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Age-Related Injuries among Male and Female Assembly Workers: A Study in the Swedish Automobile Industry

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Article abstract

This study investigates whether there is evidence of age related impairment in injury occurrence among assemblers in the Swedish automobile industry. A retrospective analysis of injuries sustained by male and female assemblers over a 10-year period (1980-1990) was conducted, employing five age categories divided into ten yearly strata and three time periods. Age-related injury ratios (IRs) were calculated for all injuries aggregated as well as for overexertions, falls and missteps, and injuries by contact. Contrary to expectation, IRs for older assemblers were generally low while consistently high IRs were recorded for younger assemblers, and for both male and female workers. The study offers no support for the likelihood of age-impairment among assembly workers of either gender. Inequalities in risk exposure and early deselection from the occupation are the most likely factors explaining these results.

Age-Related Injuries among Male and Female Assembly Workers

A Study in the Swedish Automobile Industry

LUCIE LAFLAMME

This study investigates whether there is evidence of age-related impairment in injury occurrence among assemblers in the Swedish automobile industry. A retrospective analysis of injuries sustained by male and female assemblers over a 10-year period (1980–1990) was conducted, employing five age categories divided into ten yearly strata and three time periods. Age-related injury ratios (IRs) were calculated for all injuries aggregated as well as for overexertions, falls and missteps, and injuries by contact. Contrary to expectation, IRs for older assemblers were generally low while consistently high IRs were recorded for younger assemblers, and for both male and female workers. The study offers no support for the likelihood of age-impairment among assembly workers of either gender. Inequalities in risk exposure and early deselection from the occupation are the most likely factors explaining these results.

The fatalistic conception that individual physical and mental capacities to cope with occupational demands diminish with age hinders the design of forms of production that might permit the effective and safe employment of older workers. This conception is becoming of crucial importance in occupational life since aging has already affected, and is expected to further affect, the work forces of most industrialized countries.

Not only is this fatalistic conception counter-productive, it is also counter-factual (Rabbit 1991; Warr 1993, 1994). In this respect it is important to note that the occupational activities which may be defined as "age-impaired"

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are limited in range (Warr 1993, 1994) and that, if required, older workers are generally able to counteract difficulties in meeting job demands provided that work conditions are sufficiently flexible for them to make use of acquired compensatory skills (Laville 1989; Volkoff 1989; Salthouse 1990; Gary 1991; Ilmarinen 1991; Rabbit 1991; Warr 1993, 1994). In the long run, however, rigid work conditions either force older workers to leave their jobs or cause them considerable occupational difficulties.

Among the possible undesirable outcomes of age impairment are occupational injuries (WHO 1993), and the present study focuses on these. The study investigates whether there is evidence of age-related injury risks among assembly workers in the Swedish automobile industry. Male and female assemblers are considered separately because of possible gender differences in aging processes, professional backgrounds, task assignments and hazards in the industry (Teiger 1989; Sailly and Volkoff 1990).

This particular occupation was chosen because of two characteristics that may be supposed to pose age-related problems (Warr 1993, 1994): numerous time-bound tasks and generally rigid work conditions. In Swedish industry in particular, there are clear signs of early withdrawal from the occupation among both men and women. This can be observed in Table 1 where the distributions of the populations of male and female Swedish assemblers are compared over the 1980s, employing three reference years: 1980, 1985, 1990. The table shows that, generally speaking, and regardless of reference year, male and female assemblers were concentrated in the age categories lower than 30 (nearly 50% in all three years). For both genders, no more than around 20% of the work force was older than 44, and less than 10% was older than 55. Such data, however, do not bear on the question of whether there is evidence of age impairment among those workers who remain in the job – or return to it – when older (e.g. after the age of 30).

With regard to age-related injuries, the studies conducted so far in the automobile industry provide little support for the idea that there is a positive relationship between injury incidence and age. To the contrary, they suggest that injury rates tend to be higher for employees in lower age groups and for those with low levels of experience in their occupation (Baker 1987; Baugé 1976; Oleske et al. 1989), observations that are also supported by several age-related studies of other occupations and economic sectors (Laflamme and Menckel 1995).

Among the latter studies, however, some have shown that, all occupations aggregated, women older than 45 have a higher injury rate than other women, and an especially higher rate than those below 25 years of age (Dillingham 1981a). But these differences have been explained by the uneven

distribution by type of occupation of women in different age groups rather than by variations in individual characteristics. Women older than 45 tend to be concentrated in blue-collar occupations, while those younger than 25 are proportionately more often to be found in white-collar occupations (Dillingham 1981a).

TABLE 1

Age Distributions of Swedish Male and Female Assembly Workers for Three Time Periods

Age	*1980*		*1985*		*1990*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
16–19	10.7	5.8	10.7	11.1	6.4	6.0
20–24	21.0	16.3	28.1	23.5	22.9	24.3
25–29	15.4	15.4	14.3	11.7	17.9	18.3
30–34	13.1	17.4	11.1	11.0	12.2	10.2
35–39	10.8	13.9	10.2	12.9	10.4	10.3
40–44	8.3	10.3	8.1	11.3	9.7	11.8
45–49	6.2	7.8	6.4	7.3	7.9	8.3
50–54	5.6	7.1	4.5	4.7	5.8	5.1
55–59	5.0	4.2	3.8	4.5	4.0	3.4
60–64	3.6	1.9	2.7	2.1	2.7	2.3
65+	0.3	0.0	0.0	0.0	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
N	12,995	3,147	10,075	3,636	14,701	4,075

Despite this, in the particular case of blue-collar female workers, some studies have shown that women in higher age groups not only have more accidents than younger ones (Dillingham 1981a, 1981b; Landen and Hendricks 1992) but also more than men of the same age in the same type of job. In contrast, other comparisons have indicated that, all occupations aggregated, men tend to have more accidents than women, but that these differences may well disappear when occupations with similar gender distributions are considered (Dillingham 1981b).

Generally speaking, the evidence gathered up to now concerning age and occupational accidents is unsatisfactory (Laflamme and Menckel 1995) because it comes mainly from large-scale studies (where exposure to risk is not controlled for) and from studies with a cross-sectional design (where age and generation effects might be confounded). In addition, some research findings suggest that age-related accident risks might be specific rather than diffuse – in the sense that older workers may be at greater risk

with regard to certain specific types of injuries, such as those incurred to the back or lower limbs due to falls and missteps or to overexertions (Root 1981; Oleske et al. 1989; Cloutier 1994).

Against this background, in this study age-related risks were considered longitudinally, attention being paid to both non-specific (aggregated) and specific (by type) accident risks. For the reasons outlined above, male and female workers were studied separately. The focus of the study is not on gender differences within each age stratum, but on differences in relative injury risks between age categories for each gender taken separately.

MATERIALS AND METHODS

A retrospective longitudinal analysis of injuries sustained by male and female assembly workers employed in the Swedish automobile industry was conducted for a 10-year period (1980–1990), employing five age categories divided into ten yearly strata (from 16–24 years-of-age to 55–65) and three five-yearly time periods (80–81, 85–86, 90–91). In the calculation of relative injury risks (ratios), data for numerators (injuries) and denominators (exposed workers) were taken from official Swedish sources: from the ISA (the information system on occupational injuries maintained by Sweden's National Board of Occupational Safety and Health) for the numerators; and from census data gathered by Statistics Sweden for the denominators.

The three periods match the census data. They are referred to as "periods" rather than "years" since injury data were assembled over two years (rather than one) for each reference period (i.e. 80–81, 85–86, 90–91). Because Statistics Sweden's census data were collected in November for each year of reference, it seemed preferable to use data describing the average annual number of exposed workers over a two-year period with a mid-period reference point rather than to utilize an estimate of the annual number of workers with a reference point at the end of each period.

Table 1 shows the distributions of male and female assemblers by age category for these three periods. It can be noted that, although there was a steady increase in the total number of female assemblers between 1980 and 1990, the number of male assemblers fluctuated (although it was higher in 1990 than in 1980). In the case of both genders, the overall increase was due to the attraction of younger rather than older workers to the occupation, in particular those in their twenties.

For the purpose of the study, injury data (numerator data) were taken from all 6,814 accident declaration forms involving male (5,872) and female (942) assembly workers (using the Nordic Occupation Classification) that

had reached the Information System on Occupational Injuries (ISA-system) during the three selected time periods (excluding accidents that occurred during travel to and from work). Note that in Sweden an injury must be reported, by the company, to the National Board of Occupational Safety and Health whenever an injured worker is away from work for one day or more following the injury.

The 6,814 injuries declared by assembly workers during the three time periods were broken down by gender, age category, time period and injury type (see below). A single indicator of injury frequency was used: the injury ratio (IR). The IR for a given group of workers is the ratio of all injuries that occurred during a given period in that group to the average number of employed workers in that period. A ratio greater than 1.0 indicates that the percentage for injuries is greater than the percentage for employment, and a ratio less than 1.0 indicates the opposite.

IRs by gender and age were calculated for all injuries aggregated and for three "main events" leading to injury occurrence: overexertions, falls and missteps, and all contact injuries (i.e. with an object moving, falling/flying or handled). "Main event" is one of several aspects of accidents and injuries for which regular coding takes place within the ISA system. Table 2 shows the number and proportion of injuries associated with each injury type, by gender and for both genders taken together.

TABLE 2

Injury Distributions by Type (According to Main Event) and Gender among Assembly Workers, All Time Periods Aggregated

Type of injury	*Male*		*Female*		*Both genders*	
	N	%	N	%	N	%
Falls and missteps	1,554	26.5	275	29.2	1,829	26.8
Overexertions	941	16.0	206	21.9	1,145	16.8
Contacts	3,094	52.7	437	46.4	3,531	51.8
• *with moving object*	*798*	*13.6*	*107*	*11.4*	*905*	*13.3*
• *with flying/falling object*	*964*	*16.4*	*181*	*19.2*	*1,145*	*16.8*
• *with handled object*	*1,332*	*22.7*	*149*	*15.8*	*1,481*	*21.7*
Others	283	4.8	24	2.5	307	4.5
Total	5,872	100.0	942	100.0	6,814	100.0

IRs were compared in two different ways: (1) for each age category across periods *(horizontal comparisons)* and (2) between age categories for each period *(vertical comparisons)*.

RESULTS

IRs by Gender and Age, All Injuries Aggregated

Table 3 presents IRs by age category, gender and time period, all injuries aggregated. It shows that it is only among younger assemblers (16–24 years-old) that IRs equal to or higher than 1.0 are registered, with the exception of female assemblers aged 55–65 in 1980–81. IRs were higher for younger workers than for workers from any other age category, in all time periods, for both men and women.

IRs by age category over time *(horizontal comparisons)* varied slightly, but generally not remarkably. The only age category for which substantial differences were recorded is that of older workers (aged 55–65), especially older male workers. But, as far as this age category is concerned, fluctuations might be due to insignificant changes in the small numbers of injuries and workers rather than being a reflection of "real" time-related change.

TABLE 3

Injury Ratios (IRs) by Age, Gender and Time Period among Assembly Workers, All Injuries Aggregated

Age	*1980-81*		*1985-86*		*1990-91*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
16–24	1.5	1.5	1.3	1.6	1.2	1.4
25–34	0.9	0.9	0.9	0.7	0.9	0.9
35–44	0.8	0.8	0.9	0.6	0.9	0.9
45–54	0.7	0.8	0.7	0.9	0.9	0.9
55–65	0.4	1.0	0.7	0.3	0.7	0.5

IRs by Gender and Age, For Each Accident Type

Table 4 presents IRs by age category, gender and time period, for each injury type separately: overexertions, falls and missteps, and contact injuries.

Overexertions

In all three time periods, injuries due to overexertions were incurred to the greatest extent proportionately by younger workers (16–24). This applied to both genders. But, from one time period to another, the magnitude of the differences between the IRs of younger workers and those of other age groups varied. The IRs of some other age categories fluctuated over time, in particular those of female assemblers aged 25–34 and 35–44, and male assemblers aged 55–65.

TABLE 4

Injury Ratios (IRs) by Age, Gender and Time Period among Assembly Workers, by Cause of Injury (According to "Main Event")

Age	*1980-81*		*1985-86*		*1990-91*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Overexertions						
16–24	1.4	1.5	1.1	1.5	1.2	1.2
25–34	0.8	0.6	1.0	0.9	0.8	1.1
35–44	0.9	1.4	1.0	0.7	1.0	0.7
45–54	0.9	0.8	1.0	0.9	1.1	1.0
55–65	0.5	0.4	0.7	0.2	0.8	0.4
Falls and missteps						
16–24	1.4	1.4	1.2	1.6	1.0	1.1
25–34	1.0	1.0	1.0	0.6	0.9	0.7
35–44	0.7	0.7	0.8	0.5	1.1	0.9
45–54	0.9	1.0	0.8	1.3	1.1	0.9
55–65	0.3	1.0	0.9	0.3	0.7	0.7
Contacts						
16–24	1.5	1.5	1.4	1.7	1.3	1.5
25–34	0.9	1.0	0.8	0.6	1.0	0.8
35–44	0.8	0.7	0.8	0.7	0.8	0.9
45–54	0.6	0.7	0.6	0.6	0.8	0.8
55–65	0.5	1.2	0.6	0.3	0.6	0.4

Falls and Missteps

As was the case for injuries due to overexertions, injuries due to falls and missteps tended to be sustained largely by younger workers, of both genders, in all three time periods. Variations in IRs over time by gender and age category were also frequent, especially among female workers. Again, there was less discrepancy between the IR of younger assemblers (16–24) and those of other age groups, for both genders, in the final time period.

Contact Injuries

Contact injuries were over-represented among younger workers (16–24) of both genders in all time periods. Variations in IRs over time by age category were small.

DISCUSSION

Despite suspected age impairment problems, younger assemblers (16–24) were the ones for whom consistently high IRs were recorded, among both men and women, for virtually all injury types, and in all three time periods. IRs for older assemblers (55–65) were generally low (but not the lowest) for all accident types. These main findings are discussed below.

Lower IRs among Older Workers

As suggested by the findings of earlier studies in the automobile industry, the results of the current study point to the likely possession of compensatory ability on the part of older workers (aged 55–65) rather than to a deterioration in work capacity with age. This applies to the overall injury risk and to risks of more specific types of injuries.

It had been reasonable to expect that older workers might be subject to higher injury risks because of the nature of the tasks inherent to their jobs, and also because of the work conditions prevailing on assembly lines (Teiger 1989; Sailly and Volkoff 1990; Warr 1993; 1994). In addition, injuries resulting from falls or missteps and from overexertions have previously been found to be more frequent among older workers (Oleske et al. 1989; Laflamme et al. 1993; Cloutier 1994). In the case of the current study, however, it was only on rare occasions and during particular — and varying — time periods that there was an IR greater than 1.0 for older workers for these types of injuries.

But, this scant evidence for age-impairment being involved in accidents and injuries may have at least two explanations other than that of the possession of compensatory capacities by older workers. First, in the occupation, risk exposure between age categories might be unequal and favor older workers. Second, the assemblers, male or female, who remain in the work force after the age of 55 (maybe even 45) may constitute a select group of healthier and more skilled workers than the many who have left the occupation (the so-called "healthy worker effect"). In this event, assemblers remaining in the occupation might be less injury prone than "expected" because of their high levels of skill and health.

Higher IRs among Younger Workers

The finding that IRs are higher among younger workers is not new. But it is doubtful that age alone accounts for this result. Indeed, as hinted at above, one possible explanation for the phenomenon lies in inequality of risk exposure between age categories, which may tend to penalize younger

workers. More precisely, the age difference in IRs might be the result of two factors: a physical and technical work environment that is genuinely more hazardous for younger workers and/or a lack of "relevant experience" on their part when confronted by new and unfamiliar assignments (Warr 1993, 1994). The proposition that younger workers are more exposed than others to strenuous work loads and to greater injury hazards finds some support in the sharp reductions in IRs generally found for the injury types among workers above the age of 24.

Limitations of the Study

A major limitation of this study lies in a lack of information on the work load to which assemblers of both genders in the different age groups were exposed during each time period. Analysis of such data was beyond the scope of the study, but it would be interesting to pay attention to this issue in future investigations. Direct-observation data would help to illuminate the job content and working methods of male and female workers in different age groups (for an example, see Cloutier 1994) and might contribute to explaining findings of the kind obtained in this study.

A further important drawback lies in the impossibility of making within age group comparisons with regard to accident experience, which leaves only an "average" picture available. It has been suggested, however, that variability among individuals in job performance, and therefore possibly in injury risk, increases with age (Rabbit 1991; Warr 1993, 1994).

In addition, it is possible that a more detailed characterization of the circumstances under which the accidents occurred would have helped to highlight age-related differences and age-impairment situations that may have been missed by this study. The "main event" is an interesting variable by means of which to differentiate various contexts in which injuries occur but, used alone, it might disguise significant differences (by aggregating them) rather than bring them to light. For instance, the task performed by the injured worker, the site of occurrence of the accident, and some characteristics of the injury itself (such as part of the body injured) can be used to identify multidimensional accident types. In combination with the identification of age differences, a more refined classification of injury types (based, say, on consideration of other variables in the ISA) would facilitate the development of preventive means and measures (for an example, see Laflamme et al. 1993).

Finally, the data, by their very nature, are silent with regard to the impact of differential propensity to report injury on measures of injury severity. While inequality across age strata in injury declaration may be likely, it is improbable that such a bias would significantly have affected the current

results. Naturally, IRs would be affected by a lower propensity to declare injury on the part of either younger or older workers. Nevertheless, the differences observed are sufficiently great for the current pattern to remain regardless of differential reporting. The issue of age-related differences in injury severity itself has been the subject of considerable debate in the literature (for a review, see Laflamme and Menckel 1995), and contradictory results have been obtained. As for the population under study, results presented elsewhere, on the basis of median number of lost working days per injury (the most reliable measure in this context), offer little support for the idea that injury severity increases linearly with age, be it in the case of all injuries aggregated or of injuries disaggregated by either type or gender (Laflamme et al. 1996).

CONCLUSION

The current study does not reveal evidence pointing to the likelihood that age impairment leads to higher injury rates, either generally or for specific types of injuries, among male or female assembly workers. It is likely that age impairment is manifested, above all, by workers leaving the occupation at a relatively early age. The study shows that young assembly workers of both genders are subject to relatively higher IRs than workers from other age group. Injury risk appears to be part of their overall "burden" of work. In this respect, male and female assemblers are quite similar, and the pattern is stable over time.

These results suggest that greater attention should be paid to the work conditions of young assembly workers and the injury risks to which they are exposed. At the same time, however, the availability of a relatively young work force should not blind us to the problems that the occupation might pose to older workers, particularly in the light of the aging of the work force and the substantial demands that the occupation imposes.

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RÉSUMÉ

Âge et lésions professionnelles chez les travailleurs masculins et féminins de l'assemblage : une étude dans l'industrie automobile suédoise

Cette étude tente d'apprécier dans quelle mesure il y a trace d'altération de la capacité de travail liée à l'âge, dans la fréquence relative des lésions du travail et dans leur type chez les travailleurs masculins et féminins de l'industrie automobile suédoise. Cette occupation a été retenue plus particulièrement à cause de deux caractéristiques associées à un appauvrissement de la capacité de travail et de la performance avec l'âge: le contrôle de la cadence est déterminé par la chaîne pour plusieurs tâches d'assemblage et l'organisation du travail est rigide.

Une étude rétrospective des lésions professionnelles subies par les assembleurs masculins et féminins de l'industrie automobile suédoise et s'échelonnant sur dix ans (1980–1990) a été menée, utilisant cinq catégories d'âges divisées en strates de dix ans et trois périodes de référence (1980–81, 1985–86, 1990–91). Des ratios de lésions (RL) par groupe d'âges ont été calculés tous types d'accident confondus et par type d'accident (efforts excessifs, chutes et trébuchades, lésions par contact). Pour une période donnée, un ratio de lésions (RL) pour un groupe d'âges donné est le rapport entre la proportion de lésions associées au groupe sur la proportion de travailleurs inclus dans le groupe. Un ration supérieur à 1.0 indique que le pourcentage de lésions est supérieur au pourcentage de travailleurs. Inversement, un ratio supérieur à 1.0 indique que la proportion d'accidents excède celle des travailleurs.

Les RLs pour les assembleurs les plus âgés (55 à 65 ans) se sont avérés généralement faibles (inférieurs à 1.0), sans toujours être les plus faibles, tous types d'accident confondus et pour chaque type d'accident. Chez les assembleurs les plus jeunes cependant, les RLs étaient tous élevés (supérieurs à 1.0), pour chaque type d'accident, chaque période et pour les travailleurs masculins tout autant que féminins.

L'étude n'offre aucun support à l'idée qu'il puisse y avoir trace d'altération de la capacité de travail liée à l'âge dans le risque relatif de lésion (tous types d'accident confondus et par type d'accident), tant chez les travailleurs masculins que féminins. L'inégalité d'exposition et la sortie précoce de l'emploi sont invoquées comme facteurs explicatifs de ces résultats. L'auteure soutient qu'il n'est cependant pas exclu que le vieillissement de cette population de travailleurs s'accompagne d'un changement quantitatif ou qualitatif du risque de lésion encouru par les assembleurs âgés, à plus ou moins brève échéance.