31 - NURSING EDUCATION APPLIED TO THE PROCEDURE OF ELECTROCARDIOGRAM

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INTRODUCTION

The electrocardiogram (ECG) is a noninvasive, easy to perform and low cost examination with great clinical utility, being used in almost all health institutions (GUIMARÃES, 2003). Due to its capacity to represent graphically the cardiac cycle and because it is an examination where errors in operation can have consequences for the diagnosis and the patient's life, it is essential that the learning of the ECG realization include the understanding of phenomena that can interfere with its performance (FELDMAN; GOLDWASSER, 2004).

Several have been the efforts to capacitate the nursing professionals for proper understanding of the implementation of the ECG, which although relatively simple, in most cases requires specific learning and training (ALINIER et al., 2006).

In an attempt to overcome the traditional teaching, some methodological strategies in health care have been developed and among them the experiential learning such as simulated practice has been highlighted. This strategy applied in a formative way aim to replicate essential aspects of a particular technical procedure and/or clinical situation, so that when in another similar circumstance of immediacy and real context, the care provided can be successfully performed, preventing mistakes on actual patients and ensuring better interpersonal relations and reduction of costs (ZIV et al. 2005; JEFFRIES et al. 2008).

Among the studies conducted using simulated practice, a study performed with israeli physicians evaluated in a military recruitment center, the application of a simulated practice to improve the quality of medical care for adolescents, which showed a significant improvement in the assistance (FARFEL et al., 2010).

The simulated practice has been suggested as an important tool for use in educational programs in the nursing field. In a study performed with nurses of different levels of professional experience, simulated practices were considered as a useful tool for training of the technical-operational procedures with a higher degree of learning difficulty (RYSTEDT; LINDSTROM, 2001). Another study found that the use of simulated practice in the teaching-learning process currently is one of the most important training tools to instruct future generations of nursing professionals (WILFORD; DOYLE, 2006). However, this methodology has not been applied yet in the teaching of practical procedures for the execution of the electrocardiogram.

With these considerations, the objective of this study was to evaluate the effect of training for maintenance and operation of the electrocardiograph for nursing assistants based on simulated practice.

MATERIALS AND METHODS

Quasi-experimental research, conducted in a large hospital in the city of Foz do Iguaçu, Paraná, in the period of October 2008 to February 2009. Inclusion criteria for participation in the study were: nursing assistants who develop activities in the emergency room, intensive care units (ICU) and/or hospitalization blocks (in sectors that had the electrocardiograph), and that had not received specific training to perform the ECG. Because it is a study conducted during the work shift, nurses and nursing technicians were not included due to the impossibility of these professionals to leave the nursing care. We opted for the participation of the night shift employees, one from each sector. The sample consisted of 10 nursing assistants, all from the same shift, randomly selected by draw, and also randomly divided into two groups, one experimental and one control, each with five subjects.

In the first stage, the control and experimental groups were subjected to a pre-test to verify their degree of technical and manual skills in the operation of the electrocardiograph and realization of the electrocardiogram. We utilized a data collection instrument composed of closed and open questions, divided into three sections: 1) Socio-demographic and occupational characterization; 2) 47 questions about the different stages of the technique of the electrocardiogram (including the preparation of equipment and materials; the realization of procedure ECG, and care for the maintenance of the equipment); 3) Three open questions, consisting of two problems presented on the ECG recording, its causes and solutions, and a third question directed to the experimental group about the educational method used in training. Sections 1 and 2 of the instrument of data collection were completed by the researchers. Section 2 was filled through direct observation of the procedure performed by the participants. The section 3 was individually answered only by the experimental group participants in the end of the study.

After this stage, during the regular time of work, the experimental group went through a program consisting of two parts: a theoretical part with lectures and training based on a simulated practice. The theoretical content was presented through four lectures, lasting 60 minutes each, covering the following content: 1) Basic anatomy of the heart; 2) Basic cardiac physiology; 3) Formation and conduction of electrical impulse and cardiac cycle; 4) History of the electrocardiograph and the ECG pattern. The practical content was presented to each participant individually, through 6 activities based on simulated practice, lasting 60 minutes each, covering the following content: 1) Components of an electrocardiograph (composition and function of each part); 2) Functioning of electrocardiograph; graph paper; 3) electrocardiographic monitoring, derivations and reference lines; 4) Obtaining of ECG tracing; technique and recording; 5) Possible interference by performing an ECG; 6) Care in the maintenance of the equipment, including wires and cables. Each simulation was developed following these steps: the subject performing the procedure was evaluated and when a mistake occurred, the participant was immediately asked to redo it until he has learned all the procedure, moving to the next step to complete the proposed program.

The control group did not perform the training, following their normal activities in their respective sectors. 30 days after the last practical activity, a second stage began when a post-test was applied individually, in both the experimental group and the control group, making use of the same data collection instrument of the pre-test.

In the statistical analysis, paired t test was utilized for comparison of the results of the pre-test and post-test for both of then, control and experimental group, t test for independent observations (unpaired) was utilized for comparison of the results obtained by the control group and experimental group, in both tests. For analysis purposes, we considered the significance level of $p<0.05$. In this work, we utilized the GraphPad Prism v. 2.0. (GraphPad Software, Inc., San Diego, CA, USA) for data

processing (analysis of means, standard deviations and percentages) and statistical analysis.

This study was approved by the Research Ethics Committee of State University of Maringá (UEM) (protocol no. 564/2008), and all participants signed a consent form.

RESULTS

Analysis of the sociodemographic variables of nursing assistants who participated in the study showed great similarity between the components of the control group when compared to the experimental group. Concerning gender, both groups showed 4 (80%) females and 1 (20%) male. The average age of these professionals was 29.6 ± 8.3 years for the control group and 35.0 ± 6.2 years for the experimental group. Concerning education, in the control group 4 (80%) had finished high school and 1 (20%) had incomplete higher education, in the experimental group, 3 (60%) had finished high school and 2 (40%) had incomplete higher education. In relation to time of conclusion of professional training, the control group had 5.0 ± 3.1 years and the experimental group 4.6 ± 2.7 years. Concerning the professional experience in the institution, the control group had 2.53 ± 2.14 years and the experimental group had 4.6 ± 2.7 years. In the control group, 5 (100%) participants had already performed the ECG procedure before and in the experimental group the number was 4 (80%) subjects.

To evaluate the achieved performance of each group (control and experimental), in the pre-test and post-test, it was considered the total number of errors committed by each participant (maximum of 47 errors), in their respective tests.

Figure 1 shows that the control and experimental groups obtained similar results in the pre-test (25.20 ± 6.18 errors versus 27.80 ± 10.99 errors, respectively, p= 0.6569), which demonstrates that, when compared, both groups reported subjects with similar characteristics, not only in terms of sociodemographic profile, but also considering their training on operation and maintenance of an electrocardiograph. In Figure 1, it was also observed that the experimental group showed a significant reduction (p = 0.0209) in the number of errors (6.60 ± 2.70 errors) committed in the post-test when compared to results in the pre-test (27.80 ± 10.99 errors). The result obtained by the experimental group in the post-test was also significantly lower (P <0.001) than the post-test of control group (23.20 ± 6.14 errors). In the control group, a significant difference (p = 0.5210) was not observed between the result obtained in the post-test (23.20 ± 6.14 errors) compared to the results obtained in their pre-test (25.20 ± 6.18 errors).

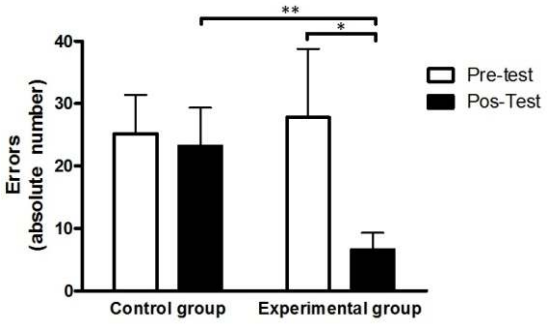


Figure 1 - Comparison of results obtained by the control and experimental groups according to the number of errors made in the pre-test and post-test. Data shown as mean ± standard deviation. *p <0.05 (paired t test), **p <0.001 (unpaired t test).

Analyzing the results obtained by both groups in each question, the largest number of committed errors (> 50%) in the control group pre-test, concerning the equipment and material preparation, occurred in questions 8, 9, 11,12 and 13 (Table 1). In the experimental group, the result was similar in the pre-test, where the largest number of errors (> 50%) also occurred in questions 8, 9, 11, 12 and 13, but adding the question 1. In the post-test, the control group continued obtaining a high number of errors in questions 8, 11, 12 and 13, while the experimental group did not show a high number of errors (> 50%) in any question concerning equipment and materials preparation (Table 1).

Table 1 - Number and percentage of errors made by the control and experimental group, in pre and post-test, in preparing equipment and materials. Foz do Iguaçu, 2009.

Evaluated material	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	n	%	n	%	n	%	n	%
1. Electrocardiograph with graph paper	2	40	2	40	3	60	1	20
2. Trolley for equipment	1	20	1	20	0	0	0	0
3. Power cord	0	0	0	0	0	0	0	0
4. Grounding cable	1	20	1	20	0	0	0	0
5. Patient cable with 5 or 10 channels	1	20	0	0	1	20	0	0
6. Cardiac precordial electrodes	2	40	0	0	1	20	0	0
7. Cardiac edge electrodes	0	0	0	0	0	0	0	0
8. Internal rechargeable battery	5	100	4	80	5	100	2	40
9. Tray, gauze package, 70% alcohol	4	80	2	40	3	60	0	0
10. Conductive gel	2	40	3	60	2	40	1	20
11. Towel paper	5	100	4	80	4	80	0	0
12. Sheet to not expose the patient	3	60	4	80	5	100	0	0
13. Specific form to attach the ECG	5	100	5	100	4	80	1	20
14. Pen to identify the exam	0	0	0	0	1	20	0	0

When analyzing the questions related to performing ECG procedure, it was observed that out of the 23 questions (Table 2), in pre-test, the control group showed a high number of errors (> 50%) in 12 questions (1, 2, 4, 5, 6, 11, 12, 14, 15, 16, 17 and 19), which represents more than half the questions asked. In the post-test, this same group had 8 questions with more than 50% of errors in this topic, a large percentage of errors persisted in questions 1, 5, 8, 14, 15, 16, 17 and 19. In experimental group pre-test, a large number of errors (> 50%) was observed in 14 questions (1, 4, 5, 6, 8, 9, 10, 11, 12, 14, 15, 17 and 19). In the post-test, this number was reduced to two questions (11 and 14).

Table 2 - Number and percentage of errors made by the control and experimental group, in pre and post-test, during performing ECG. Foz do Iguaçu, 2009.

Evaluated procedure	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	n	%	n	%	n	%	n	%
1. Neurological level of the patient	4	80	3	60	4	80	0	0
2. Guide the procedure	3	60	2	40	2	40	0	0
3. Lay patient in supine position	0	0	1	20	1	20	0	0
4. Expose only the chest, MMSS/MMII of the patient	3	60	1	20	3	60	1	20
5. Instruct the patient not to move during the exam	5	100	4	80	4	80	1	20
6. Check if there is no contact wi th metals and ornamen ts were removed	3	60	2	40	4	80	1	20
7. Clean the skin with 70% alcohol	2	40	2	40	2	40	0	0
8. Perform trichotomy if necessary	1	20	4	80	4	80	2	40
9. Apply conductive gel	2	40	2	40	3	60	0	0
10. Place the 4 extremity leads correctly	1	20	1	20	3	60	0	0
11. Place the 6 precordial leads correctly	4	80	2	40	4	80	3	60
12.Check electric current, grounding and internal rechargeable battery	4	80	2	40	3	60	1	20
13. Turn on the device	1	20	0	-	1	20	0	0
14. Select the noise filter	5	100	4	80	5	100	3	60
15. Select the derivation gain (N/2, N, 2N)	5	100	4	80	5	100	1	20
16. Select the record speed: 25, 50 and 100 mm/sec	5	100	5	100	4	80	1	20
17. Calibrate register with signal of 1 mV (millivolt)	3	60	4	80	4	80	0	0
18. Select manual or automatic mode	2	40	1	20	1	20	1	20
19. Check if there is no indication of loose electrode	3	60	3	60	4	80	2	40
20. Record 6 peripheral leads (4 cycles)	0	0	1	20	2	40	0	0
21. Record 6 precordial leads (4 cycles)	0	0	2	40	1	20	0	0
22. Record long DII (6–8 cycles)	1	20	2	40	2	40	1	20
23. Register patient name, record, date, time and signature on the form	2	40	1	20	2	40	0	0

In relation to the procedures performed after the ECG and preventive maintenance of the electrocardiograph, out of the 10 items (Table 3), it was observed in the control group during the pre-test, 6 items showed more than 50% of errors (3, 4, 5, 6, 7 and 8) and in the post-test were 7 items (3, 4, 5, 6, 7, 8 and 9). In the experimental group, during the pre-test, 8 questions had more than 50% errors (1, 2, 3, 4, 5, 6, 7 and 8) and in post-test there was more than 50% errors in only one question (item 5).

Table 3 - Number and percentage of errors made by the control and experimental group, in pre and post-test, on the procedures adopted after performing the ECG and preventive maintenance of the electrocardiograph. Foz do Iguaçu, 2009

Evaluated procedure	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	n	%	n	%	n	%	n	%
1. After E CG, remove cables and electrodes and wipe the excess of gel fr om the patient's skin with towel paper	1	20	1	20	3	60	0	0
2. Help the patient to put on clothes	2	40	0	0	3	60	1	20
3. Clean with water the pear type electrodes or clamps	4	80	4	80	4	80	1	20
4. Check if there is no d rying rubber and connections	5	100	5	100	5	100	2	40
5. Check if there is no cracking plastic parts and connectors	5	100	5	100	5	100	3	60
6. Check if there is no oxidation of metal parts	5	100	5	100	5	100	1	20
7. Check if there is no breaking of the cables	4	80	5	100	5	100	0	0
8. Left cables stretched and equip ment conn ected to the electrical current	4	80	4	100	5	100	1	20
9. Immediately informed supervision about non - conformities relat ed to accessories and equipment	1	20	3	60	2	40	1	20

The last section consisted of three open questions, and in two of them the participants were introduced to problems that may occur at the time of ECG recording, which should point to the possible causes and solutions, and a question about the method used in this study for the experimental group. The first question related to an ECG tracing, where the baseline is presented unstable, irregular and thick line. The probable causes that should be pointed out would be the patient's anxiety, possible movement or muscle tremor, that can drive the failure to accommodate the electrodes. The solutions should be directed to keep the patient relaxed, check and correct fixation of the electrodes. Regarding this question, in pre-test, both in the control and experiment group, the percentage of accuracy was only of 20% (1 participant). In post-test, two participants (40%) in the control group had the correct answer, while four participants (80%) in the experimental group answered correctly.

The second question presented the problem of not recording of ECG leads, and the possible causes that should be appointed: electrodes loose, break or poor contact of the patient cable connector on the end or at their tips (oxidation). A possible solution would be to verify that the pointed ends of the cable would not be oxidized, check the cable connection or if there was some defect in the cable and replace it if necessary. In the control group, both pre-test and post-test, only one participant in each phase mentioned the correct answer (20%). In the experimental group, at pre-test, 2 participants (40%) mentioned the correct answer, while in the post-test, all participants answered correctly (100%).

The last open question was applied only to the experimental group, to verify the professionals' opinion concerning the method used for training. Frequent statements referred to the reduction of doubts regarding the operation of the electrocardiograph and the performance of the electrocardiogram, and that the method used facilitated learning. Besides, the achievement was effective because of the reduced number of participants. Participants also reported increased security in the performance of the ECG.

DISCUSSION

It is known that the technical competence, specifically in nursing group, it is related to the development and improvement of cognitive and motor abilities for directed assistance for the to obtain clear and visible results (CUNHA; VALÉRIO, 2009).

In the present study, it was observed a significant decrease in the frequency of errors committed in the post-test by the experimental group compared to the pre-test results for this group and post-test in the control group. Moreover, the experimental group also had fewer errors in the post-test related to the open questions.

These results demonstrate that the educational program applied, based on lectures and simulated practice, promoted an increase in practical knowledge and skills of nursing assistants on the operation and maintenance of an electrocardiograph. In this study, the number of errors committed by subjects in the control and experimental group at pretest was very large,

exceeding more than 50% of applied questions, especially in the case of questions concerning the performance of the procedure and equipment maintenance. This confirms that group participants had not attended any kind of the training course before. In the analysis of errors in the procedure of the ECG in the pre-test, out of the 23 items evaluated, the control group had 12 items with more than 50% errors, while the experimental group had 14. In the post-test, the control group had 8 items with more than 50% errors, while the experimental group had only 2. However, in the pre-test, many of them made mistakes considered basic, such as: not guide the patient and let the patient exposed, as well errors classified as serious, which can lead to wrong diagnoses, such as improperly placing the precordial leads. This was part of a practice that continued to show the percentage of errors greater than 50% even in the post-test experimental group.

Recent study conducted in London (England), came to similar results, finding that 51% of nurses and 69% of doctors who work in emergency care of patients with suspected coronary artery disease did not know the correct position of precordial leads, there were lots of variations in positioning and significant changes in the registry, revealing the need for training of these professionals (RAJAGANESHAN et al., 2008).

Concerning the procedures adopted after the ECG and preventive maintenance of the electrocardiograph, it was found that all subjects were unaware of the operating specifications regarding the maintenance of the equipment. For this lack of information, they ended up not doing the cleaning, conservation and appropriate packaging of the components of an electrocardiograph. Only the experimental group there was a decrease in the number of errors in the post-test related to such procedures. This result is similar to that found in a study conducted in the ICU of a public hospital in Salvador, Bahia (Brazil), which assessed the level of knowledge of health professionals on the technical and operational information contained in equipment manuals. The results showed that most of the study population was unaware of these specifications and recommended that this information should be part of the process of training employees in order to increase the longevity of the equipment, reduce maintenance costs and promote quality care (MADUREIRA , 2000).

When asked about the educational procedure they have undergone, it was found in this study that the proposed training was approved by the experimental group. The individual activity with small groups of simulated practice provided a better use of educational training.

A recently published study (Burke et al., 2006) that compared the effectiveness of different educational methodologies, came to a conclusion that the more practical and based on behavioral models is the method used, the greater the efficiency of training. The results obtained in this study also corroborate this conclusion.

CONCLUSION

In this study, we verified that the applied training, based on simulated practice, proved to be efficient and an important method of teaching and learning of nursing skills, and that if applied properly, it can contribute in the nursing training.

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NURSING EDUCATION APPLIED TO THE PROCEDURE OF ELECTROCARDIOGRAM

ABSTRACT

The aim of this study was to evaluate a training program based on lectures and simulated practices related to teaching of operation and maintenance of the electrocardiograph for nursing professionals in a large hospital in Foz do Iguaçu-PR. Quasi-experimental research, carried out with 10 nursing assistants. These were divided into two groups, control and experimental, initially submitted to a pre-test to assess their degree of technical skill. Only the experimental group underwent an educational training. Then both groups were evaluated with a post-test. The experimental group showed significant difference (p = 0.0209) when the result obtained in the post-test (6.60 + 2.70 errors) was compared to their pre-test (27.80 + 10.99 errors), and also in comparison with the result of post-test of control group (p <0.001). In conclusion, the applied educational program was efficient to train the execution of electrocardiogram.

KEYWORDS: Nursing; Education; Electrocardiography.

L'ÉDUCATION EN SOINS INFIRMIERS APPLIQUÉE À LA PROCÉDURE DE L'ELECTROCARDIOGRAMME

SOMMAIRE

Le but de cette étude était d'évaluer un programme de formation d'exposés magistraux et pratiques simulées liées à l'enseignement de l'opération et la maintenance d'un électrocardiographe pour les professionnels des soins infirmiers dans un grand hôpital à Foz do Iguaçu, Paraná. L'étude quasi-expérimentale a été menée avec 10 infirmiers auxiliaires. Ils ont été répartis aléatoirement en deux groupes, expérimental et de contrôle, initialement soumis à un pré-test pour vérifier leur niveau de compétences techniques sur la procédure. Seul le groupe expérimental a été soumis à la formation pédagogique. En suite, les deux groupes ont été évalués au post-test. Le groupe expérimental a montré une différence significative (p = 0,0209) dans le résultat obtenu dans le post-test (6,60 ± 2,70 erreurs) par rapport à leur pré-test (27,80 ± 10,99 erreurs) et aussi dans la comparaison avec le groupe de contrôle post-test (p <0,001). On conclut que le programme éducatif utilisé a été efficace dans la formation d'exécuter l'électrocardiogramme.

MOTS-CLÉS: Soins infirmiers, l'éducation, d'électrocardiographie.

EDUCACIÓN EN ENFERMERÍA APLICADO AL PROCEDIMIENTO DE ELECTROCARDIOGRAMA

RESUMEN

El objetivo de este estudio fue evaluar una formación basada en clases expositivas y en las prácticas basadas en la simulación relacionadas con la enseñanza de la operation y mantenimiento del electrocardiógrafo para las enfermeras, en un gran hospital de Foz do Iguaçu-PR. Investigación casi-experimental, realizada con 10 auxiliares de enfermería. Estos fueron divididos en dos grupos, control y experimental, inicialmente presentado a un pre-test para evaluar su grado de habilidad técnica. Solo el grupo experimental realizó capacitación de la formación educativa. Entonces los dos grupos fueron evaluados en post-test. El grupo experimental mostró una diferencia significativa (p = 0,0209) en el resultado obtenido en el post-test (6,60 ± 2,70 errores) en comparación con su pre-test (27,80 ± 10,99 errores), y también en comparación con el post-test del grupo de control (p <0,001). Se llegó a la conclusión de que el programa educativo aplicado fue eficaz en la formación para ejecutar el electrocardiograma.

PALABRAS CLAVE: Enfermería; Educación; Electrocardiografía.

EDUCAÇÃO EM ENFERMAGEM APLICADA AO PROCEDIMENTO DE ELETROCARDIOGRAMA

RESUMO

O objetivo do estudo foi avaliar um treinamento baseado em aulas expositivas e práticas simuladas relacionadas ao ensino da operação e manutenção do eletrocardiógrafo para profissionais de enfermagem, em um hospital de grande porte em Foz do Iguaçu-PR. Estudo quase-experimental, realizado com 10 auxiliares de enfermagem. Estes foram separados aleatoriamente em dois grupos, controle e experimental, submetidos inicialmente a um pré-teste para verificar o seu grau de habilidade técnica sobre o procedimento. Apenas o grupo experimental foi submetido ao treinamento educacional. Em seguida, ambos os grupos foram avaliados no pós-teste. O grupo experimental apresentou diferença significativa (p=0,0209) no resultado obtido no pós-teste (6,60 ± 2,70 erros) quando comparado ao seu pré-teste (27,80 ± 10,99 erros) e também na comparação com o pós-teste do grupo controle (p<0,001). Conclui-se que o programa educacional aplicado mostrou-se eficiente no treinamento para execução do eletrocardiograma.

DESCRITORES: Enfermagem; Educação; Eletrocardiografia.