Ergonomics for primary prevention of work-related stress in an Emergency Department

Re A.
Department of Psychology
University of Torino
Via Verdi, 10
10124 Torino Italy
+39 011 6702805
re@psych.unito.it

Micheletti M.
Department of Animal and Human Biology
University of Torino
Via Accademia Albertina 13
10123 Torino Italy
+39 011 6704526
margherita.micheletti@unito.it

Occelli C.
Department of Psychology
University of Torino
Via Verdi, 10
10124 Torino Italy
+39 011 6702055
cristiano.occelli@unito.it

TOPICS
Occupational stress

Healthcare architecture and organization

Healthcare quality and ergonomics

KEYWORDS
Occupational stress, occupational workload, participation

1. INTRODUCTION
In recent years ergonomics, according to its systemic approach, has displayed a strong interest in healthcare systems, especially in relation to health promotion and service quality [10] [1] [4] [2] [3] [8] [6] [7] [9] In this context, particular importance is attached not only to external users' safety and satisfaction, but also to internal staff protection. This may be achieved, on the one hand, through the adoption of measures for the protection of operators' health and safety and, on the other hand, through the promotion of preventive actions removing or changing the organizational, environmental and relational factors that may be a source of discomfort and stress. Recent studies published by the [3]have pointed out that work stress involves more than one European worker out of four, and seriously affects healthcare workers, especially in hospitals [6].Ergonomics considers occupational stress as the cumulative result of the interaction between operators and their working environment. A poor interaction can intensify operators' stress both directly and indirectly, since it increases the risk for the patient.
The quality of life and work environments is a fundamental objective in ergonomics and it becomes crucial in healthcare systems because of the complexity of aspects involved. The ergonomic intervention aims to promote people's wellbeing, increasing the level of the healthy performance.
The present study wishes to present an ergonomic analysis carried out in an Italian hospital Emergency Department. The research started from a request by the management demanding external support in dealing with the high levels of operators' stress progressively arisen after a deep reorganization of the Department. In the ergonomic research the aim is searching for factors determining stress among health operators during their daily work activities. The study explored aspects related to physical and psychological environment, work conditions and work rates, organizational structure and relationships of the Department and all the actors involved.
Therefore, ergonomic intervention is developed with the goal of primary prevention, as it is aimed at reducing stressful factors, rather than enhancing people resources to deal with a stressful environment.

2. METHODOLOGY
The present work was developed within a regional project focused on work-related stress in health care systems. The study was performed through a one-year collaboration with an Emergency Department in a hospital in the North of Italy. The research was conducted with a qualitative methodology because of the heterogeneity of tasks, operators, and difficulties coexisting in the observed system. The aim was to construct a success case exportable in other fields.
The study was conducted within the methodological framework of the ergonomic analysis of work activity, with the objective of pointing out environmental, instrumental, cognitive and organizational aspects affecting nurses', physicians' and other operators' everyday work activities. The team was composed of researchers with different backgrounds allowing them to cover both physical and organizational aspects.
In such a research the use of different ways of data collection is crucial, because different techniques may emphasize complementary aspects of the problems. The integration of different results allows to construct a complete image of the system, focusing on sectors and fields that need an intervention for the improvement of working conditions and general performance. First of all, semi-structured interviews were conducted with the people in charge of the department (i.e. head physician and head nurse) to collect data on the structure and the organization of the whole system. The first part of the study aimed at getting an overall view of the research field, choosing the suitable techniques for the data collection and defining the sample composition. In the past few years the Emergency Department has faced deep structural and organizational changes leading to a complete turnover of the group of physicians while keeping the group of nurses mostly intact. The head physician and the head nurse had the task to inform all the operators about the research aims and its expected phases.

- Semi-structured in-depth interviews were conducted with 7 nurses and 8 physicians; in the first part of the research expert nurses were interviewed to get to know the history of the whole system through the memory of the operators. The aims of this phase were: a) to find the differences between real and established activities; b) to point out elements that characterize problematic situations; c) to collect relevant episodes of effectiveness or ineffectiveness; d) to emphasize the point of view and the expertise of operators.
- Observations were conducted by two experts in physical and organizational ergonomics, in order to analyse the work environment from different perspectives. The researchers observed the patient's course in the department from his/her arrival to his/her discharge; a nurse working at the triage station for the whole shift; finally, a nurse's and a physician's shift in the medical visiting room. The observational data were then crossed with interview results.
- Interview and observation results were discussed in

three discussion groups, one involving nurses, another one physicians, the third with all the operators. The aim of this phase was to collect operators' feedback and to enlarge the knowledge base and the operators' participation in the study.

Moreover, an analysis of the official documents was conducted to get to know the established procedures and activities and to compare the results with the real operators' activities.

3. RESULTS

Results confirm the synergies between different factors in determining the stress level.
Most problems and difficulties highlighted by interviews were confirmed through observations, and this is the reason why we discuss the results together, integrating data from two different perspectives. Considerations about discussion groups will be dealt with separately because such groups debated aspects more related to relationships and the whole system.

3.1 Interviews and observations

A categorical-type content analysis was applied to interview transcripts, to point out relevant stressor categories. Thirty significant categories were identified: in the following section only a few will be illustrated, especially those categories connected with problems highlighted during observations.

3.1.1 Poor functional space organization

Different aspects of the physical environment were described as problematic by all the operators: space, layout, microclimate, lighting.
All operators asserted that the microclimate was very unpleasant because visiting rooms have no windows, no natural light and are bad-aired; this situation is worsened by a bad heating system. The operators working for a long time in such conditions frequently report feelings of isolation and alienation from the real world.
Many of the problems particularly concern the triage station layout (see Figure 1), and the patient's access to the Department.

Figure 1. Triage station.

The entrance door of the Emergency Department reflects light both internally and externally (see Figure 2), preventing nurses from seeing the number of patients ringing the bell and what their situation is. A lot of people have access to the Department through that door (patients, relatives, other operators), and nurses' work would be easier if they could recognize seriously hurt patients quickly.
Nurses have to stand up frequently to open the door manually, to verify the patient's typology and to control the entrance flow. Sometimes the door is opened by the administrative staff because the nurse is registering a patient or is temporarily absent from the triage station. In some observations we found out that also patients and their relatives sometimes open that door.
The height of the desk is another problematic aspect of the triage station. The desk is too high both for patients and nurses; the operator cannot assess patient conditions with a "first glance" considered essential to establish the patient's level of gravity. Nurses have to stand up and to go round the desk to better evaluate the patient's conditions and to take his/her vital parameters.

Figure 2. Entrance door: inner side.

A widespread logistic problem is the chronic lack of beds for hospitalization. The Emergency Department frequently manages patients out of its competence who have to be admitted to hospital. This is a factor that worsens the risk of crowding and influences the workload of all operators. During observations physicians often had to interrupt their work (i.e. to visit patients) and to phone other hospital Departments to look for a bed. Similar situations extend patients' waiting time and affect the workload of the whole system, increasing the perception of lack of spaces.

"*…we have three visiting rooms and if we have three critical patients they are full… so the space for visiting is limited to one room for medicine and one room for surgery, the others (patients) are queuing in the corridor…*"

One of the most evident problems also emerged from observations is actually the Emergency Department lack of space both in the tiny visiting rooms – very little functional space is available, and this does not allow the presence of people, tools, objects, even in unforeseen situations, which is most common in real activities – and in the corridors. These spaces, although wide, are difficult to walk through with a stretcher, as there are other stretches and wheelchairs in the way (see Figures 3a, 3b). Many patients lying on stretches are left in the corridor waiting for the first visit, for admission or assistance, with other patients coming and going in and out of the visiting rooms and corridor.

"*…once I've called a consultant I leave the patient waiting in the corridor because I don't know when the consultant comes… and I take another patient in… when the consultant comes I try to make a room available…*"

The internal corridor in particular is perceived as the core of the Emergency Department itself and the whole system centres on it. In some cases nurses attend patients directly in the corridor (putting them on a drip, putting an oxygen mask on them, takings their temperature or blood pressure…) which further emphasizes the lack of room, the crowding and the use of the corridor as a working environment rather than a place to simply walk through. As patients often have to wait long, the corridor also becomes a

place where their primary needs are satisfied, with a great number of people and things passing. This inevitably causes uneasiness, as pointed out both in interviews and observations.

Figure 3a. Corridor as wheelchairs depot.

Figure 3b. Corridor as stretchers depot.

Lack of functional space also affects visiting rooms: the space available to the operator to move around the patient's stretcher is scant even for the simplest interventions (such as taking a blood sample). If equipment is placed near the patient to measure his or her parameters (e.g. for an electrocardiography), operators have no room left for walking and working.
The way is so obstructed at times that even the door leading to the corridor cannot be reached. Therefore operators sometimes use the door opening onto the next room in order to get to the corridor. This means that visiting rooms are used as a place to walk through as well as a place for working.

3.1.2 Physical and cognitive workload

Many operators are often busy with extra tasks that add up to the actual workload required by their role and function, which causes them to be constantly tired and unenthusiastic. One of the most reported issues during interviews, especially as far as nurses are concerned, is understaffing, which makes it desirable and often necessary to take on duties that do not entirely belong to the profession and therefore are a source of discontent and frustration.

"*After you've seen thirty dumb things, you might underestimate the thirty-first even if it's something serious, because you're weary of seeing thirty dumb things the doctor in charge should've seen…*"

"*You go it alone, 'cause if you wait for this one and that one… I mean, if the right people were in their right places – physicians, nurses, administrative staff... – the situation would be much easier, you'd work better, you'd be even more relaxed, less frustrated… 'cause that's the bad feeling you get from it: you're being asked three thousand things, you have patience and are alone, at the end of the day you're afraid of making mistakes and then, you know, … you don't work in a factory, you can't say 'I got it wrong – well, never mind*'*…*".

3.1.3 Time pressure

Interviews have shown that in a situation like that of the triage stress risk is particularly high because of the fast pace of work and the high levels of attention required.

"*The bell rings, the button is automatic, you open and three people might come in, from different family groups, so you get up and ask what's the problem. You decide which one is the most urgent, take only the person requiring the most immediate response and you'll get the other ones later; in the meantime another two people come and perhaps the ambulance…*"

The observations conducted on the activities carried out by triage nurses have actually pointed out that there is a constant request of their attention (frequent bell ringing, signals, voice calls, sirens…) and of their performances, which, in addition, are varied and characterized by urgency, and therefore by a high level of time pressure. As other sections of this essay highlight, triage activity is the most stressful for nurses, due to a number of factors, only a part of which is related to the actual duties implied by their role. Different "corrigible" factors increase the workload and the causes for dissatisfaction and discomfort. For example, on the triage desk lie many unused or useless objects. The persisting presence of unused tools in already crowded and insufficient spaces may be seen as an important indicator of the perception of urgency related not only to the type of users and seems to imply a chronic psychological discomfort.
Even inside the Emergency Department visiting rooms the workload is massive and lasting for too many consecutive hours, or at least so it is perceived by a large number of operators, including many physicians. The number of working hours is large per se, but it appears still more demanding in view of the required commitment and attention.

"*It happens to me every day and also at night, sometimes… I go home at least one hour and a half after my shift is finished… I often go home many hours later…*"

"*It's a highly demanding job both from a cultural and a physical point of view, and also from the point of view of stress and responsibility, because here we are asked to decide what is serious and what is not, to make a diagnosis, to make a decision about a patient in a very short time while considering other patients at the same time. Everything is urgent and you must stop, interrupt your visit, the consultant calls you, tells you he/she's going to see the patient you've asked him/her to visit but stands there waiting… here we take stretchers back and forth to help the nurses*"

3.1.4 Problematic interactions with the information system

One of the problems highlighted in individual interviews concerns the information system and the program through which patients' analysis, diagnosis and prognosis are managed from triage registration to discharge. Beside organizing and recording activities, the information system should speed up the whole process. This, however, is often not the case; rather, problems using the system itself are actually a source of stress.

"*The information system originates various problems because it's new, it's used in a different way by each operator and above all it often undergoes blocks and delays…*"

"*…exam results may be ready, but the medical report on them isn't, so you have to call…*"

It can be deduced from the interviews that the system is considered inadequate and that operators themselves are aware that communication among programmers, management and final users has not worked in the choice of the information system and in the changes made to it. Therefore the system does not obey ergonomic principles:

"*…this system is unsuitable to us, and when it's settled a little bit another change comes in... I don't know why, you change something and this causes something else to change which was OK …*"

"…this program meets neither our needs nor the patient's, so we are the ones who have to conform to the program…"

We have observed ourselves that the information system creates uneasiness because of the high refresh rate and frequent standstills (that may last for several minutes) making it very difficult, according to doctors and nurses, to follow envisaged procedures because of the difficulty switching from computer to paper, particularly in emergency situations. This is also a cause for concern to operators using the system who have to follow the computer based registration procedure under pressure. In visiting rooms, physicians also find it a cause for pressure and stress to have to recover, when the system does not work properly, information on the patient relying only on makeshift paper supports and their own memory.

"*It gets stuck, it stops working and you switch to paper…*"

"*…the server is down: all the patients' information I can see on this screen are no longer available to me… so I pass on to paper but I don't know what was done to them four or five hours ago; when we have forty patients in the department… it's hard to remember everything, you know… then those who have already had the misfortune of being visited must wait… you follow your nose…*".

3.1.5 Relational issues and sharing of procedures

Interaction and communicative problems frequently emerge; some problems concern colleagues working in the same department, some other relate to specialists coming from other departments, yet others to patients and their relatives.

This emerged above all during interviews to nurses who are actually the ones who get in contact with everybody else (colleagues, health workers, physicians, patients and their relatives). There are also tensions among physicians due to overlapping fields of competence and lack of clarity on which procedures must be followed when contacting external specialists. Lack of clear and precise procedures ends up affecting even personal relationships among colleagues, both inside and outside the department, thus overcharging the whole system.

"*…when I first came I quarrelled with several physicians about patients… if you want to get along well with everyone you don't talk about work… during my shift I do what I want, during your shift you do what you want...*"

"*Everybody goes his own way…*"

"*Specialists are usually late and you have to insist if you want them to come… sometimes they say we're know-it-alls and there's no need for them…*"

Both physicians and nurses in the Emergency Department recognize a big distinction in the Hospital according to work group or Department: they perceive the rest of the hospital is sometimes hostile, but this also suggests a great sense of belonging linking the various operators.

"*…since the Emergency Department was set up, it has been resisted by every part of the hospital (Departments, head physicians…), there's considerable friction between Emergency Department physicians and the rest of the hospital, which of course affects the people working here*".

One of the relational problems causing further pressure on emergency department operators is the relationship to patients' relatives: as interviews also show, this is not uniformly managed through standard procedures. Some triage nurses allow relatives into the internal corridor whereas others firmly send them back to the waiting room. Others let relatives in only if their presence might turn out to be useful (foreign patients who cannot speak Italian, old people, children or people unable to describe their condition…).

"Some of my colleagues don't even let one relative in and even blame me for letting more than one in, but when nobody gives information, after a while I let them in, so that they can ask the physician…"

Nurses often complain about the pressure put on them by relatives and blame physicians for being partly responsible for this stress, as they do not duly inform the relatives waiting outside on the patient's state.

Conflicts between operators concerning the use of spaces produce further discomfort. For example, nurses' interviews repeatedly highlighted a problematic definition of spaces involving the procedures to be followed at the triage station for registered patients waiting to be visited. Triage nurse should reassess waiting patients, but the position of the patients in the internal corridor makes this task difficult. Physicians want to close the door of the internal corridor to isolate a path for serious patients. In this situation if the triage nurse wants to monitor patients he/she has to move from the triage station and go to the corridor because of the closed door (see Figure 4). This door represents the core of a constant conflict between the necessity of monitoring patients and that of isolating the internal corridor … This emphasizes the lack of clear procedures among health operators. Results also highlighted different perspectives and expectations between physicians and nurses, relating to the work system and to the organization of the patient's course.

Figure 4. Access door to internal corridor.

Ergonomic analysis tries to make clear and to integrate the different positions (see 3.2).

3.1.6 Privacy

In surgery visiting rooms privacy is often guaranteed; in medical visiting rooms some problems arise, even though operators try to avoid them, because of the great flow of people and materials. It is easy to intrude patients' privacy at the triage station and in the department corridors because of restricted spaces and crowding.
In front of the triage desk there is a yellow line marked out on the floor to protect patients' privacy, but the distance between the line and the desk appears to be too short. Moreover, the triage station overlooks an open and often congested corridor used as waiting space (see Figure 5). Sometimes a lot of people get in and the queue in that narrow place does not ensure any form of privacy.

Figure 5. Lack of privacy at the triage station.

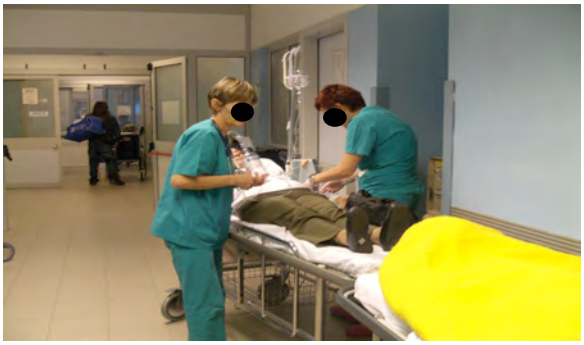

Figure 6. Attending patients in the corridor.

Some patients, when discharged, ask to use the triage phone to call their relatives or friends. The risk here is to create more and more crowding in a narrow space, and to keep a phone busy which could be of use for emergencies; but it is still a lack of privacy both for the calling person and other patients registering at the triage.
When nurses attend patients directly in the corridor privacy is inexistent as treatment (medical consultation, observation, phleboclysis, etc…) is done near other patients (see Figure 6).

3.2 Group discussions

Results were discussed with specific and mixed groups, in order for every group to become aware of the other groups' perspective.
In the first groups nurses and physicians confronted each other with the data of interviews and observations.
From these basis, physicians acknowledge the lack of shared procedures, for example concerning medical information to be supplied to relatives: each operator gives information according to his/her own choice. They recognize that the organization of the Emergency Department is not optimized, but they accept it like something that cannot be changed, maybe after not very fruitful attempts made in the past. Notwithstanding this, physicians do not seem to be aware of triage station activities: for example they recognize nurses' workload, but do not figure out all the tasks and duties nurses have to face in everyday work, such as people interacting with them and all the other elements that, in addition to patients, make the whole system heavy. Therefore, from this discussion a demand of integrated points of view on the system emerged.
The group of nurses focused the discussion on the same themes emerged from interviews and observations, with more details. In this case the interactions with relatives are perceived much more important in comparison with physicians because nurses have to make up for lack of information. Two different ways to "see" the Emergency Department emerge: physicians are focused on patients, the visiting rooms and the internal corridor while nurses have a more integrated view because of their "space" of activities is much more widespread.
Nurses must adapt to different physicians that attend patients in different ways. Some problems arise from an unclear definition of tasks, activities and roles both in the Department between different operators and in relation with other Departments of the hospital. Operators have to face their own tasks, but they feel overloaded by other duties that they do not think are under their competence. On the other side (especially) nurses feel powerless in comparison with the structure demands and needs; they would to be appreciated in their work activities and to be held in due consideration as active part of the system, participating in decisions concerning the Department activities.
Within the mixed discussion group, including physicians, nurses and health workers, we aimed to mobilize an "enlarged research community" able to build up a common operative image as a pre-condition to identify priority interventions and to highlight how the suggested solutions would impact on the overall system. In this context the data collected in the previous phases were presented to stimulate the discussion. The importance to know the "work" of each other was indicated as a fundamental topic to solve some problematic issues in the Department. The colleagues' activities cannot be appreciated and integrated in one's way of working if they are not known and if physician's psychological and working space remains focused only on the visiting room.. Only with an integrated view formulated by all different operators will be possible to stem the fragmentation of activities depicted in the different phases of the research.

4. CONCLUSIONS

The process is still under way, but a first validation was reached by the groups of operators, focusing on the necessity to redefine the current service organization and the triage station.
The work hypothesis is to form different mixed (operators, researchers) working groups to allow a participated solution of the most problematic issues. These groups aim at finding strategic solutions to problems that can be solved within the service and that can be faced in an autonomous way. It is important to distinguish these problems from those requiring the participation and the commitment of other parts of the overall hospital system not to come up to expectations that could be a source of further stress.
The working groups will be focused on shared aspects highlighted in the previous discussion groups:

1. sense of belonging, defense of the group and of its role compared to the rest of the hospital
2. motivation to change
3. sharing of procedures

4. delegating some aspects of management among operators
5. patient-centred approach
6. knowledge and awareness of one's colleagues' work

One of the major issues concerns patient safety, which seems to be the main aspect to be emphasized in order to involve higher levels of decision-making. This is because risk moves from the environment to the patient through the health operator: patient safety is strictly linked to operators' wellbeing.

5. ACKNOWLEDGMENTS

We wish to thank the head physician and the head nurse for their valuable contribution to the planning and the evolution of this work, and all the healthcare staff for its strong commitment and deep motivation to carry out the present study.

6. REFERENCES

[1] Albolino, S., Ernst, B. Uno standard ergonomico per il confezionamento dei medicinali. *Ergonomia* 2005; 3: 9-12. 14-21.

[2] Cappelletti, M., Gipponi, E. Wayfinding: che cosa è e cosa potrebbe essere. *Ergonomia* 2005; 1; 1-4: 20-23.

[3] European Agency for Safety and Health at Work *Working on stress*, Office for Official Publications of the European Communities, Luxembourg, 2002. http://osha.eu.int/ew2002/ (accessed March 2008).

[4] Fifield, B. Design Continuum. Casi di ergonomia applicata alla progettazione degli strumenti biomedicali. In Fiorani, M., Ranzani, F. (eds.) *Ospedali e sistemi per la sicurezza del paziente. Quaderni di ergonomia.* Moretti e Vitali, Milano, 2006.

[5] Gazzano, N., Gostinelli, M. 2005. Accoglienza in ospedale. Uno sguardo interdisciplinare tra antropologia e scienze infermieristiche. *Ergonomia* 2005; 1; 1-4: 16-19.

[6] ISPESL *Annual Report*, Dipartimento di documentazione, informazione e formazione, 2000. www.ispesl.it/informazione/argomenti/AnnualReport2000/ (accessed March 2008)

[7] Montagna, S., Ferrari, E., Spano, M. Competenza e percezione del rischio nel percorso di cura del paziente chirurgico. In Bagnara, S., Tartaglia, R., Tosi, F. (eds.) *L'ergonomia tra innovazione e progetto. Sistemi di lavoro e stili di vita. Quaderni di ergonomia.* Moretti e Vitali, Milano, 2006.

[8] Montanari, R., Gentile, F., Marzani, S., Tesauri, F. Heading e Under-heading. Il fattore umano nella progettazione degli allarmi. Un confronto tra dispositivi biomedicali e automotive. In Fiorani, M., Ranzani, F. (eds.) *Ospedali e sistemi per la sicurezza del paziente. Quaderni di ergonomia.* Moretti e Vitali, Milano, 2006.

[9] Parlangeli, O., Ciani, N., Marchigiani, E., Bracci, M., Palmieri, S. Elaborazione cognitiva di giudizi di qualità in ambito sanitario: indagine in un Reparto di Terapia Intensiva Neonatale. In Bagnara, S., Tartaglia, R., Tosi, F. (eds.) *L'ergonomia tra innovazione e progetto. Sistemi di lavoro e stili di vita. Quaderni di ergonomia.* Moretti e Vitali, Milano, 2006.

[10] Ranzani, F., Gazzano, N., Tripodi, C. Wayfinding. Accessibilità e accoglienza negli ospedali. In Fiorani, M., Ranzani, F. (eds.) *Ospedali e sistemi per la sicurezza del paziente. Quaderni di ergonomia.* Moretti e Vitali, Milano, 2006.

[11] Re, A., Micheletti, M., Occelli, C. Fattori di stress per gli operatori sanitari: analisi ergonomica di una postazione di triage. *Ergonomia applicata: sanità e servizi. Quaderni di Ergonomia*, Moretti e Vitali, Milano, in press.

[12] Tosi, F. I requisiti ergonomici per la progettazione in ambito sanitario. In Tartaglia, R., Baglioni, A. (eds.) *Ergonomia e ospedale. Valutazione, progettazione e gestione di ambienti, organizzazione, strumenti e servizi*, Il Sole 24 Ore S.p.A, Milano, 2002.