

An ergonomic analysis of work in the process of professional rehabilitation in Brazil

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Abstract. The purpose of this study is to describe the use of the Ergonomic Analysis of Work (EAW) in the process of rehabilitating workers, insured by the National Institute of Social Security (INSS) in Brazil, and to conduct a brief analysis of the instrument used by this body. Information obtained from EAW enabled the demand, the requirements of the activity and the skills needed to perform the tasks in the workplace to be determined, thus aiding the decision of the INSS as to rehabilitating the workers and their return to their jobs.

Keywords: professional rehabilitation, analysis of job, social security in Brazil

1. Introduction

In recent years, the world of work has undergone transformation processes such as industrialization, technological advances and seen an increase in productivity. These changes have brought about reformulating the organization of work, and require workers constantly to seek training and acquire new skills [11,13].

Thus, this new organization of work has become a complex matter that, on the one hand could help and assist people in their quality of life and on the other hand harm them in several systems. This has led to the emergence of occupational diseases and accidents at work, which sometimes incapacitate workers, causing, apart from damage to workers' health, an adverse impact on business profits, since the provision of quality services is reduced and the cost of treating and rehabilitating injured employees is high [19, 11].

In Brazil, general data on accidents at work, in 2009, from the Statistical Yearbook of Accidents at Work of the Department of Social Security and the National Institute of Social Security (INSS in Portuguese) reveal that 723,452 thousand work accidents were recorded. Compared with 2008, the number of accidents at work increased by 4.3%. Among the 2008 records, there were 17,693 cases of work-related diseases, 623,026 workers were laid off due to temporary disability, 13,047 workers because of permanent disability and 2,496 people died [3].

According to Todeschini, the Director of Occupational Health and Safety Policies Department of the Ministry of Social Security, the cost of accidents and inadequate work conditions reach R\$50 billion per year [7]. These events cause an enormous social and economic impact on public health in Brazil.

Thus, in order to minimize this impact, INSS provides rehabilitation services devoted exclusively to reintegration into the labor market when the insured worker loses, temporarily or permanently, the ability

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to ensure their survival through a professional activity. This comes about by means of the Professional Rehabilitation Program (PRP) [5].

This form of Social security in Brazil is an insurance policy that guarantees the income of the taxpayer and his/her family, besides offering several other benefits in cases of illness, injury, pregnancy, imprisonment, death and old age. To achieve this, employers and employees have to make financial contributions every month [6].

In 2009, the number of clients registered in INSS professional rehabilitation services reached 57,600. Of the clients whose initial assessment was inconclusive, 10.2% returned to work, 26.6% were deemed ineligible and 63.2% eligible to participate in the rehabilitation program. About 18,600 clients were rehabilitated, causing a 21% increase in the monthly average of clients on the program [4].

The individual who has been rehabilitated, prepared and guided in their vocation, by having been made aware of his/her role in society, may again become a productive and fulfilled person [15]. According to Article 136, of Chapter V of Decree No. 3.048/99, the Ministry of Social Insurance, Professional Rehabilitation is:

"educational or re-educational assistance or that of professional adapting or re-adapting which has been set up under the generic name of professional habilitation and rehabilitation in order to provide to beneficiaries who have been partially or totally incapacitated for work, on a mandatory basis, regardless of financial need, and to people with disabilities, the means indicated to bring about their re-entry into the labor market and into the context in which they live" [5].

In the PRP, the multidisciplinary team consists of medical experts, public servants with school-leaver or higher education qualifications from various disciplines, the latter being responsible for evaluating the potential for work of the insured worker, planning the professional program for their return to work, making visits to companies whenever necessary so as to analyse the job, and so forth [5].

The Analysis at the Workplace (APT in Portuguese) aims to identify whether the function analysed is compatible with the worker's abilities and limitations. This function can be the same as that exercised previously by the worker or else, one indicated by the company for his/her rehabilitation, whichever it may be, the aim is to seek his/her return to work. Among the various foci of APT, that of an ergonomic character stands out. This looks at the human as the center

of the attention being given and its specific objective is to study workers' real activity [2,16].

The information obtained enables the demand, the requirements of the activity and the skills needed to perform the tasks in the workplace to be determined [20], because, on considering only the description of the functions (the work prescribed), the risk of there being rehabilitation into a post that is incompatible with the abilities of the insured is increased, which may aggravate the clinical picture and increase the length of lay-off, thus causing the costs to the government to increase.

The ergonomic analysis of work is centered on the study of work activity which makes it possible to compare and contrast the activities laid down for workers with the way that they do them, by observing the strategies used by the workers to respond to the demands of the task [21].

To do so presupposes the use of different stages, such as analyzing the demand. In INSS, this is conducted by a professional rehabilitation team during which they establish a pre-diagnosis based on cross-checking the worker's actions within his/her function in the company. This results from conversations with the worker and the company, an analysis of the work prescribed and physical and/or psychosocial examinations [1].

After the pre-diagnostic stage, systematic observation is carried out, during which the professional adviser uses the EAW, i.e. the activity is analyzed, using a standardized instrument APENDIX VIII OI No. 116 INSS/DIRBEN of 05/25/2005, besides open and informal interviews with the worker who undertakes this function and/or with managers [1].

As reported, the advent of industrialization and new organizations in the production sector has led to a larger number of accidents and occupational diseases, thus causing a high number of people to become disabled and increasing Social Security costs in Brazil. Thus the need is perceived for actions aimed at professional re-allocation in order to reintegrate this manual labor force, who will then be able to contribute to the country's economic growth. This takes place by means of Professional Rehabilitation.

Thus, the purpose of this study is to describe the use and importance of the Ergonomic Analysis of Work in the process of the professional rehabilitation of those insured under the INSS and to conduct a brief analysis of the instrument used by this body.

2. Materials and Method

2.1. Design of the study:

This is a descriptive and exploratory study. It is descriptive since it aims to analyze the characteristics of facts or phenomena, and exploratory as it aims to provide the researcher with greater familiarity of a particular phenomenon to be further investigated [9].

This study is related to the Research Project entitled "Occupational Therapy in the Process of Professional Rehabilitation: a partnership between

UFPE and INSS." It was developed in partnership with the Technical Unit for Professional Rehabilitation of Executive Directorate - Recife / PE, during university extension activities.

2.2. Characterization of the subjects:

Five male subjects, with INSS insurance, took part in the study, as described in Table 1.

Table 1

Characterization of the subjects

SUBJECT	AGE	PLACE VISITED	FUNCTION	REASON FOR LAY-OFF
1	43	Shoe Shop	Salesman	Sharp pains in the knee (had surgery)
2	36	Can factory	Production technician	Coalizão tarsal bilateral
3	33	Plastics factory	Operator of manufacturing machines	Sharp pains in the leg (femur fracture)
4	51	Battery factory	Production mechanic	Slipped disc

Data collection:

Data were collected between September 2009 and November 2010 during four visits, in accordance with the demand from the INSS, in places of different branches of economic activity, including a shoe shop and three manufacturing companies: a can, a battery and a plastics factory.

The collection techniques used were: the direct observation of jobs in a real work situation, interviews and the recording of images based on the on-the-job assessment instrument used by INSS - APPENDIX VIII HI No. 116 INSS/DIRBEN, of 05/25/2005. Using this instrument was not possible in two of the workplaces analysed due to the demands presented by the job. Other information needed was obtained by consulting the insured workers' records, held by INSS.

The instrument used by INSS is divided into objective and subjective questions and applied by means of interviews and observation. It includes questions that cover the steps and activities that the worker performs within his/her function, as well as data on this, such as the nature of the function, materials and equipment used, characteristics of the environment, risk conditions, the physical and psychosocial characteristics required to implement activity, organizational issues, and so forth.

It is also proposed to analyse the frequency with which the worker performs actions such as: different positions (standing, squatting, sitting, kneeling); movements (of the cervical spine, trunk, upper and

lower limbs) and strength (lifting weighty objects from the ground, carrying and/or pushing). These factors are quantified and measured as per the frequency of action up to 25%, from 26 to 50%, 51 to 75% from 76 to 100%, in accordance with the total length of work activity.

3. Results

Job Description Analyses (JDAs) were carried out in accordance with the demands of the INSS, given that in the process of professional rehabilitation, this step is not always necessary.

Thus, JDAs may have different objectives, namely to investigate a possible return to the job performed previously by the insured or to identify a new job compatible with the worker's skills and contra-indications. The first objective was the target when there was a mismatch of interpretations, if there was a disagreement between the company and the INSS PRP team with regard to the contra-indications for the insured as to his return to the current job. And as to the second goal, the choice of jobs to be analyzed occurred in accordance with a prior analysis of the job description suggested by the company. Therefore, Tables 2, 3, 4 and 5 refer to the jobs analyzed.

Subject 1 (Table 2), a 43 year-old, poorly educated man, felt severe pain in his knee and the contra-indications for him are to lift and carry weight, constant walking about, prolonged orthostatism, going up and down stairs and squatting frequently.

Before that and after conducting the JDAs, the choice made was for the insured to return as a salesman, the same function as he had exercised previously, in a protected job with prevention and safety measures, because there is incompatibility with

the other jobs analyzed because of his physical disability and limited level of education.

It is worth stressing that for this job it was not possible to apply the job description assessment instrument due to the intense demand presented by the activity.

Table 2
Subject 1 – Shoe shop

JOB	STEPS	ABILITIES DEMANDED IN THE JOB
Stockman	<ol style="list-style-type: none"> 1. Unloading the truck; 2. Organization of the stock; 3. Cleaning the shop; 4. Packaging merchandise (when necessary). 	<ul style="list-style-type: none"> • Standing posture throughout the working day; • Gets on and off the truck and goes up and down steps to unload and arrange merchandise;
Shoe salesman	<ol style="list-style-type: none"> 1. Approaching the client; 2. Requesting merchandise in stock; 3. Puts the shoes on the client's feet; 4. Prepares the purchase order; 5. Passes the client on to the Cashier. 	<ul style="list-style-type: none"> • Standing posture throughout the working day; • Squats; • Bimanual skills.
Cashier	<ol style="list-style-type: none"> 1. Receives and handles amounts in cash; 2. Verifies cheques; 3. Does credit card transactions; 4. Fills in client record by using a computer; 5. Takes on packer role when necessary. 	<ul style="list-style-type: none"> • Standing posture throughout the working day; • Flexion of the knees; • Postural control; • Bimanual skills; • Demands a certain level of education (memory, attention span, logical reasoning, calculations).
Packer	<ol style="list-style-type: none"> 1. Receives merchandise sold from the sales assistants; 2. Checks against the fiscal document; 3. Packages into bags, or as a present 4. Collaborates with tidying up and cleaning the shop. 	<ul style="list-style-type: none"> • Standing posture; • Postural control.

Subject 2 (Table 3), felt severe pains when standing or walking about for a long time and was diagnosed as having bilateral tarsal coalition (CID S934), which is considered an occupational disease, such that working standing up and/or walking about frequently are contra-indications; he had undergone two surgical operations.

After the visit during which the JDA was conducted, the data analyzed in the study on the skills required for the functions were not compatible with the insured's abilities because of the physical effort

required by the activity, and so the company agreed to the possibility of reallocating the employee to an administrative area compatible with his administrative skills.

The function of a Total Productive (TPM) technician, analyzed in one of the JDAs, of Subject 2, is an activity that includes several tasks. Therefore, the instrument in APPENDIX VIII OI No. 116 INSS/DIRBEN of 25/05/2005 cannot be fully applied, since it does not allow job information compatible with this reality to be adequately recorded.

Table 3

Subject 2 – A can manufacturing factory

JOB	STEPS	ABILITIES DEMANDED IN THE JOB
TPM technician	1- Analysis and planning of report; 2- Analysis of faults (statistics on the number of faults in the system); 3- Planning a stoppage of work in the company (holidays) and maintenance; 4- Needs survey; 5- Offering training to new staff.	<ul style="list-style-type: none"> Resistance to working quickly for long periods; Resistance to working standing up; Skilful use of hands and arms; feet and legs; and fingers;
Production Technician	1- Operates inside spray machine; 2- Observes the application of varnish using injectors with nozzles; 3- At the start and end of the shift, cleans the nozzles; 4- Lifts the door where the nozzle is; 5- Conducts sample tests; 6- Weighs the dosage of the varnish; 7- Cleans the work environment.	<ul style="list-style-type: none"> On feet, walking (51% to 75%); Standing, fixed position (26% to 50%); Sitting (25%); Flexion of the coxo-femoral joint (25% to 50%); Extension of the coxo-femoral joint (50% to 75%); Flexion of the knee joint (25% to 50%); Extension of the knee joint (50% to 75%).

According to the INSS medical expert, when considering Subject 3 (Table 4), it is recommended he should not do activities that involve prolonged orthostatism, constantly walking about, going up and down stairs and squatting due to a sequel of the fracture in his left femur (CID-S72 .2).

After the JDA, it was found that the function undertaken by the insured person, apart from physical exertion, due to the constant walking about and loading of goods, requires a high level of being alert, due to the process of overseeing the machine. To

perform this task, about one month of in-company training is needed, but the function does not require experience.

Given the above, the medical expert contra-indicated a return to the job in view of the worker’s physical constraints and the company did not provide another activity so he could be rehabilitated. So, after discussing what motivated the insured, he was referred for training in the community (a computer course and administrative assistant).

Table 4

Subject 3 – Plastics factory

JOB	STEPS	ABILITIES DEMANDED IN THE JOB
Manufacturing machine operator	1- Putting the role on the crane hook so it is taken to the machine; 2- Starting the machine (electronic system); 3- Supervises the running of the machine using the panel; 4- Issues reports; 5- Cleans the machine; 6- Mounts wooden box in which to put the roll with film or plastic paper (finished product); 7- Gives supplies to the pump.	<ul style="list-style-type: none"> Standing posture, fixed; On feet, walking about (51 to 75%); (Alternating with the posture of being seated) May have to squat. Coxo-femoral flexion and extension (51 to 75%); Semi-flexion of the knee (51 to 75%), Going and up and down stairs, sporadically.

Subject 4 (Table 5), who is 51 years old, held the function of production mechanic. He complained of pains in the lumbar spine, showing a herniated disc (CID-M51), the contra-indications for him as per the INSS medical expert being activities that require intense physical exertion, constant walking, standing for long periods, going up and down stairs, and squatting.

Thus, as a result of the contra-indication recommended by the INSS medical expert, combined with the information collected in the literature surveyed, these pointed to the incompatibility of the worker performing the function he had performed since it was observed that there are movements that are not recommended, which intensify pains in the region of the spine, such as carrying weight and squatting. In addition, the standing posture, required

in all stages of production, is considered harmful to the health of these workers when adopted with great frequency during the working day.

Given the above, it was noted that it was possible to adapt the job by alternating between standing and sitting postures and avoiding flexion of the trunk for loading goods, by adding pauses that allow the body to relax the muscle groups most affected. However, considering the nature of the task and the specific characteristics of that job, for which there is an intense demand for walking about, in agreement with

the company, the suggestion was made to the company that it might change the function of the insured. However, the company did not carry out the rehabilitation and later filed for bankruptcy so the insured's return was not possible. In view of this, the case was discussed with the PR technical team and it was decided to offer the insured due invalid retirement and is associated with the insured's socio-professional circumstances and the loss of employment.

Table 5

Subject 4 – Battery factory

JOB	STEPS	ABILITIES DEMANDED IN THE JOB
Production mechanic	<ol style="list-style-type: none"> 1. Observation of the lamp making machine; 2. Supplying the machine with filaments; 3. Observes the conduct of production; 4. Adjust the machine when needed; 5. Should the employee not be able to adjust it, he should communicate this to the technician in charge. 	<ul style="list-style-type: none"> • Posture of static standing and /or walking about (around 75% of the time); • Flexion, extension, inclination and rotation of the cervical spine; • Flexion, extension, adduction and abduction of the shoulder; • Flexion and extension of the elbow, wrist and fingers; • Prono-supination of the forearm; palmar grasp reflex; • Flexion, extension, inclination and rotation of the thoracic-lumbar spine; • Flexion and extension of the hip, knee and ankle; • Strength: light and moderate, box: from one place to another (90° elbow); spade: unilateral above head level.

4. Discussion

The PRP team comprises medical experts and professional supervisors (PS), who are high-level experts from several disciplines. After the referral of the insured, by the medical expert, to the PRP process, it is for the PS to assess the insured's other physical abilities and potentialities, as well as their socio-professional circumstances. Later, at first, attempts are made to contact the employing company with a view to changing the function of the job or adapting it so that the insured may return to work. If necessary, visits are made to the company to conduct a JDA. The employing company has the right to refuse to let the insured return, in which case the PS should guide the latter to a conscious choice of a new activity in the labor market. Should this be done, the insured is prepared for a new job by means of courses and training events in the community.

After returning to work, the insured is monitored "in loco" and by means of contacts with the company.

Subjects 1 and 3, both received contra-indications as to activities requiring prolonged orthostatism and constant walking about on account of the leg pain from which each suffered.

Working in the static position and standing throughout the working day, is extremely tiring, because it requires intense static work from the musculature involved, especially in the lower back and legs. There is a need to intersperse standing postures with activities that can be carried out when sitting down.

After conducting the job description analyses of the respective insured staff, it was noticed, in the case of Subject 1, among the jobs studied, there was the possibility of his returning to the same function in a protected job, so as to guarantee special measures to this insured worker so that he could do the activity safely. However, in the case of the insured Subject 3, the activity performed was not compatible with his abilities and the employer did not provide another activity for his rehabilitation. The PS needed to guide the insured in choosing a new trade and to make vocational courses available in the community.

In relation to Subject 2, who was diagnosed with tarsal coalition, two jobs were analyzed so as to examine the possibility of return, during which it was found that the insured's skills did not match what was needed by the job, because both jobs required standing postures, which were contraindicated by the medical expert and the literature.

The triad of pain, deformity and stiffness are almost always present in the clinical framework of this pathology. Pain is the most common complaint and this can lead to the impossibility of taking short walks [17, 18].

As set out previously, Subject 4 has a herniated disc and in his current job, about 75% of his time is required to be in the 'static standing posture and/or walking about.' The maintenance of standing posture for a long time seems to it that there is an alteration in posture. What may well be adopted are asymmetrical postures of torsions and inclinations, besides lumbar lordosis, which is due to the muscles that support the spine relaxing [14].

Characteristics such as approaching old age and a poor education may affect the PR process adversely, which together with the refusal of a company to receive the rehabilitated employee back is another factor that hinders the Professional Rehabilitation of the insured person. For Mahayri (2004), during the PR process, the end goal, namely the return to work sometimes cannot be achieved because some difficulties may be found to be inherent in the person being rehabilitated and/or in the employer. With regard to the person insured, there may be the possibility of physical, mental and emotional impairments being present, in addition to the low level of education, which can become an impediment to reallocation to other jobs. As for the employer, this is due to their resistance to having a rehabilitated employee or because they do not have jobs that are compatible with the new needs of rehabilitated workers.

In this process of job analysis, using the INSS tool to evaluate jobs assists in collecting data regarding the physical, cognitive and social context during the activity performed by the employee and thus contributes towards taking a decision about onward referral of the person insured.

However, some gaps are perceived in relation to the application and content contained therein, as there is mismatch between the purpose of the instrument and how to evaluate the job, and this thus requires, so as to analyze the data more accurately, a

greater period of time to implement it in order to avoid misleading results in the cases examined.

Therefore, the analysis of the data collected in this assessment tool is based on subjective impressions, and requires the quantification of these data in percentages which can vary depending on the professional supervisor's perception. In addition, the instrument has a dynamic of limited applicability which makes it difficult to analyse different demands in the same job. As shown, for example, during the JDA of Subject 1, when it was impossible to apply the section corresponding to the frequency of the postures, movements and forces required by the job, due to the different tasks performed by the worker at this site.

In this situation, to specify the percentages effectively, it is necessary to use a camcorder to obtain more accurate records regarding the activity performed.

"The projection of a filmed sequence with commentary is frequently the most effective method for preserving the characteristics of the activity and recording the data which it is impossible to annotate in real time." [10]

At the same time, the need to improve the JDA process conducted by the INSS PRP staff is noticed, because this allows the demands and requirements of the activity to be determined, thus promoting the choice of environments and jobs compatible with the abilities and limitations of the rehabilitated individuals.

5. Conclusion

Therefore, it is concluded that conducting an analysis of real work is important, because only making a descriptive analysis of the task may result in the insured being erroneously reallocated.

Given the above, the JDA conducted by the INSS Professional Rehabilitation team was of fundamental importance to an understanding that there are elements harmful to workers' health and their occupational performance involved in the task performed during their working day. This is because, based on the JDA, the job skills required can be cross-referenced to the abilities and limitations of the insured, thus contributing to the final decision about the insured, and analyzing the factors that influence the effectiveness of professional rehabilitation.

As to the INSS instrument used for JDA, it is noted that there are barriers both to the content and form of its application, so it is suggested this instrument should be improved so that the results produced by the JDA may be even more reliable.

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