Despite recent progress in information technology, health care institutions are constantly confronted with the need to adapt to the resulting new processes of information management and use. Facilitating an effective technology implementation requires dedication from informatics nurses (INs) to bridge the gap between clinical care and technology. The purpose of this study was to explore the working experiences of INs, and alternatives to assist the growth and development of the specialty. This qualitative study recruited 8 participants, and data were collected in 2009 by use of interview guides related to work roles, responsibilities, competencies, and challenges. The emerged themes included (a) diversified roles and functions, (b) vague job description, (c) no decision-making authority, (d) indispensable management support, and (e) searching resources for work fulfillment. 

Findings indicate that for organizations where nursing informatics development is ongoing, the IN role should be clearly defined as a specialist with identified support resources and decision-making authority. Nursing informatics interest groups should further develop training and certification programs to validate the professional image of the role. Concepts of nursing informatics should be included seamlessly throughout the educational curricula and informatics competency-based courses designed to strengthen student's technology use and data management capabilities. (Index words: Competency; Experiences; Informatics nurse; Interviews; Nurse roles)
Although the above studies have focused on different user populations, the work experiences of INs have not been explored in Taiwan. Job satisfaction and the career achievements of INs are areas that should receive consideration because they have a substantial effect on nurses who dedicate themselves in this area and benefit organizations with more competent workers (Bowman-Hayes, 2009; Brokel, 2007).

**Literature Review**

**The Emergence of Nursing Informatics**

In 1992, ANA recognized Nursing Informatics as a specialty area. The ANA defined Nursing Informatics as a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice (ANA, 2008). INs communicate and coordinate across multiple disciplines and manage data for patient care and support nursing practice by developing and maintaining information systems (ANA, 2008; Hunt, Sproat, & Kitzmiller, 2004). In 1995, the American Nurses Credentialing Center (ANCC) established an IN certification program focusing on computer literacy, information literacy, and professional development/leadership (ANA, 2008). Today, the testing contents of the certification examination include not only knowledge and skills in information technology but also data management and knowledge generation (ANCC, 2014b). In order to take the certificate examination, applicants must have certain continuing education (CE) hours or Nursing Informatics working experiences (ANCC, 2014a). The obtaining of the certification demonstrates that the nurse can work in an organization as an IN with competencies (Kenney & Androwich, 2012).

In 1996, hospitals in Taiwan began the transition from a process of paper medical records system to a computerized health care record system, which created a need for the IN. In 2006, the Tainanese Nursing Informatics Association (TNIA) was established to promote the concept of Nursing Informatics and the development of nursing information systems in health care organizations. In 2008, there were less than 20 INs in Taiwan, but in 2011, R.C. Feng (Chair of the American Nursing Informatics Association [ANIA]) indicated that there were nearly 30 INs (personal communication, October 18, 2011). Although this path did not proceed as expected, by 2012, nearly 23 medical centers had established IN specialist positions (Kuo, Chang, Feng, Westra, & Ball, 2012).

In Taiwan, because hospitals have traditionally focused on the diagnoses and treatments of patient illness, the development of INs may not have drawn the attention of health care providers. Tasks related to the incorporation of technology into nursing practice, such as system design and development, data management, research, and evaluation often rely heavily on the work of INs. Previous studies have shown that nurses in Taiwan must be competent with knowledge and skills in information systems to work in this era of technology (Hwang, Chen, Chang, & Hsiao, 2008; Lin, Lin, Jiang & Lee, 2007). However, compared with the United States, where nursing informatics has been developed for more than 20 years and has a complete curriculum design, in Taiwan, nursing informatics is still in its beginning stages, and a well-planned nursing curriculum is needed (Hwang et al., 2008).

**Factors Affecting the Development of IN Specialty**

The introduction of technology has not only changed the clinical environment of health care but also has greatly influenced nurses’ patient care process. Specific factors that affect nurses’ technology use have been identified as user education and training, device availability, and system usability (Lee et al., 2009; Ward et al., 2011). In addition, nurse’s involvement in the planning process is vital (Huang & Lee, 2011b; Lee et al., 2009). Therefore, INs can be a facilitator in promoting technology use such as training the end user or developing the electronic health record (EHR) system to document nursing impact on health care outcomes and to further utilize data in the EHR for outcome analysis to refine best care for clinical practice to assist nurses (Warren & Thompson, 2010).

In order to work between patient care and technology applications, INs are expected to demonstrate informatics competencies in computer and information literacy, professional development, and leadership (ANA, 2008). In 1996, ANIA queried its members regarding the Nursing Informatics specialty role, responsibilities, and challenges. Results indicated that lack of interdepartmental communication and cooperation were work challenges, and information technology, management, and training skills were important to supporting their roles and job competencies (Rosen & Routon, 1998). A survey conducted in 2000 exploring U.S. registered nurses’ CE in informatics revealed that only 21% of respondents had taken informatics contact hours in the previous year. In addition, it was identified that Internet access, working in hospitals, and not performing direct patient care were predictive factors of IN competency (Kleib, Sales, Lima, Andrea-Baylon, & Beath, 2010). Informatics competencies are mostly defined in informatics knowledge/skills and attitudes toward technology or IN role (Choi & De Martinis, 2013; Hwang et al., 2008). Bowman-Hayes (2009) suggested that informatics competencies are not only part of INs but also, through working relationships, will likely transfer to bedside nurses. In addition, administrative support of on-the-job training, provision of electronic resources, or access to their decision support were also identified as important (Wahoush & Banfield, 2014).

In the United States, the core responsibilities and certification standards of INs are well developed. For example, the Alliance for Nursing Informatics has indicated that this role consists of (a) managing the design and implementation of technology, (b) providing improved patient-centered care, and (c) reducing nurses’ paperwork workload (Greenwood, Murphy, Sensmeier, & Westra, 2011). By contrast, in Taiwan, IN standards and responsibilities have been determined by domestic or local organizations, which results in inconsistent criteria across different regions and work settings (Hwang et al., 2008). Without guidelines for practice, INs may have to...
use trial-and-error methods to achieve the desired work performance. As a result, this study was conducted to explore INs’ challenges and alternatives to advance this specialty.

Methods
Study Setting and Participants
This study used a qualitative research approach and one-on-one, in-depth interviews to collect data. A purposive sampling was applied to recruit participants. Because the IN’s role in Taiwan is primarily confined to medical centers and only 16 INs in 14 hospitals were available during the data collection stage, the recruiting criteria included nurses who have a baccalaureate degree and have been working in a hospital as an IN for more than 6 months. Of the 16 available INs, 1 was excluded for not meeting the education criteria, 6 others declined the interview because of scheduling conflicts, and the pilot study interviewed 1 IN. This left 8 INs (from 8 hospitals) in the formal study. The interviews were conducted in a conference room of their work hospital.

Data Collection
The first author interviewed all the participants, and data collection began after obtaining approval from the institutional review board of a local university where she studied for the master’s degree. This study was divided into three phases. Phase 1 occurred from June 2008 to March 2009, and basic information regarding the INs was collected such as the number of hospitals with a job entitled as IN, job descriptions, and the number of nurses working as an IN. These INs were potential informants and were contacted by telephone to verify their job description and practice status. Data collection procedure and interview outlines were developed as well.

Phase 2 was in April 2009. A pilot interview was conducted to validate the interview guidelines (whether the semistructured questions were clear to the interviewee) and to estimate the interview time and unexpected problems (such as calls from work or interruptions from co-workers to the room where the interview was ongoing). An IN who answered the invitation first was invited for the pilot interview in the dining area of that work hospital. Four questions regarding the IN role, work content, competency, and organizational support were proposed. It was determined that the interview process took more than 1 hour, the questions were too broad for the interviewee to answer, and the dining area was not an appropriate setting for the interview. These results were used to refine further interviews.

Phase 3 was conducted from May to October in 2009. Eight participants were informed of the study purpose, and interviews were arranged at a time and place convenient for them. Before the interview, each IN was asked to sign an informed consent form acknowledging their voluntary participation, and that they could withdraw from the study without any penalty. Participants filled out the form with previous working experience, years working as an IN, and age. The interviews were tape recorded with their consent. Each interview lasted approximately around 40–60 minutes, and the five interview questions were as follows:

1. What is your IN job description? Are there any differences from the work you did before?
2. How do you describe your roles and responsibilities as an IN?
3. What competencies do you think an IN should have?
4. What is the most impressing and frustrating example of working as an IN?
5. What do you think your organization can do to support the growth of this IN position?

Data Analysis
Data were analyzed based on the qualitative content analysis process (Elo & Kyngäs, 2007). First, transcribed data were read thoroughly to determine meaningful content and assign coding (repeated words or phrases such as computer problems, print problems, communications, coordination, training, and teaching). Then, the identified content and codes were organized and classified into clusters to form meaningful categories (such as problem solver, coordinator, and educator). Finally, these categories were linked or integrated with each other to form a main theme (“diversified roles”). The data analyst (the first author) had been working as a clinical nurse for 7 years in pediatrics and obstetrics-gynecology before working as an IN for another 2 years. She had taken a qualitative course in her master’s study. While conducting this study (her thesis) of interviewing INs, she constantly discussed the interview skills, data coding and analysis, and results interpretation with one of the teaching faculty members who specialized in qualitative research. During the discussion process, the goal was to reach a consensus toward the emerged labels and the logical paths taken to arrive at those labels (Houghton, Casey, Shaw, & Murphy, 2013).

Rigor
Four criteria were established to test the accuracy of the collected data: credibility, transferability, dependability, and confirmability (Houghton et al., 2013; Thomas & Magilvy, 2011). To ensure credibility, we transcribed the interview content word by word and then checked by the informant to ensure that the content was what respondents expressed in the interview. To confirm dependability, the principle investigator recorded and reviewed each reflective thought of the interview process and also wrote memos and notes during the interview visit when observing the interactions between the IN and other care providers. To warrant confirmability, we constantly discussed data labels and logical paths for emerged categories or themes with a nursing faculty member (mentioned above) to obtain mutual agreement. Finally, transferability was enhanced by including numerous quotes from participants’ verbal descriptions in the findings of this study (to demonstrate raw data and emerged themes).
Results

Scenario descriptions were labeled with letter codes (such as A, B, or C). Seven females and one male were interviewed. Their average age was 34 (range from 29 to 42), and each had served as an IN for an average of 2.4 years (range from 6 months to 5 years). Data analysis revealed five themes: diversified role and function, vague job description, no decision-making authority, indispensable management support, and searching resources for work fulfillment.

Diversified Roles and Functions

If a nurse takes care of a patient, they know their role and functions to meet patients' needs. However, as an IN, they are titled as a nurse, but because they do not provide patient care activities, they received calls ranging from fixing computer problems to writing computer codes for nursing. Their role could be described as a system analyst, a coordinator, a problem solver, or a trainer. Most of the respondents thought of themselves as system analysts because they worked on the development of a nursing information system that related to system testing and user problem solving. One stated:

My responsibilities mainly involve maintaining the nursing information system and collecting and analyzing data. I am also responsible for the training sessions, promoting the system to the nursing staff, gathering comments on the system, and providing feedback to the information technology office or the vendor for further system modification. It's quite different from what I did for patient care before (H).

Others viewed themselves as a communicator or coordinator whose job was to bridge the gaps between different users (nurses and nurse managers). Not only must INs meet the needs of the nurses using the system, they must also report the usage outcome to nurse managers, who might have a different perspective on the use of technology:

The biggest frustration that I am plagued with is that supervisors and nurses can have differing [documentation] needs on a single matter. For example, while the nurses prefer to cut and paste words to save charting time, the supervisor is worried about similar words and phrases losing individualization of patient description and will ask nurses to create unique records so they won't be charting similar content for every patient. It is very difficult to put each of the parties in the other one's shoes (C).

An IN meets end users frequently, and consequently, they are asked to troubleshoot numerous computer and software problems. Eventually, this becomes part of their workload:

The most common problem that I had come across before was some word processing issue, but now, problems with Excel are common too. But none of them are information system related. Once I was asked to help them design a worksheet in Excel, like a shift schedule for nurses in that unit. So I designed a number of function keys in the worksheet to count the different shifts for nurses. Then, in case they needed more functions to count the overtime fees, I taught them how to do that as well. Though I acted like an educator on these tasks, none of them was related to the system implementation process (F).

Vague Job Description

Different from traditional nurses' work over three shifts and performing care routines, INs do not have a specific job description. They are uncertain of their work responsibilities and duties. In some cases, the administrators expect INs as nurses who know how to write programs to design and develop nursing information systems alone. Lack of a defined or established job description or work content has prevented some INs from executing their job responsibilities:

Every day when I work, it's a constant struggle for me because I don't know what I am supposed to do. No one ever told me what to do or how to do my job (B).

Because there is a lack of specified roles and functions, INs' duties have no defined area, resulting in a mix of tasks that require him or her to deal with nonpatient care situations. Clinical nurses often believe that INs are responsible for assisting them with any computer-related problem:

The most stressful thing...[pause] is that when nurses are unsure of whom to ask for help, they will ask me. [Sighs] As long as the problem is computer related—such as a screen shutting down or a mouse that doesn't work—they will all call me and ask me to solve the problem, which constantly adds to my workload (E).

No Decision-Making Authority

Being able to make decisions are valued by any nurses; however, this autonomy does not seem to be present under the title of IN. Working as an IN in communication with staff from different departments regarding information technology use occasionally requires decisions to be made when there is a disagreement between two parties working on the implementation of the same project. Unfortunately, most of the INs do not think their opinions are valued. Instead, they see themselves as mediators or messengers for information transmission but cannot take a position or influence the final decision:

I have been involved in many [contentious] issues, but have no right to make any decisions. Then, I realized that I am just a messenger (F).

I feel that an IN is not suitable for the hospital setting because, when you need to communicate and coordinate with other staff members, you need to have a position or title equal to that of a supervisor. If you want to work as an IN, you need to come into the position with a certain level of decision-making power.
You need to have a title like head nurse or head of nursing informatics to be at the same level as the managers you are negotiating with (H).

The majority of respondents also mentioned that, because their supervisors were unaware of an IN's job responsibilities, misunderstandings occurred:

When you were a head nurse, you were entitled to have certain management level, and your final decision was what people had to abide by. But now, as an IN, you have become more of a secretary, spending a lot of time recording what you have done in detail to make a status report. But it's not about the time spent recording; it's about the feeling of not being completely trusted and respected as a specialist.

**Indispensable Management Support**

INs need support from their supervisor for their work performance and, even, to guide them how to do their job. Nonetheless, because they did not provide patient care, most of the managers viewed them as a computer technician and would evaluate them by paperwork outcomes that could cause considerable frustration:

It's possible because most supervisors don't understand what nursing informatics is, they don't know how to utilize us. For example, suppose that you had spent a lot of time analyzing a physical assessment template for varied care specialties and had discussed with nurses regarding whether to use yes-no or multiple choice input items for different units. Despite all this hard work, your supervisor wants to see immediate results, and questions what have you been doing all the time and where the outcome [the final assessment sheet] is (E).

However, when INs received the support they needed from administrators, they could perform the job confidently. As one said:

If the supervisor is willing to support you, things will be easier. For example, when I started working here, we needed to implement a nursing information system for the out-patient department. This was a big project and no one was sure whether it would succeed or not. It occurred to me that we could give laptop computers as a reward for those who learned the system best. When I proposed this idea to the CEO of the hospital, he immediately approved the idea, which certainly boosted the motivation for the staff to use the new technology (H).

**Searching Resources for Work Fulfillment**

Most of the participants mentioned that they worked alone and had no formal training or education in NI before being placed in the position. They would search for problem-solving alternatives and looking for fulfillment in work. Skills in database or system analysis had been expressed as essential competencies.

I wish I had some experiences in the system analysis to understand the process of system development (B).

Concepts such as database or needs assessment could be useful, because we cannot work like a programmer. If we were capable of these abilities, it could be easier for my job … Additionally, doing research is a plus to show the final outcome (E).

However, after some trial and error, they finally developed solutions and found alternatives to streamline their work by either searching answers from personal networks or relying on on-line resources. One said:

Since working in this IN position, I started to use e-mail and phone calls to consult with INs at other hospitals for advice. Some would share with me their experiences and the difficulties they had encountered, and few even gave me specific examples of solutions. Then I would prepare a summary of the different options to the supervisors. I would also get on the Internet to search for problem solving on information system project management (E).

Other interviewees viewed the system development process as an achievement. One described their sense of accomplishment as follows:

[System implementation] It's like having built a house by yourself, the feeling of getting something done from scratch step by step, or having solved someone's problem and feeling needed (B).

Another interviewee described the process this way:

I think what makes me happy is getting acknowledged by other nurses and by my supervisor, because my job is to save their work time. For example, ever since we implemented the nursing documentation system, nurses no longer need to spend time on charting different worksheets, thus eliminating duplicate paperwork. Besides that, they do not need to compete with doctors to get patients' paper records for charting, either. This really brightens my day (H).

**Discussion**

The study results show that INs have diversified role duties such as systems analysis, communication/coordination, and problem solving. Their work content includes designing nursing information systems, training nurses, and evaluating usage outcomes, which are consistent with the designed tasks required for INs in the United States (ANA, 2008; Brokel, 2007). Although the number of INs is increasing in clinical settings and this specialty is growing in Taiwan, obstacles remain because there is no well-defined job description and supervisor support (Hwang et al., 2008). Because technology evolves and the use of EHR is mandated, the job tasks for INs are expanded from technology designer or user trainer to data analyst or knowledge/evidence generator to support patient care (Bowman-Hayes, 2009). Nonetheless, with proper on-the-job training and hands-on practice, INs can still demonstrate professional competency in their work (Warren & Thompson, 2010).

In addition, clinical nurses and management supervisors have different or competing views of technology use. This
created a situation in which each group was only concerned with itself and failed to support the other groups. Supervisors who were focused on management and care effectiveness showed little interest in developing new technology for the needs of their staff, and they were sometimes unenthusiastic about cooperating with the INs. Therefore, the INs in this study believed that their official title should be established at the same level as that of a head nurse or, in other words, at the level of someone who has decision-making authority to optimize the coordination and communication process. In fact, because of technology implementation, most of the INs work on redesign workflow, developing policy and procedures and conducting staff on-the-job training that all relate to staff management. Therefore, nursing supervisors certainly would benefit from education in informatics and collaboration with INs (Brokel, 2007).

This study demonstrated that without on-the-job training or formal education, most of the INs worked independently seeking resources to complete their tasks. They used a variety of channels for support, such as searching the Internet to find relevant information, calling others who could provide assistance, or consulting with their peers. One survey identified information seeking behaviors for nurses and students with results showing that electronic information sources are used often for both groups and followed by interpersonal and print resources for nurses and students, respectively (Wahoush & Banfield, 2014). Some participants in this study expressed the desire to take informatics courses or a training program to enhance their informatics competencies. Hwang et al. (2008) proposed that in Taiwan, because of inadequate technology-related curriculum and limited hands-on experience, graduates from nursing schools have not learned sufficient informatics related knowledge and skills for their clinical activities, thus, hospitals should provide on-the-job training with nursing information education to cope with the increasing complexity of the health care environment. For nursing education, incorporating knowledge/skills in technology and data management within curriculum design can enhance students' informatics competency (Bowman-Hayes, 2009; Choi & De Martinis, 2013; Wahoush & Banfield, 2014). The nursing informatics interest group such as TNIA may provide training courses or certificate programs focusing on system design and development, project management, and the role and function of the IN to assist the professional growth and career development of INs (Kuo et al., 2012).

The findings from this study have several implications. First, having the support and trust of supervisors and other nurses is essential to the success of the IN staff. Therefore, a practice scope and standard should be established as guidelines for health care organizations such that IN can be recognized as a specialty practice. Nursing Informatics: Scope and Standards of Practice is a guidebook published by ANA (2008) that is a suitable reference for the role definition and job descriptions of INs in Taiwan or other countries where nursing informatics is under development.

Second, the concept of an IN specialty should be integrated into on-the-job training such as a new staff orientation program. Therefore, when users encounter a technology problem, they can quickly perform problem-solving skills or search for available resources. Furthermore, if nursing schools could incorporate knowledge and skills of nursing informatics within curriculum design either at the baccalaureate or masters’ level, nursing students could acquire competencies in technology and data management knowledge and skills that could help them work as an IN or IN specialist.

Lastly, professional groups should actively promote seminars and workshop activities in nursing informatics. They should initiate specialty networks to encourage nurses to share their experiences and establish connections within the nursing informatics field. Given that information about job opportunities, vendors, hospital policies, and regulations is most often passed through these informal channels, work on developing this field could benefit INs.

Study Limitations
The limitation of this study is that data were collected in 2009 and may not reflect current trends, although the authors are not aware of any sources of more current data in Taiwan.

Conclusion
IN plays an indispensable role in nursing, especially when an organization is implementing new technology and needs an IN to work as a specialist between nursing and information technology departments. When implementing an IN position, practice standards and guidelines should be established to improve and strengthen problem-solving processes, career autonomy, and job responsibility. In addition, if IN practice is recognized as a formal specialty and empowered with decision-making authority and support from supervisors, INs will be able to fulfill their duties and improve work performance in the hospital care environment.

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