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Effect of de-industrialisation on working conditions and self reported health in a sample of manufacturing workers

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Study objective: To explore the impact of de-industrialisation over a 20 year period on working conditions and health among sawmill workers, in the province of British Columbia (BC), Canada.

Design and Setting: This investigation is based on a sample of 3000 sawmill workers employed in 1979 (a year before the beginning de-industrialisation) and interviewed in 1998. The sample was obtained by random selection from an already gathered cohort of approximately 28 000 BC sawmill workers. Change in working conditions from 1979 to 1998 are described. Self reported health status, in 1998, was used as a dependent variable in logistic regression after controlling for confounders.

Main results: Downsizing in BC sawmills eliminated 60% of workers between 1979 and 1998. Working conditions in 1998 were better for those who left the sawmill industry and obtained re-employment elsewhere. Workers who remained employed in restructuring sawmills were approximately 50% more likely to report poor health than those re-employed elsewhere.

Conclusions: Working conditions and health status were better for workers who, under pressure of de-industrialisation, left the sawmill industry and obtained re-employment outside this sector.

Industrial employment among the seven richest OECD nations decreased by 24% between 1971 and 1991 with the largest decreases observed for Canada, the USA, and UK.^{1,2}

To assess the long term health impact of de-industrialisation two groups of workers must be investigated; those downsized by the process and the survivors of downsizing who remain employed in restructured industries.

Ideally the investigation of the health impact of de-industrialisation requires longitudinal datasets that seek to answer the following four basic questions. Firstly, what was the size and severity of de-industrialisation? Secondly, over the long term, what were the re-employment experiences of downsized workers, according to new occupations attained and, new physical and psychosocial work conditions? Thirdly, for those workers who survived de-industrialisation, how did the restructuring process change their work conditions? Fourthly, over the long term were there any differences in health status between workers who remained employed in restructured sawmills and those re-employed in other sectors?

The downsizing/restructuring process has unfolded in different ways over the past two decades among different nations, industries, and even companies within the same industry. Many Canadian resource industries went through severe downsizing beginning in the recession of the early 1980s.³ In the sawmill sector in British Columbia (BC) unemployment reached 44% at the height of the recession in 1982.⁴ This paper explores the impacts of de-industrialisation in the sawmill industry in BC.

METHODS

This investigation is based on a cohort of approximately 28 000 sawmill workers who worked for at least one year between 1950 and 1998 in one of 14 BC sawmills. Methods used in building the original cohort are outlined elsewhere.⁵ Information on the extent of downsizing between 1979 and 1998 and the re-structuring of occupations in sawmills was obtained from this dataset.⁶

As well, a sample of 3000 sawmill workers, who were employed in 1979 at one of the 14 study sawmills, was drawn

Table 1 Interview status

Interview status	Number	Percentage
Long questionnaire	1885	62.9
Short questionnaire	270	9.1
Questionnaire respondents sub-total	2155	72.0
Refusals	126	4.2
Deceased	18	0.6
Needs translator	8	0.3
Not located	693	22.8
Total	3000	100.0

randomly from the cohort. (The year 1979 was chosen as a "baseline" because the recession began one year later in 1980). Interviews were conducted with 2155 of these workers. A total of 1885 interviews were "face to face" whereas 270 were conducted by telephone because respondents were located in isolated towns. This investigation is based on responses to the 1885 face to face interviews (table 1).

In face to face interviews, information was obtained on self reported health status in 1998, demographics, health behaviours, work history, and task level work conditions obtained.^{7,8} Task level work characteristics were measured using a shortened version⁹ of Karasek's demand/control instrument.¹⁰ Detailed information on methods used to obtain this sample are outlined elsewhere.¹¹

Self reported health status, at time of interview, was reported on a 5 point scale and dichotomised into "good" (good or excellent) and "poor" (fair, poor, bad) health status for use in logistic regression analysis. Current smoking status, age, income, highest education attained, occupational category in 1979 and 1998, job strain in 1998 (demand/control), and frequency and duration of unemployment were controlled to discover if self reported health status at time of interview differed between downsized workers and survivors in restructured sawmills

Figure 1 Number of workers per mill per year.

RESULTS

The broad impact of downsizing was determined from the entire cohort dataset by calculating the number of workers employed at each mill by year during the study period. In 1979 approximately 700 workers were employed in each mill. By 1996 the number of workers employed per mill averaged 280 workers a "downsizing" of approximately 60% of the 1979 workforce (fig 1).

Table 1 shows that 2155 respondents (72%) were interviewed, that 126 (4.2%) respondents refused an interview, and 693 (22.8%) of respondents were not located. Table 2 shows that the proportion of those not located for interview

increased with decreasing duration of employment in a study mill. In other words, non-respondents were more likely than respondents to have been employed for a short duration in a study sawmill.

Using the random sample of 1885 workers interviewed face to face, we determined that 75.4% of workers were 65 years or less in 1998. Of these, 42.2% were still employed in a study sawmill, 40.1%, were employed outside the sawmill sector, and the remaining 17.7% were not employed at time of interview because of early retirement, disability, or unemployment (fig 2). Of the 40.1% of workers employed outside the sawmill sector, 37.2% were in the service sector, 29.3% were employed in non-sawmill forest products manufacturing (mainly pulp and paper mills), 12.8% were in construction or renovation, 9.8% were in transportation, 8.6% were in non-forest products manufacturing and 2.3% were employed in fishing or farming.

Over the 19 year study period, the average duration of unemployment for those who found re-employment outside the sawmill sector was 11 months compared with 6.6 months for those who remained employed in the sawmill sector. The mean number of episodes of unemployment was 0.50 for those employed in the sawmill sector and 0.72 for those employed outside this sector. As well 16.5% of workers employed outside the sawmill sector had three or more episodes of unemployment compared with 10.3% of those who remained employed in a sawmill. Finally 37.8% of workers re-employed outside the sawmill sector had durations of unemployment of two years or more compared to 23.7% of survivors.

Table 2 Duration of employment by interview status

Duration of employment in a study sawmill	Number interviewed (%)	Number refused (%)	Not found/other (%)	Total (%)
1-5	277 (52.6)	13 (10.3)	237 (33.0)	527 (17.6)
5-15	446 (65.1)	26 (20.6)	213 (29.6)	685 (22.8)
15-25	622 (76.8)	34 (27.1)	154 (21.4)	810 (27.0)
25-35	511 (82.3)	35 (27.7)	75 (10.4)	621 (20.7)
>35	299 (83.8)	18 (14.3)	40 (5.6)	357 (11.9)
Total	2155	126	719	3000

Figure 2 Labour force participation of workers in 1979 and at time of interview.

Table 3 Percentage difference in physical and psychosocial work conditions at time of interview for workers employed outside the sawmill sector and in a sawmill by occupational category at time of interview

Job type	Control		Social support		Psychological demand		Physical demand		Noise	
	*SM	Non-SM	SM	Non-SM	SM	Non-SM	SM	Non-SM	SM	Non-SM
Managers	27.5	†26.9 (-2.2)	6.0	6.7 (10.5)	12.8	13.7 (6.6)	2.4	2.1 (-14.2)	2.6	2.1 (-23.8)
Trades	24.2	24.8 (2.4)	5.8	5.8 (0)	13.2	12.6 (-4.8)	3.0	2.9 (-3.4)	3.4	2.9 (-17.2)
Semiskilled	22.2	23.3 (4.7)	5.4	5.9 (8.5)	13.2	12.9 (-3.9)	2.7	2.7 (0)	3.2	2.8 (-14.3)
Unskilled	20.7	22.4 (7.6)	5.2	6.0 (13.3)	13.3	12.4 (-7.3)	3.0	2.7 (-11.1)	3.3	2.4 (-37.5)

*SM=sawmill; non-SM=non-sawmill sector. †Numbers in parentheses indicate percentage difference in scores between non-sawmill and sawmill sectors; that is, (non-sawmill-sawmill sector scores).

How did work conditions change for those who remained employed in sawmills?

Firstly, the process of restructuring eliminated approximately one quarter of job titles between 1979 and 1998. Most of the eliminated job titles, made obsolete by the introduction of new technology, were in the unskilled category (mainly labouring and clerical jobs). Secondly, this structural reduction in job titles at the bottom of the occupational hierarchy was accompanied by a reduction in the number of managerial employees by 67% and the number of tradesmen by 50%. At the same time, the proportion of semiskilled job titles approximately tripled so that the net result of restructuring of job titles and elimination of job positions was a flattening of the occupational hierarchy.

Thirdly, physical and psychosocial work conditions improved slightly during the period of sustained restructuring in the sawmills as the proportion of “high strain” jobs (jobs characterised by high psychological demands and low control) decreased from 26.2% in 1979 to 23.3% in 1998, a decrease of 11.1%. Noise and physical demand also decreased modestly during the restructuring period. Coworker social support remained unchanged over this time period.

What were work conditions like for those who obtained re-employment outside the sawmill sector? Firstly, approximately two thirds of downsized workers were re-employed either in the service sector or the non-sawmill portion of the forest products sector (mainly pulp and paper mills) in 1998. While 3% of sawmill workers were employed in managerial jobs within sawmills in 1998, 34.2% of workers downsized during the recession of the early 1980s and re-employed outside the sawmill sector were managers. The proportion of workers re-employed in unskilled jobs was 18.0% outside the sawmill sector compared with 46.2% in sawmills.

Secondly, control and social support scores were 3.1% and 8.1% greater for workers employed outside sawmills, while psychological demand, physical demand, and noise scores were, respectively 2.4%, 7.2%, and 23.2% less. As well, the relative advantage in control scores for the non-sawmill workers increased monotonically moving down the occupational hierarchy (table 3).

Did self reported health status in 1998 differ for sawmill and non-sawmill workers? After controlling for age, highest education attained, income in 1998, occupational category in 1979 and 1998, task level job strain (demand/control) in 1998, and frequency and duration of unemployment during the study period, workers who remained employed in a restructured sawmill reported lower self reported health status than workers who were downsized from a sawmill and obtained re-employment elsewhere (OR= 1.47; 95%CI 1.02 to 2.11).

DISCUSSION

This investigation shows that downsizing in BC sawmills after the recession of the early 1980s resulted in the elimination, over a 19 year period, of 60% of workers from study sawmills. Based on follow up of a random sample of cohort members in

Key point

- In a sample of sawmill workers, psychosocial and physical conditions of work and health status were better for workers who, under pressure of de-industrialisation, left the sawmill industry and obtained re-employment outside this sector.

1979, approximately half of those under 65 and in the labour force in 1998 were still employed at a study sawmill, and the other half were employed outside the sawmill sector.

For those employed in restructuring sawmills, elimination of (mainly) unskilled job titles and flattening of the occupational hierarchy resulted in persistent threats of unemployment and decreased within mill occupational mobility, particularly for unskilled and semiskilled workers.

In contrast, the approximately 50% of downsized workers had, by 1998, moved into a labour market characterised by a much broader range of occupational categories than found within restructured sawmills. A much greater proportion of workers re-employed outside the sawmill sector were managers and tradesmen compared with workers who remained employed in sawmills. As well as providing a broader range of “high end” occupational categories, these non-sawmill sector jobs, in 1998, provided “better” task level physical and psychosocial work conditions than were available in restructured sawmills.

In short, working conditions, measured both in terms of occupational categories and physical and psychosocial work conditions, improved for those workers downsized by the recession of the early 1980s and re-employed outside the sawmill sector relative to workers who remained employed in restructuring sawmills even though workers eliminated from sawmills by de-industrialisation experienced longer total duration of unemployment as well as more episodes of unemployment over the study period. As well, after controlling for confounders, workers who remained employed in restructuring sawmills were approximately 50% more likely to report poor health than their counterparts who left the industry.

Because downsizing in the early 1980s proceeded strictly on the basis of seniority, those most likely to be laid off in the early 1980s were also those with the lowest duration of employment. This group is over-represented among non-respondents (table 2). By 1998, members of this group would have probably been located if they were employed at a study sawmill so they also represent those workers in 1998 who were either living outside BC, or if employed, were working outside the sawmill sector in the province.

A group selected in the particular conditions of the early 1980s, (that is, with catastrophic lay offs occurring over a short period, proceeding strictly on the basis of seniority, and attributable to severe economic recession), was likely to be quite healthy simply because they were younger than the rest of the sample and because, unlike the situation of unemployment occurring in a stable economy, the proportion of workers selected into unemployment because of ill health would have

been relatively low. Thus, if we had been able to interview all workers in the sample, observed differences in self reported health between sawmill and non-sawmill workers might have been larger than the differences that were in fact observed.

These results cannot be generalised. Labour market conditions after severe downsizing as well as the depth and character of the restructuring process and its impact on working conditions, will differ depending on nation, region, industry, and historical time period under investigation. For example, results obtained in a different investigation of de-industrialisation, in which the alternative (non-industrial) labour market operated less efficiently than in this current investigation, could consign downsized workers to long term cycles of unemployment with associated deficits in health not observed in this study.

The lack of generalisability for this investigation is also a strength as it shows the importance, when investigating the impact of a widespread social process such as de-industrialisation, of grounding epidemiological investigation in concrete social and historical circumstances.

Finally, how is this study policy relevant? Most studies of unemployment focus on short-term health outcomes after unemployment instead of the long term impacts.¹² As well, while the experience of unemployment has been linked to adverse health outcomes less is understood about the impacts on health among workers who survive downsizing alone or downsizing that occurs in conjunction with workplace restructuring.

However, widespread downsizing of manufacturing workforces in developed nations has occurred over the past quarter of a century.¹ This trend is likely to continue with technological innovation in manufacturing and, furthermore, is likely to continue in conjunction with sustained restructuring of manufacturing industries.¹³ The long term health impacts of downsizing/restructuring have been under investigated despite the fact that this process is widespread, in the industrialised world and has affected and continues to affect many workers.^{14 15}

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REFERENCES

- 1 **Castells M**, Aoyama Y. Paths towards the informational society: eEmployment structure in G-7 countries, 1920–90. *International Labour Review* 1994;**133**:6–33.
- 2 **Rifkin J**. *The end of work: The decline of the global labour force and the dawn of the post-market era*, New York: Putnam's Sons, 1996.
- 3 **Barnes T**, Hayter R. British Columbia's private sector in recession, 1981–86: Employment flexibility without trade diversification. *BC Studies* 1993;**98**:20–42.
- 4 **Allen D**, Cohen C. *Forestry Sector Labour Adjustment Study*. Employment & Immigration Canada, Industry, Science & Technology Canada, Labour Canada, Ministry of Forestry. Ottawa: 1988.
- 5 **Hertzman**, C, Teschke K, Ostry A, *et al*. Cancer incidence and mortality in sawmill workers exposed to chlorophenols. *Am J Public Health* 1996;**87**:71–9.
- 6 **Ostry A**, Marion SA, Green L, *et al*. Downsizing and industrial restructuring in relation to changes in psychosocial conditions of work in British Columbia sawmills. *Scand J Work Environ Health* 2000;**26**:273–7.
- 7 **Pineo P**. *Revisions of the Pinio-Porter-McRoberts socioeconomic classification of occupations for the 1981 census*. QSEP Research Report No. 125, Program for Quantitative Studies in Economics and Population. Hamilton, Ontario: McMaster University, 1985.
- 8 **Statistics Canada**. *Standard Occupational Classifications*. Ottawa: Statistics Canada, 1980.
- 9 **Ostry A**, Marion SA, Green L, *et al*. A comparison of expert-rater methods for assessing psychosocial job strain. *Scand J Work Environ Health* 2001;**27**:1–6.
- 10 **Karasek**, R., Gordon G, Pietrovsky C, *et al*. *Job content instrument: questionnaire and users' guide*. Lowell: University of Massachusetts, 1985.
- 11 **Ostry A**, Barroetavena M, Hershler R, *et al*. *A comparison between the effort-reward imbalance and demand control job strain models*. Toronto: Institute of Work and Health Working Papers Series (working paper no 130), 2001.
- 12 **Jin RL**, Shah PC, Svoboda TJ. The impact of unemployment on health: a review of the evidence. *Can Med Assoc J* 1995;**153**:529–40.
- 13 **Hobsbawm EA**. *Age of extremes: the short twentieth century, 1914–1991*. London: Abacus, 1994.
- 14 **Iversen L**, Sabroe S, Damsgaard M. Hospital admissions before and after shipyard closure. *BMJ* 1989;**299**:1073–6.
- 15 **Bartley M**, Fagin L. Hospital admissions before and after a shipyard closure. *Br J Psychiatry* 1990;**156**:421–4.