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RESEARCH

Nursing educational intervention for the identification of Adverse Events in hemodialysis

Intervenção educacional de enfermagem para a identificação dos Eventos Adversos em hemodiálise

Intervención educativa de enfermería para la identificación de los Eventos Adversos en hemodiálisis

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ABSTRACT

Objective: To develop an educational program aimed at the qualification of the nursing technicians that makes possible the understanding of Adverse Events (AE), aiming to adapt the data records; to elaborate tools for the records of the AE in hemodialysis patients; and to assess the knowledge before and after the educational program. **Method:** An educational intervention was conducted through a classroom and online course on how to recognize and record AE in hemodialysis. The effectiveness of the program was assessed through the gain of knowledge measured through online record of the AE in fictitious problem cases before and after the course. **Result:** Sixteen nursing technicians participated in the study. In the initial test, the mean score was 3.7 ± 0.3 points and in the final assessment was 4.2 ± 0.3 points (p=0.0002). **Conclusion:** It was possible to verify that the educational intervention contributed to increase the knowledge of the participants and that the training of these can be achieved with classroom and online learning courses.

Descriptors: Adverse Events; Educational Intervention; Hemodialysis; Nursing; Patient Safety.

RESUMO

Objetivo: Construir um programa educacional voltado para a capacitação dos técnicos de Enfermagem, que possibilite a compreensão dos Eventos Adversos (EA), visando adequar os registros de dados; elaborar instrumentos para os registros dos EA em pacientes em hemodiálise; e avaliar o conhecimento antes e após o programa educacional. **Método:** Foi realizada uma intervenção educacional através de um curso presencial e *online*, sobre como reconhecer e registrar os EA em hemodiálise. A efetividade do programa foi avaliada através do ganho de conhecimento medido através do registro online do quadro de EA em casos-problema fictícios antes e após o curso. **Resultados:** Participaram do estudo 16 técnicos de Enfermagem. No teste inicial, a nota média foi 3,7±0,3 pontos e na avaliação final, 4,2±0,3pontos (p=0,0002). **Conclusão:** Foi possível verificar que a intervenção educacional contribuiu para aumentar o conhecimento dos participantes e que a capacitação destes pode ser alcançada com cursos presenciais e a distância.

Descritores: Eventos Adversos; Intervenção Educacional; Hemodiálise; Enfermagem; Segurança do Paciente.

RESUMEN

Objetivo: Construir un programa educativo orientado a la capacitación de los técnicos de Enfermería, que posibilite la comprensión de los Eventos Adversos (EA), buscando adecuar los registros de datos; elaborar instrumentos para los registros de los EA en pacientes en hemodiálisis; y evaluar el conocimiento antes y después del programa educativo. **Método:** Se realizó una intervención educativa a través de un curso presencial y online, sobre cómo reconocer y registrar los EA en hemodiálisis. La efectividad del programa fue evaluada a través de la ganancia de conocimiento medido a través del registro online del cuadro de EA en casos-problema ficticios antes y después del curso. **Resultados:** Participaron del estudio 16 técnicos de enfermería. En la prueba inicial, la nota media fue de 3,7 ± 0,3 puntos y en la evaluación final, 4,2 ± 0,3puntos (p = 0,0002). **Conclusión:** Fue

posible verificar que la intervención educativa contribuyó a aumentar el conocimiento de los participantes y que la capacitación de éstos puede ser alcanzada con cursos presenciales ya distancia.
Descriptores: Eventos Adversos; Intervención Educativa; Hemodiálisis; Enfermería; Seguridad del Paciente.

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INTRODUCTION

The emergence in the mid-20th century of efficient methods of extrakidney clearance, especially hemodialysis, allowed early death to cease to be the inevitable destination of patients who lost function (partial or total) of their kidneys. Hemodialysis and kneyid transplantation are now responsible for the survival of about 2 million people worldwide. Brazil, along with the United States, Italy, Japan and Germany, is one of the 5 countries where more patients are dialyzed and transplanted[1].

It is estimated that in 2016, 122,000 chronic kidney patients were on chronic dialysis treatment in Brazil[2]. The most common etiologies of Chronic Kidney Disease in Brazil are hypertension (34%), diabetes *mellitus* (30%), chronic glomerulonephritis (9%) and renal polycystic disease (4%)[2].

Despite continuous technological advances and improved understanding of clinical complications, patient survival in a hemodialysis program is still very low when compared to the normal population. Today, the expected survival time for patients in the United States once dialysis is started is only 8 years for patients between 40 and 44 years of age and approximately 4.5 years for patients between 60 and 64 years[3-4].

In Brazil, using estimated data obtained through the Brazilian Dialysis Center, the number of deaths in dialysis in 2014 was 21,281, corresponding to a gross mortality rate of 19.0%[5]. As a comparison, crude mortality among hemodialysis patients in Brazil is lower than that reported for the USA dialysis population[6], but higher than in countries such as Japan[7]. The morbidity of these patients is also high and problems such as cardiovascular and cerebrovascular alterations[8], complications due to abnormalities of mineral metabolism[9], malnutrition[10-11], infections[12] and other complications are common.

Among the factors capable of improving survival and reducing morbidity, it is assumed that the role of professionals involved in the dialysis procedure is important. Although there is no clear research attesting to the possibility that the quality of the dialysis may be influenced by the caregiver team, the inverse correlation of the quality of the team with the survival and with the decrease of the morbidity should not be neglected[13]. In this way, the professionals involved with dialysis therapy are expected to be extremely well prepared for their task.

Among these professionals, we would like to highlight the work of the nursing technicians. According to the Ordinance 389, dated March 13, 2014, from the Ministry of Health[14], dialysis units in Brazil must have one nursing technician for every 4 patients under hemodialysis. Due to the physical proximity at work and, therefore, the ability to monitor patients, the nursing technician has high importance in the hemodialysis care.

Nursing training schools are designed to train a professional skilled for general care and, therefore, the teaching of hemodialysis is not part of their compulsory curriculum. Thus, it is necessary for students to seek, in addition to the technical course, an improvement to better qualification for hemodialysis. However, these courses are optional and there are no legal requirements to carry them out. In practice, hemodialysis technicians learn the specific care and skills necessary to care for these patients within the dialysis unit in which they work[15-16]. The advance of new techniques and new knowledge in hemodialysis treatment is constant and this requires continuous education of these professionals.

Among the educational aspects necessary for the progression of professionals' knowledge involved with hemodialysis, the patient safety practices deserve relevance.

According to the World Health Organization, patient safety is defined as reducing the risk of unnecessary harm associated with health care processes to an acceptable minimum. This "acceptable minimum is related to everything that is feasible before the current knowledge and within available resources and the context in which care is provided"[17-18]. Due to the specificities of the dialysis, Hemodialysis Centers are places that are very exposed to the risks for Adverse Events (AE), defined as incidents that occur during the delivery of health care resulting in harm to the patient[17,19-20].

In recent years, concern about quality has been increasing due to the high rate of occurrence of AE during care, resulting in often serious and irreversible consequences for everyone involved[21-22]. For these reasons, it is important that the patient under hemodialysis be continuously observed. The presence of clinical changes during or even outside the hemodialysis session should be carefully analyzed and recorded. Obviously, in order to invest in improvement of patient safety, there is a need to improve the collection of information about Adverse Events[21].

One of the important functions for the nursing technician concerns the adequate recording of the dialysis session[23]. For example, adverse events occurring during a hemodialysis are important because the mere mention of these events, without the description of the outcomes, makes its follow-up incomplete and does not allow adequate measures to be taken to understand it, when possible, their minimization.

Based on the relationship between the need for continuous learning for the hemodialysis technician and the need for better understanding and better recording of Adverse Events in hemodialysis, we developed a work where we created a record of Adverse Events and an educational program aimed at understanding this subject for nursing technicians.

OBJECTIVE

To develop an educational program aimed at the qualification of nursing technicians that makes possible the understanding of Adverse Events and that aims to adapt the data records. To elaborate tools for the Adverse Events records in patients on

hemodialysis and to assess knowledge before and after the educational program.

METHODS

Ethical aspects

This study was preceded by the approval of the Research Ethics Committee of the *Faculdade de Ciências Médicas* e *da Saúde* (FCMS) of the *Pontifica Universidade Católica de São Paulo* (PUC-SP). All participants signed the Informed Consent Term.

Design, period and place of study

This was a study about learning, almost experimental, prospective, longitudinal, descriptive, and quantitative approach. The data refer to an intervention project. The research was carried out from October 10 to November 10, 2016, at the dialysis unit of the Dialysis and Kidney Transplant Center of Sorocaba (*CDTR*).

Participants of the study

The 23 nursing technicians from *CDTR* were invited to participate in the study. Three of them did not participate in the study: two were temporarily away from service and one refused to participate. In the course of the educational intervention, four other technicians had to abandon the research, for several reasons. Thus, 16 nursing technicians concluded the study. For the satisfaction survey in relation to the course we obtained responses from 14 participants.

Definition of Adverse Event

Adverse Event was considered any and all clinical and/or laboratory complications presented by the patient undergoing hemodialysis, regardless of their origin. An Adverse Event could have been initiated inside or outside the hemodialysis session[20]. The characterization of the event as hemodialysis-dependent or not was one of the components of the educational intervention.

Study protocol

The study was carried out in 4 phases. The first phase corresponded to the creation of tools for the development of the course. Initially, a tool for the uniform recording of Adverse Events was developed, as it can be seen in Chart 1.

Also in the first phase of the study, the educational intervention was developed, which was based on classroom and online mixed teaching. For online teaching and assessments before and after the course, we use the Moodle platform, which is a platform for distance learning based on the free software (www.moodle.org). Access to the Moodle platform was done through authorization from the *Pontifícia Universidade Católica de São Paulo*.

The assessments were done using 20 problems in the form of fictitious clinical cases, which offered situations that should be recorded by the nursing technicians. Chart 2 shows an example of the clinical case used and in Chart 3, the expected responses should be observed and the answers correspond to the filling of the table itself.

In the second phase of the study, even before the course itself, the students received individual clinical cases and were asked to complete the record of the detailed changes in the clinical case. Access to problems and virtual information was unique for each student, through the use of a login and a password. Responses could be sent up to one week after receiving the clinical cases. After this period, the activity was done and it was no longer possible to respond.

In the third phase, Blended-Learning[24-26] and distance learning were carried out using the Moodle platform. On the platform, explanatory classes and roadmaps were made available to fill out the adverse events in the developed worksheet. This training was available on the platform throughout the period up to the end of the course. In order to develop the classroom training, the researcher herself appeared on stipulated days and times, to talk with the participants and to clarify any doubts regarding the theoretical content. The duration of this activity was 2 weeks.

Chart 1 - Individual tool for records of Adverse Events

Date		Complication Description	Conduct	Medication Treatment	Other Conducts	Dialysis Time X Adverse Event	Outcome	Complications related to HD	Venous Access	AVF Puncture	Adverse Event Classification
Initial	Final	Weakness, imminent sensation of death, loss of consciousness and hypotension.	XXXXXX	SS 0.9% 400ml	XXXXXX	2nd and 3rd hour.	Solved.	Yes.	*Permcath*.	None.	Mild.
4/12/16	4/12/16										

Note: Individual chart for each patient, created by the researchers for the annotation of the topics related to Adverse Events. AVF- Arteriovenous Fistula; HD- Hemodialysis; ss- Saline Solution.

Chart 2 – Situation problem (Fictitious case)

Clinical case 20

Mr. Pedro Rodrigues, 70 years old, has AVD in RUL and has been under hemodialysis for 4 years. On July 20, 2016 he came to the dialysis session with general discomfort, reported that he had had severe diarrhea (watery stool) for 1 day and his weight was below usual dry weight. His BP was 90x60mmHg and HR of 100bpm. When trying to turn on hemodialysis machine, the nursing technician found it difficult to puncture the very weak AVF. It took 5 efforts to perform the puncture and 30 minutes after the beginning of the dialysis. The patient presented hematoma in the AVF, forcing the machine to shut down. Assessed by the medical team, dipyrone, solution saline (1000 ml) and Imosec were administered. On 07/22/16 the patient returned to dialysis, referring to improvement of diarrhea and the overall picture. BP = 110/70 mmHg. The hematoma was much better and the puncture of the AVF was possible, without complications.

Note: Problem created by the researcher. AVF- Arteriovenous Fistula; BP- Blood Pressure; HR- Heart Rate; RUL- Right Upper Limb.

Chart 3 – Expected Adverse Event additions in the chart

Date		Complication Description	Conduct	Medication Treatment	Other Conducts	Dialysis Time X Adverse Event	Outcome	Complications related to HD	Venous Access	AVF Puncture	Adverse Event Classification	Observation
Initial	Final	The patient refers to diarrhea for 1 day and general discomfort. The patient presents BP of 90x60 and HR of 100bpm. Presenting complications with AVF after 30 minutes of dialysis initiation, presenting hematoma in AVF.	Was assessed by medical personnel.	Dipyrone, SS 0.9% 1000ml and Imosec were administered	The hemodialysis session was shut down after 30 min.	0 and 1st hour.	Solved.	No.	AVF.	More than 4.	Mild.	On July 22, the patient returns to the hemodialysis session, referring an improvement in the diarrhea discomfort. It presents improvement of the hematoma in AVF and it is possible to perform a new puncture without complications.
7/20/16	7/22/16											

Note: Answers created by the researcher. AVF- Arteriovenous Fistula; BP- Blood Pressure; HR- Heart Rate: HD- Hemodialysis; SS- Saline Solution.

The 4th phase consisted of a new assessment of the students, after the course, also through the Moodle platform. The students received the same previous case, also in an individualized way and also an additional clinical case, destined to another student in the first assessment. This distribution was made randomly and without knowledge of the participants, in such a way that it was greatly reduced to the possibility that they would discuss the cases with each other. This activity also lasted 1 week.

In total, the educational intervention, including pre and post-course assessments lasted 30 days.

The variation of the hit ratio in the first and second tests was used as an assessment of the course. We consider as questions each field of the tool that should be filled according to the understanding of each student and according to the learning that they obtained during the course. Therefore, in question number 1, the participants had to fill the field with the initial date of the event described in the clinical case, in question number 2, the final date of the AE closure. In question number 3, the event occurred and in the fourth question, the conduct taken in front of the event. In questions 5 and 6, the students had to describe, respectively, the drug treatment that was performed in the event and the complementary conduct, such as request for exams and other procedures that were required according to the AE. In question number 7, it was necessary to describe the moment at which the AE occurred, related to the time elapsed from the hemodialysis. In the eighth question, students should describe the outcome of AE and in questions 9 and 10, students should report, respectively, whether or not that event had any relation to the hemodialysis session and what type of venous access the patient had. The eleventh question asked students to describe how many punctures had been made in the patient's AVF, and in question 12 students were required to report how serious the AE had occurred. Clinical cases contained all the necessary information for the answers. The 12 questions were mandatory so that the tests could be considered and could be sent to the system. At the end of each proposed test, the student found a field called "observation", which was optionally filled out and with the purpose of enriching the annotation if the student judged necessary.

The answers to the questions were analyzed individually. The researcher considered the score of each student's response based on her degree of satisfaction. The assessment was transformed into a numerical scale, obeying the following criteria: note 1: the researcher completely disagreed with the response provided; note 2: the researcher partially disagreed with the response provided; note 3: the researcher did not agree or disagree with the response provided; note 4: The researcher partially agreed with the answer; note 5: totally agreed with the answer. The maximum average that each student could get was therefore 5 (five). Another observer, a nurse specializing in nephrology, also accessed the tests and agreed with the researcher's score.

The comparison of the means of each response between the moments before and after the course for each nursing technician was analyzed statistically through the Student's T test, which was also used to compare the scores obtained after the course among the students who were tested by the against those who had already responded to this same test before the course. The Excel - Microsoft Office Professional Plus 2010 program was used for calculations.

At the end of the study, a course satisfaction survey was conducted for participants. This study was answered by 14 of the participants of the course, without the identification of the respondent. Seven items related to the course were assessed: Access/password, proficiency of course content, gain of knowledge, distance course, attendance of course, duration of the course; and course certification. The construction of the answers and interpretation were done using the Likert scale, where the "A" answer meant lack of student approval, "B" partial lack, "C" indifferent, "D" partial approval, and "E" total approval.

RESULTS

Of the 16 nursing technicians (students) participating, 9 were female (56%). The mean age of the participants was 39 ± 8.9 years and the mean time of experience in the hemodialysis sector was 10 ± 5.9 years, ranging from 22 to 57 years of age. The 16 students accessed, in total, 825 times the course in the Moodle platform, with an average of 51.6 ± 21.7 accesses.

In the initial test, the average grade of students was 3.7 ± 0.3 points (of a maximum of 5). In the final assessment, after the course, there was a significant increase in the mean score of the assessments: 4.2 ± 0.3 points (p = 0.0002). As explained earlier, in the final test, students, in addition to responding to the same initial test case, also responded to another problem, which was the same one that was being used for the initial and final assessment of another student. When we compared the results between the new and repeated case assessments after the course, we observed that the assessment was similar among students who had never seen this case against students who already knew the case of the initial assessment: 4.3 ± 0 , 3 points versus 4.2 ± 0.3 points, respectively (p = 0.26). Table 1 shows the initial and final mean of each question. As can be seen in this table, questions 1, 5, 7, 9, 10 and 11, which corresponded respectively to the table fill fields: Event Date, Medication Treatment, Event Time, Vascular Access Type and Number of punctures, obtained a high score (3.6 or higher score), even in the initial test, meaning that they were questions of easy interpretation and a topic well known to the participants. As can be seen in Table 1, the (filling the field) questions 2,3,4,6,8 and 12 had low success rates (grades below 3.6) in the initial test. They corresponded, respectively, to the fields: Adverse Event Final Date, Event Description, Outcome, Description of Conduct, Description of Complementary Conduct and Event Severity Classification. In the assessment after the course, questions 2,3,4 and 6 were answered in a significantly better way. The means of question 8 and 12, although they were higher in the post-course test, did not improve significantly.

At the end of the research, a satisfaction survey was conducted on the course, answered by 14 technicians. 12 of the technicians agreed that the course was well used by them and 2 nursing technicians reported that the course was indifferent in terms of achievement. The 14 respondents reported that their knowledge of the subjects covered increased.

DISCUSSION

Creating mechanisms that allow the understanding of potentially dangerous factors during the practice of care may be an important strategy to decrease the usual risks of a dialysis session[27].

It is estimated that about 98,000 patients died each year in the United States at the end of the 20th century, secondarily to medical errors potentially subject to prevention[28]. In the case of Hemodialysis, studies confirm the need for standardization of procedures to decrease problems[29].

The hemodialysis Adverse Events record tool we have adapted in our research provides information that goes beyond the data usually noted about an Adverse Event on hemodialysis. With this information, a given event can be easily understood when analyzed. It is even possible that this documentation can serve as

Table 1 – Average of assessments for each question before and after the course

Assessment Questions	First Mean/ SD	Final Mean/ SD	*p*
1. Initial Date	4.8±0.7	5.0±0	0.333
2. Final Date	2.7±1.9	4.2±1.3	0.009
3. Complication Description	3.0±0	3.6±0.5	0.0005
4. Conduct	3.1±0.6	3.6±0.6	0.040
5. Medication Treatment	3.6±0.6	3.9±0.6	0.096
6. Other Conducts	3.1±0.8	3.8±0.4	0.016
7. Dialysis Time X Adverse Events	4.0±1.1	4.4±1.2	0.231
8. Outcome	3.4±1.4	3.9±1.4	0.317
9. Adverse Events related to Hemodialysis	4.0±1.4	4.1±1.3	0.669
10. Venous Access	5.0±0	5.0±0	-
11. Puncture of the Arteriovenous Fistula	5.0±0	5.0±0	-
12. Adverse Event Classification	2.8±1.3	3.6±1.5	0.102

a roadmap for conducting standardization and understanding the outcome of events. The tool and course were based on the most common adverse events in hemodialysis, such as those cited by Sousa *et al*.[19] and Garrick *et al*.[20].

We started with the idea of developing a table as a record tool where we tried to include columns that met the specifications for Adverse Events. The table allowed the technicians to describe the Adverse Event that occurred in the dialysis session, even if started before hemodialysis. We believe that the record of the Adverse Event is detailed in a uniform manner and that it mainly brings us accurate information about the event and the outcome, and the conclusion of the Adverse Event.

Characterizing an Adverse Event is a difficult task. Adverse events can only be considered as those resulting from iatrogenesis[30]. In our study, we chose to describe any clinical alterations presented by the patient as an Adverse Event, even if they were not originated by the procedure of hemodialysis itself. One of the filling fields in the table asks, exactly, whether or not the event presented by the patient was due to dialysis.

The filling of the table by the participants proved difficult in some fields, especially before the course. The course improved the understanding of Adverse Events and the completion of the table, and therefore, the students' final assessment was clearly superior to the initial one. Only two subjects did not obtain significant improvement of their understanding after the educational intervention: the annotation of the outcome of the event and the classification of the Adverse Event. The comparison of the responses to the same test before and after the course, with the answers to the different tests that were being answered for the first time after the course was also similar, indicating an overall improvement of knowledge after the course. The training provided in the course contained relevant information from the literature on the definition and classification of an Adverse Event according to WHO, as well as providing information that enabled the correct completion of the spreadsheet.

Study limitations

We can point out as limitations the small number of participating technicians and the fact that the methodology did not use real data from the unit's daily practice.

Contributions to the Nursing

We believe that Blended-Learning has proved to be a useful tool for the training of nursing technicians in a dialysis unit. The Moodle platform of PUC-SP allowed the application of the contents chosen to be managed at a distance and was an efficient tool for online assessment as well. Participants from the course were satisfied in the satisfaction survey.

CONCLUSION

In this study, we have demonstrated that the educational tool on Adverse Events in hemodialysis was efficient for the improvement of the knowledge about the subject by the nursing technicians and that the proposed record systematization can contribute to the organization and improvement of data collection in a systematic way about Adverse Events.

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