a tendency to begin a spell of lost work time on Monday.

Medical Coverage and the Monday Effect

One simple explanation for the Monday effect in injury rates is that workers post-date their weekend injuries in order to recover their medical costs through the workers' compensation system. A critical check on this interpretation is that Monday injury claims are more likely among workers who lack medical insurance coverage. Unfortunately, our WC claims data set contains no direct information on the medical insurance status of injured workers. In the absence of this information, we proceed by using a two-sample estimation technique that combines medical insurance coverage data from the March Current Population Survey with data on the timing of WC injury claims from our administrative data files.[6]

Consider a sample of weekday injury claims, and let $y_i = 1$ if the i[th] injury claim is reported on a Monday, and 0 otherwise. Assume that π_i, the probability that $y_i = 1$, is a function of a set of characteristics of the worker involved in the injury (x_i), and an indicator for whether the individual has off-the-job medical coverage (m_i):

$$(1) \qquad \pi_i = x_i'\beta + m_i\gamma.$$

If the Monday effect is due to the fraudulent filing of WC claims for off-the-job injuries, then one would expect $\gamma < 0$, since uninsured workers have a higher incentive to file a false claim than do insured workers. Actual medical coverage is unobserved in our sample of injury claims. Suppose that a secondary sample is available, however, that includes medical coverage information as well as data on a vector of predictors z_i (some of which may be included in x_i) that are correlated with medical insurance coverage status. Let

$$(2) \qquad P(m_i = 1 \mid z_i) = z_i'\theta.$$

The coefficients of equation (1) can then be estimated consistently by a simple two-step procedure. The first step is to estimate equation (2) on the secondary sample. In the second step, equation (1) is estimated by ordinary least squares, replacing unobserved medical coverage with its imputed value ($z_i'\hat{\theta}$). This procedure is similar to conventional two-stage least squares, with two important differences: (1) the "first-stage" equation is estimated on the secondary sample, rather than the main sample; and (2) the full set of "exogenous determinants" of π_i (the full set of x's) is not necessarily included in the vector of predictors z_i. Nevertheless, it is easy to show that this two-sample two-stage estimation method is consistent, and to derive appropriate standard errors for the estimated coefficients of equation (1). Details are provided in the statistical appendix of Card and McCall (1995).[7]

Our secondary source of medical insurance information is the March 1987 Current Population Survey (CPS). Supplementary questions in this survey enable us to determine whether a given individual has any form of medical insurance coverage (through his or her own job, a government program, or another family member). We fit equation (2) to the CPS subsample of employed individuals in the 12 midwestern states, using as predictors of medical coverage a quadratic function of age, a set of 3

[6]Two-sample estimation methods were analyzed by Murphy and Topel (1985), Angrist and Krueger (1992), and Arellano and Meghir (1988).

[7]This procedure is a special case of the two-step estimation procedure discussed by Murphy and Topel (1985). Our standard error formulas account not only for the estimation of the first-stage equation in the secondary sample, but also for the fact that both (1) and (2) are linear probability models, and are therefore conditionally heteroskedastic.

gender/marital status interaction dummies, 6 occupation dummies, 8 industry dummies, and interactions of the log weekly wage with marital status, industry, and industry-by-gender. This equation is only moderately successful in predicting medical insurance coverage, with an R-squared coefficient of 0.13.[8] Although predicted medical coverage is therefore a noisy indicator of true coverage, we believe that the predictions are accurate enough to permit meaningful inferences in the second stage analysis.

A maintained assumption in this two-sample procedure is that medical coverage status has the same relationship with the predictor variables in the CPS sample as in the WC claims sample. In order to assess the plausibility of this assumption, we used a similar two-stage procedure to first estimate a weekly *wage* equation for the CPS sample and then predict a wage for each individual in the WC claims file.[9] As it turns out, the estimated coefficients from the CPS sample provide a surprisingly accurate wage forecast for injured workers. The mean forecast error is less than 0.3%, and the correlation of the predicted and actual wages for individuals in the claims file is 0.57. These findings suggest that the two samples are quite similar (conditional on observable worker and job characteristics), and that the assumptions needed to justify the two-sample procedure are plausible.

Table 2 illustrates the variation in medical insurance coverage rates across various employee groups and the corresponding variation in the size of the Monday effect in injury rates. Column 1 gives the percentage of individuals with medical insurance coverage in each group, estimated from the March 1987 CPS sample. Columns 2 and 3 show the percentage of all weekday injuries and the percentage of all weekday *back* injuries that occur on Monday for each group. As shown in column 1, medical insurance coverage rates are substantially lower for younger and single workers, and for workers with lower weekly wages. Perhaps surprisingly, however, the fraction of Monday injuries is virtually constant across demographic groups and wage quartiles. These simple tabulations provide little support for the hypothesis that the Monday effect in injury rates is attributable to the post-dating of weekend injuries by uninsured workers.

A potentially stronger test of the link between medical insurance coverage and the Monday effect is obtained by stratifying workers into groups based on their predicted probability of insurance coverage, and then comparing the fraction of Monday injuries across groups. Rows 4a to 4d present medical insurance coverage rates and percentages of Monday injuries for workers grouped into quartiles by the imputed probability of insurance coverage. Again there is no evidence that workers with lower coverage rates have a higher fraction of Monday injuries. Even for back injuries, which tend to be highly concentrated on Mondays, there is no indication of a larger Monday effect for workers with the lowest probability of medical coverage.

The Distribution of Work Hours over the Week

An important assumption underlying the comparison of injury rates by day of the week is that the distribution of work hours is constant across weekdays. If the probability of working on Mondays varies with the same characteristics as the probability of medical insurance, then the simple comparisons in Table 2 may be misleading. To assess this possibility, we used information on weekly work schedules from the May 1985 CPS to construct a sample of individuals who usually work at least one weekday per week.[10] (People who work *only* on the

[8]The estimated coefficients of the prediction equation are reported in Appendix Table 2 of Card and McCall (1995). The most important predictors of insurance coverage are the marital status/gender interactions and the wage interaction terms.

[9]We used only age, age-squared, marital status/gender dummies, occupation dummies, and industry dummies to predict the wage.

[10]The "Work Schedule and Dual Job Supplement" of the May 1985 CPS asks all respondents which days

Table 2. Probability of Medical Coverage and Relative Probability of Monday Injury, by Worker's Characteristics.

Group	*Probability of Medical Coverage (1)*	*Percent of Weekday Injuries on Monday (2)*	*Percent of Weekday Back Injuries on Monday (3)*
1. All Workers	89.4	23.0	25.3
2. *By Age/Marital Status/Sex:*[a]			
a. Younger Single Men	74.5	23.1	25.9
b. Older Single Men	85.6	22.9	25.2
c. Younger Married Men	89.9	23.0	26.5
d. Older Married Men	96.2	23.3	25.8
e. Younger Single Women	77.2	22.6	24.6
f. Older Single Women	85.7	22.5	21.8
g. Younger Married Women	91.9	23.7	25.7
h. Older Married Women	95.2	22.3	25.0
3. *By Quartile of Weekly Wage:*			
a. Quartile 1	76.7	23.0	23.2
b. Quartile 2	87.0	22.2	25.8
c. Quartile 3	95.7	22.6	25.9
d. Quartile 4	97.5	24.0	26.1
4. *By Quartile of Predicted Probability of Medical Coverage:*[b]			
a. Quartile 1	69.1	22.2	23.5
b. Quartile 2	89.1	23.5	25.4
c. Quartile 3	95.1	22.6	25.7
d. Quartile 4	98.0	23.5	26.4

Notes: Entries in column 1 are for midwestern workers in the March 1987 Current Population Survey who report earnings and weeks of work for the previous year. Entries in columns 2–3 are for injuries in Minnesota during 1985–89.

[a]Younger workers are those under 30 years of age. Older workers are those age 30 or older.

[b]Probability of medical coverage is imputed using data on age, gender, marital status, average weekly wage, industry, and occupation. Individuals are then sorted into quartiles based on their predicted probability of medical coverage.

weekends are excluded, since these individuals would never report a weekday injury.) We then computed the fraction of weekday workers at work on each regular workday.

For workers with relatively high probabilities of medical coverage (that is, those in the upper three quartiles of the predicted medical coverage distribution), the probability of being at work on any given weekday is roughly constant. For those in the lowest quartile of the medical coverage distribution, however, the fraction at work is lowest on Monday and rises over the week. Further investigation revealed that this pattern is attributable to the work schedules of retail trade employees. Low-wage workers in retail trade have a relatively low probability of medical coverage, and are also more likely to work later in the week than earlier. Within the retail trade sector, then, the expected fraction of on-the-job injuries occurring on Monday for workers with low medical coverage rates is *less than 20%*. As a result, a comparison of daily injury rates may fail to show a larger Monday effect for uninsured workers than for insured workers, even if uninsured workers are more likely to post-date weekend injuries. A simple correction for the differen-

of the week they normally work on their main job. Our analysis is based on non-self-employed workers who report an hourly or weekly wage for their main job, and report that they usually work at least one regular workday per week.

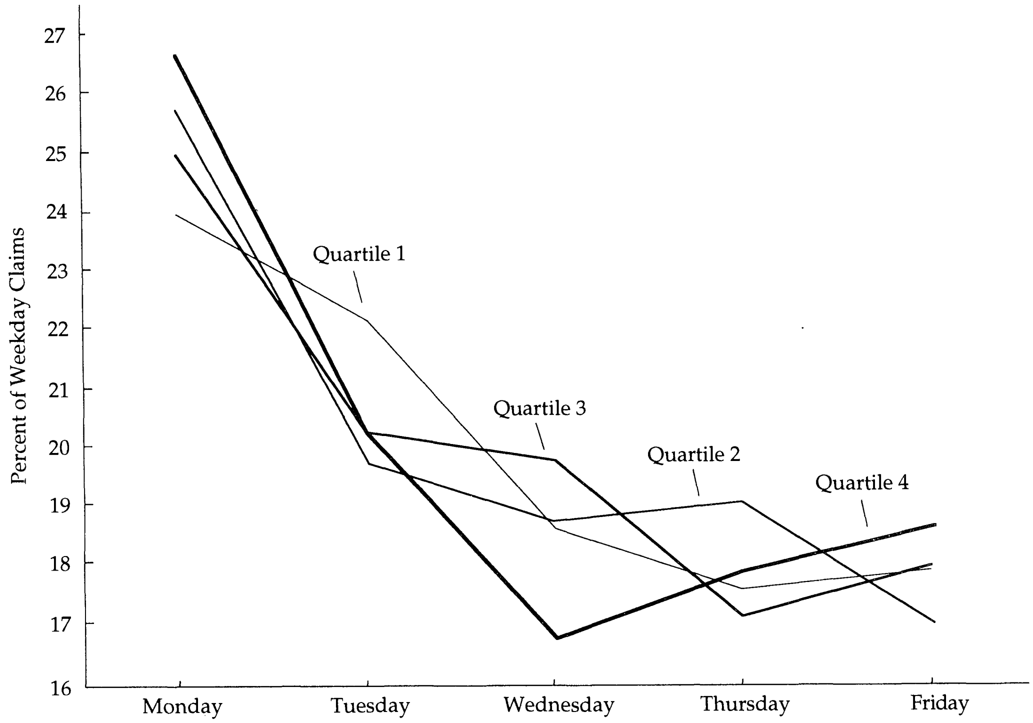

Figure 2. Distribution of Weekday Back Injuries, by Quartile of Predicted Medical Coverage.

tial probability of Monday work is to exclude retail trade employees from the analysis. As it turns out (see Card and McCall 1995, Figure 3), this exclusion effectively equalizes the probability of working on different weekdays for the first quartile group.

We also conducted a more formal analysis of the relationship between medical insurance coverage rates and the probability of working on Monday. Specifically, we fit a series of linear probability models for the event of working on different weekdays (among the sample of people who usually work at least one weekday), including as an explanatory variable the estimated probability of medical coverage ($z_i'\hat{\theta}$) formed from the coefficient estimates of equation (2). The results show that workers with a higher probability of medical insurance are more likely to be at work on *any* weekday. Moreover, the effect of the estimated medical coverage variable is larger on Mondays. This pattern persists in models that include demographic and industry controls in addition to the predicted coverage variable. When we exclude retail trade workers from the sample, however, the estimated effect of the medical coverage variable is constant across weekdays. Based on these findings, we conclude that the assumption of an equal distribution of work hours across weekdays is valid, providing that retail trade employees are excluded from the sample.

Figure 2 shows the distribution of weekday back injury claims by quartile of predicted medical coverage for a sample that excludes retail trade workers. For each of the four coverage groups, a higher fraction of back injuries are reported on Monday than on other weekdays. Indeed, the distributions of injuries across the week are quite similar for all four groups. There is no indication that workers with low medical coverage rates have a larger

"Monday effect" in their back injury rates.[11]

Although the May CPS data suggest that workers with different rates of medical coverage have similar relative probabilities of working on Mondays, it should be emphasized that the CPS data pertain to *scheduled* hours rather than actual work hours. If absentee rates are higher on Mondays, and the differential is correlated with the determinants of medical coverage, then our analysis may understate the effect of medical insurance coverage on Monday injury rates. Statutory holidays are one source of differential absenteeism rates across weekdays. A holiday weekend not only reduces the expected number of Monday injury claims, but may also lead to an increase in the number of Tuesday claims (Smith 1989). In the analysis below, we test for the effect of holidays by comparing specifications that exclude major holidays (New Years, Memorial Day, Labor Day, Fourth of July) and treat the day after a holiday as "Monday."

A second possibility is that non-holiday-related absences are higher on Mondays than other weekdays. We are aware of only one recent study that reports absenteeism rates by day of the week. This study (Barmby, Orme, and Treble 1991) concluded that absenteeism rates on Mondays are about the same as or slightly lower than on Tuesday–Thursday, and actually peak on Fridays.[12] Given this finding, we present some specifications below that exclude Friday injuries. We have been unable to find any studies or data sources that break down absenteeism patterns by day of the week and demographic characteristics. Thus we cannot directly test whether workers with lower medical coverage rates have higher Monday absenteeism. This limitation must be kept in mind in interpreting our results.

Models for the Relative Probability of a Monday Injury

Table 3 presents a series of estimates of the effect of imputed medical insurance coverage on the probability of a Monday injury. Specifically, the table reports estimates of the coefficient γ in equation (1) for various samples of weekday injury claims. Column 1 presents estimated coefficients from models with no other control variables. Columns 2 and 3 report estimates from multivariate models: the specifications in column 2 include 19 demographic, occupation, and industry control variables, and the specifications in column 3 include an additional 25 control variables for the nature and cause of the injury. The upper and lower panels of the table report estimates obtained from samples that either include or exclude claims from workers in retail trade. We present estimates for all injury claims, and for subsamples that include only back injuries or injuries classified as muscle strains. (There is considerable overlap between these categories: about 30% of the back injuries are classified as strains, while about 55% of strains are back injuries.) We also consider several different ways of treating claims reported on holidays, post-holiday workdays, and Fridays.[13]

It is important to keep in mind that the coefficients in these models measure the effect of insurance coverage on the *relative* fraction of weekday injuries that occur on Monday: they provide no information on the relation between medical insurance coverage and overall injury rates. In fact, tabulations of the March 1987 CPS suggest that workers without medical insurance coverage have slightly lower overall probabilities of a WC injury claim.[14] However, our interest here is in the effect of medical insurance on the *timing* of weekday inju-

[11]The same pattern emerges when we consider all injuries and not just back injuries.

[12]Barmby, Orme, and Treble (1991) analyzed data for a single British firm.

[13]One could argue that workdays following a holiday are equivalent to a Monday in terms of the number of off-the-job injuries that have accumulated prior to the start of work (Smith 1989). Hence, in the specifications in rows 3, 4, 5, 7, 8, and 9, we treat the workday after major holidays (January 1, July 4, Memorial Day, Labor Day) as a "Monday."

[14]In the entire CPS sample of adult workers with earnings in the previous year, 1.76% report receiving WC payments. This fraction is 1.57% for workers without medical insurance coverage and 1.79% for workers with medical coverage.

Table 3. Estimated Effect of Medical Coverage on the Conditional Probability of a Monday Injury.

		Models with Additional Controls for:	
Injury Category	*No Controls* *(1)*	*Worker Demographics and Industry* *(2)*	*Injury Type/Cause, Worker Demographics and Industry* *(3)*
1. All Industries:			
a. All Injuries	0.04 (0.03)	0.06 (0.04)	0.05 (0.05)
b. Exclude Fridays, Major Holidays, and Post-Holidays	0.05 (0.03)	0.08 (0.05)	0.06 (0.06)
c. Exclude Holidays, Treat Post-Holidays as Mondays	0.04 (0.03)	0.06 (0.04)	0.06 (0.06)
d. Back Injuries Only (No Holidays, Treat Post-Holidays as Mondays)	0.10 (0.06)	0.17 (0.09)	0.17 (0.09)
e. Strains Only (No Holidays, Treat Post-Holidays as Mondays)	0.02 (0.05)	0.07 (0.08)	0.06 (0.08)
2. Excluding Retail Trade:			
f. All Injuries	0.02 (0.03)	0.01 (0.05)	–0.02 (0.06)
g. Exclude Holidays, Treat Post-Holidays as Mondays	0.02 (0.03)	0.02 (0.05)	–0.01 (0.05)
h. Back Injuries Only (No Holidays, Treat Post-Holidays as Mondays)	0.07 (0.06)	0.13 (0.10)	0.13 (0.10)
i. Strains Only (No Holidays, Treat Post-Holidays as Mondays)	0.02 (0.05)	–0.01 (0.08)	–0.01 (0.08)

Notes: Standard errors, corrected for heteroskedasticity and two-step estimation method (see text), are in parentheses. Table entries are estimated coefficients of imputed medical coverage from linear probability models for the event of a Monday injury, estimated on the sample of weekday injuries. Models in column 2 include control variables for gender, age, age squared, marital status (interacted with gender), industry (8 categories), and occupation (6 categories). Models in column 3 include 25 additional controls for the nature and cause of the injury.

ries, rather than the overall number of such injuries.

Most of the estimated coefficients in Table 3 are positive—the opposite of the sign predicted by the hypothesis that workers without medical insurance are more likely than those with medical insurance to report a Monday injury. Consistent with the fact that retail trade employees with low probabilities of medical coverage are less likely to work on Mondays than are their counterparts in other industries, the exclusion of retail trade workers leads to some reduction in the estimated coverage coefficients. Even when retail trade workers are excluded from the sample, however, the coefficients are positive or close to zero.

Two other conclusions emerge from Table 3. First, different ways of handling claims filed on holidays or on the day after a holiday have little effect on the estimation results (compare the estimates in rows b and c with those in row a). Similarly, redefining the pool of weekday injuries to exclude Friday claims has little or no effect on the results. Second, although we expected to see a larger effect of insurance coverage on the weekly pattern of back injuries and strains than on patterns of other injuries, the data do not confirm this prediction. The estimation results for the subsample of injuries classified as "strains" are very similar to the results based on broader samples of injuries, and the results for back injuries actually point toward slightly *positive* effects of medical coverage on the probability of a Monday claim.

We have estimated a variety of alternative specifications to probe the robustness of these conclusions. In particular, we investigated the effects of adding two additional control variables to our analysis: the pre-injury wage, and a set of dummy variables representing the worker's benefit-replacement rate while on temporary disability. Our analysis of the replacement rate is motivated by the observation that employees with higher replacement rates who are injured off the job have a stronger incentive to file a fraudulent claim and receive temporary disability payments, rather than work through the recovery period. It is therefore interesting to check whether our inferences about the effect of medical coverage on the magnitude of the Monday effect are robust to the inclusion of measures of the replacement rate.

In Minnesota, the WC benefit rate is fixed at two-thirds of the pre-injury wage, subject to a maximum and minimum linked to the state average weekly wage.[15] The combination of minimum and maximum rates implies that the replacement rate falls into 5 ranges: greater than 1 (for the small percentage of workers who earn less than 20% of the state average weekly wage); exactly 1 (for the 10% of workers whose wage is between 20% and 50% of the state average weekly wage); between 2/3 and 1 (for the 20% of workers who earn between 50% and 75% of the state average wage); exactly 2/3 (for roughly 50% of workers who earn between 75% and 150% of the state average wage); and less than 2/3 (for the 20% of workers who earn more than 150% of the state average wage).

Our findings from these extended specifications are presented in Table 4. For brevity, we report only the results obtained on samples that exclude workers in the retail trade industry. (Results for the overall sample are similar.) In general, neither the level of wages nor the range of the benefit replacement rate exerts an independent effect on the probability of a Monday claim, and the addition of these variables has no effect on our conclusion that the Monday effect in WC claims is unrelated to the probability of medical insurance coverage.

Denial of Liability

Just as employees who are injured off the job have an incentive to file fraudulent WC claims, employers and insurers have an incentive to screen out these claims. In Minnesota, employers who intend to dispute the validity of a claim begin the process by filing a "Notice of Denial of Liability" (see Minnesota House of Representatives Research Department 1988). The pattern of denial rates by day of the week and probability of medical coverage provides further evidence on the hypothesis that the Monday effect in injury rates is attributable to the post-dating of weekend injuries by uninsured workers. If the Monday effect reflects fraudulent claims, we would expect employers to monitor Monday claims more carefully than claims filed on other days, and to be more likely to deny liability for Monday injuries.

Minnesota employers filed a notice of denial of liability for about 10% of the injury claims in our sample. Comparisons of denial rates by day of the week reveal that Monday injury claims were no more likely to be denied than claims on other days, even for workers with the lowest probabilities of medical coverage.[16] The same conclusion emerges for the denial rates for

[15]Minnesota laws during our sample period set a subminimum benefit ($75.20 per week in October 1987) as a lower bound on all benefits, and a primary minimum such that claimants whose benefits would be below the primary minimum under the two-thirds formula receive the lower of the primary minimum benefit amount and their weekly wage.

[16]Across all workers, the probability that an accident claim on Tuesday–Friday is denied is 10.3%, versus 10.2% for Monday claims. For workers in the lowest quartile of the medical coverage distribution, the probability that a Tuesday–Friday claim is denied is 9.8%, versus 9.6% for Monday claims.

Table 4. Estimated Effect of Medical Coverage on the Conditional Probability of a Monday Injury—Further Results.

	All Injuries			*Back Injuries*		
Explanatory Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1. Medical Coverage (Imputed)	0.047 (0.065)	0.048 (0.059)	0.046 (0.065)	–0.035 (0.200)	0.065 (0.164)	–0.030 (0.199)
2. Log Weekly Wage	–0.007 (0.011)	—	0.001 (0.018)	0.023 (0.027)	—	0.030 (0.038)
3. *Replacement Rate:*[a]						
a. RR > 1	—	0.074 (0.032)	0.075 (0.043)	—	0.010 (0.067)	0.044 (0.081)
b. RR = 1	—	0.010 (0.013)	0.010 (0.020)	—	–0.006 (0.028)	0.013 (0.038)
c. RR Between 0.67 and 1	—	0.010 (0.009)	0.010 (0.012)	—	–0.011 (0.018)	–0.001 (0.022)
d. RR < .66	—	0.017 (0.010)	0.016 (0.012)	—	0.012 (0.020)	0.004 (0.022)

Notes: Standard errors, corrected for heteroskedasticity and two-step estimation method, are in parentheses (see text). Table entries are estimated coefficients from linear probability models for the event of a Monday injury, estimated on the sample of weekday injury claims, *excluding claims in retail trade.* All models include controls for gender, age, age squared, marital status (interacted with gender), industry (8 categories), and occupation (6 categories).

[a]Replacement rate (RR) is the ratio of the injured worker's weekly benefit amount to his or her pre-injury wage. The replacement rate is statutorily determined as a function of the pre-injury wage. An indicator for individuals with a replacement rate equal to two-thirds is excluded.

back injuries, which tend to be more heavily concentrated on Mondays. These patterns do not suggest that employers or insurers are more likely to question the legitimacy of Monday claims by groups of employees with low insurance rates (or indeed by any group of employees).

We have also conducted a more formal analysis of the determinants of the probability of denying liability, based on the following model:

$$\text{(3)} \qquad \text{P(deny liability)} = x_i'\mathbf{a} + m_i\mathbf{b} + \text{Monday}_i\mathbf{c} + m_i \times \text{Monday}_i\mathbf{d},$$

where x_i is a vector of characteristics of the i^{th} injury claim, m_i is an indicator for whether or not the worker who filed the claim has medical insurance coverage, and Monday$_i$ is an indicator for a Monday injury. The coefficient **d** measures the relative effect of medical coverage on the probability that the employer denies liability for a Monday injury. If uninsured workers are more likely than insured workers to file fraudulent Monday claims, then we would expect **d** to be negative, assuming that fraudulent claims are more likely to be denied. As in our analysis of Monday injury rates, we can estimate equation (3) by replacing m_i with a consistent estimate of the probability of medical coverage ($z_i'\hat{\theta}$). The results of this exercise are reported in Table 5.

Columns 1–3 of Table 5 present estimation results for the overall injury sample. The model in column 1 excludes any additional control variables, while the model in column 2 adds controls for the characteristics of the injury and the worker, as well as dummy variables for injuries reported on holidays, post-holiday workdays, and Fridays. Finally, the model in column 3 adds the injured worker's weekly wage, and indicators for the range of the worker's benefit-replacement rate (RR). Parallel sets of models are reported in columns 4–6 for the subsample of claims

Table 5. Estimated Effect of Medical Coverage on the Probability That the Employer Denies Liability for the Injury.

	All Injuries			*All Injuries Excluding Fridays, Holidays, etc.*[a]			*Back Injuries*		
Explanatory Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
1. Monday Injury (1 = Yes)	0.01	0.02	0.01	0.01	0.01	0.01	−0.08	−0.10	−0.07
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.08)	(0.09)
2. Medical Coverage (imputed)	0.06	−0.14	−0.07	0.05	−0.15	−0.08	−0.08	−0.17	−0.07
	(0.02)	(0.04)	(0.07)	(0.02)	(0.04)	(0.07)	(0.05)	(0.07)	(0.14)
3. Monday Injury × Medical Coverage	−0.02	−0.02	−0.02	−0.01	−0.02	−0.02	0.09	0.11	0.07
	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.09)	(0.09)	(0.10)
4. Log Weekly Wage	—	—	0.03	—	—	0.03	—	—	0.04
			(0.01)			(0.01)			(0.02)
5. *Replacement Rate:*[b]									
a. RR > 1	—	—	0.09	—	—	0.09	—	—	0.16
			(0.02)			(0.01)			(0.05)
b. RR = 1	—	—	0.06	—	—	0.06	—	—	0.07
			(0.01)			(0.01)			(0.02)
c. RR Between 0.67 and 1	—	—	0.02	—	—	0.02	—	—	0.03
			(0.01)			(0.01)			(0.01)
d. RR < .66	—	—	−0.02	—	—	−0.02	—	—	−0.02
			(0.01)			(0.01)			(0.01)
6. Controls for Personal and Injury Characteristics[c]	no	yes	yes	no	yes	yes	no	yes	yes
7. Controls for Fridays, Holidays, and Post-Holidays[d]	no	yes	yes	no	yes	yes	no	yes	yes

Notes: Estimated standard errors, corrected for heteroskedasticity and two-step estimation method (see text), are in parentheses. Models are linear probability models for the event that the employer files a Denial of Liability form, disclaiming responsibility for the injury.

[a]Sample excludes all injury claims filed on Fridays, major holidays, or the weekday immediately following a major holiday.

[b]Replacement rate (RR): see note to Table 4.

[c]Controls for gender, age, marital status, industry, occupation, and nature and cause of the injury.

[d]Controls for injury claims filed on Fridays, major holidays, or the weekday immediately following a major holiday.

that excludes injuries on holidays, post-holiday workdays, and Fridays, and in columns 7–9 for the subsample of back injuries.

With respect to the presence of a Monday effect in denial rates, the results in Table 5 are clear-cut. There is no indication of higher denial rates for Monday injuries, nor of a differential Monday effect in the denial rate for uninsured workers. Contrary to our expectations, employers do not seem to scrutinize Monday injuries more carefully than injuries on other weekdays.

On the other hand, the results suggest that employers are more likely to deny liability for the injuries of uninsured workers, and particularly workers with higher replacement rates, *regardless of the day of their injury.* The models in columns 2, 5, and 8 show a highly significant reduction in denial rates for insured workers. Once controls for the wage and replacement rate are introduced (columns 3, 6, and 9), the medical coverage effect falls in magnitude and is no longer statistically significant. In these specifications, however, the replacement rate variables are highly significant, and show a consistent pattern of higher denial rates for workers with higher replacement rates.[17]

One possible explanation for these findings is that workers with higher replacement rates are more likely to file questionable or fraudulent injury claims (on *any* day of the week) in hope of beginning a spell of WC benefits. We would then expect to see a higher probability that employers contest the injury claims of workers with higher replacement rates.[18] Even if workers with different replacement rates have the same probability of filing a fraudulent injury claim, however, employers may be more likely to dispute the claims of workers with higher replacement rates, since the employer's net cost of an injury spell (the WC benefit minus the savings in wages) is higher for these workers. Based on the evidence in Table 5, it is difficult to distinguish between these alternative explanations.

In summary, the patterns of denial of liability for WC injury claims show virtually no evidence of a Monday effect, nor of a larger Monday effect for workers who lack medical coverage for their off-the-job injuries. If a higher fraction of Monday injury claims than of claims on other days are truly fraudulent, it is hard to explain why employers do not scrutinize these claims more carefully and deny liability for a higher fraction of Monday injuries. Thus, the absence of a Monday effect in denial rates is consistent with our findings on the relative rate of Monday injuries for workers with higher and lower probabilities of medical insurance. In neither case do the results support the view that the higher overall rate of Monday injuries is driven by a higher rate of fraudulent claims by workers who lack medical insurance.

Summary and Conclusions

This paper is motivated by a simple observation: certain types of injuries are more likely to arise on Mondays than on other weekdays. This "Monday effect" has been interpreted as evidence that some employees who are injured off-the-job during the weekend report their injuries as having occurred at work (Smith 1989). Workers without medical insurance have a particularly strong incentive to "post-date" weekend injuries and file an injury claim on Monday. To evaluate the effect of this incentive, we use a two-sample estimation strategy to combine injury data by day of the week from the Minnesota Workers' Compensation system with medical insurance coverage data from the March Current Population Survey. Contrary to our expectations, we find that employees with low rates of medical insurance coverage were no more likely than other workers to file a Monday injury claim.

One explanation for this finding is that employees with low probabilities of medical insurance coverage are less likely than other workers to work on Mondays. Indeed, low-wage workers in retail trade have below-average medical coverage rates and are less likely than other workers to work earlier in the week. When we exclude retail trade employees from our analysis, however, we continue to find that medical insurance coverage rates are unrelated to the relative fraction of Monday injuries. We also check for the effect of holiday weekends by excluding injuries filed on major holidays and post-holiday workdays. Again, we find no indication that workers who lacked medical insurance filed more Monday injury claims than did other workers.

Just as employees have an incentive to report off-the-job injuries as having occurred at work, employers and insurers have an incentive to screen out fraudulent claims.

[17]We also estimated specifications that included interactions of the Monday indicator with indicators for the different ranges of the replacement rate. These models show no indication of a differential Monday effect in denial rates for workers with different replacement rates.

[18]Chelius (1982) analyzed the effect of replacement rates on the frequency of WC injury claims, and argued that a higher rate of injuries for workers with higher replacement rates may reflect either lower safety incentives for these workers, or a higher rate of fraudulent claims among workers with higher replacement rates.

In fact, employers denied liability for about 10% of the injury claims in our sample. If a higher fraction of Monday injuries are fraudulent, we would expect to see higher denial rates for these injuries, especially for claimants with the lowest probabilities of off-the-job medical insurance. Consistent with our conclusions based on the Monday effect in injury rates, however, we find that employers were no more likely to deny liability for Monday injury claims than for claims made on other days—even for workers with low probabilities of medical coverage.

These findings suggest two tentative conclusions. First, the interpretation of the "Monday effect" in injury rates as evidence of fraudulent claim behavior may be inappropriate. A higher fraction of back sprains, strains, and similar injuries occurs on Monday than other weekdays. However, these injuries are evenly distributed across the work force, and are not associated with a higher probability that the employer will dispute liability for the injury. An alternative explanation for the "Monday effect" is that a higher fraction of strains, sprains, and back injuries truly arise on Mondays, perhaps as a consequence of the return to work after a weekend hiatus. Recent research suggests that a similar Monday effect arises in the weekly pattern of heart attacks among the working population—an effect that is surely unrelated to fraud (Willich et al. 1994). We believe that the evidence in this paper is more consistent with a physiologically based explanation for the Monday effect than with an explanation based on fraudulent claim filing.

Second, concern that the Workers' Compensation system is covering the costs of off-the-job injuries for workers without medical insurance has led to growing interest in "24 hour" coverage plans and other alternatives to the current WC system. Our findings suggest that more evidence is needed to firmly establish the rate of fraudulent claim activity and to evaluate the benefits of any reform in the WC insurance system.

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