ORIGINAL ARTICLE

How low can they go? Potential for reduction in work injury rates

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Injury Prevention 2004;**10**:292–295. doi: 10.1136/ip.2004.005280

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Background: There is a considerable variability in occupational injury rates across companies, even within the same industry. The aim of this study was to estimate how many injuries could be prevented if all firms could achieve the performance of their better peers.
Method: Data were obtained from the Workplace Safety & Insurance Board of Ontario on all insured firms in the province. Within rate groups (firms in the same type of business) the number of injuries expected if all firms had a lost time injury rate at the 25th percentile of the distribution for the rate group were estimated. The total number of injuries were compared with the expected number, after adjusting for firm size and type of injury.
Results: Overall, using the 25th percentile as a benchmark, 42% of lost time injuries in Ontario could be prevented.
Discussion: There is considerable potential for prevention of work injuries based on currently achieved, non-optimal benchmarks.

In the 1990s, there was a substantial reduction in work injury rates in many Western jurisdictions. For example, in Ontario, Canada, the number of allowed lost time claims to the workers' compensation system fell from 184 444 in 1990 to 95 568 in 2002[1] and the rates have also fallen considerably.[2] Similarly, the United States Bureau of Labor Statistics[3] reports a drop in lost workday cases per 100 full time workers from 4.1 in 1990 to 3.0 in 2000. In Ontario, claims for non-lost time injuries also fell, albeit more modestly, from 205 770 in 1990 to 185 161 in 2002.

Even with these reductions, some workplaces still have much lower rates than others within the same type of business. Organizational factors have been linked to lower injury rates[4–6] with studies exploring the role of leadership[7] or high performance work systems.[8] Workers' compensation systems typically take account of the variability in injury rates in providing incentives for companies to improve their safety. Firms with higher rates than the norm may be charged a greater premium, while firms with lower rates than the norm may be granted rebates of part of their premium. For example in Ontario, this type of experience rating was phased in during the 1990s.

Given these differences between companies, we might ask what would happen if companies with higher injury rates were able to reduce the number of injuries to achieve the level of performance of companies with low injury rates. This is akin to ''benchmarking'', defined as ''the analysis and comparison of performance across organisations or parts of an organisation, with view to improvement''.[9] A review in the health care field found that audit and feedback can be effective in improving professional practice.[10]

The aim of this paper is to estimate the potential for prevention of work injuries if all companies achieved a lost time injury rate at the 25th percentile for companies in the same type of business. We use data from the province of Ontario, Canada.

METHOD

In Ontario, workers' compensation insurance is provided by the Workplace Safety & Insurance Board (WSIB), which is the sole provider. Records of all eligible lost time compensation claims for work related injuries made in the province are documented by the WSIB. (Not all industries are covered compulsorily. Roughly 30% of workers are not covered. For example, the financial sector is not obliged to provide WSIB coverage to its employees.) A unique firm number representing the employer is included in each claim record. In turn, each firm is allocated to a rate group, a classification of the type of economic activity conducted by the firm. Examples of rate groups include logging; nickel mines; metal furniture manufacturing; grocery and convenience stores; restaurants and catering; and hospitals. Overall, there are 215 rate groups.

Most companies pay premiums based on their rate group standard (perhaps adjusted by experience rating) based on insurable earnings. They are known as Schedule 1 firms. A small number of organizations are grouped under Schedule 2, and are essentially self insured—they pay the actual costs of benefits, medical care, and administration to the WSIB.

For each Schedule 1 firm in the province we obtained data for the period 1998 to 2001. This included the estimated number of employees, and the number of lost time injuries for which a successful claim was made. We excluded injuries in Schedule 2 firms from this study, as estimates of the numbers of employees are not available.

Within each rate group, we estimated the injury rate for each firm—calculated as the number of lost time injuries per 100 full time equivalent (FTE) workers per year. From the distribution of injury rates (within the rate group) we found the 25th percentile for firms with at least one lost time injury over the four year period. (In many rate groups, especially with smaller firms, if we had not excluded firms with no injuries, the 25th percentile rate would have been zero. We return to this point later.) For each firm, we multiplied the number of FTE employees by the rate at the 25th percentile to obtain the expected number of injuries over the four year period. We added these expected numbers for all firms across the rate group. As well, we added the observed numbers of

Abbreviations: FTE, full time equivalent; PR_{25}, potential reduction in rate using 25th percentile as target; WSIB, Workplace Safety & Insurance Board

Box 1: Calculations for rate group, unadjusted: example of pulp, newsprint, and specialty papers

- Total number of lost time injuries (LTI) = 1200.
- Total FTE over four years = 99 164.
- LTE rate at 25th percentile of companies with ⩾1 LTI per 100 FTE = 0.874.
- Total number of LTI if all firms experienced LTI at 25th percentile = 99 164 × 0.874/100 = 866.6.
- Potential reduction in LTI = 1200−866.6 = 333.4.
- Potential percentage reduction in LTI (PR_{25}) = (333.4/1200) × 100 = 27.8%.

injuries across all firms within the rate group. The total observed minus the total expected numbers provides an estimate of the possible reduction in injuries in the rate group. We labelled this potential reduction as PR_{25}. Box 1 shows an example of the calculations.

Adding the observed and expected numbers across all rate groups gave an overall difference, an estimate of the number of preventable injuries in Schedule 1 firms in Ontario. The difference divided by the total observed number, multiplied by 100, gave the overall percentage potential reduction using the benchmark of the 25th percentile.

Since the injury rates are higher for smaller firms, we distinguished companies with a mean annual number of FTE employees less than 20 from those with a mean annual FTE greater than or equal to 20. To allow for possible confounding by size of firm, we repeated the estimations of preventable injuries separately for the smaller and larger companies within each rate group, and then added the results across all rate groups. We also made a further adjustment, taking account not only of size but also of type of injury. We distinguished musculoskeletal injuries from others, and again repeated the calculations in the separate strata.

While our primary analysis used the 25th percentile as the benchmark injury rate, we also repeated the calculations using other percentiles. As well, we noted above that since many small firms had no lost time injuries from 1998 to 2001 they were excluded from the calculations. Since we were thus excluding these firms from estimation of the expected number of injuries, this could have led us to underestimate the expected number, and correspondingly exaggerate the potential for prevention. As a check on this, an extra analysis applied the rate at the 25th percentile to *all* firms within each rate group (or stratum within rate group) to recalculate the PR_{25}.

RESULTS

Overall, there were 351 533 lost time claims (injuries) in Schedule 1 companies from 1998 to 2001. Of these 291 442 (83%) occurred in employees of larger companies and the remaining 17% in smaller firms.

Table 1 shows the potential reduction with no adjustment—the estimate is 27% of all injuries. Adjustment for size gave a higher estimate. In smaller firms the potential reduction was 37%, and in larger firms it was 46%, so that overall the figure was 45%. Taking account of both size and injury type reduced this estimate to 42%.

Estimates of the potential reduction for different "benchmarks"—that is, different percentiles, are shown in table 2. As expected, the figures increase with lower percentiles, and decrease with higher percentiles. At the 35th percentile, the preventable fraction is over one quarter, when adjusting for both firm size and injury type.

Table 1 Potential reduction in injuries: unadjusted, adjusting for firm size, and adjusting for firm size and injury type

Adjustment	Total injuries	Potential reduction (%)
No adjustment	351533	94905 (27)
Adjustment for size		
<20 FTE/year	60091	22321 (37)
⩾20 FTE/year	291442	135409 (46)
Total	351533	157730 (45)
Adjustment for size and injury type		
<20 FTE/year		
MSK injuries	31997	11760 (37)
Other injuries	28094	9669 (34)
⩾20 FTE/year		
MSK injuries	193386	92615 (48)
Other injuries	98056	34433 (35)
Total	351533	148477 (42)

FTE, full time equivalent; MSK, musculoskeletal.

Table 2 Potential reduction (%) in injuries using different percentages as benchmarks, with and without adjustment for firm size and injury type

	Adjustment		
Percentile used as benchmark	None	Firm size	Firm size and injury type
10	60	68	65
15	49	61	57
20	30	53	50
25	27	45	42
30	16	37	35
35	4	29	26

Note: as an example, if all firms achieved the injury rate at the 20th percentile of their rate group, and adjustment is made for firm size, 53% of all lost time injuries could be prevented.

Applying the 25th percentile rate to all firms, not just those with at least one injury, made little difference to our estimate for larger firms, reducing the percentage reduction from 44% to 38%. However, for smaller firms the calculations suggested there would be a substantial *increase*—more than doubling—in the number of injuries. Combined with the results for larger firms, the net estimate was a reduction of 5%. We discuss this finding below.

DISCUSSION

Using our *a priori* choice of the 25th percentile of the lost time injury rate as a "target" with adjustment for both firm size and type of injury, we estimated that 42% of lost time injuries could be prevented in Schedule 1 firms in Ontario. This is a substantial potential reduction in the burden from 352 000 to 203 000 lost time injuries.

There were some possible limitations of our analyses. Firstly, the data on firm size are estimates, based on the insurable payroll, not on counts of employees. However, since our comparisons were made within rate groups—companies in the same type of business—errors are likely to be in the same direction for all companies in the rate group, and hence to have only minor effects on our results.

A related issue is that there are likely some other unchangeable characteristics of the firms that affect their injury rates, and our calculations did not allow for these—the information was not available to us. While such characteristics likely account for some of the differences in rates between

companies, there is evidence to suggest their contribution may be minor. Several studies have found that organizational factors under the control of management are related to injury rates.[11] Also, Leigh found that job characteristics were better predictors of injuries than were personal characteristics such as age.[12] As well, safety trade magazines contain case studies of organizations that have been determined to reduce their injury rate, with strong commitment and involvement of their chief executive officers, and have achieved dramatic reductions. One typical report found that a company's lost time injuries fell from 35 in 1991 to just five in 1993.[13]

The numerator in our calculations is the number of successful claims for lost time injuries, and there may be under-reporting. This is in part why we chose the 25th percentile, not a lower one. While the number (and rate) of injuries in some companies may be reduced as a result of failure to report injuries, the 25th percentile is not ''extreme'', so that presumably at least some firms with lower rates achieve them through good safety policies and practices. As well, the 25th percentile is not a target that might be seen as unrealistic, and should be achievable by poorer performing companies. Further, our calculations imply that firms with rates below the 25th percentile will *increase* their rates to this level. Since most could be expected to continue to perform well, our estimate of PR_{25} is biased downwards.

Under-reporting might also have been (partly) responsible for the drop in lost time rates in the province. Although there is evidence of under-reporting to workers' compensation systems in Canada,[14] the proportional drop in workers' compensation injury rates are similar to those found in national surveys,[2] and self reports from workplaces show improvements in safety related organizational policies and practices.[15] Together, these findings suggest that under-reporting did not account for much of the drop in injury rates in Ontario.

The much lower estimates of potential prevention when we apply the lost time rate to *all* companies requires some explanation. We restricted the analysis to companies with at least one injury because otherwise the 25th percentile rate would have been zero in the smaller firms for most rate groups, so that our estimate of PR_{25} would have been 100%, a desirable but unrealistic figure.

Indeed, overall only one in eight smaller companies reported *any* lost time claims. In our calculations, though, the 25th percentile rate—based on firms with at least one injury—was applied to *all* firms to estimate the expected number of injuries, even though in practice the great majority could be anticipated to have none. This led to a substantial overestimate of the expected, and in turn a large underestimate of PR_{25} (which indeed became negative). Since the corresponding effect for larger companies was quite modest, we conclude that the estimate in the smaller companies is an artefact. We also note that even when the 25th percentile of the overall distribution of rates was non-zero, we used that rate to calculate the expected number of injuries, which again led to an underestimate of preventable injuries.

The data on claims included both illnesses and injuries. Some illnesses will have resulted from exposures many years earlier, and hence not be under the current control of the firms. However, for many illnesses, without reviewing the individual claim forms, we could not determine if they resulted from recent or long-past exposure. (They were classified, for example, as ''toxic effect of substances''.) As a check we excluded all illness categories for which there was any doubt or that were certainly due to much earlier exposures, and re-ran the analysis. This reduced the number of claims by 9598 (less than 3%). The PR_{25} changed minimally, affecting only the decimal place in the percentage (in fact increasing from 42.2% to 42.3%).

Key points

- Occupational injury rates vary widely across firms in the same type of business, known in Ontario as rate groups.
- ''Better'' companies (at 25th percentile of the injury rate distribution for their rate group) achieve their level of performance using currently available technology and organizational practices and policies.
- If all firms reached the 25th percentile rate for their rate group after adjusting for firm size and injury type, we estimate 42% of lost time injuries could be prevented.

The results should be of great interest to policymakers and agencies charged with reducing work injuries. There are large variations in injury rates between firms within the same rate groups, that is, engaged in the same type of work. As noted earlier, firms' injury rates have been related to organizational policies, practices and attitudes, which puts them in the realm of management control. Policymakers can thus point out to firms with poorer safety that reducing injuries is realistic.

While we acknowledge that injury rates may also result from firm characteristics which may be unchangeable (or unrealistic to change, at least in the short term, such as the age distribution of the workforce), we believe that the 25th percentile is a reasonable target for companies with higher rates. Our methodology compares firms in the same type of business, so that the firms cannot claim that the target set is unachievable because their industry is inherently risky. To the contrary, many of their peers—likely their competitors—are performing at or better than the target level. This further implies that no new technical breakthroughs are needed for improvement, and the burden of proof can be placed on firms above the 25th percentile to show why their rate is higher than others' in the rate group. We argue that knowledge of safety techniques and the will to improve can substantially reduce the burden of injuries at work.

ACKNOWLEDGEMENTS

We thank colleagues at the Institute for Work & Health for comments on this work. Tony Culyer, Sheilah Hogg-Johnson, and Cam Mustard made helpful suggestions on the draft manuscript.

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LACUNAE

Technology and road safety

Technology is arriving steadily as an injury prevention tool to deter, detect, and remove dangerous motorists. Although red light cameras and speed cameras reduce traffic danger, the motorist lobby pushes back against law enforcement technology (see *Inj Prev* 2003;**9**:293–4). Another technology is also advancing. Post de facto evidence gathering ''black boxes'' have been used for decades in airplanes for understanding failures but they often remain unused in motor vehicle collisions. Canadian courts have now used their evidence for the first time. In a fatal collision, the black box helped explain what actually occurred. With massive damage to the cars and no skid marks, the police doubted the surviving motorist's claim of only slightly exceeding the 50 km/h speed limit. Without good evidence, they would have accepted the survivor's claim that the deceased motorist ran a red light. But the black box showed the surviving motorist was driving at nearly triple the speed limit. With that knowledge, the court convicted the driver of dangerous driving causing death and sentenced him to 18 months in jail. But as with law enforcement technology, the use of black boxes will undoubtedly come under attack. Researchers will need to promote the road safety benefits of black boxes with documentation (from www.cbc.ca/stories/2004/04/14/canada/blackbox_20040414; submitted by Peter Jacobsen).

Responsibility and serving alcohol

The Australian High Court has ruled that a woman who, after drinking all day, was run down by a car, cannot recover from the drinking establishment on the grounds it should have cut her off sooner. Chief Justice Murray Gleeson said ''the onus should not be on clubs to prevent injury to those who drank to excess'' and wrote: ''There are many forms of excessive eating and drinking that involve health risks, but, as a rule, we leave it to individuals to decide for themselves how much they eat and drink. There are sound reasons for that, associated with values of autonomy and privacy''. The decision was split 4–2, dissenting Justices argued that the club should have thrown her out long before, that it had a legal duty ''to prevent her drinking herself into a state where she was liable to suffer injury'', and expressed concern that the decision would ensure clubs could profit from alcohol without accepting any responsibility for the harm it might cause (from *Sydney Morning Herald*, June 2004; submitted by Ian Scott).