Accident management implementation focused on working costs: A participatory assessment approach.

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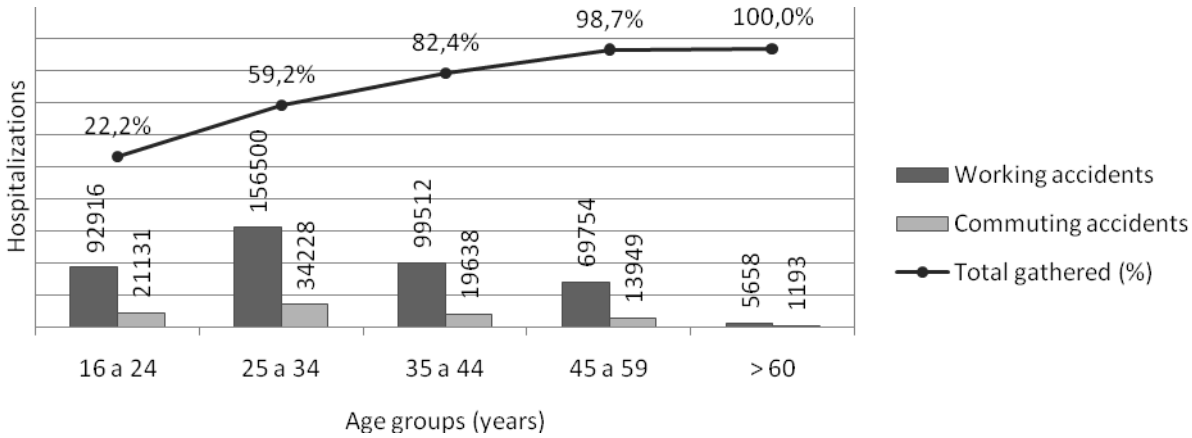
Abstract

Occupational Accidents (OA) are generally associated with elevated economic and social costs. This is obvious for the company occupational health and safety department (OHS), but not so obvious for the company general management, which is responsible for the approval of financial resources. These hidden costs which compromise the investments needs for reduction of OA. This study aims to create a systematic assessment of the accident associated costs of a large metalworking company, through the use of a participatory approach. In this approach, employees responsible for the accident management and care are invited to assist in the development of the systematic cost management. Their knowledge about accident management and care may assist to identifying the activities performed in these situations and attribute cost components to these activities. The logical structure of the systematic proposal is based on the method of Activity-Based Costing (ABC), with the aims focused on evaluation of the occupational accident costs and their relation to the cost of activities, understanding their performance and providing long-term solutions.

Keywords: Occupational Health and Safety; Activity Based Costing; Accident Cost Management; Participatory approach.

1 Introduction

An occupational illness or injury causes a significant disturbance to the balance of the work environment in which it occurs (Jallon, Imbeau, & de Marcellis-Warin, 2011). In Brazil, 514.479 hospitalizations were registered by the Social Insurance Ministry (SIM), only in 2009 (Figure 1), with more than 80% of these people until 44 years, the dominant part of the country workforce.



Source: SIM.

Figure 1 - Cases of typical OA and commuting accidents by age in Social Safety insured of Brazil in 2009.

OA are associated with high economic and social costs, and economic costs are not only borne by those injured but also by the enterprises concerned and the government (Shalini, 2009). These may be in the form of either direct or indirect. Direct costs may be in the form of material damage and down-time, and financial losses through experience-related insurance Premium and a share of the medical expenses (Shalini, 2009). Indirect or hidden costs may be in the form of overtime work made necessary by accidents, retraining expenses and intangible factors such as loss of company prestige and deteriorating industrial relations, may have a substantial impact on the quality and profitability of production (Shalini, 2009).

Managers tend to underestimate the indirect/hidden costs and, consequently, the benefits of investing in prevention (Jallon, Imbeau, & de Marcellis-Warin, 2011). These benefits may be more visible to members of the OHS, which usually include physicians, safety engineers, nurses and technicians. Moreover, these workers haven't the knowledge to cost management, and the company will adopt these policies more readily if managers are convinced that they are worthwhile financially. (Lanoie & Tavenas, 1996). In addition, OHS may demonstrate their value, reducing the costs of the company with avoid of workplace accidents, also increasing the managers and employees motivation to increase prevention efforts with other accident statistics (Rikhardsson & Impgaard, 2004). The costs of OA could be also used in connection with bids, customer profitability calculations, and project cost management, and OHS may have a stronger intra-organizational political position (Rikhardsson & Impgaard, 2004).

Costs of injuries related to work were evaluated in several studies using methodologies generally based on ABC. With the same theoretical basis, this study aims to create a method for assessing the working accident costs for a large metallurgy company, based on cost components presented in performed activities, using the participation of accident managers and care personnel. The evaluated company, has policies to reduction of working accidents, but, not based on the accident costs. The participation of the OHS employees enables to understanding of real needs, and can treat the data so as not to jeopardize the work of those responsible, creating indexes of performance through low complexity and low expenditure of time to perform these activities. It is possible that the initial approach does not meet the total needs of the company, so we will consider continuous improvement, held annually. The important thing is that the insertion of the new model, allows changing the preventing culture in the company.

2 ABC approach

ABC is a method based on resource consumption by activities involved in producing a particular product, including processing, transportation services, materials, inspections and all other stages of production that may affect costs (Andrade, Pessanha Filho, Espozel, Maia, & Qassim, 1999). The ABC system is basically performed in two phases (Bornia, 2002): In the first phase, the organization should be modeled in activities which, chained, forming processes, differentiating ABC from traditional methods because it facilitates support for actions to improve the company, the second phase, costs are assigned to activities.

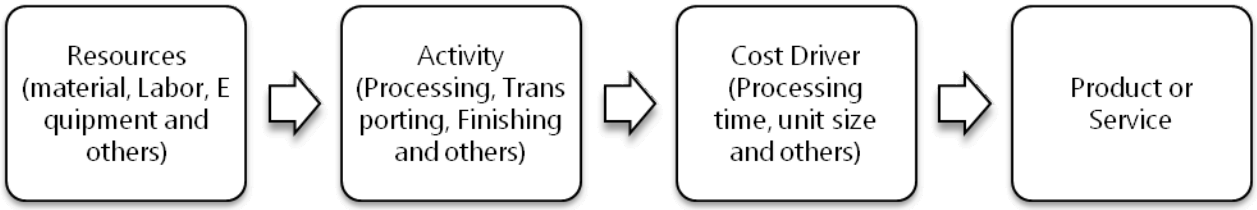


Figure 2 - ABC model. Adapted (Andrade, Pessanha Filho, Espozel, Maia, & Qassim, 1999).

ABC is seen in operations in a company in a more accurate and consistent than the traditional method of cost (Andrade, Pessanha Filho, Espozel, Maia, & Qassim, 1999). The basic idea of ABC is to take the costs of various activities of the company and understand their behavior, finding bases that represent the relationships between these products and activities (Bornia, 2002). Measuring the costs of products and

activities properly, you can determine the price of the product, improve its processing, and by eliminate activities that do not add additional value, better plan operations, determine the commercial strategy and finally measure their operating properly (Khozein, 2009).

Advantages offered by ABC (Bornia, 2002): Form a vision of process against the functional view, essential to the rationalization of business processes; The cost calculation is more accurate; Makes it possible to recognize that activities are significantly influencing the spending of the company; Improves the management of the company and not only improve cost system. Disadvantages presented by ABC (Bornia, 2002): The modeling of the production system (determination of the activities) is much more laborious than the traditional cost methods; Calculation of the cost of activities is also more difficult.

We consider four factors that have an impact on the size of the costs of workplace accidents, appointed by Rikhardsson & Impgaard (2004): type of accident and length of absence, wage structure and policies, OHS management system scope, and production process vulnerability. For these, we consider different work characteristics and number and types of accidents, absence payment responsibility (Company in the first 15 days and Social Insurance after), workers position (sector), OHS system scope, policies and formal activities, and available employee replacement.

3 Method

This is an applied study, which seeks through the use of stakeholder, involved in the processes of working accidents care and management, implementing the existing accident management system by including costs management. In a first instance, the aim is presenting for some stakeholders, the concept of a management system including accident costs. In the first step, the initial model was presented to the safety engineer in order to promote the interest in the company. After, they were invited to participate, the OHS employees and company consultants, including those responsible for accident management and treatment/care of the victims, including: two technicians, a safety engineer and a nurse. The advisory group was composed of an ergonomist (First author), and an engineer (second author), and a manager (third author), responsible for cost management. The group discussed: costing methods, methods of safety management, Brazilian standards and bureaucratic aspects.

In the second step, the research continues based on four steps (Bornia, 2002), with adapted objectives: 1) Factory background, in order to understand the organization of the company, what are the functions of OHS, as they are performed, and who is responsible. The information was requested by researchers and obtained by the members of the company management and OHS management; 2) Activities description, in order to define a model with the activities that are normally executed because the occurrence of OA. The information was requested by researchers and obtained by the members of the OHS management; 3) Cost components, in order to define the measurable cost components presented in the activities that were chosen. The information was requested by researchers and obtained by the members of the OHS management, and the cost of the component has been obtained by the members of the company management; 4) System design and Implementation, in order to define the model for cost management system, adapting the current model of accident management. The model was created by researchers and approved by the members of the company management and OHS management. Each step was performed with scheduling of a meeting for discussion of the proposals and finalized through the approval of all stakeholders.

4 Results & Discussion

4.1 Company background

The company used to conduct the study operates in the metallurgical industry, from product development to manufacturing them. This company has OHS management as Regulatory Standard (NR4), Internal Commission for Accident Prevention (ICAP) and Council of Ergonomics (COERGO). These services

have the support of external consultants, and are responsible for risk management, OA management, occupational diseases prevention, conduct of education programs and filing documents. These activities are reported internally to 597 employees divided into twenty sectors as shown in Table 2, which are also represented OA occurring in 2011 due to the removal.

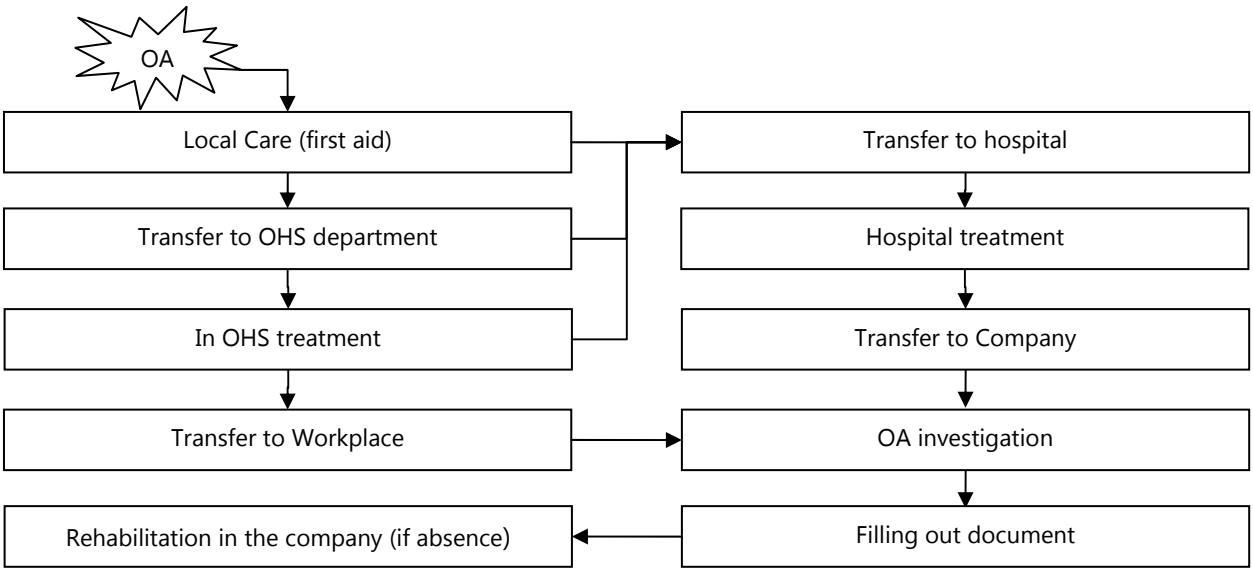
Table 1 - Distribution of employees by sectors and OA as a function of days of absence.

		OA in 2011 as days of absence				
nº	Sector	Employees	< 15 days	> 15 days	Deaths	All
01	Management	97	0	0	0	0
02	Stockroom	10	0	0	0	0
03	Light alloys	34	2	0	0	2
04	Heating the oil	1	0	0	0	0
05	Wire	6	0	0	0	0
06	Package 1	62	1	0	0	1
07	Package 2	24	0	0	0	0
08	Stampings	68	4	1	0	5
09	Expedition	15	0	0	0	0
10	Laboratory	2	0	0	0	0
11	Maintenance	24	1	0	0	1
12	Assembly 1	38	2	1	0	3
13	Assembly 2	30	0	0	0	0
14	Patrimony	7	0	0	0	0
15	Paint 1	71	0	1	0	1
16	Paint 2	27	1	0	0	1
17	Prototype	14	0	0	0	0
18	OHS	6	0	0	0	0
19	Welding	39	2	0	0	2
20	Pipes	22	0	1	0	1
All		597	13	4	0	17

Source: The company management.

4.2 Activities and Cost Components

OHS and project team developed a model used in the company, including all activities carried out by OHS management and external services (Figure 3).



Source: OHS Management.

Figure 3 - Activities performed after the occurrence of OA.

For each activity, were allocated the cost components are considered measurable and within the capacity of OHS management. These were considered costs of skilled labor in the care and transportation, cost of inputs used in the care, medical costs, administrative costs and other costs (compensation, retirement pay, cost of training replacement staff, overtime, etc.). We did not consider: Opportunity costs, loss of performance, company image commitment and other immeasurable costs.

4.3 System design and implementation

Once the activities and cost components were defined, and approved by the consulting team and OHS, assessment tables were created with current accident management, adding cost information for each individual OA and information joint interpretation of general data (Figure 4).

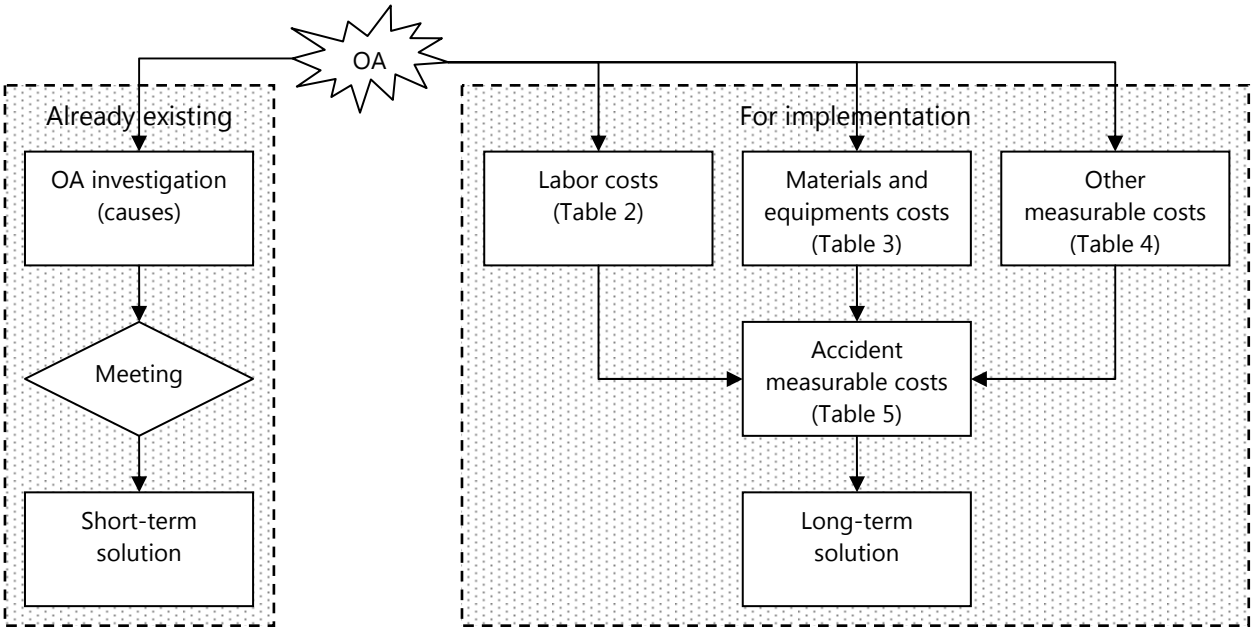


Figure 4 - Model of OA management implemented with cost management.

The information generated by the current system of accident management allows creating short-term solutions to eliminate risks of OA. The proposed model can also create long-term solutions through cost analysis by sector, by type or OA severity. Furthermore, it allows understanding the process created from the accident occurrence, and making improvements in OA care and OA management. Table 3 shows the labor cost, during the service to victims of OA and during the investigation and management of OA. This table do not contents the labor cost of the OA victim.

Table 2 – Labor cost components per activity.

	Cost component (total minutes)														
Activity	A	B	C	D	01	02	03	04	05	06	. . .	16	17	18	19	20
Local Care (first aid)	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Transfer from workplace to OHS department	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
In OHS treatment	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Transfer from OHS department to workplace.	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Transfer from company to hospital.	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Hospital treatment	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Transfer from hospital to company	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
OA investigation	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Filling documents.	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Rehabilitation in the company (if absence)	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Overtime	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
All labor costs:	0,00															

Note: The labor cost components labeled from 1 to 20 represents the factory sectors, and from A to D represents the OHS employees (Safety engineer, safety technician, nurse and brigade firefighter, respectively).

Table 4 shows the inputs used in first aid, OHS treatment and rehabilitation in the company, and table 5 shows other measurable costs which are obtained in accounting, and includes services provided by others.

Table 3 – Cost of materials and equipment by activity.

Activity	Input cost
Bandage (low complexity)	0
Bandage (medium complexity)	0
Bandage (high complexity)	0
Immobilization (Bandage)	0
Immobilization (Splint)	0
Immobilization (Long board)	0
Other procedures	0
All input costs:	0,00

Note: Other procedures include all or any activity that is not performed frequently in attendances.

Table 4 - Other measurable costs.

Activity	Total Activity Cost (R$)
Cost for medical transportation	0,00
Cost for hospital care	0,00
Legal costs (injury)	0,00
Consultancy costs (Short-term solutions)	0,00
Legal costs (Penalties for delayed production)	0,00
Maintenance costs (Inputs)	0,00
Others	0,00
All costs:	0,00

Note: Some data in this table depend on information to be obtained from other sectors such as maintenance and general administration, or depend on the time for completion as solutions and legal process, and may be delayed in the registry.

Table 6 shows the summary of all OA investigated, in order to compare data quickly and allow the decision-making regarding the long-term improvements, aimed at reducing OA that have the greatest impact on the costs of the organization. This table complements the existing information on accident investigations, where they are compared according to magnitude and days of absence from work.

Table 5 - OA total costs.

nº	OA short description	Labor costs	Material costs	Other costs	Total costs
01	E.g.: OA date + OA type (Cut, crushing, burning, etc.) + Sector (Management, maintenance, prototyping, assembly, etc.) + Absence days.	Table 3 results.	Table 4 results.	Table 5 results.	Sum of the results of table 4, 5 and 6.
02	(...)	(...)	(...)	(...)	(...)
03	(...)	(...)	(...)	(...)	(...)
04	(...)	(...)	(...)	(...)	(...)
05	(...)	(...)	(...)	(...)	(...)
06	(...)	(...)	(...)	(...)	(...)
31	(...)	(...)	(...)	(...)	(...)
32	(...)	(...)	(...)	(...)	(...)
33	(...)	(...)	(...)	(...)	(...)
34	(...)	(...)	(...)	(...)	(...)
35	(...)	(...)	(...)	(...)	(...)
Total accidents costs in 2012:					Sum of total costs.

Note: Any OA follow the same pattern shown in Example 01.

The tables were implemented, and the results will be presented at regular meetings of stakeholders to the necessary changes. The overall results are presented for management to enable more reliable investments.

5 Conclusion

This work represents a first step in implementing a costing method of OA based on activities together with all persons of the company involved in the investigation tasks and accident management at all stages of design.

The method implementation was possible because of organizational factors, and concern about issues related to OA. The integration of the multidisciplinary involved employees played an important role for the exchange of knowledge among members, the possibility of deployment, aiming real needs of the OHS and the company management. The full acceptance was due to the possibility of increased political force of OHS in relation to long-term decisions related to safety.

Another important point was the academic education of OHS members (safety engineer, manager and nurse) for the understanding of the project. The interest of all the parties to make improvements and provide safety solutions is facilitated with this method because it creates a closed relation between OHS management and Company management.

This study will enable the creation of initial strategies for long-term solutions, such as: organizational changes, management changes, and workplace changes. These, aimed at reducing OA and therefore reduce company costs, and also improving quality and increasing productivity. Furthermore, the possibility of changing the method makes possible the implementation itself continuously, which may include more activities and cost components.

6 Proposal for future studies

The next stage of this project provides a measurable quantification of costs defined in this study for a year, to highlight the impact of accidents on the company's costs.

Other sectors of the economy can use this strategy to start an approach to costs in the sectors of safety, which may have different activities and cost components, and therefore other impacts on the organization.

7 Acknowledgments

Despite the secrecy required by the partner company, we would thank the SESMT members, not mentioning names, for their collaboration in this project, since they are of fundamental importance also for continuity.

References

Andrade, M., Pessanha Filho, R., Espozel, A., Maia, L., & Qassim, R. (1999). Activity-based costing for production learning. *Int. J. Production Economics* , pp. 175-180.

Bornia, A. C. (2002). *Análise gerencial de custos: Aplicação em empresas modernas.* Porto Alegre: Bookman.

Hendrick, H. W. (September de 2003). Determining the cost–benefits of ergonomics projects and factors that lead to their success. *Applied Ergonomics , 34* (5), pp. 419-427.

Jallon, R., Imbeau, D., & de Marcellis-Warin, N. (2011). Development of an indirect-cost calculation model suitable for workplace use. *Journal of Safety Research , 42* (3), pp. 149-164.

Khozein, A. (2009). The factors effective in a succeed implementing Activity Based Costing and Management. *International Conference on Information Management and Engineering*, (pp. 380-384).

Lanoie, P., & Tavenas, S. (1996). Costs and benefits of preventing workplace accidents: The case of participatory ergonomics. *Safety Science , 24* (3), pp. 181-196.

Monnery, N. (1999). The costs of accidents and work-related ill-health to a cheque clearing department of a financial services organisation. *Safety Science , 31*, pp. 59-69.

Rikhardsson, P. M., & Impgaard, M. (2004). Corporate cost of occupational accidents: an activity-based analysis. *Accident Analysis & Prevention , 36* (2), pp. 173-182.

Shalini, R. T. (2009). Economic cost of occupational accidents: Evidence from a small island economy. *Safety Science , 47* (7), pp. 973-979.

Vink, P., Koningsveld, E. A., & Molen, J. F. (July de 2006). Positive outcomes of participatory ergonomics in terms of greater comfort and higher productivity. *Applied Ergonomics , 37* (4), pp. 537-546.