The Impact of an Intensive Educational Program Regarding Preeclampsia on Health Professional Knowledge

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Preeclampsia is a multi-system disorder unique to human pregnancy with multi-system involvement. Worldwide, it causes >500,000 fetal and neonatal deaths and >70,000 maternal deaths every year. Limited knowledge of health professionals in direct connection with complications of pregnancy, and inability to keep up with medical knowledge, has potentially severe effects on the quality of care and increases maternal and perinatal mortality. The aim has been to identify the impact of an intensive educational program regarding preeclampsia on health professionals knowledge at Clinical Hospital of Obstetrics and Gynecology Polizu in Bucharest, Romania. The study design was quasi-experimental. A total of 89 health professionals, including 12 resident physicians, 12 midwives and 65 nurses at Clinical Hospital of Obstetrics and Gynecology Polizu in Bucharest in the Department of Obstetrics and Gynecology participated in the study. The study was designed in three phases: Assessment phase, Implementation phase and Evaluation phase. The intensive educational program regarding preeclampsia has a highly significant positive influence on the knowledge of health professionals. There was a clear transfer of knowledge among the participants. The following resulted across all 31 examined knowledge areas: Resident physicians: Category Score /Criteria Pre-Test (No./%): Inadequate 1 (8.3%), Moderate 9 (75%), Adequate 2 (16.7%), Midwives: Category Score /Criteria Pre-Test (No./%): Inadequate 8 (66.7%), Moderate 4 (33.3%), Adequate 0 (0%), Nurses: Category Score /Criteria Pre-Test (No./%): Inadequate 60 (92.3%), Moderate 5 (7.7%), Adequate 0 (0%). After Trainingsprogramm, the amount of knowledge in the field preeclampsia increased impressively: Resident physicians: Category Score /Criteria Post-Test (No./%): Inadequate 0 (0%), Moderate 0 (0%), Adequate 12 (100%), Midwives: Category Score /Criteria Post-Test (No./%): Inadequate 0 (0%), Moderate 3 (25%), Adequate 9 (75%) with a (p<0.002), Nurses: Category Score /Criteria Post-Test (No./%): Inadequate 0 (0%), Moderate 10 (15.4%), Adequate 55 (84.6%) with a (p<0.001). Based on the findings of the study, it can be concluded that the intensive educational program regarding preeclampsia led up updating of the knowledge and improved qualification of the health professionals. This is expected to improve the quality of care for patients and reduce maternal and perinatal preeclampsia-related mortality in Romania.

Keywords: preeclampsia, eclampsia, educational program, knowledge, health professionals

Despite global efforts to reduce maternal mortality by 75% by 2015, a little more than 300,000 women died worldwide of complications in pregnancy or birth in 2015. Maternal mortality reduced almost by half since 1990, as calculations of US researchers on the order of the World Health Organization in the Lancet [1] show, but still is far from the target of 75% and unacceptably high. 13.1 maternal deaths per 100,000 live births were recorded in Romania in 2015. While maternal mortality dropped to 8.4 deaths per 100,000 live births in 2016, it rose to 12.5 deaths per 100,000 live births in 2017 [2]. Preeclampsia is a multi-system disorder unique to human pregnancy with multisystem involvement. It causes >500,000 fetal and neonatal deaths and >70,000 maternal deaths every year [3]. A new study reports that the costs for preeclampsia for the US health care system was 2.18 billion dollars in the first year [4]. Preeclampsia can deteriorate quickly and without warning. It is not recommended to classify it as mild or severe [5]. It usually occurs after 20 weeks of pregnancy and may be overlaid by other hypertensive disorders. Preeclampsia is the most frequent form of hypertension that complicates pregnancy. It is mostly defined by the occurrence of new hypertension plus new proteinuria [6]. Proteinuria is not a prerequisite for a diagnosis of preeclampsia [7]. All women need access to pregnancy care during pregnancy, qualified support while giving birth, and care and support in the weeks afterwards. Support during pregnancy can improve the mother's outcome in this respect [8]. Preeclampsia recognition requires well-trained staff and equipment. Precise and frequent blood pressure measurement, combined with knowledge of the relevance of its values and access to professional medical care are indispensable for timely treatment of preeclampsia [9]. Delays in access to high-quality care was identified as one of the most important determinants of avoidable maternal death [10,11]. A bad result for the patients may occur if one of these factors suffers an unacceptable delay. For example, the inability to recognise an emergency may delay the decision to provide care. The ability of the patient or the health professional to recognise an emergency in time partially depends on the educational level of the patient or health professionals [12]. The intensive educational program is run at the Clinical Hospital of Obstetrics and Gynecology

Polizu in Bucharest, Romania, Tertiary IM hospital in the South of the country, which was called *the most modern maternity in Romania* and *the maternity-fetal care unit of excellence* in 2016 [13]. There, preeclampsia and eclampsia, as well as any other obstetric complications are treated, among other things. Its mission is enabling those who are already active in the health care disciplines to use their specialist knowledge and skills to promote training of health care professionals. Understanding the relevance of the intensive educational program of the health professionals must be supplemented by knowledge and application of strategies [14-17]. The strategies are use of medical language, supporting written key items with illustrations to ensure understanding of the health professionals and, if necessary, facilitate successful transfer of the information to other health professionals with different health competence levels. Primary prevention is very important in order to recognise an early stage of preeclampsia, followed by appropriate treatment within an appropriate time frame. This way, resident physician, qualified trained nurses and midwives can play an important role as decision-makers in order to save the lives of women.

Experimental part

This study was conducted at the Clinical Hospital of Obstetrics and Gynecology Polizu in Bucharest, Romania, in the Department of Obstetrics and Gynecology in 2019. It used a quasi-experimental design as the best to scientifically determine efficacy of the planned intensive training program for knowledge and reference to practice. A total of 89 health professionals, including 12 resident physicians, 12 midwives and 65 nurses in the Department of Obstetrics and Gynecology participated in the study.

Tools for data collection

Data collection used a survey as an instrument of gathering data, questions were based on the related UpToDate literature. It was chosen a highly structured survey with pre-defined content and format, having almost entirely only closed questions with fixed answer choices. The structure of the survey followed exactly the approached hypotheses and the conceptual framework of the study. As such, the survey was composed of two main parts.

First part included: Demographic characteristics with 13 items: Age, Gender, Education level, Position, Profession grade, Hospital section, Year of employment in hospital, Total years of experience, number of cases with preeclampsia managed in the last month, Knowledge of current standardized guidelines for the management of preeclampsia/eclampsia, Participation to training program for the management of preeclampsia/eclampsia, Participation to obstetrics field education program, The opinion about the importance of education programs for reducing maternal mortality in the field of obstetrics.

Part two concerned: A questionnaire with 31 questions, divided into 7 topics. Each topic is subdivided into further sub-topics: Prevention 3, Prediction 1, Pathophysiology 1, Definition 3, Diagnosis 4, Management 10, Treatment 9.

Grading: The level of knowledge about preeclampsia was measured using 31 questions, to each question was given a score of (1) if the answer was correct or the answer was Yes or a score of (0) if the answer was wrong or the answer was No.

Total score: For each topic was measured a score which was calculated by adding the questions represented by the respective topic. Score $<= 50\%$ - Level of knowledge is Inadequate, Score 51 to 75% - Level of knowledge is Moderate, Score $> 75\%$ - Level of knowledge is Adequate.

Procedures: The study was conducted from early January to the end of February 2019. It was designed and divided into three phases: Assessment phase, Implementation phase and Evaluation phase.

Assessment phase: This phase served to identify the basic knowledge of health professionals who were willing to participate in the study and who were informed about the purpose and manner of the study before the program was conducted. The 89 health professionals were divided into groups of 15 participants that met on different dates. Completion of the questionnaire took about 30 minutes.

Implementation phase: The intensive educational program regarding preeclampsia took place in sessions of about 180 minutes. The intensive educational program included: PowerPoint-supported lectures on the introduction of preeclampsia and for comparison of hypertension disorders, several video clip presentations demonstrating progressive signs and symptoms of preeclampsia and progressive case studies. The health professionals had visual feedback and practical exercises to recognise acute crises of a chronic disease in a case study. The case study showed a realistic patient situation that enabled the health professionals to develop problem solution skills, investigate complex processes of disease and apply their new knowledge. The health professionals participated in a group discussion after each case study in order to support knowledge transfer. The group discussions facilitated learning and were subject-centric in order to supplement the affective and cognitive areas alike.

Evaluation phase: The subsequent test used the same questionnaire as the preceding one. Completion of the questionnaire took about 30 min again. Comparison between the data collected before and after implementation was used to determine, measure and assess efficacy, knowledge and improvement of health professionals in the area of preeclampsia after the intensive educational program.

Results and discussions

The intensive educational program regarding preeclampsia has a highly significant positive influence on the knowledge of health professionals. There was a clear transfer of knowledge among the participants ($p \leq 0.001$).

Demographic characteristics

Most participants are nurses (73%); the average age is 41.6 ± 9.735 years; the majority of participants are female (95.5%); a small percentage have university studies (38.2%); there is some homogeneity with regard to the hospital section in which they work, with the highest share being for Section II (30.3%) and the lowest share being for Section III (20.2%); the average experience in the hospital was (13.36 ± 10.254) years, almost similar to the value of the average total experience (14.47 ± 10.755); the average number of cases with preeclampsia managed in the last month is less than 1 (0.8 ± 2.035); most participants didn't know the current standardized guidelines for the management of preeclampsia/eclampsia (73%) and didn't participate in a training program for the management of preeclampsia/eclampsia (88.8%); most of the participants participated in a obstetrics field education program (71.9%); Two thirds of the participants (67.4%) consider the education programs for reducing maternal mortality very useful.

Most of the scores for the analyzed topics and the total score for the level of knowledge increased significantly

Table 1
AVERAGE VALUE OF PRE- AND POST-EDUCATIONAL PROGRAM
TOTAL SCORES FOR THE RESIDENT PHYSICIANS

Criteria	Pre-Test	Post-Test	p*
	Mean ± SD	Mean ± SD	
Topic – Prevention	1.75 ± 1.055	3	0.010
Topic – Prediction	0.67 ± 0.492	1	0.046
Topic– Pathophysiology	0.83 ± 0.389	1	0.157
Topic – Definition	2.42 ± 0.669	2.75 ± 0.622	0.102
Topic – Diagnosis	2.25 ± 0.965	3.92 ± 0.289	0.003
Topic – Management	6.08 ± 1.929	9.25 ± 0.965	0.004
Topic– Treatment	5.42 ± 0.9	8.83 ± 0.389	0.002
Total score	19.42 ± 3.77	29.75 ± 1.712	0.002
*Related-Samples Wilcoxon Signed Rank Test			

Category Score /Criteria	Pre-Test	Post-Test	p**
Inadequate (No. / %)	1 (8.3%)	0 (0%)	-
Moderate (No. / %)	9 (75%)	0 (0%)	
Adequate (No. / %)	2 (16.7%)	12 (100%)	

**Marginal Homogeneity Test

Table 2
THE AVERAGE VALUE OF PRE- AND POST-EDUCATIONAL PROGRAM
TOTAL SCORES FOR MIDWIVES

Criteria	Pre-Test	Post-Test	p*
	Mean ± SD	Mean ± SD	
Topic– Prevention	1 ± 0.426	3	0.001
Topic – Prediction	0.33 ± 0.492	1	0.005
Topic – Pathophysiology	0.42 ± 0.515	0.83 ± 0.389	0.059
Topic – Definition	2.17 ± 1.193	2.67 ± 0.492	0.194
Topic– Diagnosis	2.08 ± 1.165	3.08 ± 0.793	0.027
Topic– Management	3.75 ± 1.288	8.33 ± 1.435	0.002
Topic – Treatment	3.25 ± 1.215	7.42 ± 1.084	0.002
Total score	13 ± 3.542	26.33 ± 2.839	0.002
*Related-Samples Wilcoxon Signed Rank Test			

Category Score /Criteria	Pre-Test	Post-Test	p**
Inadequate (No. / %)	8 (66.7%)	0 (0%)	0.002
Moderate (No. / %)	4 (33.3%)	3 (25%)	
Adequate (No. / %)	0 (0%)	9 (75%)	

**Marginal Homogeneity Test

post-educational program versus pre-educational program (p<0.05), with the exception of scores for the pathophysiology and definition of preeclampsia topics, where the differences observed weren't statistically significant (p>0.05). The share of resident physicians with adequate total scores post-educational program (100%) increased statistically significantly in comparison to the share of resident physicians with adequate scores pre-educational program (16.7%).

Table 3
AVERAGE VALUE OF PRE- AND POST-EDUCATIONAL PROGRAM
TOTAL SCORES FOR NURSES

Criteria	Pre-Test	Post-Test	p*
	Mean ± SD	Mean± SD	
Topic– Prevention	1 ± 0.729	2.92 ± 0.322	<0.001
Topic– Prediction	0.43 ± 0.499	0.92 ± 0.269	<0.001
Topic– Pathophysiology	0.45 ± 0.501	0.97 ± 0.174	<0.001
Topic– Definition	1.74 ± 0.756	2.71 ± 0.458	<0.001
Topic – Diagnosis	1.51 ± 0.904	3.11 ± 0.812	<0.001
Topic– Management	2.51 ± 1.359	8.4 ± 1.043	<0.001
Topic – Treatment	3.35 ± 1.217	7.48 ± 1.147	<0.001
Total score	10.98 ± 3.38	26.51 ± 2.593	<0.001
*Related-Samples Wilcoxon Signed Rank Test			

Category Score /Criteria	Pre-Test	Post-Test	p**
Inadequate (No. / %)	60 (92.3%)	0 (0%)	<0.001
Moderate (No. / %)	5 (7.7%)	10 (15.4%)	
Adequate (No. / %)	0 (0%)	55 (84.6%)	

**Marginal Homogeneity Test

The total score increased significantly post-educational program versus pre-educational program (p<0.05); with the exception of scores for the pathophysiology and definition of preeclampsia topics, where the differences observed weren't statistically significant (p>0.05). The differences between the score performance categories measured pre- and post-educational program were statistically significant (p=0.002), as such the share of midwives with adequate total score post-educational program (75%) increased statistically significantly in comparison to the share of pre-educational program midwives with adequate total score (0%).

All the scores measured for the 7 topics and also the total score increased significantly post-educational program in comparison to pre-educational program values (p<0.001). The differences between the score performance categories measured pre- and post-educational program were statistically significant (p<0.001), as such the share of nurses with adequate total score post-educational program (84.6%) increased statistically significantly in comparison to the share of pre-educational program nurses with adequate total score (0%). The intensive educational program regarding preeclampsia has a highly significant positive influence on the knowledge of health professionals. There was a clear transfer of knowledge among the participants. (p ≤ 0.001). By comparison, Abed-El Sayed reported in 1994 that the reasons for a lower pre-test result could be in various factors, such as knowledge deficit and lack of understanding of how and when to apply knowledge in practice [18]. This study found that there were no written guidelines, records and standards regarding preeclampsia for health providers in the clinical department. These results correlated with the study by Chen et al. 2011, and Tsai, P.S. 2011 and confirmed that a bad structure in clinical areas contributed to bad care for the patients[19]. A current study by Remadurg et al, 2016, reported that training and regular evaluation of knowledge and competences of the health professionals in connection with early diagnosis and

immediate treatment of preeclampsia had to be updated [20]. Another study recommends that nurses and midwives not only should improve their knowledge, but also their practice, to ensure competence regarding patient care [21]. The same result was brought by the study by Ariff et al. 2013, which could prove the importance of training programs for health professionals. It emphasised the necessity of regular evaluation of health personnel training to close gaps and develop targeted further education modules [22]. Stellenberg EL et al. also came to the conclusion that measures should be taken aggressively to improve knowledge in their study from 2016 [21].

Table 4
THE SHARE OF PARTICIPANTS WITHIN THE STUDY WHO CORRECTLY IDENTIFIED THE DOSE OF MAGNESIUM SULPHATE RECOMMENDED BY WHO, PRE- AND POST-EDUCATIONAL PROGRAM, IN COMPARISON TO THE PROFESSIONAL CATEGORIES

Professional categorie	Pre-Test (Correct answer)	Post-Test (Wrong answer)	p*
Resident Physician	3 (25%)	12 (100%)	0.004
Midwife	0 (0%)	1 (8.3%)	1.000
Nurse	4 (6.2%)	25 (38.5%)	<0.001

*Related-Samples Mc-Nemar Test

Data from table 4 and figure 1 illustrates the share of participants within the study who correctly identified the dose of magnesium sulphate recommended by WHO, pre- and post-educational program, in comparison to the professional categories. Referring to the professional category, only for resident physicians (p=0.004) and nurses (p<0.001), the McNemar tests showed statistically significant differences between pre and post-educational program percentages of respondents who responded correctly, in both cases, the post-educational program percentages being significantly higher in comparison to the pre-educational program percentages. The study results support the recommendation of magnesium sulphate as a life-saving medicine and the best strategy for preventing and treating convulsions in severe preeclampsia/eclampsia [23-26]. The risk of eclampsia halves if patients with severe preeclampsia are treated with magnesium sulphate [27]. While it is imperative for health professionals to know what drugs should be used for effective management, only one quarter of the resident physician know the proper loading and maintenance doses of magnesium sulphate that is recommended by the World Health Organization. Oladapo et al. 2015 report that poor knowledge among health professionals makes it hardly surprising that pregnancy complications cause a higher degree of maternal deaths than any other cause, including postpartum hemorrhage [28]. Health professionals should be sufficiently trained to administrate magnesium sulphate at the right time and at the right amount, but they also need to know the warning signs for magnesium sulphate toxicity and the proven antidote, calcium gluconate. In our study, Currently, this knowledge is lacking.

The McNemar test showed significant differences between the percentages of correct answers pre- and post-educational program (p<0.001), noting that the share of participants who correctly identified the signs of toxicity was significantly higher post-educational program (59.6%) versus pre-educational program (13.5%). There results are in agreement with the study of Gorrie et al. [29]. Misconceptions among medical professionals concerning the potential dangers of magnesium sulphate has contributed to the drug's non-use [26]. Such misunderstandings may also lead to suboptimal practices, such as infrequent blood pressure and proteinuria measurement, and the use of diazepam in place of magnesium sulphate [31,32].

It cannot be emphasised enough that blood pressure monitoring during pregnancy is crucial for the safety of mothers and babies [33,34]. It has turned out that blood pressure values during pregnancy are connected to a continuous inverse effect on foetal growth [35]. Hypertensive disorders in pregnancy that are not examined and diagnosed may lead to premature births, still births, intrauterine death, intrauterine growth restriction and termination of pregnancy [36-38].
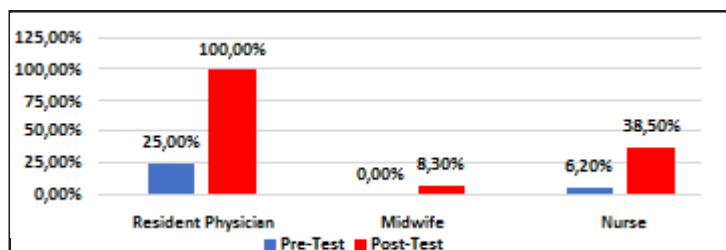

Fig. 1. The share of participants within the study who correctly identified the dose of magnesium sulphate recommended by WHO, pre- and post-educational program, in comparison to the professional categories
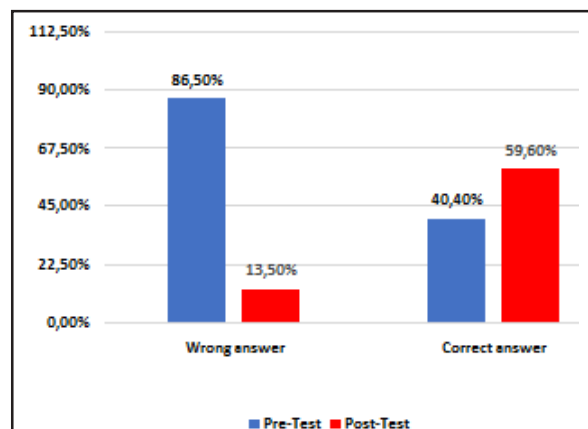
Table 5
THE SHARE OF PARTICIPANTS WITHIN THE STUDY WHO CORRECTLY IDENTIFIED THE SIGNS OF TOXICITY FOR MAGNESIUM SULPHATE, PRE- AND POST-EDUCATIONAL PROGRAM

Criteria	Pre-Test	Post-Test	p*
Wrong answer	77 (86.5%)	12 (13.5%)	<0.001
Correct answer	36 (40.4%)	53 (59.6%)	

*Related-Samples Mc-Nemar Test

Fig. 2. The share of participants within the study who correctly identified the signs of toxicity for magnesium sulphate, pre- and post-educational program
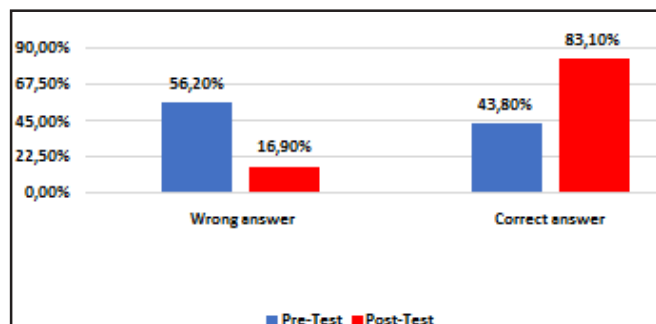
Table 6
THE SHARE OF PARTICIPANTS WITHIN THE STUDY WHO
CORRECTLY IDENTIFIED THE VALUES FOR BLOOD PRESSURE AT
WHICH ANTI-HYPERTENSIVE TREATMENT IS INDICATED FOR A
PREGNANT WOMAN, PRE- AND POST-EDUCATIONAL PROGRAM

Criteria	Pre-Test	Post-Test	p*
Wrong answer	50 (56.2%)	15 (16.9%)	<0.001
Correct answer	39 (43.8%)	74 (83.1%)	

*Related-Samples Mc-Nemar Test

Fig. 3. The share of participants within the study who correctly identified the values for blood pressure at which anti-hypertensive treatment is indicated for a pregnant woman, pre- and post-educational program

The McNemar test showed significant differences between the percentages of correct answers pre- and post-educational program (p<0.001), noting that the share of participants who correctly identified the values for blood pressure at which anti-hypertensive treatment is indicated was significantly higher post-educational program (83.1%) versus pre-educational program (43.8%). In the past, the focus was on preventing eclamptic seizures that are associated with a greater morbidity and mortality among neonates and mothers alike. Delayed treatment of hypertension is the main cause of this condition. The majority of women who die of severe preeclampsia die from stroke [39]. Only administration of blood-pressure-reducing medicines can prevent stroke. This is the key to saving lives in case of complications at severe preeclampsia [26,40-42]. In contrast to the relatively simple prevention of eclamptic seizures, there is a gap in knowledge and application of therapeutic measures to prevent stroke by controlling blood pressure. Typically, systolic blood pressure of ≥160 and/or diastolic blood pressure ≥105 has been recommended to be treated [43]. In practice, clinicians institute start treatment on a lower level of systolic or diastolic blood pressure already.

Table 7
THE SHARE OF PARTICIPANTS WITHIN THE STUDY WHO
CORRECTLY IDENTIFIED THE PREVENTION OF PREECLAMPSIA,
PRE- AND POST-EDUCATIONAL PROGRAM

Criteria	Pre-Test	Post-Test	p*
Wrong answer	76 (85.4%)	13 (14.6%)	<0.001
Correct answer	2 (2.2%)	87 (97.8%)	

*Related-Samples Mc-Nemar Test

The McNemar test showed significant differences between the percentages of correct answers pre- and post-educational program (p<0.001), noting that the share of participants who correctly identified the prevention of preeclampsia was significantly higher post-educational program (97.8%) versus pre-educational program (14.6%).
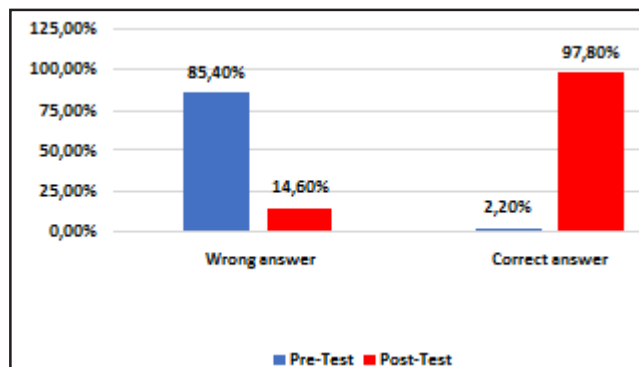

Fig. 4. The share of participants within the study who correctly identified the prevention of preeclampsia, pre- and post-educational program

There are no clear strategies to prevent the onset of preeclampsia, although more recent studies show that aspirin at a dose of 150 mg per day from the 11 to 14 weeks of gestation until 36 weeks of gestation resulted in a significantly lower incidence of early preeclampsia [44]. P Rachael James showed that early diagnosis was able to improve the result of pregnancy, since improved maternal and fetal progress control led to earlier recognition of clinical symptoms of disease, medications could then be given at need [45].

Conclusion

Prevention is so much better than healing because is saves the labour of being sick (Thomas Adams 1618) and *Death caused by preeclampsia is avoided with early detection and effective treatment of women with preeclampsia* (WHO, 2011).

Based on the findings of the study, it can be concluded that the intensive educational program regarding preeclampsia had a high significantly positive influence on the knowledge of health professionals (p ≤0.001). This is the first study for the educational program of health professionals regarding the management of preeclampsia that was conducted in Romania and evaluated both subjective and objective practices of preeclampsia management, as well as the attitude towards the guidelines for preeclampsia management. Many knowledge gaps of health professionals at the Clinical Hospital of Obstetrics and Gynecology Polizu in Bucharest, Romania were found in this study. This is not acceptable according to the preeclampsia knowledge standards.

Recommendations

ZERO Maternal Mortality in Romania by Pre-eclampsia. We must always remind ourselves that a maternal death is an avoidable death and nobody should die or become seriously ill because of their own ignorance or their health care providers. Further educational programs are required to prepare lesson strategies to improve learning and commitment of health professionals regarding emergencies connected to birth. Beyond this, use of simulation training, case studies, evidence-based practices and records is recommended to identify and avoid error sources in daily teamwork. Clinical guidelines for preeclampsia should be developed to reduce complications during pregnancy and the resulting increased maternal and perinatal mortality in Romania.

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