Original Article

Discovering the barriers to spread the usage of peripherally inserted central venous catheters in the neonatal intensive care units: A qualitative research

Ali Zargham-Boroujeni, Zahra Mahdavi-Lenji[1], Marzieh Hasanpour, Alireza Sadeghnia[2]

Abstract

Background: By increasing the survival of immature newborns, intravenous access methods, used to provide intravenous therapy, became more important. More attention has been recently paid on peripherally inserted central venous catheters in newborns, although it is yet unknown in Iran. In this study, we tried to discover the barriers to spread the usage of peripherally inserted central venous catheters (PICC) in the neonatal intensive care units of hospitals affiliated to Isfahan University of Medical Sciences.

Materials and Methods: In this descriptive explorative qualitative research, conducted from December 2011 to April 2012 with purposeful sampling and snowball method, participants were selected from nurses and residents of neonatology and neonatal specialists working in Alzahra, Shahid Beheshty, and Amin hospitals, until data saturation occurred. Data were analyzed with thematic analysis proposed by Broun and Clarke in 2006.

Results: Data analysis yielded 175 initial codes, 12 sub-themes, and 3 main themes. The main themes included barriers related to procedure and maintenance, barriers related to persons providing care, and barriers related to management and planning.

Conclusions: One of the major problems in premature newborns during hospitalization is long-term and safe intravascular access; therefore, more use of PICC is needed. A complete planning is also needed to eliminate barriers and to provide required catheters. Educating the personnel is also necessary.

Key words: Barrier, central venous, Iran, neonatal intensive care unit, nursing, peripheral catheterization, qualitative research

Introduction

In recent years, survival of immature infants has increased.[1] Based on WHO report, 1 out of 10 infants born in 2010 were immature, resulting in 15 million immature births in a year.[2] These infants are not able to fulfill their needs orally. Consequently, intravenous access is so crucial among them to provide them with fluids and intravenous therapy.[3] In order to have intravenous access, the first option in infants is short peripheral catheters which are appropriate for short-term intravenous therapy. There are restrictions for infusion of fluids. In infants with prolonged hospitalization, usage of these catheters may lead to frequent catheterization.[4] To solve this problem, various types of central conventional catheters are available that are inserted by physicians who have surgical skills, putting the infants in danger of pneumothorax and hemothorax.[5]

Peripherally inserted central venous catheters (PICC) are the other type of catheters which are inserted through peripheral veins and can diminish the complications of conventional central catheters.[5,6] Insertion of these catheters in central veins decreases some complications such as thrombosis, and catheter occlusion and leakage, compared to short peripheral catheters. On the other hand, as this procedure is conducted in the ward and bedside, patients' monitoring is preserved and patients' transfer out of the ward for catheter insertion is cancelled.[7] Another advantage in using these catheters is safe infusion of irritating drugs or those with high osmolality and non-physiologic acidity.[8-10] In cases of intravenous therapies longer than 6 days, their insertion is recommended.[11] In spite of having the above-mentioned advantages, these catheters are not risk free. The most common complication is catheter-related sepsis. Thrombosis, leakage, phlebitis, catheter embolism, and extravascular fluid aggregation are their other complications.[12,13] Since these catheters are often

Nursing and Midwifery Care Research Center, [1]Faculty of Nursing and Midwifery, [2]Department of Neontology, Faculty of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

Address for correspondence: Dr. Marzieh Hasanpour, Nursing and Midwifery Care Research Center, Faculty of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: hasanpour@nm.mui.ac.ir

inserted by professionally trained nurses,[12,14] the rate of complications can be significantly diminished through promotion of nursing care quality and professional education.[15] Despite the available evidences from the studies conducted in developed countries concerning the advantage of PICC,[8,9,14] short peripheral catheters are vastly used in neonatal intensive care units (NICUs) for long-term intravenous therapies, total parenteral nutrition, and injection of irritating drugs in Iran, leaving the infants subjected to frequent catheterization and the resulting complications.[16] Meanwhile, most of these complications can be prevented by appropriate application of PICC.

To the best knowledge of the researcher, the only Iranian related study is of jalalian-Taghadomi *et al.* (2004-2005) on the patients who had undergone coronary bypass surgery, which was conducted to measure Central Venous Pressure (CVP) with emphasis on the position of the catheter tip.[17] With regard to aforementioned issues, the question is, "what are the barriers for using PICCs even after 40 years of their first use in infants in Iran, despite their advantages?" The researcher, based on the study her observations in NICU, believes that perhaps the high cost of these catheters has restricted their use, although studies have reported its cost efficacy.[18,19] Since its insertion needs staffs training, less number of educated staffs can be a prohibiting factor in this regard. With regard to these barriers in other countries, no article was found on searching the available databases. It was necessary to investigate the experiences of the physicians and nurses who were working in these wards and were familiar with its advantages, with regard to the existing barriers in its application.

As the obtained data are the product of the participants' experiences and to investigate the phenomena deeply,[20] qualitative research seems to be an appropriate method to find the answer for the study question. Therefore, this study was designed and conducted to discover the barriers in spreading the usage of PICC in the NICUs.

Materials and Methods

This was a descriptive explorative qualitative study conducted to discover the barriers of application of PICC among the nurses and secondary year residents of neonatology and neonatal specialists working in three hospitals of Alzahra, Shadid Beheshti, and Amin, affiliated to Isfahan University of Medical Sciences. Gholami Motlagh *et al.*, quoting from Kazemi *et al.*, state that descriptive approach in qualitative research is used when there is little information about a specific phenomenon.[21] After the research project was approved by the ethical committee of the university and research permission was issued in nursing and midwifery faculty, purposive and snowball sampling was conducted in 4 months (December 2011–April 2012) up to data saturation. Data were collected using semi-structured deep interviews and informal observations and field notes. The interviews were conducted inside the ward classroom in the morning shifts (except for one case). After taking a written informed consent, a formal interview of average length of 30 min was conducted. The anonymous interviews were recorded and coded to the relevant participants. In some cases, it was needed to refer to the participant to clarify some obscure points after transcription of the interviews. After the analysis and conducting interviews with 14 participants, the data were almost saturated and the sampling ended. To increase the rigor of the data, we used peer deliberating and peer review, and data collected in three different environments and from the individuals with different educational qualifications and occupations (triangulation of place and individuals) through interviews, informal observations, and field note recording (triangulation methods). Also, the narrations and extracted codes were given to some experts well-acquainted with qualitative research, and the subjects' viewpoints were considered and followed.

Data analysis

The data analysis was conducted by thematic analysis suggested by Brown and Clark (2006) through deductive method. Most of the thematic analysis steps are similar to other qualitative researches.[22,23] In the present study, after each interview, the interviews were listened to and transcribed verbatim.

To assure precise transcription, the interviews were listened to several times. After each interview, data analysis started and primary coding was conducted. This process went on for the other interviews sequentially. In the first step of analysis, primary ideas were highlighted in text. After reading the obtained data frequently and extracting primary ideas, primary codes were formed. Then, the primary related codes were grouped as sub-themes. Next, the related sub-themes were categorized forming main themes. In the last step, the extracted themes were reviewed to assure the relevancy with the codes.

Results

The data were obtained from interviews with 14 participants. The participants comprised eight female nurses, five male physicians, and a female physician. The findings included 175 primary codes, 12 sub-themes, and 3 main themes. The main themes were barriers related to

Table 1: Main themes and sub-themes

Themes	Sub-themes
Barriers related to procedure and maintenance	1-1 Catheter use related factors
	1-2 Complications
	1-3 Insertion skill
	1-4 Nursing care
Barriers related to the persons providing care	2-1 Treatment team function
	2-2 Personal and motivational factors
	2-3 Parents' role
Barriers related to management and planning	3-1 Legal and support problems
	3-2 Human power shortage
	3-3 Financial problems
	3-4 Availability
	3-5 Educational problems

procedure and maintenance, barriers related to persons providing care, and barriers related to management and planning [Table 1].

Barriers related to procedure and maintenance

Participants' experiences showed that the concern about complications is one of the barriers in usage of these catheters. A participant said:

"… perhaps one of the reasons the physicians do not agree (to use them) is their fear due to its high risk. In fact, all we do, if not appropriately done, have some complications."

Some of the participants talked about usage of these catheters as a time-consuming procedure and described that application of PICC may take a long time. Also, shortage of insertion skill is another important issue they face. Nurses' ability to take care of the catheter played an important role in their idea.

Concerning this skill, one of the participants stated:

"… we have no skill at the beginning of the work, but the guys (nurses) get gradually experienced and can insert (the catheters) by themselves."

A nurse as a participant talks about nursing care:

"… the nurse should be able to protect this (the catheter). It means that the patients, if cared well from the arrival to discharge, I mean good (appropriate) nursing care, never face positive CRP or any other problems."

Barriers related to persons providing care

Participants talked about lack of teamwork and professional reliance, lack of self-perseverance to make changes, resistance to change, and parents' objections

A participant said:

"… it is due to the fact that our teamwork is not good. That means there should be interaction between physicians and nurses."

Another participant talked about the necessity of self-perseverance to make changes as a personal factor:

"… now I, in hospital, am working on PICC; yet nobody has accepted my word, I should not give up, but some (personnel) support me well, our matron supports me well."

Regarding the association between lack of skill, high cost, and parents' objection, one of the participants said thus:

"… specially at the beginning, we had a lot of waste, it goes without saying that it makes problems… As patients' accompanying persons ask, 'where is it (the catheter) that we bought for US $10.00?'"

Barriers related to management and planning

Some nurses talked about their fear and concern about the legal issues related to insertion of these catheters. They stated that insertion is not yet in their job description, and this worries them. Some other participants were worried about the less number of nurses working in NICU and mentioned that it can act as an obstacle in taking appropriate care of the catheter. Catheters' high cost was an issue mentioned by nearly all of the participants. They believed that due to the high price, usage of these catheters may not be economical. A participating nurse stated:

"… something we faced while working here is the high price these catheter impose to the patients' accompanying persons…. Most of the times, the high price has been a problem-making factor."

Another participating nurse said:

"… due to its high cost, not all hospitals accept that, you see, a small hospital usually does not tolerate expensive equipments."

Some of the participants talked about inadequate access to these catheters and claimed that provision of the needed catheters and their accessory equipments can increase their usage. Educating the personnel about these catheters was also important in their opinion.

One of the participants explained about the effect of more education about catheters, based on her own experience, as follows:

"… in a seminar in Tehran, there was a female doctor coming from a foreign country. I think one of the hospitals had educated her about the catheters, yes in fact she had

gone to a hospital to be educated … She had precisely been trained for this (catheter) and worked with that(catheter)."

Another participant indicated thus:
"… a nurse can do this (insert the catheter), but just a well-trained nurse… Untrained nurses should not try it, as it is an access way to a central vein, if not careful, the vein may be ruptured. This should be done by a trained nurse. I mean he/she should know about venous anatomy and its possible complications, a known person, not everybody."

Discussion and Conclusion

With regard to the findings, the results were collected in three themes: barriers related to the procedure and maintenance, barriers related to persons providing care, and barriers related to management and planning. With regard to the barriers related to procedure and maintenance, one of the participants' main concern was the incidence of complications. On the other hand, the participants believed that as their usage is limited, their complications have remained unknown leading to prohibition of their usage.

Meanwhile, all their complications are almost known,[24] and numerous studies have been conducted on their complications, comparing them with other peripheral and central catheters.[10,14,25,26]

Xia *et al.* in a retrospective study conducted in China compared one of their most important complications, infection, in the two groups of PICC and peripheral intravenous catheter (PIV), and showed that there was no significant difference concerning incidence of septicemia in these two groups.[10] This study showed a possibility of infection in the use of peripheral intravenous catheters too; therefore, if there is a concern for complications in the use of PICC, it must also be there for PIV. When there is no chance of intravenous access through peripheral catheters, the only way is to send the infant to OP for central catheter that is inserted under general anesthesia and results in, according to various studies, more complications compared to PICC.[14] Meanwhile, there are studies reporting more complications for PICC compared to central catheters inserted through surgery. Turcotte *et al.* in a systematic review study compared two types of catheters and showed that there was no significant difference between them concerning infection, but thrombotic complications were notably more in PICC. They concluded that there was no clear evidence showing that PICC is better than central catheters in critical care environments and they also found it essential to conduct comparative studies to investigate the level of complications.[26]

However, possible complications should not be a reason for ignoring insertion, as the complications can be diminished by high-quality nursing care and nurses' education concerning these complications.[15] Participants indicated catheter insertion as a time-consuming procedure. Although apparently PICC insertion takes more time compared to peripheral intravenous catheters, it should be noted that on one hand, venous access is not convenient in infants due to prolonged hospitalization, and on the other hand, PICC, if cared and maintained well, can remain working for a long time with no need for peripheral intravenous catheters. Schwengel *et al.* (2004) reported the average time of insertion for PICC and peripheral intravenous catheters as 19 (15-25) min and 5 min (3-12), respectively, in patients ranging from infants to those of 14 years of age.[18]

It should be mentioned that in the above study, all the patients were not infants, and the subjects' age range possibly led to shorter average of time for insertion. On the other hand, the subjects were fresh patients recently hospitalized and prepared for surgery, whose peripheral veins were intact.

Participants' experiences showed that skill and experience in insertion is an essential element to insert these catheters. Lourenco and Ohara (2010) believed insertion of PICC needs technical and clinical judgment skills and informed confident and efficient decision making, and the professionals administering them should have acquired theoretical and practical related knowledge through special training courses.[27]

Nurses' capability concerning taking care of these catheters is of great importance from the viewpoint of the participants. Nursing care can obviously affect the incidence of complications and the outcomes for the patients. Camp-Sorrell states that daily intravenous therapies influence nursing care. Nurses' responsibility concerning maintenance of intravenous access tools is increased and their key role in prevention of complications related to these tools is highlighted by the increase in need for intravenous therapies. Usage of long-term tools give the nurses the chance of emphasizing on important caring aspects and patients' monitoring, instead of spending a lot of effort on temporary (short-term) intravenous tools.[28]

However, caring is the main duty of nurses and they should obtain necessary skills concerning taking care of intravenous tools to preserve them in order to provide the patients with a better care.

With regard to the barriers related to persons providing care, lack of teamwork and inter-professional trust was among the factors affecting treatment team's function from the viewpoint of the participants. It is obvious that teamwork increases nurses' self-confidence and self-efficacy. On the contrary, playing the role of a mere operator and lack of active function in patients' treatment diminish nurses' efficiency and self-confidence and delay their professional progress leading to their lower attention to patients' needs.[29]

The participants mentioned personal factors such as lack of self-perseverance, resisting against changes, and outdated information as the reasons for not using these catheters.

Lourenco and Ohara (2006) investigated the scientific knowledge level of nurses concerning PICC and showed that nurses constantly need to update their knowledge and information concerning this procedure to promote their quality of care toward infants.[27] However, many individuals may gradually lose their knowledge through time due to forgetfulness and this fact reveals the necessity for updating their knowledge.

Most of the participants considered the role of the parents so important and added that giving adequate explanation to the parents is crucial.

With regard to direction of caring progress toward the family-centered cares, parents, in addition to physicians and nurses, play a key role in taking care of the infants, and their satisfaction with the treatment is also important. Obtaining a written or an oral consent is essential to insert PICC. Meanwhile, parents' disagreement was found as an inhibiting factor in the present study. Lourenco and Ohara mention that informing the parents is a part of insertion technique. They concluded that after medical and nursing team found the PICC insertion to be necessary, the patients and their families should be guided. Family members have the right to know about the options of treatment, benefits, risks, and expected costs, as well as the experience and competency of those staffs administering the procedure.[27] Therefore, it is an absolute right of the parents to be informed about the advantages and risks of these catheters so that they could decide freely.

With regard to barriers related to management and planning, participants' experiences revealed their concern in relation with legal issues of the catheters' insertion.

They stated that this procedure has not been listed in job description of the nurses, and authorities' support plays an important role in spreading their usage. In nurses' job description issued by Ministry of Health, PICC has not been included. Meanwhile, in countries where PICC is used, it is inserted by nurses. In paragraph 1 of resolution no. 258 of 2001 in Federal Nursing Association, nurses have been licensed to insert PICC.[30]

Pettit and Wyckoff (2007) in the second clinical guide printed for neonate care nurses argue that the nurses authorized to insert PICC should consult with their State Nursing Board to determine whether this procedure is in their field of nursing interventions or not. Insertion of PICC may be considered as an advanced nursing intervention, and therefore needs to be approved by an interdisciplinary committee as a standard procedure.[31] The imbalance between the number of nurses and the number of beds in NICUs was also an important issue, based on some participants' views. With regard to the observed nurse–bed ratio, which was in some cases 1:3, this concern seems logical as high workload decreases the quality of care,[32] which should be considered by the authorities. Participants' experiences showed that high price and lack of medicare coverage was an obstacle in the usage of PICC. At the first glance, high price of PICC compared to PIV seems to impose high costs to the patients, but in the long term, PICC is more economical. Schwengel *et al.* (2004) reported that although the cost of PICC is 1.5–4 folds more than that of PIV, they reasoned that better satisfaction with PICC has made it cost-effective.[18] Xu *et al.* (2008) reported that in a time interval of more than 10 days, PICC is more cost-effective compared to PIV.[19] Based on participants' experiences, lack of proper training in insertion and taking care of PICC was among the major barriers, as the catheter should be inserted by experienced individuals. Some of them indicated lack of information about these catheters and inadequate knowledge as the factors for not using them, which need a precise programming to be solved.

Now, insertion of these catheters is not in the BS and MS curricula of the nursing students, and no specific organization is responsible for its education and insertion. Web search with Persian key words concerning its education in Iran yielded no scheduled education on it.

Education about these catheters promotes nurses' skill and quality of care, reduces complications, and increases their cost efficacy. Anh and Susan (2005) showed that with designing an educational intervention based on Albert Bandora's social learning theory, an increase is seen in the nurses' knowledge and self-efficacy concerning PICC, leading to a notable reduction in the level of catheter obstruction (29%-8.5%) in a 6-month period.[33]

With regard to the current need which is felt for PICC insertion, an increase in its use is predicted. Based on the findings of the present study, there are still problems in PICC application, which can delay the trend of its progress. It is suggested to have a precise program for organized education of the staffs about insertion and its care, with an emphasis on prevention of the complications, based on international standards in order to use them as a safe treatment option for the infants hospitalized for a prolonged time.

This procedure is suggested to be included in the job description of NICU nurses. One of the restrictions of the present study was the generalization of the results. As the problem in PICC usage prevails all over Iran and this qualitative study was conducted in just one city, the findings cannot be generalized.

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References

1. Stoelhorst GM, Rijken M, Martens SE, Brand R, den Ouden AL, Wit JM, *et al*. Changes in Neonatology: Comparison of two cohorts of very preterm infants (Gestational Age <32 Weeks): The project on preterm and small for gestational age infants 1983 and the leiden follow-up project on prematurity 1996-1997. Pediatrics 2005;115:396-405.
2. Howson Ch, Kinney M, Lawn J. Born too soon global action report on preterm birth. Chapter 1. Preterm birth matter. 2012. p. 9. Available from: http://www.who.int/pmnch/media/news/2012/201204_borntoosoon-report.pdf [Last accessed on 2013 Jan 28].
3. Sharp EL. Developing a nurse-directed peripherally inserted central catheter team in the neonatal intensive care unit. Newborn Infant Nurs Rev 2006;6:225-9.
4. Sundquist BS, Swanson A. Neonatal infusion therapy: preventing complications and improving outcomes. Newborn Infant Nurs Rev 2006;6:193-201.
5. Matsuzaki A, Sumino A, Koga Y, Hatano M, Hattori S, Hara T. Long –term use of peripherally inserted central venous catheter for cancer chemotherapy in children. Support Care Cancer 2006;14:153-60.
6. Yamadi R, Morita T, Yashiro E, Otani H, Amona K, Tei Y, *et al*. Patient- report usefulness of peripherally inserted central venous catheters in terminally Ill cancer patient. J Pain Symptom Manage 2010;40:60-6.
7. King DS, Cruz ED, Kaufman J. A model for a Nurse- Led Program of bedside placement of peripherally inserted central catheters in neonates and infants with congenital cardiac disease. Cardiol Young 2010;20:302-7.
8. Pettit J. Assessment of Infants with peripherally inserted central catheters: Part 1. detecting the most frequently occurring complications. Adv Neonatal Care 2002;2:304-15.
9. Walshe LJ, Malak SH, Eagan J, Sepkowit KA. Complication rates among cancer patients with peripherally inserted central catheters. J Clin Oncol 2002;20:3276-81.
10. Xia B, Tang J, Xiong Y, Li XH, Mu DZ. Peripherally Inserted central catheters and the incidence of candidal sepsis in VLBW and ELBW infants: Is sepsis increased?. World J Pediatr 2010;6:154-7.
11. O'Grady NP, Alexander M, Patchen DE, Gerberding JL, Heard SO, Maki DG, *et al*. Guidelines for the prevention of intravascular catheter-Related Infections. Center Dis Control Prev 2002;51:1-26.
12. Deborah C. Minimizing risks associated with peripherally inserted central catheters in the NICU. MCN Am J Matern Child Nurs 2001;26:17-22.
13. Barria RM, Lorca P, Munoz S. Randomized controlled trial of vascular access in newborns in the neonatal intensive care unit. J Obstet Gynecol Neonatal Nurs 2007;36:450-6.
14. Franceschi AT, da Cunha ML. Adverse events related to the use of central venous catheters in hospitalized newborns. Rev Lat Am Enfermagem 2010;18:196-202.
15. Janes M, Kalyn A, Pinelli J, Paes B. A Randomized trial comparing peripherally inserted central venous catheters and peripheral intravenous catheters in infants with very low Birth Weight. J Pediatr Surg 2000;35:1040-4.
16. Nikfarid L, KHojasteh N, GHanbarian A. Investigation of relation between dwell time of peripherally intravenous catheters in hospitalizad neonates and Children. HAYAT 2006;12:17-25.
17. Jalalian-Taghadomi R, Motahedi B, Gannad MA, Pevandi A. Use of Intravenous Electrocardiogram in Placement of the Tip of Peripherally Inserted Central Catheters in an Optimum Position. Iranian Surg J 1384;13. Available from: http//:www.SID.ir. [Last accessed on 2012].
18. Schwengel DA, McGready J, Berenholtz SM, Kozlowski LJ, Nichols DG, Yaster M. Peripherally Inserted Central Catheters: A Randomised, Controlled, Prospective Trial in Pediatric Surgical Patients. Int Anesth Res Soc 2004;99:1038-43.
19. Xu J, Cai W, Tang Q. Economic Effectiveness of Peripherally Inserted Central Catheters vs Peripheral Intravenus Catheters in Neonatal Infusion Therapy. Clin Nut Suppl 2008;3:195.
20. Oskouie F, Peyrovi H. qualitative research in nursing.1st ed. Tehran, Iran: Iran University of Medical Science; 2005. p. 21-2.
21. Gholami-Motlagh F, Karimi M, Hasanpour M. Iranian nursing students' experiences of nursing. Iran J Nurs Midwifery Res 2012;17:S107-14.
22. Rahmati-Khameneh S, Mehrabi T, Izadi-Dehnavi M, Zargham-Boroujeni A. The Process of Major Depressive Disorder (MDD) in Woman Referred to the Health Centers. Iran J Nurs Midwifery Res 2011;16:244-52.
23. Broun V, Clarke V. Using Thematic Analysis in Psychology. Qual Res Psychol 2006;3:77-101.
24. Roke JM, Ramasethu J, Alfred CA. Central Venous catheterization. In: MacDonald MG, Ramasethu J, editors. Atlas of procedures in neonatology. 4th ed. Philadelphia, United States of America: Lippincott Williams & Wilkins a Wolter Kluwer; 2007. p. 216.

25. Ohki Y, Yoshizawa Y, Watanabe M, Kuwashima M, Morikawa A. Complications of percutaneously inserted central venous catheters in Japanese neonates. Pediatr Int 2008;50:636-9.
26. Turcotte S, Dube S, Beauchamp G. Peripherally Inserted Central Venous Catheters Are Not Superior to Central Venous Catheters in the Acute Care of Surgical Patients on the Ward. World J Surg 2006;30:1605-19.
27. Lourenço SA, Ohara CV. Nurses' knowledge about the insertion procedure for peripherally inserted central catheters in newborns. Revista. Latino-Americana de. Enfermagem 2010;18:189-95.
28. Camp-Sorrell D. State of the science of oncology vascular access devices. Semin Oncol Nurs 2010;26:80-7.
29. Shams B, Kheradmand A, Mahmoodi M, Hosseini F, Rafaie E, Vaghefdavari F. Interns' Viewpoints about Nurses' Capability and Behavior towards Patients and Interns. Iran J Med Educ 2005;12:63-7.
30. Federal Board of Nursing. Resolution No. 258 of July 12, 2001. Rio de Janeiro [Accessed on July 21, 2006]. Available from: http://www.portalcofen.gov.br/ legislação/r258.htm. [Last accessed on 2013 Jan 28].
31. Pettit J, Wyckoff MM. Peripherally Inserted Central Catheters: Guideline for Practice. 2nd ed. National Association of Neonatal Nurses. Available from: http://www.NANN.org. [Last accessed on 2007].
32. Kane RL, Shamliyan TA, Mueller C, Duval S, Wilt TJ. The Association of Registered Nurse Staffing Levels and Patient Outcomes: Systematic Review and Meta-Analysis. Med Care 2007;45:1195-204.
33. Anh N, Susan M. A Theory-based Intervention to Improve Nurses' Knowledge, Self-efficacy, and Skills to Reduce PICC Occlusion. J Infus Nurs 2005;28:173-81.

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