

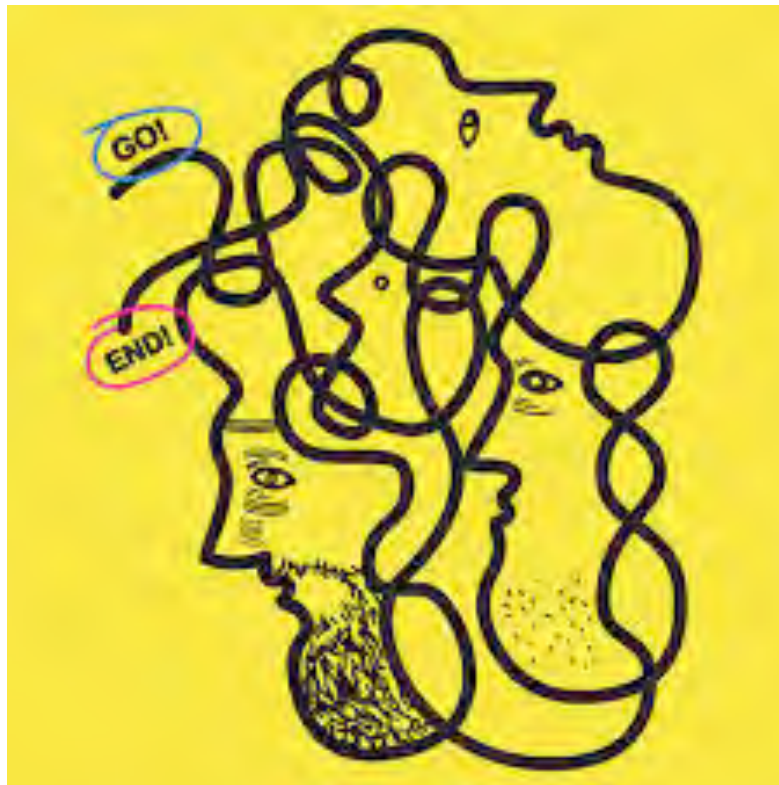


Consulta Interassociativa  
Italiana per la Prevenzione

Campagna 2016-2017: Ambienti di lavoro sani e sicuri ad ogni età



## Aging E-book **AGING AND WORK**



Edition- August 2018

- 1. AGING AND WORK: GENERAL CONSIDERATIONS**
- 2. MANAGING THE AGING HEALTHCARE WORKFORCE**



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## INTRODUCTION

### *What is CIIP?*

Italy, like many other European countries, is experiencing a rapid aging of its workforce. Such phenomenon is due to demographic and economic factors as well as to the increase in retirement age. The *partial* replacement of retiring workers by younger ones causes two main problems: on the one hand, employers ignore which tasks to assign to aged workers; on the other hand, the workload of younger workers increase significantly.

CIIP, i.e. the Italian Inter-Associative Prevention Council, involves professional and scientific societies whose members are either public or private occupational physicians, ergonomists or professionals in the field of occupational and environmental safety and health. These societies, according to their different functions and peculiarities, deal with ergonomic issues and approaches such as work organization, biomechanics, toxicology, also focusing on the relation between human beings, machines and the environment. CIIP set up a working group on the issue of "Aging and work" with the aim of analyzing the topic and proposing management methods for aging in workplace.

The CIIP Group actively promotes public meetings on the aging topic in the Italian territory.

In the present E-book we provided physio-pathological information about aging in the workplace, taking into account the multiple approach defined by Illmarinen and others and highlighting resources and critical aspects of contemporary Italian contexts. Inspired by an interesting proposal and checklist by French INRS (French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases) and by local researches and professionals of Clinica del Lavoro in Milan, the Group proposes risk assessment methods considering employees' age together with their physical, mental and organizational ergonomic tasks.

The Group underlines that workplace health promotion is necessary but not sufficient if a specific prevention plan to reduce risks is not implemented. It is therefore necessary to update the actual welfare support, allowing gradual retirement.

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Since 2014, the Working group has been very active in the organization of conferences, seminars and courses on the topic of aging in the workplace. All the reflections and studies which came with these initiatives allowed the publication of the first edition of this E-book.

Further material is available at [www.ciip-consulta.it](http://www.ciip-consulta.it) section "Gruppo invecchiamento e lavoro".

CIIP joined the European Campaign "Healthy workplaces for all ages" 2016-2017. See <https://healthy-workplaces.eu/> for further information on the topic of aging in the workplace.

#### **Aims of the Aging E-book**

Provide a synthesis of numerous studies and experiences, along with some proposals on the multiple approach towards aging, addressed to:

- Human Resource Department
- Employers
- Health and Safety managers and officers
- Workers' safety representatives
- Workers and trade unions
- Health and safety technicians
- Occupational physicians

And with the aim of contributing to the promotion of discussions and interventions.

# 1. AGING AND WORK: GENERAL CONSIDERATIONS

## 1.1 AN AGING WORLD

*Giovanni Costa*

We are presently witnessing a dramatic shift in the age demographics of the global community. In short, the 'baby boomer' generation that followed the end of the Second World War is now entering the 50 plus age bracket, making this one of the largest age cohorts. Adding to this is the fact that life expectancy has also increased in much of the developed world. Changing social and business needs means that this age group will not automatically embrace retirement. For financial and/or psychological reasons some people are now working well into their late 60s.

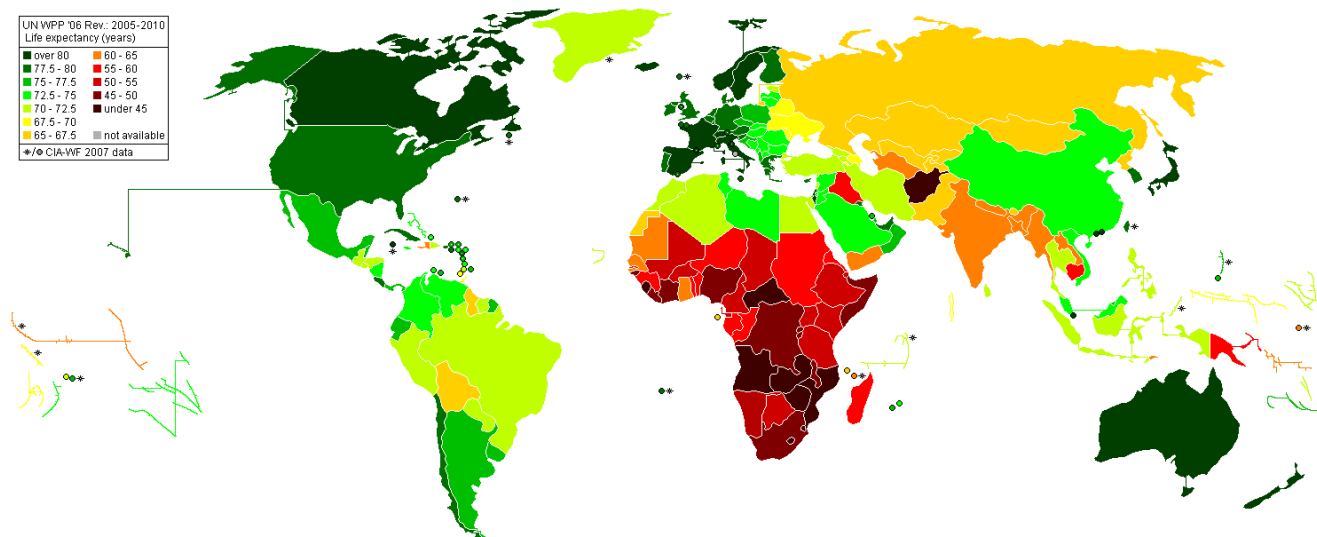
These trends have a number of implications for working time. What are the health implications of an aging workforce? How do we sustain good work ability into the latter years? What do we know about aging and shiftwork? What actions are required in the workplace to support aging workers?

This paper is not meant to be a comprehensive review of this area but aims at highlighting the complexities involved in understanding aging at work.

### Context

Today's world population is about 7 billion and is estimated to reach 9.2 billion people by 2050 (United Nations 2007). This growth will be driven in part by the general improvement of our living and working conditions during the last century, that has sharply increased our life expectancy. The global 'age pyramid' was earlier characterized by a broad base of younger people, with elder people at the peak. This pyramid is in transition as a general trend towards decreased birth rates and increasing life (and healthy life) expectancy is far more evident in the industrialized and post-industrialized countries. This pattern is also becoming clear in the developing countries, with large exceptions among African countries (Figure 1).

**Figure 1: Life expectancy at birth in 2012 (WHO)**



1	Monaco	89.57
2	Macau	84.48
3	Japan	84.46
4	Singapore	84.38
5	San Marino	83.18
6	Hong Kong	82.78
7	Andorra	82.65
8	Switzerland	82.39
9	Guernsey	82.39
10	Australia	82.07
11	Italy	82.03
12	Sweden	81.89
13	Liechtenstein	81.68
14	Canada	81.67
15	France	81.66

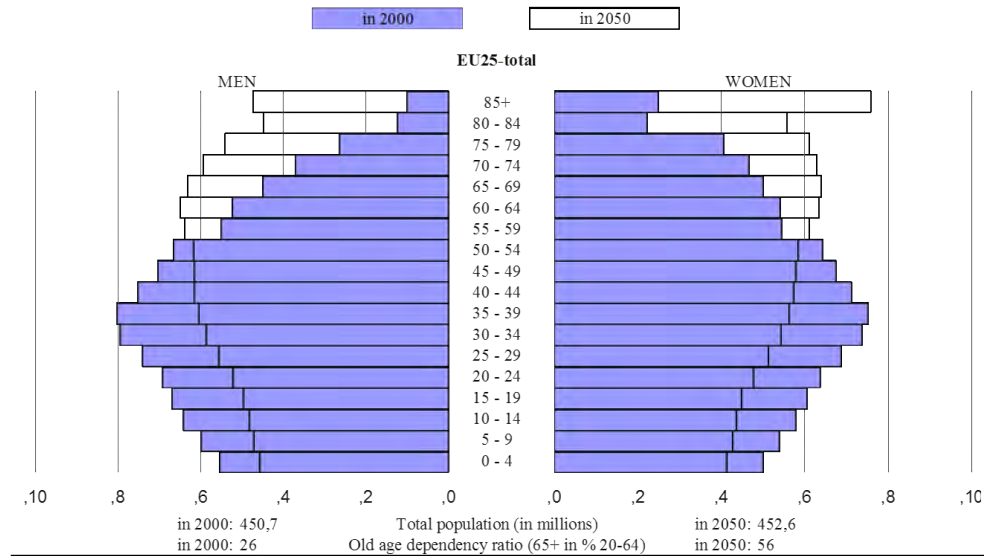
100	China	75.15
101	Serbia	75.02
102	Barbados	74.99
103	Oman	74.97
104	American Samoa	74.91
105	Solomon Islands	74.89
106	Saint Vincent and the Grenadines	74.86
107	Saudi Arabia	74.82
108	Romania	74.69
109	Gaza Strip	74.64
110	Malaysia	74.52
111	Venezuela	74.39
112	Bulgaria	74.33
113	Seychelles	74.25
114	Thailand	74.18

209	Uganda	54.46
210	Botswana	54.06
211	Lesotho	52.65
212	Nigeria	52.62
213	Mozambique	52.60
214	Gabon	52.06
215	Namibia	51.85
216	Zambia	51.83
217	Somalia	51.58
218	Central African Republic	51.35
219	Swaziland	50.54
220	Afghanistan	50.49
221	Guinea-Bissau	49.87
222	South Africa	49.56
223	Chad	49.44

In Europe, projections show a marked increase for older age by 2050. As a marker of this growth, the old age dependency ratio (ratio between people over 65 and those aged 20-64) will increase from 26% to 56% (Figure 2).

**Figure 2: Population by age group and gender, in 2000 and 20150, in percentage of total population in each age group, in Europe**

(Source: OECD Demographic and Labour Force database, used in PECD (2007), Society at a Glance: OECD Social Indicators 2006).



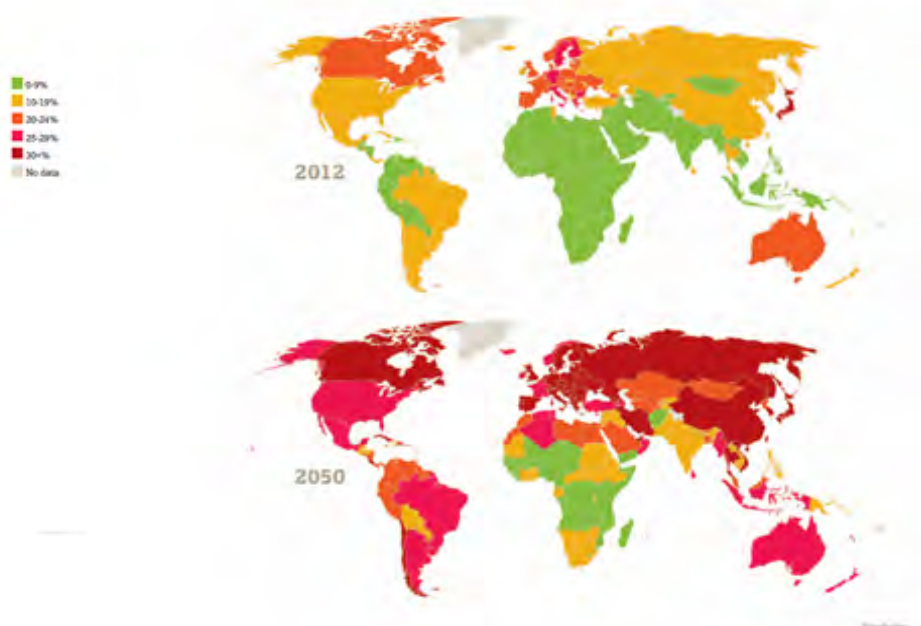
A similar trend can be found in Australia (21% to 48 %) and the USA (21% to 39%). This ratio is even more dramatic in Japan where the projected increase is from 28% to 72%.

The aging population is not restricted to developed countries. Mexico currently shows a classical age pyramid, yet its old age dependency ratio is predicted to increase from 9% to 35% by 2050.

This same pattern holds for Brazil, India and China. However, the exception, appears to be most of the African countries, where age distribution is estimated to remain similar (Figure 3).

**Figure 3: proportion of population aged 60-plus in 2012 and 2050**

(Source: UNDESA Population Division, Population Aging and Development, 2012, Wall Chart, 2012)



## 1.2 AGING OF THE WORKFORCE, RETIREMENT AND HEALTH

Angelo d'Errico

Over the next few years many European countries, including Italy, are projected to experience a rapid aging of their population.

Such a phenomenon is due to two major factors: one the one hand, an increase in life expectancy (OECD, 2011), reaching 79.5 years for men and 84.9 for women (CIA World Factbook, 2015) in Italy; on the other, a low fertility rate (Aggarwal et al., 2013) calculated at 1.1 children per woman.

From 2010 to 2030, the ratio between the working-age population (aged between 20 and 65 years) and those over the age of 65 will increase from 29% to 39%, hindering the sustainability of the Italian pension system.

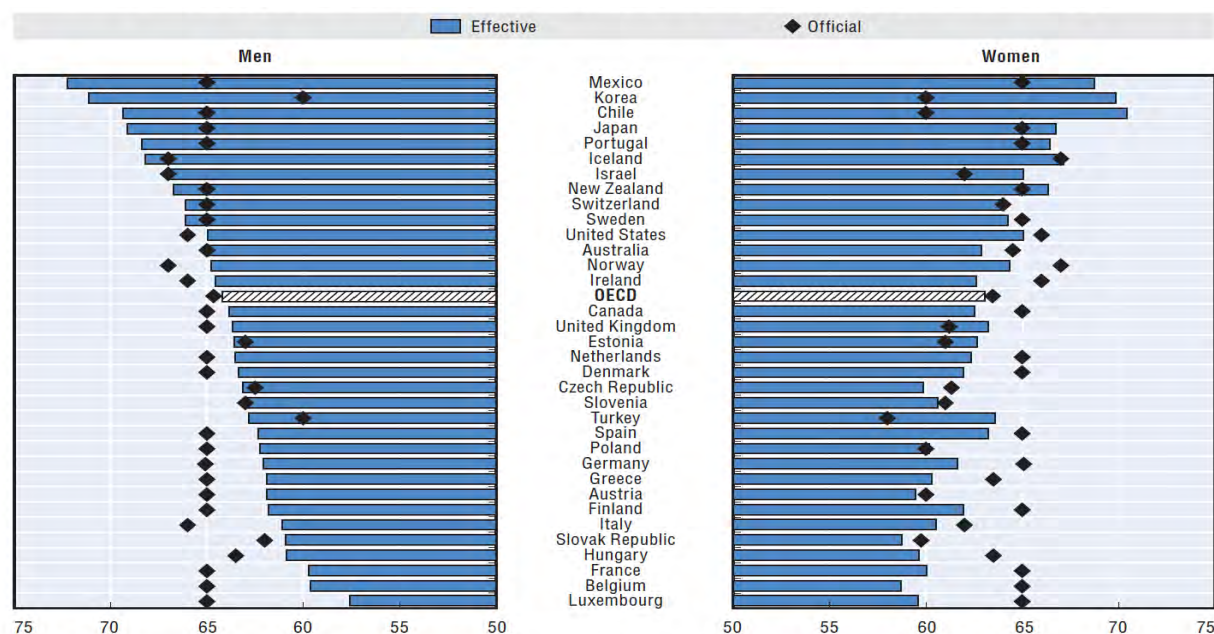
Population aging has led many European governments to reform public pensions, raising the retirement age<sup>1</sup> (Jagger et al., 2008) in order to keep a greater number of older employees in the workforce.

Over the past twenty years, retirement age has increased from 60 to 65, up to 67 in most European countries (OECD, 2013).

In 2001, more than 50% of those defined as older European workers (over the age of 50 or 55, according to different definitions), were either retired or unemployed; moreover, although significant differences among countries have been reported, retirement age was lower among poorly educated workers and manual workers (OECD, 2003).

Ten years later, upon the implementation of pension reforms, the European situation has changed and most countries have either tightened or discouraged access to early retirement schemes (OECD, 2013) (Figure 4).

**Figure 4: Average effective age of labour market exit and normal retirement age**



Note: Effective retirement age shown is for five year period 2007-12. Pensionable age is shown for 2012.

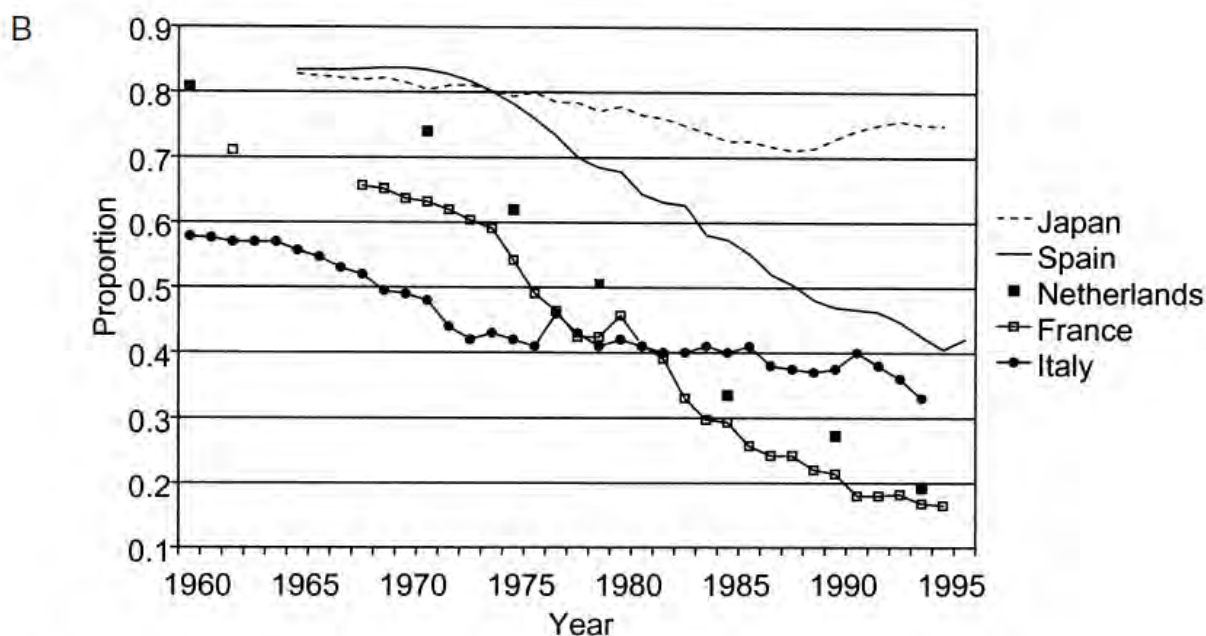
Source: OECD estimates based on the results of national labour force surveys and the European Union Labour Force Survey.

StatLink <http://dx.doi.org/10.1787/888932907186>

<sup>1</sup> Age at which workers are entitled to receive full benefits from retirement plans with no reduction due to early

In the mid '90s, before the implementation of Dini's and Amato's pension reforms, Italy presented a limited number of older workers, especially over the age of 60, with few women and less than 20% of men. (Gruber & Wise, 2007, Figure 5).

**Figure 5: Proportion of working men aged between 60 and 64 years (Gruber & Wise, 2007).**



The abovementioned reforms raised the retirement age to 65 for men and 60 for women; however, a lower contribution period needed to receive a full pension (37 years since 1995) along with waves of early retirement in the second half of the '90-s prevented the majority of employees from working past the age of 60. By raising the retirement age to 67, or alternatively requiring 42 years of contributions in order to retire, Fornero reform led to a new increase of the effective age at which workers retire from work (OECD, 2013).

The sixth report by the European Foundation (2015) cites that the percentage of workers over the age of 50 in the EU27 increased by 10% in ten years (from 24% to 35%):

<https://www.eurofound.europa.eu>

It is worth mentioning that the extension of working life particularly concerned less educated workers.

Among all workers, those were the ones who felt the greatest impact of late retirement on their health. This is due to older workers' greater susceptibility to the health effects of exposure to occupational hazards, also because of their worse health conditions.

A study revealed that one third of the Dutch workforce over the age of 45 reported at least one chronic disease (Koolhaas et al., 2012). The SHARE data (Survey of Health, Aging and Retirement in Europe) showed that more than 30% of European workers aged between 50 and 64 years had at least one mobility limitation (either an upper extremity limitation or a limitation in the execution of fine movements), and suffered from two or more chronic diseases (OECD, 2014).

Furthermore, although work ability decreases with age, work demands do not change considerably, often leading to an unbalance between functional capacity and the level of work demands among older workers.

Overall, most companies will not have sufficient financial resources in order to adapt work conditions to a significant number of workers with functional limitations or serious chronic diseases.

As a consequence, such employees risk both unemployment and disability retirement. In order to achieve sustainable employment, work demands must be adapted according to both health status and work ability of each worker.

Data on the level of exposure to occupational hazards by age group from Eurofound's fifth survey<sup>2</sup> (2012) showed that occupational exposure does not change significantly among workers of both genders over the age of 50-60 (Table 1).

As far as ergonomic factors are concerned, among workers over the age of 60, compared to those aged between 56 and 60 years, a slight decrease of the proportion of subjects of both genders exposed to painful and tiring postures, upper limbs repetitive movements and manual handling of loads was observed; on the other hand, an increase of the proportion of individuals who stand in an upright position for long periods of time and those involved in manual handling of people was noted (the latter case applied to women only).

With respect to psychosocial factors, further observations have been made: firstly, a 10-15% decrease of subjects exposed to high quantitative work demands; secondly, a similar increase in workers' control dimension in the workplace (decisional authority and use of skills).

Moreover, although emotional and cognitive demands do not change among men, they slightly decrease among women.

Overall, average working hours per week decrease slightly, remaining longer among men (average 38.1 hours/week).

In view of the subtle changes in the exposure to occupational risk factors among workers over the age of 60, the question is – would a decrease in the expected work ability allow these workers to keep performing their job?

It is worth mentioning that older workers' decline in work ability presents individual variability due to the manifestation of chronic diseases and functional limitations potentially related to them.

In order to answer this question, it would be necessary to estimate the number of older workers with reduced work ability or suffering from serious chronic diseases potentially causing its decrease.

**Table 1: Proportion of workers exposed to physical hazards for at least half of the working shift, and means of exposure to psychosocial factors at work, by age class and gender.**

(Source Eurofound Survey, 2010)

	Awkward postures	Repetitive movements (upper limb)	Manual material handling	Persons handling	Standing	Quantitative demand	Emotional demand	Cognitive demand	Skill discretion	Decision authority	Working hours (weekly)
<b>Men</b>	(%)	(%)	(%)	(%)	(%)	mean	mean	mean	mean	mean	mean
<b>21-40 yrs</b>	36.5	55.5	28.0	4.1	62.8	34.9	48.0	38.7	65.0	59.8	43.0
<b>41-50 yrs</b>	36.6	54.3	27	3.5	57.6	31.9	51	39.5	66.9	63.1	43.5
<b>51-55 yrs</b>	37.2	52.2	23.9	2.9	59.7	31.1	53.2	38.4	65.2	61.5	42.5
<b>56-60 yrs</b>	32.7	48.9	22.8	1.9	55.3	29.5	52.1	37.5	65.6	64.7	41.4
<b>61-65 yrs</b>	29.1	47.2	19.3	3.7	58	25.7	52.8	37.7	68.8	70.1	38.1
<b>Women</b>	(%)	(%)	(%)	(%)	(%)	mean	mean	mean	mean	mean	mean
<b>21-40 yrs</b>	30.2	52.1	11.9	8.4	54.9	30.1	53.9	30.2	63.2	56.7	35.7
<b>41-50 yrs</b>	35.2	54.8	13.7	10.8	55	30	58.5	31.1	65	60.8	35.6
<b>51-55 yrs</b>	35.5	55.5	12.7	9.4	53.3	28.9	58.9	31.5	62.9	60.1	35.7
<b>56-60 yrs</b>	33.2	49.3	12.4	8.8	53.6	27.1	60	29	63.6	60.8	33.9
<b>61-65 yrs</b>	29	52.2	10.3	8.6	57	23.4	58.2	24.6	63.7	66.9	31.5

<sup>2</sup> One of the few extensive surveys available providing fair estimates on the level of exposure by age group

Data on older workers' health status are limited due to the low number of workers who, until few years ago, continued to work past the age of 55-60 in western countries.

Many studies showed that the prevalence of numerous diseases or disorders among workers over the age of 60 is lower than the one observed among younger workers. Such figures can be explained with the so called "healthy worker effect" which affects older workers and allows them to be healthier than those who retire.

In order to solve this problem, data from the Multipurpose Survey on Health carried out by Istat in 2003 have been used to estimate the proportion of older workers with chronic diseases and functional limitations among the general population who had been employed at least once in the past. Considering that the average retirement age in Italy is 61, an attempt was made in order to estimate the proportion of subjects among the age of 62-67 suffering from serious health problems, namely those who are expected to continue to work according to Fornero reform.

The national Health Survey carried out in 2013, with more than 120,000 individuals included, provides information about 24 chronic diseases, different types of functional limitations and disabilities (physical, sensory, mental, etc.).

Among such diseases, only some have been selected- the ones able to cause a decrease in work ability, considering only those diagnosed by a physician and, in order to focus on those characterized by higher severity, selecting in some cases only those involving drug consumption:

- Coronary artery disease: previous myocardial Infarction, or angina pectoris involving drug consumption
- Previous stroke
- Other cardiac diseases, involving drug consumption
- Malignant tumors
- Parkinson's disease
- Liver Chirrosis
- Kidney/renal failure
- Chronic bronchitis and emphysema, involving drug consumption
- Serious chronic anxiety, involving drug consumption
- Depression, involving drug consumption
- Arthrosis, involving drug consumption

The prevalence of subjects suffering from the abovementioned diseases has been estimated also stratifying subjects by occupational social class, categorizing subjects into 4 classes (entrepreneurs and directors; managers and employees; independent workers; labourers, apprentices and members of cooperatives). Working subjects have been classified according to their current position, while retired and inactive subjects according to the occupation they had in their last job.

Subjects with either blindness or deaf-mutism disability, mobility problems, mental insufficiency or diseases, along with those who declared to be permanently unable to work have been excluded from the analysis. This exclusion was based on the consideration that these subjects were affected by health problems so severe that prevented them from being touched by the reform, but enabled them to retire early, namely at the age of 60 for men and 50 for women in compliance with Legislative Decree n. 503/1992.

Table 2 shows the prevalence of the abovementioned diseases among subjects aged between 62 and 67 years, considering either all occupational classes or manual workers only, by gender.

**Table 2. Prevalence of chronic disease in those aged 62-67 employed, inactive or retired in the past**

pathology	% total men	% men workers	% total women	% women workers
coronary heart disease	7.0	5.5	1.7	2.0
brain stroke	6.4	6.3	4.7	5.0
other heart diseases	1.8	1.5	0.9	0.8
malignant tumors	3.2	2.4	3.7	2.6
parkinson's disease	0.3	0.5	0.2	0.2
cirrhosis of the liver	0.4	0.7	0.3	0.2
kidney failure	1.8	2.0	1.2	2.2
chronic bronchitis and emphysema	3.7	4.5	3.5	4.0
AT LEAST ONE PHISICAL PATHOLOGY (arthrosis excluded)	20.2	19.6	13.8	13.9
severe chronic anxiety	1.7	1.9	5.3	6.6
severe chronic anxiety (in therapy)	0.9	0.9	3.4	3.6
depression	2.7	3.1	6.6	7.8
depression (in therapy)	1.6	1.7	4.8	5.1
AT LEAST ONE PHISICAL PATHOLOGY (arthrosis excluded) + MENTAL	24.0	23.5	21.1	22.1
AT LEAST ONE PHISICAL PATHOLOGY (arthrosis excluded) + MENTAL in therapy	21.4	20.5	17.9	17.6
arthrosis	11.4	11.9	25.9	31.2
AT LEAST ONE PHISICAL PATHOLOGY (including arthrosis) + MENTAL	32.0	32.1	38.8	43.1
AT LEAST ONE PHISICAL PATHOLOGY (including arthrosis) + MENTAL in therapy	29.3	28.6	36.3	39.9
bad health (bad or very bad)	8.2	9.4	10.1	14.5
severe functional limitations	6.9	7.3	6.7	9.2
functional limitations	33.2	35.8	35.0	40.8

Among all diseases, osteoarthritis was the most common, with high percentages among men (26%) and women (31%) labour workers. Unfortunately, such generic information prevents from identifying specific musculoskeletal diseases or assessing their severity. As a side note, it has to be said that in the space of this article, the definition of arthrosis has been limited to subjects who have used pharmaceuticals in the past 12 months in order to cope with the disease. Nevertheless, observed prevalence estimates are coherent with the results of other studies on general older population carried out in Italy and other countries. For instance, a recent English study estimated that one fifth of the subjects aged between 60 and 64 years had disabling osteoarthritis in one of the four joint regions (hand, hip, knee or foot) (Thomas et al., 2014). First of all, it is known that musculoskeletal diseases are more common among older subjects over the age of 50-55 (Sim et al., 2006; Plouvier et al., 2011); secondly, the most affected anatomic regions are the lumbar spine and the upper limb, followed by the knee and the hip (Punnet & Wegman, 2004).

As far as the lumbar spine is concerned, a French study showed that 20% of the subjects of both genders among the age of 55 and 64 years experienced low back pain for at least 30 days in the past 12 months and more than 10% dealt with chronic low back pain<sup>3</sup> (Gourmelen et al., 2007).

A Portuguese study estimated that the prevalence of chronic low back pain among subjects aged between 56 and 65 years was 14% (9.4% women, 18.1% men), half of whom reported chronic mobility limitations (Gouveia et al., 2016). An Italian study carried out in Marche region showed a

<sup>3</sup> Any persistent or intermittent low back pain that lasts for more than three months

30% prevalence of low back pain among subjects aged between 45 and 64 years. No distinction based on the severity of symptoms was provided (Salaffi et al., 2005).

With regards to upper limb disorders, a Swedish study on the general population pointed out that 21% of the subjects aged between 55 and 64 years reported chronic upper extremity pain associated with physical impairment, with two third of cases found among women (Gummeson et al., 2003). The shoulder and the proximal part of the upper limb was the most common painful area (being reported by 21% of men and 27% of women), followed by elbow/forearm (9% of men and 16% of women) and wrist/hand (6% of men and 23% of women) areas.

As far as lower limbs musculoskeletal disorders are concerned, a Spanish study estimated that 18% of men and 37% of women among the population aged between 60 and 69 years suffered from osteoarthritis associated with knee pain and about 30% of them reported high difficulty or inability to climb up five steps or to reach up objects from the floor (Fernandez-Lopez et al., 2008). In France, the prevalence of knee osteoarthritis among the general population upon clinical examination resulted in 8% among subjects aged between 50 and 59 years and 12% among those aged between 60 and 75 years; the correspondent figures for subjects suffering from hip osteoarthritis was 6% and 5% respectively. Moreover, a Finnish questionnaire survey conducted among employees of the City of Helsinki pointed out that 31% of men and 36% of women over the age of 60 suffered from chronic pain; the corresponding figures for disabling chronic pain were 6% for men and 11% for women (Sastaamoinen et al., 2005).

Given the increased prevalence of chronic morbidity among older workers, a greater number of subjects with reduced work ability is expected. On the basis of prevalence estimates of chronic diseases and functional disorders observed in the Italian population aged between 62 and 67 years, approximately 25-30% of men and 35-40% of women are expected to report reduced work ability because of functional mobility limitations, serious mental disorders or pathological alterations due to systemic diseases. Such estimates are coherent with those reported by different authors in other European countries.

For instance, a study carried out on a sample of the Finnish working population showed that 26% of workers aged between 50 and 64 years had reduced physical work ability while 20% reduced mental work ability (Miranda et al., 2010).

Studies on the differences among workers either suffering or not from chronic diseases show that subjects suffering from a chronic disease face more difficulties in performing their own job activities, require more support from supervisors and colleagues; they also manifest lower levels of "work ability" (Koolhas et al., 2012), a concept introduced at the end of the '80s by the FIOH (Finnish Institute of Occupational Health) in order to identify workers at risk of work unbalance due to work demands, personal resources and perceived health (Ilmarinen & Tuomi, 1993). Different studies demonstrated that work ability, measured by the Work Ability Index, is negatively influenced by age, high levels of physical and psychosocial demands, unhealthy lifestyles and poor fitness levels (Ilmarinen et al., 1997; Tuomi et al., 1997; Van den Berg et al., 2009).

The WAI questionnaire covers the following seven dimensions of self-reported work ability:

- 1) subjective estimation of current work ability compared with lifetime best
- 2) subjective work ability in relation to both physical and mental work demands
- 3) number of diagnosed diseases
- 4) subjective estimation of work impairment due to diseases
- 5) sickness absenteeism during the past year
- 6) own prognosis of work ability after 2 years
- 7) psychological resources (enjoyment of daily tasks, activity and life spirit, optimism about the future)

A number of authors reported strong associations between workers' perceived health and their level of work ability. For instance, a Dutch study estimated that the presence of chronic diseases, perceived health and the exposure to psychosocial factors in the workplace could explain 40% of the changes in work ability among workers employed in different manufacturing sectors (Koochlaas et al., 2014). Another study conducted on a sample of Norwegian women, showed that 8.9% of them had very reduced work ability; levels increased to 57% among women reporting either physical or mental health problems (Gamperiene et al., 2008).

Low levels of work ability among workers suffering from chronic diseases are shown by other studies as well (Sorensen et al., 2008; Ahlstrom et al., 2010). In the abovementioned study, the proportion of workers with very reduced work ability ([Click the LINK here](#)) increased with age, reaching the highest peak among the age of 40-49 (16.4%), then dropping to 9.7% among the age of 50-67, probably due to the "healthy worker effect" previously mentioned, which allows healthier subjects to continue to work in unfavourable work conditions.

However, a decrease in work ability is more likely caused by chronic conditions rather than by age itself – the latter, in fact, could only explain less than 10% of the decrease in WAI's score along people's working life (Goedhard & Goedhard 2005).

Furthermore, the socioeconomic position among the workforce with reduced work ability has been investigated: results showed that blue collar employees presented a higher prevalence of reduced work ability than white collar ones, especially high grades ones (Aittomaki et al., 2003).

The possibility that the recent increase of retirement age may force subjects with reduced work ability to continue to work is worrying; especially if considering that they might become a large part of all workers over the age of 60.

#### KEY POINTS

- Upon the implementation of pension reforms in Italy and Europe over the last few years, the absolute number and percentage of aged workers (over the age of 55) have increased.
- Overall, although work ability decreases with age, especially due to musculoskeletal, mental and cardiovascular diseases, work demands do not change considerably.
- Possible unbalance between functional capacity and level of work demands among aged workers.
- Data from Multipurpose Survey on Health carried out by Istat in 2003 were coherent with those of many other European studies, showing that one third of the subjects aged between 62 and 67 years (those majorly touched by Fornero reform) reported functional limitations and at least one physical or mental disease.
- The decrease in work ability due to such limitations and diseases prevents subjects from performing numerous work activities – especially if manual and involving exposure to ergonomic factors.
- Most companies will not have sufficient financial resources in order to adapt work conditions to a significant number of workers with functional limitations or severe diseases.
- A decrease in productivity and higher rates of sick leaves for workers with limitations will follow, possibly leading to unemployment and/or early retirement.
- The above mentioned social costs should be taken into account while assessing the cost-benefit model associated to the increase of retirement age.

### 1.3 PHYSIOLOGY OF AGING AND WORK

*Rinaldo Gherzi*

The scientific literature reports various definition of aging, such as: “gradual biological process that involves numerous changes for the organism such as a gradual and constant decrease in environmental adaptability, reduced functional reserves of the organs and system and, as a consequence, reduced abilities to survive as well as higher possibilities to either die or experience an increase in frailty”. (G. Ricci, 2013)

Human aging is strongly associated with inseparable bio-psycho-social aspects. For this reason, the approach towards aging management in the workplace cannot be solely and exclusively biomedical; on the contrary, it involves numerous healthcare professionals, business management, individual behaviors and social policies.

Many questions about the biology of aging are still open. Among the most common lines of thought on the subject, we highlight the evolutionary-fatalistic theory and the autopoietic theory: the first one favoring the survival of those who are more fertile and the second one, supported by biotechnological approaches (Cremonesini V., 2013), suggesting an indefinite survival that is tangibly reduced by chance and external threats.

Although biological validations and common sense are in support of the first theory, the autopoietic perspective is nowadays more widespread (Ferrara N. 2005; Laurence D. et al., 2011)

At a practical level, it is fundamental to go beyond evolutionary and genetic predeterminations on life expectancy and work on other factors, avoiding or at least reducing the exposure to environmental risks.

Biology and medicine have identified some practical criteria and orientations in order for both retired and young people to age better.

Psychological and psychosocial approaches also provide interpretations on the correlation between aging, work and retirement with the aim of highlighting possible connections between individual conditions, different jobs and the approach to retirement and the following period.

Although society and governments tend to devote a higher degree of attention to active aging especially due to the problem of self-sufficiency, new problems on how to safeguard employment are arising for aging workers as well.

Biomedical and psychosocial perspectives provide some experiences and orientations that require an interdisciplinary approach in order to properly manage aging in the workplace.

We need to move further in this direction. This e-book aims at contributing towards a small professional step, broadening the discourse to other interlocutors with economic, law, politics and social backgrounds. How?

- By proceeding towards the effective construction of what the 2016-2017 European campaign called “healthy workplaces for all ages” fostering health promotion, subsidizing and control interventions.
- If such change is not entirely achievable, by managing the “different age groups” in the workplace, identifying suitable tasks and conditions for aged workers.
- By concretely and broadly assessing the problems of the elderly who are either partially able or unable to perform the same task they carried out before retirement.

OMS conventionally defines:

**Ageing** (UK /**aging** (USA) **workers** those over the age of 45

**Aged workers** those over the age of 55. Chronological age does not necessarily coincide with biological and social age.

## The aging process

The biological causes of aging are still largely obscure. Gerontology textbooks (Ferrara, 2005) usually present different theories, none of which provides a full story of the aging mechanism. Professionals generally agree on the complexity and multifactoriality of the aging process that often involves overlapping factors and different causes.

Biological experiments along with clinical observation of different species allowed the formulation of numerous theories such as evolutionary, genetic and gene-controlling, cell senescence, neuroendocrine and immune senescence theories.

Some of the crucial elements involved in the above-mentioned theories are:

- Nucleic acids (DNA, RNA)
- *P53* protein (also called “the guardian of the genome”)
- Mitochondria – producing the energy currency of the cell and regulating cellular metabolism
- Ribosomes- involved in protein synthesis
- Endocrine system- controlling insulin response
- Immune system- with its protective/pro-inflammatory role

Chronic inflammatory processes play a crucial role in these models as possible causes of promotion and progression of diseases (atherosclerosis, cancer, diabetes mellitus, bowel and central nervous system diseases) as well as of premature aging.

Health promotion campaigns aim at managing all aspects associated with the prevention of chronic inflammatory processes (and some kinds of cancer), such as abstinence from cigarette smoking and healthy eating. Weight control among the elderly decreases inflammatory processes caused by molecules in visceral and retroperitoneal adipose tissue.

Phenomena of premature aging of organs and functions are well documented in Occupational Health. Among the causes we highlight: carbon monoxide poisoning exposure to ionizing or ultraviolet radiations on the skin, carbon disulfide poisoning (causing arteriopathy), exposure to toxic industrial chemicals or airborne pollutants (leading to pulmonary fibrosis), acute or cumulative biomechanical overload (Barbe, 2006; HSE, 2010).

The interaction between external threats, individual factors and restorative mechanisms might cause premature aging and functional limitations among workers who perform either physical or mental stressful activities (e.g. vascular diseases among employees working inadequate shifts) (Manav V. et al., 2012)

Carbone et al. (2005) have found a lower prevalence of chronic degenerative diseases among young male office workers compared to male drivers, porters and manual workers, thus suggesting that the last group of tasks is arduous and might accelerate the aging process.

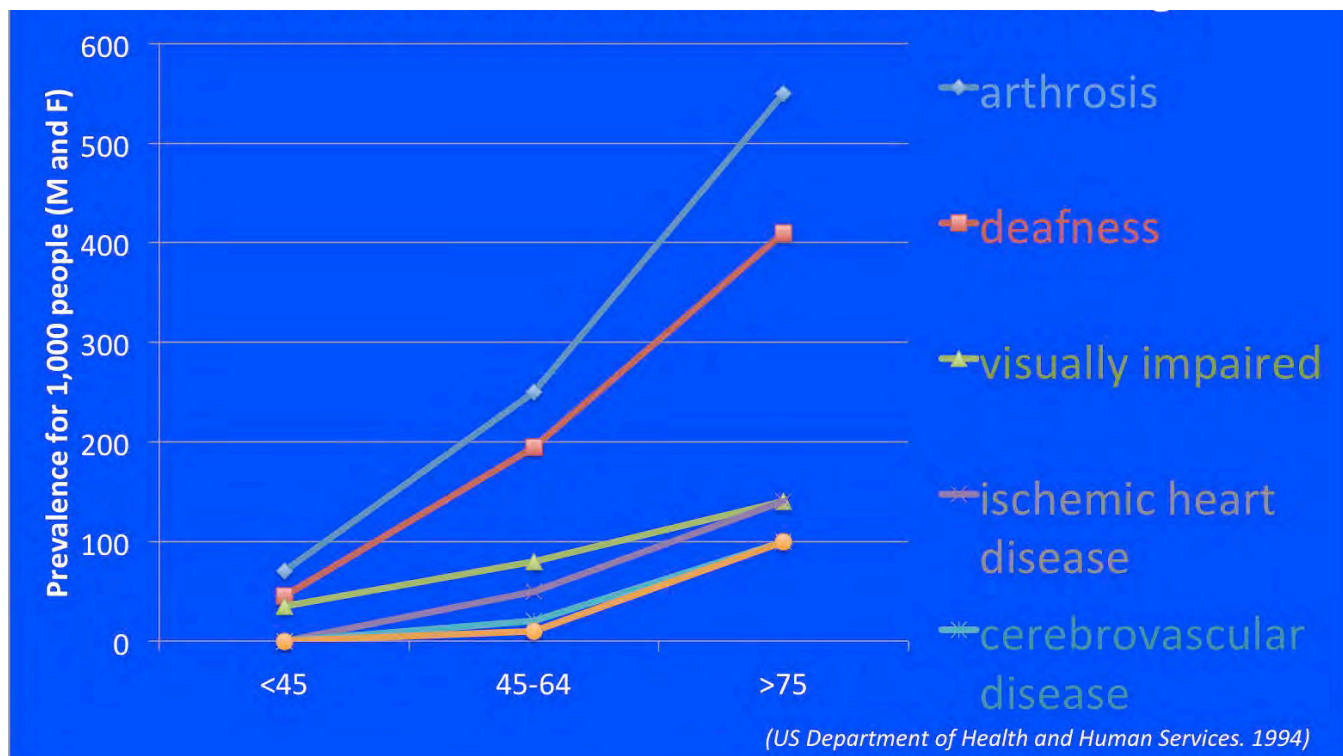
Although some workers can experience the so called “healthy worker effect” mentioned in chapter 1.1, it is generally true that functional limitations are more likely to increase with chronological age.

## Different types of aging

Three different types of aging have been identified in the biomedical field:

- Aging with one or more diseases: the one experienced by most elderly people, especially beyond retirement. As shown in previous chapters, an increased prevalence of some diseases is already reported during working life: the causes, however, can be multiple and not necessarily work-related. As a consequence, a higher number of aged workers equals a higher percentage of workers who suffer from such diseases (Scheme 1)

**Scheme 1: Prevalence of chronic conditions in relation to age**



- Biological aging: that experienced by most people with no serious diseases.
- “Successful” aging: that experience by those who do not suffer from any particular disease and whose physical and mental performances are, in old age, similar to those of younger people.

Other scholars make a distinction between **physiological aging** (senescence: age-related morphological and functional changes) and **pathological aging** (senility: age-related physical decline) (Wilson J. F. e Kiguchi E.L., 2011).

The concept of "**active aging**" has also been applied to work, not only to comply with economic obligations and/or choices about retirement age but also as a possible source of wellbeing.

Good working conditions are tolerated for a longer period of time and can have a positive impact on workers' health (leading to either "biological" or "successful" aging), especially if implemented from an early age.

Active aging among **aged workers with one or more diseases** should involve a balance between residual physical fitness and work demand. Such a change could radically improve working conditions and lead to a reasonable accommodation of UNO terminology on disability (SIVA, 2015). Activity limitations, role changes, training for other suitable jobs and redeployment are some of the measures that might be necessary.

We believe it is more appropriate to support this kind of approaches rather than promote the label "frail subject", which can cause unnecessary alarm and exclusion.

In this context, social security measures are fundamental for the survival and improvement of aging workers with major impediments or disabilities.

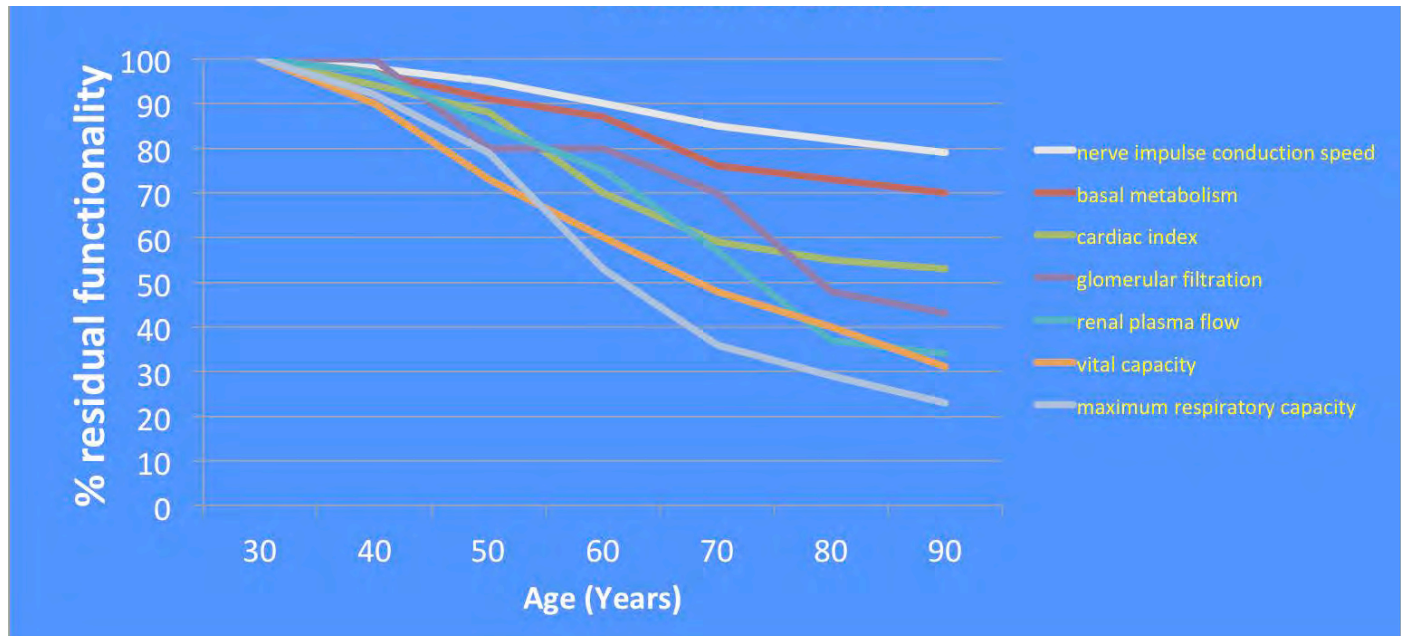
An increase in retirement age can lead to a lower percentage of employability, despite improving interventions.

## Aging and fitness for work

Three fundamental aspects must be highlighted:

- **The different involvement of organs and functions in the aging process:** for instance, the eye is affected sooner than the central nervous system (Scheme 2)

### Scheme 2: Effects of aging on some functional indices based on cross-sectional studies



- **Variability increases with age.** The consequences of this are important to either define limits by age group within the field of occupational hygiene or to tailor the assessment of fitness for work for people who are the same age and perform the same job.
  - In other words, guidelines of the so called “administrative medicine” on the limits of exposure of different age groups can only be indicative – the occupational physician must assess for each case working condition, motivating his decision to the worker and reporting it in the patient’s medical records. It is a delicate topic because sometimes occupational physicians might wrongly assess workers’ fitness for work, leading to workers’ unemployability and unjust exclusion, in contradiction with ICOH ethical code of Occupational Safety and Health Professionals.
- The association **between functional decline and work demands**, at the basis of the work ability concept. The value of the Work Ability Index depends on both individual conditions and the type of activity performed (SIVA, 2015)

Overall, aging inhibits protein synthesis, leading to muscle mass and strength loss, an increase in body fat, a decrease in bone mineral density and an impairment/alteration of the immune function.

Table 3 and the bibliography briefly illustrate the main functional modifications of physiological aging during working life.

The following chapters on risk assessment and health surveillance will analyze these aspects from different point of views, focusing on ways in which it is possible to improve working conditions and individual behaviors, as well as on how to implement further medical assessment for aged workers.

**Table 3: functional alterations by organ and function of physiological aging during working life"**

<b>ALTERATIONS of ORGANS OR FUNCTIONS</b>	<b>CAUSES OR DETAILS</b>
<b>VISUAL ABILITY</b>	
Reduced accommodation (focusing on close objects)	Stiffness of the crystalline lens and/or weakening of ciliary muscles
Early symptoms of macular degeneration	
Visual field defect (up to 20-30%)	
Reduced visual acuity	These disorders can increase with poor lighting, bright lights and very small character/objects
Reduced ability to differentiate between similar dark colors	
Increased light sensitivity	
<b>HEARING ABILITY</b>	
Reduced speech perception in noisy situations	Presbycusis which elicits high-frequency hearing loss
<b>MUSCULOSKELETAL SYSTEM</b>	
MUSCLE STRENGTH	Between 20 and 60 years of age we lose 15- 50% of our muscle strength Reduced fatigue resistance
MUSCLE-TENDON STRUCTURES	Reduced resilience
JOINTS	Gradual loss of functionality with consequent difficulty to work in extreme postures; after age 45 progressive increase of osteoarthritis
<b>CARDIOVASCULAR SYSTEM</b>	
	Reduced cardiac output and maximum heart rate during exertion
<b>RESPIRATORY SYSTEM</b>	
	Possible decline in lung functions (40%) from age 30 to 65
<b>THERMOREGULATION</b>	
	Increased susceptibility to thermohygro-metric stress
<b>NERVOUS SYSTEM</b>	
BALANCE	Increased difficulty in maintaining balance during exertion, in awkward postures, on slippery floors.
SLEEP DISORDERS	Reduced tolerance to night shifts
<b>COGNITIVE FUNCTIONS</b>	
REACTION TIMES	Longer reaction times Greater difficulty in processing information and developing inductive reasoning
MEMORY	Long-term memory, acquired knowledge and experience compensate for reduced cognitive functions, especially in old age. Reduced short-term memory and attention during difficult tasks, especially if new.
ATTENTION	Reduced tolerance to multitasking (performing complex tasks simultaneously: writing while talking on the phone) – our brain is not able to process two or more complex tasks simultaneously. Performing tasks consecutively, where possible, is more productive and safe. This is especially true for complex tasks that require concentration; it is not relevant for tasks performed automatically (e.g. driving and talking or listening to the radio). Reduced tolerance to noisy environments Greater difficulty in processing information and developing inductive reasoning

MENTAL FATIGUE	<p>In terms of mental functions and mental fatigue, we report an observation by P. Cenni (SIE) on technical norms of ISO 10075 “Ergonomic principles related to mental workload” and ISO 6385, “Ergonomics principles in the design of work systems”:</p> <p><i>“in ISO 10075 the term “mental” has been associated with work experiences and behavior that involve the following aspects:</i></p> <p style="padding-left: 40px;"><i>cognitive</i> <i>emotional</i> <i>social</i></p> <p><i>that are interdependent and, therefore, should never be considered separately”</i></p>
USE OF IT	<p>The spread of the so called “<b>Industry 4.0</b>” requires different resources and challenges for both aged workers and young ones.</p> <p>Those in charge of designing must devote particular attention to the interfaces between workers and the equipment that either help or replace human labor: artificial intelligence and cybernetic between different sources of information will partially compensate for individuals’ cognitive abilities. On the one hand, different methods, environments and working hours (e.g. telework) can benefit aged workers with mobility impediments; on the other, they can cause their isolation.</p> <p>Challenges involve a greater mental fatigue due to different factors: heavy workload, responsibility in setting and updating automatic production lines, intervention in case of inconvenient or accidents (problem solving) etc.</p>
TRAINING	<p>A proper training aimed at developing digital and IT literacy as well as an in-depth knowledge of the production cycle is fundamental.</p> <p>Aged workers, together with experts can definitely represent a resource, transferring skills and knowledge.</p>
TEMPI DI LAVORO	<p>Other critical aspects for aged workers are frequent changes to schedule or work location, along with new forms of conciliation between work and personal life (especially for traditional artisans who are often available 24/7).</p> <p>Innovations can be adopted in different ways, obtaining different results on the quality and quantity of products and on workers’ wellbeing.</p>
STRESS TOLERANCE	<p>The perception of work-related stress increases up to 50-55 years of age and then decreases (not always).</p> <p>Aged workers find it more difficult to adapt to changes and are more concerned about unstable working conditions.</p> <p>Taking care of children, aged or sick relatives can have a major impact on the stress perceived by women (but not only).</p>
<b>SUSCEPTIBILITY TO OTHER RISKS</b>	
<p>Cumulative effects and increased percutaneous absorption of toxic substances</p> <p>Threshold limit values and biological indicators of ACGIH U.S.A. are estimated for exposures “day after day, for 8 hours per day and 40 hours per week over a working lifetime”. The average working lifetime is 40 years (eg. ACGIH and NIOSH for noise exposure). Working lifetimes with longer exposures should be reduced.</p>	
Reduced tolerance to hyperbaric conditions	
Reduced tolerance to mechanical stress	

Table based on OMS 1993; Chan G.. 2000; Costa G. 2004 e 2015; Illmarinen J.2001, 2012; Malchaire G., 2006; Alpess F. et al. 2007; Cisme, 2012;

#### 1.4 A MULTIPLE APPROACH TOWARDS ACTIVE AGING IN THE WORKPLACE IN ITALY

Rinaldo Gherzi

The "Active ageing and solidarity among generations" European Campaign, carried out in 2012, suggested multiple measures, highlighting the following:

- changing attitudes towards aging
- introducing permanent update
- training managers on aging issues
- adapting work to age, making it more flexible
- adapting health services to the needs of an aging population. Laws against the discrimination of elderly people (hirings, layoffs) must be taken into consideration

Table 4 reports useful considerations to contextualize general criteria established by Nord European studies, considering Italian peculiarities.

Experiences of aging management in other countries have been cited in the bibliography.

**Table 4: Possible applications of the multiple approach towards aging management in the workplace in Italy (CIIP Working Group)**

STRENGTHS	CONDITIONS	WEAKNESSES
<b>ERGONOMICS AND OCCUPATIONAL HYGIENE</b>		
Legal and regulatory support Extensive documentation and range of manuals Health and productivity benefits for young and older people	Merge physical, mental and organizational ergonomics: cultural leap Investments in technological innovation	Spread still insufficient Lack of knowledge and experiences of work organization Costs/ benefits are not taken into account
<b>REVIEW OF SOCIAL SECURITY LEGISLATION</b>		
Universality Opportunity to make choices: voluntary phased retirement/ early retirement	Widening of regulations lists of hash jobs Modulation by sector or tasks taking into account life expectancy and work ability index	Financial restrictions and choices Legislative difficulties: penalties, rigidity and distortions
<b>PLACEMENT AND REINTEGRATION OF DISABLED PEOPLE WITH DISABILITIES</b>		
Regulatory support	Analysis and improvement of procedures Corporate collaboration	Limited labor market
<b>CARE FOR ILL AND DISABLED PEOPLE</b>		
Regulatory support Universality (diversified)	Adequacy and accuracy in allocating services and benefits Focus resources on people who cannot work due to health or poverty	Financial restrictions and choices
<b>HEALTH SURVEILLANCE, ASSESSMENT OF FITNESS FOR WORK AND POTENTIAL APPEAL TO THE MEDICAL BOARD</b>		
Regulatory support (age-sensitive risk assessment: <i>Safety and Health at Work Directive 89/391/EEC</i> ) Subjectivity Voluntary and adequate workplace health promotion (screenings, lifestyle)	Collaboration with occupational physicians in assessing risk taking into account age and individuals more exposed to risks Corporate collaboration Workers' knowledge Workers' involvement Occupational physicians' autonomy	Excess of medical aspects, Defensive medicine Bureaucracy Modulation of periodicity and level of supervisions Lack of compatible/adequate jobs Abuses or discrimination in workplace health promotion

CORPORATIVE MANAGEMENT OF AGING		
Regulatory support (age-sensitive risk assessment: <i>Safety and Health at Work Directive 89/391/EEC</i> ) Involvement and responsibility of corporations Individual solutions Safety and positive impact on maintenance/ development of productivity	Corporative culture Culture and instruments for valuers and consultants Participation of corporative figures (RSPP, MC, RLS, RSU, workers)	Complexity of risk assessment, that should be simplified without losing sensitivity Difficulty in shifts and voluntary part time Resistance to work organization changes Lack of compatible jobs Distortions
NORMS ON EXPOSURE LIMITS BY AGE GROUPS		
Universality Cogency	Adequacy Feasibility	Limited scientific support Reliability of risk assessment methods and contents Age discrimination Economic disadvantages (shift work allowances) Rigidity toward interindividual variability
NEGOTIATION		
Involvement and responsibility of social parts Maintenance/development of productivity	Corporate culture Welfare culture	Non universality Monetization risks

The working group expressed concern over the employability of aged workers, especially those suffering from diseases.

As far as our own reality is concerned, small companies tend to ignore the problem whereas bigger ones- either public or private- make little effort to find a solution.

The multiple approach is the best instrument to manage such a complex issue. We chose to concretely explore the topic by highlighting some general key points:

- social security aspects
- ergonomic approach
- age-sensitive risk assessment
- health promotion

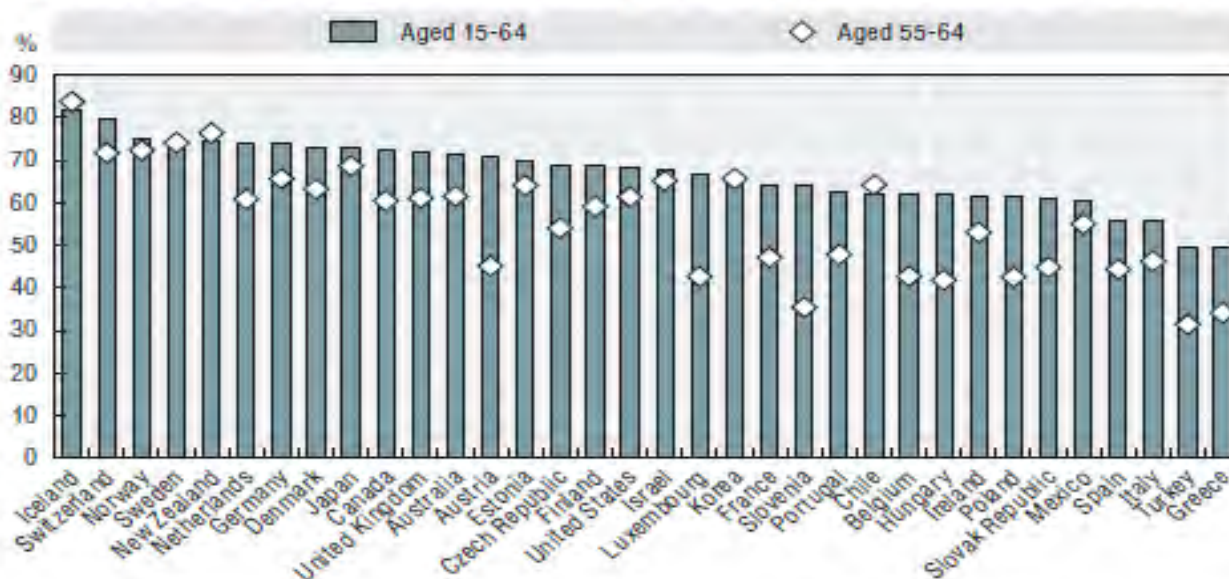
## 1.5 SOCIAL ASPECTS: TRENDS IN EMPLOYMENT AND RETIREMENT AGE

Giovanni Costa

Given that we expect a generally healthier population with a longer life expectancy, there is some evidence to suggest that some people will continue to work more years than in the past.

In the OECD countries some 80% of people aged 25-49 are employed compared with 60% of people aged 50-64. However, there are large differences among countries. More than 70% of people over 50 years work in Sweden, Iceland, New Zealand, Switzerland and Denmark, while less than 50% work in Hungary, Austria, Belgium, Italy, Poland and Turkey (Figure 6)

**Figure 6: Employment rates by age group, OECD (2015)**



Source: OECD (2015), Labour market statistics, Main Economic Indicators (database), <http://dx.doi.org/10.1787/data-00046-en>.

Employment figures in Europe are similar to the OECD. The employment rate of people aged 55-64 is about 43%, with a range from 28% (Poland) to 70% (Sweden). From 1997 to 2006, average employment of workers aged 55-64 years has progressively increased from 36% to 43% (Romans and Kotecka 2007).

In proportional terms, less than 5% of Europeans aged 60 plus are employed. This figure is estimated to increase significantly to about 7-10% over the next 30 years if the present legislations on retirement are maintained. Official retirement age varies from between 60 and 65 years among countries. However, a number of EU countries are increasing the retirement age and if this occurs, we expect this proportion to increase to some 15-25% (Romans 2007).

The changes to the legislation on employment and on statutory retirement age suggest an increasing number of people aged 60 plus will be active and willing to work into later life. This additional working time is driven by personal choices governed by better health, industry demand for their expertise and other economic constraints and political considerations.

In keeping these people healthy and working, we must find ways to maintain and promote good work ability (Ilmarinen 2001, Ilmarinen and Rantanen 1999). Good work ability results in a better quality of life, higher productivity and, consequently, a more satisfactory retirement period with lower social costs both for the individual and the society.

**KEY POINTS**

- Health and safety interventions in the workplace, ergonomics and organizational improvements can facilitate the prevention of work-related disorders and, where possible, the employment of people with limitations.
- The topics investigated in this article are not new; however, an aging workforce requires particular attention, adequate and tailored solutions in order to safeguard health, old age and work rights.
- The prevalence of numerous diseases increases with age. The most frequent are cardiovascular diseases (from Hypertension to ischemic heart disease), neoplasia, diabetes mellitus (commonly type 2 among adults or 2s (senile) among subjects over the age of 65), musculoskeletal or nervous disorders and diseases.
- The more people grow old in the workplace, the more they are subject to disorders, work-related or professional impediments and diseases.
- Scientific publications and guidelines on occupational health investigate and update procedures for prevention in the workplace, health surveillance and assessment of fitness for work.
- Theory and practice of the multiple approach towards aging management in the workplace, defined by Ilmarinen et al. (2001), are the most exhaustive resources available to assess such a complex and multifactorial issue.

## 1.6 WHEN WILL PEOPLE BE ABLE TO RETIRE?

Rinaldo Gherzi

To acquire a good understanding of some complex, ever-changing elements in the Italian framework such as current laws, law proposals and enforcement modes, it is often necessary to turn to experts of the field or offices run by Trade Unions.

The World Economic Forum showed some critical aspects associated with the increase in working age, which is partly due to a continuous raising of the retirement age in Italy.

Setting aside any economic approach, we hope that the side effects of the aging of the working-age population will be taken into account. Those who blame the low percentage of active population in our country are probably right; in fact, in order to sustain our social security system, active workers are required to be part of the labor force for a longer period of time. However, this is a complicated issue and may involve other softening synergies such as the surfacing of informal jobs and the increase in employment.

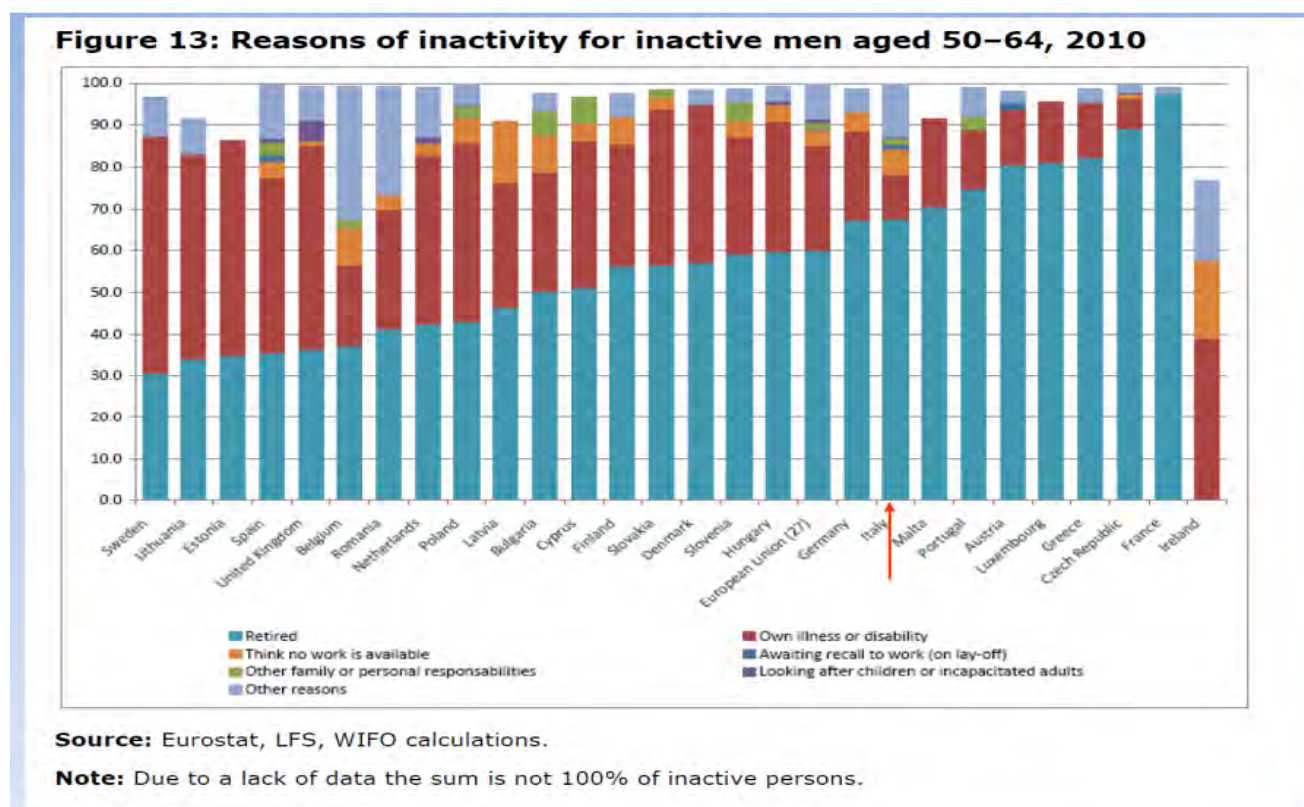
It is true that most of today's jobs are suitable for aged workers and that the remaining can be improved and made suitable for workers of "all ages" (2016-2017 European campaign supported by CIIP and the project linked to it, E.capacit8, whose logo shows the improbable infinite symbol  $\infty$ ); however, this is not always achievable.

The raising of retirement age entails a greater number of workers with limitations or unfit for work, especially "aged workers with disease" or those whose job is particularly exhausting or demanding. Redeployment for these workers can be hard.

Figure 7 shows an estimate of the reasons for inactivity among inactive men aged 50-64 across several countries in 2010.

### Figure 7: Reasons of inactivity for inactive men aged 50-64, 2010

(Source: Eichhorst et al., 2011)



The image suggests that although a higher retirement age is associated with “savings on retirement costs”, it entails greater social costs due to older people who are no longer able to work.

Besides, we think that the definition of work under harsh conditions should be reviewed and widened (Fontana et al., 2014), thus causing a lowering of retirement age; de facto, current conditions are not very accessible and they lack solid scientific basis. Even the new soft loans addressed to people who work under harsh conditions are currently subject to several restrictions.

However, improving pension and retirement costs for insured citizens would not entirely solve the issue of an aging workforce, hence the need for the aforementioned multiple approach.

The sustainability of our social security system cannot be based solely on delaying the retirement age. Social security systems with higher retirement age (which, on one hand, corresponds to “savings on retirement costs”) show an increase in other welfare costs and a more complex management of workers’ limitations and fitness for work. It is necessary to review and widen the definition of work under harsh conditions. Gradual retirement is advised.

## 1.7 ERGONOMIC APPROACH

Rinaldo Ghersi, Olga Menoni

There are treaties and encyclopedias devoted to Ergonomics. On the Internet, on institutional websites about health and safety in the workplace (OIL, ISPEL now INAIL, POLICLINICO/ERGONOMIA, INRS, INHST, IRSST, HSE, NIOSH, OSHA), there is plenty of material on the subject. This chapter will only cover some of the aspects, starting from the definition of ergonomics and referring, for further details, to specific chapters in this AGING E-book and its future updates dedicated to single industrial sectors.

The dictionary *Nuovo Zingarelli*, 1986 defines Ergonomics as the “Discipline that studies working conditions and environment to adapt them to workers’ psycho-physical needs”, while the International Ergonomic Association (San Diego 2000) specifies that it is the “scientific discipline concerned with the understanding of interactions between human factors and other elements of a system; it is the profession that applies theory, principles, data and methods in order to optimize human well-being and overall system performance”.

The latter, in particular, seems to hint at a discipline that shares several goals with Occupational Medicine:

- Prevention of work-related distress, disorders or diseases (with an eye to health protection as defined by the World Health Organization (WHO) in Art. 2.1 or by *Safety and Health at Work Directive 89/391/EEC*)
- Adaptation of work conditions for “all ages”, in line with the slogan of the European campaign, hence a better redeployment of aged workers, both “healthy” and “with a disease”
- Maintenance of productivity in terms of both quality and quantity despite aging workers.

The use of ergonomics is often ambiguous or hides a dual effect, as it happens for many disciplines and jobs. However, from our point of view, the goals listed above *can* be pursued by an ergonomic approach to the aging workforce, even though it may not be sufficient, in some situations, to solve the issues (as showed in the basics of the multiple approach).

Briefly, there are different types of ergonomics, each acting within its own scope:

**Physical ergonomics** is the most known and it is often subject to laws and standards: manual material handling, biomechanical overload of the upper and lower limbs, postures, lighting and eye strain, microclimate, noise, vibrations...

Legal and normative directives (ISO, EN, UNI) in the field are quite well known yet not thoroughly spread and applied. Eurofound’s sixth European Working Condition Survey focuses on risks due to awkward body postures or postures perceived as tiring or painful: about 30% of the working population is exposed to such a risk for a consistent part of their work shift.

As for biomechanical overload and body postures, absolute risk acceptability or unacceptability for each body region is defined by standards ISO 12226 and UNI EN 1005-4, along with technical report ISO TR 11295 (despite its limitations), thus providing specific criteria for an adequate organizational analysis of any given task.

Supporting human wisdom, ergonomists have been working on body postures for a long time (as shown by RULA, REBA, OWAS methods and TACOs application).

None of the mentioned methods defines an assessment mode other than age.

### **Cognitive ergonomics**

Old workers often rely on experience to counterbalance their reduced short-term memory and longer reaction times. Much has been done in this direction, yet not enough.

The diffusion of important methods – even simplified – is still limited; to mention a few: user-oriented planning/design, usability evaluation, organizational analysis and analysis of human error applied to occurred or potential injuries.

*At work as well as off work, software programs do not always simplify our tasks and user manuals are often incomprehensible.*

With regard to these aspects, Table 3 shows some needs expressed by the workers (especially, but not only, aged ones).

In addition to the *Safety and Health at Work Directive 89/391/EEC*, ISO 10075 “Ergonomic principles related to mental workload”, ISO 6385 “Ergonomics principles in the design of work systems”, ISO 9241/2010 on human-system interaction and ISO EN 14915 on software ergonomics are the applicable regulations.

### **Organizational ergonomics: work organization**

An important subject for ergonomists and professionals of the health and safety industry. All risk assessment methods should include a large section devoted to organizational analysis, aimed at identifying preventive strategies or a possible re-design of the workspace that also involves organizational features.

It is and always will be a matter of the utmost importance in the healthcare sector (today and tomorrow): working hours, actual shifts, management, loads, holidays and rest days, availability, training and education, roles, relationships...

This sector shows a number of difficulties perceived by health and safety operators and affecting enterprises and trainers.

More research-action that fit our context are required; we need to validate and adapt methods created and tested somewhere else to our specific reality and give real value to our human resources, including old workers, and positive experiences.

### **Ergonomics and evidence based medicine**

The medical literature shows the results of applying evidence-based assessment methods, all created in different sectors and for different purposes, to the management of an aging working population (Marradi et al., 2010).

A systematic review (Cloostermans et al., 2015) addressing the efficacy of individual programs and workplace programs aimed at deterring aged workers from leaving work reports “limited evidence for an effect on early retirement reduction and insufficient evidence concerning ability and productivity”.

The mentioned review (the first we have found in the literature) calls for the need to build a «sustainable employability» that before 40-45 years of age, emphasizing the figure of the «aging worker» more than the «aged worker».

The study highlights the importance of the possibility for elder workers to manage parts and modes of their work autonomously, such as the alternation between work and short breaks.

As for the relationship between ergonomics and evidence based medicine (or preventive medicine), we share the idea of eliminating or not implementing preventive interventions that have been proven to be ineffective (Ars Tuscany, Prevention based on evidence, 2014), as well as of researching and documenting effectiveness indicators of improving interventions; on the other hand, we are skeptical as to whether reject or postpone a priori preventive interventions, often recommended in technical

reports or provided for by laws, if their efficacy has not been proven by efficacy or quality evaluation tools of studies started in a laboratory or within a controlled clinical experimentation (not always adequate to the prevention of distress or pathologies).

Additional occupational challenges need to be faced concerning the assessment of risk exposure in the past, the identification of control groups and the response rate of workers to diagnostic procedures for research purposes. IEA (International Ergonomics Association) president Marras, author of a reliable text about the occupational physiopathology of the spine (Marras W.D, 2008), is also tackling some important aspects of “evidence-based ergonomics”.

Besides, in many countries occupational physicians monitor group of workers performing similar or different tasks for years. This monitoring process, both “cross-sectional and longitudinal”, should not be belittled as an “episodic narration” carried out by evidence-based medicine experts only. Despite its limitations, if carried out accurately, properly documented and implemented, this activity can be of great importance, as it provides information on helpful preventive interventions – as helpful as a solid bibliographic review on the matter, if any available. Ideally, the two sources should be combined and used as a single tool.

#### **KEY POINTS**

- PHYSICAL, COGNITIVE AND ORGANIZATIONAL ERGONOMICS could help us reach the desired goals concerning the prevention of work-related distress/disorders/diseases and may contribute to healthy aging by safeguarding employability.
- Although a few cases have been faced in the past, ERGONOMICS EXPERTS are yet to express their opinion about a real adjustment of working conditions to aged workers.

## 1.8 AGE-SENSITIVE RISK ASSESSMENT AT WORK

*Tiziana Vai, Olga Menoni, Marco Tasso*

Some groups of workers can be subject to the same risks and conditions of colleagues, but result more exposed due to individual characteristics such as age, origins, gender, physical conditions or contract. Italian legislation provides that risk evaluation must take into consideration workers' individual characteristics, in order to adapt work to workers and not vice-versa.

Possible operational steps for an inclusive risk assessment are:

- Identification of occupational risks usually considered during risk assessment.
- identification of duties and tasks particularly exposed to the abovementioned risks
- Qualitative and quantitative assessment, risk estimation
- Analysis of age-related individual factors that are likely to increase risk susceptibility

The checklist we included is a practical tool for a first analysis of jobs and tasks, **that takes age into account and is useful to** discuss priorities, propose possible improvements or develop in-depth studies on risk identification and assessment.

As early as 2000 and within the context of economic competition and innovation policies, the European Union highlighted that social inclusion, valorization of human resources and job reclassification were key elements to achieve global development. The organization also provided an action framework to prevent damages among older workers based on risk assessment. (European Council, Lisbon 2000 and following Lisbon Treaty).

Recently, the European Agency for Safety and Health at work has further specified that not all workers are equally exposed to the same risks: some groups are either more exposed than others or work under particular conditions.

When we talk about workers who are more exposed to risks we include those exposed to specific risks associated with age, origins, gender, physical conditions or the position held in the company. These factors could either put workers in a more vulnerable position or entail specific requirements in the workplace.

The *Safety and Health at Work Directive 89/391/EEC* stipulates that workers' individual factors (such as age) should be taken into consideration by employers when assessing risks with the aim of adapting work to the individual (and not vice versa) as much as possible.

Diversity and diversity management (and, within this context, "age diversity" management) are nowadays key issues in the field of Safety and Health at work. Diversity, however, has rarely been studied from the point of view of risk assessment. Practical assessment tools suitable for disabled people, immigrant workers, older workers, women and temporary workers are still sporadic.

Risk assessment must include all the elements connected to workers' health and safety, from the tools and substances used in the execution of their job to the workplace setting. Work-related stress risk, risks faced by pregnant workers, those (associated) with age diversity, foreign origins e those connected to a specific work contract must all be taken into consideration.

Employer and manager's obligations as well as workers' abilities and conditions must be considered before task assignment.

The employer must implement measures suggested by the Occupational Physician. In case the worker cannot safely carry out a specific job or task, the employer must assign him equivalent -or inferior- job or task, ensuring the reward of the previous job.

The European Agency provided some useful key points for age-sensitive risk assessment:

- Due consideration and concrete commitment shall be devoted to diversity issues.
- Assumptions on hazards and on exposed subjects should be avoided as much as possible
- Workforce diversity should be regarded as a valuable resource, not a problem. It is fundamental to take into consideration the entire workforce, including cleaners, maintenance workers, temporary workers, part-time workers etc. Work and preventive measures must be adapted to workers. Work adjustment is a key principle of EU law.
- The needs and requirements of the entire workforce must be considered during the planning process in order to avoid adjustments if disabled, older or immigrant workers are subsequently employed.
- Aspects of Health and safety at work should be integrated in all actions directed at improving fairness , equality in the workplace, including equality plans and policies against discrimination.
- Risk assessment officers, managers, supervisors etc. must be provided with a training course and information on health and safety risk diversity.
- All workers should be provided with a proper training course on health and safety at work.
- An inclusive risk assessment must adopt a participatory method that engages the concerned workers and is based on an accurate examination of the work environment.
- Examples of good practice in the field of risk assessment must be adopted, involving different preventive measures (work adjustment to the individual, adaptation to technical progress, provision of appropriate information to workers, provision of a specific training course etc.)
- It should be assumed that a risk assessment among more vulnerable workers is beneficial for all workers, regardless of their age, gender, nationality and physical characteristics.

Some measures that could benefit the entire workforce are listed below:

- space/ workstations should be adjusted (and suit the needs of disabled, older workers etc.) through the installation of access ramps, elevators, light switches etc.;
- ergonomic equipment (suitable to the needs of each worker) must be adopted – in this way the specific task can be carried out by a higher range of workers (women, older workers, short people etc.) requiring, for example, less physical strength;
- accessible information on health and safety must be provided (in order to be available to immigrant workers)
- methods and strategies to keep older shift workers engaged on the job must be developed; such strategies would benefit the entire workforce (regardless of age), making shiftwork more accessible to new employees.
- Workplace changes and new equipment purchasing must suit the needs of the entire workforce.
- Expert advice should be sought if either the company or the organization is not capable of managing the risks of a specific group of workers; health and safety authorities, professionals, ergonomists, organizations for disabled and immigrant workers etc. can provide such a service.
- In order for preventive actions to be effective, stakeholders must be involved: workers, workers' representatives, works councils, occupational health and safety professionals, contractors and subcontractors, etc.

The statement "avoid assumptions on hazards and on exposed subjects" made by the Agency is fundamental in the reflection upon the procedure usually undertaken to assess risks.

Risk assessment among exposed subjects is usually conducted as if they were an abstract working population, composed of "standard" subjects: variables such as age, geographic origin, type of contract, gender, that highly influence the exposure to occupational risks, are not taken into consideration.

It is therefore necessary to revise previous theoretical and methodological approaches to risk assessment, promoting a process that aims at finding solutions rather than wasting time on mere formalities.

Firstly, it is necessary to assess not only the risk but the individual, integrating the assessment approach based solely on quantitative models and parameters (checklists, algorithms, surveys). The correlation between risk factors and individual characteristics of the exposed subjects must be investigated; an assessment model that is able to predict the probability of a harmful factor to become dangerous and cause harm must be developed. This analysis must go beyond harmful factors (often investigated as already regulated) and include the minimized factors such as work organization, relationships, time frames, abilities etc. The latter, indeed, play an important role in the assessment of age-related risks.

The literature reports numerous useful observations on the correlation between risk factors/working conditions and the aging process.

The work done by the French Institute INRS has been particularly relevant, identifying among older workers a number of health conditions and proposing a tailored checklist highlighting risks and priority preventive measures for workers of all ages. The checklist can be downloaded in PDF version from INRS' website

<http://www.inrs.fr/accueil/produits/mediatheque/doc/publications.html?refINRS=ED%206097>

Guided by this proposal, we further developed the model, taking into consideration all risks and their degree of harmfulness according to the age factor, as provided for in the *Safety and Health at Work Directive 89/391/EEC*.

Scarcity of technical-scientific elements and guidelines identifying age-related "threshold levels" for the majority of risk factors (also due to inter-individual variability) has been a limitation.

Where possible, we integrated the INRS checklist with the assessment for specific tasks. The reason behind our choice is that the identification of specific tasks that are particularly exposed to age-related risk allows to elaborate preventive solutions and facilitates adaptability.

Some possible (general) operational steps are given below. Starting from the concepts defined by INRS we developed a new checklist freely available on the [CIIP's website](#).

Development of new tools, identification of job tasks and assessment of age-related harmful factors must be progressively pursued starting from the "difficult working conditions" highlighted in the "Sixth European Working Conditions Survey" by Eurofound.

Eurofound: Sixth European Working Condition Survey "difficult working conditions" for aged workers

- Painful or tiring positions (endured for at least one quarter of the time at work)
- No opportunity to learn new things
- Shiftwork
- No training course completed in the last 12 months
- Need for reorganization
- Fast-paced work environment
- Negative social behavior
- Inability to change work methods
- Fear of losing the job in the next six months
- Poor career prospects

The possible operative passages are the following:

- a) Identification of occupational risks usually considered during risk assessment. It is particularly necessary to identify risks for which **physiological aging involves a “universal” higher susceptibility, i.e. extended to the entire exposed workforce.**

As proven by the literature previously mentioned and based on our own professional experience, such risks might require preventive measures to avoid premature physical wear and tear guarantee mental and physical health:

- biomechanical overload
- postural stress
- night work and shiftwork
- harsh climate and microclimate conditions
- intense noise
- intense vibrations
- poor lighting
- severe time restrictions
- work-related stress factors
- risk of slips, trips and falls

- b) Jobs and tasks particularly exposed to the **abovementioned** risks

It is necessary to provide a detailed description of duties, tasks and roles, taking into consideration age distribution (for instance, under and over 45 years of age). Such a description might highlight some subsidiary aspects such as a different distribution of tasks according to IT abilities (usually more developed among younger workers) or qualification – that might, in turn, lead to discrimination against older generations, etc.

- c) Qualitative assessment, quantitative assessment, risk estimation.

Risk assessment consists in the attribution of a level of probability that a specific factor causes damage not because of its intrinsic property or quality, but also in relation to different age-related susceptibility.

Risk factors provided with available and applicable age-adjusted **harmfulness parameters** are few: there are some instructions for the biomechanical risk of manual material handling as well as a preventive indication that implies a hypersusceptibility assessment among workers over 50 for eye strain resulting from VDT work.

As far as the majority of risk factors is concerned, it is necessary to conduct an in-depth analysis on the frequency of age-related disorders and diseases as well as on threshold levels of harmfulness associated with aging.

Information collected so far allows us to make a qualitative estimate of the main risk conditions on which to focus corrective action plans.

- d) Age-related individual factors that are likely to increase risk susceptibility (aging with disease). There is a further area of action that is less focused on risk management and linked to individual health conditions, to disabling diseases causing functional capacity impairment. The identification of age-related risks at work might facilitate the implementation of **individual/tailored** measures in order to adapt roles/tasks with workers' fitness for work.

The checklist in Excel **is not** a risk assessment but a first analysis of **jobs and tasks** that is useful to discuss priorities, propose possible improvements or develop in-depth studies on risk identification

and assessment. The checklist has already been experimented and can be tailored for different working sectors, integrating the entries to suit sectorial specificities.

Each risk entry is provided with a sheet suggesting preventive guidelines and improvements: so far, this part is only **partially filled**; suggestions are often obvious and repetitive because the aim is not to draw final solutions but to propose a common tool that is capable of collecting and sharing experiences and good practice.

The software (Excel sheet) for the compilation is available with examples on the [CIIP's website](#).

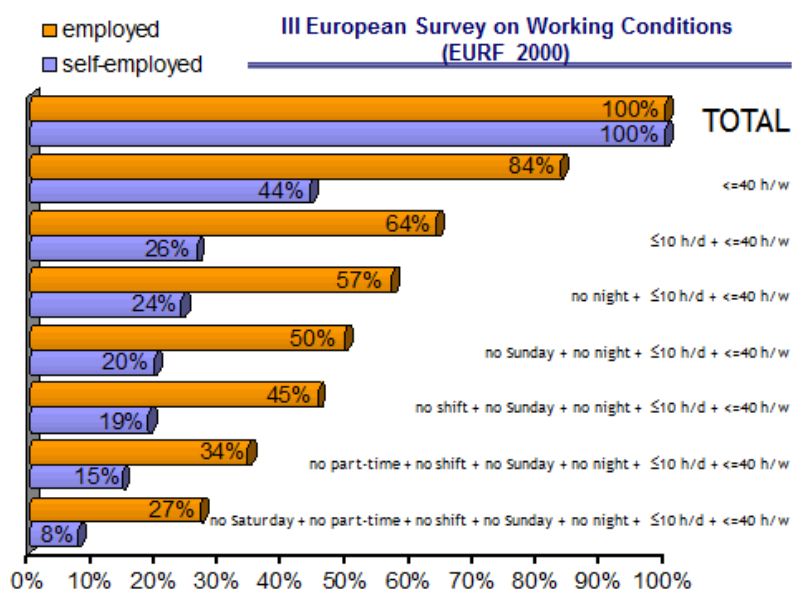
## 1.9 AGING AND SHIFTWORK

Giovanni Costa

### Trend in working hours

The Third European Working Conditions Survey in 2000 (Paoli and Merllié 2001) reported that only 24% of the active population work “normal” or “standard” hours, that is from Monday to Friday between 7/ 8 am and 5/6 pm, whereas 76% of the population is engaged in irregular or “non-standard” working hours, including shift and night work, week-end work, split shifts, on-call work, compressed weeks, telework, part time work, variable/flexible working time, etc (Figure 8).

**Figure 8: Characteristics of working hours in employed and self-employed workers in 15 EU countries in 2000.**



The 4th EU survey (2005) confirmed the end of the standard working arrangements and also identified a growing diversity in the weekly working hours among 31 European countries. The results showed a range from 34 h on average in the Netherlands to 55 h in Turkey, and from a minimum of 8 h as part-time work to a maximum of 90 h as overtime work. The percentage of evening work ranged from 36% to 58%, whereas for night work the range was 18% to 24%. Overall, some 21.9% of men and 10.7% of women worked on shifts that include night work (Parent-Thirion et al. 2007).

Data from the International Labour Office (ILO, 2007) suggests that globally the annual hours worked per person surpassed 1800 h in 27 countries out of the 52 monitored from 1996 to 2006. In particular, six Asian economies worked some 2200 h.

In Europe the 4th EU Survey reported that 16.9% workers worked 48 h per week or more, ranging from 11.1% in Luxembourg to 32.1% in Turkey. Moreover, the “composite indicator of working time”, that takes into account all the hours connected to work, shows that women have much more (+20%) time constraints than men, both in part-time and full-time jobs, mainly due to unpaid working hours (excluding family obligations). We need to better understand the impact of these changes in terms of employee health and what we can do to assist.

Harman (1998) has suggested that aging is the highest risk factor for disease in industrialized countries and this is the case from about the age of 28. Age-related disorders that influence life expectancy depend on several exogenous factors (e.g. environment, diet, work) that account for 70-80% of these outcomes, and on genetic factors that account for some 20-30% of cases (Finch and Tanzi 1997). Twin studies have shown that the genetic influence on life expectancy amounts to about 28% in men and 23% in women (Herskind et al. 1996).

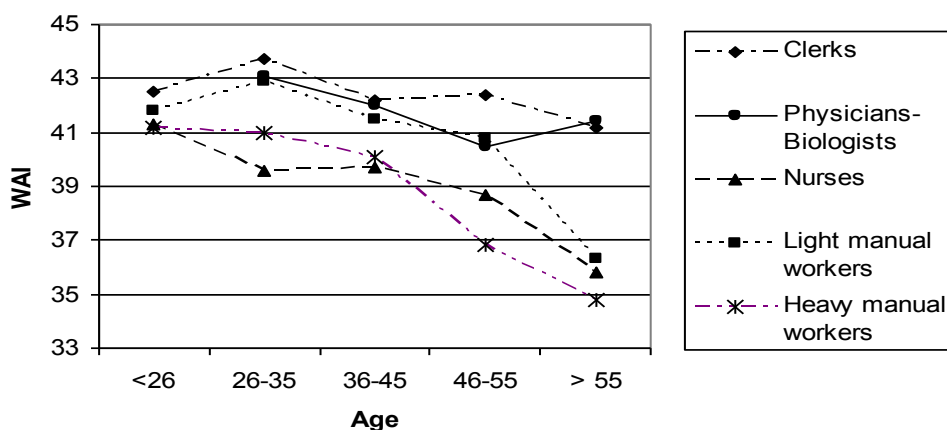
Some authors have considered other aspects of aging at work important in relation to psycho-social factors such as psychological and social age. However, it is difficult to evaluate properly these typologies as most studies are cross-sectional and therefore often unable to establish a causal relationship.

In fact, cross sectional studies cannot discriminate health effects due to aging with those due to changing environmental factors, such as living conditions, and are subjected to strong bias from the healthy worker effect.

Chan et al. (2000) have suggested that aging and performance can be considered as a trade-off which is not generally understood in the work place. For example, aged workers do not have more accidents, but they tend to be more severe; their absenteeism is less frequent but of a longer duration; their adaptability to new technologies is slower but only when training is inadequate. Overall, Chan and colleagues consider that performance in aged employees is not decreased because they compensate by being better organized. Further, their work efficiency is sustained by a higher job commitment, behavioral stability and reliability. These findings would suggest that in the work place, the crucial problem is not the decrement of biological functions, but finding the right balance between the employees, their available resources and the job demands (Ilmarinen 2001).

The relationship between age and work ability was recently demonstrated in a study of some 1500 participants employed in different economic sectors (Costa and Sartori 2007). We found a general decline in the Work Ability Index (according to Tuomi et al. 1998) as age increased. However, this relationship varied by the type of job. The most prominent decrease was recorded in heavy blue-collar workers (e.g. construction workers) and nurses. In light manual workers the decline was less evident, while the index was almost unchanged in white collar workers, such as clerks, physicians and biologists (Figure 9)

**Figure 9: Mean Work Ability Index (WAI) scores in men of different occupations**



These findings are consistent with data from a longitudinal French study (VISAT) on aging (Molinié 2005). In general, their results suggest that, at the age of 52, 6% of men and 14% of women consider not possible to keep their job until retirement. These figures change dramatically among managers and executives (4.5% for both sexes), clerks (3.5% men, 11.8% women) and blue collars (11.2% men, 15.6% women).

We need to find the best way to match work tasks with psycho-physical conditions of the workers in order to better conciliate work ability with aging.

### **Aging and (in)tolerance to shiftwork and night work**

Shift and night work require employees to work at times that disrupt their lives from the biological and social synchrony, that is enjoyed by day workers. In the short term, these temporal changes interfere with the psychophysical homeostasis (circadian rhythms, sleep/wake cycle), performance efficiency (vigilance, errors, accidents) and family and social relations. In the long term, shift and night work are well-known risk factors linked with several psychosomatic disorders, gastrointestinal, psychoneurotic and cardiovascular illnesses, and probably also cancer. These health problems translate into higher economic and social costs for the individual, the enterprise and the society.

The impact of shiftwork however is moderated by many intervening variables. These include the actual shift schedules and job demands, social conditions, coping strategies and individual factors,

aging being one of the most important (Costa 2003, Härmä 1996).

The critical age for increasing intolerance to shift and night work seems to be about 45-50 years of age. The research suggests this is due to chrono-biological factors, psycho-physical aspects and to social conditions (Figure 10).

**Figure 10: Psycho-physical aspects connected to aging**

*More vulnerable people: **AGEING WORKERS***

- *Weakening of the circadian system*
- *Impaired psycho-physical conditions*
- *Reduced sleep restoration*
- *Higher relative work loads*
- *Reduced Work Ability*
- *Resistance to change*
- *Increased work discrimination*




Aging is associated with a more difficult adjustment of circadian rhythms to night work, to increased sleep disturbances (Härmä et al. 1994, Härmä et al. 1998), and to reduced tolerance for longer work hours, such as in the case of 12-h shifts (Aguirre et al. 2000, Bourdouxhe et al. 1999).

The difficulty in achieving adequate circadian adjustment is due to a number of factors, that include: a) a weakening of the circadian system, resulting from molecular and functional changes in the suprachiasmatic nuclei that makes them less responsive to light (Bliwise 1999), thus circadian rhythms becoming more prone to internal desynchronisation (Van Good and Mirmiran 1986, Czeisler et al. 1992, Van Someren 2000); b) an earlier phasing (morningness) of circadian rhythms; c) a slower circadian adjustment over successive night shifts (Härmä et al. 1994); d) a reduced sleep duration with consequent increased sleepiness during waking hours. There is evidence to suggest that alertness and performance efficiency of aged workers suffer more from the homeostatic sleep process (that is, the duration the previous waking period) than the circadian process, compared with younger workers. (Figure 11)

**Figure 11: Sleep problems connected to aging and shift work**

*Sleep problems connected to ageing and shift work*

- *Reduced sleep duration*
- *Early awakenings*
- *Reduced sleep quality: < deep sleep (SWS)*
- *Higher propensity to sleep during the day*
- *Day sleep: > stage 1, < SWS, > diuresis, > awakenings*
- *Lower amplitude of biological circadian rhythms*
- *Slower phase adjustment to perturbed sleep/wake cycle*
- *Greater influence of the homeostatic process on sleepiness and fatigue*



From the psycho-physical point of view, health deterioration increasing age may be more pronounced in shift workers than workers due to chronic fatigue and problems with sleep (Koller 1983, Härmä 1996, Brugère et al. 1997).

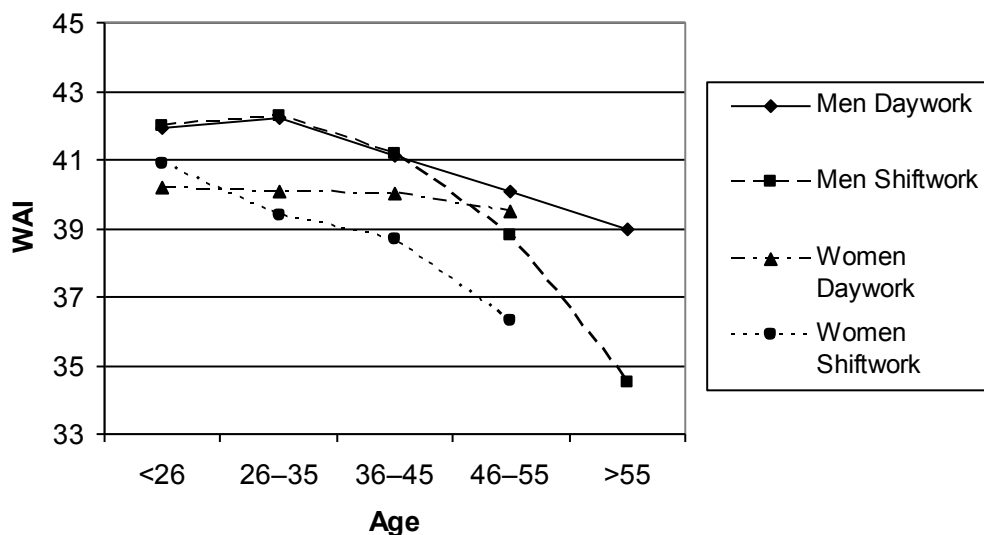
A natural reduction of sleep length, earlier awakening and a reduced quality of sleep, leads to increased sleepiness and napping among older people during the day. EEG recordings have showed that sleep after night shifts in older people contained more stage 1, less slow-wave activity and was more frequently interrupted by longer awakenings.

Further evidence linking the deterioration of sleep with aging is found in the French prospective study ESTEV. This study reported some interesting findings. First, a general and constant decrease of sleep quality between 32 and 52 years. Second, a higher proportion of complaints in the younger shift workers (ages 32 and 42) compared with day workers. Third, an increase in sleep complaints between workers aged between 42 and 52 years (Derriennic et al, 1996).

According to some epidemiological studies on cardiovascular diseases, the relative risk for coronary heart disease is more than 40% for shift workers vs. day workers in general, but rises to 60% in men and 300% in women aged 45-55 years.

Our Italian study on work ability (Costa and Sartori 2007) previously mentioned showed a more significant trend of decreased WAI scores and aging in shift workers than in day workers. Once again the problems were more acute for women, with work ability declining a decade earlier than men (Figure 12).

**Figure 12: Mean Work Ability Index (WAI) scores in health care workers according to gender and shiftwork**



From a chrono-biological perspective, we should also consider the possible interactions between functions with different temporal scales that can increase the complexity of the picture. For example, both ultradian (i.e. brain and cardiovascular activity), circadian (i.e. sleep/wake cycle, hormonal secretion) and infradian (i.e. menstrual cycle, aging) rhythms impact on vigilance, performance efficiency, fatigue and well-being. Their interactions may result in different outcomes according to the relative phase and weight of each factor. Further, these interactions will vary with the peculiar characteristics the individuals, groups, and working conditions involved.

### ***Actions on employment of aging workers***

We have highlighted in this review that workforce is aging and not that will necessarily retire at 60 years of age. We have also presented evidence that non-standard working arrangements are linked with health impairments and more so it seems in aged workers.

In March 2001 the European Council laid out an ambitious target in raising the employment rate for workers aged 55-64 from 26.3% (2000) to 50% by 2010. The Council emphasized that responsibility for tackling this issue is to be shared between the generations by means of a 'a progressive increase of

about five years in the effective average age at which people stop working in the European Union should be sought by 2010'.

On the other hand, the Council committed its members to promote active aging, notably by: fostering working conditions conducive to job retention (i.e. continuing training, health and safety at work, innovative and flexible forms of work organization); eliminating incentives for early exit from the labor market; encouraging employers to employ aged workers.

To achieve this goal of the European Council (which has not yet been reached by many countries) it is necessary to act at multiple levels.

First, it is necessary to improve and sustain the work ability of people across the age span. Work ability is a dynamic process that changes throughout life, and is the result of the interaction between individual resources (including health, functional capacity, education, know-out, motivation), working conditions (environment, tools, human relations), and the surrounding society. Work ability sets the basis for individual employability, that can be supported by several actions (e.g. legislation about work and retirement) and social attitudes (e.g. age discrimination) aimed at increasing job opportunities.

The link between work ability and successful aging leads us to consider three levels of action for keeping aged workers in good health (Toomingas and Kilbom 2000, Tuomi et al. 2001), in particular aimed at:

1) Work organization: good practice should tackle the following:

- a) a general improvement of working conditions;
- b) more flexible and reduced working hours (in particular night work);
- c) compensative measures in terms of rest periods and commuting
- d) policies favoring a smooth transition from employment to retirement (i.e. part-time, flexibility);
- e) job rotation and reduced work load;
- f) assignment to tutorial tasks to ensure job competency.

2) Workers:

- a) improvement of physical fitness;
- b) access to continuous education and training;
- c) better support from management to career development, training and flexibility;
- d) personal planning to pensioning;
- e) tailored health surveillance and rehabilitation plans in case of health disorders.

3) Enterprises: they should be committed to:

- a) looking for more flexibility both at the group and the individual levels;
- b) giving strong support to workers' preferences and job training;
- c) promoting motivation and integration among age groups, avoiding inter-generational conflicts;
- d) differentiating actions among age groups;
- e) guaranteeing adequate personal career plans.

A survey conducted in Finland (Ilmarinen, 2005) among employers and employees reported that the fundamental actions to allow an actual prolongation of working life are the following:

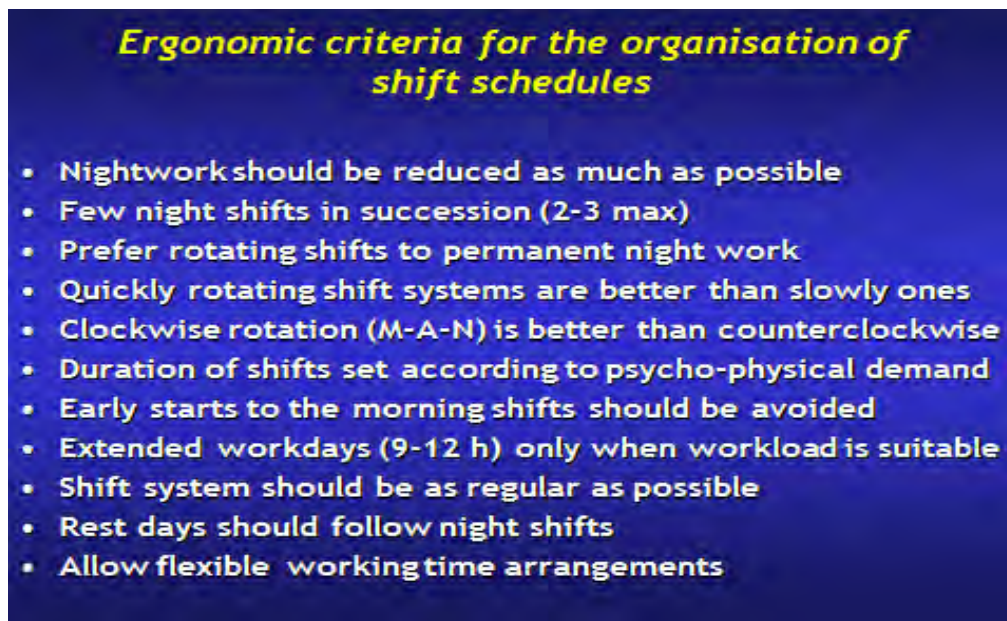
- a) according to employers: promoting healthy relationships in the workplace (82%), improving rehabilitation interventions (35%), reducing workload and restrict working hours (32%)
- b) according to employees: improving work environment and conditions (71%); improving management and supervision (68%); guaranteeing health and safety in the workplace (59%); reducing workload and restrict working hours (56%), further boosting workers' professional training (40%); promoting a regular occupational health surveillance (36%).

### ***Actions for aging shift workers***

There are some policy directions that specifically address the concerns for shift workers.

The ILO Convention no. 170 and Recommendation 171 (1990) and European Directive 2003/88/EC *concerning certain aspects of working times* (2003) clearly point out that 'working time arrangements should take into account as far as possible worker's personal preferences'.

**Figure 13:** Ergonomic criteria for the organization of shift work schedules



In addition to the well-known ergonomic criteria for the arrangement of shift schedules (Figure 10), some specific recommendations can be made to support aging workers (Costa 1998, Costa et al. 2005, Hakola and Härmä 2001, Härmä and Ilmarinen 1999, Härmä and Kandolin 2001, Knauth and Hornberger 1998, Kogi 1996, Koller 1996). In particular:

- a) limiting or avoiding night work after 50 years of age
- b) giving priority for shift workers to transfer to day work
- c) giving more choices for preferred shifts (e.g. morning shifts)
- d) reducing work load
- e) shortening working hours
- f) increasing rest pauses/periods
- f) arranging more frequent health checks
- g) counselling and training on the best coping strategies concerning sleep, diet, stress management, and regular exercise.

Taking into consideration the high inter-individual variability in tolerance shiftwork, a systemic approach is needed, that is capable of providing a balanced integration between individual aspects, working conditions and community policies. Thus, it is necessary to adopt flexible and tailored interventions, capable of giving aging shift workers proper support for maintaining a satisfactory work ability.

The search for strategies to increase working time flexibility requires several interventions that adopt a short- and a long-term perspective (Costa 2004, Griffiths 2000, Knauth et al. 2000).

In the short-term, one may expect that work hours may be altered for limited periods in terms of increased or decreased hours worked per day and/or changed positioning of work hours.

In the long-term, interventions should be linked to more complex planning and/or adjustment of working careers, and to adaptations of working life in response to changing social conditions (i.e. delayed and/or gradual retirement).

Flexible arrangements of working hours over the long term (e.g. bank hours, part-time work) may be of interest for both employees and employers to ensure that the work force is available for longer planning periods as workload is more tolerable.

An interesting point from the 3rd European Survey on Working Conditions (Costa et al. 2006) is that the lack of flexibility in working hours has a stronger negative effect as compared to night work, suggesting the importance of having some control on adjustment and adaptation strategies that is further evidenced by the necessity of having a strong social support.

## 1.10 HEALTH SURVEILLANCE FOR AGED WORKERS

Donatella Talini, Tiziana Vai, Carlo Nava, Olga Menoni

In order to detect and monitor disorders and pathologies that are most impacted by age (e.g., musculoskeletal and cardiovascular disorders, chronic and degenerative diseases in general), occupational physicians should integrate or modify protocols and instruments used for health surveillance according to the aging workforce.

A subject's work ability depends on the balance between workloads and individual resources; work conditions can also impact a worker's adaptability. The questionnaire used to calculate the Work Ability Index can be considered a health surveillance tool and may be crucial in the monitoring of the aging process of workers, allowing for prompt intervention, if needed.

The adaptation of the statement of fitness for work to different tasks within a job by an occupational physician is an instrument for the prevention and protection of the health status of "aged" workers. However, it is not the only one and should be integrated with other preventive interventions.

It is strongly advisable for occupational physicians to use a specific shared software and save a digital copy of the data collected through health surveillance; this would contribute to a constant monitoring of health examinations, thus allowing OPs to identify any differences, even small, caused by the aging process.

When dealing with the aging of the workforce, the limitations certified by the occupational physician can be a crucial tool in the prevention of potential severe consequences and the protection of workers' health.

An aging-oriented health surveillance aims at assessing a worker's fitness for specific tasks while considering the work environment, Risk Assessment and all possible corrective interventions that could still be implemented.

The approach should start from the idea of "ordinary" aging (i.e., "physiological") throughout a subject's working life. This would not interfere with the natural aging process and may actually affect it positively thanks to the early adoption of a healthier lifestyle.

Occupational physicians have a key role. They have to complete/modify health surveillance protocols and tools considering the aging process; on the basis of the data in their possessions, they should guarantee an effective collaboration to the drafting of a Risk Assessment Document (*Safety and Health at Work Directive 89/391/EEC*) with an eye to workers' age differences.

Within the context of health surveillance, occupational physicians should strive to develop specific and personalized approaches based on specific (e.g., harsh jobs) and technical regulations, best practice, guidelines, experiences and grids for the identification of possible hazards which could both pose a problem to aged workers and affect the normal aging process of younger workers.

To better assess workers' health status and thus be able to suggest, or prescribe, through their statement of fitness for work, corrective interventions that could adjust the condition and organization of work (both in general and in a more specific sense), health surveillance should pay particular attention to the clinical history and the development of health promotion interventions aimed at improving lifestyles in general (concerning eating habits, physical exercise, smoking, use of psychotropic substances, etc.). It should also urge people to adhere to population health screenings.

Assessing the number and type of injuries and occupational diseases reported in the last few years can also contribute to deepen the knowledge of the subject.

A great part of this will depend on choices and investments in terms of productivity and labor law. As for "aged workers with issues", an analysis of fitness in frequent pathologies among old people and on legal and social aspects in the Italian framework can be found in Italian in *Quaderno di Medicina*

Legale e del Lavoro no. 1, 2015 “The aged worker, fitness for work, early aging”.

The booklet also includes a summary of current regulations on the placement of disabled workers, another difficult subject in many situations and realities (SIVA, 2015).

In the light of the gradual aging of the workforce, occupational physicians need to pay particular attention to the aspects summarized and further discussed below.

**VISUAL ABILITY:** reduced accommodation (focusing on close objects) due to stiffness of the crystalline lens and/or weakening of ciliary muscles (it can be balanced out with glasses); visual field defect (up to 20-30°) and reduced visual acuity; reduced depth perception and reduced ability to differentiate between similar dark colors; increased light sensitivity due to a beginning of cataract or slow pupillary reflex, especially with poor lighting, bright lights and very small characters/objects.

**HEARING ABILITY:** presbycusis which elicits high-frequency hearing loss (consider any previous exposition to noise in the workplace), and reduced speech perception in noisy situations.

**BALANCE:** altered sensorium (dizziness, vestibular dysfunctions).

**MAXIMUM MUSCLE STRENGTH:** between 20 and 60 years of age we lose 15-50% of our muscle strength, which causes reduced tolerance to acute intense exertion, reduced fatigue resistance, greater vulnerability to cumulative biomechanical overload (the definition of exertion according to Borg rate is individual).

**JOINTS:** gradual loss of functionality with consequent difficulty to work in extreme postures; after age 45, progressive increase of osteoarthritis and possible effects of cumulative biomechanical overload (coxarthrosis, gonarthrosis, rizarthrosis...).

Reduced resilience to cumulative overload of muscles and tendons.

**CARDIOVASCULAR SYSTEM & RESPIRATORY SYSTEM:** from age 30 to 65, possible decline in lung function (40%) with consequent difficulty to carry out prolonged heavy tasks and/or work in harsh climates or microclimates; reduced cardiac output and maximum heart rate during exertion.

**SLEEP DISORDERS:** after age 50, a qualitative and quantitative sleep reduction alters the circadian rhythm, reduced tolerance to night shifts (see G. Costa's contribution).

**THERMOREGULATION:** greater difficulty to maintain body temperature in case of significant variation of outer temperature and other climatic or microclimatic parameters.

**COGNITIVE FUNCTIONS:** longer reaction times and reduced short term memory and attention span; less tolerance to disorganization; more time needed to think and learn new tasks; difficulty in learning new tasks, especially complex ones; less tolerance to changes and possible increase in work related stress (discrepant/debatable/controversial results have been shared on this issue). Some studies showed greater differences in stress resistance among subjects than age groups; sometimes healthy aged workers perceive less stress than young workers but experience more difficulties trying to adapt to changes and concern more about possibly losing their job. (Aging workforces and aging occupations: a discussion paper - New Zealand, 2007).

**DISORDERS:** Greater incidence and prevalence of chronic and degenerative diseases (diabetes, heart diseases, tumors), often with two or more at the same time. After age 50, frequent presence (30-60%) of at least one diagnosed disease, often affecting the musculoskeletal system (osteoarthritis, etc.) or the cardiovascular system (high blood pressure, heart diseases, etc.). Incidence of depression and dementia also increases with age.

The evaluation of such aspects is not intended as a reason to develop discriminatory approaches; on the contrary, it is mainly aimed at supporting the correct integration into work of hypersusceptible subjects. Workers' professionalism and personal work ability should always be taken into account.

## Work ability and [Work Ability Index](#)

After an ad hoc training of all involved professionals, monitoring the “Work Ability Index” with serial measurements, could be an important objective reference for a correct deployment and management of workers, especially those over 50.

Along with other items, the questionnaire can be used to monitor an aging worker, or a homogeneous group of workers, by assessing the coherence between workloads and health condition, or vulnerability, through approximate scores.

It can also be used for cross comparisons of different groups of workers.

In this case, the self-assessment questionnaire created by Illmarinen (translated by G. Costa) could be considered a useful addition to Health Surveillance to enrich risk knowledge.

However, individual Work Ability Index scores of single workers cannot and must not be the foundation of a statement of fitness for work.

A statement of fitness for work should rather stress the pathology severity and actual functional limitations in the light of the specific tasks performed by the worker and their relative noxae.

A subject’s work ability depends on the balance between work demands and individual resources; the condition in which subjects performs their tasks affects their adaptability. Above all, work ability is a matter of balance between work and personal resources; such balance can vary throughout a subject’s working life.

Maintaining and promoting work ability requires the cooperation of employers and all professional figures, including public institutions whose duties, in Finland, involve maintaining their employees’ work ability.

The Work Ability Index (WAI) is an instrument for the evaluation of work ability. It is a widely spread and studied index in the occupational industry. In a 1997 longitudinal study, such index was able to foresee the incidence of unfitness for work among Helsinki municipal clerks aged 50. Nearly two thirds of those with poor work ability had received a disability support pension over the next 11 years, while one third of those who were allowed to maintain the same job and, at the beginning, showed poor work ability, were able to improve their work ability thanks to appropriate interventions in terms of organization and rehabilitation. Further studies highlighted that as age increases, about 30% of workers over 45 (both genders) face a significant decrease of WAI, although it differs according to industry sectors. People who work in telecommunications, electronics, banking and the insurance sector seem to be the least penalized. Individual differences in work ability increase with age. An active population over 45 years of age is more heterogeneous than younger workers.

About 15-30% of workers aged 45 reach a mediocre or low score at WAI; unless corrective or preventive action is taken, they may lose their work ability.

It is then evident how WAI can be some sort of a “thermometer” apt at measuring the aging phenomenon; very low indices are associated with an existent issue while adequate indices are associated with a possible correctness of the chosen corrective intervention. It can also identify subjects at risk, monitor them throughout time, reveal if the health promotion program is having any effects on involved workers and compare groups of workers (e.g., different ages, different tasks, different department, etc.).

The WAI score is calculated using a self- or hetero-assessed questionnaire (filled out either by the workers themselves or by an operator during an interview). It includes questions on both physical and mental work demands, health condition and the worker’s resources.

This widespread tool has been translated into many languages and it originated by the idea that work ability is a worker’s most important asset; however, it is a complex concept as well as the result of the modulation of several factors.

Considering the previous paragraph, this questionnaire can truly be considered an instrument of

health surveillance (Costa et al, 2007) and it can be crucial for the monitoring of the aging process of workers. Filling out the questionnaire takes 10 to 15 minutes while the assessment ranges from 3 to 5 minutes, which makes it a very simple tool. Because it includes questions on sensitive data concerning workers' disorders and work ability, participation must be voluntary and the questionnaire must be administered and used only if workers give their consent, in full compliance with the protection of personal data.

By filling out the questionnaire, each worker obtains a score (the WAI) ranging from 7 to 49 total points, which is calculated by summing the points of 7 factors:

- 1- one's current work ability compared with one's life-time best (0-10 points);
- 2- work ability in relation to the demands of the job (2-10 points);
- 3- number of current diseases diagnosed by a physician (1-7 points);
- 4- estimated work impairment due to diseases (1-6 points);
- 5- sick leave during the past year;
- 6- one's own prognosis of work ability 2 years from now (1,4 e 7 points);
- 7- mental resources (1-4 points).

The total score is calculated following the instructions provided by the Finnish Institute of Occupational Health in Helsinki (Tuomi K, Ilmarinen J, Jakkola A, Katajarinen L, Tulkki A. Work Ability Index. Finnish Institute of Occupational Health, Helsinki. Rautoja and Pietilainen, Helsinki. 1998) and work ability is assessed by comparing the resulting WAI with specific criteria.

It can feature names (such as those used for health surveillance) or it can be anonymous (for risk assessment) and only show the name of the company, the task or homogeneous group, gender, age or age range and any possible codes assigned (and remembered) by the worker (e.g., initials of their mother and their own birth year) for longitudinal studies.

### **More instruments for occupational physicians**

Questionnaires for the assessment of occupational distress and work-related stress could also be useful instruments for occupational physicians; in case of subjects over 50, depending on single cases, modes and frequency of administration can vary. However, because the questionnaire includes questions about work conditions and interpersonal relationships to which not all workers are willing to answer, not even in an interview with an occupational physician who is bound by doctor patient confidentiality, the use of anonymous questionnaires for homogeneous groups is advisable to assess and monitor risks.

This would allow to draw conclusions and make comparisons between homogeneous groups rather than individuals. Individual data can be elicited through questions about the medical history, giving reasons for their link to the individual's health surveillance and allowing them to decide whether to answer.

It is strongly advisable for occupational physicians to use a specific shared software and save a digital copy of the data collected through health surveillance. The experience of Veneto region concerning the healthcare sector is very interesting.

This could facilitate the analysis of the results, including those carried out by age, and would contribute to an ongoing monitoring of workers' health examinations, thus identifying differences, even small, due to progressive aging.

The software programs used by occupational physicians should also uniform their procedures, thus facilitating the analysis of large cohorts of workers and their comparison.

This would broaden the knowledge, also in terms of monitoring of the aging process, and would integrate the actual consequences of workers' health surveillance.

### **The statement of fitness for work**

The statement of fitness for a specific work is required (when envisaged by the law) to perform any work tasks identified as “at risk” on the Risk Assessment Document.

The statement of fitness for work issued by an occupational physician can be defined as “the evaluation of the possession of necessary psychophysical requisites and the absence of contraindications to the performance of a specific task in relation to, first and foremost, the presence of occupational risk, confirmed and reported on the Risk Assessment Document, and to the job’s characteristics that, for subjects with specific disorders, could contribute to worsening the health condition and safety in the workplace” (*Safety and Health at Work Directive 89/391/EEC*).

As such, it is the final step of a journey started by an occupational physician after a critical analysis of the collected data. The assessment process can end in several different ways, summarized below according to our reading and operational proposal:

- fit for work: fully fit for work;
- partially unfit (temporarily or permanently): fitness (cannot be changed by prescriptions) is limited to some tasks included in the job;
- unfit for work: unfitness (cannot be changed by prescriptions) concerns all tasks included in the job, hence the worker cannot be used productively for that job;
- temporarily unfit for work: unfitness, either total or partial, is limited in time;
- fit with conditions: fully fit if some given conditions are met.
- fit with restrictions, i.e., excluding given situations or tasks.

A statement of fitness for work can be either permanent or temporary; a permanent fit note implies that the underlying health condition will not change throughout a subject’s working life. A temporary fit note implies that the health condition is limited in time.

For what concerns the aging of the labor force, the restrictions issued by an occupational physician – especially for unfit subjects – can be essential instruments for the prevention of possibly more severe consequences and the protection of a worker’s health status. In the light of the experience acquired so far, the dynamics of the aging of the labor force highlights the need for new approaches to the management of the phenomenon, characterized recently by a progressive increase in the number of non-fit workers, especially in some sectors (including healthcare).

A multiple approach is crucial, as well as the customization of the statements of fitness for work; as mentioned above, instead of simply apply the existing bureaucratic definition, which often leads to expulsions, marginalization or disputes, they should reflect the real differences among individuals and tasks.

## 1.11 WORKPLACE HEALTH PROMOTION

Rinaldo Ghersi

The workplace, along with the school, hospital, city, island, and marketplace, has been established as one of the priority settings for health promotion into the 21st century.

Because people spend most of the day at their workplace, it is easier to reach and involve them there both by spreading information and knowledge about the importance of a healthy and active lifestyle, and by providing opportunities to move (route home to/from work, using the stairs, mobility exercises during the break, walking groups...). By operating on the adult population, pushing them to improve their lifestyle and their physical efficiency, we are also safeguarding the future elder population, making sure they are in better psycho-physical conditions. To operate on the elder population itself means to preserve general wellness conditions, which, in turn, guarantees better working validity and ability.

To further stress the importance of a health strategy, the 2014-2018 National Prevention Strategy listed Workplace Health Promotion among its goals and pointed out the model used in Lombardy as a valuable reference. As a consequence, all the Regional Prevention Strategies did, too.

Below are a few brief reflections:

Starting with the fact that all protections for health and safety in the workplace must be provided and that they should be given maximum priority, nonetheless the workplace could become a favorable place (as is the school) to develop health promotion strategies addressed to workers and, consequently, their families.

However, a specific distinction must be made and explained to companies and workers:

- Workplace health promotion, intended as a well-defined strategy, is a voluntary activity; it is not mandatory for workers or companies. Even if workers are participating in the activity, occupational physicians should be involved in the light of the *Safety and Health at Work Directive* 89/391/EEC (as well as the multiple approach to active aging). After all, many occupational physicians actively promote health within their Health Surveillance (counselling for smoking cessation, eating disorders, alcohol, etc.). Besides, more and more companies (especially multinationals and/or big, structured corporations) are investing on workplace health promotion, with the aim of safeguarding health conditions and work ability of the workforce (be it for the workers or for the company's profit) and earning/receiving the allotted financial benefits (INAIL- National Institute for Insurance against Accidents at Work-, IRAP, etc.).
- Workplace health promotion cannot and must not replace risk prevention and health surveillance.
- The European campaign 2016-2017 and national initiatives are promoting examples of best practice concerning the management of the aging workforce. Such useful content can contribute to feasibility estimations.

EU OSHA Campaign, Healthy Workplaces for all Ages, 2016-2017 <https://healthy-workplaces.eu/en>

### KEY POINTS

-The workplace, along with the school, hospital, city, island, and marketplace, has been established as one of the priority settings for health promotion into the 21st century (WHO).

-WHP programs should be implemented in companies that comply with the regulations concerning prevention, health and safety in the workplace.

- WHP programs can be beneficial for aged workers' working ability and productivity, allowing them to keep doing their job safely until retirement age.

- It is necessary to share such experiences on an international scale and assess their effectiveness and actual cost-benefit relationship. This would allow for an optimization of strategies.

## **1.12 HUMAN RESOURCE DEPARTMENT, OCCUPATIONAL PHYSICIAN AND HSO**

*Quintino Bardoscia, Giovanbattista Rosa*

The best corporate management realities have always kept work conditions and workers' health into account, both for "defensive" reasons and, although more rarely, for cultural reasons.

Over the past decades, the Human Resource Department often limited their role to internal "referee" in case of disputes between specialists who pushed for more protective measures and line managers who considered them as obstacles to productivity.

However, things have been changing. As a topic, workers' health is no longer perceived as refractory and defensive; instead, it has become a part of a wider concept known as "corporate wellness". It is finally clear that avoiding unhealthy or dangerous tasks is not enough; actively promoting worker's psychophysical well-being is advantageous and efficient.

Omitting any considerations concerning sensitivity and corporate values that more and more fall out of the pure economical aspect, people have realized that "actual" healthier employees also mean "actual" healthier, more productive and effective companies. Some companies are even working on a "company fitness index" (CFI) that measures all aspects of corporate wellness as a whole; from sick leaves to lost nights due to insomnia, from the number of overweight employees to those who report chronic work stress and much more.

In terms of social responsibility, promoting spontaneous initiatives – without explicit requests from union trades or evident risks reported by the specialists – is no longer considered a philanthropic whim. It is a practice requested by public and private institutions, European agreements and "corporate policy" used by numerous multinational corporations.

The first signal of a more responsible Human Resource Department was the introduction, some years ago, of occupational health indicators (first of all, the reduction of preventable workplace injuries) in many managerial incentive systems.

This new approach is partly visible in the outsourcing policies that for many reasons prevailed in the modern production systems, especially for dangerous or uncomfortable productions. In view of the many notorious situations in which outsourcing was a way to abate the willingness to deal with the increasing health issues, an ever-greater number of companies, in compliance with the indications provided by the institutions that define the sustainability ratings, in addition to union trades requests and regulations, is intervening spontaneously through the Human Resource Department and HSOs to apply their health and safety standards (minimal comfort, too, more and more often) to their contractors and suppliers.

This has been made possible by the ongoing fast aging of the work force (among OECD countries, Italian companies show the highest mean age for workers) due also to Fornero Law, on one side, and the growing importance of "sustainability reports" within the "Corporate Social Responsibility". On one side, it is evident how workers' motivation and performance depend nowadays on their psychophysical health condition, as well as on stress management, a proper organization of working hours and times, a shared interest in the reduction of work ability caused by the aging process and in the prevention of injuries and inabilities (mental and physical). The attention paid to this aging process revealed a strong relationship between prevention, lifestyles, health, unfit status and safety. On one side, companies will find themselves with a working population made mostly of subjects aged 50 and above whose overall "fitness" will be essential to the future of the company itself. On the other side, they will soon be dealing with a big percentage of "elderlies", aged 65 and even above, who will require some sort of changes to the work organization and flows, work stations and, in general, the whole work and production process.

Such awareness, especially widespread among large companies, may mean that time has come for a direct involvement of the Human Resources in health and safety programs; because they traditionally represent the "organizational culture" of a company and deal with the selection, development and management of people who are part of the production process, their role is nothing but crucial. Their contribution is relevant throughout the entire preventive process, from the analysis of the functional demands of jobs, tasks and activities, to the identification of exposure levels of workers to traditional

physical and chemical risk factors, from the evaluation of organizational, psychosocial and gender risks, to the study of the aging process in the workplace.

The development of a corporate Prevention Program aimed at promoting health and active aging protection, technical and plant interventions, while also focusing on peculiar anthropological, epidemiological and social characteristics of the corporate population is fundamental.

In brief, it is necessary to adopt a biopsychosocial approach to risk assessment, to the social connotation of the workforce and the analysis of anonymous and collective data acquired by occupational physicians through health surveillance and the creation of a Prevention Program.

A circular ergonomic process that facilitates the adjustment, over a pre-established time, of the workplace and work organization to the real work ability of people who perform such assigned activities on a daily basis, also considering their geographical origins, gender and age.

A process that could be described as of “reasonable accommodation”, that is “any change in the workplace or the way things are customarily done that provides an equal employment opportunity to each individual (including people with a disability)”.

The idea of “reasonable accommodation” was introduced in the early '90s in the United States with the American with Disability Act, within the scope of programs promoting integration and non-discrimination of minorities, including people with disability.

In May 2001, the World Health Organization published a new classification system called the I.C.F. (International Classification of Functioning, Disability and Health): it measures and classifies the levels of human functioning and links personal factors, associated with individuals and their community, with environmental factors related to the physical and relational sphere. Hence, the possibility to study, describe and classify the physiological phenomena associated with the aging of the workforce in order to monitor their physical and cognitive impact on several job activities.

The ICF has been used by Italian I.N.A.I.L. to manage the reasonable accommodation of industrially disabled people (due to injury or disease) in need of employment services.

The role of the Human Resources is emerging as closer and closer to the Health and Safety Department, not only for their contribution as specialists but also as a bridge between the technical culture, represented by HSOs, and the biological culture suggested and demanded by occupational physicians.

No longer mere referees in the debates between prevention specialists and line managers, HR managers are now becoming actual key players in the prevention game.



## 2. MANAGING THE AGING HEALTHCARE WORKFORCE

### 2.1 THE AGING OF THE HEALTHCARE WORKFORCE

*Olga Menoni, Donatella Talini*

The aging of the workforce and of patients seems to be an unstoppable phenomenon that present significant challenges to the national health service, requiring the implementation of innovative strategies.

Overall, the aging of the healthcare workforce will have a considerable impact on the healthcare system; for this reason, personnel policies need to be reoriented.

The number of nurses over the age of 45 will increase, reaching more than 50% of the entire staff. Keeping older nurses in the workforce will definitely cause serious problems, already reported in the literature, that need to be taken into account: tasks that require considerable physical effort and work-related stress can be less tolerated by an older workforce.

It is fundamental to keep nurses in the workforce as much as possible due to their experience and the lack of new hires. In order for this to happen the (physical and organizational) work environment must allow them to provide professional performances.

A greater employee commitment, new role definition, clarifications, constant monitor and new interconnections are urgently needed.

"Case management" models should be concretely applied; the redefinition of functional areas must be strictly managed and monitored.

Besides, it is strongly advisable to redefine culture and values according to the tradition and ethical code of nurses and physicians, on one side, and to the needs of the healthcare sector; the central role of the individual (patient, user etc.) must be highlighted as it helps with the interpretation guidelines and professional experiences associated specific patients, who need to be informed and consulted.

Professional communication becomes therefore crucial, especially within the staff and on a multi-professional and inter-professional level.

An efficient handover could instantly benefit the quality of care and patients' safety through a constant monitor of clinical decisions.

Within this context, age becomes an important factor that highly affects individuals' work ability. Gender must also be considered, especially for nurses and OSS, who are mostly women and are often in charge of parental care (addressed to family and children between 25 and 40 years of age and to parents and other relatives over the age of 50).

A double workload, work and family, that radically influence their health status and overall wellbeing.

For these reasons, it is easily predictable that certified disabilities, absence from work due to law 104 (for the actual workers or their own relatives) increase with age.

Multitasking, another constant in today's working life, is another factor that can cause double, triple, even quadruple workload.

Multitasking means performing one two or more tasks at the same time, thus using more cognitive resources than usual. The amount of daily mental workload of healthcare professionals, therefore, increases.

This increases the probability of error (adverse event, any undesirable experience associated with the use of a medical product in a patient; it is a complex process and involves different individuals).

Adverse events usually involve the nurse staff and are caused by the wrong interpretation of a medical treatment, the transcription of medical products on sheets used for administration of medicines, the administration of non-prescribed or withdrawn medications, the lack of patient identification, all the tasks that require a high level of attention and are, therefore, more affected by

habit or distraction. Such tasks are more common among experienced professionals rather than new entrants (who devote a higher level of attention to numerous tasks that are still new to them).

The use of check-lists can partially solve the problem and reduce the probability of such mistakes together with rule-based mistakes. Older healthcare professionals can count on their long professional experience that can and must be widely exploited from the ergonomic point of view.

The aging of the workforce in the hospital/healthcare sector is common to all developed realities and sectors (OECD, 2014) as the result of two main factors: demography (associated with the aging of the general population) and economy (related to the financial crisis faced by social security systems).

Moreover, the steady increase in retirement age accelerates the aging of the workforce quite sharply, having important consequences in terms of organization and management (Buerhaus et al., 2000; Camerino, 2004 ; Keller et al., 2010, Maricchio 2013).

The European NEXT study, conducted from 2002 to 2006, had already studied nurses' working conditions and health status by age (age ≤ 45 years → 29%) in ten European countries; a further factor that has been studied was the desire of leaving the nursing profession.

In most countries, older nurses admitted they had thought about leaving their job more often than younger colleagues. The results have shown that poor health among nurses is very common in many healthcare realities. Current economic, political and demographic trends suggest that the number of nurses working in poor physical health is going to increase.

This situation represents a future challenge for health surveillance in the workplace. The results of the European NEXT study showed that, in order for nurses to stay healthy while working, preventive interventions must take into account all factors associated with work organization.

In the USA, one physician out of three works past age 65, in Canada one out of ten does. In Italy, most general physicians are over the age of 55 while those with less than 40 years are the minority. The biological age of healthcare professionals is becoming more and more important, given the technological and technical changes that are occurring in the healthcare sector and require a high degree of adaptability. Besides, integration difficulties might be faced due to the generation gap between healthcare professionals.

In Italy, the aging of the workforce in the healthcare sector is linked to an increase in health problems that, in turn, lead to a higher number of certifications of unfitness for work for some jobs.

Surveys conducted in this sector demonstrated that healthcare professional (nurses, in particular) experience an earlier and substantial decrease in WAI while aging compared to workers who perform lighter tasks/office workers.

The NEXT Study also showed that a healthy work environment led to higher levels of WAI whereas lower levels of WAI led to the desire of leaving the job.

The major organizational changes that are currently occurring in the healthcare sector do not always guarantee a healthy work environment (Costa G. et al., 2005).

The history of the Italian welfare system in the last 15 years accounts for a change that is currently relatively fast.

Hospitals along with northern and central Italian regions are in charge of the care for acute health conditions/ severely ill patients whereas local health units deal with medical care and rehabilitation.

Moreover, new figures providing basic health care (nursing aides) have emerged due to the lack of nursing staff (especially in some areas) and the economic crisis.

The topic of the aging workforce in the healthcare sector arose in Italy due to the difficulty in the management of workers with conditions.

**Table 5: mean chronological age of healthcare workers in wards.**

Year	Hospital/Nursing home	Mean age	N° exposed subjects	% Fit with conditions
96-99	Hospital wards	36	1566	6
	Nursing homes		1535	12
2003	Hospital wards	36,5	2603	14
2006-8	Hospital wards in Liguria region	42	1994	14
2008-9	Nursing homes in Veneto region	41	178	8
2015	Hospital wards in Apulia region	48	2717	8-17

Since 1997, after developing the MAPO index for risk assessment of patient manual handling in hospital wards, the Ergonomics of Posture and Movement (EPM) Research Unit conducted a first multi-centered study (1999) in different Hospitals of northern and central Italy. Three further studies to validate MAPO methodology with the aim of ensuring that increasing levels of exposure caused greater damage to the lumbar spine). Data collection has been organized by age and gender (Battevi et al., 2006; Battevi et al., 2012; Cantarella et al., 2018).

Table 4 highlights the extent of the problem by reporting the mean age of healthcare workforce in wards: changes began around 2004-2006.

Besides, an evolution in terms of aging of the workforce in nursing homes and hospitals was reported in Liguria, Piedmont and Apulia regions.

As highlighted in the last study, older age groups cause difficulty in the management of "active aging": an actual management and control of preventive strategies, as suggested by the recent technical report ISO TR 12296, is the only solution.

**Table 6: distribution by age groups of the studied reported in Table 5.**

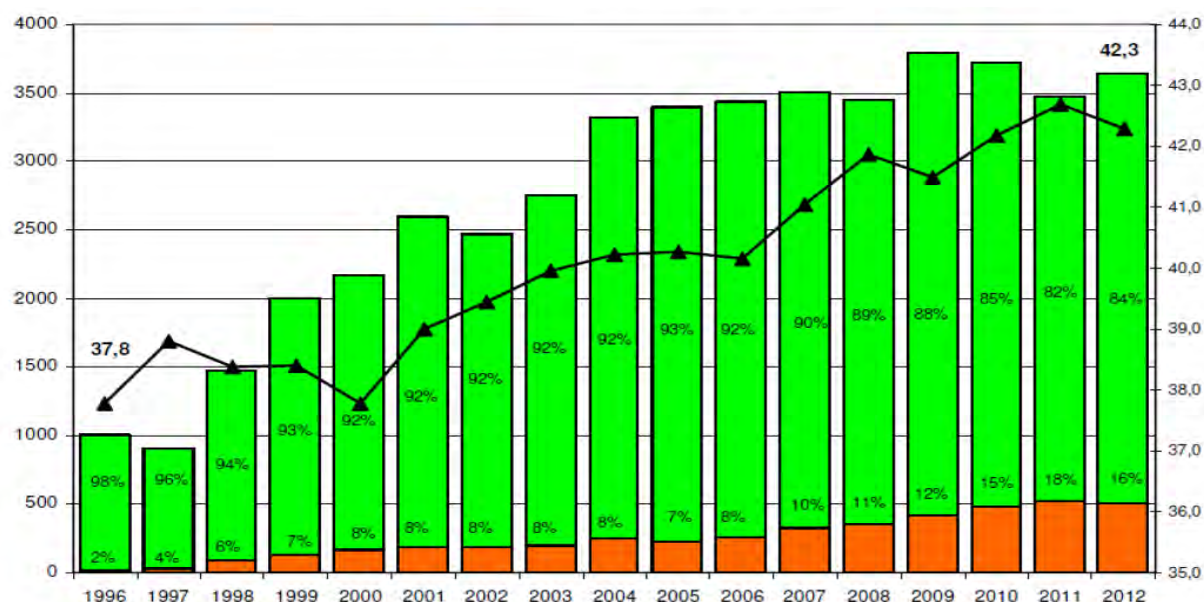
Year of the study	AGE GROUPS			
	<= 25	26-35	36-45	>45
	%	%	%	%
96-99 Hospitals	13 %	48 %	23 %	16 %
96-99 Nursing homes	8 %	40 %	35 %	17 %
2003 Hospitals	4,7 %	45,3 %	30 %	20 %
2006-8 Hospitals	1 %	16 %	49 %	33 %
2008-9 Nursing homes	5 %	20 %	34 %	41 %
2015 Hospitals	0,1 %	6,9 %	29 %	64%

A recent study conducted in Tuscany (Talini et al., 2014) analyzed the results of 20-year medical examinations of a hospital workforce in Tuscany.

All medical examinations accounted for the mean age of workers in the period considered (Table 7).

**Table 7: proportion of limitations on the total amount of medical examinations conducted in a**

■ medical examination with limitations    
 ■ medical examination with no limitations    
 —▶ mean age of subjects

**big hospital in Tuscany**

Other studies (Berliner HS, 2002; Piccoli et al, 2008; Guardini, 2011) pay particular attention to the problem of managing an aged workforce (table 8)

**Table 8: mean age of healthcare operators in other studies.**

Year	Hospital	Mean age	N° exposed to MHP	References
2000	Nurses in USA	45,2	Not reported	Berliner HS,2002
2006	Hospital wards in Piemonte region	38-40	2800	Piccoli M, 2008
2008	Hospital wards in Friuli region	39-41	2150	Guardini I, 2011

The aging of the workforce in the healthcare sector requires efficient management on different levels (occupational physicians, Health and Safety managers, Workers' safety representatives), focusing on organizational and environmental aspects in order to minimize health problems that usually increase with age.

## 2.2 PROPOSAL FOR AN INTEGRATED APPROACH

*Olga Menoni, Tiziana Vai*

Many political and procedural strategies adopted by different documented companies have been formulated in order to help an organization develop an answer to musculoskeletal disorder among "hypersusceptible" healthcare workers (especially aged ones).

Before talking about the implementation of a preventive strategy plan in the Italian healthcare framework it is necessary to define the main "environmental" characteristics of health facilities, that usually range from:

- Furnished buildings, often obsolete and requiring renovation, used 24/7 (thus leading to difficulties in maintenance and renovation)
- Buildings used by workers, patients, visitor, volunteers. As highlighted in the first part, aging healthcare professionals find it more difficult to
  - Cope with major physical efforts (69%)
  - Stand for a long period of time (59,5%)
  - Maintain awkward postures (57,1%)
  - Deal with time pressure (35,7%)
  - Be interrupted while working (28,6%)
  - Multitask (26,2%)

Healthcare professions, especially nursing, have several characteristics: they are exposed to manual patient handling, awkward and fixed postures, prolonged and fixed standing position, shiftwork and night work. The work environment is emotionally intense; stress and reduced work ability should be always taken into account.

One of the main problems of the active aging in the healthcare sector is the prevention/aggravation of diseases (musculoskeletal, in particular) as well as the management of shifts and workload. Other important psychosocial factors are reported in F. d'Orsi's chapter.

The obvious consequence of the redeployment of hypersusceptible workers to roles with reduced workload and acceptable shifts is the risk of premature pathological aging of younger workers.

Developments in the healthcare systems, especially in Europe, have meant that hospitals are increasingly viewed as centres for the short – term treatment of acute patients, while long-terms care is delivered in the patient's own home or in other structures. Such change leads to an increase in the total number of patients whose clinical conditions require their handling and/or lifting (causing biomechanical overload).

Italy presents numerous regional differences, concerning:

- Average length of stay for patients in medical/surgical wards
- Ratio healthcare professionals/number of beds
- Different tasks of healthcare professionals
- Lack of workers
- Type of shifts

Other European countries opted for an actual management of aged workers' safety through a shared preventive strategy.

A systematic revision of preventive interventions on the risk of biomechanical overload in this sector (Hignett et. Al.) proved since 2003 that intervention based solely on training had limited impact on the rate of occupational injuries.

The adoption of corporative policies and specific procedures to implement them helps the organization manage its resources – in terms of different roles (occupational physician, health and safety managers, workers' health and safety representatives...)- that cooperate to manage difficulties and find optimal solutions.

The following aspects should be taken into account to plan and organize a safe and efficient task assignment program:

- Analysis of work organization for different professional profiles, preferably by task. The occupational physician should help define work tasks and corresponding risks; He should also be involved in tailored programs that may be necessary in case of presence of workers with conditions. See previous chapter for Health Surveillance.
- Supply of proper equipment that should be available before workers' training program
- Environmental prevention (spaces suitable for the use of equipment or beds/ stretchers handling)
- Workers' training – as provided for by TR ISO 12296: the definition of a role aimed at supporting workers (ergo-coaches, peer leaders) proved to be beneficial in reducing musculoskeletal disorders. Ergo-coach and peer leader are different terms that define a professional figure that originated in the Netherlands and is now spreading throughout Europe and the USA with the aim of training workers to the correct use of equipment provided in the workplace.
- Nurses and head nurses should cooperate to implement best practice initiatives and check the effectiveness of the actual use of the equipment provided.

This kind of risk management strategy would actually allow the promotion of age diversity management in the healthcare sector as well as a significant improvement of quality care.

In order to promote active aging in the workplace, the will/possibility to manage the age of the entire workforce is fundamental.

Integrated solutions are absolutely necessary:

- Improving workplace adaptation (e.g. improving and implementing safe work procedures, carefully managing shifts, assessing equipment, lighting and floor conditions), assigning appropriate tasks to aged workers, especially to those with conditions. Increasing teamwork, reducing manual handling of loads, reducing/avoiding shiftwork and work in the emergency and operating rooms, etc.) ;
- Monitoring all workers' work ability with adequate instruments (Illmarinen's questionnaire in Italian, by Costa) in order to maintain/improve it through health promotion interventions (especially associated with smoking, diet and physical activity)
- Favoring early retirements due to disability - not common in our country due to the economic crisis that is hindering national economic policies.
- Allowing aged workers -who are not disabled enough to retire early but are unfit for their job and not redeployable- the access to unemployment benefits.
- Increasing the duration of unemployment benefits
- Favoring early retirement of shift workers and night workers
- Detailed age management strategies should be promoted to reduce the negative effects of the present situation (which can only get worse, given the latest pension regulations) and enhance those abilities that improve work performances, using them as precious resources within the system.

## 2.3 AGE-SENSITIVE APPROACH TO RISK MANAGEMENT

*Olga Menoni, Donatella Talini, Carlo Nava, Marco Tasso*

The main risk factors for healthcare professionals are:

- **Ergonomic factors:** manual handling and lifting of patients; awkward or painful postures;
- **Psychosocial factors:** high work pace or excessive workload; threats and physical violence; shiftwork; work-home balance;
- **Biological factors:** risk of exposure to potentially infected body fluids/ airborne agents;
- **Risk of injury:** accidental falls; needlestick injuries/sharp object injuries

In terms of aging, ergonomic and psychosocial factors require particular attention.

### 2.3.1 RISK ASSESSMENT FOR THE MUSCULOSKELETAL SYSTEM

Available literature on biomechanical overload risk in relation to age does not provide any specific criteria.

The main question remains how to interpret the different tasks performed by different professional profiles from the point of view of the extent of biomechanical overload for subjects aged  $\geq 45$  and link them to work organization: studies on occupational biomechanics provide a complex answer for what concerns the lumbar spine.

Through biomechanical models, such studies defined tolerance limits (with regards to different applied forces) for every anatomical structure of the functional unit of the spine (intervertebral disc, ligaments-tendons, posterior articular processes); such limits must not be exceeded to avoid biological damage to the single parts of the vertebral column (Marras 2008).

From 2000 to 2010, these studies went from mostly static models, used to estimate the compressive forces impacting the intervertebral disc in several work situations, to multidimensional models that observe the dynamics of movements. Especially for the lumbar spine, such models highlighted the influence of physical exposure factors related to the risk of Low Back Pain.

These biomechanical models consider both single tasks causing a specific overload that exceeds tolerance limits ("traumatic acute failure") and cumulative overload (excessive handling frequency, exposure duration or age).

For what concerns age, the lowering of tolerance limits has been widely discussed in the reviews investigating the relationship between physical exertion (occupational) and overload of the lumbar spine (Marras, 2008; Jager 2008).

Dortmund University identified age-and-gender related limits for lumbar-disc compressive forces (Table 9).

**Table 9: Age and gender related limits for lumbar disc compressive forces, here applied to the evaluation of manual patient transfer activities**

Dortmund recommendations evaluating the biomechanical load on the lumbar spine during manual materials handling			% Reduced tolerance by age
AGE	FEMALES	MALES	
20 years	4,4 kN	6,0 kN	
30 years	3,8 kN	5,0 kN	
40 years	3,2 kN	4,1 kN	
50 years	2,5 kN	3,2 kN	43%
60 years	1,8 kN	2,3 kN	59%

Current methodologies for Manual Patient Handling risk assessment do not provide any classifications by age, as observed in the review issued by 2012 Technical Report ISO 12296, specifically dedicated to patient handling and entitled “Ergonomics - Manual handling of people in the healthcare sector”. This technical report fills in a specific gap in the international panorama of physical ergonomics regulations and identifies the need for a strategic approach to the issue and an adequate risk assessment providing useful elements to manage risk and including the following items: number of patients to be handled, number of ward operators, aiding systems and their actual usage, features of the handling environment, training of the operators in charge of handling patients.

The preliminary review of the most qualified bibliography on the matter, found in TR 12296, identified the following main factors that, all together, characterized specific occupational exposure to the risk associated with patient handling and awkward postures:

- number of dependent patients;
- type/degree of total or partial lifting tasks performed regularly;
- structural aspects of working environments and wards;
- equipment available and actual use;
- specific training for operators.

Risk assessment provides the basic knowledge to detect those elements that may actually lead to better working conditions after a corrective intervention. Besides, through an up-to-date risk assessment, implemented corrective actions can be monitored and verified.

An analysis of such aspects can be carried out using the MAPO methodology included in TR 12296 (Menoni et al., 2014). A widespread method in Italy, it recognizes the following exposure levels (Table 10).

**Table 10: levels of exposure to patient handling risk with MAPO methodology**

Mapo index	Exposure level
0	ABSENT
0,1 - 1,5	NEGLIGIBLE
1,51 - 5	MEDIUM
>5	HIGH

#### **Assessing the risk associated with patient handling in relation to age**

The aforementioned main studies on occupational biomechanics highlight that aged subjects shouldn't perform manual patient handling, even with a partner. Below are some suggestions for an effective management of active aging of the workforce:

- Subjects over 50 years of age can only handle patients using aids and with a partner (even partially collaborative patients).

By doing so they would be able to remain in their ward and maintain their specific expertise.

managing such restrictions is more complicated if the operators are exposed to high risk, therefore:

- Subjects over 50 years of age shouldn't be assigned to wards presenting high risk.

Besides, considering their reduced tolerance to excessive loads...

- Subjects over 50 years of age will be exposed to a greater Mapo index than the rest of the working population in the ward.

- Subjects over 50 years of age should never be assigned to shifts as single operators.

For population < 45 years of age, risk estimation criteria can be defined for the shoulder and knee regions concerning the level of risk associated with manual material/patient handling and exertion applied by upper limb (ISO 11228-11226-1005-4 and 5; Marras 2008; Reid 2010); such criteria are showed in Table 5 – 1st column.

Considering their reduced tolerance for biomechanical overload, subjects  $\geq 45$  are exposed to a higher level of risk of musculoskeletal disorders (affecting shoulders, knees, lumbar spine) – see table 11

**Table 11: criteria for the evaluation of biomechanical overload risk by age macro-groups.**

ESTIMATE OF PHYSICAL RISK		SHOULDER	LUMBAR SPINE	KNEE
< 45 years	$\geq 45$ years			
		Hard exertion with Borg scale >5 (from 6 to 10) or awkward postures (flexion or abduction of upper limb $\approx 60^\circ$ )	Manual handling of non-cooperative patients/loads or flexion >45°+ rotation/inclination or flexion >60°	Manual handling of non-cooperative patients/loads or squatting postures
		Moderate exertion with Borg scale from 3 to 5	Lifting of patients /loads with aids + flexion >45°	Lifting of patients /loads with aids with no previous training
		Easy exertion with Borg scale < 3	Lifting of patients/loads with aids, acceptable postures	No MHP, MHL nor squatting postures

a. Assessing tasks and overall risk in relation to age

When dealing with physical hazard in the healthcare sector, the following considerations are necessary:

- musculoskeletal disorders are among the main causes of morbidity in the healthcare sector, leading to an increasing number of “fit with restrictions” or “fit with conditions” notes which emphasize a real issue concerning actual and possible restrictions in the assigned ward/sector.
- a positive association (see chapter 2.4) was found between musculoskeletal disorders affecting the lumbar spine and other regions (shoulder, knees) and patient care tasks.

An analytic reconstruction is necessary to assess physical hazard for every professional profile and, at the same time, implement an active management of the workforce in the healthcare sector.

An easy digital instrument was created for the analysis, similar to that introduced in chapter 1 but entirely designed for the healthcare sector.

The main goal is a quick, overall identification of possible risk factors in relation to age macro-groups. This simple tool can be used by different users, such as:

- HSOs
- Occupational Physicians
- Workers Safety Representatives (WSR)

Data collection is performed as described in chapter 1 and provides recap information on corporate data, workers' group divided into age macro-groups, performed tasks in the analyzed job in line with the scheme showed below (and taken from the risk parameters relevant for age defined in the INRS checklist).

<b>AGE-SENSITIVE RISK MANAGEMENT</b>			
<b>DATA OF HOSPITAL/RESIDENTIAL CARE FACILITY AND OPERATORS</b>			
<b>HOSPITAL/RESIDENTIAL CARE FACILITY</b>	<b>TASK</b>		
	<b>MALES</b>	<b>FEMALES</b>	
<b>N° WORKERS</b>			
<b>&gt;45 YEARS</b>			
<b>JOB DESCRIPTION</b>			<b>IF YES x</b>
<b>LIST OF TASKS</b>	<b>A</b>		
	<b>B</b>		
	<b>C</b>		
	<b>D,E,F.....</b>		
<b>DEFINITION OF PRESENT AND ABSENT RISKS FOR EACH TASK DESCRIBED</b>			
<b>RISKS ASSOCIATED WITH PHYSICAL WORK</b>			
<b>RISCHI ASSOCIATED WITH WORK ORGANIZATION</b>			
<b>RISCHI ASSOCIATED WITH WORK ENVIRONMENT</b>			
<b>FACTORS THAT PENALIZE THE DEVELOPMENT, USAGE AND TRASMISSION OF KNOWLEDGE (REPORTED BY JOB AND NOT BY TASK)</b>			
<b>PSYCHOSOCIAL FACTORS (REPORTED FOR JOB AND NOT BY TASK)</b>			

A digital instrument together with a legend on how to use different excel sheets can be downloaded from [CIIP's website](#).

The last pages of the Excel file aim at identifying the most effective preventive strategies for every risk factor highlighted in the recap as a summary of all tasks.

The excel sheet "results" helps to define important risks associated with age: it is therefore fundamental to define a prevention plan following the instructions reported in the excel file.

As mentioned in other chapters, a more specific tool for the analysis of workloads needs a reconstruction of performed tasks along a timeline that links the extent of biomechanical overload and "target organs of the musculoskeletal system".

A similar tool, applied to a professional reality such as inpatient wards, would include the following items:

- professional profile and relative working hours
- age macro-groups ( $\leq 45$  years,  $> 45$  years)

The following data are reported in the initial phase:

- total number of nurses divided by age macro-groups
- total number of OSS divided by age macro-groups
- total number of nurses' aides divided by age macro-groups
- number of beds (in-patient wards); number of admissions/day (services; ER); number of surgeries/day (surgery units)

Some Italian integrated safety management systems (GUIDELINES OF VENETO REGION ON SGS) provide very detailed reports of all tasks and activities as a result of a solid collaboration between occupational physicians, HSOs, WSRs and head nurses, with the aim of better managing workers with restrictions.

The same logic can be applied for workers with lower tolerance to physical risk.

This section shows an example taken from the collaboration between Clinica del Lavoro Milano - Department of Ergonomics and Tuscany region: a "specific three-year program aimed at training prevention technicians of the 16 local health units across the Tuscan region" that ended with a conclusive seminar held in Florence on 7 May, 2014.

A sample reconstruction for healthcare workers in a hospital ward on their morning shift (7.00-14.00). The same method can be applied to reconstruct the other shifts as well.

Table 12 shows the characteristics of the staff in charge of care activities; the ward hosts a remarkable number of dependent patients and a large number of exposed workers aged > 45.

**Table 12: description of the medicine ward (staff and main features)**

PROFESSIONAL PROFILE		AGE <= 45 YEARS		AGE > 45 YEARS	
NURSES		5		21	
NURSING AIDES		1		14	
Nurses' typical shifts		7:00-14:00	14:00-21:00	21:00-7:00	
Nursing aides' typical shifts		7:00-14:00	14:00-21:00	//	
N° BEDS	N° 54	Type of beds: height-adjustable with manual lifting of bed head and foot			
TYPE OF PATIENTS					
Self sufficient		Fully non-cooperative		Partially cooperative	
N° 7		N° 28		N° 19	
Lifting aids 1 for obese people		Other aids BEDS		Notes	

From the difference in working hours of the two professional profiles we can deduce that night shifts are assigned to qualified nurses only.

Tasks involving biomechanical overload are generally performed by OSS whereas qualified nurses, in this ward, are in charge of monitoring vital signs, making rounds with medical staff, compiling nursing documentation.

Below is a description of the single tasks performed in the aforementioned ward during morning shifts (tables 13, 14 and 15), divided by professional profiles and age macro-groups.

**Table 13: tasks generally performed by nursing aides during their morning shift and their biomechanical overload for subjects aged ≤ 45**

Schedule	NURSING AIDES' TASKS	Biomechanical overload for ≤45 years					
		shoulder		Lumbar spine		knee	
MORNING SHIFTS							
7.00 - 7.20	Communicating with medical staff, nurses and doctors						
7.30 - 8.30	Assisting patients with bathing and patient handling						
8.30 - 9.15	Serving breakfast						
9.15 - 10.30	Assisting non cooperative patients with bathing; helping them move						
10.30 - 10.45	Break						
10.45 - 11.30	Managing the cleaning/disinfection of mattresses ( $\alpha$ )	$\alpha$		$\alpha$			
11.30 - 12.30	Assisting physiotherapists <i>with patient handling</i>						
12.30 - 13.00	Serving lunch to non cooperative patients						
13.00 - 14.00	MHP ( $\beta$ ) for rest - hygiene	$\beta$		$\beta$		$\beta$	

**Table 14: tasks and their biomechanical overload for nursing aides aged > 45**

Schedule	NURSING AIDES'S TASKS	Biomechanical overload for >45 years		
		shoulder	Lumbar spine	knee
MORNING SHIFTS				
7.00 - 7.20	Communicating with medical staff, nurses and doctors			
7.30 - 8.30	Assisting patients with bathing and patient handling			
8.30 - 9.15	Serving breakfast			
9.15 - 10.30	Assisting non cooperative patients with bathing; helping them move			
10.30 - 10.45	Break			
10.45 - 11.30	Managing the cleaning/disinfection of mattresses ( $\alpha$ )	$\alpha$	$\alpha$	
11.30 - 12.30	Assisting physiotherapists with patient handling			
12.30 - 13.00	Serving lunch to non cooperative patients			
13.00 - 14.00	MHP ( $\beta$ ) for rest – hygiene	$\beta$	$\beta$	$\beta$

**Table 15: tasks generally performed by nurses during their morning shift and their biomechanical overload**

Schedule	NURSES' TASKS	Biomechanical overload for $\leq 45$ years		
		shoulder	Lumbar spine	knee
MORNING SHIFTS				
7.00 - 7.20	Communicating with medical staff			
7.30 - 9.15	Collecting blood samples; preparing medication; 2/3 ECGs			
9.20- 11.30	Examination with physicians, short periods of MHP ( $\beta$ )	$\beta$	$\beta$	$\beta$
11.30 - 12.00	Requesting diagnostic tests			
12.00 - 13.00	Administering medication			
13.00 - 14.00	Writing records			
Schedule	NURSES' TASKS	Biomechanical overload for >45 years		
MORNING SHIFTS		shoulder	Lumbar spine	knee
7.00 - 7.20	Communicating with medical staff			
7.30 - 9.15	Collecting blood samples; preparing medication; 2/3 ECGs			
9.20- 11.30	Examination with physicians, short periods of MHP ( $\beta$ )	$\beta$	$\beta$	$\beta$
11.30 - 12.00	Requesting diagnostic tests			
12.00 - 13.00	Administering medication			
13.00 - 14.00	Writing records			

An organizational analysis of different professional profiles could facilitate the identification of tasks that need a preventive action and the precise reconstruction of all tasks within a job. It would be possible, then, to discuss priorities, suggest improvements or proceed to an in-depth risk identification and assessment.

This analytical reconstruction should be carried out for all professional profiles by a team including an occupational physician, head nurse, HSO and WSR. Work teams are emerging in big hospitals,

although still sparse, with the aim of creating specific employment programs for healthcare operators with restrictions/conditions. However, such realities still need validation.

Only large-scale strategic interventions have proven to be effective, on the long run, in the management of “risk” for operators with a consequent reduction of sick-leaves, absence rate and related costs, thus promoting a better healthcare experience for patients. As reported in the international literature, partial interventions (e.g., focused only on operator training or the acquisition of handling devices), showed significant limitations and were not able to put the underlying investments to good use.

### **Managing the prevention of biomechanical overload in the healthcare sector**

The literature concerning the risk associated with manual patient handling highlights how the use of handling devices should be the foundation of a complex management of patient handling risk.

Handling devices include wheelchairs, hospital beds, gurneys, lifts and slings, any aid for the patient’s hygiene and “minor aids”.

To properly choose and utilize such equipment, operators must be theoretically and practically trained. The following steps describe an effective strategy aimed at reducing the risk associated with manual patient handling:

1<sup>st</sup> STEP – perform RISK ANALYSIS to establish:

- Priority
- detailed analysis of different types of patient handling tasks that require aids
- detailed analysis of different types of disabilities affecting patients
- detailed analysis of environment where the equipment will be used

2<sup>nd</sup> STEP – make a “LIST OF ERGONOMIC REQUIREMENTS” in view of the purchase of new equipment. The list should include:

- preliminary ergonomic requirements of necessary devices
- specific ergonomic requirements
- request of at least 2 trial weeks (of the equipment) in the specific ward/sector to allow both a “TECHNICAL TRAINING” on the use of the equipment provided by the manufacturer and a “TRAINING FOR A CORRECT USE AIMED AT REDUCING THE RISK” provided by professionals in charge of such training within a company (ergo-coaches, back care advisers, etc.).

3<sup>rd</sup> STEP – after purchasing the equipment, a procedure to test its usage should be implemented. According to the international scientific community, a correct prevention management should follow a MULTIFACTORIAL APPROACH with specific ergonomic principles (“top-down” and “bottom-up”); specifically, the participation of different subjects in the strategies that will be set up.

## 2.4 HEALTH SURVEILLANCE FOR HEALTHCARE PROFESSIONALS

*Donatella Talini, Carlo Nava, Tiziana Vai, Olga Menoni*

The issues related to the aging of the workforce in the healthcare sector, especially hospitals, are evident and they will impact economy and production, as well as the social and health sphere. In the near future, old patients will be assisted by old health operators, causing an increase in the number of operators working in non-ideal physical conditions, due to both their age and physically demanding situations faced regularly for a long time. Expanding the staff is no longer an option; nowadays, health units are subject to financial restrictions that make it very hard for them to hire new workers.

Through the analysis of the health surveillance performed by occupational physicians, some recent Italian studies revealed an increase in the number of health issues among healthcare professionals and a consequent increase in the number of restrictions/conditions issued by occupational physicians, as well as the increase in the number of “unfit” workers for specific tasks. This caused a “misunderstanding” concerning the actual reason for the dismissal of healthcare workers deemed unfit for work, which led to specious media campaigns about workers who are not willing to work while the real issue was actually to be ascribed to:

- Aging of the workforce
- Interruption of the turnover
- Wearing due to physical overload, overloading shifts and environmental inadequacies

Besides, healthcare professionals need to face an additional issue.

Scientific societies, policy makers, insurance companies and patient associations have been wondering, for example, about the limit beyond which a physician can no longer be a good physician, which means they can guarantee patient safety and high-quality treatment. After all, there is an age limit for jobs impacting people’s safety: for example, regular health checks are mandatory for commercial pilots over 40 and they must retire at 65.

Despite several recommendations found in the literature concerning the issues associated with clinical risk management (Tartaglia R., Westbrook JI), which often include organizational aspects, there are no mandatory checks, at present, aimed at investigating such aspects in the healthcare sector. In addition to the health status of single workers, perhaps an adequate assessment should also cover the structural and organizational condition of the clinical work environment (see chapter, “Assessing the risk in the healthcare sector”), which, as previously mentioned, could pose a problem to the implementation and maintenance of prevention best practice (given the existent underlying problems) and/or could hinder the redeployment of workers with restrictions/conditions as well as increase the risk of a “pathological” aging of healthcare operators due to inadequate workloads.

Occupational physicians should start from the concepts expressed in the previous chapter on health surveillance ([click here](#)), adjust them to single sectors and refer to best practice and studies in the literature. Because the damages caused by organizational deficits and biomechanical overload are particularly relevant when it comes to aged workers, occupational physicians will need to rely on established assessment tools (e.g., commonly used for biomechanical risk), as well as new, reinvented tools, outgrowing the stereotype of a health surveillance based on strict periodicity and traditional tools for clinical diagnosis. Instead, they should seek new, less conventional indicators such as the number of hours worked in excess of contracted hours, the analysis of work shifts (morning, afternoon and especially night shifts) and the attention to hierarchical aspects, not only in terms of career but also of recognition of individual responsibilities.

## Health surveillance for biomechanical overload risks

The literature shows how biomechanical overload (i.e., the constant mechanical solicitation of tissues associated with manual material handling exceeding critical levels) can cause discomfort and degenerative alterations of bones and joints, not only in the low back region but also the upper limbs, especially the shoulders.

According to the latest bibliography (Silverstein et al, 2008; Harkness et al, 2003; Hoozemans et al, 2002), the shoulder joint seem to be the best target for preventive interventions, be they technical, organizational, or health-related (Trinkoff., 2006, Smedley. 2003, Maso, 2003, Harkness, 2003, Devereux, 2001; Vasseljen, 2001; Miranda, 2008; Hoozemans, 2002; Viikari-Juntura, 2001; Croft, 2001; Silverstein, 2008; van der Windt, 2000; Ariens, 2000; Palmer, 2001).

Besides, a 2010 review investigating the relationship between occupational risk factors and knee disorders (Reid C.R., 2010) highlights two common risk factors; standing from a squatting/kneeling posture more than 30 times/day, lifting loads >10 kg more than 10 times/week. Some risk factors causing knee osteoarthritis are intrinsic, such as obesity, age, previous accidents and/or knee surgeries. In particular, female healthcare professionals who had worked for more than 5 years (Anderson et al, 2012) had increased risk of developing knee or hip osteoarthritis, and the risk is increased by such cofactors as obesity or age over 50. Because such disorders are work-related (WMSDs), A HOMOGENEOUS CLASSIFICATION OF DISORDERS AND PATHOLOGIES would be helpful; its lack results in a plethora of scientific studies on the matter.

For what concerns the lumbar spine, the term Low Back Pain (LBP) is used internationally, yet its definition varies according to the author. In Italy, the most used term is "*lombalgia acuta*" (acute low back pain), which correspond to some extent to the American term Low Back Injury.

Despite the evident diversity preventing a comparison between different epidemiological studies, there is significant agreement on the main risk factors for musculoskeletal disorders and pathologies:

**Physical factors** (e.g.: heavy work(loads), lifting loads, wrong postures), **organizational factors** (e.g.: shortage of workers, work shifts) and **psychosocial factors** (e.g.: poor social support) (Bongers, 1993, Toivanen, 1993, Camerino D., 1999,2001, 2004; Marras, 2000, Violante, 2004; Yip 2001; Hoogendoorn, 2002, Harkness, 2003, Linton, 2000; Linton, 2001; Davis 2000; Iles 2008, Mehlum, 2008, Plouvier 2009, Hooftman 2009).

Because WMSDs have a multifactorial etiology, individual risk factors should also be considered (Ferguson, 1997; Hooftman, 2004; Battie 1990; Cady, 1985; Miranda, 2002, Marras, 2000), including gender, body composition, genetic and family factors as well as age.

As widely explained in chapter 1, biomechanical overload has a great impact on aged workers' work ability, especially considering that musculoskeletal issues are more frequent among subjects falling in higher age groups. The female peculiarity should also be considered, since women account for about 70% of healthcare professionals (excluding physicians).

The use of a shared health questionnaire is therefore advisable. A structured patient case history could provide information on diagnosed disorders and pathologies affecting the three "main target organs"; lumbar spine, shoulder and knee.

A questionnaire administered to "homogeneous" groups of exposed workers can be used to facilitate the emersion of a higher number of diseases or "sentinel events".

To prevent this data collection from turning into mere exercise with no elaboration attached, collected data on health surveillance could be used to manage, guide and even test implemented preventive

strategies. The role and importance of the contribution of occupational physicians to the management of workers protection in the healthcare sector is still to be discussed.

A standardized protocol should provide minimum prevalence data concerning:

- Distribution by gender and at least the next prevalences with age groups above and under 45
- Prevalence of subjects with acute or chronic disorders (tendons) affecting the shoulders
- Prevalence of subjects with low back pain in the previous 12 months
- Prevalence of subjects with lumbar disc hernia
- Prevalence of subjects with gonarthrosis
- Percentage of subjects with a fit with conditions note
- Percentage of subjects with a fit with restrictions note (temporary/permanent)

## 2.5 PSYCHOSOCIAL RISK IN THE HEALTHCARE SECTOR

*Fulvio D'Orsi*

If able to plan according to their own needs, to work at their own pace and if independent from others, aged workers can perform the same tasks as younger ones.

Shiftwork is better tolerated if in line with biological rhythms, if not subject to unexpected changes and, above all, if working hours are not extended.

The extension of working life is not a problem on its own; problems rise due to low staff turnover, workforce reduction, increased workload and poor corporate culture.

Unlike other sectors that strive to keep up with technological progress, the healthcare industry aims at developing a staff policy that promotes an equal distribution by age of workers.

One of the most relevant stress factors in the healthcare sector is the increasing workload, often due to workforce reduction. Aged workers are particularly exposed to this factor, showing less physical endurance and often requiring longer periods of time and rest to perform their duties.

Unexpected peaks in workload, pace set by a colleague or a machine, lack of breaks, shifts, split shift are relevant risk factors. Overall, either the extension of working hours or frequent and unexpected changes in work schedule do not allow proper recovery time.

Shiftwork, night work, on-call duties are heavier tasks; catching up on sleep becomes harder as we age and this can lead to fatigue accumulation, shorter attention span and higher risk of error and injury. Moreover, work fragmentation and multitasking demand etc. are less tolerated due to poorer concentration.

The lack of recognition from employers and coworkers as well as the lack of involvement in transmitting knowledge is a relevant stress factor among aged workers. The latter are often excluded from training programs, being considered unworthy of investment.

The job of aged workers can be monitored more strictly due to their higher difficulty in adjusting to change.

The imposition of new work methods, of the use of improper or unusual PPE, the lack of participation in decision-making, strict supervisory protocols are hardly borne.

Work methods that do not allow workers to disconnect from work after a long day (limitless use of technology for communication: mobile phone, emails.. ) are more challenging to manage as we get older.

Aged workers find it more difficult to adjust to either technical, organizational or procedural changes that occur in the internal environment.

New work methods, new technologies, new values can be negatively experienced if not adequately implemented.

The challenge of either adjusting to change or ensuring productivity can hinder aged workers' career development as well as their access to the reward system. Assessment methods that do not enhance work experience and seniority, favoring quantity over quality, lead to workers' self exclusion. Highly competitive environments can also be a major source of stress.

The exclusion of aged workers from shifts and night work (that often results in additional workload for other workers) can cause conflicts. Instead of being supported, aged workers who are entitled to an exemption are often emarginated by colleagues: this is detrimental since workers' vulnerability increase with age.

Aged workers are also increasingly vulnerable to aggressive behaviors of critical patients and their relatives. Workers' perceived vulnerability to potential aggressors increase with age, leading to a higher risk.

Interventions should aim at ensuring a balance between work demands and individual work ability. Recent studies (HSE, 2011) have demonstrated that such balance would allow aged worker to not take more sick leave than younger colleagues, nor have more injuries.

The intervention strategy of the healthcare sector is twofold and aims at enhancing workers' experience, abilities and autonomy in managing workload.

Reorganization processes must support workers, especially aged ones, ensuring involvement and proper training programs that are designed to recognize their potential.

Strategies and objectives must be extremely transparent to reduce the fear of "what could potentially happen". The impact on individuals' life (change of position/ relocation) must be fair and impartial; age discrimination must absolutely be avoided. (HIRES 2011)

A factor that needs to be taken into consideration in the healthcare industry is the emotional involvement of aged workers when dealing with death and sufferings.

The ability to empathize with patients avoiding emotional involvement (keeping a "safe distance") is essential.

Such skill is learnt through work experience and transmitted with examples that are fundamental in preventing work-related stress among healthcare professionals.

Table 16 below reports the most relevant stress related factors in the healthcare sector along with critical aspects of aging.

The list of work-related stress factors has been included in the new checklist proposed by INAIL for the healthcare sector.

A table (Table 16) with possible preventive and corrective measures associated with work-related stress factors is available at [Regione Lombardia's website](#). The table was elaborated by Lombardy Operational Unit and Occupational Medicine Unit of San Gerardo Hospital in Monza in collaboration with INAIL, Department of Medicine, Epidemiology, Occupational and Environmental hygiene (DiMEILA) within the project CCM 2013 of Ministry of Health.

Summary of the table by A.Fattori<sup>4</sup>

**Table 16: Work-related stress- examples of risk control measures**

WRS RISK FACTORS	POSSIBILE PREVENTIVE and/or CORRECTIVE MEASURES
<b>Emotional demands</b> (eg. contact with human suffering, patients at high risk of death etc.)	<ul style="list-style-type: none"> <li>▪ Plan interventions on how to manage emotionally demanding situations such as death, pain and terminal illnesses</li> <li>▪ Implement counseling services and/or psychological support for employees</li> <li>▪ Implement clinical supervisions and peer support services that allow to develop and/or strengthen relational/communicative skills and to elaborate work-related emotional aspects.</li> </ul>

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<p><b>Potential risk of verbal and/or physical aggression and harassment by third parts</b></p>	<ul style="list-style-type: none"> <li>▪ Develop <b>guidelines</b> on how to manage episodes of violence, threats and other traumatic events</li> <li>▪ Introduce <b>training programs</b> and/or <b>seminars</b> on stress management (eg. <b>Training courses</b> and/or <b>interactive seminars</b> on coping strategies in critical situations - conflict with users, aggressions...) aimed at strengthen relational/communication skills, workers' problem solving</li> <li>▪ Implement a <b>debriefing after a traumatic event</b> to acquire knowledge on possible reactions to events and emotions and perceived symptoms</li> <li>▪ Ensure adequate support to workers who experience traumatic events</li> <li>▪ Introduce a <b>peer support</b> service</li> <li>▪ Avoid lonely jobs compatibly with organizational needs</li> <li>▪ <b>Legally protect</b> workers</li> </ul>
<p><b>Management of clinical emergency</b> (situations of clinical emergency, sudden worsening conditions)</p>	<ul style="list-style-type: none"> <li>▪ Define and share protocols and procedures</li> <li>▪ Ensure adequate human and instrumental resources</li> <li>▪ Implement training programs aimed at developing workers' ability to manage emergency and problem solving from a psychological point of view</li> </ul>
<p><b>Shiftwork</b> (including overnight shifts, weekends and holidays) with increased request of overnight care, extended working hours, overtime hours; leading to: accumulation of working hours and/or leave not taken, inadequate management of shift rotation</p>	<ul style="list-style-type: none"> <li>▪ Schedule shifts on a monthly basis, possibly considering workers' needs</li> <li>▪ <b>Legally protect</b> workers</li> <li>▪ Schedule shift rotations considering working conditions and tasks</li> <li>▪ Limit overtime (especially after evening shifts and/or holidays), compatibly with organizational needs and/or potential emergencies</li> </ul>
<p><b>Presence of numerous distractions</b> while performing tasks that require high degree of attention and concentration (eg. Telephone calls, inadequate requests by patients, visitors and/or patients' relatives, unscheduled communications with colleagues and/or superiors, form-filling, etc)</p>	<ul style="list-style-type: none"> <li>▪ Ensure a clear definition and attribution of tasks and jobs</li> </ul>
<p><b>Intense Bureaucratic load</b> due to procedures and protocols that results from economic bounds</p>	<ul style="list-style-type: none"> <li>▪ Guarantee clarity and simplifications of protocols and procedures to be followed while performing tasks</li> <li>▪ Organize periodic coordination/staff meetings aimed at defining the priorities of the Operative Unit.</li> </ul>
<p><b>Intense work load and work pressure</b>, due to deadlines, short and/or infrequent rest breaks, intense quantitative and qualitative work load (often do due the lack of workforce)</p>	<ul style="list-style-type: none"> <li>▪ Favour an equal distribution of workload among operators adopting transparent and shared criteria.</li> <li>▪ Monitor work load, tasks assigned and scheduled shifts frequently</li> <li>▪ Delegate tasks that can be delegated</li> <li>▪ Implement adequate rest breaks during shifts</li> </ul>

<p><b>Occupational biological risk</b> (eg. infection, risk of HIV/HCV/HBV from accidental needlestick injuries)</p>	<ul style="list-style-type: none"> <li>▪ Program update meetings for workers on biological risks and preventive/control measures</li> <li>▪ Define procedures for the prevention of occupational infections</li> <li>▪ Implement vaccination campaigns (eg. hepatitis B and influenza vaccinations...)</li> </ul>
<p>Constant <b>need of update</b> and/or difficulty to update due to technological innovations and digital devices (eg. Medical records, information on how to administer medications and medical treatments in electronic format etc.)</p>	<ul style="list-style-type: none"> <li>▪ Organize technical training courses aimed at developing adequate skills to use new pieces of equipment and devices.</li> <li>▪ Guarantee adequacy and maintenance of the equipment</li> </ul>
<p><b>Difficult work-life balance</b>, due to shiftwork (especially overnight shifts)</p>	<ul style="list-style-type: none"> <li>▪ Strengthen corporate welfare (i.e. corporate crèche and/or convention with <i>crèche</i> near the workplace, recreation centres for workers' children that organize activities in the summer time and/or Christmas holidays , after-school activities)</li> <li>▪ Schedule shifts on a monthly basis considering workers' needs (if possible).</li> <li>▪ Limit overtime, compatibly with organizational needs and/or potential emergencies</li> </ul>
<p><b>Lack of professional recognition and/or social support by superiors</b> and/or colleagues</p>	<ul style="list-style-type: none"> <li>▪ Favor communication among management/workers and colleagues</li> <li>▪</li> </ul>
<p><b>Lack of communication</b></p>	<ul style="list-style-type: none"> <li>▪ Promote the spread of information among the entire workforce</li> <li>▪ Implement adequate communication tools</li> </ul>
<p><b>Role conflict</b></p>	<ul style="list-style-type: none"> <li>▪ Program coordination/group meetings in order to clearly define functions and responsibilities, identify tasks and duties for each job</li> <li>▪ Favor the spread of the corporate organizational chart</li> </ul>
<p><b>Inadequacy/lack of resources</b> (eg. Lack of beds, maintenance of equipment and structures etc.), lacks from an ergonomic point of view</p>	<ul style="list-style-type: none"> <li>▪ Protect workers' safety by monitoring maintenance and availability of plants, equipment and aids (eg. Adjustable beds, use of lifting aids and minor aids)</li> </ul>
<p><b>Lack of autonomy and control</b> on work pace and workload</p>	<ul style="list-style-type: none"> <li>▪ Promote workers' involvement by organizing meetings where they can express their own thoughts and suggestions</li> <li>▪ Improve workers' communication (i.e. bulletin board, e-mails) and involvement (es. periodic staff meetings) aimed at including workers in the decision making process of the Operative Unit.</li> <li>▪ Favoring the spread of managerial, organizational, technical-scientific e cultural knowledge in the workplace.</li> <li>▪ Favoring workers' involvement in work planning</li> </ul>

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## 2. MANAGING THE AGING HEALTHCARE WORKFORCE

### 2.1. Managing the aging healthcare workforce *O. Menoni, D. Talini*

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