Safety and health experience of pilots and flight attendants

Air transportation workers have a comparatively high rate of disabling injuries and illnesses; pilots and flight attendants commonly sustain serious sprains and strains

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Since passage of the Airline Deregulation Act, economists and public policy officials have been debating its effects.[1] The debate has been confined to the effects of deregulation on industry concentration, productivity, pricing, and passenger safety. Several studies have been conducted regarding labor-management relations in the airline industry following deregulation,[2] but only one study has investigated the health and safety of the workers.[3]

While studies have focused on the risks of flying from the passenger's viewpoint, occupational safety and health hazards faced by airline workers have been ignored. However, some of the same conditions that cause occupational injuries and illnesses in the airline industry may prove harmful to passengers.[4]

This article briefly discusses the structure of the airline industry. It also identifies the characteristics of injuries and illnesses experienced by pilots and flight attendants such as: principal physical condition, part of the body affected, source, and event.

The airline industry

There have been three distinct periods in the airline industry since deregulation.[5] The first period (1978 to 1981) witnessed the creation and entrance of new, low cost, mostly nonunion carriers, for example, People's Express, Muse, Midway, and New York Air. By paying low wages and leasing planes and maintenance services, these new carriers enjoyed cost advantages which reduced the profit margins of the established carriers.[6] The established airlines suffered losses, and each responded differently to the new competitive climate.[7] To compete with the new carriers, several innovative plans were introduced: frequent flier programs, computer reservation systems, the hub-and-spoke system, and holding companies (used to establish nonunion companies).

The second period (1982 to 1985) was initiated with Braniff Airlines filing for bankruptcy.[8] A deep recession, rising fuel prices, and new, low cost competition forced existing airlines to cut wages, change work rules, implement two-tier wage programs, and to eliminate jobs.[9] As Seth D. Rosen argues, "From a labor relations standpoint, the years from 1982 to 1985 were the worst of times for [airline] unions."[10] Management of the established carriers also sought to increase employees' productivity by changing work rules, increasing hard flying time, and instituting an overall speedup of the work process.[11]

The third period (1986 to 1992) is characterized by consolidation and expansion through merger. There were 15 mergers in 1986, more than in any other year in aviation history.[12] As a

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result of the mergers, industry concentration has increased, producing what one analyst has termed a "tight oligopoly." [13] The largest eight airlines now account for 92 percent of the domestic market.[14]

What does the future hold for the airline industry? The U.S. airline industry may undergo further consolidation with American, Delta, and United emerging as the dominant carriers.[15] These three airlines are currently the only U.S. carriers with strong balance sheets.[16] Competition in the airline industry is also expected to become more globalized.[17]

Although the airline industry has gone from regulation to competition to oligopoly since 1978, studies have not shown any evidence of deterioration in air travel safety as measured by either the number or the rate of fatalities. Specifically, from 1978 to 1988, the number of departures increased from 5,015,939 a year to 7,200,000 per year and the number of aircraft hours rose from 6 million to 10 million per year, while the accident rate remained relatively unchanged at 0.314 per 100,000 hours of operation.[18]

However, it is argued that although accidents have not increased, the margin of safety has deteriorated, especially during the 1980–86 period.[19] The increase in low cost competition forced the existing carriers to defer maintenance, forego the replacement of defective parts, and to ignore Federal safety limits.[20] It has only been since 1986, concomitant with increased consolidation in the industry, that the margin of safety has improved.[21]

The occupational injury and illness rate as well as the extent and characteristics of the injuries and illnesses to airline pilots and flight attendants could be affected by structural changes occurring in the airline industry. The new, low cost entrants (or competitors in bankruptcy proceedings) could put pressure on management to reduce costs by abrogating work rules and increasing speedup, thereby resulting in more injuries and illnesses.

Injury and illness experience

The incidence rate for occupational injuries and illnesses (based on Bureau of Labor Statistics survey data) for all workers in the "transportation by air" industry for selected years is shown in table 1. This industry includes all workers involved in providing air service, including ground personnel. The incidence rate, calculated in terms of 100 full-time workers, gives a rough indication of the level of risk faced by such workers.[22]

In 1988, the injury and illness rate per 100 full-time workers for airline workers was 13.0 percent, compared with the private sector average of 8.6, an indication of the hazardous nature of the air transportation industry. Between 1978 and 1988, the injury and illness rate for the airline industry has remained relatively constant. (Airline deregulation was effective in 1979.)

Table 1. **Occupational injury and illness rates for the airline industry and the private sector**

Year	Incidence rates per 100 full-time workers[1]		
	Total cases	Lost workday cases	Lost workdays
Transportation by air[2]			
1974	14.4	6.9	77.6
1978	13.4	8.4	93.7
1982	13.6	7.6	101.4
1986	13.0	7.8	117.4
1988	13.0	7.6	130.1
Private sector[3]			
1974	10.4	3.5	54.6
1978	9 4	4.1	63.5
1982	7.7	3.5	58.7
1986	7.9	3.6	65.8
1988	8.6	4.0	76.1

[1] See footnote 22 to text for method of calculation.

[2] Industry number 45, based on the *Standard Industrial Classification Manual*, 1967, 1972, and 1987 editions.

[3] Excludes farms with fewer than 11 workers, private households, and the self employed.

SOURCE: U.S. Bureau of Labor Statistics, *Occupational Injuries and Illnesses in the United States by Industry*, (Washington, U.S. Government Printing Office, various editions).

The lost workday case rate measures the number of injuries and illnesses that result in days away from work or restricted work duties, or both, per 100 full-time workers. In 1988, the lost workday case rate in the airline industry was 7.6, almost twice that of the private sector. The industry's lost workday case rate in 1988 was slightly less than in 1978 .

A proxy for the severity of the injury is the total lost workdays per 100 full-time employees. In 1988, this measure was 130.1, almost twice that of the private sector (76.1). The incidence rate for total lost workdays in the airline industry has increased by more than one-third since 1978, while the lost workday case rate declined. Therefore, the recuperation time for the average lost workday case in the airline industry rose by 1 week—from 11 lost workdays per lost workday case in 1978 to 17 days in 1988. A similar trend was noted in the private sector.

While occupational injury and illness rates provide useful information on the frequency of safety and health problems at the industry level, they do not provide information on the occupation of the injured worker and the injury itself. To provide this information, the Bureau of Labor Statistics developed the Supplementary Data System, which is based upon information on lost workday cases contained in State workers' compensation reports.

The Supplementary Data System has its limitations. First, not all States participate in the Supplementary Data System, and those that do so differ in the kinds of cases they are required to report to the workers' compensation agencies.[23] Second, the number of States participating in the Supplementary Data System program differs from year to year.[24] Third, the participating States may change the information collected as well as the reporting criteria.[25] Fourth, the Supplementary Data System data base does not control for macroeconomic variables or decisions at the firm level that can affect the injury rate.[26] Fifth, the first year in which Supplementary Data System data is readily available is 1980, making a comparison of data before and after deregulation rather difficult.

With these limitations, it is not possible that use of the Supplementary Data System will allow the researcher to describe the injury and illness experience of airline workers with great precision. Nevertheless, information contained in the data set is unique and the results obtained could lead to further research.[27] Because of the limitations discussed above, this article will focus on 1988 data for 14 participating States, the most recent year for which data are available.

Based on data from the Supplementary Data System, tables 2 through 5 present the characteristics of injuries and illnesses for pilots and attendants in the airline industry.[28] The data include disabling injuries and illnesses caused by crashes and other occupational injuries and illnesses. Because crashes are relatively infrequent, most of the injuries and illnesses incurred are due to everyday "on the job" factors.

Sprain and strain is the leading injury and illness condition for pilots and flight attendants, accounting for 38 percent of total injuries and illnesses for pilots and 46 percent of total injuries and illnesses for flight attendants in 1988. In the private sector, sprain and strain is also the principal injury condition, constituting 45 percent of the total number of injury and illness cases.

The second most common injury condition for pilots is fracture (that is, broken bones), accounting for 15 percent of their disabling injuries in 1988. For flight attendants, the second most common injury condition was contusions and bruises, accounting for 10 percent of their disabling injuries and illnesses.

Occupational illnesses made up a greater share of total cases for pilots and flight attendants than for the private sector.[29] Further examination of the Supplementary Data System data in 1988 indicates the preponderant occupational disease for both flight attendants and pilots was "effects of changes in atmospheric pressure," accounting for 18 percent (411 of 2,261 total cases) of occupational injuries and illnesses for flight attendants and 8 percent (17 of 225 total cases) of occupational injuries and illnesses for pilots.[30]

The source of injury and illness for airline pilots and flight attendants is presented in table 3. Not surprisingly, the preponderant source of injury and illness for flight attendants is "vehicles," constituting 32 percent of total injuries and illnesses. Of the 717 total injuries and illnesses due to vehicles, 432 cases resulted from nonpowered vehicles such as hand carts, 233

Table 2. **Distribution of occupational injury and illness cases by condition, airline industry and the private sector, 1988**

Physical condition	Private sector[1]	Transportation by air	
		Pilots	Flight attendants
Total cases	906,154	225	2,261
Percent of total	100	100	100
Amputations	1	—	—
Heat burns	2	—	—
Chemical burns	1	—	—
Contusions and bruises	10	4	10
Cuts and lacerations	12	6	4
Fractures	9	15	4
Abrasions and scratches	3	4	—
Sprains and strains	45	38	46
All occupational diseases	6	18	25
All other classifiable	6	11	6
Nonclassifiable	5	4	4

[1] Coverage varies somewhat from State to State, depending on workers' compensation laws. Almost all States exclude shipbuilding and water transportation services; some also exclude small farms.

NOTE: Columns may not add to 100 percent due to rounding. Dashes indicate no data or data that do not meet publication standards.

SOURCE: Bureau of Labor Statistics, 1988 Supplementary Data System. Fourteen States participated, including Arkansas, California, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Michigan, Mississippi, Missouri, Oklahoma, Oregon, and Texas.

cases resulted from contact with aircraft, and 50 cases, from motor highway vehicles.

A second principal source of injury and illness for flight attendants is air pressure, accounting for 20 percent of that job's case total. The majority of cases (399 of 450 cases) was due to low air pressure.

A third principal source of injury and illness for flight attendants is "boxes, barrels, and containers," accounting for 16 percent of that job's total injuries and illnesses in 1988. Of the 363 injuries from boxes, barrels, and containers, 82 involved "bags and sacks," while 48 involved "pots, pans, dishes, and trays."

There were 187 injuries due to contact with working surfaces (that is, the floor, ground, and stairs), accounting for 8 percent of total injuries and illnesses for flight attendants. Of these injuries, 83 involved contact with the floor, 35 with the ground, and 37 with stairs and steps.

For pilots, the preponderant source of injuries and illnesses is also vehicles, constituting 22 percent of total injuries and illnesses in 1988.

Table 3. **Distribution of occupational injury and illness cases, by source, airline industry, and the private sector, 1988**

Source	Private sector[1]	Transportation by air	
		Pilots	Flight attendants
Total cases	906,154	225	2,261
Percent of total	100	100	100
Boxes, barrels, and containers	14	12	16
Chemicals	2	2	—
Hand tools	7	2	—
Machines	6	—	—
Metal items	10	1	1
Vehicles	9	22	32
Work items	4	—	—
Working surfaces	15	19	8
Air pressure	—	8	20
All other classifiable	32	31	19
Nonclassifiable	3	3	2

[1] Coverage varies somewhat from State to State, depending on workers' compensation laws. Almost all States exclude shipbuilding and water transportation services; some also exclude small farms.

NOTE: Columns may not add to 100 percent due to rounding. Dashes indicate no data or data that do not meet publication standards.

SOURCE: Bureau of Labor Statistics, 1988 Supplementary Data System. Fourteen States participated, including Arkansas, California, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Michigan, Mississippi, Missouri, Oklahoma, Oregon, and Texas.

Of 49 such injuries, 42 were due to the aircraft, and 6 were due to powered highway vehicles.

The second most common source of injury and illness for pilots is contact with working surfaces, accounting for 19 percent of total injuries and illnesses in 1988. Out of 43 total working surface injuries in 1988, 19 were due to contact with the ground, 9 were due to contact with the floor, and 8 were due to contact with stairs and steps.

Injuries due to boxes, barrels, and containers are a third primary source of injury and illness for pilots, making up 12 percent of total injuries and illnesses in 1988. Of 27 such cases, 11 involved "bags and sacks."

Investigation of the category "all other classifiable" reveals that the preponderant source of injury and illness for both flight attendants and pilots in this category is bodily motion. [31]

An interesting finding is that (within the "all other classifiable" category) only five disabling injuries and illnesses out of a total of 2,261 for flight attendants had noise as a source. For pilots, there were no injuries or illnesses reported in the 1988 Supplemental Data System which had noise as a source.

Table 4 indicates the type of accident, event, or exposure leading to injury or illness (that is the external circumstance). A preponderant event for pilots and flight attendants is "overexertion," accounting for 17 percent of total cases for pilots, and approximately 33 percent of total cases for flight attendants. The private sector also had "overexertion" as the preponderant injury or illness event.[32]

An examination of "overexertion" injuries for flight attendants shows that 330 of 737 of those injuries were caused by "pulling or pushing objects," while 266 were caused by "lifting objects." For pilots, in 1988, out of 39 total injuries due to overexertion, 22 were caused by "lifting objects," while 4 were caused by "pushing or pulling objects."

The second preponderant incident for flight attendants in 1988 was "struck by or against," accounting for 15 percent of total accidents. Of the 345 injuries in this category, 136 were caused by striking against a stationary object, while 81 were caused by being struck by a falling object.

Injuries caused by falls were a third preponderant accident in 1988 for flight attendants, accounting for 9 percent of the total. In examining "falls," 111 of 213 such incidents were caused by falls to the walkway, 35 were caused by falls on the stairs, and 18 were caused by falls onto or against objects.

A second common accident for injured pilots is "transportation accidents other than motor vehicles," almost all of which (21 of 22

Table 4. **Distribution of occupational injury and illness cases by event or exposure, airline industry and the private sector, 1988**

Event or exposure	Private sector[1]	Transportation by air	
		Pilots	Flight attendants
Total cases	906,154	225	2,261
Percent of total	100	100	100
Struck by or against	25	13	15
Falls	17	18	9
Caught in, under, between	6	3	4
Rubbed or abraded	2	4	—
Bodily reaction	7	14	5
Overexertion	32	17	33
Contact with temperature extremes	2	—	1
Contact with radiation, and caustics	3	5	2
Motor vehicle accident	3	—	2
Transportation accidents, other than motor vehicle	—	10	8
All other classifiable	2	14	19
Nonclassifiable	2	2	2

[1] Coverage varies somewhat from State to State, depending on workers' compensation laws. Almost all States exclude shipbuilding and water transportation services; some also exclude small farms.

NOTE: Columns may not add to 100 percent due to rounding. Dashes indicate no data or data that do not meet publication standards.

SOURCE: Bureau of Labor Statistics, 1988 Supplementary Data System. Fourteen States participated, including Arkansas, California, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Michigan, Mississippi, Missouri, Oklahoma, Oregon, and Texas.

cases) were caused by aircraft. Such incidents make up only 8 percent of total injuries and illnesses to flight attendants, almost all of which (173 of 176) were caused by aircraft.

Incidents caused by falls are another leading event for injured pilots. Of 41 such injuries, 19 were caused by falls from the walkway, while 5 were caused by falls on stairs, and 4 were caused by falls from vehicles.

Table 5 indicates the body part affected by the injury or illness. Injuries and illnesses affecting the "trunk" were 30 percent of total injuries and illnesses for pilots, of which the majority of cases (52 of 67) affected the back. The second principal body part affected for pilots was "lower extremities" (23 percent of total), of which 25 of 52 cases affected the knee, and 14 cases affected the ankle. Injuries and illnesses to the "head and neck" accounted for 19 percent of the total injuries and illnesses for pilots, of which a large majority were to either the internal ears (17 cases) or to the eyes (15 cases).

With flight attendants, the "head and neck" and the trunk were the preponderant body parts affected by injury and illness, each 29 percent of the job's case total. In the "head and neck" category, the majority of cases were to the internal ears (466 of 647), followed by neck injuries (69 of 647). Of the injuries and illnesses to the trunk, the majority (450 of 656) were to the back, followed by the shoulders (92 of 656). Injuries to the lower extremities, 14 percent of the case total, were primarily to the legs (132 of 322 cases) and to the foot (96 cases).

Finally, data on duration of employment available from the Supplementary Data System files for 11 States indicate that 11 percent of injured flight attendants in 1988 were employed less than 1 year and 22 percent were in their second or third year of employment. Of the

Table 5. **Distribution of occupational injury and illness cases by body part affected, airline industry and the private sector, 1988**

Body part	Private sector[1]	Transportation by air	
		Pilots	Flight attendants
Total cases	906,154	225	2,661
Percent of total	100	100	100
Head and neck	9	19	29
Upper extremities	25	12	13
Trunk	36	30	29
Lower extremities	19	23	14
Multiple body parts	8	8	12
Body systems	3	7	3
Nonclassifiable	1	—	—

[1] Coverage varies somewhat from State to State, depending on workers' compensation laws. Almost all States exclude shipbuilding and water transportation services, some also exclude small farms.

NOTE: Columns may not add to 100 percent due to rounding. Dashes indicate no data or data that do not meet publication standards.

SOURCE: Bureau of Labor Statistics, 1988 Supplementary Data System. Fourteen States participated, including Arkansas, California, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Michigan, Mississippi, Missouri, Oklahoma, Oregon, and Texas.

injured pilots in 1988, 20 percent were in their first year of employment and 25 percent were in their second or third year of employment.

IN SUMMARY, one question that needs to be further investigated is why pilots and flight attendants suffer a higher incidence of occupational disease than do private sector workers. As the airlines consolidate into global competitors, future research should focus on the effects of longer flights, fatigue, and stress on worker health and safety.

Footnotes

[1] See, for example, Elizabeth E. Bailey, David R. Graham, Daniel P. Kaplan, *Deregulating the Airlines* (Cambridge, MA, The MIT Press, 1985); U.S. General Accounting Office, *Deregulation: Increased Competition is Making Airlines More Efficient and Responsive to Consumers* (Washington, U.S. Government Printing Office, 1985); S. A. Morrison and C. Winston, *The Economic Effects of Airline Deregulation* (Washington, The Brookings Institution, 1986); Alfred E. Kahn, "Airline Deregulation—A Mixed Bag, But a Clear Success, Nevertheless," *Transportation Law Journal*, Vol. 16, No.2, 1988, pp. 229–52; Leon N. Moses and Ian Savage, eds., *Transportation Safety in An Age of Deregulation* (New York, Oxford University Press, 1989); and Paul Stephen Dempsey, *Flying Blind: The Failure of Airline Deregulation* (Washington, The Economic Policy Institute, 1990).

[2] See Herbert Northrup, "The New Employee Relations Climate in Airlines," *Industrial and Labor Relations Review*, January 1983, pp. 167–81; Charles Craypo, *The Economics of Collective Bargaining* (Washington, The Bureau of National Affairs, 1985), pp. 114–39; Peter Cappelli, "Airlines," in David B. Lipsky and Clifford B. Donn, eds., *Collective Bargaining in American Industry* (Lexington, MA, Lexington Books, 1987); Jean T. McKelvey, ed., *Cleared for Takeoff: Airline Labor Relations Since Deregulation* (Ithaca, NY, ILR Press, 1988); and Kenneth W. Thornicroft, "Airline Deregulation and the Airline Labor Market," *Journal of Labor Research*, Spring 1989, pp. 163–81. The general consensus of these studies is that there has been a weakening in the collective bargaining strength of the labor unions in the airline industry.

[3] W. Kip Viscusi, "The Effect of Transportation Deregulation on Worker Safety," in Leon N. Moses and Ian Savage, *Transportation Safety in an Age of Deregulation*, pp. 70–89. This study utilizes aggregate injury and illness data for the entire airline industry.

[4] *Ibid.*, p. 70.

[5] This delineation was suggested by Seth D. Rosen, "A Union Perspective," in Jean T. McKelvey, *Cleared for Takeoff: Airline Labor Relations Since Deregulation*, pp. 11–35 .

[6] Bailey and others, *Deregulating the Airlines*, pp. 80 and 93. See also U.S. Office of the President, *Economic Report of the President* (Washington, U.S. Government Printing Office, 1989), p. 187.

[7] Rosen, "A Union Perspective, " p. 13.

[8] Braniff has reorganized and with a staff of 300 employees, the airline began flying four domestic routes as of July 1, 1991. See Edwin McDowell, "New Braniff Airline to Start Flying July 1," *The New York Times*, June 19, 1991, p. C4.

[9] For further discussion, see David R. Graham and Daniel P. Kaplan, "Airline Deregulation is Working," *Regulation*, May-June 1982, p. 31; Northrup, "The New Employee Relations Climate in Airlines," p. 169; Craypo, *The Economics of Collective Bargaining*, p. 126; Rosen, "A Union Perspective," pp. 18–21; Thornicroft, "Airline Deregulation and the Airline Labor Market," p. 175; and Paul Stephen Dempsey, *The Social and Economic Consequences of Deregulation* (New York, Quorum Books, 1989), p. 115.

[10] Rosen, "A Union Perspective," p. 21.

[11] See Craypo, *The Economics of Collective Bargaining*, pp. 126–36; Peter Cappelli, "An Economist's Perspective," in Jean T. McKelvey, *Cleared for Takeoff*, p. 59; Robert Moorman and Esperison Martinez, Jr., "Negotiating Trends Stiffen," *Air Line Pilot*, April 1986, p. 12; Arlie Russell Hochschild, *The Managed Heart* (Berkeley, University of California Press, 1983), p. 124.

[12] Rosen, "A Union Perspective," p. 20.

[13] William G. Shepherd, "The Airline Industry," in Walter Adams, ed., *The Structure of American Industry*, 8th ed. (New York, Macmillan, 1990), p. 228.

[14] Dempsey, *Flying Blind*, p. 13. In 1978, the largest eight airlines controlled 81 percent of the traffic. One argument is that despite the increase in concentration at the industry level, competition on individual routes has increased. Morrison and Winston argue that the number of competitors at the route level has increased from 1.52 in 1978 to 1.90 in 1988. See Stephen A. Morrison and Clifford Winston, "The Dynamics of Airline Pricing and Competition," *The American Economic Review*, Papers and Proceedings, May 1990, p. 390. See also Kahn, "Airline Deregulation," p. 232; and Laura M. Smith and Daniel P. Rich, "In Air Travel, Competition is Up," *Christian Science Monitor*, Mar. 24, 1989, p. 19.

[15] Kevin Kelly, "Plane Monopoly: Flying New Order Skies," *In These Times*, Apr. 24–30, 1991, p. 3. See also Ronald Rosenberg, "Turmoil in the Skies," *Boston Globe*, Dec. 23, 1990, p. A51.

[16] Rosen, "A Union Perspective," p. 29.

[17] Samuel Skinner, "Revolution in the Airline Industry," Speech delivered to the National Press Club, Washington, DC, Jan. 23, 1991. See also Asra Q. Nomani and Laurie McGinley, "Airlines of the World Scramble for Routes in Industry Shakeout," *The Wall Street Journal*, July 23, 1991, pp. A1, A8.

[18] Chris Black, "Scares Aside, Skies are Friendly," *Boston Globe*, Aug. 12, 1989, p. 3; See also Shepherd, "The Airline Industry," pp. 236–37. However, John R. Nance has argued that accident and death statistics are " . . . worthless as a gauge of airline safety, since only the complete absence of a safety buffer will show up as a clear trend in the number of passengers killed and the number of aircraft destroyed." See John R. Nance, "Economic Deregulation's Unintended but Inevitable Impact on Airline Safety," in Leon N. Moses and Ian Savage, eds., *Transportation Safety in an Age of Deregulation*, p. 203.

[19] Nance, "Economic Deregulation's Unintended Impact," p. 188.

[20] Bennett Harrison and Barry Bluestone, *The Great U-Turn* (New York, Basic Books, 1988), p. 96.

[21] Nance, "Economic Deregulation's Unintended Impact," p. 202.

[22] Specifically, the rate is calculated in the following manner:

$$(N/EH) \times 200{,}000$$

where

N = number of injuries and/or illnesses;

EH = total hours worked by all employees of the industry during the calender year; and

200,000 = base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year).

For further discussion of the calculation of the occupational injury and illness incidence rate, see *Handbook of Methods*, Bulletin 2285 (Bureau of Labor Statistics, 1988), pp. 98–101.

[23] *Handbook of Methods*, p. 102.

[24] In 1980, for example, 31 States and the Virgin Islands participated; in 1986, 23 States and the Virgin Islands participated; and, in 1988, 14 States participated.

[25] Carol Conroy, "Work-Related Injuries in the Meatpacking Industry," *Journal of Safety Research*, Summer 1989, p. 52.

[26] *Ibid.*, p. 52.

[27] Studies that have used Supplemental Data System data bases include: Martin Personick and Katherine Taylor-Shirley, "Profiles in safety and health: occupational hazards of meatpacking," *Monthly Labor Review*, January 1989, pp. 3–9; Martin E. Personick and Judy R. Daley, "Profiles in safety and health: work hazards of mobile homes," *Monthly Labor Review*, July 1989, pp. 15–20; Conroy "Work-related injuries in the meatpacking industry, pp. 47–53.; Martin E. Personick and Elyce A. Biddle, "Job hazards underscored in woodworking study," *Monthly Labor Review*, September 1989, pp. 18–23; and Martin E. Personick, "Profiles in safety and health: eating and drinking places," *Monthly Labor Review*, June 1991, pp. 19–26.

[28] In 1988, there were 83,000 civilian pilots of whom 90 percent were employed by commercial airlines; almost all of the 88,000 civilian flight attendants were employed by commercial airlines. See *Occupational Outlook Handbook* (Bureau of Labor Statistics, 1990).

[29] These figures should be interpreted with caution because the data collected by OSHA understates the actual extent of occupational illnesses, particularly those with a long gestation period. See Harvey J. Hilaski, "Understanding statistics on occupational illnesses," *Monthly Labor Review*, March 1981, pp. 25–29. See also *BLS Handbook of Methods*, p. 101.

[30] For the private sector, inflammation of joints, nervous disorders, and systemic poisoning were the most prevalent types of occupational illnesses in 1988. Pilots did not have any cases classified as inflammation of the joints, whereas flight attendants had 17 incidents out of 2,261 cases classified as "Conditions of the Nervous System." Pilots had 8 of 225 total cases classified as systemic poisoning, whereas flight attendants had 16 out of 2,261 classified as such.

[31] "Bodily motion" is to be named as the source when the injury results solely from the stress or strain induced by a free movement of the body or its parts or from the assumption of an unnatural position. See *American National Standards Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries* (New York, American Standards Association, Inc., 1963), Appendix A, p. 16.

[32] Overexertion applies only to nonimpact cases in which the injury resulted from excessive physical effort as in lifting, pulling, wielding, or throwing. *Ibid.*, p. 23.