RESEARCH REPORT

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The effect of supervisory training on lost-time injury rates in construction

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Abstract

Many organizations, companies, and agencies at the forefront of construction health and safety in have long emphasized supervisory training as a key factor for improving health and safety performance [1,2,3]. While much has been written on this subject in trade magazines and elsewhere, little quantitative research has been published on this subject.

A recent decision in the construction sector in Lambton County (the area surrounding Sarnia, Ontario, Canada) provided an opportunity to examine the issue using reliable data for both supervisory training and injury experience. The study cohort represents 39.3 million hours of construction work in the pre-intervention period and 41.5 million hours post-intervention.

The results show that as the density of trained supervisors increases, there is a statistically significant reduction in the rate of lost-time injuries. Non-linear regression analysis—formula $Y=b_0+(b_1/t)$—yielded an R^2 value of 0.523 and a p-value of 0.043 for the Lambton County data. The provincial data yielded an R^2 value of 0.812 and a p-value of 0.006.

These results support efforts to make supervisory training a mandatory requirement in Ontario construction, as part of a multi-faceted strategy to reduce injuries and fatalities.

1. Introduction

The Ontario construction industry has a relatively high rate of both fatal and non-fatal injuries compared to other industrial sectors [4,5,6,7], and it faces many occupational health and safety challenges.

Supervisors are seen as one of the most important agents for controlling hazards on construction sites. The importance of supervisory training has long been emphasized by many organizations, companies, and agencies [1,2,3], and is generally recognized as a key factor for improving occupational health and safety. This recognition is reflected in the number and range of health-and-safety training programs targeted at supervisors. Also, articles in Health and Safety trade magazines and other non-technical publications commonly identify supervisory training as a key factor in improving H&S performance. Authoritative data to support this belief, however, is scarce.

In recent years, representatives from both labour and management in Ontario construction have initiated discussions to make supervisory training a requirement under the province's construction-safety regulations. They argue that such mandatory training could be a key factor in driving further improvements in occupational health and safety in construction [6].

This study examines data on injury rates and health-and-safety training for supervisors within the cohort of construction work undertaken on behalf of members of the Sarnia Lambton Industrial Education Co-operative (IEC) [8], a group consisting of the major buyers of construction in the Lambton County.

The concentration of petrochemical and similarly large industrial facilities in the Sarnia/Lambton County region offers a unique opportunity to assess the influence of safety culture on construction activity. The major buyers of construction in Sarnia have a more advanced safety culture than buyers in other areas have. This may be due to the inherently dangerous nature of the work, processes, and materials that the clients deal with and their concern over responsible care—not only for their own employees, but also for others working at their facilities, as well as the general public and the environment. Their health and safety values are imposed on construction firms and their workers as part of the contractor selection and oversight processes.

Incidental data analyses over the years have consistently shown that Lambton County has a much lower injury rate than the provincial average, and further, that the members of the Sarnia Construction Association (generally the large construction employers based in Lambton County, much of whose work is performed for the major buyers) have a much lower injury rate than their provincial counterparts.

In 2004, IEC members (major construction buyers/clients) required construction firms carrying out work at their premises to ensure that the construction supervisors had completed the *Basics of Supervising* training program offered by the Construction Safety Association of Ontario (CSAO). The training addresses legal responsibilities, communications, problem solving, health and safety programs, site emergencies and accident investigation, and how to understand and prevent construction injuries and fatalities. It is provided either as a three-day instructor-led training course or as self-paced home-study program. All successful applicants were required to pass a supervised examination.

This demand for the training prompted an intense delivery program in the Lambton-County area throughout 2004-2007. The number of persons trained during this period is shown in Table 1 and 2.

2. Materials and Methods

2.1 Data sources

Data for this project was drawn from three primary sources.

IEC

Each construction contractor working at an IEC-member project is required to submit both the number of hours worked and the number of "reportable injuries" monthly. Each IEC member forwards the totals for their facility to the IEC.

WSIB

Ontario's Workplace Safety and Insurance Board (WSIB) compiles employer-submitted data on employment, lost-time injuries (LTIs), and no-lost-time injuries (NLTIs). The data was obtained via the WSIB's Enterprise Information Warehouse. This data was used to provide the measures on LTI and NLTI rates for Lambton County and for all Ontario.

CSAO

The Construction Safety Association of Ontario provides training as one of its services and maintains data on people trained in a variety of health and safety programs.

2.2 Additional comments on the data

The WSIB data obtained at a "county" level does not match exactly to the IEC data, since contractors with head offices in Lambton County may carry out work in other areas, and, conversely, not all of the work for IEC clients is performed by companies based in Lambton County.

Since contractors working at IEC-member properties also perform work elsewhere, they get the benefit of having trained supervisors at these non-IEC projects. Also, the workforce is mobile. Supervisors who were trained for an IEC project could move and be employed within another construction firm that has no direct ties to IEC projects.
For these reasons, the Lambton County data is probably a very good surrogate to measure the influence of mandatory supervisory training.

Hours worked

The **IEC hours data** is based on actual hours worked from employer-provided reports submitted to the IEC-member client.

The **WSIB hours** data is derived from assessable earnings/payroll data submitted by employers. There is a maximum value for assessable earnings—currently $73,300 per annum per worker—which may lead to some underestimation of the actual hours worked when referring to this data for sectors with high wage rates.

The assessable earnings data is divided by the average hourly wage rate to get the hours data. The average hourly wage rate is determined by the WSIB by monitoring a large sample of the payroll data submitted in support of disability claims. The average hourly wage would tend to overestimate the hours worked in a scenario with high wage rates, since the average would be lower than the actual hourly wage at IEC projects.

The result of these two effects is that the WSIB hours-worked data for a unionized construction firm is likely to be somewhat higher than the actual hours worked.

Within the IEC cohort, there have been changes in the number of IEC members during the study period. The growth in hours worked during the study period reflects both the true growth in this sector as well as increasing membership and reporting within the IEC membership.

Reportable injuries

The IEC data includes work-related injuries and illnesses that result in medical-aid treatment and/or disability involving modified work or days off work. For example, if a construction worker was injured and sought treatment at the client's on-site medical facility, an external clinic or hospital, or the worker's family physician, it would be classed a "reportable" injury. Construction employers report this information to the IEC client. Contract requirements for IEC members include reporting of such injuries as well as those that result in time away from work.

The WSIB data includes "no-lost-time injuries" (NLTIs) as well as "lost-time injuries" (LTIs). An NLTI is a case in which an injured worker seeks medical treatment via a physician, clinic, or hospital emergency service. An LTI is a case in which an injured worker was unable to return to work the next day. This data would include injuries that were reported by employers based in Lambton County regardless of where the worker was injured, not just those injuries occurring during work for an IEC-member client.

The WSIB data would also include chronic/latent disease cases that would not normally be reported to the IEC, since the diseases may not have been linked to the work being undertaken at the time of the report. The data set for 1996-2006 includes 38 such cases out of the 432 lost-time injuries reported in Lambton County for that period. Those claims account for 8.8% of all lost-time claims compared to 1.8% for the province as a whole. This difference may be due to enhanced awareness of the links between occupational exposure and illness, and/or higher-than-average exposure to asbestos in the Lambton-County region (32 of the 38 cases involved cancers and 16 of those were for mesothelioma).

3. Results

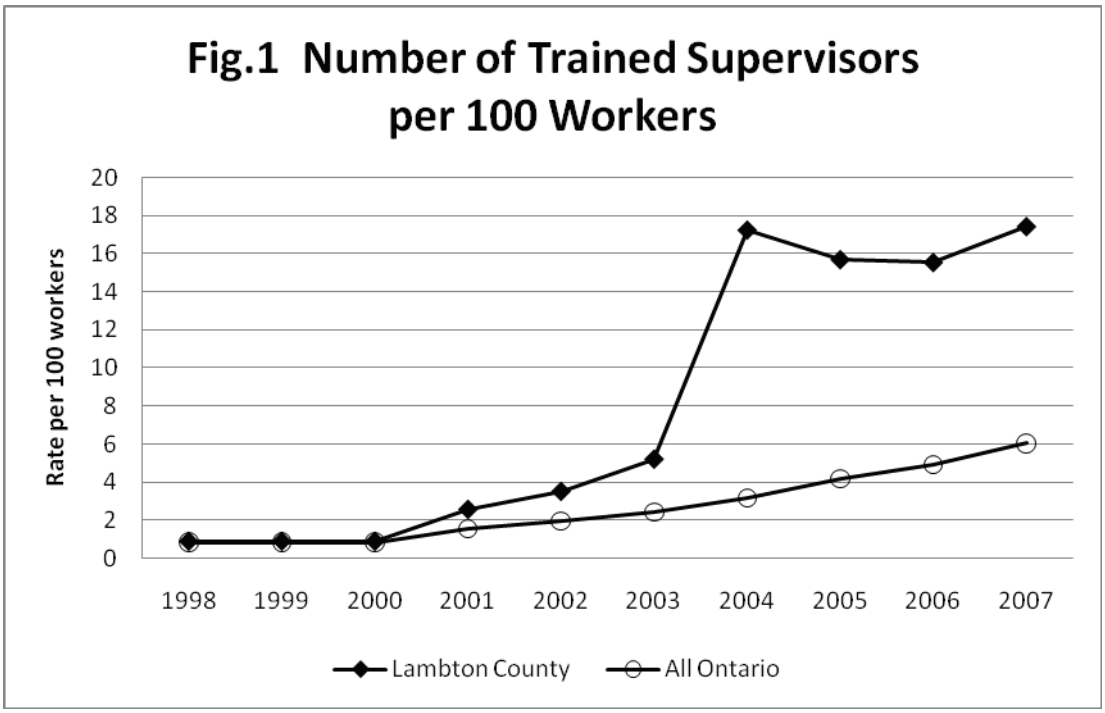
Table 1: Number of Supervisors Trained, 2000-2007

# of Supervisors Trained	2000	2001	2002	2003	2004	2005	2006	2007
Sarnia	27	66	36	54	372	299	37	212
All Ontario	1517	1,553	1,125	1,600	1,974	3,006	2,188	3,257

Cumulative Sarnia	27	93	129	183	555	854	891	1,103
Cumulative All Ontario	1,517	3,070	4,195	5,795	7,769	10,775	12,963	16,220

Table 2 – Rate of Trained Supervisors, 2000-2007

# of trained supervisors per 100 workers	2000	2001	2002	2003	2004	2005	2006	2007
Sarnia	0.90	2.57	3.51	5.20	17.23	15.67	15.53	17.41
All Ontario	0.82	1.53	1.94	2.43	3.16	4.17	4.91	6.04



As shown in Figure 1, the rate of trained supervisors in Lambton County was similar to the provincial rate prior to 2004. In 2004, the IEC contract requirement for trained supervisors caused the rate of trained supervisors in Lambton County to increase substantially. The rate has been maintained at approximately 16 trained supervisors per 100 workers since 2004.

Hours and Injuries

Data for the years 1998-2007 (inclusive) are shown in the following tables.

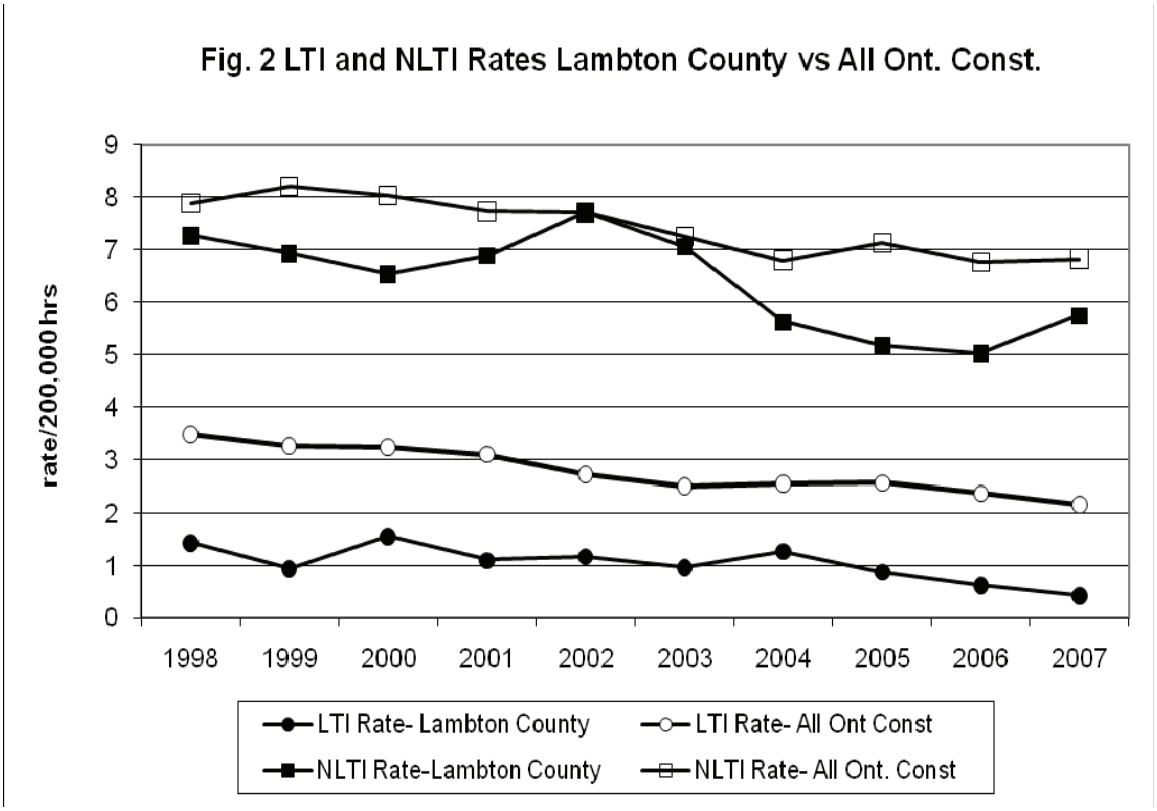
Year	Derived Hrs Worked—All Ont. Construction	Derived Hrs Worked—Lambton	IEC Hrs	LTI Lambton	NLTI Lambton	IEC Reportable Injuries
1998	304,027,295	6,000,284	4,081,000	43	218	47
1999	327,318,717	5,745,815	3,635,000	27	199	35
2000	369,672,792	6,030,763	3,715,000	47	197	37
2001	400,227,384	7,237,561	5,028,000	40	249	58
2002	433,021,946	7,345,654	4,520,600	43	283	66
2003	473,359,652	7,032,381	3,629,300	34	248	52
2004	495,187,574	6,443,161	3,807,100	41	181	25
2005	516,100,477	10,897,814	7,188,422	48	282	61
2006	527,197,106	11,478,075	7,641,953	36	288	38
2007	534,838,725	12,671,300	8,584,623	27	364	35

Injury Frequency Rates

The calculated frequency rates per 200,000 hrs are shown below.

Year	LTI Freq., Lambton	LTI Freq., Ont	NLTI Freq., Lambton	NLTI Freq., Ont.	IEC Reportable Injury Rate
1998	1.43	3.48	7.27	7.89	2.3
1999	0.94	3.25	6.93	8.2	1.93
2000	1.56	3.23	6.53	8.04	1.99
2001	1.11	3.1	6.88	7.73	2.31
2002	1.17	2.72	7.71	7.7	2.92
2003	0.97	2.51	7.05	7.25	2.87
2004	1.27	2.56	5.62	6.79	1.31
2005	0.88	2.57	5.18	7.12	1.7
2006	0.63	2.37	5.02	6.76	0.99
2007	0.43	2.16	5.75	6.81	0.82

These data show that the injury rates in Lambton County are consistently “better” than the provincial average injury rates.



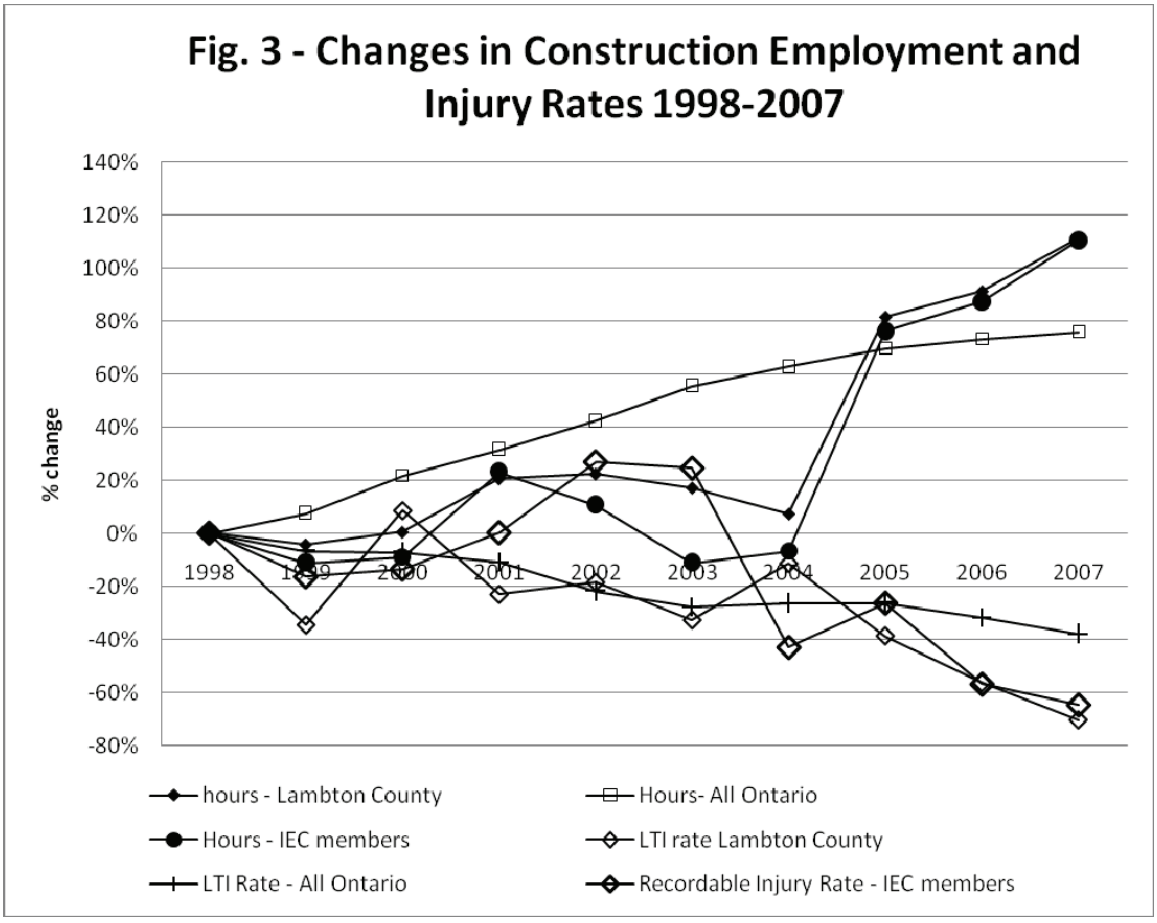
The Lambton LTI and NLTI rates are consistently much lower than those in the rest of the province although the difference in the NLTI rates is not as profound. This may be due to a heightened awareness of the importance of early medical intervention in preventing minor injuries from progressing to more serious injuries that result in temporary disability. Anecdotally, there have been reports that employers with heightened safety awareness will seek medical treatment for their workers when other employers normally would not.

The smaller difference in NLTI rates than in LTI rates may also be due to the higher proportion of work in rate groups where the risk of eye injury is greater. There is a relatively high proportion of industrial construction involving welding and grinding in Lambton County. This kind of work may be partially responsible for the increased incidence of NLTIs. Eye injuries are much more likely than other injuries to be treated at a medical facility. Data to confirm this hypothesis are not available due to limitations in the data recorded in the WSIB database.

During the period 2001 – 2004, Lambton county was not experiencing significant growth in construction employment. Since 2004, however, the rate of employment growth in Lambton County has substantially exceeded the provincial growth rate.

Since 2004, there has been a marked improvement in the LTI rate in Lambton County. It has exceeded the improvement rate in the rest of the province. This is notable, since Lambton county was already operating with a lower LTI rate than the rest of the province and still managed to show twice the rate of improvement during a time of tremendous employment growth. Conventional wisdom suggests that employment growth would be associated with an *increased* risk of injury due to an increase in the number of new workers and new companies.

The influence of IEC client work can be seen when comparing the change in employment data for Lambton County and that reported by the IEC.



4. Discussion of factors—other than supervisor training—that may have influenced injury rates in Lambton County

Discussions with contractors, associations, and other sources familiar with construction activity in the Lambton County area indicate that the nature of work undertaken since 2004 in the area has not been significantly different from that done in prior years. The volume of work has increased, but not the nature of the work.

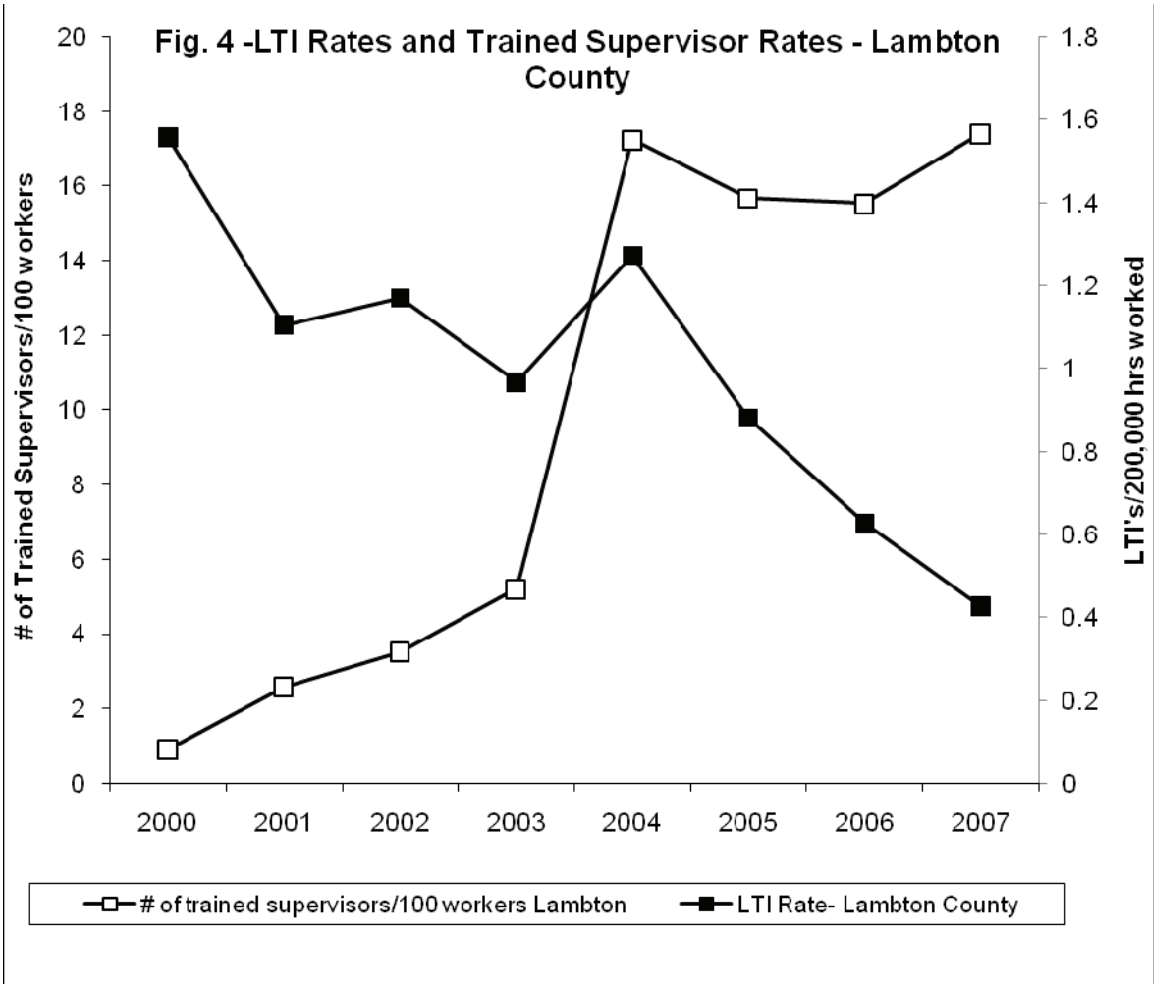
There has not been a major change in the construction tools, materials, equipment, or processes used during this period in Lambton County. Additionally, the same contractors appear to be carrying out the majority of the work during this period.

One might wonder whether the change in performance may be due to changes in administrative practices within the companies and/or the WSIB, but there have been no major changes to WSIB policies on claim acceptance or rejection practices that might artificially affect the rates in Lambton County. Comments from those working with contractors in the area indicate no significant change in how they are dealing with either the MOL or the WSIB, and no significant change in their disability-management plans.

The level of enforcement by the Ministry of Labour in Sarnia remained relatively unchanged during this period, in that no additional inspectors were assigned to Sarnia during the period.

Results

The experience in Lambton County since IEC members implemented mandatory supervisory training appears to demonstrate a relationship between enhanced lost-time injury reduction and increased density of trained supervisors (see fig 4). There is an obvious improvement in performance occurring after the 2004 “mandatory supervisory training” requirement came into effect.



This data was analyzed using non-linear regression. The formula $Y=b_0+(b_1/t)$, yielded an R^2 value of 0.523 and a p-value of 0.043 for the Lambton County data. The provincial data yielded an R^2 value of 0.812 and a p-value of 0.006.

Linear regression analysis showed a statistically significant relationship for the provincial data, but not for the Lambton County data.

5. Conclusions

WSIB injury data show a relationship between, on the one hand, the density of supervisors who have received training in both basic supervisory skills and in health and safety, and, on the other hand, the rate of lost-time injuries.

This relationship appears to be linear when looking at a province-wide data set, and non-linear when looking at data from an area where the trained-supervisor density is much higher. In Lambton County and the Sarnia area in particular, the influence of major buyers of construction imposing this mandatory training requirement as part of the construction contract has yielded positive change.

The data support the view that requiring construction supervisors to be trained in basic supervisory skills and health and safety knowledge will reduce the frequency of disabling injuries.

In order for such reduction in lost-time injuries to become more universal, this mandatory requirement for supervisory training must be implemented on all construction projects. In Ontario, supervisory training can be made a mandatory requirement in the Construction Regulation under the provincial *Occupational Health and Safety Act*.

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References

1. Construction Industry Institute, Supervisory Development for the Construction Industry Research Report R 40-11, 1996, University of Texas, Austin Tx, USA.
2. Construction Owners Association of Alberta, Model Contractor's H&S Program (1996) Edmonton, Alberta, Canada 1996.
3. F. E. Bird, Management Guide to Loss Control, Institute Press, Atlanta Georgia 1974.
4. Construction Safety Association of Ontario and the Workplace Safety and Insurance Board of Ontario, Construction Industry Health and Safety Summit 2007 –– Toronto, Ontario Canada.
5. Construction Safety Association of Ontario, Annual Reports 1980-2007, Toronto, Ontario, Canada. www.csao.org
6. Workplace Safety and Insurance Board of Ontario, Premium Rates Manuals 1980-2008, Toronto, Ontario, Canada. www.wsib.on.ca
7. Center for Construction Research and Training, Construction Chart Book, 4th Edition, Silver Springs, Maryland 2007.
8. For more information on the IEC, refer to http://www.sarniasafety.com.

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