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Different perceptions of risk amongst workers in a biotechnological production unit.

Carmem L.C. Marinho*, **Carlos M. Freitas**, **Carlos M. Gomez** : CESTEH - Centro de Estudos da Saúde do Trabalhador e Ecologia Humana, Escola Nacional de Saúde Pública, FIOCRUZ, Rua Leopoldo Bulhões 1480, Manguinhos, 21041-210 Rio de Janeiro, Brazil, and **Wim M. Degraeve** : Departamento de Bioquímica e Biologia Molecular, Oswaldo Cruz Institute, FIOCRUZ, Av. Brasil 4365, 21045-900 Rio de Janeiro, Brazil.

* Corresponding author:

E-mail: cmarinho@manguinhos.ensp.fiocruz.br

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SUMMARY

Factors that may contribute to the successful implementation of biosafety programs were evaluated from the perspective of the perception of risk held by the various actors for whom the programs are targeted. The study was carried out in a biotechnological vaccine production unit in the public sector in Brazil, and adopted a methodology that combined both quantitative and qualitative approaches. Different perceptions of risk in the work process and environment held by professionals in the production and administration areas, as well as by those occupying management positions, were analysed. The results show the importance of taking into consideration such perceptions in the formulation of biosafety programs, particularly since the latter aim at achieving changes in behaviour in the way risks are dealt with. The paper further suggests that these perceptions are somewhat related to the various forms of participation in the productive process.

Keywords : risk perception, biosafety, biotechnology, risk management, work environment

INTRODUCTION

The development of biotechnology has been gradually growing in relevance, due to the impact this technology is expected to have on priority areas related to the fulfilment of basic human needs, such as food production, vaccines, pharmaceutical drugs, the treatment of effluents, agriculture and the production of bio-insecticides, amongst others. This impact arises from the potential of biotechnology both to generate new products and to optimise the use of existing ones [3]. In the face of the rapid development of new biotechnological processes and possible associated risks, scientists, governments and interest groups have, since the 1970's, been debating its biosafety aspects. Regulation proposals have, in general, been geared to assess environmental issues and the safety of the professionals who handle microorganisms in scientific research or in industrial production processes [2,11,13,14].

As suggested by Slovic [16], in order to ensure the changes in attitude, hoped for with the introduction of safety programs, it is essential that these should take account of the various ways in which risks are perceived and dealt with. A better understanding of how workers perceive risks in the workplace may have important implications not only for the safety of those individuals, but also for the development of strategies for environmental protection and safety in production [9].

The various studies on risk perception in the field of psychometrics have shown, through methods of risk evaluation by scales and multi-varied analyses, the limitations of probability analyses of risks because they do not consider the different attitudes of individuals in the face of risk [1,7,8,17]. Social studies, on the other hand, using the results of qualitative research about specific social groups, or even including secondary sources, point out that social, political and economic relations and interests, as well as cultural values, are a determining factor in the way risks are perceived [4,5,19,20].

Although the literature on perception of risks has been growing significantly over the last years, there are few reports related to specific groups of the population or to workers exposed to risk. Among the latter, those carried out with workers in nuclear plants using psychometric methods [10,15] and those with workers in chemical plants, following a qualitative line of research [6,12], are worth mentioning.

From those studies we may infer that the individual's experience in the workplace, as well as the social division of the work itself, conditions the various perceptions of and attitudes to risk. In the light of these findings, the present study attempts to integrate qualitative and quantitative approaches. The quantitative data provide general indicators of the understanding of the work environment, of the variety of risks present and of the work

organization; while the qualitative analysis allowed us to interpret the meaning given to the above factors by the actors involved. This combination of approaches can support, in a more consistent way, the elaboration of biosafety information and the development and implementation of training programs.

MATERIAL AND METHODS

For this study we selected a vaccine production unit in the public sector, where a wide variety of risks (biological, chemical, radioactive and ergonomic) are constantly present. The unit has 234 workers distributed as follows: 153 in production activities (Group I), 35 in administrative activities (Group II) and 46 in management positions either as sector, service, laboratory or department supervisors (Group III). In the three groups there is a majority of male workers (60% in groups I and II, 69.6% in group III) which may be due to an earlier policy where some tasks or even some sectors of production were regarded as more appropriate for the male gender.

The initial phase of the study consisted in participating observation, where informal relations were established which later contributed significantly towards a qualitative handling of the data obtained. At a later stage, structured questionnaires with open and closed questions were applied. We interviewed 35 production workers (group I), 10 administrative workers (group II) and 46 holders of management posts (group III). Our assumptions were that present experience (group I), or past experience (group III) of risk situations in the process of production of kits for immunological screening and vaccines would have conditioned perception in these groups. For this very reason and as done previously in a study by Sjöberg and Drottz-Sjöberg [15], we also interviewed workers that were not directly exposed to the risks present in production (Group II).

The selected sample was representative of all the different sectors and professional groups in the production process. In the case of managers, however, rather than using a sample, we interviewed every member of the group because we felt that, given the greater power in making important decisions related to the prevention and safety measures to be adopted, their perception of risk was particularly relevant. All workers interviewed in this study participated voluntarily, after being informed about the purpose and methodology.

The closed questions included factors related to the work environment, such as temperature, ventilation, illumination and space, and some indicators of how the work processes were organised, such as lack of safety in the conditions the work was carried out, requirement for constant attention, anxiety, monotony, overwork, excessive speed or repetitiveness, pressure or indifference from the management, dissatisfaction with the relationships within the team, etc. With regard to risks, more general questions about the presence of the various elements of risk in the workplace were combined with specific questions about the presence of radioactive, ergonomic, biological, chemical and physical

risks. The open questions helped to assess the general impressions of those interviewed about the work conditions and possible background situations that might interfere with their perceptions of risk.

RESULTS AND DISCUSSION

Data on the views by the various professional groups regarding the conditions in which the work is carried out and their perception of the various risks involved are presented, so as to emphasise the interrelation between the two variables.

Factors referring to the working environment

In general, workers from all three groups regarded their work conditions as unsatisfactory, although in different ways. Temperature, as seen in Figure 1, was the predominant factor (54.3% for group I, 70% for group II and 47.8% for group III). This can be explained by the presence of areas with very low temperatures (cold rooms and production rooms) and very high temperatures (washing rooms with boiling tanks, autoclaves, ovens, etc.). A large number of production workers are subjected to abrupt changes in temperature since they are constantly circulating between these areas. For group II, the low temperatures in the air-conditioned offices, particularly for those with computers, may have been one of the reasons why 70% of the people interviewed referred to this factor. On the other hand, in relation to ventilation, only 10% of those interviewed in this group mentioned discomfort.

Figure 1 Factors that cause discomfort, related to the working environment. Group I (production workers); group II (administrative personnel); group III (managers).

The presence of noise was mentioned by similar percentages of people in the three groups (48.6% for group I, 40% for group II and 43.5% for group III). Noise results from using obsolete or poorly maintained equipment such as freezers, capping machines, or air conditioners. It is worth noting that for most of those interviewed, this situation was the result of the limitations imposed by management to the maintenance sector which acts primarily in emergencies, taking care of equipment with improvised solutions. A worker from group I summarises this picture: "... there are people here going deaf ..., we've complained but nobody does anything Noisy machines, the work mustn't stop ... the worker gets deafer ...".

Illumination of the workplace also seems to be often inadequate for the work carried out (17.2% for group I, 30% for group II and 26.1% for group III) but specially so for the administrative workers.

The workspace itself is also seen as an important source of discomfort for workers in all

three groups (34.3% for group I, 50% for group II and 39.1% for group III), but particularly for those in the administrative sector. This is probably a result of the disordered growth of this production unit. It may be worth considering here whether deficient planning of new sectors to be introduced, with the consequent negative impact on the work environment and conditions, is a specific problem of the public services. One should consider that the way the workspace is organised may be determinant both for the perception of risk and for increase or decrease of the risks themselves.

Factors referring to the organization of the work process

The importance of the organizational elements of the work, often neglected, became evident in this study, as shown. Typical dimensions of Taylor-type work processes, such as repetitiveness, speed, monotony and overwork, generated greater insecurity and dissatisfaction. The psycho-social impacts of this combination of elements manifest themselves through a high degree of expressed or latent anxiety. It is symptomatic that more than half of the production workers considered work repetitiveness as a discomfort. As one of them states it: "... It's like a machine, you arrive and you know exactly what you're going to do. Let's say I've got used to it ...". For this group, besides being repetitive and monotonous, the work routine also means constant overwork and being forced to keep up an accelerated rhythm so as to respond to the demands of the unit itself and of the Ministry of Health. Repetitiveness is also perceived as a discomfort for 50% of the interviewed in group II.

Figure 2. Factors that cause discomfort, related to the organization of the work process. Group I (production workers); group II (administrative personnel); group III (managers).

For group I, unlike for the other groups, anxiety doesn't seem to be a preponderant factor. This does not mean that their job is less stressful, but perhaps it just shows that there are different ways to confront the problem of dissatisfaction with the general conditions in the work organization. In contrast, a large part of the workers (70%) in group II considered anxiety as a problem, which may be reflecting dissatisfaction with factors such as the demand for constant attention (60%), or management's lack of interest (50%), and the repetitiveness of the work (50%). Dissatisfaction with the relationships between colleagues, monotonous work and working at a rhythm regarded as too fast, is also significant in this group, affecting about 40% of the workers. In group III, about 50% of the workers mentioned, besides anxiety, overwork and dissatisfaction with the relationships between colleagues.

Global dissatisfaction with the work conditions is, no doubt, one of the main factors leading to anxiety in groups II and III. It is important here to consider that this anxiety may have been influenced by the timing when the study was carried out. This was the final

period of a specific administrative management and the uncertainty surrounding the implementation of change, which was nevertheless regarded as essential, was mentioned by the large majority of those interviewed from these groups. This situation is in itself quite worrying, since the anxiety found in a large number of workers from these two groups, is not only a factor influencing their perception of risk, but may also be leading to stress, thus becoming an additional risk.

Perception of Risks in the Workplace.

Organizational factors and satisfaction with the work influences the way risks in the workplace are perceived, whether these risks are of the potentially catastrophic kind, or just part of the everyday work routines [9,10,12,15]. As pointed out, workers from the three groups, albeit in different ways, did not consider the factors related to the conditions prevailing in the work environment, nor the organization of the work to be very satisfactory. As can be seen in figure 3, in groups I and III, respectively 88.6% and 93.5% of the workers point out the existence of risks at work. In group II (administrative workers), this percentage was 70%. These results, although surprising, may be reflecting the general character of the question, which was merely intended to detect whether the workers as a whole, in each group, perceived risks or not in their working environment. Surprisingly, in the case of specific risks (physical, chemical, biological, radioactive and ergonomic) group III presented, in general, the highest percentages (63% for physical, chemical and biological, 8.7% for radioactive and 34.8% for ergonomic risk) being followed by group I (51.4%, 48.6%, 40%, 2.9% and 22.9%). These figures may seem paradoxical, since production workers are more exposed to risk in their routine activities. However, this difference can be related, among other things, to the experience of work accidents. The average of accidents in groups I and III is about 70%, and 48% and 51.6%, respectively, of the workers in those groups had suffered more than one accident. The number of accidents that led to the worker being discharged was slightly higher in group III.

Figure 3 Perception of risks in the workplace. .Group I (production workers); group II (administrative personnel); group III (managers).

In terms of attitudes, group I showed a more defensive posture (a feeling of doubt and fear in face of the risks present, deriving, amongst other reasons, from their reduced participation in the decision making process on risk control). Group III took on a more watchful attitude (a feeling of mistrust and fear about possible damages, but also presented suggestions about precautions or ways to eliminate risks). Taking defensive or watchful attitudes in the face of risk, according to Stallen and Coppock [18], is determined by the hope people have to find safe alternatives for the present risk situation. A lack of hope that safety measures will be adopted could lead to an artificial reduction in the individual's fear, and he/she would tend to underestimate or cover up this fear, so as to reduce the stress

generated by the dissatisfaction with the prevailing situation. Nelkin and Brown [12] add that such attitudes derive largely from the possibilities people may or may not have of controlling their general work conditions. For these authors the sense of powerlessness that derives from situations regarded as irreversible or uncontrollable may be expressed either by exaggerating or by minimising the actual problems. In the light of these assumptions, the degree of participation in the decision-making about control or reduction of risks may, therefore, reflect the different perceptions of the various groups. The fact that in group III, the levels of perception (both general and specific) were relatively higher, may reveal the greater power of expression of this group, without necessarily corresponding to their effective power to modify specific situations. One of the members of this group expresses this limitation: "... I think that the directors should pay more attention to the Unit's technical body with regard to changes that could lead to an improvement in the work conditions. Middle level management should be heard more often ..."

In evaluating the risks mentioned by workers in group I (production) who represent the main activity at this unit, one notes that for this group the radioactive risk is almost non-existent, and in fact, in this particular production unit, activities with radioactive material are few and use low amounts of the material. Physical risk appears as the most present for this group and this may reflect the fact that workers are constantly handling often poorly maintained equipment. Chemical risk appears in a higher percentage than biological risk, and this does not seem to reflect the characteristics of this production unit, since different kinds of vaccines (bacterial and viral, inactivated or attenuated) are produced and a P3 containment facility is at its disposal for research and development. It is possible that the fact the workers are dealing with the production of vaccines may give them the idea that they are dealing with a harmless product. For instance, it is a common practice for some workers to self-inoculate with an oral vaccine, left over after bottling.

Radioactive risks were mentioned more often in group II (administration), a group that has the lowest probability of exposure. This may derive from the deficient information these workers have about the unit's production activities, and also because radioactive risks have been widely publicised in the media in relation to various accidents, particularly those at Chernobyl and Goiania. It may also be merely translating the discomfort the group feels with regard to their physical space. Nevertheless, the figures are in consonance with observations in other studies which found that there is a tendency for risks to be viewed as important when activities or substances are perceived as not under the control of individuals, or as unknown, highly complex and liable to have immediate or long-term adverse effects. [1,7,8,9,17]. It is likely that these factors, added to the effective presence of radioactive substances in the research activities of another sector within the same building, may have contributed to this perception of radioactive risks, precisely in the group that has fewer possibilities of contact.

FINAL CONSIDERATIONS

Throughout this study, conceived as a contribution towards the formulation of biosafety programs, we have affirmed the importance of the perception professionals have about risks. The various forms of participation in the work process itself condition perception. It is not sufficient, therefore, to establish technical guidelines and procedures, without considering the level of understanding of the subjects involved, and one should be being aware that the acceptance of such guidelines is not only a result of more or less information on biosafety.

Companies and institutions build an internal culture over time, the same way as their employees have a trajectory of familiarity with the relationships that have developed in the workplace. Collective and individual trajectories are the basis for the perceptions about this workplace and the risks present therein. Consequently, it is not possible to think of perception of risk in general terms, but of different perceptions resulting from the factors considered above.

Since biosafety programs intend to introduce changes in behaviour so as to have a more effective control of risks, they must also take into consideration that these changes come about slowly and often in a different way from what was expected [16], given that strong beliefs do not change easily.

On the other hand, having in mind that the perception of risks and the resulting behaviour may generate results that will contribute to increasing or diminishing the risks themselves, it becomes necessary to increase the number of studies in this field. Perceptions of risk are measurable but are usually disregarded by technical studies of risk. As noted by Douglas and Wildavsky [5], the acceptability of risks and the choice of how to live are made at the same time. We can say that the acceptability of risks and the choice of how to work, are also made at the same time, and both are part of the dialogue about how to improve conditions and social relations in the workplace.

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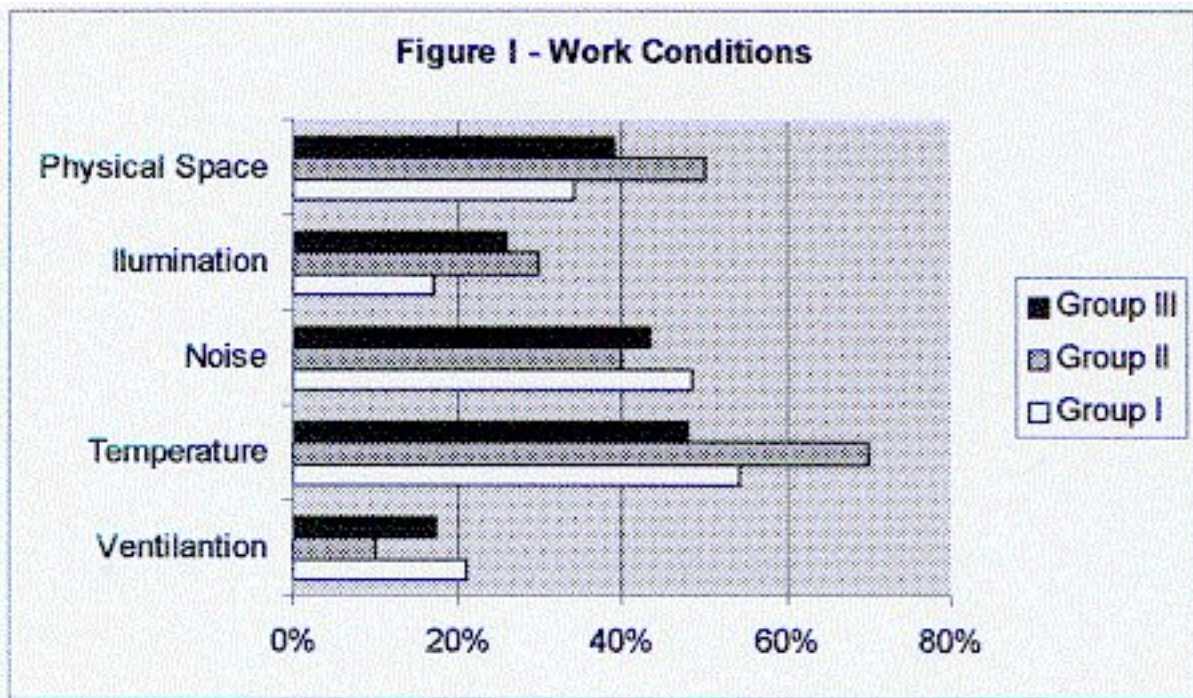


Figure 1. Factors that cause discomfort, related to the working environment. White bars: group I (production workers); gray bars: group II (administrative personnel); black bars: group III (managers). A: illumination; B: physical space; C: ventilation; D: noise; E: temperature.

Figure II - Factors that cause discomfort, related to the organization of the work process

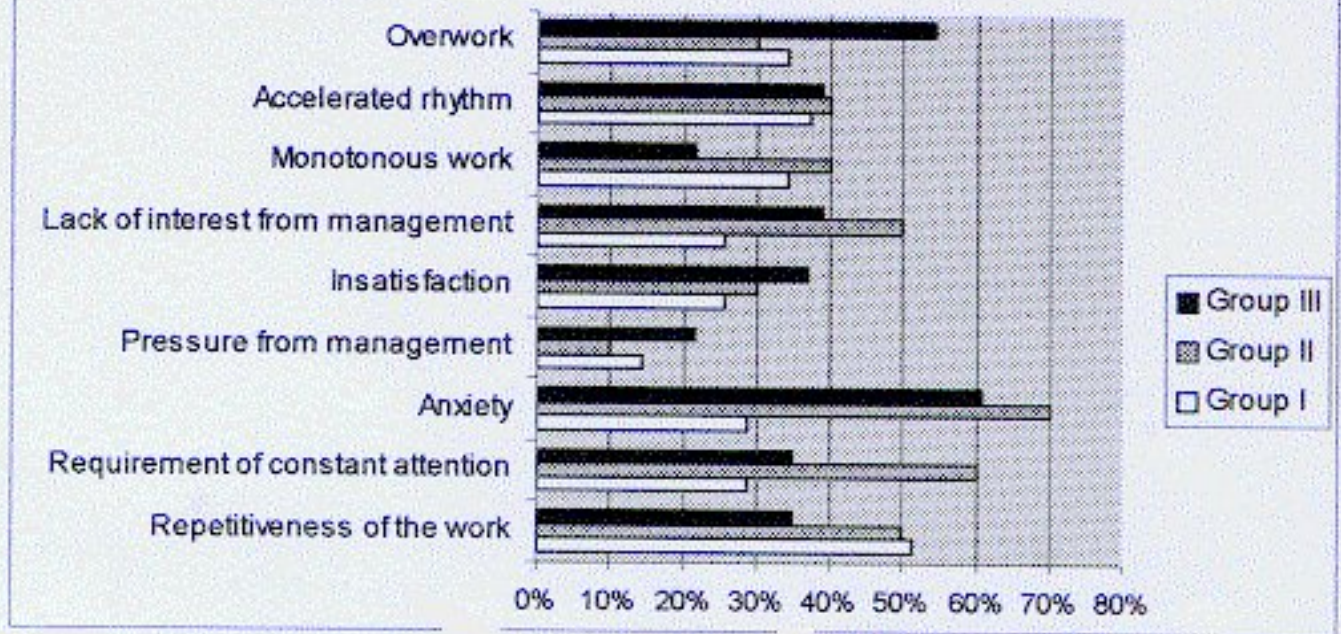


Figure 2. Factors that cause discomfort, related to the organization of the work process. White bars: group I (production workers); gray bars: group II (administrative personnel); black bars: group III (managers). A: pressure from management; B: dissatisfaction with relationships within the work group; C: unsafe conditions for the work to be carried out; D: lack of interest from management; E: requirement of constant attention; F: anxiety; G: monotonous work; H: overwork; I: accelerated rhythm; J: repetitiveness of the work.

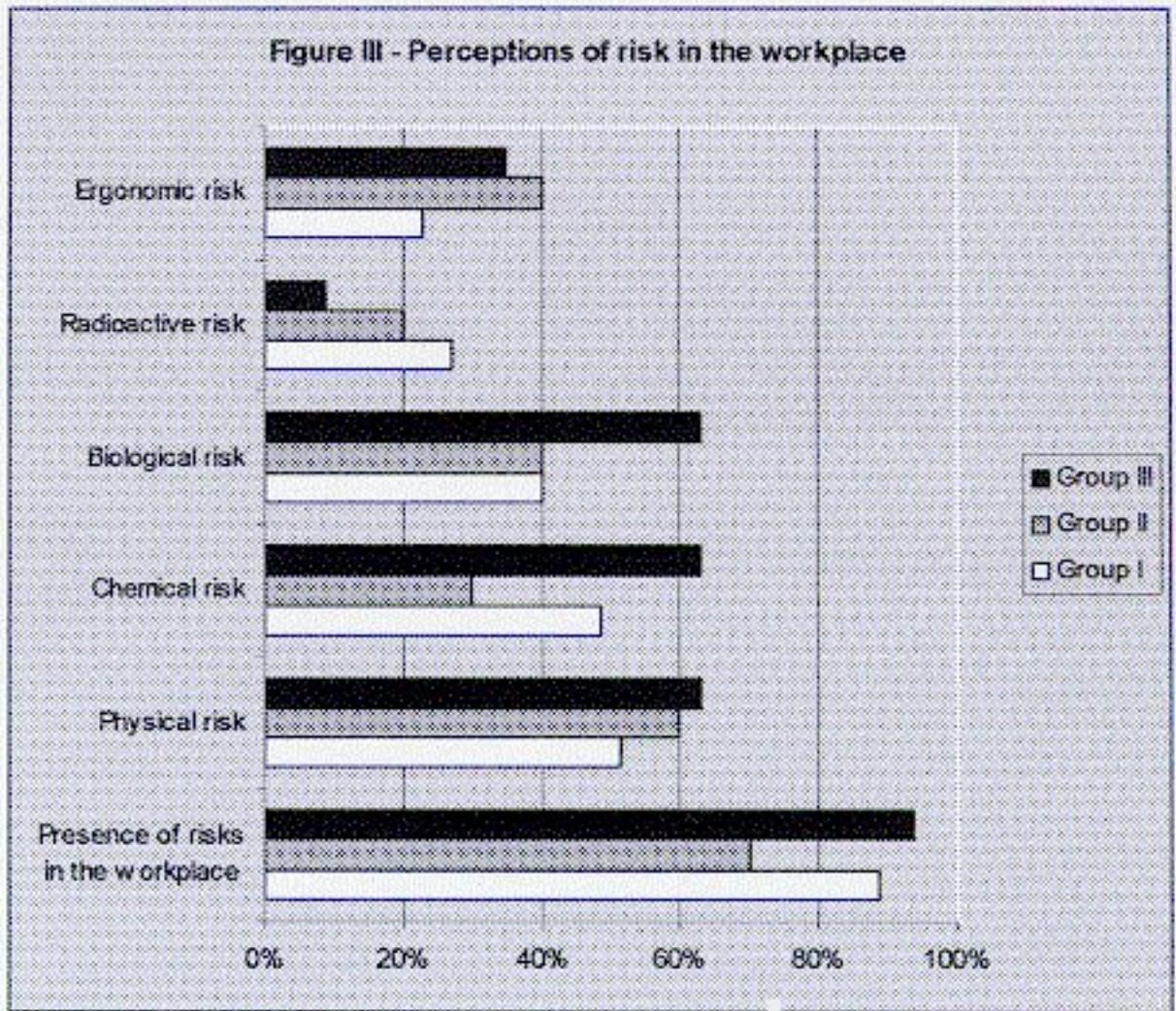


Figure 3. Perception of risks in the workplace. White bars: group I (production workers); gray bars: group II (administrative personnel); black bars: group III (managers). A: presence of risks in the workplace; B: radioactive risk; C: ergonomic risk; D: biological risk; E: chemical risk; F: physical risk.