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Original Research

Learning Curve of Central Venous (CV) Line Placement Skills in Emergency Medicine Residents

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Abstract

Background: Without mastering Central Venous (CV) Line placement skills, medical graduates will not have sufficient clinical competence to perform this sensitive procedure. The level of proficiency in each repetition of any skill, such as CV Line, can be checked and recorded by means of a learning curve.

Method: This article was cross-sectionally conducted in 80 emergency medicine resident students. In order to collect data, a checklist was used to measure the level of proficiency in installing CV Line, according to the experts and available sources, after each time performing the skill and recording observations and before performing this skill again (with an interval of 1-3 days), The student's proficiency score was calculated by the emergency medicine assistant out of 100 and recorded in the learning curve, and this process continued until reaching the clinical proficiency stage, that is, reaching a smooth line in the learning curve. Then all the data were recorded and subjected to statistical analysis.

Results: The results showed that there was a significant difference between the average scores of clinical skills in five stages. The clinical skill level scores in the first time (13/29) were significantly lower than the clinical skill level scores in the second, third, fourth and fifth time, and overall, the clinical skill level scores and the ability to do work increased over time.

Conclusion: After five times performing the CV Line embedding, the students will reach clinical proficiency in doing it.

Keywords: Central Venous, Emergency Medicine, Residents.

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Introduction

Central venous catheters (CVCs) are catheters that are placed in large veins such as neck (internal jugular vein), chest-chest (subclavian vein), or thigh (femoral vein). Today, the use of these catheters in outpatient and inpatient settings is increasing, so high quality training should be conducted under the supervision of experts to train the human resources responsible for its placement, so that complications during the procedure can be reduced. The problems caused by CVC installation can be divided into two categories. The first category is related to the loss of skin integrity and the development of opportunistic bacterial and fungal infections and sometimes bloodstream infections (1). Central venous catheter-related infection increases mortality from 4 to 20 percent (2). Studies indicate varying infection rates related to CVCs. One study estimates over 160,000 central line-associated bloodstream infections (CLABSIs) annually in Europe, causing around 25,000 deaths (3). In a multicentric study, the incidence rate of central catheter-associated bacteremia was reported as 11.8% (4). Approximately 25% of inserted central venous catheters show asymptomatic colonization, and infection rates range between 7% and 42% (5). Though catheter-related sepsis occurs in a small percentage of patients, its impact is significant due to the widespread use of CVCs (6). Another problem caused by CVC placement is its potential mechanical complications that harm the patient and increase the length of treatment and costs. Common mechanical complications include the formation of hematoma, hemothorax, and arterial puncture, which usually occur during catheter placement by unskilled hands (7). Pneumothorax, which is also called pulmonary collapse, occurs during placement and due to the impact of the needle on the lung and the creation of an air leak, with the incidence varying between 1% and 6.6%. Higher rates are reported in emergency situations and with larger numbers of needle passes during insertion (8). In some cases, delayed pneumothorax and contralateral hydrothorax can occur as complications of CVCs (9,10).

The risk of complications due to CVC placement is directly related to the experience of the person performing the procedure (11) and the competence of the individual performing the catheter placement is one of the strongest predictors of complications (12). Therefore, it is necessary to train medical students to perform the procedure in a principled manner with minimal side effects. In a study, it was shown that after standardization and training on correct hand washing, the incidence rate of CLAB decreased from 7.7 per 1000 days of patients having a central venous catheter to 1.4 (13). In addition, to solve the problem of this complication, the Health Development Institute has introduced an evidence-based intervention called the catheter care bundle, which has better results for patients. This bundle or standard care includes hand washing, skin washing with chlorhexidine and skin antiseptic solutions, standard precautions, choosing the right place, daily care of the catheter insertion site and removing it on time (12). Therefore, the way of embedding the lines and the bundle of their care should be included in the educational calendar of medical students and people with less experience. Studies show that the education and service delivery system in the future should be based on teamwork, standard protocols, patient-centered care, updated medicine based on evidence and information technology (14), but substantial evidence supporting this transition is still lacking. To achieve this goal, managers and educational planners must establish infrastructure and conduct comprehensive research to identify the most effective methods of service delivery, including procedures like the installation of intravenous catheters. This entails gathering robust evidence and exploring innovative approaches to ensure successful implementation. The learning performance of medical assistants is evaluated by many methods. Also, methods such as supervision, real patient care and other methods are used for this purpose (15). In order to determine an objective standard that indicates the sufficient number of times to perform a skill, the level of proficiency in each repetition of that skill can be examined and recorded, which is called a learning curve. The learning curve theory is based on the principle that the time required to perform an activity decreases with the repetition of that activity (16). The learning curve can be used for simple skills such as memorizing a word, intermediate skills such as CV Line and complex skills such as cystoscopy (17-19). This curve is drawn in the coordinate system in such a way that the horizontal axis shows the number of times the skill is performed and the vertical axis shows the level of mastery, and with that, the learning rate of the students is evaluated. In fact, the learning curve is the changes created in a person's proficiency as a result of performing a skill different time (16). The learning curve is based on the beginner-to-expert theory of Benner and colleagues, according to which repeated practice of skills causes a gradual increase in overall clinical proficiency (20). Common methods for developing standards using the learning curve include three criteria: smoothing the learning curve, achieving a defined level of mastery (e.g., 75%), and ensuring a specific percentage of learners reach the desired proficiency. The target proficiency percentage can be selected according to factors such as skill sensitivity, length of training period, continuity or lack of continuity of training, and the level of education of learners (21,22). By drawing a learning curve, a standard can be achieved for the frequency of performing clinical skills. So in this study we aimed at investigating the number of CV Line insertions through the jugular vein to obtain the necessary clinical adequacy based on the standard learning curve.

Methods

This research is a prospective cohort study, which was conducted for emergency medicine residents of Kerman University of Medical Sciences in 2017-2018. The sample of the study consisted of emergency medicine assistant students of Kerman University of Medical Sciences who had previously been trained to apply the CV line through the jugular vein theoretically and practically, but had not performed this skill in a clinical setting until the time of the study. Also, they did not have any organ defects or diseases that would cause problems in performing clinical skills. All the second- and third-year residents were included in the study in a period of 12 months by census method, except for those meeting exclusion criteria.

The research comprised two stages. Firstly, a standard checklist was developed, and experts determined the required score for clinical adequacy. In the second stage, the performance of the assistants was observed, and the CV Line skill score was assessed based on the checklist. For the first stage, based on specialized sources and the opinion of emergency medicine specialists, a number of criteria were selected to check the clinical adequacy of CV line placement, and its validity and reliability were checked by all emergency medicine specialists working in Kerman University of Medical Sciences. In the second stage, the performance of clinical skills by students and its effect on the level of clinical proficiency were repeatedly measured, and this practice continued until the learning curve smoothed out (less than five percent change or reaching 100 percent proficiency).

After obtaining approval and coordination with the research environment officials, two coordination meetings were conducted with the research team and the educational group director. Eligible students were selected from clinical departments using the research unit's selection form. After explaining the research objectives and obtaining informed consent, their personal characteristics were collected through a relevant questionnaire. To reinforce theoretical information, oral training sessions were conducted at the beginning of each training period. The proficiency checklist, outlining the skill stages, was provided to assistants for review. A one-week interval was implemented for regularity and to minimize possible behavior changes. During instances of performing CV Line on conscious adults, the researcher assessed skill proficiency using the checklist. The student's proficiency score, out of 100, was recorded in the learning curve after each performance. This process continued until reaching clinical proficiency, characterized by a smooth line in the learning curve (less than a five percent change in proficiency over three consecutive measurements or reaching 100 percent proficiency). Subsequently, all data were recorded and subjected to statistical analysis.

Data with SPSS 21 software and using descriptive statistics (mean, standard deviation, relative and absolute frequency distribution, percentile). To analyze the data, a repeated measures analysis of variance (ANOVA) was employed due to the multiple measurements taken during the learning process. The assumption of sphericity was tested using Mauchly's sphericity test, and Greenhouse-Geisser correction was applied when the assumption was violated.

Results

In this study, 30 students were examined to assess the difference in the mean scores of clinical skills across five stages, utilizing a repeated measure analysis of variance (ANOVA). Initially, Mauchly's sphericity assumption was assessed through the Mauchly's sphericity test, and the results are presented in Table 1. The results in Table 1 indicate a violation of the sphericity assumption ($p = 0.00$). Therefore, a Greenhouse-Geisser adjusted repeated measures ANOVA was deemed necessary. The outcomes of the repeated measure ANOVA, considering the lack of sphericity assumption, are presented in Table 2. Considering the results in Table 2, the calculated F value for the effect of stages is significant ($F = 320.572$, $p = 0.00$), indicating a significant difference in mean scores of clinical skills across the five stages. Post hoc tests were conducted to examine specific differences among means, and the results are presented in Table 3. Table 3 illustrates a significant difference in all mean scores of clinical skills. The post hoc tests indicate a significant difference in clinical skill scores among all stages.

Discussion

In this cross-sectional study conducted among assistant students at Kerman University of Medical Sciences to assess the frequency of central catheter placements for achieving clinical proficiency, a significant difference was observed in the average scores of clinical skill levels across five stages. The results indicate a noteworthy distinction in all clinical skill scores. Specifically, the clinical skill level scores at the initial assessment (13.29) were significantly lower than those in subsequent assessments (second, third, fourth, and fifth). Overall, there is a discernible upward trend in clinical skill level scores, reflecting an improvement in the ability to perform tasks over time. Similar findings were reported in Gettman's study, which explored the required frequency for mastering cystoscopy skills (19), and in studies related to compliance calculations for central venous catheter care (23).

In the first study, Gettman and his colleagues tried to find the frequency of performing cystoscopy to achieve clinical adequacy based on the learning curve in a computer-simulated form. The results showed that the people participating in the study achieved mastery in this field with the standard of performing cystoscopy 6 times. In the second study, East et al. during a study in 2005 investigated the effect of nursing education on CV line compliance under a training program. The results showed that complications caused by CV line insertion improved significantly after training. In their study in 2003, Grantcharov and his colleagues investigated the number of times required to gain proficiency in performing laparoscopy according to the level of previous skill of the doctors. The results of this study also estimate the number of times required to gain proficiency in performing laparoscopy between 2 and 7 times (48), which is similar to the present study. Also, in the study of Pandian et al., which used the learning curve to check the level of proficiency of flexible laryngoscopy in 15 medical students on a mannequin, they also suggested performing the skill 6 times to achieve the necessary proficiency (24).

The results of Ines Prach et al. and Erman et al.'s study on students' cardiopulmonary resuscitation skills and Arthur et al.'s study on human skills demonstrated that continuous practice of the skill, even for a short period of time, enhances the learning of certain factors, such as the practiced time distance (25, 26). We did not work on this variable in our study, but what is clear is that environmental conditions and personal characteristics of the learners can lead to a decrease in proficiency, which can be one of the main reasons for changes in the learning curve, decrease in accuracy and concentration. In some details, it may be due to the increase of proficiency in learners due to factors such as false self-confidence about acquiring sufficient proficiency and decreasing anxiety and fear of performing skills (21,22). Sun (2010), Burritt (2009) and Yang (2006) also showed in their studies that in the frequency of performing a clinical skill, there is an increasing trend of proficiency at first, but after that, it either has a downward trend or remains stable (27-30). This fact is well clear in the graph obtained from our data analysis in the fourth chapter.

Considering that medical education is expensive and faces a large volume of work, lack of human resources and equipment for education, the clinical training of medical assistants should be planned in such a way as to achieve sufficient proficiency, stabilize skills and facilities. and the existing conditions, balance will be established. Of course, in this regard, conducting a study on the difference in the retention rate (that is, the length of time a person remembers a learned skill) so that the learning curve can be used to determine the number of times clinical skills are learned and determine the number of times The standard of skill performance, while achieving effective clinical training, saved costs and instead of spending time on performing clinical skills in which mastery has been gained, time should be spent in performing skills in which the level of mastery gained is as high as sufficiency of 75% is not reached and besides that, new skills that are the future job needs of doctors should be included in their curriculum. Compilation of educational standards will help evidence-based education and is one of the ways to improve the quality of education and educational efficiency. Standardization of assistant clinical skills training program, in addition to the above, can help to save educational resources, document schedule of the training program, design a log book to record clinical skills, modify the training program, and finally improve the clinical competence of graduates. In view of the above, the aim of this study is to determine the appropriate educational standard for the frequency of CV Line placement through the jugular vein based on the smoothing of the learning curve, the average of achieving 75% proficiency, and the percentage of students who have achieved the required proficiency. In the present study, in addition to strengthening the body of knowledge about how to acquire clinical competence in relation to medical skills; In particular, the insertion of central venous catheters should be evaluated as a challenging issue in the field of patient safety, which is one of the significant topics of research in the last two decades.

Conclusion

Embedding CV Line five times leads to the improvement of results in the clinical competence of medical students in the field of emergency medicine. Using the results in the medical assistant training curriculum can be one of the most practical results of this research. Also, the results of this study have helped evidence-based education and are among the strategies to improve the quality of education and improve patient safety through infection control.

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All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

References

1. Loomba G, Dhandapani M, Ramachandran R, Kaur S. A RANDOMISED CONTROL TRIAL TO EVALUATE EFFECTIVENESS OA AN INTERVENTION PACKAGE ON INTERNAL JUGULAR VEIN CATHETER RELATED INFECTION AMONGST THE PATIENTS UNDERGOING HEMODIALYSIS, PGIMER, CHANDIGARH. Nephrology Dialysis Transplantation. 2017;32(suppl_3):iii671-iii2.

2. Castagna HMF, Kawagoe JY, GonÃ§alves P, Menezes FG, Toniolo AR, Silva CV, et al. Active surveillance and safety organizational goals to reduce central lineâ€"associated bloodstream infections outside the intensive care unit: 9 years of experience. American journal of infection control. 2016;44(9):1058-60.

3. Menger J, Kaase M, Schulze MH, Dudakova A, Rosin K, Moerer O, Scheithauer S. Central venous catheter contamination rate in suspected sepsis patients: an observational clinical study. Journal of Hospital Infection. 2023 May 1;135:98-105.

4. Patil HV, Patil VC, Ramteerthkar MN, Kulkarni RD. Central venous catheter-related bloodstream infections in the intensive care unit. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2011 Oct;15(4):213.

5. Parra-Flores M, Souza-Gallardo LM, García-Correa GA, Centellas-Hinojosa S. Incidence of infection associated with central venous catheter and related risk factors in patients on total parenteral nutrition in a third level hospital. Cirugía y Cirujanos (English Edition). 2017 Mar 1;85(2):104-8.

6. Putterman C. Central venous catheter related sepsis: a clinical review. Resuscitation. 1990 Aug 1;20(1):1-6.

7. McGee DC, Gould MK. Preventing complications of central venous catheterization. New England Journal of Medicine. 2003;348(12):1123-33.

8. Tsotsolis N, Tsirgogianni K, Kioumis I, Pitsiou G, Baka S, Papaiwannou A, Karavergou A, Rapti A, Trakada G, Katsikogiannis N, Tsakiridis K. Pneumothorax as a complication of central venous catheter insertion. Annals of translational medicine. 2015 Mar;3(3).

9. Girgin NK, Arici S, Turker G, Otlar B, Hotaman L, Kutlay O. Delayed pneumothorax and contralateral hydrothorax induced by a left subclavian central venous catheter: a case report. Clinics. 2010;65:562-5.

10. Thomas CJ, Butler CS. Delayed pneumothorax and hydrothorax with central venous catheter migration. Anaesthesia. 1999 Oct;54(10):987-90.

11. Runyon BA. Paracentesis of ascitic fluid: a safe procedure. Archives of internal medicine. 1986;146(11):2259-61.

12. Haire WD, Lieberman RP. Defining the risks of subclavian-vein catheterization. Mass Medical Soc; 1994.

13. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. New England Journal of Medicine. 2006;355(26):2725-32.

14. Gahlot R, Nigam C, Kumar V, Yadav G, Anupurba S. Catheter-related bloodstream infections. International journal of critical illness and injury science. 2014;4(2):162.

15. Richardson WC, Berwick DM, Bisgard JC, Bristow LR, Buck CR, Cassel CK. Crossing the quality chasm: a new health system for the 21st century. Institute of Medicine, National Academy Press Washington, DC; 2001.

16. Fioretti G. The organizational learning curve. European Journal of Operational Research. 2007;177(3):1375-84.

17. Olson MH. An introduction to theories of learning. Psychology Press; 2015.

18. Loukas C, Nikiteas N, Kanakis M, Moutsatsos A, Leandros E, Georgiou E. A virtual reality simulation curriculum for intravenous

cannulation training. Academic Emergency Medicine. 2010;17(10):1142-5.

19. Gettman MT, Le CQ, Rangel LJ, Slezak JM, Bergstralh EJ, Krambeck AE. Development of a standardized curriculum for teaching cystoscopic skills using a computer-based endourologic simulator. Simulation in Healthcare. 2009;4(2):92-7.

20. Benner PE, Tanner CA, Chesla CA. Expertise in nursing practice: Caring, clinical judgment, and ethics. Springer Publishing Company; 2009.

21. Gagne RM. The conditions of learning and theory of instruction New York: Holt. Rinehart and Winston. 1985.

22. Azizi F. Medical education: mission, vision and challenges. Tehran: Ministry of health and medical education. 2003;398.

23. Haas NA. Clinical review: vascular access for fluid infusion in children. Critical care. 2004;8(6):478.

24. Grantcharov TP, Bardram L, Funch-Jensen P, Rosenberg J. Learning curves and impact of previous operative experience on performance on a virtual reality simulator to test laparoscopic surgical skills. The American journal of surgery. 2003;185(2):146-9.

25. Pandian V, Laeeq K, Skinner M, Masood H, Stewart CM, Weatherly R, et al. Learning curve for competency in flexible laryngoscopy. The Laryngoscope. 2010;120(10):1950-3.

26. Oermann MH, Kardong-Edgren S, Odom-Maryon T, Hallmark BF, Hurd D, Rogers N, et al. DELIBERATE PRACTICEofMOTOR SKILLSinNursing Education: CPR AS EXEMPLAR. Nursing Education Perspectives. 2011;32(5):311-5.

27. Arthur Jr W, Bennett Jr W, Stanush PL, McNelly TL. Factors that influence skill decay and retention: A quantitative review and analysis. Human performance. 1998;11(1):57-101.

28. Yung MW, Oates J, Vowler SL. The learning curve in stapes surgery and its implication to training. The Laryngoscope. 2006;116(1):67-71.

29. Son G-M, Kim J-G, Lee J-C, Suh Y-J, Cho H-M, Lee Y-S, et al. Multidimensional analysis of the learning curve for laparoscopic rectal cancer surgery. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2010;20(7):609-17.

30. Burritt J, Steckel C. Supporting the learning curve for contemporary nursing practice. Journal of Nursing Administration. 2009;39(11):479-84.

Tables

Table 1. To collect data, a proficiency checklist was used to assess CV Line placement skills, as shown below:

CV Line Placement Skill Proficiency Checklist

Scoring:

- **Rejected (0):** Not performed or incomplete.
- **Failed (1):** Performed with inadequacies.
- **Passed (2):** Successfully performed.

Items:

1. **Indication and Contraindication Assessment:**
    - 0: Not assessed
    - 1: Assessed with appropriate consideration of indications and contraindications.
2. **Pre-Procedure Equipment Preparation:**
    - 0: Not prepared
    - 1: Properly selected and prepared necessary equipment before initiating the procedure.
3. **Appropriate Technique Selection:**
    - 0: Inappropriate
    - 1: Selected suitable technique based on patient conditions.
4. **Hand Hygiene and Proper Use of Protective Gear:**
    - 0: Not observed
    - 1: Practiced proper hand hygiene and used appropriate protective gear.
5. **Correct Prep and Drape Application:**
    - 0: Not performed
    - 1: Successfully performed prepping and draping.
6. **Effective Local Anesthesia and Sedation Utilization:**
    - 0: Not applied
    - 1: Utilized suitable local anesthesia and sedation techniques.
7. **Patient Positioning According to Chosen Technique:**
    - 0: Incorrect
    - 1: Placed the patient in an appropriate position considering the chosen technique.
8. **Needle Insertion with Appropriate Technique:**
    - 0: Incorrect technique
    - 4: Correctly inserted the needle using suitable techniques (heparinization, depth, angle, site).
9. **Proper Wire and Catheter Placement:**
    - 3: Correctly placed wire and catheter.
10. **Correct Catheter Embedding Duration:**
    - 0: Incorrect duration
    - 1: Properly embedded the catheter for the appropriate duration.
11. **Assurance of Inserted Catheter's Functionality:**
    - 2: Ensured functionality of the inserted catheter.
12. **Secure Catheter Fixation:**
    - 0: Not secured
    - 1: Adequately fixed the catheter in place.
13. **Post-Procedure Chest X-ray Consideration:**
    - 0: Neglected
    - 1: Considered post-procedure chest X-ray after completion.

Table 1. Mauchly's Test Results for Sphericity Assumption

Within-Subject Factor	Mauchly's Test	Chi-Square	Df	Significance	Greenhouse-Geisser Epsilon
Stages	0.064	25.75	9	0.0	0.580

Table 2. Results of Repeated Measure ANOVA

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F Value	Significance
Stages	401.44917	35.2	19.19316	320.572	0.00
Error	0.072276	43.67	0.7533		

Table 3. Post Hoc Test Results

Stages Comparison	SE	Mean difference	Significance
Stage 1 vs. Stage 2	0.69	-13.33	$p < 0.01$
Stage 1 vs. Stage 3	1.37	79.75	$p < 0.01$
Stage 1 vs. Stage 4	1.12	38.84	$p < 0.01$
Stage 1 vs. Stage 5	1.11	47.87	$p < 0.01$
Stage 2 vs. Stage 3	1.29	-46.12	$p < 0.01$
Stage 2 vs. Stage 4	0.99	-83.25	$p < 0.01$
Stage 2 vs. Stage 5	1.41	-34.8	$p < 0.01$
Stage 3 vs. Stage 4	0.57	-13.36	$p < 0.01$
Stage 3 vs. Stage 5	1.4	-33.22	$p < 0.01$
Stage 4 vs. Stage 5	1.16	-96.08	$p < 0.01$

Figure 1 displays the results of the analysis, indicating the following significant findings: The clinical skill scores at Time 1 (M = 29.13) were significantly lower than those at Time 2, 3, 4, and 5. The clinical skill scores at Time 2 (M = 46.42) were significantly lower than those at Time 3, 4, and 5. The clinical skill scores at Time 3 (M = 93.74) were significantly lower than those at Time 4 and 5. The clinical skill scores at Time 4 (M = 30.68) were significantly lower than those at Time 5. In summary, over time, there has been a notable increase in clinical skill scores, indicating an improvement in the ability to perform tasks.

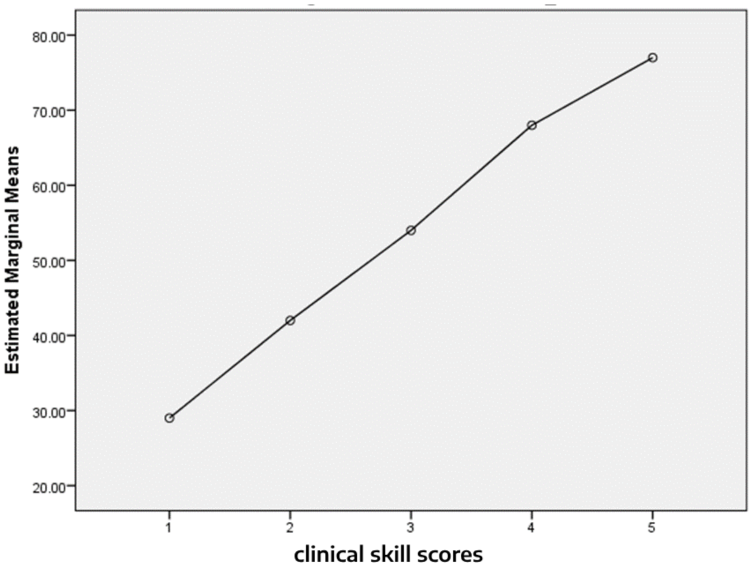

Figure 1: Learning curve