NURSING FAULTS IN THE RECOVERY PERIOD OF SURGICAL PATIENTS

Tânia Couto Machado Chianca[1]

Chianca TCM. Nursing faults in the recovery period of surgical patients. Rev Latino-am Enfermagem 2006 novembro-dezembro; 14(6):879-86.

This is a descriptive study based on the theory of human error, in order to analyze and classify nursing errors during the nursing care of surgical patients at recovery. Twenty-five (25) fault reports were collected through a semi-structured interview. Those reports were submitted to 15 nurse experts to evaluate the risk of seriousness; human, equipment and organizational factors involved; members interaction; information and reversibility of the accident. Faults were directly attributed to psychosocial and organizational aspects, equipment and seriousness. A multidimensional scaling test (MDS) was applied and a graph was obtained. It showed four groups of faults, due to problems related to sensory-motor, procedure, abstraction and supervision control. In conclusion, the faults were caused by non-defined personnel roles, continuing education deficiency, non-systematic observation, inadequate space and equipment.

DESCRIPTORS: postoperative care/nursing; iatrogenic disease; health facilities

LAS FALLAS DE ENFERMERÍA EN EL PERIODO DE RECUPERACIÓN DE PACIENTES QUIRÚRGICOS

Estudio descriptivo-exploratorio, fundamentado en la Teoría del Error Humano, con objeto de analizar y clasificar fallas de enfermería durante la atención a pacientes en el postoperatorio inmediato. A través de entrevista semiestructurada, fueron recopilados 25 relatos de fallas, sometidos a la evaluación de 15 enfermeros especialistas con respecto a 7 variables. Estas fueron reducidas a aspectos psicosociales/equipamiento, organizacionales y gravedad mediante el análisis de componentes principales. Fue realizado un teste de escalonamiento multidimensional (MDS), resultando en un gráfico con 4 grupos de fallas. Estos fueron interpretados como siendo al nivel sensorio-motor, de procedimiento, de abstracción y de control de supervisión. Las fallas fueron causadas por indefinición de papel, capacitación deficiente, observación asistemático, inadecuación física y de equipamientos.

DESCRIPTORES: cuidados postoperatorios/enfermería; enfermedad iatrogénica; instituciones de salud

FALHAS DE ENFERMAGEM NO PÓS-OPERATÓRIO IMEDIATO DE PACIENTES CIRÚRGICOS

Estudo descritivo-exploratório, fundamentado na Teoria do Erro Humano, para analisar e classificar falhas de enfermagem durante a assistência a pacientes em pós-operatório imediato. Através de entrevista semi-estruturada coletou-se 25 relatos de falhas que foram submetidos à avaliação por 15 enfermeiros especialistas quanto a 7 variáveis. Essas foram reduzidas a aspectos psicossociais/equipamento, organizacionais e gravidade pela análise de componentes principais. Realizou-se teste de escalonamento multidimensional (MDS) e obteve-se gráfico mostrando 4 grupos de falhas, que foram interpretados como sendo no nível sensório-motor, de procedimento, de abstração e de controle de supervisão. As falhas foram causadas por indefinição de papel, treinamento deficiente, observação assistemática, inadequação física e de equipamentos.

DESCRITORES: cuidados pós operatórios/enfermagem; doença iatrogênica; instituições de saúde

[1] Assistant Professor, Minas Gerais Federal University College of Nursing, e-mail: tchianca@enf.ufmg.br

INTRODUCTION

This study was based on our concern about nursing care for patients during the immediate postoperative period in Brazilian hospitals, most of which do not offer post-anesthesia recovery (PAR) units that are properly equipped, functioning, with a sufficient number of qualitatively trained staff for systemized high-quality care delivery to patients. We believe that adverse situations during nursing care delivery to PAR patients increase error possibilities and decrease the system's reliability; the team working in the PAR room is responsible for the adequate handling of equipment and material; the definition of tasks and functions and the relations between team members interfere in the occurrence of human errors; access to information and knowledge can decrease their occurrence; and similar central components can be detected in apparently distinct errors.

In this study, we aim to contribute to a more qualified care delivery, with reduced human error risks. Thus, we decided to test the human error reference framework in perioperative nursing care (more precisely in the immediate postoperative period), which was proposed by engineers, physiologists and cognitive psychologists to improve the reliability of human execution[1], in this case in the perioperative nursing area.

Situations involving human operators are a common theme in ergonomics, covering human error among other aspects[2]. In this study, we use the conceptual model by James Reason[3], which establishes the origins of basic human error types and the generic error structure system, largely derived from the human action classification by Jen Rasmussen (skill-rule-knowledge). The system allows for three basic error types: skill (mistakes and slips); rule and knowledge (errors in their true sense).

The behavior based on the level of skills corresponds to the sensory-motor performance during actions or activities which, after formulating the intention, acts without conscious control (disentangled, automated and integrated behaviors). Errors at this level are related to changes in the level of coordination, space or time[3].

Behaviors based on rule and knowledge, on the other hand, are assumed after the individual becomes aware of a problem. The rule-based level is the connection between family problems and already established solutions through the standards. Errors are related to the wrong application of the standard or mistaken memories about the procedures.

At the knowledge-based performance level, errors are related to appropriate task selection and limitations in the work environment. At this level, when the individual is confronted with unknown situations, actions must be planned with the help of analytic processes and already acquired knowledge. Errors emerge from limitations in material resources or through the rational process that involves insufficient or incorrect knowledge. The three levels can coexist.

Errors are closely connected with the notion of intent[3] and actions leading to errors can be intentional or involuntary (non-intentional). Involuntary actions normally derive from moments of lack of care, when we become aware that our actions deviated from our intent. These action **mistakes** occur when we perform highly automated tasks, in very familiar environments.

Slips are hidden, unintentional forms of errors, generally involving memory failures that do not necessarily manifest themselves in actual behavior.

When actions are intentional and occur as planned, they can still be wrong if they do not reach the expected objective. In this case, the plan may not be adequate, leading to so-called **errors**. These errors are generally related to individuals' lack of experience who, based on earlier experiences, make incorrect analogies[4].

In Brazilian nursing, studies have been developed about medication errors[5-6], but we are not aware of any studies that have classified, quantified, typified or analyzed errors in other health areas, in an attempt to understand and predict them and create prevention strategies.

The surgical center is a socio-technical-structured system[7], aimed at delivering patient care during the pre-, trans- and immediate postoperative periods, and efforts should be made to increase the system's probability of success, its reliability, which is closely related with the control of human mistakes in activities, as well as with the control of mistakes in the equipment and surgical environment. These may create behaviors that lead to insecurity in the system.

This study aimed to analyze and classify errors committed by the nursing team in patient care during the immediate postoperative period.

MATERIAL AND METHOD

Wrong behaviors and attitudes can be studies with the help of statistical, epidemiological or case analysis methods. Various professionals have used multivariate statistical techniques to group data. When confronted with subjective variables, which supposedly exist when mistakes are committed, we inquire, for example, about the relevant factors are to analyze a human error. What are its causes? The answers to these questions can be discovered by constructing objective scales, obtained through multivariate data and analyzed per factor or on the basis of data about dissimilarities, using multidimensional scaling (MDS) to interpret them.

In this study, we decided to construct an objective scale of subjective attributes, using Statistical Program for Social Sciences (SPSS) software to analyze the distance between data that indicate the degree of dissimilarity (or similarity) between two things[8].

The study was authorized by the Research Ethics Commission at the Clinical Hospital of Minas Gerais Federal University and by the boards of the involved universities. All nursing team members and experts signed an informed consent term.

Study participants

As we intended to collect information about mistakes occurred during immediate postoperative patient care, we requested reports on relevant mistakes, in which the caregiver's behavior entailed negative consequences for his/her objective. For this purpose, we used the Critical Incident Technique[9] as a reference to obtain negative incidents, asking the following question, whose content was validated by nursing experts: think about one occasion during which you witnessed or participated in a fault or human error during immediate postoperative patient care delivery. Describe what happened, the situation, the type of patient, the surgery, what the person did and what the consequences of the error/fault were.

Our sample consisted of fault reports that were considered valid, complete, clear and precise and were collected from nursing team members who worked at surgical center units and post-anesthesia recovery rooms (PAR) of ten medium and large-sized hospitals in Belo Horizonte, based on semistructured interviews.

Initially, we collected 31 fault reports, 25 of which could be used. The remaining six reports were withdrawn because contents were repeated and because they were incomplete (containing situation, behaviors and consequences). A title and abbreviation [10] were attributed to each report, as illustrated by the example below.

Overdosis(over) - *Patient during immediate postoperative period after osteotomy of the right tibia, high blood pressure, taking Adalat on a regular basis and complaining of pain. The patient received an intravenous analgesic and, soon afterwards, the nursing auxiliary administered a new dose of Isordil, talking with another colleague while she delivered care to the patient. After receiving the two drugs, the patient's blood pressure, initially at 130 x 80 mmHg, changed to 90 x 60 mmHg. The patient got hypotension as a result of the interaction between the two drugs, as both are hypotensive agents. Blood pressure was verified frequently until stabilizing at 120 x 70 mmHg.*

Instrument elaboration and error report assessment procedures

We elaborated an instrument to be applied among experts, who had to judge the reports with respect to the following variables: severity; degree of foreseeability; human, equipment and organizational factors; group relations and information. These variables were chosen to cover the flaw in itself, as well as personal, social, organizational and equipment aspects. We defined the variables that we consider to be involved in immediate postoperative nursing care and elaborated a five-point Likert scale for each variable. The instrument was tested in a group of three faculty-researchers, one nurse and two occupational psychologists. After their suggestions had been incorporated, the instrument was considered good, favoring the typification of nursing errors[10].

Each judge received 25 pages, each of which contained one report, with scales to make records on each of the seven variables. For each variable, an explanation was given and the expert had to grant a score to the factor's role in each fault. The provided scores were calculated and the median values for each report were entered into a matrix.

Fifteen experts collaborated, including nurses, who were specialized in surgical center and immediate postoperative patient care. Experts were chosen at random. We looked for characteristics like professional experience at a Surgical Center Unit, including immediate postoperative patient care, availability and agreement to participate in the study.

Data treatment and analysis

We obtained 25 fault reports, which were analyzed by 15 judges in terms of seven variables, who considered five degrees, totaling 2,625 evaluation scores. Joining the 15 judges' median scores for each fault report, we constructed a matrix with 175 median values. Fifty percent of judgments were concentrated either above or below these.

Next, we applied Principal Components Analysis (PCA) and, in choosing the number of components, we considered the established criterion[11], that is, latent roots higher than one. This allowed us to isolate three orthogonal factors, corresponding to 67% of total variance, with a view to obtaining significant and non-correlated components from a theoretical point of view. PCA is a variant of factorial analysis, used to reduce the number of variables correlated by a small number of independent variables.

After extracting the main axes, these were submitted to orthogonal rotation, using the most popular procedure, which is the varimax method[12]. In this procedure, new coordinate (principal component) axes cross one another. This implies that different principal components are independent, without any mutual relation.

PCA alone does not tell us what we will find in conceptual terms. Thus, it was complemented with multidimensional scaling (MDS), so as to find an adequate graphic arrangement for the nursing mistakes and allow for mutual comparisons.

We used the simplest MDS model to obtain a classical dissimilarity matrix. Data were symmetrical and the two-dimensional Euclidian model could be used for the matrix. The coordinates outlined by the computer program generally are not susceptible to direct observation, but can be sketched randomly and the directions taken in the MDS configuration can provide interesting aspects for interpretation.

RESULTS

Eighty percent of the ten hospitals in Belo Horizonte - MG, where the reports were collected, offered a PAR venue. Only 20% of these used appropriate beds. In the remainder, patients were placed in beds with bars; 70% had an emergency cart with a heart defibrillator. In 50% of the PAR, oxygen and vacuum exits were channeled per bed. It should be highlighted that, in all hospitals with a PAR venue, nursing auxiliaries offered patient care, without the presence of a nurse.

The experts considered the organizational factor as totally or quite determinant of mistakes in 24 (96%) reports. Group relations played a (totally or quite) determinant role in 14 (56%) reports. The information factor was considered to be totally or quite determinant in 20 (80%) mistakes and the human factor in 24 (96%). The equipment factor was not determinant in 19 (76%) mistakes.

As to the degree of foreseeability, most experts considered none of the fault reports as unforeseeable. They considered 18 (72%) errors as totally or quite foreseeable. As to the severity of mistakes, the experts judged that four (16%) mistakes could have led to the patient's death; 5 (20%) could have determined a permanent limb or function deformity, loss or uselessness or irremediable moral damage; temporary limb, consciousness or function weakness in 11 (44%) mistakes; damage to physical, mental or moral integrity without causing weakness in 5 (20%) fault reports. None of the mistakes under analysis was considered as having little possibility of damaging the patient's physical, mental or moral integrity.

Based on the obtained median values and applying PCA after rotation through the varimax method, we could isolate three orthogonal factors, i.e. components I, II and III. The components' factorial loads are presented in Table 1. Component I, called psychosocial and equipment aspects, covered the following variables: human factor, information and group relations. When applying PCA, the equipment factor (with a high negative individual factorial load -.63) was also grouped in component I. However, the equipment factor is opposed to the other three variables because it is conceptually different from psychosocial aspects, and is therefore called a bipolar component. It is bipolar because it implies that psychosocial aspects are opposed to the equipment factor. A low score on this component implies that an equipment fault prevailed in the fault reports, while a high score indicates the prevalence of psychosocial aspects in the fault.

Component II was called organizational aspects. This component is also called bipolar because it implies that the organizational factor is opposed to the degree of foreseeability. The degree of

foreseeability and the organizational factor have high individual factorial loads, the former with a negative (-.83) and the latter with a positive load (.78). This means that organizational causes prevail over the mistakes' degree of foreseeability. The more organizational the causes of mistakes are, the lower their degree of foreseeability will be.

Table 1- Structure of nursing fault components

Variables	Components		
	I	II	III
Human factor	.80*	.22	.16
Information	.78*	-.23	-.12
Equipment factor	-.63*	.18	.39
Group relations	.61*	.35	13
Degree of foreseeability	.04	-.83*	-.03
Organizational factor	.08	.78*	-.09
Severity	.02	-.09	.92*

* Factorial load (>.35) considered to interpret factors

Component III corresponds to error severity, with an individual factorial load of .92. The more severe the fault is, the higher the prevalence of the organizational and psychosocial/equipment factors that produced it.

By applying the PCA procedure, the number of variables was reduced from seven to three - psychosocial and equipment aspects, organizational aspects and severity. Then, the obtained data (means of median values) were submitted to MDS. We used to simplest MDS model to obtain just a classical matrix of the program, the dissimilarity matrix. Data were symmetrical and the two-dimensional Euclidian model could be used.

The program produces the history of the interaction. As the minimal s-stress is lower than 0.001, SPSS reached this value in only four interactions. The s-stress measures the best arrangement, ranging from 1 (worst grouping) to 0 (best grouping). The program generated two other adaptation measures, the "Kruskal stress" measure (0.04492) and the squared correlation coefficient (r-squared = 0.99262) between the data and the distances. All three arrangement measures indicate that the bidimensional Euclidian model describes the mistakes perfectly.

In the AGITATION (AGT = -4.512 and 0.4134), RETENTION (RET = -4.515 and 0.4133) and SELO (-4.504 and 0.4141), the median values of the experts' scores for the seven variables indicated that the organizational and human factors, as well as information, totally determined the mistakes. Group relations were quite determining. The equipment factor did not play a determining role in these mistakes. In the three reports, the mistakes were considered as totally foreseeable and causing temporary limb, consciousness or function weakness.

The fault reports called CORTE, DRENO and OVERDOSIS (OVER) presented differences in mean values among almost all variables, although the stimuli coordinators in dimensions 1 and 2, used to create the MDS graph, are practically the same, (CORTE= -0.4510 and 0.4127; DRENO= -0.4510 and 0.4127; OVER= -0.4507 and 0.4108), approximating them in terms of similarity.

The stimuli coordinates for the fault pairs called SOLITUDE (SOLI) and PIECE (PECA) represent the mutually most distant number in the two dimensions (SOLITUDE= 2.1105 and 1.0196; PECA= -1.7471 and -0.1282). In Figure 1, they are shown in the upper left and lower right angle (drawing imaginary lines on the 0,0 axis). These mistakes are the most distant, that is, the differences between them are the greatest. Therefore, the set of reports - COMMENT (COMT), EXCHANGE (TRO), TRANSFIX (TRAF), HIT (PANC) and PIECE (PECA) - located on the left in the graph, are most different from the set of reports SOLITUDE (SOLI), SECRETION (SECR), LARYNX (LARIN) and OMISSION (OMI), located on the right in the graph.

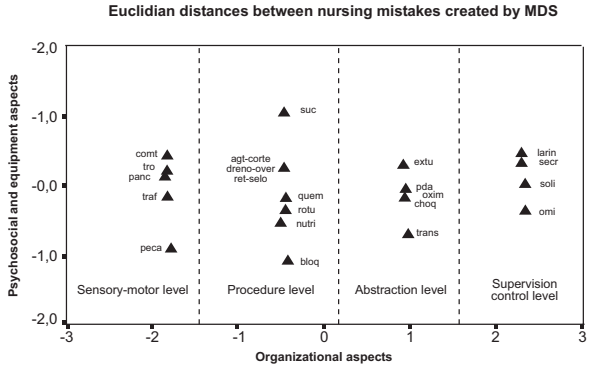

Figure 1 - Representation of distances between nursing mistakes and their complexity levels

Figure 1 presents the MDS map, based on the matrix data that correspond to the distances between the 25 fault reports, in terms of the seven variables under analysis, which were grouped in the three factors. It graphically presents the similarities and/or dissimilarities among them, referring to the three components indicated by the PCA. We distinguished four groups of mistakes (sensory-motor,

procedure, abstraction and supervision control level), which are similar in the dimensions we found (psychosocial, equipment and organizational aspects).

Table 2 - Representation of non-contemplated nursing interventions that determined mistakes and their corresponding socio-technical-structured system areas

System	Nursing mistakes	Creating nursing interventions
Technological (15 reports)	Secretion, Shock, Label, Feeding, Drain, Agitation, Seal, Suction, Retention, Block, Overdose, Burn, Transfix, Exchange, Piece	Risk identification, Care management in shock: volume, Medication administration: parenteral, Tube care, Safety intensification, Fall prevention, Environmental administration, Safety, Technology management, Tube care: lung, Emotional support, Care in emergency situation, Medication therapy for: overdose, Skin condition monitoring, Topical treatment, Surgical care: circulation
Social (5 reports)	Comment, Arrest, Extubate, Solitude, Omission	Safety intensification, Environmental administration, Safety, Resuscitation, Care in emergency situation, Risk identification, Fall prevention
Structural (5 reports)	Hit, Cut, Oximeter, Transfer, Larynx	Technology management, Fall prevention, Environmental administration, Safety, Safety identification, Positioning

When the mistakes occurred, we considered that the nursing actions were not realized as they should have been. Table 2 presents the nursing interventions[13] that were not implemented or implemented inadequately, according to the surgical center areas the mistakes refer to (technological, social or structural). The interventions are intermediary causes in the occurrence of mistakes, determined by the inadequacy of the physical area, lack of definition of team member roles, deficient staff training, asystematic observation and equipment inadequacy.

DISCUSSION

The analysis of median values showed that the human factor was considered determinant for the large majority of the reported mistakes. Prevention measures could have been established, as they were considered foreseeable. Moreover, the human factor, lack of information and, to a lesser extent, group relations were considered as determinant for the mistakes, most of which displayed a relatively low severity level. We observed the prevalence of organizational causes over the mistakes' degree of foreseeability, i.e. the more organizational their causes are, the lower their degree of foreseeability.

The PCA showed the prevalence of human and social aspects over equipment-related fault causes. We detected that the involvement of organizational, psychosocial and equipment aspects decreases the foreseeability of mistakes, leading to more severe consequences for patients in most cases.

We applied MDS to obtain a map that graphically presented the similarities and/or dissimilarities between the four interpreted fault groups. **Sensory-motor mistakes** are characterized by the detection of problems, data processing, through the senses and the control of motor actions to solve them. This level is based on skills and is related to the execution of highly routine activities in the work environment, with the occurrence of lapses and involving predominantly intrinsic (psychosocial) system aspects. We found the following sensory-motor mistakes: comment, exchange, hit, transfix and piece[10].

In all reports, the actions that should have been carried out did not happen - not making inconvenient comments to colleagues while delivering care; lack of attention in labeling and putting anatomical pieces in the appropriate place to send them on to the lab; putting the patient in a safe location, and care with drainages and infusions while transporting patients from the operating room to the PAR, preventing catheter transfixation and observing whether catheters and drains are closed. In the reports, nursing team members' lack of perception and continuous observation of patients and the environment were observed.

Procedure levels refer to answers to problems related to pre-established rules, to service routines. It is the rule-based level. All mistakes are related to the deficient standardization of technical routines and lack of experience, revealing the degree of automation in task actions. The mistakes referred to the lack of testing and periodical maintenance of devices like the secretion aspirator; leaving the patient alone while still under the effect of anesthesia; putting the patient in an insecure place; not observing the patient's clinical conditions; not knowing about drugs that interact; lack of knowledge about drains and infusions and how to take care of them; not knowing how to act in hemodynamic instabilities and anesthetic emergencies. These mistakes were called: suction, agitation, cut, overdose, retention, seal, burn, label, feeding and block[10].

Abstraction mistakes refer to the answer due to abstraction problems in the handling of concepts and logical proposals. It is the knowledge-based level. These involve perception, observation and surveillance errors related to the patient's continuous observation, remaining by his side, perceiving signs and symptoms of abnormalities, paying attention to the patient's clinical responses to the anesthetic-surgical act and surveillance. The mistakes called extubate, arrest, shock and transfer[10] referred to accidental extubation and risk of falls during patient transport; the employee's total lack of knowledge about resuscitation maneuvers in cases of cardiorespiratory arrest and about clinical observation with a view to the early detection of signs of hypovolemic shock; damaged and insufficient oximeters.

Supervision control mistakes maintain a close correlation among the earlier levels (sensory-motor, procedure and abstraction); the interaction between nursing team members, anesthetist, surgeon and patient requires constant attention, observation, perception and surveillance to detect different problems and actions required for their solution. It is a level based on rules, skills and knowledge. The lapses, mistakes and errors that occur at this level culminated in very severe errors, whose psychosocial and organizational aspects are important in producing the errors. We found the following supervision control mistakes: larynx, secretion, solitude and omission[10], referring to situations in which the patient had a glottis edema and there was no laryngoscope in the room; presented non-aspired secretion at the appropriate moment; presented cardiorespiratory arrest because he was alone, besides a case in which the doctor was called and did not respond.

We consider that essential factors for error analysis and related to the environment, the task and the individual[14]. From the perspective of the surgical center as a socio-technical-structured system[7], we believe that individual aspects include the human factor (knowledge, aspirations, expectation, motivations, opinions and values) and group relations (social interactions), which correspond to the social system. The task is related to equipment, materials, techniques, physical area and activities, corresponding to the technological system. Environmental factors include the institution's philosophy in terms of its goals and values, involving the organizational factor (organization, flow chart, function and service descriptions, standards, rules, regulations and regiments) and information, which refer to the structural system.

In view of this conception, we consider that "accidents generally result from inadequate interactions between man, task and environment"[15], and that mistakes refer to deviations that determined low system reliability. Reliability is "the probability that a system will execute functions without mistakes within a given time interval"[15].

The mistakes we found can be classified in terms of organizational, psychosocial/equipment and severity aspects, and we arrived at four basic levels at which they occur: sensory-motor, procedure, abstraction and supervision control. These levels are connected with the human cognitive activities of skill, rule and knowledge, to different extents and involving mistakes deriving from lapses, mistakes and errors.

CONCLUSIONS

We consider that the theory of human error can enrich the analysis and prevention of nursing mistakes and conclude that the human factor permeates all mistakes, which were mostly produced by mistakes and lapses in the task planning phase. The lack of skill and attention played a determinant role in mistakes during nursing care delivery to patients in PAR.

Mistakes are basically due to psychosocial and organizational aspects and consist in lapses and mistakes at sensory-motor and procedure level, which occurred during task planning; and in errors at abstraction and supervision control level, occurred during task preparation and execution. The equipment factor does not determine the mistakes and, the greater the severity of the fault, the higher the prevalence of the organizational and psychosocial aspects that produced it.

Sensory-motor and procedure mistakes are light and moderate, while abstraction and supervision control mistakes are either severe or very severe. We identified five basic causes during nursing care to patients in PAR - physical inadequacy, lack of role definition, deficient training, asystematic observation and equipment inadequacy, all of which were connected with psychosocial and organizational aspects that determined fault severity.

The mistakes are based on the behavior of the entire man-task-environment system. In this context, mistakes are caused by system objectives that are not complied with. The improved reliability of the surgical center system, especially of the PAR care task, is illustrated by essential reparations, such as training and recycling, role definition, physical restructuring, qualitative and quantitative equipment adaptation, besides the implantation of nursing care systemization for care delivery to perioperative surgical patients, in which sequences of activities defined by a nurse are deliberately carried out to guarantee that patients receive the best possible care.

ACKNOWLEDGEMENTS

Our sincerest thanks to Prof. Dr. Paul Stephaneck, Retired Full Professor from the University of São Paulo at Ribeirão Preto Faculty of Philosophy for serving as the advisor to our Doctoral Dissertation, which gave rise to the results presented in this article.

REFERENCES

1. Khon LT, Corrigan J, Molla SD. To err is human: building a safer health system. Washington: National Academy Press; 2000.
2. De Keyser V, Nyssen AS. Les erreurs humaines en anesthésie. Le Trav Hum 1993; 56(2-3):243-66.
3. Reason J. Human error. 3ed. Cambridge: Cambridge University Press; 1992.
4. Leplat J.Error analysis, instrument and object of task analysis.Ergonomics 1989; 32(7):813-22.
5. Chianca TCM, Freitas MEA, Carvalho AP, Souza LO, Ricaldoni CA. Classificação dos erros de enfermagem ocorridos em um hospital privado de Belo Horizonte. Rev Min Enfermagem 2000; 4(1/2):2-8.
6. Carvalho VT, Cassiani SHB. Erros na medicação: análise das situações relatadas pelos profissionais de enfermagem. Rev Hosp Clin Faculdade de Medicina de São Paulo 2000; 33(3):322-30.
7. Avelar MCQ, Jouclas VMG. Centro cirúrgico: sistema sócio-técnico-estruturado. Hosp. Adm Saúde 1989; 13(4):152-15.
8. Young FW, Harris DF. Multidimensional scaling. In: Norusis MJ. SPSS for windows: professional statistics. New York: SPSS; 1992. p.157-223.
9. Dela Coleta JA. A técnica dos relatos críticos: aplicação e resultados. Arq Bras Psicol Aplicada 1974 abril-junho; 26(2):35-58.
10. Chianca TCMC. Análise sincrônica e diacrônica de falhas de enfermagem em pós-operatório imediato. [Tese]. Ribeirão Preto (SP): Escola de Enfermagem de Ribeirão Preto/ USP;1997.
11. Keyser HF. The varimax criterion for analytic rotation in factor analysis. Psychometrica 1958; 23:187-200.
12. Dunteman GH. Principal components analysis. Beverly Hills: Sage Publications; 1989.
13. McCloskey JC, Bulechek GM. Classificações de intervenções de Enfermagem. 3ªed. Porto Alegre (RS): Artmed; 2004.
14. Rasmussen J. Human errors: a taxonomy for describing human malfunction in industrial installation. J Occup Accidents 1982; 4:311-33.
15. Iida I. Ergonomia: projeto e produção. São Paulo: Edgard Blücher; 1990.

Recebido em: 26.4.2004
Aprovado em: 13.9.2006