The aging Brazilian worker: the role of ergonomics in predicted scenery.

José Luiz Garcia Hermosilla*, Elaine Angelita Watanabe*, Graciana Aparecida Simei Bento da Silva*, Walther Spinelli Filho*, Ethel Cristina Chiari da Silva*, Vera Mariza Henriques de Miranda Costa*

* Programa de Pós Graduação, Mestrado Profissional em Engenharia de Produção, Centro Universitário de Araraquara – UNIARA, Araraquara, Brasil.

Email: jlghermosilla@hotmail.com; angeltaw@hotmail.com; graciana.si@gmail.com; fisioclinica1@terra.com.br; e-chiari@uol.com.br; vmhmcosta@uniara.com.br

Abstract

The growth rate of the elderly population in Brazil is the largest among all age segments, together with the natural aging process of the world's population. This fact reflects the aging of the working population and its consequent participation of people over 60 years in the work force. This portion of the population presents growing physical limitation to the exercise of activities, which can be accelerated on the basis of working conditions. The aging of the population requires adjustments in relation to labour market flexibility, considering both the physical limitations of this population, more subject to risks of accidents and lower degree of mobility, physical strength and proportionately lower level of education, as the demands of the own work. The goal of this literature review is to discuss the functional aging (ability to work) and the contributions of the ergonomics area to this phenomenon. Ergonomics has important role, not only on the appropriateness of jobs on the worker's conditions, as well as in the ongoing evaluation of the factors that contribute to these conditions, promoting the situational diagnosis and propose adjustments that balance early requirements and occupational demands. As a result, this paper emphasizes the importance of ergonomic solutions at workstations in order to offset the decline in physical ability of older worker. It is also the importance of the suitability of new policies that can promote/keep the worker's functional capacity, providing they are ageing on economic activities.

Keywords: the aging population, labor, functional capacity, ergonomics.

1 Introduction

The aging of the population is a worldwide phenomenon (TSUNO and HOMMA, 2009). The elderly population is growing faster than world population, at a rate of 2.5% per annum, at this time (CARTER and O´DRISCOLL *apud* PENATTI, 2010), and reports of the United Nations-UN, predicted an increase of three times the number of people 60 years and more in the world for the next 43 years (FELIX, 2007).

This aging population process is known as demographic transition and it is caused by two factors that together, contribute to the change in the age structure of populations: reduced mortality rates and the drop in birth rates. (COSTA et al., 2001).

Giatti and Barreto (2003) claim that developing countries are those that present the most significant processes of demographic transition, nowadays. The number of Brazilian with 60 years old and more has doubled in 20 years, from 7.2 million in 1980 to 14,5 million in 2000 (GIATTI and BARRETO, 2003). Projections indicate that in 2025, the Brazil will occupy the sixth place among the countries of the world with the largest number of elderly (Queiroz and Prado, 2010).

In this context, Brazil does not have a young predominance in your population since, for the WHO, an aging population is the one where the proportion of people aged 60 years and over is 7% of the total population, with a tendency to increase participation in the age pyramid (COSTA *et al*, 2003).

To corroborate this claim, data from the IBGE (2010), show that the proportion of the Brazilian population above 60 years is approximately 11% of the total population, with prospect of future growth. Also with

this fact, the country's fertility rates are falling, with no prospect of significant changes (WONG and CARVALHO, 2006).

Currently, the representativeness of all age ranges up to 25 years in the Brazilian population pyramid is much shorter than their representativeness in 2000, except for adult and elderly groups, increasing their participation over the years (IBGE, 2010). Another important characteristic is the feminization in old age, i.e. the more aged is the elderly population, the greater the proportion of women in that population (KRELING, 2008).

According to Giatti and Barreto (2003), the prospect of greater population growth until 2020 is the age group formed by people above 50 years of age, a fact which reflects the aging of the Brazilian economically active population (PEA). The ageing of the working population also occurs as a result of the demographic transition process (GIATTI and BARRETO, 2003).

The country will be in elderly dependency work ratio with the increase of this population, in 2050 (MOREIRA, 1998).

According to IPEA (2006), the forecast for 2030 is that approximately half of the work force has over 45 years, due to falling birth and mortality rates of Brazil.

Projected growth of elderly PEA for the next two decades old is 3.6% per annum, and, for the same period, it is estimated that the total PEA grows in proportions similar to the reorder level, i.e. somewhere around zero, causing the elderly group lead to greater pressure for job creation (WAJNMAN et al, 2004).

In Brazil, approximately 30.4% of the elderly retirees or pensioners continue working (IBGE, 2004), unlike what happens in other countries, where the retirement benefit encourages workers to stop work. (WAJNMAN et al, 2004).

The trend is that the levels of labour activity of older persons remain stable, demonstrating that, despite the limitations caused by aging, it is irreversible the participation of workers over 60 years in the workforce (WAJNMAN et al, 2004).

One of the considered care about the participation of older people in the labour market, is about the loss of their functional capacity (BELLUSCI and FISCHER, 1999).

It is known that aging is a natural process, which is inherent to every human being, but the body suffers from functional and anatomical changes, that influence health conditions of the elderly and their quality of life (VECCHIA et al, 2005). The main limitations associated with the aging process are physical weakness, illnesses and apathy that occur in a variety of ways in different types of organisms: reduction of reaction time, eyesight and hearing, tactile sensitivity, bone mass and muscle strength, increased stiffness, changes in posture and balance in the walk, which increase the propensity to falls and immobility (PENATTI, 2010).

The World Health Organization (WHO) defines functional disability as the difficulty, due to a disability, to perform typical activities and personally desirable in society. The capacity is often assessed by indicative statement of difficulty or need help basic personal care tasks and more complex tasks, needed to live independently in the Community (PARAHYBA and SIMÕES, 2006). Gordilho et al (2000) characterize functional capacity as maintenance of mental and physical skills necessary for independent living and unattended.

Studies indicate that each year about 10% of the elderly population (75 years and more) loses his independence in one or more activities of daily living (SANGLARD and PEREIRA, 2005).

Thus, it becomes important to worry about the balance between the capacity of older workers and the demands of work, in an effort to reduce conflicts between productivity expected by enterprise and a healthy participation of older persons in the workforce of the same (BELLUSCI and FISCHER, 1999).

In this context, the ergonomics tries to relate the understanding of interactions among humans and other elements or systems, and the application of theories, principles, data and methods to design in order to optimize human well-being and overall system performance (International Ergonomics Association, 2000).

This bibliographic research analyzes the phenomenon of ageing functional (ability to work) of the Brazilian worker and the role of ergonomics in this context.

This article is organized into four sections: the first contextualizes the phenomenon of aging Brazilian worker's functional; the second deals with the literature review about the aging theme and its relation to work, as well as the ergonomic aspects associated with; the third section presents ergonomic efforts and contributions found in the literature front theme, and finally, conclusions, discussing the theme strategic developments.

2 Ageing, labour and ergonomics

The World Health Organization (WHO) defines as an aging stage one with 45 years of age or older (CAMARANO and PASINATO, 2008).

Camarano and Pasinato (2008) argue that from such age accentuates the loss of some functional capability, if preventive measures or working conditions, that are best suited to this new reality, are not adopted.

Ergonomics relates directly with these rules work, being a term adopted in the main European countries (in the United States the term is assumed to be human factors) to this new scientific discipline, which tries to understand the relationships and interactions among humans and other elements or systems to maximize human well-being and system performance (Internacional Ergonomics Association/IEA, 2000).

Ergonomics had its origin in the period between 1939 and 1945, during World War II as a result of a systemic effort of various professionals from three multidisciplinary areas of Exact Sciences: (engineers, mathematicians, statisticians, etc.), Humanities (psychologists, anthropologists etc.) and biomedical (doctors, physiologists, etc.) who have worked together to develop solutions to the problems of expensive and complex military equipments , such as submarines, planes, tanks, radars, communication devices etc. The result of this work was very satisfactory and went on to be tapped in the industry after the war (RIO and PIRES, 2001).

The application of the physiological bases of human body in ergonomics takes into account only those aspects which are directly related to the achievement of a work. Physiological aspects most influential work performance, and therefore must be known and taken into account for the older worker, corresponds to the integrated operation of the nerves and muscles, the functioning of human metabolism, the structure of the spine, senses of sight, hearing and kinesthetic sense (KROEMER and GRANDJEAN, 2005).

All human activities work that involves movement and forces is made through contraction and distension muscle that are controlled by the central nervous system. The muscles represent approximately 40% of the weight of a person. The human body has 434 striated muscle and the amount of muscles is identical on any human being. The difference between people and their physical strength is the volume of these muscles and the progression of aging worker's functional (KROEMER and GRANDJEAN, 2005).

Static work in standing position is highly stressful, especially on older workers, by requiring too much effort of the muscles. If the job is more dynamic stand, this fatigue will be lower depending on the blood pumping effect, caused by their movements. The work in the standing position should be avoided whenever possible, or be alternated with work in seated position (IIDA, 1990).

MORAGAS (1997) points out that the psychology of work, which until then used frequently to chronological age for evaluation and selection of personnel, recognizes that the elderly of 65 years may be excellent employees, as long as the tasks to be performed are consistent with their skills and

possibilities. In addition, if the elderly lack the physical strength, they can compensate this limitation with less effort needs. And if your ability of reaction is slower, your occupation may be given in posts where it is not required greater speed. MORAGAS (1997) shows that this theory of compensation may be useful to explain the potential of older people in today's society, since they are prepared to develop it and the company is willing to use the potential of the elderly.

According to the WHO (2012) "the rate of decline of functional capacity of an individual is determined, at least in part, by our behaviours and exposures across the whole life course. These include what we eat, how physically active we are and our exposure to health risks such as those caused by smoking, harmful consumption of alcohol, or exposure to toxic substances". The differences between old and young people will be reduced with a better understanding of the ageing phenomenon and with improvements in worker's lifestyle, which assist on health, force and cure or control of diseases.

With regard to productivity of older workers, there is decrease in strength and muscular endurance, but most current jobs has requirements that can satisfy the healthiest people up to 70 years or more. The reaction time of the elderly at work is greater, but his experience makes up for this limitation. Older workers can be prepared through their work lives, strategies to address the problems, in order to compensate their physical limitations or cognitive; on the other hand, the firms must develop acts that take into account the characteristics of this kind of workers. (MORAGAS, 1997; BARBOSA et al, 2007).

It is important to call attention to various aspects of the working conditions that should be the object of special attention on the part of many professionals who deal with aging workers: work organization, psychological factors, ergonomic, physical and chemical means (OMS, 1993; RODRIGUES et al, 2011). To make full use of the capacities of older workers, the workplace must be adjusted to the physical changes that occur with the aging (such as the decrease in hearing, vision and muscular strength). The work has great importance in the socio-economic context of the people, because it is from it that gets the sustenance, dignity and builds up the identity of individuals, which makes it possible to call the current society "the work society" (PERES, 2002). The human being grows up and prepares itself for working, because it is from it that will come his social growth and its sustainability (BULLA and KAEFER, 2003).

Speed, precision, obedience, among other desirable values of wage labour in production lines, was encouraged in the capitalist society of the Western world. The worker came to be seen as a component or a piece, performing its activities in the first half of the 20TH century, due to scientific management and Fordism (PACHECO, 2002). During this period (20th century) there was overestimating the value of young's power, since this group responds to the ideological demands of the contemporary capitalist society, which gives priority to the production and reproduction (MENNOCCHI, 2009).

Currently, the labor market, due to the large number of labor, alienates young people (through low wages) and excludes the over 40 years old, heirs of the Ford culture (highly specialized), replacing them for workers with another profile, i.e. the multi-purpose and multifunctional from the toyotist era, who are more involved with the company's goals and results (MASSON, 2009).

According to Neri (1996), older employees are removed from strategic meetings and training within the companies, being relegated to unproductive and often coming to the resignation. This is because these professionals are considered slow, inflexible, rebels and unproductive; on the other hand the production is directly related to the speed, productivity, effectiveness, flexibility, involvement and teamwork. However, in some sectors of the economy as in consultancies, older workers are most requested due to the great experience accumulated during years of work (PERES, 2002).

In these circumstances, the limit of the worker age is based on the company needs or what kind of training it is disposed to offer, i.e., it depends on the organizational culture of the company (PERES, 1998).

All persons above 60 years old, in Brazil, are considered elderly according to the Brazilian Statute of the Elderly (2004) that ensures the rights of that population range. However, the aging brings prejudice, since it can be associated with the negative characteristics such as loss of health, dependence and non-adaptation (PERES, 2002; DUTRA, 2007).

In this context, there are retired individuals who have sold their workforce as merchandise and no longer have more expressive value to the capitalist way of production; this exclusion associated with the new situation presented to them (idleness) can take them even a depression, because they believe do not have more value to society (PACHECO, 2002). Several studies show high depression rate in recent years preceding retirement (FONSECA and PAUL, 2003).

The elderly population should be prepared for changes in the labour activities, activities that may or may not continue after retirement (BULLA and KAEFER, 2003), because nowadays, the elderly stop working in better condition than in the past, having a life expectancy after retirement even long (ALVES JR, 2005). This becomes favorable for the elderly because today the low values of retirement received force them to stay working, in the labour market to complement the family income (BULLA and KAEFER, 2003).

According to Mennocchi (2009), society expects and requires an active elderly, but for this it is necessary that during the life of the worker, he had good conditions such as e.g. suitable conditions and work environment.

3 Results

The transformations that has been happening since the 20TH century in the structure of the market and in productive organization, as a result of a change in an economic system based on industrial production for economy with dominant service sector – implies changes in incidence and prevalence of risks on workers ' health (CAMARANO and PASINATO, 2008). Thus, several studies were conducted to raise awareness about this new reality.

The work done in the Finnish Institute of Occupational Health-Finland, found that the capacity for work of Finns was deteriorating prematurely, reflecting on diseases and symptoms that were ultimately leading to early retirement or invalidity. The study found that aging can hamper the achievement of tasks, especially when the job requires physical demand, because they decrease the capacity for work by influencing the worker's life. However it was pointed out that the recognition, respect and the positive attitude of the superiors, improved ability to work. Thus, the study showed that the improvement of human relationships was the key to maintain or even increase the capacity to work (TUOMI et al., 1991).

From this Finnish study, was created the index of capacity for work (ICW) whose purpose is to evaluate the functional conditions of workers. This index applied on workers from Dutch construction with the aim of assessing the association of individual characteristics, health issues, lifestyle factors and work-related factors with ability to work, concluded that the work-related risk factors were associated with the capability to the work, indicating the physical workload reduction and psychosocial in daily life of those workers (ALAVINIA et al, 2007). Already the study with nurses who work during nighttime, mostly females aged 24 to 59 years and roster of 12:0 worked to rest 60, Chillida (2003) noted that the majority of respondents (72.4%) reported that the work during nighttime interfere in daily life (53.1% of these responded negatively due to social prejudice, changing moods and daily habits). The application of index of ability for work notes that the higher the working time on nighttime period, less the ability to work of these professionals, demonstrating the need for measures aimed at the promotion, maintenance, and restoration of capacity for work.

Andrade (2002), conducted a study with service workers of hygiene and cleanliness in a university hospital and to apply the ICW observed that a large number of workers presented to the work capacity between moderate and bad categories; the age group of 50-60 years presented lower capacity compared to 30-50 years. Also found that workers who reported having a larger number of diseases have a low ICW and a large number of medical licenses. It was also found that workers who had a diagnosis of musculoskeletal disorders had his work rate decreased.

Musculoskeletal changes that occur with age contributing to decline in worker productivity due to increased risk of injury. The changes include reducing the mobility of the joints, decreased muscular endurance and increasing the reaction time and movement (McMAHAN and PHILLIPS, 1999).

A study involving 127 employees, with and without history of symptoms of musculoskeletal injuries, assessed the impact of personal factors work in functional capacity, showed that these factors have significant relation with the ability to work. Pain and departures were variables associated and accounted for 59% of the occurrences of low labour capacity (WALSH et al, 2004).

Another study conducted with retired workers in the chemical industry, noted discomfort on the part of them: they can retire young, fear of unemployment and changes in the labor market and technology. The studied workers, even professionals with high qualification, showed signs of physical and emotional suffering at work, the organizational and technological changes, mainly due to the numerous selections (MARÍN, 2001).

In a study that evaluates the ability to the work of young rural workers who care for plants and flowers in Holambra/Brazil, noted the emergence of diseases with medical diagnosis or musculoskeletal and respiratory problems.; the more risk factors raised by workers were the ergonomic work such as crouching, standing work, repetitive movements, time pressure (WELLE, 2008). Corroborating this claim, McMahan and Phillips (1999) cite the factors contributing to the increase in cases of repetitive stress injury are three: the increase in work in the area of services and high-tech, the age of the worker and the reduction of turnover of the worker; in this same survey, although most workers had the ability to work in great categories and/or good, women showed greater fatigue score, that may be associated with, among other things, the holding of domestic services (double workday), as well as greater female participation in the labor market and households headed by women (WELLE, 2008).

Study that assessed the ICW in 35 years old workers or older, showed that older workers have better capacity to work; this suggests that with the aging occurs a selection of workers the fittest and healthiest, because only these remain working in the more advanced age groups (MONTEIRO et al, 2001).

Ornellas (2004) studied the capacity for work of metallurgical workers and noted that they have a good index of ability to work, but found that frequent exposure to ergonomic risks such as weight lifting and repetitive movements cannot have their effects minimized by PPE (personal protective equipment), causing a high rate of musculoskeletal diseases. Also noted, that the time spent to locomotion to the work influenced negatively on the capacity for work. And yet, the higher the level of schooling improved their ability to work (ORNELLAS, 2004).

There are also cases of inadequate practices in some sectors which may cause fatigue in workers, as can be observed in the study by Masson (2009). The survey consists of a cross-sectional epidemiological study of character quanti-qualitatively, with application of questionnaires in 105 truck drivers transporting cargo to the Warehouse (vegetables, fruit and eggs) and market of flowers of Campinas (CEASA). The tested sample was constituted only by males, with average age of 37.5 years and low schooling. Most of the workers presented great capacity for work, but the perception of fatigue manifested itself with more intensity on the item "difficulty of concentration and attention". It was noted then, correlation between the index of ability to work and fatigue, indicating the decline of the first with the second increase, to individuals who made use of stimulant drugs at the wheel, which in turn, is considered an illegal practice (MASSON, 2009).

Despite the worker has its capacity diminished with age on the basis of physical decline, and have higher costs associated with errors and accidents that may suffer, in reality, what it is observed is that these workers have smaller indexes of accidents when compared to younger workers. The skill, experience and maturity in the trials have much relationship with this fact. However, when older workers are injured on, lose more time in your recovery and require specialized care and therefore higher costs (SILVERSTEIN, 2012).

Ergonomic modifications in work place are needed to compensate for the diminished physical capacities of older workers; these actions have basically three objectives: reduce extreme joint movement, reduce excessive force and reduce highly repetitive tasks (McMAHAN, S.;PHILLIPS, K., 1999; SILVERSTEIN,M., 2012)

4 Conclusion

The Brazil is also affected by ageing population that occurs worldwide and is manifested through higher rates of growth in adult and elderly segments of the population, as a consequence of the increase in longevity. This change in the age structure of the Brazilian population causes numerous consequences, especially those related to health, work and income. This research has dealt with an ageing population, their working conditions and how the functional disability can affect performance for work after the age of 60. This research involved also the ergonomic factors and their influence on the loss of functional capacity of the worker, as well as the adaptations that could contribute to improving the health of the worker, without compromising the results of the work.

It may be affirmed that in the future, the elderly group is that else presses the labour market towards employment generation. In general, people from 45 years of age, start to feel the loss of some functional capability, which requires changes and adaptations to the workplace. Physiological aspects that most affect job performance correspond to the integrated operation of the nerves and muscles, the functioning of human metabolism, the structure of the spine, senses of sight, hearing and kinesthetic sense. These factors affect workers with more advanced ages.

It was found that working on foot requires a lot of effort of the muscles and should be alternated between sitting and standing position at work. The lack of physical strength appears with the advancement of age, plus the ability to become slower reaction; however this can be compensated with the maturity of these workers. This fact is explained by the theory of compensation, which claims to be able to perform better for older workers compared to younger ones, subject to compliance with its limitations. The performance of older adults in today's society can be satisfactory if the requirement for physical strength in jobs is less as well as the requirement for speed of response. These factors can be compensated for the great experience of older persons in different situations and their ability to develop strategies to cope with difficulties. However this tradeoff occurs since people are prepared to develop it and since that society is willing to use the potential of the elderly. On the other hand, there are several researches that contest this affirmation, based on studies that have shown that in many situations this compensation was not proved. (SKIRBEKK, V., 2008)

It was also noted that improvements in lifestyle for older people can reduce differences between young and old, such as physical exercise, for example; and that changes should happen not only in personal scope of workers, but also in the workplace itself, so that it becomes more productive and health provider. Attention should be focused on the organization of work, psychological factors and ergonomic, physical and chemical means. In order to use the full potential of older workers, the workplace must fit the physical changes that occur with aging (diminished hearing, vision and muscle strength).

Factors that should be considered in this context are those related to repetitive work, laying material weight, speed of operations, needed for manual-precision and aerobic demands. It is important to note that the organization of work requires greater flexibility in relation to the rhythm, duration and cognitive and physical requirements, preserving also the emotional state of older workers.

One of the main conclusions of this work is that society expects and needs an active elderly, however, for this to occur it is necessary that he had conditions during his lifetime, mainly a suitable working environment.

Another important aspect is that in spite of early deterioration of the functional capacity of some workers, recognition, esteem and the positive attitude of superior, can improve the capacity for the work. In addition, note that risk factors associated with the job are more strongly associated with the ability to work, suggesting a reduction of the physical workload and psychosocial of the workers. Works in nightly periods interfere negatively in daily life due to social prejudice, changing moods and daily habits. It is concluded that the higher the working time on nighttime period, less the ability to work.

It was also noted that workers who reported the largest number of diseases have lower capacity to work and workers who have musculoskeletal disorders has her work rate decreased. Another important fact is

the direct relationship between work ability and personal factors. It was also discussed that retired workers feel uncomfortable in the workplace for fear of unemployment and changing market conditions, due to technology. Work can lead to muscle-respiratory and musculoskeletal disorders, if the environment is not appropriate, as seen in the rural work with young workers; however, the risks reported with more frequency by these workers were about ergonomics: working on foot, crouching, repetitive movements and pressure for production; women showed more signs of fatigue, which can be associated with its double workday – performing domestic services.

An important finding was natural selection made by the market where only the elderly healthier and able remained working. In addition, it was noted that education positively influences the ability to work.

So, the aging is not the factor that causes the professional decline during the work active life: the short education, adaptations badly finished, the content, the organizations e the physical conditions to execute the tasks are the causes of this kind of decline; this happens when the senior worker is evaluated based on young workers pattern (LAVILLE, 1989 apud SILVA, 1998).

In general, it can be seen that the recommendations to adequation of the work places are reduced to three categories: physical agents (light, vision and hearing), cognitive agents (mental loading, rhythm and complexity of the tasks), and ergonomic agents (postures, design of the tools and the automatizations of the repetitive tasks) (BARBOSA, 2007).

In conclusion, the ageing population in the context of global competitiveness and increased productivity of the undertakings concerned requires adequate measures and policies on working conditions for the ageing population, in order to maintain and/or enhance their functional capacity, delaying his departure of economic activities (CAMARANO and PASINATO, 2008). Ergonomic solutions in jobs are needed to compensate for the decline in physical ability of older worker. In order to have a greater control over the lesions on this population, actions are needed to reduce the extreme movements of the joints, the muscular effort and highly repetitive tasks (McMAHAN and PHILLIPS, 1999). A strategic program for the older workforce must consider 4 factors: balancing the mental and physical demands of the work and workers; consider the specific needs of older persons in work such as those relating to passage through retirement; attention on the physical and mental limitations of the worker when is young, so keep your ability when get older (SILVERSTEIN, 2012). Other way to get advantages of the older worker but it is not consensual is adequate the demands of the work to the limitations of older workers; some researches support that these kind of worker have better indexes like satisfaction, absenteeism and reliability than younger; there are studies whose conclusions are opposite depending on the kind of activities where they were researched (SILVERSTEIN, 2012).

References

Alavinia, S.M; Van Duivenhooden,C.; Burdorf,A. (2007). Influence of work-related factors individual characteristics on work ability among Dutch construction workers. Scand J Work Environ Health; 33(5): 351-7.

Alaves Jr, E. D. (2005). A intergeracionalidade contribuindo à superação dos modelos associativos segregacionistas: a universidade do tempo livre de Rennes integrando idosos e aposentados. Medelin : Civitas, p. 139- 175.

Andrade, C. B.(2002) .Envelhecimento e a capacidade para o trabalho dos trabalhadores do serviço de higiene e limpeza de um hospital universitário. Dissertação (mestrado) Universidade Estadual. Faculdade de Ciências Médicas. Campinas, SP: (s.n.).

Barbosa, A. et al; Vilagra, J.M.; Barbosa, S.C.; Moro,A.R.P.; Campos,N.; Cruz,R.M. (2007) Envelhecimento cognitivo ou transformação cognitiva? XXVII Encontro Nacional de Engenharia de Produção. ENEGEP, 2007.

Bellusci, S. M. Fischer, F. M. (1999). Envelhecimento funcional e condições de trabalho em servidores forenses. Revista Saúde Pública., São Paulo.

BRAZIL.(2004). Statute of the Elderly: Federal law n° 10741, de 01 de outubro de 2003. Brasília, DF: Secretaria Especial dos Direitos Humanos.

Bulla L. C.; Kaefer C. O.(dez, 2003). Trabalho e aposentadoria: as repercussões sociais na vida do idoso aposentado. Revista Virtual Textos & Contextos, nº 2. Textos & Contextos Revista Virtual. Nº 2, ano II.

Camarano, A.A.;Pasinato, M.T.(2008). Envelhecimento funcional e suas implicações para a oferta da força de trabalho brasileira. Texto para Discussão N.1326, Rio de Janeiro.

Chillida, M. S. P.(2003). Capacidade para o trabalho e trabalho noturno entre trabalhadores de enfermagem de um hospital universitário. Dissertação (mestrado) Universidade Estadual de Campinas. Faculdade de Ciências Médicas. Campinas, SP: (s.n.).

Costa, E.F.A.;Porto, C.C.; Almeida, JC.; Cipullo, J.P.; Martin, J.F.V.(2001). Semiologia do idoso. In: PORTO, CC. Semiologia Médica, 4ª. ed., Rio de Janeiro: Guanabara – Koogan.

Costa, E.F.A.; Porto, C.C.; Soares, A.T.(dez, 2003). Envelhecimento populacional brasileiro e o aprendizado de geriatria e gerontologia. Revista da UFG, vol.5, n°02. Obtido em 03 de 02 de 2012, de http:// www.proec.ufg.br.

Dutra, A. R. A. (2007) Adequação das condições de trabalho ao trabalhador que envelhece. XXVII Encontro Nacional de Engenharia de Produção, Foz do Iguaçu, PR, outubro.

Felix, J.(2007). Economia da Longevidade: uma revisão da bibliografia brasileira sobre envelhecimento populacional.VIII Encontro da Associação Brasileira de Economia da Saúde - ABRES.

Fonseca, A. M.; Paúl, M. C.(2003). Health and aging: does retirement transition any make difference? Reviews in Clinical Gerontology, 13, 257-260.

Giatti, L.; Barreto, S.M.(2003). Saúde, trabalho e envelhecimento no Brasil. Caderno Saúde Pública, Rio de Janeiro, 19 (3): 759-771.

Gordilho, A.; Sergio, J.; Silvestre, J.; Ramos, L.R.; Freire, M.P.A.; Espindola, N.; Maia, R.; Veras, R.; Karsch, U.(2000). Desafios a serem enfrentados no terceiro milênio pelo setor saúde na atenção integral ao idoso. Rio de Janeiro: Unati.

IBGE (2012). Síntese de Indicadores sociais 2003, Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro, 2004. Obtido em 2012, de IBGE Instituto Brasileiro de Geografia e Estatística: http:// www.ibge.org.br

IBGE (2012). Censo 2010. Instituto Brasileiro de Geografia e Estatística, 2010. Obtido em 22 de 01 de 2012, de IBGE Instituto Brasileiro de Geografia e Estatística: http:// www.ibge.org.br

IEA/Internacional Ergonomics Association (2012). O que é ergonomia? Obtido em 28 de 01 de 2012, de ABEPRO Associação Brasileira de Engenharia de Produção: http://www.abergo.org.br.

IPEA.(2006). Brasil: o estado de uma nação: mercado de trabalhe, emprego e informalidade. Instituto de Pesquisa Econômica Aplicada, Brasília.

Kreling, N. H.(2008). Envelhecimento, trabalho e renda: uma análise na região metropolitana de Porto Alegre. Indic. Econ. FEE, Porto Alegre, v. 36, n. 1, p. 67-76.

Kroemer, K. H. E; Grandjean, E.(2005). Manual de Ergonomia: adaptando o trabalho ao homem. Porto Alegre: Bookman.

Iida, I.(1990). – Ergonomia – Projeto e Produção. Editora Edgard Blücher Ltda.

Marín, L. L.(2001).Saúde e trabalho na indústria química: um estudo da qualidade de vida de trabalhadores aposentados. Tese (doutorado) Universidade Estadual de Campinas. Faculdade de Ciências Médicas. Campinas, SP: (s.n.).

Masson, V. A.(2009). Fadiga e capacidade para o trabalho entre motoristas de caminhão do entreposto hortifrutigranjeiro e mercado de flores de Campinas -SP . Dissertação de Mestrado. Campinas, SP: [s.n.].

Mcmahan, S.; Phillips, K.(1999). America´s aging workforce: Ergonomic solutions for reducing the risk of CTDs. American Journal of Health Studies; 15, 4; ProQuest Research Library pg 199.

Mennochi, L. M.(2009). Representações sociais de professores e alunos sobre envelhecimento e educação em um programa de Universidade Aberta à Terceira Idade. Dissertação (Mestrado em Psicologia do Desenvolvimento e Aprendizagem) – Universidade Estadual Paulista, Faculdade de Ciências, 179f, Bauru.

Moragas, R. M.(1997). Gerontologia social**:** envelhecimento e qualidade de vida. Tradução Nara C. Rodrigues. São Paulo: Paulinas.

Monteiro,M.S.;Gomes,J.R.;Ilmarinen,J.;Korhonen,O.(2001).Capacidade para o trabalho e envelhecimento entre trabalhadores altamente qualificados. In: Anais do Congresso de Pós Graduação de 30 anos da USCAR.

Moreira, M.M.(1998). O envelhecimento da População Brasileira: intensidade, feminização e dependência. Rev. Brasileira Estudos Pop., Brasília, 15(1).

Neri, A. A.(1996). Os profissionais de recursos humanos, a empresa e o trabalhador que envelhece. Dissertação (Mestrado em Administração de Empresa). Instituto Metodista de Ensino Superior de São Bernardo do Campo, São Paulo.

OMS/Organización Mundial de La Salud (1993). El envejecimiento y la capacidad de trabajo: informe. Ginebra.

Ornellas, T. C. F.(2004). Capacidade para o trabalho entre trabalhadores de empresa metalúrgica de uma cidade do interior paulista. Dissertação (mestrado) Universidade Estadual de Campinas. Faculdade de Ciências Médicas. Campinas, SP : [s.n.].

Pacheco, J.L.(Ago,2002). Educação, Trabalho e Envelhecimento: estudo das histórias de vida de trabalhadores assalariados focalizando as relações com a escola, como trabalho e com os possíveis sintomas depressivos, após a aposentadoria. Tese (Doutorado em educação). Faculdade de Educação – Gerontologia. Universidade Estadual de Campinas. 416f. Campinas–SP.

Parahyba, M.I.; Simões, C.C.S.(2010). A prevalência de incapacidade funcional em idosos no Brasil. Rio de Janeiro, 2006.

Penatti, V.V. Intervenções fisioterápicas e qualidade de vida na terceira idade. Rev. A terceira idade – estudos sobre envelhecimento SESC/SP, São Paulo, vol.21, n°49.

Peres, M A C. (mar,1998). A idade como fator de exclusão no mercado de trabalho. Programa institucional de bolsas de iniciação científica: CNPq: PIBI/PRP-UNICAMP. Processo n. 108510/97-2: relatório final.

Peres, M. A. C.(2002). Trabalho, idade e exclusão: a cultura organizacional e as imagens sobre o envelhecimento. Dissertação (Mestrado em Filosofia e Ciências Humanas) – Universidade Estadual de Campinas, Instituto de Filosofia e Ciências Humanas, s.n., Campinas, SP.

Queiroz, Z.P.V. ; Prado, A.R.A.(2010). Mudanças adequadas aos usuários idosos: humanização do atendimento na instituição hospitalar. Rev. A terceira idade/estudos envelhecimento SESC/SP, São Paulo, vol.21, n° 49, 2010.

Rodrigues,D.A.; Costa Junior,J.C.; Silva,L.A.; Lebiedziejewski, M.R.R.; Andersen, M.A.; Normanha Filho, M.A. (2011) Permanência ou reinserção do idoso no mercado de trabalho de Curitiba: existe gestão de pessoas preparada? Cadernos da Escola de negócios, Curitiba, 08: 01 – 17 vol.1

Rio, R. P. do; Pires, L. Ergonomia: fundamentos da prática ergonômica; São Paulo: LTr.

Sanglard, R.C.F.; Pereira, J.S.(Jul/Ago, 2005). A influencia do isostreching nas alterações dos parâmetros da marcha em idosos. Rev. Fisioterapia Brasil, v.6, n°4.

Silverstein, M.(2012). Designing the age-friendly workplace. Every year, more wrinkles are showing up at work as the 80 million americans born between 1946 and 1964 are entering their 60s with many potentially productive years still ahead. Occupational Hazards 29, Dec., 2007. Obtido em 30 de janeiro de 2012 de: http://www.occupationalhazards.com

Skirbekk, V. (2008) Age and Productivity Capacity: Descriptions, Causes and Policy Options. International Institute for Applied Systems Analysis. Oxford Institute of Ageing. Ageing Horizons, Issue No. 8, 4–12.

Tsuno, N. Homma, A.(2009). Ageing in Asia – tha Japan experience. Ageing Int 34:1 – 14.

Tuomi, K.; Esklinen. L.; Toikkanen, J.; Jarvinen, E.; Ilmarinen, J.; Klockars. M.(1991). Work load and individual factors affecting work ability among aging municipal employees. Scand J Work environ Health, 17. 128-34.

Vecchia, R. D., Ruiz, T., Bocchi, S. M., & Corrente, J. E. (2005). Qualidade de vida na terceira idade: um conceito subjetivo. Revista Brasileira de Epidemiologia,8 (3), 246-252. Disfunções decorrentes do processo de envelhecimento.

Wajnman, S.; Oliveira, A.M.H.C.; Oliveira, E.L.(2004). Os idosos no mercado de trabalho: tendências e consequências. Livro Os novos idosos brasileiros: muito além dos 60? Cap. 14, Rio de janeiro.

Walsh, I.A.P;Corral,S.;Franco ,R.N.;Canetti,E.E.F.;Alem,M.E.R.;Coury,H.J.C.G.(2004). Capacidade para o trabalho em indivíduos com lesões músculo-esqueléticas crônicas. Rev. Saúde Pública. 38 (2):149-59.

Welle, M. C. S.(2008). Fadiga e capacidade para o trabalho entre trabalhadores rurais de flores e plantas da região de Holambra – SP. Dissertação (Mestrado) Universidade Estadual de Campinas. Faculdade de Ciências Médicas. Campinas, SP : [s.n.].

WHO/World health organization (2012). Ageing and Life Course. Obtido em 13 de 04 de 2012, de WHO World Health Organization: http://search.who.int/search?q=working+conditions+aging+functional&ie=utf8&site=default_collection&client=_en&proxystylesheet=_en&output=xml_no_dtd&oe=utf8

Wong, L.L.R. Carvalho, J.A.(jan/jun, 2006). O rápido processo de envelhecimento populacional do Brasil: sérios desafios para as políticas públicas. Revista bras. Est. Pop., São Paulo, v. 23, n. 1, p. 5 – 26.