



NURSING WORKLOADS IN NUCLEAR MEDICINE
CARGAS DE TRABALHO DA ENFERMAGEM EM MEDICINA NUCLEAR
CARGAS DE TRABAJO DE LA ENFERMERÍA EN MEDICINA NUCLEAR

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ABSTRACT

Objective: to identify types of workload to which nursing professionals are exposed while working in nuclear medicine. **Method:** this is an exploratory study with qualitative approach carried out with eight nursing workers of two nuclear medicine services located in Santa Catarina. Data collection occurred through non-participant observation and semi-structured interviews, using the Content Analysis technique in data analysis. **Results:** Nursing workers are exposed to the workload typical of nursing activities added to the physical burden arising from exposure to radiation, a factor that can boost wear. **Conclusion:** investing in training actions and recognizing the workloads to which nurses are exposed is essential to minimize the wear of nursing workers in nuclear medicine. **Descriptors:** Workload; Nuclear Medicine; Worker's Health; Nursing Specialties.

RESUMO

Objetivo: identificar as cargas de trabalho a que os profissionais de enfermagem estão expostos durante o trabalho em medicina nuclear. **Método:** estudo exploratório, com abordagem qualitativa, realizado com oito trabalhadores de enfermagem de dois serviços de medicina nuclear localizados em Santa Catarina. A coleta dos dados se deu por observação não participante e entrevista semiestruturada, utilizando-se a técnica de Análise de Conteúdo na análise dos dados. **Resultados:** os trabalhadores de enfermagem estão expostos a todas as cargas de trabalho típicas do fazer da enfermagem, somadas à carga física advinda da exposição à radiação, fator que pode impulsionar desgastes. **Conclusão:** investir em ações de capacitação e reconhecer as cargas de trabalho a que estão expostos é primordial para minimizar os desgastes dos trabalhadores de enfermagem em medicina nuclear. **Descritores:** Carga de Trabalho; Medicina Nuclear; Saúde do Trabalhador; Especialidades de Enfermagem.

RESUMEN

Objetivo: identificar las cargas de trabajo a que los profesionales de enfermería están expuestos durante el trabajo en medicina nuclear. **Método:** estudio exploratorio, con enfoque cualitativo, realizado con ocho trabajadores de enfermería de dos servicios de medicina nuclear localizados en Santa Catarina. La recolección de los datos fue por observación no participante y entrevista semi-estructurada, utilizándose la técnica de Análisis de Contenido en el análisis de los datos. **Resultados:** los trabajadores de enfermería están expuestos a todas las cargas de trabajo típicas del hacer de la enfermería, sumadas a la carga física de la exposición a la radiación, factor que pue impulsionar desgastes. **Conclusión:** invertir en acciones de capacitación y reconocer las cargas de trabajo a que están expuestos es primordial para minimizar los desgastes de los trabajadores de enfermería en medicina nuclear. **Descriptores:** Carga de Trabajo; Medicina Nuclear; Salud del Trabajador; Especialidades de Enfermería.

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INTRODUCTION

Health care institutions are considered complex organizations, designed to receive and treat sick individuals.¹ The work in these institutions is carried out by different professions involving workers with skills in different knowledge and techniques, including multiple knowledge and practices, in order to assist individuals in health status.²

Nursing is among the professions working in nuclear medicine (NM), a specialty linked to the support and care to users who undergo diagnostic procedures or therapy involving the use of unsealed sources of radioactive materials administered *in vivo*.

Nursing, like any other profession, incorporates elements of the health work process (object, instruments, purpose and product) adapting them to their know-how.³ Thus, NM Nursing work object takes on a unique characteristic compared to other radiology sectors and diagnostic imaging: after radiopharmaceutical injection, the patient - nursing work object - becomes the emitting source of ionizing radiation, which is detected by special equipment of nuclear medicine.

That is, in nuclear medicine work, the source of radiation is not a device that can be turned on and off when needed. In nuclear medicine, the patient becomes the emitting radiation source and this patient has a direct contact with the nursing staff. Thus, nuclear medicine services (NMS) can be classified as complex social environments depending on the workloads present in the work organization.

Workloads have a variety of meanings, but for this study we adopted the concept of elements that dynamically interact with each other and with the worker's body, generating adaptation processes which result in wear.⁴ They can be classified according to their materiality and can be internal or external to the worker's body. Internal workloads refer to physiological and psychological loads and are so classified because they are internal manifestations in workers. As for the external loads, these can be physical, chemical, biological (or organic) and mechanical.^{5,6}

Workloads are responsible for causing wear in workers, as not only the relationship with the work can influence the falling ill and/or suffering of workers, but also the elements that are present in this relationship. The higher the workload, the greater the wear experienced by the worker. Moreover, precariousness in work organization and the difficulties of the profession also lead to manifestation of wear.⁷

Thus, the importance of knowing and acknowledging the workloads comes from the possibility of minimizing them and/or avoiding them in order to reduce their effect on the worker's body.⁵ Thus, this study aimed to identify the workloads to which nursing professionals are exposed while working in nuclear medicine.

METHOD

The study had qualitative approach and exploratory nature as these tools make it possible to unveil little understood social processes, and allows the creation of new concepts.⁸ The research was conducted in two private institutions named here institution A and B, located in the state of Santa Catarina, specialized in nuclear medicine procedures. Both institutions carry out diagnostic procedures and are in line with the standards of the National Nuclear Energy Commission (CNEN). Only one of the services has specific inpatient units for performing radioiodine therapy. The institutions surveyed have provided service for more than 15 years in the abovementioned State through private consultations, health plans and also through the Unified Health System.

The study included all Nursing workers of both institutions, which were not removed for any reason, thus totaling eight investigated professionals.

Data collection was conducted from February to April 2015. In order to meet the requirements of the Resolution 466/2012 of the National Health Council,⁹ the study started after receiving approval from the Ethics Committee on Human Research of the State Health Secretariat under Opinion number 966.949, CAAE number 41359314.4.0000.0115, besides obtaining the signature of informed consent form by the participants.

Non-participant observation and semi-structured interviews were used to survey data. These were conducted by researchers at the participants' workplace. The observation happened previously to the interview and was recorded in a field diary, totaling 32 hours of observation. The non-participant observation aimed to identify the workloads present in the nursing practice in nuclear medicine through careful observation of activities, tasks performed, time required for performing each task and workloads in the relationship between the worker and the work done. Semi-structured interviews were intended to know the activity of nursing professionals in nuclear medicine from the perspective of the workers, as well as to provide subsidies that could

reaffirm or refute the information obtained in the observation. The interviews were recorded and transcribed verbatim.

To ensure confidentiality and anonymity, participants were identified by the letter P followed by numbers representing the order in which the interviews were conducted and the professional category to which they belong. Furthermore, nurse and nursing technician categories are not distinguished in the presentation of results.

The analysis of the empirical material was performed using thematic analysis, which allows specific deductions on a certain fact.¹⁰ The analysis consisted of three phases: pre-analysis, through organization of data and exhaustive reading of the field diary and transcripts of interviews; material exploration and treatment of results, which identified the main activities carried out by workers associating them with workloads and separating them into thematic units; and finally, inference and interpretation, through the critical reading of thematic units based on the adopted reference.

RESULTS AND DISCUSSION

Despite the large influx of patients, the surveyed institutions have a small number of nursing workers. The institution A has three nursing professionals: one nurse and two nursing technicians; and the institution B has five nursing professionals: one nurse and three nursing technicians. Four of the surveyed professionals had completed their training in the past five years and only one professional has concluded the course in within the last year. However, only one of the nurses has specialization. It is evident that the NM work carried out by these professionals is relatively recent, considering that only two participants work for more than five years with nuclear medicine. The other surveyed workers act in this area for over a period ranging from 2 to 3 years.

About the workload schedules performed weekly, including other employments, five workers have a workload of 40 hours per week, two have more than 40 hours per week and only one employee has a workload of 30 hours per week. However, only two professionals have a second job that also involves exposure to ionizing radiation. Thus, these workers experience double exposure to different workloads.

The results presented below correspond to the data analysis and will be discussed in two categories: Working in Nuclear Medicine from the Perspective of Nursing Workers and Nursing workloads in nuclear medicine.

♦ Working in Nuclear Medicine from the Perspective of Nursing Workers

Exposure to ionizing radiation is intense in NM service. Aware of that, researchers questioned participants on how often they were exposed to ionizing radiation in this type of service and all participants reported that exposure to ionizing radiation occurs all the time during the work shift. Participants were also asked to report what moments they thought they were more subject to exposure to ionizing radiation. All responded that this happens at the time of administration of radiopharmaceuticals. However, the professionals also cited the moment of providing care to hospitalized patients for radioiodine therapy as one of the activities where greater exposure takes place, as shown in the speeches transcribed below.

We puncture people and inject the radioactive material into the patient, every day we are exposed to radiation all the time while working. (P2) I think the exposure is lower in cardiac myocardial scintigraphy, but I worry when I have to get inside the room to assist a patient, there the dose is much higher. (P5)

This answer was also referred to by the majority of participants when questioned about the situations they consider harmful to health. However, when asked about being afraid to work with ionizing radiation, only one professional reported being afraid. The others say they never felt afraid.

Nevertheless, when asked about the training they have received to work with NM, most professionals reported that this was short, lasting a few hours and aiming at getting familiar with the service. The qualification or training activities approached issues related to radioprotection for both patients and professional mostly in a superficial manner. However, some professionals said they have never received training or qualification.

What I learned, I did from day to day, putting my hands on the work. (P6) When we come here, we do not have the ability to understand what is ionizing radiation. (P3)

In this perspective, workers value the actions of qualification and training, as can be observed in their speeches:

Training is important to be aware of how to work, how to protect us. (P7) The more skilled and trained in nuclear medicine, the better. (P2)

However, despite valuing the training actions, only one of the surveyed professionals said to participate in refresher events and courses directed to NM.

Furthermore, there were flaws in the knowledge of the surveyed professionals in relation to wear from work in MN. This fact is evident when workers were asked about the health consequences of occupational exposure to ionizing radiation.

I can develop cancer. (P8) We can even develop anemia and leukemia. (P3) I don't know well the consequences, but I know they are cumulative (P4)

Thus, it is observed that the skin lesions, leukopenia, infertility, and others are forms of wear not known by the workers.

When it comes to the work involving ionizing radiation, it is extremely important to make use of personal protective equipment (PPE). It was observed that the most of the surveyed professionals use the radiological protective clothing and respect the distance from the radioactive source. The use of the dosimeter was reported by all participants. However, one of the institutions does not use the dosimeter ends, which is important in nuclear medicine services because the workers' hands are constantly exposed, besides the possibility of contamination at the moment of applying the radiopharmaceutical injection.

I use PPE to protect myself and I keep a distance from injected patients. (P1) I always try to use the lead apron, procedures gloves and the dosimeter. (P8) What I try to use is the lead coat, lead syringe holder, and procedures gloves. (P7)

Thus, it was found through observation that the areas surveyed make use of PPE as well as lead aprons, thyroid shield, acrylic glasses and procedure gloves. However, although professionals affirm to use the protective material, this was not observed at all times.

Finally, the workers were asked about the difficulties of working with MN.

I have difficulty related to exposure, when it really happens? What can radiation cause? (P4) I have difficulties in protecting myself, make sure it's all right (P7) The workload is different from radiology professionals, shouldn't it be the same? (P5).

In short, it is observed that the difficulties of working with NM are related to effective methods to get protected from radiation, the working hours through which exposure to ionizing radiation happens and the understanding of ionizing radiation phenomenon.

♦ Nursing workloads in nuclear medicine

It is evident that the workloads found in medical service employing radiological technologies are quite extensive and result from the interaction between the workers' body, their work and the work environment.⁵

Radiological nursing incorporates relatively
English/Portuguese

common loads of the hospital work environment and specific risks of the activity that involves the use of ionizing radiation.

The observations of the work routine of professionals working in the nuclear medicine service made it possible to correlate the types of workloads with the various situations that nursing professionals are occupationally exposed to during the performance of their work activities. The workloads and the situations where they are manifested were synthesized in the Figure 1.

Workloads	Workload Generating Situations
Physiologic	Incorrect posture to inject the radiopharmaceutical agent, manipulating the computer and lifting patients up the stretcher.
	Use of PPE - uncomfortable and forced position and immobility.
	Driving wheelchair patients down and up the ramp.
	Lead trash (heavy).
	Cramped rooms making it difficult to move.
Psychological	Use of the stairs several times a day.
	Repetitive activities that become mechanized.
	Schedule with large flow of tests.
	Insecurity: workers face situations of doubt - absence of training to professionals.
	40 working hours or more with exposure to ionizing radiation.
Physical	Multiple employments.
	Lack of knowledge about the risk imposed by the ionizing radiation to which one is getting exposed.
	Exposure to ionizing radiation.
	Contamination during injection of the radiopharmaceutical agent or by contact with excretions of the patient.
	Very cold rooms.
Biological	Excessive moisture.
	Double working hours.
	Radiopharmaceutical administration (intravenous or inhalation).
	Withdrawal of the parenteral punch introducer.
	Passing vesical catheter.
Mechanical	Assistance in the use of recipients to collect urine
	Assistance to patients with emesis.
	Exposure to body fluids.
	Computer installed in inappropriate location.
	Chairs in poor state to use.
Chemical	Lack of elevator maintenance and lack of lead door.
	Physical structure of the institution.
	Parenteral drug and radiopharmaceuticals handling.
	Use of decontaminating chemical products.

Figure 2. List of the workloads evidenced in the nursing work process in nuclear medicine services, Florianópolis (SC), Brazil, 2015.

The identification of the workloads to which nursing professionals are subjected during NM work shows that the activity requires care. Besides the workloads inherent to the profession, there are workloads specific to nuclear medicine. It is also noted that workloads are not unique and the same situation can lead to different loads on the workers' body.

The NM work is an important area where the nursing action is inexcusable. However, its complexity requires specific training and knowledge from the professionals, especially in relation to the various workloads to which they are susceptible and that cause wear of the workers' body. One of the most worrying types of wear is the exposure to ionizing radiation, classified as a physical load.

Data analysis showed that many workloads interrelate and the same task can generate different loads. In the NM work, physiological loads come from physical effort, ergonomically incorrect and uncomfortable positions that professionals adopt while

executing their activities⁵ especially during the administration of the radiopharmaceutical.

However, in most cases, these erroneous positions are difficult to be minimized or avoided because some tests such as the study of blood flow in bone scans, injections in the *stress* phase of myocardial scintigraphy or punctures in children, require that the professional adopt a position that benefits the quality of the procedure and the patient safety, but compromises the health of workers.

The moments of assistance to patients also trigger exposure to physiological loads, especially in situations in which it is necessary to lift the patient up and transfer patients from the stretcher to other places or transport patients with impaired mobility. These functions are performed repeatedly during the day and, in most cases, unconsciously by nursing workers, as they are part of their work process, which aims to

meet and care for patients with any sort of difficulty.

The limitation of the physical structure and the bad working conditions of the institution can generate wear at work.¹¹ This is especially true in situations that require the use of stairs to provide faster assistance. This situation was observed at various moments during the working day. Also, rooms with cramped environments were noticeable. Movement is difficult due to the placement of much furniture on the site. Frequent exposure to these loads can cause many forms of wear, and the most frequent of them are musculoskeletal injuries.¹¹

This space limitation worsens when professionals need to use personal protective equipment (PPE), mostly composed of lead,¹² which makes it heavy. Thus, workers have difficulty to move and to perform activities, making too much body effort and generating discomfort. Because of this difficulty, workers often choose to perform their duties without proper protection, as noted during myocardial stress scintigraphy and while performing punctures in children.

We emphasize the seriousness of this fact; besides physiological loads, there is physical burden arising from exposure to ionizing radiation. This may cause harm to these workers, leading to the emergence or worsening of pathologies in the near future.¹³ An important wear on the workers' health coming from the physical load of getting exposed to ionizing radiation is the appearance of leukopenia. This may turn the professional more susceptible to infections. Thyroid diseases, cataracts, nausea and other illnesses are also possible.¹⁴

Negligence in the use of personal protective equipment is inadmissible in a service whose main working tools include ionizing radiation. The use of PPE is one of the basic requirements of the National Nuclear Energy Commission (CNEN) for the development of a safe work.¹⁵ Therefore, besides having the responsibility to follow the rules, organizations must perfect them in their work environment,¹³ encouraging and supervising the adoption of such rules by workers.

It is noteworthy that the use of procedure gloves by all the studied professionals, except in some preparations of parenteral drugs, was observed. The physiological loads resulting from the constant use of PPE can cause wear such as pain in the spine, legs, hips and physical fatigue.¹⁶

Regarding the psychological loads, insufficient number of workers and a full

schedule make these professionals stay longer in the institutions, and play fast and mechanized functions, given that most of the exams are repeatedly carried every day, turning the work into a routine. The deficit in the number of nursing professionals can compromise the quality of care and lead to removal of workers due to physical and mental burnout caused by work overload.¹¹

A schedule without breaks and the workforce make the nurses of the two institutions accumulate activities beyond their managerial functions, the operational assistance to their colleagues. The duties of nurses in NM are described in the Resolution # 211/98 of the Federal Council of Nursing (COFEN).¹⁷ According to this Resolution, nurses must act based on their scientific knowledge, enabling the systematization of the team, prioritizing better working conditions and the prevention of wear on workers' health.¹⁸ The need to resize the staff, seek better working conditions, reduce overload, and ensure safer patient care is evident.

The change could start with an effective number of professional in the institutions, as indicated by the COFEN Resolution nº 293, of 2004.¹⁹ This legislation foresees a reserve of technical personnel which would contribute to higher turnover in activities involving exposure to ionizing radiation in nuclear medicine services, thus enabling the reduction of repetitive routines, overload, physical and mental fatigue, and especially the exposure to ionizing radiation.

The imbalance in the number of professionals allows us to infer that there is a high turnover in the health services, and that this can contribute to the disqualification of workers because professionals have to divide attention to the different links and specialties. Among the eight surveyed professionals, five accumulate more than one working day, and two workers accumulated bonds with exposure to ionizing radiation. The causes for this may include low wages, unhealthy environments, deficits in social appreciation and managers' appreciation, and seek for career evolution.¹⁶

A second employment generates an excessive workload and, consequently, entails the need to analyze the reflection of this fact in the organizations. The worker's mental and physical health is compromised, which may translate into stress, anxiety, fatigue. These factors cause wear and harm not only to workers but also to organizations, reverberating in absenteeism, poor service,

financial and quality losses in the service offered.²⁰

Furthermore, excessive workload may explain the low search for refreshing courses by these professionals. Most workers understand the importance of the theoretical basis that the work in nuclear medicine requires, but they not seek improvement in new courses, lectures and conferences. Improvement and qualification generate greater knowledge, and allows resolving doubts and fears, and expanding the information accumulated on the subject.⁵

Self-protection and knowing how to work safely in a nuclear medicine service are among the main requirements that nursing workers must meet. As shown study by the International Commission on Radiological Protection (ICRP), exposure to radiation can cause cancer in the body, besides the risk of embryo and fetus malformations.²¹ Therefore, workers must receive information and training on the activities they will develop and especially on how to protect themselves from radiation while performing such activities.

Half of the nursing workers in the surveyed services had received training on how to operate the service through a brief lecture. It is noteworthy, however, that these training occurred only at the moment when professionals entered into the service. Thus, it is important that training activities for professionals who work in NM be constant. As stated in the Ordinance 453 of 1998 of the National Health Surveillance Agency, it is the employer's duty to provide training in annual basis encompassing the importance and correct use of dosimeter and PPE in order to ensure the safe performance for patients and workers.²² This was not observed in the surveyed services.

The lack of training programs in the surveyed services can explain the fact that, when workers were asked about the wear incurred by exposure to ionizing radiation, most responses were compared to acquiring cancer, ignoring the other forms of wear. Thus, permanent education brings the possibility of interaction between theoretical and practical knowledge, a room to discuss the change in the practice.¹³

The use of short, objective and repetitive responses that demonstrate the fragility of the information that professionals have on the activities they perform was observed during the interviews. This explains the persistence of doubts about radiological protection and on the phenomenon of ionizing radiation as well as how radiation may affect health. In turn,

doubts generate tension and anxiety during the course of the observed procedures.

Another load present in the NM nursing work is the physical load. This mainly involves wear from exposure to ionizing radiation, the main working tool in this service. Occupationally exposed professionals can measure their monthly absorbed dose through a thermo-luminescent dosimeter (TLD).²³ This must be used in the chest and on the extremities, such as the wrist. Monitoring the hands and wrists of the nursing professionals is important mainly due to the direct and repetitive handling of radiopharmaceuticals without lead protection at the moment of injection.²⁴

The precise monitoring of the amount of radiation received by each professional is paramount to do the correct usage of the chest x-ray dosimeter, as indicated by Ordinance n° 453, of 1998, of the National Health Surveillance Agency.²² A study on different NM services showed that the second largest dose in nuclear medicine is absorbed by the team of nursing professionals, because they are in direct contact with patients during the injection, positioning and execution of specific techniques such as pulmonary inhalation scintigraphy. The sealed sources are in the gaseous state and the nasal mucosa is an easy route for absorption of IR, reaching more easily the inner organs.²⁵

The dosimeter must be used throughout the workday and on top of the lead apron, in the region of the chest.²³ The dose is cumulative and there is no a safety threshold that does not cause damage to cells, especially on gene modification. The use of the dosimeter indicates and measures if the professional has adopted safe practices.²⁵ However, it was noted that in one of the services, the employees are instructed to use the badge underneath the lead apron, turning the measure inefficient. Again, the importance of nursing professionals develop solid knowledge concerning protection against radiation is stressed. This knowledge will contribute to radiological protection of the team itself and of patients undergoing NM procedures.²³

Safe practices must be constantly present in the nursing work, but particularly during the administration of radiopharmaceuticals, while in contact with the post-injected patients, and during decontamination of contaminated surfaces. An aggravating consequence in this type of load is the contamination with radioactive material, on clothing or skin, which was observed primarily during the injection for the *stress* phase of myocardial scintigraphy, because it is

necessary to inject the material while the patient runs on a treadmill. During this activity any carelessness or inattentive movement can contaminate the room and the worker. It is noted that the main form of protection during the realization of nursing functions handling radioactive elements is the attention to and the knowledge on the actions performed.²⁶

The administration of radiopharmaceuticals can also be classified as a biological load, involving mainly the possibility of contact with blood and microorganisms and the risk of drill cutting accidents during intravenous administration. This workload can also occur through contact with blood during withdrawal of intravenous introducer.¹¹

Secretions and excretions of patients who have already received the radiopharmacology need attention, as they may be contaminated with radioactive material. This demonstrates once again the complexity of the nursing work in these environments. Contact between the worker's skin and external agents can cause skin lesions, due to contamination by radioactive material. These lesions depend on the dose; in cases of high doses, these can cause cell death, damaging tissue physiology, and even burns.²⁴

The mechanical load during NM nursing work was observed to be related mainly to handling different work tools. The situations presented in table 1, which require more physical effort, such as use of stairs several times a day, transportation of wheelchair patients down and up ramps, inappropriate chairs and computers installed in places that do not allow a correct posture, collaborate to the emergence or worsening of damage arising from exposure to mechanical loads. In addition, the use of PPE can cause imbalance in the body and crashes during the activities.

Chemical loads in MN are present during the use of cleaning and decontaminating products when there is any contamination of skin surfaces with radioactive material or bodily fluids. The injection of the radiopharmacology represents the activity in which this workload is more often present. Any drop on the surface of the work tools - stretcher, sheet, clothes of the worker or of the patient, among others - or on the skin need to be decontaminated with urgency with chemicals.

The analysis of the obtained data shows that the health of occupationally exposed workers can be vulnerable to damage as a result of the loads presented. However, the use of PPE in some activities is neglected by some workers and the knowledge on the

effects of ionizing radiation is limited. We emphasize, therefore, the importance of knowing the workloads present in NM nursing activities so that they can be recognized by workers, and thereby, managed aiming at prevention and reduction of wear on workers' health.

CONCLUSION

The work in NN requires that nursing workers master the particularities involved in the work process of these sector, as they are exposed to multiple workloads that are intrinsic of these specific organizations.

It was observed that workers of the surveyed environments are not fully aware of the workloads they are subjected to, primarily by not having all the necessary knowledge to their practice, particularly when it comes to the physical burden arising from exposure to ionizing radiation, which has a slow and imperceptible effect in the opinion of workers. Training actions are sorely needed. Scientific support and management strategies are important in all healthcare organizations in order to minimize the wear of workers caused by workloads.

Therefore, the results of this research boost for the demand to investigate and reflect on the wear experienced by nursing workers in NN, as that the severity of workloads over these workers has been demonstrated. For this, the analysis of the organization of the nursing work in NM becomes relevant, because it is a known fact that work organization can enhance health promotion or the wear among workers.

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Submission: 2016/06/09

Accepted: 2017/02/10

Publishing: 2017/03/01

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J Nurs UFPE on line., Recife, 11(3):1279-88, Mar., 2017