Rapid Communication

Mortality Patterns following Downsizing at Pan American World Airways

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There are only a small number of studies on the health effects of involuntary unemployment (e.g., downsizing), and results are contradictory. The authors studied the mortality through 2002 of 13,370 Pan American World Airways employees who were born before 1940 and whose records were available after the company’s bankruptcy in 1991. The cohort was divided into those who left work voluntarily (55%), involuntarily (39%), and because of illness (6%). The mean year of first employment was 1963, the mean year of last employment was 1987, and the mean age at leaving the company was 55 years. Of those who left involuntarily, 56% left at the time of bankruptcy in December 1991 or later. Twenty-two percent of the cohort died during follow-up, which began at the time of leaving the company. Standardized mortality ratios relative to the US population for all causes for those who left voluntarily, involuntarily, and because of illness were 0.72 (95% confidence interval (CI): 0.69, 0.76), 0.69 (95% CI: 0.65, 0.74), and 2.40 (95% CI: 2.22, 2.60), respectively. Ischemic heart disease mortality showed a similar pattern. Internal analyses comparing involuntary to voluntary leavers after adjusting for age, race, sex, calendar time, and education yielded all-cause and ischemic heart disease rate ratios of 0.96 (95% CI: 0.87, 1.07) and 1.11 (95% CI: 0.93, 1.35), respectively. Subanalyses of those who left involuntarily at age ≥60 years, or those who left involuntarily at the time of bankruptcy, did not indicate any excess mortality (all-cause standardized mortality ratios = 0.69 and 0.64, respectively). These data do not indicate that mortality among those who left involuntarily was higher than for those who left voluntarily. Both groups showed a strong healthy worker effect.

healthy worker effect; heart diseases; mortality; personnel downsizing; unemployment

Abbreviations: CI, confidence interval; Pan Am, Pan American World Airways.

It has long been known that mortality among those who are unemployed is higher than among the employed, a phenomenon called the healthy worker effect (1). Increased mortality among the unemployed occurs largely because this group includes far more ill people. Presumably, some significant proportion of these unemployed ill people became unemployed because of their illness. However, little is known about whether involuntary unemployment per se, occurring among initially healthy people, can lead to higher illness or mortality rates.

To further investigate this subject, we conducted a mortality follow-up study among presumably healthy workers who were laid off without being on sick leave, including a large number laid off at one time because of company bankruptcy. Our study is based on personnel files obtained from Pan American World Airways (Pan Am), a large international airline, after their bankruptcy in December 1991. These records provided information sufficient for us to categorize workers into three groups: employees who left work voluntarily, involuntarily, or because of illness. We analyzed mortality of the employees through 2002 to determine whether there were differences in all-cause mortality or ischemic heart disease mortality in these three groups. Our hypothesis

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Cohort definition and follow-up

MATERIALS AND METHODS

**Cohort definition and follow-up**

The company declared bankruptcy in December 1991. After the bankruptcy, the National Institute for Occupational Safety and Health obtained electronic personnel records from Pan Am for approximately 50,000 individuals. This database was largely made up of those employed in 1982 or later, although 5 percent of these workers had left employment before 1982. From these records we assembled a cohort of 14,866 former employees born on or before January 1, 1940. We restricted our cohort to older subjects to maximize the number of deaths, given that mortality was the endpoint of the study, and to reduce costs of National Death Index follow-up. The cohort was further restricted to exclude 1) those who were not US citizens \( (n = 1,075) \), because of the lack of mortality data for noncitizens; 2) those US citizens who died while at work \( (n = 229) \), because they provided no information on mortality subsequent to leaving work; and 3) those for whom demographic or work history information was inadequate or erroneous \( (n = 192) \), because their data could not be analyzed. These exclusions left an analysis cohort of 13,370 individuals.

Follow-up began upon leaving Pan Am for the last time. The mean year that follow-up began was 1987, with an average length of follow-up after leaving work of 13 years.

On the basis of data available in personnel records, the cohort was divided according to those who left Pan Am voluntarily, those who left Pan Am involuntarily, and those who left the company because of illness (table 1). Involuntary leavers were defined as those who either were laid off or received a buyout or severance pay because of early retirement. Those who were ill were on either medical leave of absence or long-term disability when they left employment.

The remainder was considered to have left voluntarily or to have been transferred to another airline. According to the records, approximately 24 percent of voluntary leavers left to work for one of two different airlines when the company sold some of its routes to these airlines. Of those who left involuntarily, 56 percent left on or after December 4, 1991, at the time of the bankruptcy.

Mortality follow-up was conducted through December 31, 2002, via the National Death Index. Cause-of-death data were available for decedents via *International Classification of Diseases* codes current at the time of death, provided by the National Death Index. We had social security numbers for virtually all cohort members, facilitating accurate matching of our records with the National Death Index. The National Death Index returns all possible matches and classifies them as either “true” or “false,” with the “trues” matching on a large number of identifiers such as social security number, last name, and date of birth. The National Death Index further assigns subjects probability-of-matching scores and one of five classes reflecting the probability of a match. We accepted as a true match all National Death Index matches classified as “true” unless there were major discrepancies for key variables such as sex, race, and date of birth; in that instance, there was individual review, including possibly obtaining a death certificate. We accepted as a non-match all National Death Index matches classified as “false” except for all that were in class 4 with a probability score of 20 or higher or class 5 with a probability score higher than −2, which were further reviewed. The National Death Index is the principal source of cause-of-death information in the United States for deaths after 1978 and has been shown in studies submitting data on known decedents to provide complete and accurate death information (2).

**Analysis**

Life table analyses were run by using the National Institute for Occupational Safety and Health life table system for personal computers (3). These analyses were conducted separately for men and women, and separately for those who left voluntarily, involuntarily, or because they were ill. Standardized mortality ratios were calculated by comparing the

| TABLE 1. Characteristics of cohort members who left Pan American World Airways voluntarily, involuntarily, and because of illness |
|---------------------------------------------|----------------|----------------|--------------------|----------------|
| Number                                      | 7,346          | 5,228          | 796                | 13,370         |
| Percentage who died                         | 23             | 16             | 54                 | 22             |
| Percentage male                             | 84             | 82             | 87                 | 83             |
| Percentage White                            | 90             | 86             | 90                 | 89             |
| Percentage with a high school education or less | 45             | 49             | 50                 | 47             |
| Mean year of birth                          | 1930           | 1933           | 1930               | 1931           |
| Mean first year employed at Pan Am          | 1963           | 1964           | 1962               | 1963           |
| Mean last year employed at Pan Am           | 1987           | 1989           | 1984               | 1987           |

was that mortality among those who left work involuntarily might be higher than that among those who left voluntarily, under the assumption that those who left involuntarily were likely to have longer periods of unemployment than those who left voluntarily and that unemployment per se might pose a health risk.
cohort to the national population stratified by age (5-year categories), race, and sex. The National Institute for Occupational Safety and Health rates were used, which included US general population rates for 90 different categories of death and provided for a smooth transition in 1999 when the International Classification of Diseases, Ninth Revision was replaced by the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (4). Analyses were conducted for all causes and for ischemic heart disease (International Classification of Diseases, Ninth Revision, codes 410–414), the latter being the cause thought to be most likely to reflect any effects of unemployment.

In addition, separate life table analyses were run for those aged 55 years or younger, older than age 55 but younger than age 60 years, and age 60 years or older at the time they left the company. Separate analyses were conducted for those who left involuntarily at the time of the bankruptcy (December 4, 1991, or later). Finally, separate analyses were run for involuntary leavers by dividing between those who took early retirement through buyouts (25 percent) and those who did not.

In addition to standardized mortality ratio analyses, we conducted analyses by using internal comparisons within the cohort, with Poisson regression. These analyses compared ill and involuntary leavers with voluntary leavers and adjusted for age, race, sex, calendar time, and educational level (high school or less vs. more than high school). These comparisons avoid the healthy worker effect, which affects external comparisons in which involuntary and voluntary leavers are compared with the general US population, and hence are preferred for determining whether there is any adverse effect of involuntary leaving.

RESULTS

Descriptive statistics are shown in table 1. Overall, approximately 22 percent of the entire cohort were pilots, flight engineers, or flight attendants. The others included mechanics, baggage handlers, and clerical workers. Follow-up via the National Death Index was relatively complete; cause-of-death information was available for 97 percent of decedents.

Table 2 gives the standardized mortality ratio results for the cohort, with the US population as referent. Standardized mortality ratios were less than 1.00 for all causes and for ischemic heart disease among both involuntary and voluntary leavers. This finding most probably is due to a healthy worker effect when these workers are compared with the US population, which presumably includes a higher proportion of sick people than a group of workers who were healthy when they left employment. There were few apparent differences between voluntary and involuntary leavers, for either men or women. On the other hand, mortality among those who left work because of illness was approximately double the US rate for all causes and for ischemic heart disease.

Other specific causes reflected this general pattern, that is, no indication of excess mortality for involuntary versus voluntary leavers. For example, for stroke, the standardized mortality ratios were 0.56 and 0.59 for involuntary and voluntary leavers, respectively. For suicide, the respective standardized mortality ratios were 0.85 and 1.07.

Table 3 gives the standardized mortality ratio results for the cohort divided by educational level. Again, there was little indication of any difference between involuntary and voluntary leavers, for either educational level, whereas mortality among the sick was again much higher.

Internal comparisons via Poisson regression—in models incorporating reason for leaving, age, sex, race, and education—paralleled the standardized mortality ratio results. For all causes, the rate ratio for involuntary leavers versus voluntary leavers was 0.96 (95 percent confidence interval (CI): 0.87, 1.07), whereas the rate ratio for those leaving because of illness versus voluntary leavers was 3.13 (95 percent CI: 1.21, 1.40), without respect to reason for leaving.
work, consistent with a large body of literature indicating higher mortality for lower socioeconomic status groups (5). There were no significant (at the 0.05 level) interactions between reason for leaving and education, age, race, or sex.

For ischemic heart disease, internal comparison showed that the rate ratios for involuntary and ill leavers versus voluntary leavers were 1.11 (95 percent CI: 0.93, 1.35) and 2.82 (95 percent CI: 2.30, 3.63), respectively. The rate ratio for heart disease for those with a high school education or less versus those with more than a high school education was 1.36 (95 percent CI: 1.15, 1.60), again without respect to job loss category.

We conducted a series of supplemental analyses. We studied those who left work involuntarily at age 55 years or younger (37 percent), older than age 55 but younger than age 60 years (41 percent), and age 60 years or older (22 percent). All-cause standardized mortality ratios for those who were terminated involuntarily at age 55 years or younger, older than age 55 but younger than age 60 years, and age 60 years or older were 1.11 (95 percent CI: 0.93, 1.35) and 2.82 (95 percent CI: 2.30, 3.63), respectively. The rate ratio for heart disease for those with a high school education or less versus those with more than a high school education was 1.36 (95 percent CI: 1.15, 1.60), again without respect to job loss category.

We conducted the same analysis for voluntary leavers and found all-cause standardized mortality ratios of 0.76, 0.74, and 0.70 for age groups 55 years or younger, older than age 55 but less than age 60 years, and age 60 years or older, respectively.

We also looked separately at those who left work involuntarily at the time of the bankruptcy (56 percent of all involuntary leavers). Their standardized mortality ratio was similar to that for the entire group of involuntary leavers (all-cause standardized mortality ratios of 0.64 and 0.69, respectively). Separate analyses of these groups by sex or by education did not reveal any subgroups with elevated mortality. A direct comparison of involuntary leavers at the time of bankruptcy with voluntary leavers led to a rate ratio for all causes of 0.90 (95 percent CI: 0.79, 1.05) and a rate ratio for ischemic heart disease of 1.09 (95 percent CI: 0.84, 1.42). We also separated from the rest of the voluntary leavers those who left voluntarily to work for other airlines, and we found no difference in the mortality rate for voluntary leavers when data for those going to other airlines were removed. We also looked at involuntary leavers who left the company early with a buyout (25 percent) separately from all other involuntary leavers. We found little difference in

<table>
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<th>High school or less</th>
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<th>Women</th>
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<td>95% CI</td>
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<td>Involuntarily</td>
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<td>All causes</td>
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<td>0.80</td>
<td>0.65, 0.94</td>
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<tr>
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<td>2.53</td>
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<tr>
<td>Ischemic heart disease</td>
<td>2.07</td>
<td>1.48, 2.66</td>
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</tbody>
</table>

* Information on education was missing for two male decedents. The total number of deaths for men across educational groups for voluntary and involuntary leavers for all causes is not equal to the totals shown in table 2.

† SMR, standardized mortality ratio; CI, confidence interval.
DISCUSSION

Little is known about whether involuntary unemployment per se, occurring among initially healthy people, can lead to higher illness or mortality rates. There is no well-recognized or accepted mechanism by which such a phenomenon might occur, although one can hypothesize that unemployment can involve increased stress that might render an individual more susceptible to illness (6), that some individuals who lose their job lose their health insurance (7), or that the unemployed develop a worse profile of health-related behavior. However, studies on this last point do not support this hypothesis (8–10).

There are only a few longitudinal studies on health subsequent to involuntary unemployment, and results are not consistent. A Danish study of shipyard workers found increased hospital admissions for cardiovascular disease in the 3 years following layoffs among laid-off shipyard workers compared with shipyard workers not laid off (11). Janlert (12) studied construction workers in Sweden and found that unemployment led to increases in blood pressure when these workers were compared with those who remained employed. On the other hand, Kasl and Cobb (13) and Schnall et al. (14) found little evidence of an increase in blood pressure after involuntary unemployment. Ferrie et al. (15) studied 539 civil servants in the Whitehall II study 18 months after layoffs due to “privatization” in 1992. Eighteen months after privatization, after adjustment for baseline differences in health, those with insecure employment and the unemployed showed significantly more long-standing illness (not defined) than those with secure employment. However, there is ambiguity about the temporal onset of the long-standing illness reported during unemployment. Gallo et al. (16) followed 4,301 individuals working in 1992 until 2002; about 14 percent experienced involuntary job loss and did not return to work. Those experiencing involuntary job loss had more than double the risk of a self-reported myocardial infarction and of a stroke compared with those who continued working, but findings were limited by small numbers (23 myocardial infarctions and 13 strokes in the job loss group). Bartley et al. (17) conducted a follow-up of about 4,600 initially healthy men and women of working age annually from 1991 to 2001. New unemployment during any given year of follow-up was associated with a doubled risk of “limiting” illness for both men and women. It is not entirely clear from these data, however, whether the new illness itself might not have led to the unemployment, and the unemployment itself was not necessarily involuntary.

Two other mortality studies found little effect of downsizing on all-cause mortality. After 8 years of follow-up, Keefe et al. (18) found little difference in overall or cardiovascular mortality between 1,945 meat-processing workers who lost their jobs involuntarily after the plant was closed and workers at a similar plant who kept their jobs, although they did find a significant increase in hospital admissions due to self-harm among the workers employed at the plant that closed. Martikainen et al. (19) found that workers who became unemployed when their workplaces closed or underwent extensive downsizing showed little evidence of higher all-cause mortality than workers who remained employed. In contrast, mortality among workers becoming unemployed in periods of stable employment was elevated.

Our data do not indicate any increase in all-cause mortality or ischemic heart disease mortality for workers who lost their job involuntarily at Pan Am during a period of downsizing. On the other hand, increased mortality was found for those who left work because they were ill, as expected. We also found increased mortality for those with less education than those with more education, regardless of their reason for leaving, again as expected.

Our study had a number of limitations. First, we did not actively follow up workers after they left the company, so we do not know whether they found employment elsewhere. Our hypothesis is that those who left voluntarily were more likely to be quickly reemployed, whereas those who were laid off may have faced long periods of unemployment. However, we have no data to support this hypothesis. It may be that a large number of laid-off workers planned on their layoffs ahead of time and were able to find work rather quickly. However, analyses of those who left involuntarily at 60 years of age or older, who might have been particularly less likely to find new employment, did not show any particular increase in mortality.

Another limitation is that mortality is a relatively insensitive tool to judge adverse health, especially early health effects following unemployment. Our cohort showed a considerable healthy worker effect (all-cause standardized mortality ratios of 0.72 and 0.69 for voluntary and involuntary leavers, respectively). Perhaps any trends reflecting involuntary unemployment may be revealed only with longer follow-up.

Finally, our data were also limited to past personnel records. We lacked data on potentially important covariates such as smoking, obesity, and other factors that can affect mortality, which conceivably could modify (interact with) the effect of leaving employment.

In conclusion, in our study, healthy workers who experienced involuntary layoffs, compared with healthy workers who left work voluntarily, did not appear to have increased mortality from all causes, or any specific cause, during an average 13-year follow-up.

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REFERENCES


