Effect of Implementing Self-Learning Package about Oxygen Provide to Children on Nurses' Performance at Pediatric Intensive Care Unit

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Abstract

Background: Self-Learning Package is one of the most suitable teaching methods for learners. Oxygen therapy is a lifesaving, medical intervention in the management of hospitalized children. The nurses have a very important role in this regard as they should monitor carefully and regularly children who relate to oxygen therapy. **Aim of this study** was to evaluate the effect of implementing self-learning package about oxygen provided to children on nurses' performance at Pediatric Intensive Care Unit. **Research design:** A quasi-experimental research design was utilized to conduct the study. **Settings:** The current study was conducted at the Pediatric Intensive Care Units at University Hospital & Specialized Pediatric Hospital at Benha city. **Subjects:** A convenient sample of all nurses (70) and a purposive sample of children (70) on oxygen. **Tools of data collection:** Two tools: **tool (1)** A structured interviewing questionnaire and **tool (2)** observational checklists. **Results:** More than half of nurses had low total score of knowledge regarding oxygen provided to children pre-implementation of the self-learning package, while more than two thirds of them had high total score of knowledge post-implementation of self-learning package. Also, about three quarters of nurses had unsatisfactory total score of practice regarding oxygen provided to children pre-implementation of the self-learning package, while more than three quarters of them had satisfactory total score of practice post-implementation of self-learning package. **Conclusion:** Self-Learning Package was effective in improving nurses' performance regarding care of children undergoing oxygen therapy. **Recommendations:** Provision of continuing educational program in order to update nurses' knowledge and enhance their practice regarding care of children on oxygen at pediatric intensive care unit.

Key words: Children, Nurses' Performance, Oxygen provide, Pediatric Intensive Care Unit, Self-Learning Package.

Introduction

Self-Learning Package (SLP) is one of the most suitable teaching methods for learners. It is an individualized method of learning that gives learners chance to work individually according to their special needs. Face to face teaching is disappearing and distance mode of education is becoming popular **(Elewa and Elkattan, 2019)**.

Oxygen therapy is a life-saving, medical intervention in the management of hospitalized children. The goal of oxygen therapy is to prevent or treat tissue hypoxia. Oxygen should be prescribed according to the principles of drug prescription; however, the use of oxygen in clinical practice is often inappropriate without knowledge of its potential risks and benefits **(Radhi and Arar, 2021)**.

Health team members are playing a very curial role while administering oxygen therapy, as it should be delivered in attendance of a physician, or nurse. The nurses have a very important role in this regard as they should monitor carefully and regularly children who are connected with oxygen therapy. Initial investigations like ABG, Hgb, or Hct and chest X-ray should be done regularly based on physician prescription and assessed carefully. As well monitoring the level of consciousness and pulse oximetry are mandatory **(Mayhob, 2018)**.

Significance of the study

Self-directed learning has been a major topic in nursing research and practice. it is a process in which individuals diagnose their learning requirements, formulate learning goals, choose and implement learning strategies **(Towfik et al., 2022)**. Oxygen is essential to treat hypoxemia due to pneumonia and many other conditions in childhood and the neonatal period. Effective treatment of hypoxemic children requires early recognition of hypoxemia, provision of oxygen and monitoring of response to oxygen **(Pulsan and Duke, 2021)**.

According to the statistical office of Benha Specialized Pediatric Hospital, the incidence rate of oxygen therapy were more than 250 cases per month admitted to the Pediatric Intensive Care Unit, most cases were subjected to has been undergoing oxygen therapy which required knowledgeable and practiced nurses to provide nursing care for these pediatric group **(Specialized pediatric hospital statistics department, 2022).** So, it is important to conduct such a study to evaluate the effect of self-learning package about oxygen provide to children on nurses' performance at Pediatric Intensive Care Unit (PICU).

Aim of the study

The aim of this study was to evaluate the effect of implementing self-learning package about oxygen provided to children on nurses' performance at Pediatric Intensive Care Unit.

Research Hypothesis

Implementing of self-learning package are expected to improve nurses' performance regarding oxygen provided to children at Pediatric Intensive Care Unit.

Subjects and Method

Research Design:

A quasi-experimental research design was utilized to conduct the current study. The manipulation of independent variable to observe the effect on dependent variable.

Settings:

The present study was conducted at the Pediatric Intensive Care Units (PICU) at Benha University Hospital which is affiliated to Ministry of Higher Education and Scientific Research and Specialized Pediatric Hospital in Benha City which is affiliated to Ministry of Health and Population.

Subjects:

(1): A convenient sample of all available nurses (70) who are working in the previously mentioned settings regardless of their personal characteristics. The calculation is based on type 1 error 0.05 and confidence level 95%.

(2): A purposive sample of children (70) on oxygen under the following: -

- Inclusion criteria:

- Age from 1 month to 10 years.
- Both sexes.
- Children undergoing oxygen therapy.

Tools of data collection:

Tool I: A structured interviewing questionnaire:

The tool was designed by the researcher in the light of reviewing relevant

articles, previous studies and research. It was written in Arabic language and composed of three parts:

Part I: This part included personal characteristics for the studied nurses: (age, gender, level of education, years of experience and previous training programs about oxygen provide to children **{5 questions}**.

Part II: personal characteristics and medical data of the studied children including: (age, gender, diagnosis of the child, method of oxygen providing, previous hospitalization, length of hospital stay/days, blood oxygen saturation during admission at hospital, blood oxygen saturation during current time and physiological signs (Respiration, Pulse, Temperature & Blood Pressure) **{12 questions}**.

Part III: Nurses' knowledge regarding oxygen provide to children (pre and post-test format).

It was developed by the researcher based on **Shah, (2019)** and revised by supervisors to assess nurses' knowledge regarding care of children undergoing oxygen therapy. It included **17 multiple choice questions divided as the following:**

- **Nurses' knowledge regarding oxygen therapy** (definition, indications, methods, equipment, sources, precautions, nursing care) **{7 questions}**.
- **Nurses' knowledge regarding oxygen doses & toxicity** (oxygen doses, factors affecting on oxygen therapy, signs & symptoms of child responding, causes of toxicity, complications of increase oxygen therapy, oxygen considering a medication, oxygen doses differing between children, the oxygen that provides to children should be gradually stopped, the oxygen providing to children have a toxic effect and complications may happen to children as a result of excess oxygen) **{10 questions}**.

Scoring system for knowledge:

- High level of knowledge **(> 75%).**
- Moderate level of knowledge **(65% - 75%).**
- Low level of knowledge **(< 65%)**.

Tool II: Observational Checklists:

It was adopted from **MacDonald and Ramasethu, (2012)**, **Lissauer et al., (2012) and Lynn, (2014)**. To assess nurses' practices regarding care of children undergoing oxygen therapy. Observational checklists included **{100 steps}** grouped under seven main parts as:

- Hand washing **(9 steps)**.
- Vital signs **(14 steps)**.
- Nasal cannula **(17 steps)**.
- The mask **(15 steps)**.
- Headbox **(15 steps)**.
- Nasopharyngeal suction **(16 steps)**.
- Oropharyngeal suction **(14 steps)**.

Scoring System for practice:

- Satisfactory level of practice **(≥ 85%).**
- Unsatisfactory level of practice **(< 85%).**

Preparatory Phase

A review of the past and current national and international related literature was done using textbooks, articles, journals and scientific periodicals to be acquainted with the various aspects of the research problem, develop the tools for data collection. This phase took three months from the beginning of February 2021 to the end of April 2021.

Content Validity

Tool's validity was tested through a jury of three experts pediatric nursing Benha University. The experts reviewed the tool for its clarity, relevance, comprehensiveness, simplicity and applicability. Minor modifications were done in form of questions order and the terms used in formulation of questions. This phase took one month from the beginning till the end of May 2021.

Reliability

Testing reliability of proposed tools was done by the researcher using Cronbach's Alpha Coefficient test to measure the internal consistency for all tools. This turned to be (α = 0.820) for a structured interviewing questionnaire and (α = 0.850) for observational checklists. This indicates a high degree of reliability for the study tools.

Ethical Consideration

An agreement of Ethical Committee was obtained from Faculty of Nursing, Benha University. The researcher clarified aim of the study to the studied nurses before their participation to obtain their acceptance. An oral approval was a prerequisite to recruit nurses in the study. The studied nurses were assured that all gathered data was used for research purposes only and the study was harmless. Additionally, nurses allow to withdrawal from the study at any time without giving the reason. Confidentially of the gathered data and results were secured. In addition to, an orally approval was obtained from parents of children under the study, ensuring complete privacy and total confidentially.

Pilot Study

A pilot study was conducted to test the clarity, applicability and feasibility of the study tools and to estimate the time needed for each tool (I & II). It was done on 10% of the total subjects, (7) nurses who excluded from the present study to avoid sample bias and contamination. In the light of pilot study analysis, modification was done and the last form was developed. This phase took one month from the beginning of June 2021 till the end of June 2021.

Field work

The process of data collection was carried out over the period of ten months starting from the beginning of July 2021 to the end of April 2022. The researcher interviewed the nurses at the study setting, explained the aim of the study and took oral approval from nurses participating in the study to achieve the aim of the current study by theses phases: assessment, planning, implementation and evaluation phase.

1. **Assessment phase (pre-test):**

Assessment phase involved interviews with nurses to collect baseline data. The researcher was available by rotation for two days weekly (Monday and Thursday) during morning shift for three months from the beginning of July 2021 to the end of September 2021. At the beginning of interview, the researcher welcomed each nurse, explained the purpose, duration, activities of the study and took oral approval. The data of children undergoing oxygen therapy were collected by researcher from the medical record and it was taking nearly 15 minutes for each child. The researcher gave the studied nurses questionnaire for filling it to assess their knowledge and it took about 20-30 minutes. Each nurse was observed separately during their actual practice of procedures to assess their practice by using observational checklists and it took about 45-60 minutes.

2. **Planning phase:**

Based on the baseline data obtained from the assessment phase and relevant literature, the self-learning package was developed by the researcher as indicated by nurses' level of understanding in simple Arabic language. Designing the self-learning package took one month from the beginning of October 2021 to the end of October 2021.

Self-Learning Package (SLP):

The researcher was designed a self-learning package in the Arabic language after reviewing the related literature based on the actual need assessment of the studied nurses. It was covered the theoretical knowledge about

oxygen provide to children such as definition, indications, methods of oxygen provide, essential equipment and supplies for oxygen provide, different doses of oxygen provide, toxicity, precautions that should be taken while providing oxygen and nursing care of oxygen provide to children. In addition, practical procedures related to nursing care for oxygen provide to children such as procedures of hand washing, vital signs, nasal cannula, the mask, head box, nasal suction and oral suction.

3.Implementation phase:

The self-learning package distributed by the researcher to each nurse. The researcher has clarified the purpose of the study and explained how to use the package throughout the following:

- Each chapter should be read carefully and didn't cancel any page in the package.
- The questions after each chapter should be answered.
- Don't move to another chapter unless the required score is achieved.
- If the nurses didn't achieve the required score, they should return again to the same chapter.
- Nurses can return to the researcher in order to clarify the vague points.

The objective of this phase was to assist nurses who provide direct care for children to develop an independent level in relation to oxygen provide. The implementation phase was achieved through a period of three months from the beginning of November 2021 to the end of January 2022.

4. Evaluation phase (post-test):

During evaluation phase (post-test), the effect of the self-learning package on nurses' knowledge and practice regarding oxygen provide to children was evaluated by using the same forms of tools used before the implementation for all nurses. This was done immediately after the implementation and lasted for three months from the beginning of February 2022 to the end of April 2022.

Administrative Design:

An official approval was obtained from the Dean of Faculty of Nursing Benha University, hospitals directors and heads of Pediatric Intensive Care Units (PICUs) at Benha University Hospital and Specialized Pediatric Hospital in Benha City. A clear explanation was given about the nature, importance and expected outcomes of the study to carry out the study with minimal resistance.

Statistical analysis:

The collected data organized, tabulated and statistically analyzed using Statistical Package for Social Science (SPSS) version 21 for windows, running on IBM compatible computer. Data were presented using descriptive statistics in the form of numbers and percentages for qualitative variables, mean and standard deviation (SD) for quantitative variables. Qualitative variables were compared using chi-square test (X^2). Whenever the expected values in one or more of the cells were less than 5. Pearson correlation analysis were done for assessment of inter relationship among quantitative variables. Statistical significance was considered at P-value < 0.05 and a highly statistically significant was considered at P-value < 0.001.

Results:

Table (1): Reveals that about more than one quarter (27.1%) of the studied nurses were in the age group of 31< 36 years with mean age 26.0±7.07 years. Regarding gender, more than three quarters (78.6%) of the studied nurses were females. Regarding nurses' educational level, less than half (48.6%) of them had the secondary school of nursing. Concerning years of experience, more than one quarter (30.0%) of them had ≥ 7 years of

experience in pediatric intensive care unit. The majority (82.9%) of the studied nurses hadn't attended previous training programs about oxygen therapy.

Table (2): Clarifies that more than one-third (35.7%) of the studied children were in the age group of 1 month < 1 year with mean age 5.2 ± 3.1 years. Regarding gender more than half (51.4%) of the studied children were females. Regarding the diagnosis, more than one quarter (28.6%) of them had pneumonia. Concerning previous hospitalization about less three quarters (70.0%) of them were yes and the length of hospital stay more than half (52.9%) of them were 10 days < 20 days with mean 15.2 ± 9.3 days. Regarding method of oxygen therapy more than half (51.4%) of the studied children were used the oxygen mask. Regarding blood oxygen saturation during admission to hospital less than half (47.1%) of them were 65% ≤ 75% but during current time the majority (85.7%) of them were > 75%.

Figure (1): Describes that more than half of nurses (62.8%) had low total score of knowledge regarding oxygen provided to children pre-implementation of the self-learning package, while more than two thirds of them (67.1%) had high total score of knowledge post-implementation of self-learning package.

Figure (2): Describes that about three quarters of nurses (75.7%) had unsatisfactory total score of practice regarding oxygen provided to children pre-implementation of the self-learning package, while more than three quarters of them (78.6%) had satisfactory total score of practice post-implementation of self-learning package.

Table (3): Indicates the correlation between total scores of the studied nurses' knowledge and practice. It was revealed that there was high statistically significant positive correlation coefficient between nurses' total score of knowledge and total score of practice pre & post implementation of self-learning package (r = 0.82, 0.83, P = 0.000).

Table (1): Percentage distribution of the studied nurses regarding their characteristics (n = 70).

Nurses Characteristics	No.	%
Age/years		
16 < 21	14	20.0
21 < 26	9	12.9
26 < 31	13	18.6
31 < 36	19	**27.1**
≥ 36	15	21.4
Mean ± SD 26.0 ± 7.07 years		
Gender		
Female	55	**78.6**
Male	15	21.4
Educational Level		
Secondary school of nursing	34	**48.6**
Technical institute of nursing	22	31.4
Bachelor of nursing science	14	20.0
Years of experience in pediatric intensive care unit		
< 1	13	18.6
1 < 3	7	10.0
3 < 5	11	15.7
5 < 7	18	25.7
≥ 7	21	**30.0**
Mean ± SD 3.2 ± 4.51 years		
Attending previous training programs about nursing care regarding children undergoing oxygen therapy		
Yes	12	17.1
No	58	**82.9**

Table (2): Percentage distribution of the studied children regarding their characteristics and medical data (n = 70).

Children Characteristics	No.	%
Age/years		
1 month < 1 year	25	**35.7**
1 < 3	7	10.0
3 < 5	16	22.9
5 < 7	8	11.4
7 ≤ 10	14	20.0
Mean ± SD 5.2 ± 3.1 years		
Gender		
Female	36	**51.4**
Male	34	48.6
Diagnosis		
Acute respiratory distress	13	18.6
Pneumonia	20	**28.6**
Bronchial asthma	14	20.0
Sepsis	8	11.4
Chest infection	15	21.4
Previous hospitalization		
Yes	49	**70.0**
No	21	30.0
Length of hospital stay/days		
1 day < 10 days	12	17.1
10 days < 20 days	37	**52.9**
20 days ≤ 30 days	21	30.0
Mean ± SD 15.2 ± 9.3 days		
Method of oxygen therapy		
Nasal Cannula	14	20.0
Oxygen Mask	36	**51.4**
Headbox	20	28.6
Blood oxygen saturation during admission to hospital		
< 65%	21	30.0
65% ≤ 75%	33	**47.1**
> 75%	16	22.9
Blood oxygen saturation during current time		
< 65%	3	4.3
65% ≤ 75%	7	10.0
> 75%	60	**85.7**

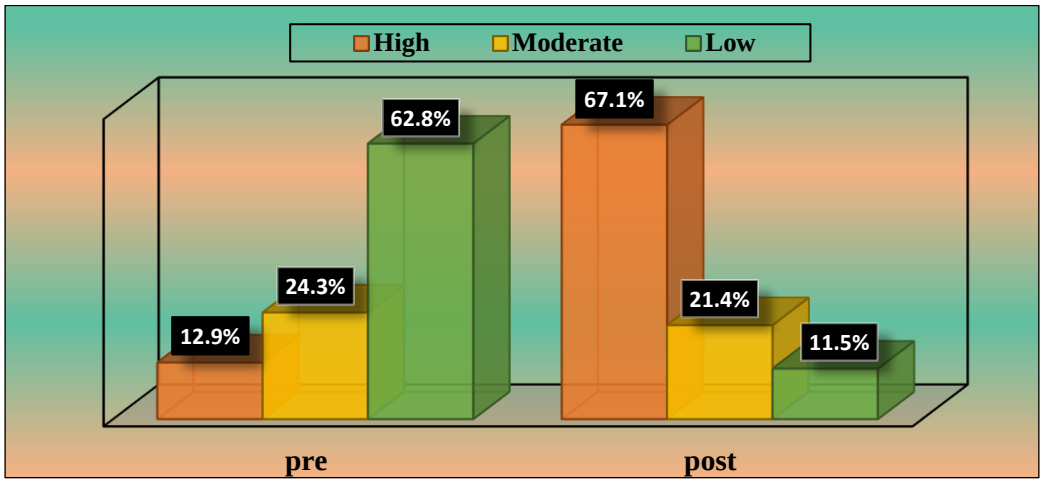

Figure (1): Total score of nurses' knowledge about oxygen provided to children.

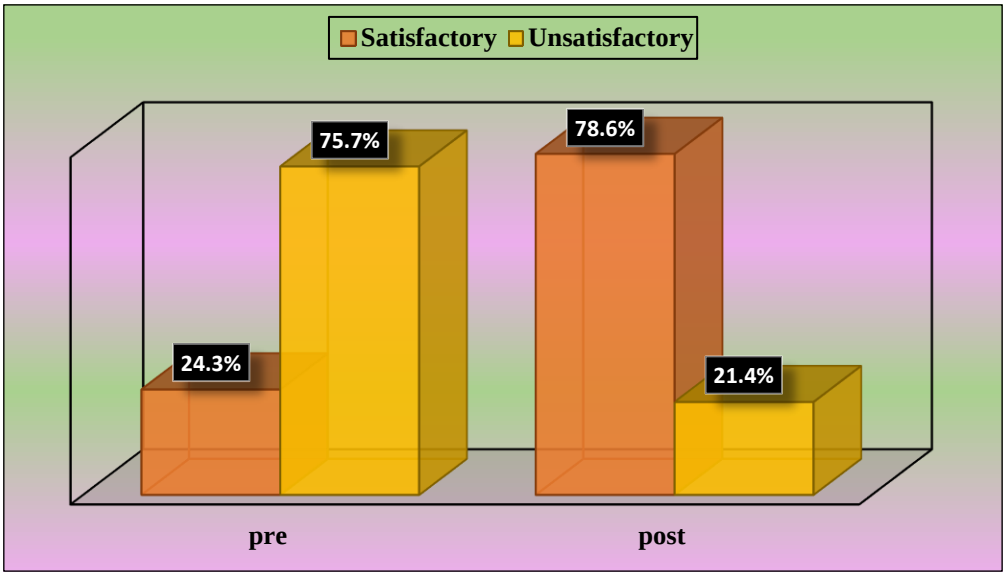

Figure (2): Total score of nurses' practice about caring for oxygen provided to children.

Table (3): Correlation between total scores of studied nurses' knowledge and practice pre & post implementation of self-learning package (n = 70).

Total score of practice	Total score of knowledge			
	Pre - (Self Learning Package)		Post - (Self Learning Package)	
	r	P	r	P
	0.82	0.000**	0.83	0.000**

Discussion

Regarding educational level of the studied nurses, the present study revealed that, less than half of them had the secondary school of nursing. This finding was disagreed with **Al-Waly et al., (2020)** who conducted a study "Nurses' Knowledge Regarding Pneumonia in Children Under Five Years of Age at Pediatric Wards in Kirkuk Teaching Hospitals" who found that less than half of the studied nurses had bachelor of nursing. From the researcher point of view, this may be due to that nursing secondary school provide the community with a large number of nursing school nurses graduates, also because university graduates always go to work abroad.

As regards years of experience of the studied nurses, the present study revealed that, more than one quarter of them had ≥ 7 years of experience in Pediatric Intensive Care Unit. This finding was similar with **Jassm and Aziz, (2020)** who conducted a study "Effectiveness of Health Educational Program on Nurses' Knowledge toward Children Pneumonia in Al-Amara City Hospitals" who found that half of nurses had work experience (1-10) years.

On assessing age and diagnosis of the studied children, the present study revealed that, more than one-third of them were in the age group of 1 month < 1 year and more than one quarter of them had pneumonia. Those findings were similar with **Pulsan and Duke, (2021)** who conducted a study "Response to oxygen therapy using oxygen concentrators run off solar power in children with respiratory distress in remote primary health facilities in Papua New Guinea" who reported that the median age of children was six months and the common primary diagnoses were pneumonia.

Concerning gender of the studied children, the present study showed that, more than half of them were females. This finding was similar with **Aghajan et al., (2019)** who conducted a study "Use of hyperbaric oxygen therapy in pediatric neuro-oncology: a single institutional experience" who reported that the majority of children were females.

Concerning the hospital stay length of the studied children, the present study revealed that, more than half of them were 10 days < 20 days. This finding was disagreed with **Miska et al., (2021)** who conducted a study "Implementation of a Critical Care Asthma Pathway in the PICU" who reported that the median Pediatric Intensive Care Unit length of stay was 2 days with an overall hospital length of stay of 4 days.

Concerning methods of oxygen therapy of the studied children, the present study showed that, more than half of them were used the oxygen mask. This finding was disagreed with **Rosala et al., (2020)** who conducted a study "National survey of feasibility of non-invasive ventilation trials for management of children with bronchiolitis" who reported that more than half of children used low-flow nasal cannula as a method for O_2 delivery.

Concerning blood oxygen saturation during admission of the studied children (table 2), the present study revealed that, less than half of them were 65% ≤ 75% while during the current time the majority of them were > 75%. This finding was disagreed with **Pulsan and Duke, (2021)** who reported that the median SpO2 before administration of oxygen in children was 80% but agreed with them because they found children who continued to have oxygen, the oxygen saturation improved to 97%.

As regards total score of the nurses' knowledge about oxygen provided to children, the present study showed that, less than eighth of them had low total score of knowledge post-

implementation of the self-learning package. This finding was similar with **Elgneid et al., (2020)** who conducted a study "Effect of Implementing Oxygen Administration Guidelines on Nurses' Performance Caring for Patients with Chest Disorders" who clarified that less than eighth of nurses at Pediatric Intensive Care Unit had unsatisfactory level of knowledge after intervention of educational guidelines. From the researcher point of view, this is due to the positive effect of self-learning package implementation about oxygen therapy for nursing staff that played an important role in developing and enhancing their knowledge.

Regarding total score of the nurses' practice in relation to caring for oxygen provided to children, the present study showed that, more than three quarters of them had unsatisfactory total score of practice pre-implementation of the self-learning package. This finding was disagreed with **Hussen, (2021)** who conducted a study "Knowledge and Practice of Nurses towards Oxygen Therapy in the Public Hospitals of Harari Region, Ethiopia" who stated that less than half of the nurses had good practice level about oxygen therapy.

As regards correlation between the studied nurses' knowledge and their practice pre & post implementation of self-learning package, the present study demonstrated that, there was high statistically significant positive correlation coefficient between total score of nurses' knowledge and their total score of practice pre & post implementation of self-learning package. This finding was similar with **Diab et al., (2022)** who conducted a study "Effectiveness of Standardized Protocol for Oxygen Therapy on Improving Nurses' Performance and Patients' Health Outcome" who documented that there was highly statistically positive correlation between total nurse' knowledge and total practice after implementation of educational program. From the researcher point of view, this result might be positive effect of the self-learning package which could help nurses to enhance their knowledge and improve their abilities to provide oxygen therapy with satisfactory performance.

Conclusion

Self-Learning Package was effective in improving nurses' performance regarding care of children undergoing oxygen therapy at Pediatric Intensive Care Unit. Besides, there was positive correlation between total score of nurses' knowledge and total score of their practice regarding care of children on oxygen therapy, as well as there were highly statistically significant differences between nurses' knowledge and practice.

Recommendations

1. Provision of continuing educational program in order to update nurses' knowledge and enhance their practice regarding care of children undergoing oxygen therapy at PICU.
2. Further research: the study should be replicated on a large random sample in a different setting for the generalization of the obtained results.

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تأثير تطبيق حزمة التعلم الذاتى تجاه الأكسجين المقدم للأطفال على أداء الممرضات بوحدة العناية المركزة للأطفال

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حزمة التعلم الذاتي هي طريقة تدريس تستخدم للتعلم الموجه ذاتيًا ويعتبر الأكسجين علاجًا أساسيًا للأطفال الذين يعانون من أمراض الجهاز التنفسي. تعتبر الممرضة عضوًا أساسيًا فى الفريق الصحى الذى يقوم بتقديم الرعاية التمريضية للأطفال الخاضعين للعلاج بالأكسجين فى وحدة العناية المركزة للأطفال. لذا هدفت هذه الدراسة إلى تقييم تأثير تطبيق حزمة التعلم الذاتي تجاه الأكسجين المقدم للأطفال على أداء التمريض بوحدة العناية المركزة للأطفال. وقد أجريت هذه الدراسة في وحدات العناية المركزة للأطفال بمستشفى بنها الجامعي التابع لوزارة التعليم العالي والبحث العلمى ومستشفى بنها التخصصي للأطفال التابع لوزارة الصحة والسكان. وقد اشتملت العينة على كل الممرضات (٧٠) الذين يعملون في الأماكن المذكوره سابقًا وعينة غرضية من الأطفال (٧٠) الخاضعين للعلاج بالأكسجين. وأظهرت النتائج أن أكثر من نصف الممرضات (٦٢,٨٪) لديهم مستوى ضعيف من المعلومات قبل تطبيق حزمة التعلم الذاتي، بينما أكثر من الثلثين (٦٧,١٪) كان لديهم مستوى عالى من المعلومات بعد تطبيق الحزمة. وأظهرت الدراسة أن حوالي ثلاثة أرباع الممرضات (٧٥,٧٪) لديهم مستوى إجمالى غير مرضى من الممارسات التمريضية قبل تطبيق حزمة التعلم الذاتي، بينما أكثر من ثلاثة أرباعهم كان لديهم مستوى إجمالى مرضى من الممارسات التمريضية بعد تطبيق حزمة التعلم الذاتي. وكشفت الدراسة الحالية عن وجود علاقة إيجابية وذو دلالة إحصائية عالية بين إجمالي مستوى المعلومات للممرضات والمستوى الإجمالي لممارستهم قبل وبعد تطبيق حزمة التعلم الذاتي. وقد اوصت نتائج الدراسة بتوفير برنامج التعليم المستمر من أجل تحديث معرفة الممرضات وتعزيز ممارساتهم فيما يتعلق برعاية الأطفال الذين يخضعون للعلاج بالأكسجين في وحدة العناية المركزة للأطفال.