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Continuous health promotion and participatory ergonomics in a small company.

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Abstract: The workplace is an ideal setting for health promotion. The regular medical examination of workers enables us to screen for numerous diseases, spread good practices and correct lifestyles, and obtain a favourable risk/benefit ratio. The continuous monitoring of the level of workers' wellbeing using a holistic approach that goes beyond the simple prevention of occupational risks enables us to promptly identify problems in work organization and the company climate.

Problems of this kind can be adequately managed by using a participatory approach. In this study participatory ergonomics groups were used to improve occupational life in a small company. After intervention we observed a reduction in levels of perceived occupational stress measured with the effort / reward imbalance model, and an improvement in psychological wellbeing assessed by means of the Goldberg anxiety / depression scale. Although the limited size of the sample calls for a cautious evaluation of this study, the GEP© strategy proved to be a useful tool due to its cost-effectiveness.

Keywords: workplace; health promotion; work-related stress; anxiety; depression; participatory ergonomics; wellbeing; best practice; work organization.

1. Introduction

The workplace is an ideal setting for health promotion. In many European countries, including Italy, the employer is compelled to set up a health surveillance service for employees exposed to occupational health risks. This mandatory medical examination offers a valuable opportunity for gathering information on the health and wellbeing of workers. The occupational physician is able to monitor health and promote healthy lifestyles, thus transforming a preventive activity into a continuous health promotion program. The transition from an activity that focused exclusively on the prevention of occupational diseases toward a strong commitment to health promotion is a natural evolution for occupational medicine that originated when levels of pollution in the workplace were much higher than today and social conditions were very different from the current ones. Nowadays psychosocial risk factors are of prime importance in occupational health [1-5], and require physicians to take a "holistic" rather than a "laboristic" approach to occupational health services in order to deal with these problems in the best possible way [6-8].

Effective workplace health promotion programmes require a strong commitment on the part of employers, managers and workers, as well as considerable medical staff involvement. The development of promotion campaigns that go beyond the usual health and safety activities in the workplace also requires specific funding and the acquisition of specialized skills. This is why it is fundamental that health promotion becomes part of the surveillance activity regularly provided for workers. Occupational health and safety services that adopt this strategy usually establish each year the objectives of the promotion campaign in a participatory way with employers and workers. This work method enables them to identify a specific theme for promotion each time and to focus attention on workers at risk. Contemporaneously, continuous screening activities that take into

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account the level of stress perceived by each worker, make it possible to monitor the conditions of wellbeing and mental health in the workplace, and enable preventive measures to be promptly implemented when necessary.

A promotion campaign that is encompassed in routine medical surveillance in the workplace requires no additional investments other than those already allocated for occupational risk prevention. It should have a very flexible structure so as not to interfere with the ordinary activities of the health and safety service. The occupational health physician plays a leading role in this activity. He/she encourages other parties involved in health promotion to carry out their various tasks of risk assessment, medical surveillance, information and training, improvement actions and verification of results that are part of the virtuous risk management circle, according to the so-called ASIA© method [9, 10]. The occupational physician plays a fundamental role in this process, especially in small companies, where resources and knowledge are often limited. This approach to workplace health promotion has been successfully applied in some companies since the early '90s [11, 12], but has been more widely used in the last 20 years.

Promotion campaigns included in routine surveillance involve administering a questionnaire containing three sections during medical examination: the first section concerns symptoms and early signs that may lead to diagnosis of the problem under study; the second analyses the main factors that can play a moderating role, for example work stress; the third deals with the consequences for physical and mental health.

An analysis of these questionnaires yields two results: the identification of people at risk and health monitoring of the group. High-risk subjects identified during screening are invited to carry out further tests under the National Health Service and, if necessary, to undertake specific treatment. In general, the campaigns provide a detailed and repeated measurement of symptoms and complaints related to the working environment. The continuous search for improvement and health promotion incorporates prevention because a reduction in workers' wellbeing can be promptly identified before the appearance of occupational diseases and specific action can be taken.

The health risks that emerge during health promotion campaigns can be addressed in two ways. If the risk factors are non-occupational, the physician will suggest ways of improving lifestyles and behaviors that workers may or may not decide to follow. If the survey highlights the presence of occupational factors, the employer must prepare a risk reduction plan. It is advisable to involve the workers themselves in these preventive measures since they are the ones who identify the problem, the ones who can often suggest possible solutions and collaborate in their application.

Setting up participatory ergonomics groups ("Gruppo di Ergonomia Partecipativa", GEP©) is a way of encouraging worker participation in improving working conditions by means of a bottom-up approach. The GEP© method is based on meetings during which all the workers who contribute to the performance of a specific work task describe their working activity in detail and identify any critical aspects. Once a problem has been identified, workers are urged to seek and discuss solutions to the problem and choose the one that appears to be the most economical and feasible. This solution is then formally presented to the management for analysis and implementation. The effectiveness of this group activity primarily depends on the ability of its members to interact with each other and find an agreement. The GEP© therefore has the function of increasing the ability to collaborate within the group and to seek collective and not individual solutions.

GEPs© were initially developed in the industrial field to solve safety problems [13] or to improve the quality of production. Subsequently this method was applied to services, and was used to improve production processes and work organization. The application of GEPs© for the prevention of musculoskeletal disorders in hospitals was given appraisal in 2007 in the European "Lighten the load" campaign [14] and was given an award in 2008 by the Italian Society of

Ergonomics [15]. GEPs© were also used for the promotion of behaviours that prevent aggression against staff in the workplace during a complex multi-year program [16] that was included in OSHA's Guidelines for Preventing Workplace Violence for Healthcare and Social Service Workers [17]. In 2017, the application of GEPs© to the health promotion of older workers was given an award in the European 'Healthy Workplaces for All Ages' Campaign 2016-17 [18, 19].

To assess work-related stress, the observations of workers participating in the GEP © are classified on a grid that includes the three most common complementary models of work-related stress. The Karasek model [20] includes the Demand / Control / Support variables. According to this model a condition of "high job strain" can occur in cases of excessive psychological work burden ("demand"), with insufficient "control" over the job. In this model, social support is an important moderator of stress. The Siegrist's model [21] postulates that excessive stress occurs when the effort made by the worker ("effort") is not compensated by adequate rewards ("rewards"); the intrinsic component of the model ("overcommitment") may have an interactive or independent role [22]. The third model refers to organizational justice [23, 24], which is divided into procedural, distributive, interpersonal and informative justice. In GEPs, the problems reported by workers are therefore classified into ten categories of factors related to occupational well-being (demand, control, support, effort, reward, over-commitment, procedural justice, distributive, interpersonal, and informative justice). One or more solutions can be proposed for each of these problems.

Although the occupational health physician promotes the GEP © meetings, he/she plays no active part in them: he/she merely records the problems reported, compares them with the main models of work-related stress to verify the existence of risk conditions, and reports the proposals for improvements formulated by the workers. These proposals are then evaluated by the company that decides whether or not they are applicable.

In a small company based in Rome, Italy, a gradual decline was observed in the level of the workers' psychological wellbeing during health promotion campaigns. This was confirmed by interviews conducted during medical examinations and prompted specific action designed to identify the causes and suggest solutions for improving the quality of working life. This intervention was carried out in 2016 by means of participatory ergonomics groups (GEPs). This article reports the observations and the short-term results of that intervention.

2. Materials and Methods

2.1 Population

The Company is a welfare and assistance agency for professionals. Since 1997 its employees have undergone mandatory health surveillance, mainly due to the " video terminal" occupational risk. Italian law stipulates that workers assigned to video terminals must undergo regular medical examination to assess their fitness for work. With the consent of the workers and the employer, in this Company the medical check-ups were also used for health promotion purposes. Over the years, promotional activities focused on numerous topics: indoor air quality, musculoskeletal disorders, workplace violence, aging, sleep and fatigue, and others, following a schedule agreed with the employer and the workers.

The Company's offices employ 57 people, with a slight prevalence of female gender. Due to the low turnover, the population has remained almost constant in number and has aged progressively. In 2015 the mean age was 47.4 (+4.9) years, with 26 male and 31 female employees; in 2017 one male worker left the company, and one female workers was taken on. This led to a slight change in the aforementioned parameters (age 49.0+5.8 years, 25 M, 32F).

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137 *2.2 Questionnaires and participatory groups*

138 In this Company we identified six work groups engaged in the same number of occupational
139 tasks. Each group, composed of all the workers (managers, officials, employees and clerks) who
140 were involved in carrying out a specific operational task, met in the presence of a physician to
141 describe their work, indicate the key issues and develop and discuss possible solutions. Their
142 observations and proposals were classified with reference to the main stress models.

143 The GEPs were set up in 2016 and all the workers participated. The proposals developed by
144 the GEPs were then transmitted to the company managers who proceeded with their gradual
145 application during 2017.

146 The workers underwent medical examinations in 2015 and 2017. On these occasions they
147 participated in two different health promotion campaigns: the first concerned aging of the
148 workforce, chronic diseases and work ability; the second aimed at promoting sleep health and
149 counteracting the metabolic syndrome. On both occasions, work-related stress and psychological
150 wellbeing were measured. For the purposes of this specific study, we will compare the data
151 collected in 2015, prior to the establishment of GEPs, with those of 2017, i.e. after implementation of
152 the improvements suggested by the workers.

153 Some questionnaires that monitored the effect of the GEPs, were used for both health
154 promotion campaigns conducted in 2015 and 2017. These questionnaires measured work-related
155 stress and the risk of developing minor psychiatric disorders (anxiety and depression), respectively.

156 Work-related stress was measured in 2015 and 2017 with the ERI questionnaire (in the short
157 validated version in Italian) [25]. The questionnaire consists of 3 items for effort, 7 for rewards, 6 for
158 over-commitment. ERI is calculated as a weighted ratio between effort and reward; values above
159 the unit indicate an imbalance between effort and reward. The reliability of the scales of the
160 questionnaire in this research, measured by Cronbach alpha, was 0.768 for effort, 0.799 for reward,
161 0.653 for over-commitment.

162 The measure of mental wellbeing used at baseline and at follow up was Goldberg's Anxiety
163 and Depression scale [26] a simple list of 9 + 9 binary items initially designed to enable General
164 Practitioners to identify which of their patients may be at risk of developing mental disorders. The
165 person who reports a score of over 4 on the scale of anxiety and more than 3 on the depression scale
166 has a 50% chance of developing a pathological condition, and the risk rises rapidly with the score.
167 In this survey, the questionnaire was found to have a good reliability, Cronbach alpha= 0.880 for
168 anxiety, 0.792 for depression.

169 This study was approved by the Ethics Committee of the Università Cattolica del Sacro Cuore
170 of Rome.

171

172 *2.3 Statistics*

173 The scores of work-related stress and those of anxiety and depression at baseline and at follow-
174 up were compared with the Wilcoxon U test for paired data. The analysis was performed with IBM
175 SPSS © Statistics 23.

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3. Results

The observations formulated during the GEPs © were initially analysed using the grid composed of the ten variables that contribute to determining work-related stress.

An analytical examination of the results thus obtained shows that all stress-related variables are mentioned at least once in each of the groups of workers consulted. Table 1 summarizes the observations made in the GEPs © with reference to the different stress-related variables.

Table 1.
Work-related problems identified by workers.

Variable	Type of problem
DEMAND	Increase in work due to changes in rules and laws. Workload is sometimes excessive, and unevenly distributed. Extension of work beyond office hours.
CONTROL	Difficulty updating skills. Excessive concentration of responsibility in the hands of a few people, lack of proxies.
SUPPORT	Gradual deterioration of relationships.
EFFORT	Fatigue derives more from relationship problems between people or groups than from the work to be carried out.
REWARD	No recognition for the work performed or encouragement in the event of difficulties.
OVERCOMMITMENT	Some workers are busy at work 24 hours a day.
PROCEDURAL JUSTICE	Procedures are not always verified.
DISTRIBUTIVE JUSTICE	Inequalities in responsibility loads. Uncertainty about individual responsibility for tasks.
INTERPERSONAL JUSTICE	Significant lack of correct conduct in relationships, verbal violence.
INFORMATIONAL JUSTICE	Lack of information. Excessive gap between managers and other workers.

In the 6 different offices in which GEPs were formed, the workers agreed to describe the same problems related to the work climate. Interpersonal relationships appeared to be difficult on account of the excessively authoritarian style adopted by the managers. This attitude was determined and aggravated by a constant lack-of-time factor, tight deadlines and limited human and material resources available for carrying out the necessary amount of work. In this climate of general tension, the relationships between different offices of the same company were also problematical, partly due to an attempt to download their own inefficiencies on the others, and partly on account of a reciprocal failure to recognize the work performed by each operating unit. The latter, i.e. the lack of material and immaterial rewards for the work done, was the one most frequently reported as a cause of work dissatisfaction. More generally, some workers reported a lack of confidence in the Company's prospects and in the management's desire to guarantee a future for the enterprise.

The workers proposed intervention for each of the main problems detected in work organization. Some of these were discarded as being too expensive or difficult to apply; others were rejected on the grounds that the intervention would lead to unpredictable results or consequences that would not obtain general approval.

The solutions that appeared simpler, cheaper and that obtained universal approval are shown in Table 2. These solutions were presented to the managers who gradually implemented them in 2017. Improvement is still under way.

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209 Table 2.

210 Solutions proposed by workers that have been implemented [I], are in progress [P], or will be
211 considered in the future [C] by the management.

212

Variable	Solutions
DEMAND	Check the workload assigned to the different offices and individuals [P]. Establish a system of verification of the activity carried out [C]. Define the correct use of emails [I]. Organize operational meetings with external experts in order to solve problems [C].
CONTROL	Improve training, not only on specific topics, but also on how to communicate [C]. Assign specific responsibilities [I]. Share corporate objectives and projects [P].
SUPPORT	Organize convivial occasions. In addition to the methods used in the past (parties, social outings, etc.), introduce collaborative activities, meetings in which everyone produces something) [I]. Stimulate hidden abilities - hobbies, workers' activities - with a reward system [C].
EFFORT	Training courses to increase resilience [C]. Summer camps for employees' children [C]. Establishment of moments of relaxation in order not to accumulate tensions that are discharged on colleagues [P]. Background music in the workplace [I].
REWARD	Establish a reward system [P]. Formal recognition (not necessarily pecuniary), that matches the objectives achieved with the means available rather than with needs [P]. Awards for workers who improve collaboration within the company [P]. Pecuniary recognition of functions [I]
OVERCOMMITMENT	Counter the habit of sending emails or phone calls outside office hours [I].
PROCEDURAL JUSTICE	Verification of procedures [I]. Planning of company's activities [C]. Planning of work in the different offices and their relations [P]. Obtain feedback from operators on how the programmes work [I]. Establish the cause of errors, not those responsible for errors [I]. Share decisions about training methods, software purchases, etc. [I]
DISTRIBUTIVE JUSTICE	Establish a system of authorizing and assigning responsibility. [I] Time commitments correctly, avoid delays or inefficiencies in other offices. [I] Avoid concentrating tasks in the hands of a single person. [I] Reassessment of tasks and assessment of productivity. Match pay with responsibilities. [I] Turnover between controllers and the controlled. [C]
INTERPERSONAL JUSTICE	Code of conduct, in the relationships between individuals and between offices. [I] Policy against verbal violence. [I]

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INFORMATIONAL JUSTICE	Regular work meetings to be carried out in each operative unit. [I] Regular exchange of information between offices on procedures and activities produced. [I] Production of an internal newsletter. [C]

In 2017, the company modified the workload for some managers by reducing their responsibilities and by setting out the tasks of each operating unit in greater detail. In all the operating units, regular meetings were introduced to schedule the weekly work commitment and solve any critical issues. Action designed to increase the recognition given to workers was planned at various levels: e.g. the promotion of some employees to higher functions; the establishment of a reward system for the most active employees; public recognition of successful achievements at work. A policy against violence at work was also introduced, with punishments for verbal aggression. Furthermore, a decision was taken to promote convivial group activities, outside working hours, to allow short breaks for relaxation during the working day, and to broadcast background music in the workplace.

A comparison of the levels of work stress perceived before this intervention on the part of the GEPs and those recorded in 2017 showed a slight, but significant increase in the mean score for Rewards and a decrease in the mean score for Effort. Over-commitment remained substantially unchanged. Anxiety levels showed a reduction that failed to reach the level of significance, while the depression score was significantly reduced (Table 3).

Table 3.

Characteristics of the population. Levels of occupational stress and of anxiety and depression risk.

Variable	Baseline	Follow-up	Difference (s.d.)	$P^{(*)}$
Age, years	47.4 (±4.9)	49.0±5.8,		
Population	57	57		
Male, N (%)	25	24		
Effort	9.27 (1.82)	8.73 (1.82)	-0.545 (1.40)	0.007
Reward	14.98 (2.54)	16.56 (3.97)	1.582 (3.95)	0.004
ERI	1.48 (0.37)	1.34 (0.60)	-0.138 (0.55)	0.002
Over-commitment	16.09 (3.69)	15.29 (2.66)	-0.800 (4.88)	0.261
Anxiety scale	6.13 (2.49)	5.67 (2.87)	-0.455 (2.20)	0.077
Depression scale	4.44 (2.61)	3.91 (2.47)	-0.527 (1.75)	0.025

(*) tested with the Wilcoxon U test for paired data

4. Discussion

In this study we observed that the changes in work organization that the company introduced in order to comply with indications from the groups of workers resulted in a slight, but significant, reduction in work-related stress. In particular, a reduction in perceived effort and an increase in rewards were observed, while over-commitment, or intrinsic stress, remained substantially unchanged. This result is in line with expectations, as the intrinsic component, or coping pattern, is

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more stable than the extrinsic components of the stress model [22]. Following the intervention on work organization, we also observed a significant reduction in the mean depression score and a non-significant reduction in the anxiety score.

Our study demonstrates that medical surveillance in the workplace can lead to a positive continuous health promotion activity, thereby encouraging healthy lifestyles and correct health practices in the population. Using a broader salutogenic approach for the continuous monitoring of workers' health is more beneficial than the mere prevention of occupational diseases, as it can detect the appearance of crucial issues in work organization before the latter induce health disorders. GEPs © can be a useful tool for revealing problems in work organization and for formulating joint solutions. Our findings indicate that the changes introduced in a small company improved the working climate by reducing stress levels and increasing the level of psychological wellbeing of the workers. This approach strives to attain synergistic effects by co-ordinating activities carried out at multiple levels. The main result of this study was the development of a method that can be successfully applied to occupational health promotion in all workplaces.

Health promotion is based on the principle of making people better able to control and improve their health. The workplace offers an ideal opportunity for health promotion activities. In this type of setting, a participatory approach to intervention for improving the work environment yields optimal results. This particular type of occupational health setting is referred to as the "supersetting approach" [27].

An approach similar to the one we adopted can be found in studies such as the Australian Healthy Workers Initiative which takes an embedded approach to workplace health promotion [28], or the Center for the Promotion of Health in the New England Workplace, an intervention research study that combines ergonomics with health promotion [29]. In small- and medium-sized enterprises in the USA [30], India [31], and Australia [32], other workplace interventions combining health protection and health promotion were conducted to create a workplace culture that valued and efficiently managed health, safety and wellbeing with a special emphasis on organisational productivity. A recent review of the literature gives some support to the idea that integrated interventions targeting occupational health and safety management may offer comprehensive solutions to complex workplace issues [33]. This type of approach seems to be advantageous especially for mental health problems [34]. On the contrary, promotion programmes aimed exclusively at modifying behaviours and educating individual workers without transforming the workplace culture may fail to obtain significant effects [35].

Occupational health activities in the workplace have two objectives: one is to protect the health of the individual worker, and can be assessed in terms of risk / benefit ratio, while the other is an epidemiological aim designed to improve the health of the group, and can be evaluated in terms of cost / effectiveness. Our intervention had a very favourable risk / benefit ratio, because the risk for a worker in adhering to a promotion campaign and filling in a questionnaire is substantially negligible compared to the advantages resulting from diagnosis of an illness or a condition of high risk. Similarly, at group level, annual health promotion campaigns have an extremely favourable cost / effectiveness ratio, as the cost of a statistical analysis of the data collected through questionnaires is minimal considering the epidemiological results collected. Using GEPs to intervene in problems concerning the working environment also has an excellent cost / effectiveness ratio, since the effectiveness of the safety measures developed with the help of the workers more than compensates for the time the physician and employees need to identify crucial issues and propose solutions. Worker involvement increases the efficiency of the ergonomic process and enables the resources needed for promotion and prevention interventions to be used in the best possible way.

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The GEP© strategy takes time, but requires above all a strong desire for collaboration on the part of both workers and the management. If this willingness to cooperate is lacking or weakens, and conflict or a search for personal solutions prevail, this kind of strategy may not be as effective as in our study.

Despite the aforementioned positive aspects, this research study has some limitations. The small size of the company, which enabled us to implement a low cost programme, constituted the principal limitation of the study. In a small sample there is clearly great variability and the final results can be influenced by a few units. Moreover, the observation interval was not ample enough to assume that the improvement observed was stable and irreversible. Further efforts are needed to develop new solutions and verify their effectiveness. The GEP© strategy can also be of help in providing this corroboration.

Another limitation of the study is that, in order to verify the results of the solutions suggested by the GEPs, we used a single model of stress, the effort/reward imbalance model. We must take into account the fact that the results might have been different if we had used the demand / control / support model or that of organizational justice. However, since all three complementary models of work-related stress have previously been used in the small company to measure self-perceived stress, in the future it will be possible to verify the effect of the actions taken also by applying the other stress models.

Another limitation is that in this study we used questionnaires, a subjective measure, rather than objective measures such as sick leave or productivity indicators. Future research could compare the subjective evaluation of workers with objective indicators, although it should be remembered that self-assessment questionnaires have always proved to be a valid measure of workers' stress and health status.

5. Conclusions

In conclusion, we are convinced that using health surveillance in the workplace to carry out continuous health promotion campaigns is better than the traditional approach that focuses only on the prevention of occupational diseases. GEPs © can be a useful tool for addressing the health risks that originate within the work environment. The participation of workers in seeking solutions to improve their occupational life increases their commitment and work engagement. The literature is unanimous in recognizing that work engagement is linked to job satisfaction, productivity and the health and safety of workers. This should urge companies to apply strategies such as GEPs for improving worker wellbeing and the quality of work.

6. Patents

A.S.I.A. © model, and GEP © participatory ergonomic groups (Gruppi di ergonomia partecipativa) method, are covered by international copyright owned by the author of this paper.

Ethics statement: The study was approved by the Ethics Committee of the Università Cattolica del Sacro Cuore of Rome.

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