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The Role Of Seniority And Self-Perceived Expertise In Ecg Monitoring

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The Role of Seniority and Self-perceived Expertise in ECG Monitoring

Thesis
Submitted to the Faculty
Yale University School of Nursing

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Nursing

Hyeusng Shin

May 20, 2013

This thesis is accepted in partial fulfillment of the requirements for the degree Master of Science
in Nursing

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Marjorie Funk

Date: May 14, 2013 _____

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Hyesung Shin _____

May 14, 2013 _____

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Abstract

THE ROLE OF SENIORITY AND SELF-PERCIEVED EXPERTISE IN ECG MONITORING

The purpose of this thesis is to examine the association of seniority and self-perceived expertise of nurses with the level of electrocardiography (ECG) knowledge. Pre-test scores and improvement in post-test scores were compared for 1,910 registered nurses based on their seniority and self-perceived expertise using Pearson correlation and Spearman's Rho. The length of nursing experience was positively related to self-perceived expertise and baseline scores, but was not significantly associated with improvement. In addition, the initial level of knowledge in ECG monitoring was not satisfactory despite the long years of nursing experience. On the other hand, nurses' self-perceived expertise was positively associated with baseline test scores and negatively associated with improvement. For more effective education in ECG monitoring, the level of knowledge in ECG monitoring should be assessed instead of assuming nurses' level of knowledge based on their seniority or perceived competencies. Future studies are required to enhance our understanding of contributing factors in knowledge improvement in ECG monitoring.

Keywords: seniority, self-perceived expertise, ECG monitoring, online education.

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Chapter 1

Clinical Problem

As the use of electrocardiographic (ECG) monitoring has become widespread in hospitals (Davidson & Barber, 2004), the importance of healthcare personnel being well-trained on ECG monitoring has increased. Because nurses are primary caregivers in a hospital setting, it is the responsibility of nurses to understand both the technology and the purpose of ECG monitoring and to bring that understanding into practice (Hannibal, 2011). However, only a limited number of studies have evaluated the level of knowledge and practices of nurses in ECG monitoring (Cadden, 2007; Drew, Ide, & Sparacino, 1991; Sangkachand, Sarosario & Funk, 2011), and most studies did not take seniority into account.

Since the differences in the level of knowledge and the competency in practice between senior and junior nurses have an influence on both individual nurses' educational needs and the efficacy of the provided learning method (Benner, Tanner, & Chesla, 1996; Gerrish, Ashworth, Lacey & Bailey, 2008; Hoffman, Aitken, & Duffield, 2009), the evaluation of educational outcomes based on seniority would be meaningful for future nursing education and quality care.

The purpose of this study is to compare the effectiveness of online ECG monitoring education from the perspective of the seniority of nurses. The effectiveness will be evaluated in two steps. The first step is a comparison of baseline ECG monitoring test scores by nurses' seniority, and the second is to document the magnitude of improvement in test scores after online education.

Chapter 2

Review of the Literature

This chapter will cover two main topics as background of this study. One is the different types of teaching methods in ECG monitoring education, and the other is the relationship of nurses' experience and their expertise. Self-perceived expertise will also be presented in the second section.

ECG Monitoring Continuing Education

In response to current rapidly changing clinical circumstances, nurses are required to be equipped with the latest knowledge, and continuing education has become an essential part of nursing practice (Atack & Rankin, 2002). Continuing education in nursing is defined as “systematic professional learning experiences designed to augment the knowledge, skills, and attitudes of nurses, thereby enriching the nurses' contributions to quality health care and their pursuit of professional career goals” by American Nurse Association (2010, p.6). In broader perspective, continuing education includes any experiences or activities to enhance knowledge, skills or values (Castledine, 2005).

Usually, ECG monitoring and interpretation has been taught separately or as part of a critical care course (VanArsdale, 1998). To evaluate its effectiveness, various types of ECG education methods have been examined.

The traditional lecture has been the most prevalent method in nursing education throughout history for its convenience to deliver knowledge to a large group. Traditional lecture is considered advantageous both financially and in terms of the lecturer's time (Jones, 1990).

However, the inaccessibility due to shift work and lack of nurses' time are pointed out as critical barriers to participation in lecture-type continuing education (Penz et al., 2007; Skees, 2010).

To make up for this weakness, newly developed educational approaches, such as online education and self-directed learning methods, serve as replacements. Especially online education is now widespread because of its flexibility in time and lower cost. In addition to this benefit, online education showed the same or even better effectiveness in ECG education for nurses or nursing students, as shown in Table 1.

Table 1. A Comparison of ECG Education Methods

Authors (Publication Date)	Study design	Research question and type and size of sample	Educational methods	Effectiveness	Notes
Spiva et al. (2012)	A descriptive comparative study	The effect of different learning methods to improve nurses' confidence and knowledge in ECG rhythm strip interpretation. Nurses who work in inpatient care settings. (medical, cardiology, critical care units) (N=135)	Group 1. Traditional classroom (comprehensive overview + practice sessions) Group 2. E-learning alone (lessons + self-test) Group 3. E-learning + 1 week study time Group 4. E-learning + debriefing Group 5. E-learning +	All four methods except for the E-learning with 1 week study time method had shown significant improvement in nurses' knowledge in ECG interpretation. All four methods except for the E-learning alone method significantly improved nurses' perception of	No comparisons by their seniority. 81 of 135 nurses (60%) had less than 3 years of nursing experience.

			debriefing + 1 week study time	confidence in ECG interpretation.	
Ray & Berger (2010)	Pilot study A direct comparison	A comparison of effectiveness and content understanding in two different ECG courses RNs and cardiac monitoring technicians. (N= 40)	Group 1. Instructor-led traditional class (8 hours x 3 days) Group 2. Blended class: electronic course + three 2 hours of instructor-led sessions	No differences were found in effectiveness, perceived effectiveness and content understanding between two groups.	Unknown background of RNs. No comparisons by their seniority. Small sample size.
Jang et al. (2005)	A pre-test-posttest quasi-experimental design	Effects of web-based ECG learning program on knowledge improvement and self-perceived motivation Korean senior nursing students (N=105)	Group 1. Self-directed web-based learning program Group 2. 2 hours of didactic lectures. (twice a week for 4 weeks)	Pre: No significant baseline differences. Post: Group 1 showed significantly lower overall ECG understanding, but significantly higher scores in ECG interpretation than group 2. No significant differences in motivation and satisfaction.	South Korea

Jang et al. (2003)	A quasi-experimental, nonequivalent control group pre-posttest design	Effectiveness of web-based ECG learning program in terms of knowledge improvement and motivation RNs (N=32)	Group 1. Self-directed web-based learning program Group 2. Traditional lecture method	Significantly more improvement of scores in Group 1 than Group 2. No significant differences in motivation.	South Korea Small sample size.
Jeffries, Woolf, & Linde (2003)	Descriptive interventional study (pre-/posttest method)	Differences between interactive multimedia CD-ROM learning methods and traditional methods in skill obtaining a 12-lead ECG. Senior baccalaureate nursing students (N=77)	Group 1. Self-study with a CD-ROM Group 2. 15 minutes of lecture including demonstration and practice	No significant differences in student satisfaction, perceived self-efficacy in learning, the improvement in scores.	Not include ECG interpretation.

Experience and Expertise

Expertise in nursing cannot be defined in a single statement. In early traditional studies, nursing expertise was described by the level of knowledge and extent of experience. These approaches demonstrate the concept of expertise in the context of social criteria rather than practical knowledge (Ericsson, Whyte, & Ward, 2007).

Benner's five levels of clinical competence – novice, advanced beginner, competent, proficient, and expert – is a distinctive approach to nursing expertise in terms of inclusion of

practical knowledge (Ericsson et al., 2007). Benner's studies show how nurses develop skills and expand their understanding in a clinical situation. According to this theory, the characteristics of experts include intuitive grasp and flexible performance with concrete experience (Benner, 1982; Benner et al., 2010).

Both time in practice and self-reflection of nurses are required to achieve a higher level of clinical competence (Benner & Wrubel, 1982). Nurses tend to reveal higher self-competence or self-perceived expertise as the length of nursing experience gets longer (Gillespie, Chaboyer, Wallis & Werder, 2011; Meretoja, Leino-Kilpi, & Kaira, 2004). One study by Bobay, Gentile, and Hagle (2009) revealed a significant influence of the longevity of nursing experience on the initial stage of expertise. However, few studies have been done on the relationships of these changes and the improvement in actual expertise and nursing practice.

Summary

Even though it is not clear that education and experience are significant predictors of improvement in nursing practice, both play an important role as the basis of nursing expertise. Thus, this study will analyze the relationship of nurses' experiences and knowledge, as the first step to find an effective method for ECG monitoring education.

The Research Questions

1. Is there an association between seniority and self-perceived expertise in ECG monitoring?

2. Is there an association between 1) seniority and 2) self-perceived expertise in ECG monitoring and the baseline knowledge of ECG monitoring?

3. Is there an association between 1) seniority and 2) self-perceived expertise in ECG monitoring and improvement in knowledge after an online ECG monitoring education program?

Operational Definitions

Seniority: A privileged position earned by reason of longer service or higher rank (Online Oxford Dictionaries, 2012). In this study seniority will be measured by years of nursing experience and years of working on the cardiac unit, obtained by self-report of nurses on the online demographic form items 7 and 8 (Appendix 1).

Self-perceived expertise: Nurses' perception about their level of knowledge in ECG monitoring by them and by other nurses. This is measured by a single question about their perception with four choices: clinical expert; above average knowledge; average knowledge; and beginner (item 9 on the online demographic form).

Online education program: This program is developed by Marjorie Funk, Barbara Drew, and Kimberly Scheibly to improve knowledge in ECG monitoring through self-online study. This program is consisted of four modules including ECG basics, arrhythmia monitoring, ischemia monitoring, and QT interval monitoring.

Knowledge of ECG monitoring: It is the ability to understand the essentials of ECG monitoring and arrhythmia, ischemia and QT interval monitoring based on practice standards for ECG monitoring. The level of knowledge was measured by an online 20-item test. The score was calculated as the proportion of items answered correctly. In this study, nurses' baseline

knowledge is measured by their score on the pre-test. Improvement in knowledge is measured by the difference between pre-test score and post-test score. The same test was used for both pre-test and post-test. 'Baseline test scores' and 'pre-test scores' are used interchangeably.

Chapter 3

Methods

Research Design

This is a sub-study of the Practical Use of the Latest Standards for Electrocardiography (PULSE) Trial (Funk et al., in progress). The PULSE Trial is a 5-year multi-site randomized clinical trial with crossover. It is designed to evaluate the effect of online ECG monitoring education and strategies to implement and sustain change in practice on three outcomes: 1) nurses' knowledge, 2) quality of care, and 3) patient outcomes. For this sub-study, a secondary analysis of cross-sectional data of nurses will be performed.

Sample

Among the total of 2,421 registered nurses who participated in the original PULSE Trial, 1,910 nurses who completed both pre-test and post-test were selected as a sample group for this study.

Setting

Seventeen hospitals participated in the PULSE Trial: 15 in the United States; 1 in Ottawa, Canada; and 1 in Hong Kong, China. Both academic medical centers and community hospitals were involved.

Data Collection Instruments

An online demographic form was used to collect data on the characteristics of nurses. Basic demographic information, the highest level of education, years of experience and

perceived expertise was included in the form (Appendix 1). The level of knowledge in ECG monitoring was measured by an online 20-item test which was developed by the PULSE Trial investigators.

Data Collection Procedures

Nurses completed a demographic form each time before they took the online test. Nurses in the experimental group in PULSE Trial took the 20-item online test at four points: baseline at time 1; right before and after the online education at time 2; and follow-up at time 3. Nurses in the control group in PULSE Trial took the online test at four points: baseline at time 1; first pre-test at time 2; right before and after the online education at time 3. Data of right before and after the online education from both groups were used for this study.

Data Analysis

Frequencies and measures of central tendency and dispersion were used to describe the sample of nurses. For the first research question whose independent variable is seniority and dependent variable is self-perceived expertise, Spearman's Rho was used to examine the relationship between two variables. The second research question has two independent variables which are 1) seniority and 2) self-perceived expertise, and the dependent variable is baseline test scores. Pearson correlation and Spearman's Rho were used for each independent variable respectively. The last research question also has same independent variables as question two: 1) seniority, and 2) self-perceived expertise. Its dependent variable is improvement in knowledge in ECG monitoring. To examine the relationship between variables, Pearson correlation and

Spearman's Rho were used for each independent variable respectively. SAS 9.1 was used for all statistical analysis.

Chapter 4

Results

Sample Characteristics

The majority of the sample was female (90%) and White (78%) nurses with a mean age of 37.46 ± 11.02 . Over 66% of nurses had Bachelor's degree, and more than half of participants took one or more in-service education classes before study enrollment. Almost half (47%) of nurses worked in an ICU (cardiac, cardiothoracic surgery, or mixed), and the mean duration of nursing experience was 11.61 ± 10.80 years. A majority (82%) of nurses rated their expertise level as 'average' or 'above average'. See Table 2 through 4.

Table 2. Demographic Characteristics of Registered Nurses (N=2,421)

Characteristics	N	%
Gender		
Female	2,181	90.09
Male	240	9.91
Race		
White (Non-Hispanic)	1,888	77.98
Asian	342	14.13
Black or African American	92	3.80
Hispanic	56	2.31
Mixed or other	26	1.07
Native Hawaiian or other Pacific Islander	12	0.50
American Indian or Alaskan Native	5	0.21
Education		
Bachelor's Degree	1,618	66.83
Associate Degree	389	16.07
Diploma	233	9.62
Master's Degree	171	7.06
Doctoral Degree	8	0.33
Work Unit		
Cardiac ICU/Coronary Care Unit	546	22.55
Cardiac medical telemetry/step-down	479	19.78
Cardiothoracic ICU	396	16.36
Mixed telemetry/step-down	310	12.81

Cardiac surgical telemetry/step-down	292	12.06
Mixed ICU	195	8.05
Others	203	8.39
In-Service Education (multiple response)		
ECG rhythm interpretation	2,113	87.28
Advanced Cardiac Life Support	1,688	69.72
12-lead ECG course	1,499	61.92
Telemetry course	1,424	58.82
Critical care course	1,354	55.93

Table 3: Age and Years of Nursing Experience (N=2,421)

	Mean \pm SD	Median	Range
Age	37.46 \pm 11.02	36.0	19-71
Years in nursing	11.61 \pm 10.80	8.0	0-47
Years in a cardiac unit	8.08 \pm 8.50	5.0	0-42

Table 4: Self-perceived Expertise in ECG Monitoring (N=2,421)

	N	%
Beginner; need to ask others for help	197	8.14
Average knowledge	1,203	49.69
Above average knowledge	787	32.51
Clinical expert and resource person	234	9.67

Research Questions 1-3: The Relationship among Variables

As shown in Table 5, there is a moderate positive relationship between years of nursing experience and self-perceived expertise ($p < 0.0001$).

Table 5: Seniority and Self-perceived Expertise (N=1,970)

	Self-perceived expertise
Years in nursing	$r_s = 0.4237$ $p < 0.0001$
Years in a cardiac unit	$r_s = 0.4851$ $p < 0.0001$

The mean pre-test score is 50.00 ± 12.28 , and the mean post-test score is 70.86 ± 14.80 .

The mean improvement from pre-test to post-test after the online ECG education was 20.86 ± 13.99 . See Table 6. Both seniority and self-perceived expertise have a statistically significant

positive relationship with nurses' baseline knowledge ($p < 0.0001$), but the degree of relationship is not strong ($r < 0.2$). See Table 7.

The negative relationship between seniority and improvement is not statistically significant ($p > 0.05$). On the other hand, self-perceived expertise shows a negative relationship with improvement in knowledge after the online education. It is a weak negative relationship, but statistically significant ($p < 0.0023$, $r = 0.0687$). See Table 7.

In summary, nurses' seniority was positively correlated with self-perceived expertise. Baseline knowledge of ECG monitoring was positively influenced by both nurses' seniority and self-perceived expertise. On the other hand, the improvement in knowledge after an online education was not related with the length of nursing experience and was negatively affected by nurses' self-perceived expertise.

Table 6: Test Scores and Improvement (N=1,970)

	Mean \pm SD	Median	Range
Pre-test	50.00 \pm 12.28	48.0	9.0 - 93.0
Post-test	70.86 \pm 14.80	72.0	12.0 - 100.0
Improvement	20.86 \pm 13.99	21.0	-33.0 - 75.0

Table 7: Relationship Among Variables (N=1,970)

	Pre-test (baseline knowledge)	Improvement
Years in nursing	$r = 0.1440$ $p < 0.0001$	$r = -0.0267$ $p < 0.2371$
Years in a cardiac unit	$r = 0.1565$ $p < 0.0001$	$r = -0.0196$ $p < 0.3856$
Self-perceived expertise	$r_s = 0.1850$ $p < 0.0001$	$r_s = -0.0687$ $p < 0.0023$
<p>. Independent variables: 1) seniority, and 2) self-perceived expertise . Dependent variables: 1) baseline knowledge measured by pre-test score, and 2) improvement . Pearson correlation was used to check the relationship between seniority and 1) baseline knowledge, and 2) improvement. . Spearman's r was used to check the relationship between self-perceived expertise and 1)</p>		

baseline knowledge, and 2) improvement.

Chapter 5

Discussion

Sample Characteristics

According to the national sample survey of registered nurses in 2008 by the United States Department of Health and Human Services, the majority of registered nurses are White (83.2%) and female (90.4%), with median age of 46. In comparison with this data, the sample in this study is 90.09% female, 9 years younger, and contains 5% fewer White nurses. In addition, the sample group includes more Asians (14.13%) than the national survey (5.8%) which may be accounted for the study participation of Hong Kong Sanatorium and Hospital in Hong-Kong. In this study, 74.22% of participants had Bachelors or a higher degree which is more than twice the national average (34.2%). The younger age of the study sample compared with the national survey may account for this difference.

The Results Related to the Research Questions

Based on study results, we can see the length of nursing experience has some role in nurses' baseline knowledge and competency in ECG monitoring. However, when we consider the actual baseline test scores (mean of 50.00 ± 12.28), it is difficult to conclude that the length of nursing experience alone is a definite prerequisite for better level of knowledge. In addition, only 9.67% of nurses rated their level of expertise as 'clinical expert' despite their average years in nursing being above the conceptual cut-off of expert level, which is 5 to 10 years. The mean years of nursing experience is 11.61 ± 10.8 years and majority of participants (81.96%) rated their level of expertise as 'average' or 'above average'. This result shows that the competency in ECG monitoring is also not determined by nurses' length of nursing experience alone. The

argument that the traditional method to judge nurses' level of knowledge by their seniority may not reflect actual level of knowledge (Bobay, 2004; Benner et al., 2010) seems to be supported by the results of this study.

The improvement in knowledge was not positively associated with either the length of nursing experience or self-perceived expertise. Since this study did not examine other factors that influence knowledge improvement, and the knowledge improvement in this study is not examined over time, this area needs more investigation before conclusions can be drawn.

Limitations

The information from participants who did not complete both pre-test and post-test was included in the analysis of demographic characteristics. However, the demographic characteristics are neither independent nor dependent variables and have a minimal role in this study.

Another limitation of this study is related to test-taking time. The time and location was not controlled during the test, and accurate tracking of the test-taking time of all participants is not possible due to the limitation of education program. A manual calculation of test-taking time revealed that a few of poor post-test results were related to an unreasonable amount of time: either too short or too long. Thus, there is a possibility that test-taking time may contribute to the results of baseline knowledge and knowledge improvement in ECG monitoring.

Conclusions

Despite the finding that both nurses' seniority and self-perceived expertise have a positive relationship with baseline knowledge, those two factors do not guarantee a high level of expertise in ECG monitoring. Nurse educators should assess learners' level of knowledge and needs before implementing education in ECG monitoring. Assuming their level of knowledge based on their length of nursing experience or competencies is not valid and could result in ineffective education for nurses.

Recommendations for Future Research

How can we improve nurses' baseline knowledge and their understanding in ECG monitoring after the education? Since multiple factors contribute to baseline knowledge and knowledge improvement in general, more studies are needed. For example, this study does not include different types of educational methods. Study result could be different for other education methods in ECG monitoring because nurses with different seniority have different strengths and weaknesses. According to Daley (2010), most continuing education programs are more effective for novices. Therefore, further research based on nurses' seniority would be beneficial for both nurses and educators.

Nursing is one of the challenging fields that require a continuous update in their knowledge and practice. However, this continuous improvement can be achieved effectively when nurses have self-motivation with enough support from outside. Thus, the factors that influence nurses' level of knowledge and motivate them to continue to improve themselves could be another area of study.

Implication for Practice

Nurse managers and educators can be benefited from the findings of this study to understand contributing factors to nurses' level of knowledge in ECG monitoring. As mentioned earlier, the pre-assessment of nurses' needs and their level of knowledge should be part of the education process in ECG monitoring to avoid ineffective education.

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Appendix 1: Demographic Questionnaire

1. What is your age? _____ years old
2. What is your gender?
 - a. Male
 - b. Female
3. What is your race/ethnicity?
 - a. White (Non-Hispanic)
 - b. Black or African American (Non-Hispanic)
 - c. Hispanic
 - d. Asian
 - e. American Indian or Alaskan Native
 - f. Native Hawaiian or Other Pacific Islander
 - g. Mixed or other, specify _____
4. What is your highest level of education?
 - a. Diploma
 - b. Associate Degree
 - c. Bachelors Degree
 - d. Masters Degree
 - e. Doctoral Degree
5. What is your role at work?
 - a. RN
 - b. LPN/LVN
 - c. Monitor Technician
6. What type of unit do you primarily work in?
 - a. Coronary Care Unit or Cardiac ICU (primarily cardiac medical patients)
 - b. Cardiothoracic ICU (primarily cardiac surgical patients)
 - c. Cardiac medical progressive care unit (telemetry/stepdown)
 - d. Cardiac surgical progressive care unit (telemetry/stepdown)
 - e. Mixed medical and surgical cardiac ICU
 - f. Mixed medical and surgical cardiac progressive care unit (telemetry/stepdown)
 - g. Mixed/general ICU
 - h. Mixed/general progressive care unit (telemetry/stepdown)
 - i. Universal beds
 - j. Other, specify _____
7. How long have you been a nurse? _____years
8. How long have you worked on a cardiac unit? _____years
9. What do you and others in your unit consider your level of expertise related to ECG monitoring?
 - a. Clinical expert and resource person
 - b. Above average knowledge
 - c. Average knowledge
 - d. Beginner; need to ask others for help
10. Type of hospital-based in-service education you have attended: (Check all that apply.)
 - a. ECG rhythm interpretation
 - b. 12-lead ECG
 - c. ACLS
 - d. Critical care course

- e. Telemetry course
11. Are you familiar with the *Practice Standards for ECG Monitoring*?
- a. Yes b. No
12. Please indicate how you have used a computer: (Check all that apply.)
- a. I spend time on the Internet
 - b. I communicate with people via e-mail
 - c. I use a computer for work
 - d. I use a computer for leisure
 - e. I use a computer for studying
 - f. I have used a computer for training/education
13. Please indicate your level of comfort with computers:
- a. Very comfortable
 - b. Somewhat comfortable
 - c. Not at all comfortable
14. Did you review the online PULSE modules any time since you originally completed the online ECG monitoring education? (*Select the appropriate option*)
- a. No
 - b. Yes
 - c. Not applicable, I have not participated in the PULSE Trial until now