

# Musculoskeletal disorders in assembly jobs in the automotive industry with special reference to age management aspects

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## Abstract

Production planners in the automotive industry are already being confronted with the problem of steadily increasing age of workers performing assembly jobs which frequently involve highly repetitive, short-cycle operations, and this problem seems likely to become more acute in the future. Two diametrically opposed solutions are being used: (1) Older workers are phased out under early retirement schemes (before musculoskeletal problems arise), and preference is given to younger workers, in many cases on a temporary, subcontracted basis. (2) Ergonomic and medical danger points in assembly processes are identified and eliminated by modification of the work model, irrespective of whether older or younger workers are involved.

The results of a case study at 256 work stations on an assembly line for middle class cars manufactured by a globally active corporation are reported. The following interactions were noted: The age of the assembly workers influences the choice of workplace. Older workers are to be found mainly in jobs with a ‘very favourable’ expert rating, younger workers in jobs with ‘(very) unfavourable’ ratings. Accordingly, age and job strain are in this case *not* independent variables. Older workers still complain of lumbar spine symptoms despite low demands imposed by their present jobs. This seems to indicate long-term cumulative effects. A major aspect however is that the spine symptoms are often induced multifactorial and rely not or not alone on work conditions. Head–neck–shoulder symptoms occur more frequently in older workers working under unfavourable conditions. Symptoms affecting the head–neck–shoulder region, the lumbar spine and the upper limbs are co-variable with body height and body mass index.

For the collective study, it was appropriate to avoid potential impairment of physical performance more or less completely by allotting jobs causing less strain to older workers.

## Relevance to industry

The current study provides the results of a field study of assembly jobs in the automotive industry concerning the relationships between workload, age and musculoskeletal symptoms as well as diverse subjective measures (job satisfaction, etc.).

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## 1. Background and aim of study

### 1.1. Introduction

Assembly work in the automotive, engineering and electrical industries occupies a key position in the overall employment scene in the European Union (EU). Roughly,

one in every seven jobs in Central Europe is dependent, either directly or indirectly, on the motor vehicle manufacturing industry which, in its evolution from Henry Ford’s first assembly lines to complex modern-day work structures, reflects both the technical and the social evolution of the industrial world (Schröder and Gericke, 2001). Only in the rare cases it is possible to discern any kind of harmony between the tasks performed by workers, precautions to protect their health and safety, and opportunities for them to develop their personality.

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Changes in demographic patterns are also tending to steadily increase the age of the workforce.

Assembly processes occupy an important position in the automotive industry—not only in existing, but also in newly created job structures, and they are also significant items in the value-added chain and in R&D budgets. If older workers are employed in assembly, it is essential to make allowance for their typical performance profile and the risk factors to which they are exposed.

The last 10 years have seen an increase in the number of workers qualifying for disability pensions on grounds of musculoskeletal disorders, especially spinal disease and repetitive strain injuries (RSI) to the hand/arm/shoulder system (Landau, 2005; Landau et al., 1996; Schaub et al., 1997, 2000). This problem needs to be addressed, not only because of the micro- and macro-economic costs involved, but also because these diseases seriously affect quality of life.

Work safety and health protection have become extremely important following implementation of the EU Framework Directive (89/391/EEC) and the accompanying specific directives, which have significant effects on the legal position of employees and employers. The EU Machinery Directive (98/37/EEC) lays down basic safety requirements for design, construction, operation and ultimately, disposal of machinery. This means that prospective assessment and analysis of potential health risks are now obligatory during the planning phase of a work system (see also Winter et al., 1999; Landau, 1999). However, little has yet been done to analyse the effect of age on level and type of health risk to which assembly workers are exposed.

If there is no age management strategy this will usually result in one of two diametrically opposed scenarios (in analogy to the dualistic approach of McGregor, 1960).

#### 1.1.1. Scenario x

Older workers are phased out under early retirement or reduced working hour schemes (before musculoskeletal problems arise). Preference is given to younger workers, in many cases on a temporary, subcontracted basis.

#### 1.1.2. Scenario y

Ergonomic and medical danger points in assembly processes are identified and eliminated by modification of the work model, irrespective of whether older or younger workers are involved.

In this case, the company pursues a carefully orchestrated worker deployment policy, which recognises the special experience and skills of older workers and prepares them for change of a job where these can be properly exploited. Specific risk factors arising from awkward body postures, highly repetitive movements and manual materials handling are avoided in cases where cost/benefit considerations limit the options to corrective, rather than prospective job design. Older workers are transferred to

jobs where their experience and ‘social intelligence’ yield benefits.

A review of work forms and workloads currently prevailing in industrial assembly work in most cases points to an increase in monotonous insertion/removal tasks, monitoring and maintenance tasks, what frequently gives rise to vigilance problems. Unilateral dynamic work, often in unfavourable postures and/or static holding work is (even) more frequent (Fig. 1 and Landau et al., 1996; Landau and Rohmert, 1992; Aminoff et al., 1996). Strenuous physical work (in excess of the worker’s individual aerobic capacity in some cases) is still demanded in a considerable proportion of assembly jobs (Karlqvist et al., 2003; Landau and Rohmert, 1992).

The following report is a case study conducted at 256 work stations at the factory of a globally active corporation. The authors’ experience indicates that these work stations were broadly typical of those to be found in the assembly processes used in European car production, especially mass production of middle class cars (Landau et al., 1996, 2007; Schaub et al., 1999a, b, 2003). However, due caution should be exercised when making generalisations from the data obtained.

The aim of the evaluation presented in this report is to filter out possible predictors of job-induced strain and of workloads on the musculoskeletal system with particular reference to the role played by age.

## 1.2. Discussion of age-related symptoms and strain

Ergonomists have devoted much time and thought to the subject of the steady increase in average age of industrial workers and to older workers’ capabilities and skills and their relation to work in manufacturing industry. We have examined over 850 sources in the literature, which are analysed by Rademacher et al. (2006).



Fig. 1. Unfavourable body postures in preliminary assembly work.

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