



# Investigating Nurses' Knowledge and Performance on the Diagnostic and Therapeutic Application of Lead aVR

Zahra Manzari<sup>1</sup>, Ali Bazzi<sup>2</sup> and Simin Sharafi<sup>3,\*</sup>

<sup>1</sup>Faculty of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>2</sup>Torbat Jam Faculty of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>3</sup>Faculty of Nursing and Midwifery, Birjand University of Medical Sciences, Birjand, Iran

\*Corresponding author: PhD Candidate in Nursing, Faculty of Nursing and Midwifery, Birjand University of Medical Sciences, Birjand, Iran. Email: siminsharafi68@gmail.com

Received 2018 August 25; Accepted 2019 February 03.

## Abstract

**Background:** The diagnostic and therapeutic uses of lead aVR in coronary artery disease, especially LAD stenosis, are very important in evidence-based nursing.

**Objectives:** The aim of this study was to evaluate the knowledge and performance of nurses in applying lead aVR.

**Methods:** In this descriptive cross-sectional study, 88 nurses working in critical care units were enrolled. The data collection tool was a researcher-made questionnaire, which assessed the knowledge and performance of nurses. The data were analyzed in SPSS software (version 16) using *t*-test, Kruskal-Wallis test, Mann-Whitney test, and correlation coefficient test.

**Results:** The mean score of nurses' knowledge was  $19.6 \pm 5.1$  (out of 60) and the majority (53.4%) had an undesirable knowledge level. The mean score of nurses' performance was  $17.3 \pm 1.1$  (out of 60) and the majority (67%) had an undesirable performance. Moreover, the performance score raised as work experience increased ( $P = 0.01$ ;  $r = 0.6$ ).

**Conclusions:** Given the inappropriate knowledge and performance levels of nurses concerning lead aVR application, it is recommended to modify the educational content and implement new educational methods in order to increase the knowledge and performance of nurses in this regard.

**Keywords:** Nurses' Knowledge, Nurses' Performance, Lead aVR, ECG

## 1. Background

Nursing is a practical profession that entails continuous care activities from simple care to comprehensive decision making in service delivery (1, 2). Although these care activities are important for nurses in all hospital units, cognitive and practical abilities of nurses in the critical care unit (CCU), particularly in the assessment of cardiovascular disease, is of significant importance (3). As one of the important care units, coronary care unit presents nurses with complex issues (4). Considering the mission and goals of coronary care nurses and the need for efficient and capable nurses in the CCU, it can be a top research priority to measure the knowledge and skills of nurses concerning electrocardiogram (ECG) interpretation in order to predict risks at an early stage and enhance mortality and morbidity management (5).

The assessment of nurses' skills and knowledge of ECG interpretation is critical in several respects, e.g., deciding on the ways of formulating foundations for job promotion and higher education, determining the gap between theo-

retical and practical education for ECG interpretation, investigating the gap between the current educational content and educational needs, increasing nurse-physician interaction in continuous evaluation of patients with heart problems, and screening inefficient nurse staff (6, 7). New educational methods including peer-led, software- and web-based training, and self-study books, as well as new devices to accelerate ECG strip review process, indicate the importance of ECG in the nursing field (8). Currently, there is a wide range of educational techniques, which can be used to train people in health and care areas concerning the application of equipment, 12-lead electrocardiogram monitoring, and ECG interpretation (9-11). Besides, nurses need to have adequate information about ECG and should be able to interpret it because they are responsible for ECG monitoring in clinical conditions (12).

Although there is no special educational content regarding the lead aVR and its determining role in acute coronary syndrome, arrhythmia, pericarditis, and pulmonary emboli, or its diagnostic role in exercise testing and drug toxicity, aVR is known as a forgotten lead de-

spite its high importance (13). Di Toro et al. studied eight patients in a clinical trial and found that the presence of the R-wave (Pseudo-R-wave) (P-wave at the end of QRS complex) in lead aVR with no other symptom in ECG is the only symptom needed for the diagnosis of AVNRT and that it increases the diagnosis sensitivity up to 15% (14).

Hence, the clinical nursing curriculum requires the evaluation of knowledge and performance regarding lead aVR and investigation of attitude, knowledge, skills, strengths, and weaknesses of its diagnostic aspects for treatment purposes so that a new approach can be adopted in educational contents in this respect (15, 16). Given the significance of lead aVR, Pahlm et al. proposed an interesting idea for diagnosing clinical problems based on this lead. In the classic view, an investigation of lead I, II, and III is initially done in the cardiac axis with a 60-degree distance between each, and then leads AVR, AVL, and AVF are examined in a 120-degree distance from each other. However, in the proposed view, all leads are simultaneously examined in the left side of the heart axis imaginary circle centered at 30° to one another so that clinical problems and nursing diagnosis can be achieved more quickly (17). Considering the fact that a one-minute faster diagnosis of the left main coronary artery by the nurse increases the chance of survival in patients by 2.2%, an investigation of lead aVR is important due to its prediction and diagnosis power (18-20).

## 2. Objectives

The current research aims at investigating the knowledge and performance of nurses concerning lead aVR.

## 3. Methods

It is a descriptive cross-sectional study conducted from March to April 2016. The nurses working in the CCU of Imam Reza Hospital and Ghaem Hospital in Mashhad constituted the research population, who were sampled by the census. The inclusion criteria comprised a minimum of one-year work experience in the CCU, informed consent to participate in research, and lack of training in the field of diagnostic use of lead aVR.

The data collection tool consisted of a questionnaire with three independent sections, including a demographics form, a knowledge questionnaire, and a performance measurement questionnaire. The two latter sections concerned the use of lead aVR, all designed by the researcher. The knowledge questionnaire was answered by self-report and contained 30 items with three answers (true/false/I do

not know). The scores ranged from 0 to 60 and were categorized as poor or inappropriate knowledge (0 - 20), moderate knowledge (21 - 40), and desirable knowledge (41 - 60).

The performance measurement section was researcher-made based on experienced real scenarios, consultations made with the cardiology specialists of Imam Reza Hospital, and review of reliable books. The section included six items on a five-point scale with the same scoring system and classification as the knowledge section. The score of the performance section was between 0 and 60, and a higher score showed better performance. It should be noted that the latest and most authoritative reference books for diagnosis in nursing and medicine were used as the basis for the initial design of the items.

The response time was 30 minutes. To determine the validity of the questionnaire, it was reviewed by 20 faculty members of the Nursing and Midwifery School and Imam Reza Hospital both affiliated to Mashhad University of Medical Sciences. 15 individuals made corrective comments, and necessary corrections were made accordingly. Ethical approval (code: 930459) was obtained from the university. To determine the reliability of the questionnaire, a test-retest was administered. The questionnaires were distributed to 20 eligible nurses working in the specialized cardiac care unit within 10 days. The correlation coefficients obtained for the knowledge and performance sections were 0.88 and 0.90, respectively. SPSS version 16 software was used for data analysis.

Descriptive statistical tests (mean, standard deviation, and frequency distribution) were used to describe the research units, and to compare the obtained data, correlation coefficient, independent *t*-test, Kruskal-Wallis, and Mann-Whitney tests were used. The significance level was considered less than 0.05.

## 4. Results

The majority of the participants were female (84%), married (68.1%), and contractual employees (52.27%). The mean  $\pm$  standard deviation (SD) of age was  $30.2 \pm 7.4$  years with the majority of them (61.3%) being in the age range of 27 - 32 years. The mean  $\pm$  SD of general and CCU work experience was  $7.1 \pm 5.3$  and  $3.2 \pm 1.3$  years, respectively. The majority of the nurses (67%) had a BSc degree, and the most important source of information on lead aVR was educational content presented during the BSc program. Other information related to socio-demographic characteristics is observed in Table 1.

The mean score of nurses' knowledge was  $19.6 \pm 5.1$  (out of 60) and the majority of them (53.4%) had an inappropriate knowledge level. The highest level of knowledge was regarding physiology and morphology of the

**Table 1.** Personal Characteristics of the Participating Nurses<sup>a, b</sup>

Variable	Values	Knowledge Score (P Value)	Performance Score (P Value)
<b>Gender</b>			
Male	14 (16)	0.08 <sup>A</sup>	0.16 <sup>C</sup>
Female	74 (84)		
<b>Marital status</b>			
Married	60 (68.1)	0.74 <sup>A</sup>	0.88 <sup>C</sup>
Single	24 (31.7)		
<b>Employment status</b>			
Formal	10 (11.3)	0.09 <sup>B</sup>	0.24 <sup>D</sup>
Contractual	46 (52.27)		
Service commitment	8 (9.0)		
Conditional	24 (27.2)		
<b>Education</b>			
Bachelor	81 (92.1)	0.22 <sup>A</sup>	0.06 <sup>C</sup>
Master	7 (7.9)		
<b>Work experience, y</b>	7.1 ± 5.3	0.08 <sup>B</sup>	0.01 <sup>D</sup>
<b>CCU work experience, y</b>	3.2 ± 1.3	0.32 <sup>B</sup>	0.08 <sup>E</sup>
<b>Source of information about ECG</b>			
Academic period	59 (67)	0.11 <sup>B</sup>	0.55 <sup>D</sup>
Workshops, conferences and seminars on heart	12 (13.6)		
Self-directed learning	17 (19.3)		

<sup>a</sup>Values are expressed as No. (%) or mean ± SD.

<sup>b</sup>Statistical test: A, Mann-Whitney; B, Kruskal-Wallis test; C, t-test; E, ANOVA.

lead waves and the lead position in the cardiac axis (67%), while the lowest level of knowledge was on AVR application in bundle branch block (10.2%) and Takotsubo syndrome (9%). The statistical analysis indicated that there was no significant relationship between the knowledge score and the variables of age, gender, education level, type of employment, and other personal variables (Table 1).

The mean score of performance in the nurses was 17.3 ± 1.1 (out of 60), and the majority of them had an inappropriate performance level (67%). No statistically significant relationship was found between individual variables and performance (Table 1). However, there was a positive significant correlation between work experience and performance ( $P = 0.01$ ;  $r = 0.6$ ).

Two-third of nurses with inappropriate knowledge about lead aVR had inappropriate performance. The results of the Spearman correlation coefficient test showed a direct relationship between knowledge and performance scores of nurses ( $P < 0.001$ ;  $r = 0.891$ ) (Table 2).

**Table 2.** Correlation Between Knowledge and Performance<sup>a</sup>

Variable/Level	No. (%)
<b>Knowledge</b>	
Inappropriate (0 - 20)	47 (53.4)
Relatively appropriate (21 - 40)	22 (25)
Appropriate (41 - 60)	9 (11.6)
Total	88 (100)
<b>Performance</b>	
Inappropriate (0 - 20)	59 (67)
Relatively appropriate (21 - 40)	29 (33)
Appropriate (41 - 60)	-
Total	88 (100)

<sup>a</sup>Statistical test:  $r: 0.891, P < 0.001$  (Spearman correlation coefficient).

## 5. Discussion

In the present study, nurses showed an undesirable level of knowledge and performance concerning the manner of using the lead aVR as a tachycardia rhythm disorder

or ventricular ectopic beat diagnostic tool in the atrioventricular node.

In a study conducted by Haghjoo et al. on patients with heart disease, the results showed that lead aVR is important for the correct diagnosis of arrhythmias and tachycardia (21). Therefore, it will be highly critical for nurses to have adequate information in order to diagnose the disorder in a timely manner and to implement appropriate treatment, which can both be lifesaving to patients and prevent unwanted complications.

The majority of similar studies report consistent results with those of the present study. Jang et al. studied nurses' knowledge of the correct use of ECG in emergency departments, intensive care units, and CCU. The results showed that the majority of nurses working in coronary care units had moderate or weak knowledge levels (22). Ejaz et al. also examined the knowledge of nurses about risk factors of cardiovascular disease. The results of their study showed a significant lack of knowledge in nurses as members of treatment teams that have the closest relationship with patients (23). In a clinical trial, Stephens et al. assessed the level of knowledge and ability of nurses to identify the exact location of the ischemic heart based on ECG, concluding that nurses of different hospital wards had low competency. They also reported that the nurses' level of knowledge significantly increased with the implementation of an educational intervention (24). Funk et al. assessed the level of knowledge, quality of nursing care, and patient efficacy, reporting that the implementation of educational interventions was effective to improve the level of knowledge and quality of nursing care (25). In this regard, Kalhori et al. showed that ICU nurses' knowledge about appropriate cardiopulmonary resuscitation guidelines was inadequate and that their knowledge and practice scores significantly increased after they received periodic education (26). Zhang and Hsu maintained that the implementation of training courses is needed to increase the knowledge of nurses and improve the quality of nurses on the correct use of ECG (27).

Therefore, considering the inadequacy of knowledge and practice of nurses and the significance of correct diagnosis of cardiac disorder as a lifesaving issue, it is highly important to hold educational courses on how to place electrocardiographs including lead aVR in the right anatomical location, make a correct diagnosis of ECG, and provide proper information to the physician to take appropriate actions. Moreover, in a study by Funk et al. that examined nurses' knowledge of the correct use of ECG, similar to Zhang and Hsu, they reported a poor knowledge level in nurses concerning the correct use of ECG (25, 27).

Another study by Stephens et al. enquired into the ability and knowledge of nurses working in different wards of

the hospital to diagnose an ischemic ECG and type of ischemia, showing that nurses did not have sufficient knowledge. In addition, this study recommended the implementation of educational programs to enhance the knowledge of nurses about the correct use of ECG and emphasized the impact of implementing educational processes through clinical trial interventions (24). Ejaz et al. evaluated the knowledge and practice of nurses about risk factors of heart disease, concluding that their level of knowledge was poor. They maintained that a set of issues could have positive effects including nurses' possession of sufficient knowledge about cardiovascular risk factors, as one of the major causes of mortality, especially knowledge of high blood pressure and vascular disorders, teaching patients to change their lifestyle, and improving health via treatment teams that have close relationships with patients (23).

In contrast, the results of some studies, such as the study of Kalhori et al. do not match the results of this study. In their study, the expert knowledge of nurses about cardiopulmonary resuscitation methods, based on the 2010 CPR guidelines, was desirable (26). The reason for the discrepancy in the results of this study and those of other studies can be attributed to the classes held before measuring the level of knowledge. Therefore, there is a need for educational and periodic courses to improve the level of knowledge of nurses about the use of diagnostic tools such as ECG. One study by Ebrahimian et al. which examined the level of knowledge of nurses in the interpretation of ECG, reported insufficient knowledge about ECG interpretation in nurses. There is a need to investigate the causes of this deficiency and minimize the problem by implementing educational interventions because heart disease would have irreparable consequences if not detected in a timely and correct manner (28). In a study that examined the effect of an educational program on the knowledge of ECG interpretation in nurses, Jung et al. reported that nurses' knowledge before the educational program was undesirable. This level of knowledge in nurses increased after the educational course completed. Therefore, the implementation of training courses can increase the knowledge and awareness of nurses (22).

In this regard, it is proposed to hold in-service or short-term courses for nurses on lead aVR and implement periodic training programs for CCU nurses, given the sensitivity of cardiovascular evaluation, the important role of lead aVR, and the need for the provision of prompt information to the physician to monitor the patient.

### 5.1. Conclusions

ECG interpretation is one of the important tasks of nurses concerning patients admitted to the CCU. Increas-

ing the skill of nurses in this regard can help greatly follow up the patients and it leads to professional and advanced care in the CCU. Given the importance of lead aVR in detecting many disorders and considering the lack of nurses' knowledge in this respect, this study highlighted the need to promote these skills through modifying the nursing curriculum and providing continuous education courses.

## Acknowledgments

This paper is based on a research project with the code 93045 approved by Mashhad University of Medical Sciences. We thank the Vice Research, the faculty members of the Nursing and Midwifery School, the Department of Cardiology of Imam Reza Hospital, and nurses participating in this study.

## Footnotes

**Authors' Contribution:** Conceptualization and design of the work: Zahra Manzari; data collection: Ali Bazzi; data analysis and interpretation: Ali Bazzi; Simin Sharafi, drafting the manuscript: Simin Sharafi; critical revision of the manuscript: Zahra Manzari, Ali Bazzi, Simin Sharafi; final approval of the manuscript: Simin Sharafi.

**Conflict of Interests:** There are no conflicts of interest in this study.

**Funding/Support:** Mashhad University of Medical Sciences funded the study.

## References

- Terzi AB. Nurse's role in the modern resuscitation era. *Hosp Chron*. 2012;**7**(1):25-31.
- Nikravan Mofrad M, Shiri H. [Intensive care in ICU]. Tehran: Noor-e-Danesh; 2005. Persian.
- Joolaee H, Alizadeh M, Fallahzadeh MH, Baseri A, Sayadi M. [Evaluation of clinical skills of family physicians in Fars province by means of observed structured clinical evaluation]. *Strides Dev Med Educ*. 2011;**7**(2):92-8. Persian.
- George A, Arumugham PS, Figueredo VM. aVR - the forgotten lead. *Exp Clin Cardiol*. 2010;**15**(2):e36-44. [PubMed: 20631863]. [PubMed Central: PMC2898534].
- Abdelaziz M, Samer Kamel S, Karam O, Abdelrahman A. Evaluation of E-learning program versus traditional lecture instruction for undergraduate nursing students in a faculty of nursing. *Teach Learn Nurs*. 2011;**6**(2):50-8. doi: 10.1016/j.teln.2010.10.003.
- Razvi S, Avizhgan M. [Comparison of lecture and group discussion methods on learning anatomical sciences: A study in PhD students]. *Iran J Med Educ*. 2012;**11**(6):580-1. Persian.
- Subramanian A, Timberlake M, Mittakanti H, Lara M, Brandt ML. Novel educational approach for medical students: Improved retention rates using interactive medical software compared with traditional lecture-based format. *J Surg Educ*. 2012;**69**(4):449-52. doi: 10.1016/j.jsurg.2012.05.013. [PubMed: 22677580].
- Glanz K, Rimer BK, Lewis FM. *Health behavior and health education, theory, research, and practice*. 4th ed. Jossey-Bass, San Francisco: Calif publisher; 2008.
- Vahabi YS, Tadrissi SD, Ghayem SH, Ebadi A, Daneshmandi M, Saghafinia M. [Comparing the effect of triage education in lecture and multimedia software on nurses learning]. *Iran J Crit Care Nurs*. 2011;**4**(1):7-12. Persian.
- Fayazi S, Abdi M, Sayadi N, Rostami S. [Assessment of cardiac intensive care nurses' performance in using intravenous Streptokinase for patients with acute myocardial infarction patients]. *Cardiovasc Nurs J*. 2012;**1**(3):50-6. Persian.
- Backstrom M, Ekman E, Mjorndal T. Adverse drug reaction reporting by nurses in Sweden. *Eur J Clin Pharmacol*. 2007;**63**(6):613-8. doi: 10.1007/s00228-007-0274-8. [PubMed: 17404719].
- Jamshidi M, Jamshidi A, Zanganeh M. Knowledge, attitude, and practices regarding contact precautions among Iranian nurse. *Azad Med Jur*. 2008;**27**(265-8).
- Askarian M, Shiraly R, Aramesh K, McLaws ML. Knowledge, attitude, and practices regarding contact precautions among Iranian physicians. *Infect Control Hosp Epidemiol*. 2006;**27**(8):868-72. doi: 10.1086/506411. [PubMed: 16874649].
- Di Toro D, Hadid C, Lopez C, Fuselli J, Luis V, Labadet C. Utility of the aVL lead in the electrocardiographic diagnosis of atrioventricular node re-entrant tachycardia. *Europace*. 2009;**11**(7):944-8. doi: 10.1093/europace/eup130. [PubMed: 19525496].
- Altun I, Ersoy N. Undertaking the role of patient advocate: A longitudinal study of nursing students. *Nurs Ethics*. 2003;**10**(5):462-71. doi: 10.1191/0969733003ne6280a. [PubMed: 14529113].
- Shrier I, Green S, Solin J, Duarte-Franco E, Guibert R, Brousseau G, et al. Knowledge of and attitude toward patient confidentiality within three family medicine teaching units. *Acad Med*. 1998;**73**(6):710-2. doi: 10.1097/00001888-199806000-00021. [PubMed: 9653413].
- Pahlm US, O'Brien JE, Pettersson J, Pahlm O, White T, Maynard C, et al. Comparison of teaching the basic electrocardiographic concept of frontal plane QRS axis using the classical versus the orderly electrocardiogram limb lead displays. *Am Heart J*. 1997;**134**(6):1014-8. doi: 10.1016/S0002-8703(97)70020-6. [PubMed: 9424060].
- Adib-Hajbaghery M. [Longitudinally investigation of the skills of cardiopulmonary resuscitation in nurse interns of Kashan University of Medical Sciences]. *Iran J Cardiovasc Nurs*. 2014;**3**(1):6-17. Persian.
- Hosseini Nejad SM, Bozorgi F, Taleshi Z, Montezer SH, Goli Khatir I, Jahanian F, et al. [Levels of knowledge and skills of medical interns in Mazandaran University of Medical Sciences about cardio-pulmonary resuscitation, 2011]. *J Mazandaran Univ Med Sci*. 2013;**22**(97):98-103. Persian.
- Makinen M, Axelsson A, Castren M, Nurmi J, Lankinen I, Niemi-Murola L. Assessment of CPR-D skills of nursing students in two institutions: Reality versus recommendations in the guidelines. *Eur J Emerg Med*. 2010;**17**(4):237-9. doi: 10.1097/MEJ.0b013e328331471b. [PubMed: 19770665].
- Haghjoo M, Bahramali E, Sharifkazemi M, Shahrzad S, Peighambari M. Value of the aVR lead in differential diagnosis of atrioventricular nodal reentrant tachycardia. *Europace*. 2012;**14**(11):1624-8. doi: 10.1093/europace/eus109. [PubMed: 22547768].
- Jang KS, Hwang SY, Park SJ, Kim YM, Kim MJ. Effects of a Web-based teaching method on undergraduate nursing students' learning of electrocardiography. *J Nurs Educ*. 2005;**44**(1):35-9. [PubMed: 15673173].
- Ejaz S, Afzal M, Hussain M, Sarwar H, Gilani SA. Knowledge, attitude and practice regarding modifiable risk factors of cardiovascular diseases among adults in rural community, lahore. *Int J Soc Sci Manage*. 2018;**5**(3):76-82.
- Stephens KE, Anderson H, Carey MG, Pelter MM. Interpreting 12-lead electrocardiograms for acute ST-elevation myocardial infarction: What nurses know. *J Cardiovasc Nurs*. 2007;**22**(3):186-93. quiz 194-5. doi: 10.1097/01.JCN.0000267822.81707.c6. [PubMed: 17545821].

25. Funk M, Fennie KP, Stephens KE, May JL, Winkler CG, Drew BJ, et al. Association of implementation of practice standards for electrocardiographic monitoring with nurses' knowledge, quality of care, and patient outcomes: Findings from the practical use of the latest standards of electrocardiography (PULSE) trial. *Circ Cardiovasc Qual Outcomes*. 2017;**10**(2). doi: [10.1161/CIRCOUTCOMES.116.003132](https://doi.org/10.1161/CIRCOUTCOMES.116.003132). [PubMed: [28174175](https://pubmed.ncbi.nlm.nih.gov/28174175/)]. [PubMed Central: [PMC5341740](https://pubmed.ncbi.nlm.nih.gov/PMC5341740/)].
26. Kalhori RP, Jalali A, Naderipour A, Almasi A, Khavasi M, Rezaei M, et al. Assessment of Iranian nurses and emergency medical personnel in terms of cardiopulmonary resuscitation knowledge based on the 2010 guideline. *Iran J Nurs Midwifery Res*. 2017;**22**(3):184-9. doi: [10.4103/1735-9066.208167](https://doi.org/10.4103/1735-9066.208167). [PubMed: [28706541](https://pubmed.ncbi.nlm.nih.gov/28706541/)]. [PubMed Central: [PMC5494946](https://pubmed.ncbi.nlm.nih.gov/PMC5494946/)].
27. Zhang H, Hsu LL. The effectiveness of an education program on nurses' knowledge of electrocardiogram interpretation. *Int Emerg Nurs*. 2013;**21**(4):247-51. doi: [10.1016/j.ienj.2012.11.001](https://doi.org/10.1016/j.ienj.2012.11.001). [PubMed: [23266113](https://pubmed.ncbi.nlm.nih.gov/23266113/)].
28. Ebrahimian A, Fakhr-Movahedi A, Davari H, Tourdeh M. [The effect of peer-nurses' lecturing on critical units nurses' retaining knowledge of electrocardiogram interpretation]. *J Payavard Salamat*. 2015;**8**(5):390-8. Persian.