Perinatal Staff Nurse Medical Device Use and Education
Edwina A. McConnell, RN, PhD, FRCNA

ABSTRACT

Background: How and what RNs working in the perinatal area initially learned about the medical devices they use and the sequelae of device use both for patients and staff were explored.

Method: Eighty-five perinatal staff nurses working at a 500-bed tertiary care hospital in a medium-size midwestern American city were surveyed using a mailed questionnaire comprised of 26 open-ended and closed-ended questions pertaining to device education, consequences of device use, demographic characteristics, and employment situation.

Results: Most participants (n = 48, 62.3%) initially learned about the most frequently used device by reading the user/instruction manual. At least 90% (n = 77) of participants indicated they initially had learned how to operate the device, its purpose, function, and patient factors indicating use. Inadequate device knowledge was related to nurse stress, and being unsure how to use the device and fear of harming the patient were the two reasons most frequently identified as causing the stress. Six percent (n = 5) of staff nurses had used a device that caused patient harm.

Conclusion: What RNs initially learn about medical devices may be related to how they learn, and the continuing increase in nurse use of medical devices has implications for all aspects of professional nursing: curriculum, teaching clinical nursing, continuing education and staff development, and research.

Registered nurses working in the perinatal area use many medical devices in the delivery of patient care, and the use of these devices has important implications for patients as well as RNs. Delivery of knowledgeable, safe care depends on nurses understanding the patients' problems that require the use of a device and how it interacts with patients, safely operating the device, recognizing patients' responses to it, interpreting data obtained from it (Carnevali, 1985), and intervening if the device malfunctions (George & Boruch, 1989).

This article describes how and what RNs working in the perinatal area learn about the medical devices they use in direct patient care, as well as the consequences of device use for both for patients and staff. This article draws on data from a larger study undertaken to explore the same issues from a broader perspective (McConnell, 1995).

As providers of direct care in the perinatal area, staff nurses are the primary users of medical devices. A medical device is any article or health care product intended for use in the diagnosis of disease or other condition or for use in the care, treatment, or prevention of diseases. A device does not achieve any of its primary intended purposes by chemical action or by being metabolized (United States Department of Health and Human Services, Public Health Service,
Food and Drug Administration, 1984). The importance of the underlying requisite knowledge and skills needed for competent device use is acknowledged by the Joint Commission on Accreditation of Healthcare Organizations’ (JCAHO) (1988) statement that “more than 90% of the time, satisfactory equipment performance depends on a trained operator” (p. 32).

The nursing literature emphasizes the importance of nurses being knowledgeable and proficient with the medical devices they use in direct care. Nurses must be technically competent with them (McCconnell, 1989, 1990; McMullen, 1990; McRae, 1993; Wiley, 1976), be able to integrate device-provided data with patients’ conditions, and intervene appropriately if the device malfunctions (George & Boruch, 1989).

Problems arise when nurses lack knowledge and understanding of the devices they use. These problems, which are not mutually exclusive, can affect patients and their care, as well as nurses themselves.

Patients can experience both physical harm and emotional distress (Abranson, Wald, Grenvik, Robinson, & Snyder, 1980; Fitter, 1986; McConnell, 1987, 1990; McMullen, 1990; McRae, 1993; Pillar, 1991; Sinclair, 1988), while RNs can become overly dependent on technology (McConnell, 1987, 1990; McMullen, 1990), increasingly liable (McRae, 1993; McMullen, 1990; Tammello, 1990), unaware of malfunctioning (Fitter, 1986; McConnell, 1987, 1990; McRae, 1993), and unable to communicate device problems to personnel responsible for device maintenance and repair (Dyro, 1983; Tammello, 1990). Furthermore, nurses can experience increased stress because of inadequate device education (Fitter, 1986; McConnell, 1987, 1990).

The nature and quality of device education can vary widely (Fitter, 1986; McConnell, 1987), and numerous authors (Fitter, 1986; Kinnick, 1989; McConnell, 1987; Pillar, 1991) have addressed medical device education and its limitations. Suggestions for improvement include both undergraduate and graduate curricula changes (Abbey, 1990; Kinnick, 1989; Walleck, 1989) and increased emphasis on hospital inservice and orientation programs (Fitter, 1986; McConnell, 1989; Pillar, 1991). See McConnell (1995) for the unabridged literature review.

Regardless of the importance of staff nurses as primary operators of medical devices, no research was found pertaining specifically to how and what staff nurses learn about the devices they use in direct patient care. The purposes of this study were to explore:

• How and what perinatal staff nurses learned about the medical devices they use in direct patient care.
• The sequelae of device use for both patients and staff.

METHOD
Sample
All RNs working at a 500-bed tertiary care hospital in a medium-size midwestern American city were invited to participate. This hospital provided many diagnostic and treatment services; thus, staff nurses used diverse devices in the direct care of patients. A staff nurse was a RN who provided direct patient care. Of the 516 nurses, 513 were eligible according to this criterion.

All participants working in the perinatal area who responded (N = 85) to a mailed questionnaire were female, and their mean age was 40.2 (SD = 8.7 years; range 25 to 64 years). The majority (80.5%) worked part-time, and the average number of hours worked in a 2-week period, excluding over-time, was 39.3 (SD = 17.12 hours; range 8 to 72 hours). Respondents had worked as RNs an average of 14 years (SD = 9.4 years; range 7 months to 40 years) and on their current unit an average of 7.5 years (SD = 8.1 years; range 2 months to 37 years). For 51.2% (n = 43) the basic level of RN education was a baccalaureate degree; 31% (n = 26) had a diploma; 15.5% (n = 13) had an associate’s degree, and 2.4% (n = 2) had a master’s degree. The highest level of RN education for 58.3% (n = 49) was a baccalaureate degree; 22.6% (n = 19) had a diploma; 13.1% (n = 11) had an associate’s degree; 6.0% (n = 5) had a master’s degree or higher.

Measures
The survey questionnaire had 26 items identified from McConnell’s (1987, 1989) previous work in the area of human-machine interface in clinical nursing practice and from selected references. Open-ended and closed-ended questions related to four areas:

• Device education.
• Consequences of device use.
• Demographic characteristics.
• Employment situation.

Questions addressing device education focused on how and what staff nurses initially learned about the device they identified as using most frequently in the direct care of patients in the past 3 months they worked. Other questions pertained to learning about devices that nurses used infrequently. Questions about consequences of devices used concentrated on staff nurse and patient outcomes and elicited infor-
TABLE 1

METHODS BY WHICH RNS INITIALLY LEARNED TO USE THE MEDICAL DEVICE THEY HAD USED MOST FREQUENTLY IN THE PAST 3 MONTHS (N = 85)

<table>
<thead>
<tr>
<th>Method of Learning</th>
<th>Percentage* of Nurses Reporting Each Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read the user/instruction manual</td>
<td>62.3</td>
</tr>
<tr>
<td>Read product literature accompanying the device</td>
<td>50.6</td>
</tr>
<tr>
<td>Trial and error (self-taught)</td>
<td>49.4</td>
</tr>
<tr>
<td>Watched a videotape or slide tape</td>
<td>46.8</td>
</tr>
<tr>
<td>Consulted the policy and procedure manual</td>
<td>37.7</td>
</tr>
<tr>
<td>Received instruction in nursing school</td>
<td>11.7</td>
</tr>
<tr>
<td>Listened to an audiotape</td>
<td>3.9</td>
</tr>
</tbody>
</table>

* Percentages do not sum to 100% because respondents were able to mention more than one method.

mation about the most positive and most negative aspects for nurses of using medical devices in the direct care of patients. Additionally, participants were asked if their use of any medical device in direct care made them feel stress and if they had ever used a medical device that caused a patient harm.

Content analysis was used to derive and quantify categories of responses for the open-ended questions pertaining to recommendations and suggestions that staff nurses had for becoming and remaining proficient with devices they used less than one time per month and for the positive and negative aspects for nurses of using devices in the direct care of patients. Interrater reliability was established between two independent coders, and Scott’s pi was calculated.

Content validity of the questionnaire was determined through a review by four staff nurses and four nurse educators expert in the area of medical device use. See McConnell (1995) for specific, additional information about the measures including items comprising the questionnaire.

Procedures

The study design was a cross-sectional survey, using a mailed questionnaire. After receiving permission from the institutional review board to contact subjects, each participant was mailed a questionnaire packet consisting of a cover letter, a questionnaire, and a preaddressed, stamped envelope. Return of a completed questionnaire was interpreted as informed consent.

A computer-generated list of the names of all RNs working as staff nurses was obtained from the hospi-
tal personnel department. Questionnaire packets were sent to home addresses as were reminder letters and replacement questionnaire packets at two follow-up points. The response rate was 63% (N = 323); of this total 26.3% (n = 85) worked in the perinatal area. The format of the computer-generated list precluded computation of a perinatal nurse response rate.

Descriptive statistics were used to describe and summarize findings. Chi-square was used to assess associations between stress and employment status, as well as between incidents of patient harm and employment status. Spearman rank-order correlation was used to assess associations between nurse stress and respondents’ ages, time on primary unit, and time as a RN, as well as between incidents of patient harm and respondents’ ages, time on primary unit, and time as a RN. Gamma was used to assess associations between number of years of RN education, how and what nurses learned initially, nurse stress, and incidents of patient harm.

RESULTS

Participants identified the external fetal monitor and patient-controlled analgesia machine as the medical devices they had used most often in the care of patients in the past 3 months. Of these devices, the perinatal nurses had used the external fetal monitor most frequently.

“Read the user/instruction manual” was the method most frequently identified to learn initially about the device participants had used most frequently in the past 3 months (Table 1). Only 11.7% had received instruction in nursing school. Number of years of RN education was not significantly associated with any method of initial learning (for each of 18 comparisons, p > .05).

Of the respondents, 75% (n = 63) had attended an inservice presentation about the medical device they had used most often in direct patient care over the past 3 months. Typically these inservice offerings were presented by a manufacturer’s representative (54.8% of cases, n = 34) or nursing staff educator (46.8% of cases, n = 29). These percentages total more than 100% because participants provided more than one answer. “Hands-on” training was part of learning to use this most frequently used device for nearly all (97.6%, n = 82) nurses.

Nearly 95% (n = 77) of respondents indicated that they had received instruction from another staff member on their unit about the device they had used most frequently in the past 3 months. In 75.3% (n = 58) of cases, this person was another staff nurse. Similarly,
the 6.1% \((n = 5)\) of participants who received instruction about this device from a staff member on another unit noted that in 60% \((n = 3)\) of cases this individual was a staff nurse.

At least 90% of respondents indicated they initially learned the following four facts about the device they had used most frequently in the care of patients in the past 3 months (Table 2):

- How to operate it.
- Its purpose.
- Its function.
- Patient factors indicating use.

Only 51% learned the scientific principles on which the device is based, and less than 50% learned facts such as potential hazards for the patient, how to document machine malfunction, and potential hazards for the user.

Only one association between RN nurse education and information learned about the device was statistically significant. Number of years of basic education level was negatively correlated with how to document machine malfunction (\(\Gamma = -0.40, p < .05\)).

The two major categories of recommendations and suggestions both for becoming and remaining proficient with devices they use infrequently (less than one time per month) were in-service programs and available literature (Table 3). A third category was “hands-on” experience.

Nurses indicated that the most positive aspect of using medical devices in direct patient care was increased quality of care (58.8%, \(n = 57\)). This category included comments about making quicker, more accurate patient assessments and evaluating the effects of medications. Two other categories of positive aspects were saving time (36.1%, \(n = 35\)) and increasing the professionalism of nurses (5.2%, \(n = 5\)). The former category included items such as decreasing the workload of nurses and facilitating the provision of patient care. Comments in the latter category included more involvement in making decisions about patient care, increased self-esteem, and enhanced career opportunities.

For nurses, the most negative aspect of using medical devices in direct patient care was providing decreased quality of patient care (53.7%, \(n = 51\)). This category included items such as nurses being unaware of the implications of device use, having less time to spend with patients, and diminishing patient dignity. Other negative aspects were lack of education and knowledge about the device (14.7%, \(n = 14\)) and consuming time (11.6%, \(n = 11\)).

Inadequate device education was related to nurse stress; 73.2% \((n = 60)\) of RNs working in the perinatal area indicated that their use of any medical device in the direct care of patients made them feel stressed. While a total of 41% identified the external fetal monitor (27.9%, \(n = 17\)) and intravenous infusion pump (13.1%, \(n = 8\)) as causing the most stress, another 27.9% \((n = 17)\) identified devices that were either “unknown” or “unfamiliar” to them (14.8%, \(n = 9\)) or those that were malfunctioning (13.1%, \(n = 8\)). The two reasons most frequently identified as causing the stress were being unsure how to use the device and fear of harming the patient.

No significant associations were found between stress and employment status, age, number of years of basic and highest level of RN education, and time worked as a RN. Stress was, however, negatively associated with length of time on current unit \((r_s = -0.26, p < .05)\).

<table>
<thead>
<tr>
<th>Information About Device</th>
<th>Percentage of Nurses Selecting This Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to operate it</td>
<td>98.8% 83</td>
</tr>
<tr>
<td>Its purpose</td>
<td>96.4% 81</td>
</tr>
<tr>
<td>Its function</td>
<td>96.4% 81</td>
</tr>
<tr>
<td>Patient factors that indicate use</td>
<td>91.7% 77</td>
</tr>
<tr>
<td>How to know if it is working properly</td>
<td>82.1% 69</td>
</tr>
<tr>
<td>How to respond to alarms</td>
<td>77.4% 65</td>
</tr>
<tr>
<td>How to troubleshoot minor problems with it</td>
<td>76.2% 64</td>
</tr>
<tr>
<td>Its limitations</td>
<td>72.6% 61</td>
</tr>
<tr>
<td>Who to notify if it malfunctions</td>
<td>64.3% 54</td>
</tr>
<tr>
<td>Safety features</td>
<td>63.1% 53</td>
</tr>
<tr>
<td>Patient factors that contraindicate use</td>
<td>57.1% 48</td>
</tr>
<tr>
<td>Effects on a patient's anatomy and/or physiology</td>
<td>56.0% 47</td>
</tr>
<tr>
<td>Scientific principles on which it is based</td>
<td>51.2% 43</td>
</tr>
<tr>
<td>Potential hazards for the patient</td>
<td>48.8% 41</td>
</tr>
<tr>
<td>How to document machine malfunction</td>
<td>36.9% 31</td>
</tr>
<tr>
<td>How to perform routine maintenance</td>
<td>33.3% 28</td>
</tr>
<tr>
<td>How to document the adverse effects of machine malfunction on patient care</td>
<td>25.0% 21</td>
</tr>
<tr>
<td>Potential hazards for user</td>
<td>22.6% 19</td>
</tr>
</tbody>
</table>
TABLE 3
CATEGORIES OF SUGGESTIONS MENTIONED BY AT LEAST 5% OF RESPONDENTS FOR BECOMING AND REMAINING PROFICIENT WITH INFREQUENTLY USED DEVICES ($N=85$)

<table>
<thead>
<tr>
<th>Suggestions</th>
<th>Becoming Proficient</th>
<th>Remaining Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n)</td>
<td>% (n)</td>
</tr>
<tr>
<td>Inservice programs</td>
<td>26.0 (33)</td>
<td>26.5 (31)</td>
</tr>
<tr>
<td>Availability of relevant literature</td>
<td>25.2 (32)</td>
<td>20.5 (24)</td>
</tr>
<tr>
<td>Hands-on experience</td>
<td>18.9 (24)</td>
<td>17.9 (21)</td>
</tr>
<tr>
<td>Availability of resource people</td>
<td>10.2 (13)</td>
<td>12.0 (14)</td>
</tr>
<tr>
<td>Videos available on units or wards</td>
<td>5.5 (7)</td>
<td>6.0 (7)</td>
</tr>
<tr>
<td>Teach or learn from peers</td>
<td>4.7 (6)</td>
<td>6.0 (7)</td>
</tr>
</tbody>
</table>

Another potential sequela of device use was patient harm. Of the 5% ($n=5$) of perinatal staff nurses indicating they had used a device that caused patient harm, 60% indicated that the incident had occurred within the past 3 months. The remainder of incidents had happened more than 12 months ago. The heating pad ($n=1$), “homemade” hot pack ($n=2$), transcutaneous oxygen monitor ($n=1$), and external fetal monitor ($n=1$) were the devices identified as being involved. Resulting harm in 80% ($n=4$) of cases was the patients’ skin being burned, while in one instance, the patient underwent “unnecessary surgery.” The primary causes of these incidents were user error ($n=2$), the “patient’s choice to stay on the heating pad without changing position” ($n=1$), and “data from the fetal monitor being difficult to interpret” ($n=1$). No significant associations were found between harm and employment status, age, number of years of basic and highest level of RN education, time worked as a RN, and time on current unit.

DISCUSSION

How RNs initially learn about the medical devices they use in direct patient care may reflect the general availability of the device and its use in clinical practice. Most staff nurses in this study graduated from their basic nursing programs before fetal monitors and patient-controlled analgesia machines were commonly used in clinical practice and subsequently included in nursing curricula. Therefore, participants initially learned about these devices on the job, and initial methods of learning may have influenced what they learned. Hands-on experience as a part of learning is both important and appropriate because the proper and safe use of devices typically involves psychomotor skills. Additionally, staff nurses appreciate being able to “play with” devices in safe environments, such as learning laboratories and inservice programs (Pillar, 1991).

The primary purpose of on-the-job device education is to help nurses learn what they need to know to safely, and potentially immediately, use the device. However, attendance at inservice programs (whether or not mandated by the JCAHO) and learning from “partially knowledgeable colleagues” (Fitter, 1986) can lead to “use ignorance” (Walleck, 1989). Nurses, as in this study, may learn to operate the device without understanding the scientific principles on which it is based, its limitations, or its safety features. The absence of comprehensive technological education with resultant inadequate knowledge is thought to increase nurse stress and incidents of patient harm (Abbey, 1990; Fitter, 1986; Walleck, 1989). Indeed, perinatal staff nurse stress was associated with using unknown or malfunctioning devices, thus corroborating findings of Fitter (1986), Sinclair (1988), and McConnell (1987, 1990).

The external fetal monitor may have caused RN stress because data from this device are used in making decisions that can ultimately affect the life of the mother and fetus. Similarly, the patient-controlled analgesia machine may have caused stress because it is used to administer medications that can have serious consequences if administered incorrectly. The negative association between stress and length of time on current unit suggests increased familiarity and comfort with the perinatal unit and experience with devices used in the care of perinatal patients.

Although the number of incidents of patient harm in this study was small, the primary causes of user error and being unable to interpret data, corroborate findings of Abramson et al. (1980) and Sinclair (1988) and emphasize the importance of comprehensive device education. Additionally, these incidents of patient harm highlight that any misused device, whether simple (e.g., heating pad, homemade hot pack) or complex (e.g., fetal monitor), can cause patient harm. As the perinatal staff nurses indicated, their use of medical devices on behalf of patients is a double-edged sword. These devices enable nurses to provide increased quality of care, as well as decreased quality of patient care, while causing widespread nurse stress and some patient harm. A factor common to both the positive and negative effects of device use in direct patient care is knowledgeable and proficient device use.

A limitation of this study is that participants may
have had difficulty remembering how and what they initially learned about the medical devices. Furthermore, because the terms “stress” and “patient harm” were undefined, their interpretation was determined by the individual nurses. Information about stress and patient harm may be underreported because of nonresponse bias. Nurses who experienced the most stress and/or had used a device that caused patient harm may have been less likely to respond.

RECOMMENDATIONS
Despite the small sample size and the fact that the perinatal staff nurses working in this hospital may not represent the general population of those working in the United States, the findings suggest that, throughout their careers in this “dynamically changing practice profession” (Education and Credentialing Committee of American Association of Colleges of Nursing [AACN], 1992, p. 1), RNs will be required to become competent with an ever-changing array of devices. This probability has implications for all aspects of the nursing profession. Recommendations fit into the areas of curriculum, teaching clinical nursing, continuing education and staff development, and research.

Curriculum
Acquisition of knowledge for competent device use never ends. It begins at the undergraduate level and continues throughout the nurse’s career. Therefore, because the mission of undergraduate programs is to prepare safe, beginning level practitioners, curricula should include the fundamentals of safe device use (Abbey, DePalma, & Rome, 1986a). The large number of devices, including the various brands of different devices, as well as the different generations of the same devices, make it impossible for students to learn how to use each specific device. Thus, curricula should provide students with knowledge and understanding of the scientific principles on which various categories of devices are based.

The AACN’s guidelines for incorporating technology into professional nursing education (Education and Credentialing Committee of AACN, 1992) offer curricula suggestions. The guidelines address not only the knowledge RNs need to use technology in the delivery of patient care but also the clinical judgments and related skills they need for safe and appropriate technology use. Including this information in curricula would provide a foundation of device education on which inservice and continuing education, as well as individual nurses, could build. Additionally, ample hands-on experience in a safe environment is imperative.

Teaching Clinical Nursing
Medical devices are the nursing profession’s slaves, not their masters. Patients expect medical devices to be used in their care, and they expect nurses to use them knowledgeably, while remembering that patients are people (McConnell, 1989). Faculty teaching clinical nursing can help students achieve this goal in several ways. First, faculty can help students:

- View devices as adjuncts to care which have limitations.
- Improve their assessment skills so they have more confidence in them.
- Integrate the data obtained from devices with the patient’s condition.

Seeing the “big picture” of patients’ care, including appropriate application and use of devices, can minimize overdependence on technology. Second, faculty members can help students identify and locate reliable and accurate sources of information about the devices. Such sources may include biomedical engineering personnel, other designated resource people, policy and procedure manuals, user/instruction manuals, product literature, and videotapes or audiotapes. Additionally, some devices, such as infusion pumps, have “help” screens. Third, faculty can help students learn to solve problems and think critically, using a comprehensive technological approach to devices.

Inservice and Continuing Education
The number and complexity of medical devices used in direct patient care continue to increase at a time when money for inservice and continuing education programs is decreasing. This situation demands innovation, the development of creative partnerships, new ways of learning, and an increasing commitment on the part of each RN to be competent with the devices they use. Furthermore, administration and management must be supportive of staff nurses’ learning and facilitate their involvement in educational activities. Even the most effective learning method is useless if staff nurses are unable to participate.

Inservice programs and availability of relevant literature on the unit or ward were the methods most frequently suggested by participants for becoming and remaining proficient with devices they use frequently. However, to be useful, inservice programs must meet learners’ needs in terms of scheduling and content, and teaching-learning strategies must be appropriate for the level of the learners and the content to be taught. Relevant literature must be “user friendly” and readily available.

Staff nurses who use devices may benefit from
attending inservice programs presented collaboratively by personnel from nursing staff education, biomedical engineering, and manufacturers. A collaborative endeavor may enhance the possibility of comprehensive device education, with broad-based information being presented that could be transferred to similar equipment in other situations. Self-paced modules, computer-assisted instruction, and videotapes might also be helpful, but time still must be allotted for hands-on experience.

The frequency of competency testing may need to be adjusted, depending on how often nurses use a particular device. For example, nurses who work with a device nearly every day may need to complete a competency module annually, while those who work with a device every 1 or 2 months may need to complete a competency module every 3 months.

The AACN guidelines could be used as a template for program development to ensure appropriate information is included. Similarly, the JCAHO standards (1995) can be consulted and used in program development. More specifically, resources available from the Association of Women's Health, Obstetric, and Neonatal Nurses could be consulted. Such resources include “Nursing Practice Competencies and Educational Guidelines: Antepartum Fetal Surveillance and Intrapartum Fetal Heart Monitoring” (Nurses’ Association of the American College of Obstetricians and Gynecologists, 1991) and the “Essentials of Electronic Fetal Monitoring” (Association of Women’s Health, Obstetric, and Neonatal Nurses, 1994). The latter, a comprehensive introductory program, includes three videotapes and a competency validation manual.

In the future, RNs may use inservice programs on the Internet and virtual reality to learn to use medical devices. Although still in early development, virtual reality offers nurses the opportunity to practice skills in a realistic setting without subjecting patients to the device. A virtual environment is a computer-simulated world of sights and sounds that responds to a person's actions. A head-mounted display contains tiny television screens that offer a computer-generated scene; headphones supply corresponding sounds; and gloves with sensors relay hand movements to the computer (McConnell, 1996; Sheridan & Zeltzer, 1993; Taubes, 1994).

Advances in information technology also make it possible for manufacturers to be available 24 hours a day, 7 days a week via a toll-free telephone number or interactive program. One such example is the PC-IABP™, Datascipe Corporation's (n.d.) software program for off-site monitoring of the intra-aortic balloon pump, balloon pump education, and patient record management. The PC-IABP™ software program and telephone communications via modem enable an off-site clinician to be fully on-line with the System 95 or System 97 IABP console (McConnell, 1996).

Research

Future research should focus on several areas. These are:

- A comparison of how and what RNs working in the perinatal area learn about “simple” versus “complex” medical devices.
- Aspects of inservice education programs that invite attendance and promote effective learning.
- Characteristics of user friendly written materials.
- A comparison of methods and content of device education programs and relationships to nurse stress, incidents of patient harm, and quality of care, including patient outcomes.
- Reasons for nurse stress when using medical devices.
- Replication of Abbey, DePalma, and Rome's (1986a, 1986b) surveys of bioinstrumentation instruction in NLN-accredited baccalaureate and master's programs.

REFERENCES


