ORIGINAL ARTICLE

Impact of Educational Program on Sudanese Nurses' Performance Regarding CPR in ALGadarif State Hospitals

ELTURABI ELSAYED EBRAHIM*, AHMAD M. SALEH
Department of Nursing, College of Applied Medical Sciences, Prince Sattam Bin Abdulaziz University, Alkharj, Riyadh, Saudi Arabia
Elturabi Elsayed Ebrahim, Department of Nursing, College of Applied Medical Sciences, Prince Sattam Bin Abdulaziz University, Alkharj, Riyadh, Saudi Arabia, torabisayed@hotmail.com
**Corresponding author´s contact address, email address and telephone number*

ABSTRACT

Background: Cardiopulmonary resuscitation (CPR) is the first step to save a life in and out of hospital arrested patient, cardiac arrest is one of the leading causes of death worldwide the nurse is important to know how to perform ideal cardiopulmonary resuscitation.
Methods: A quasi-experimental hospital base study design, involved a systematic collection, analysis, and interpretation of data to evaluate the current practice. The sample consists of 100 eligible nurses who had a diploma, a B.Sc, and a Master of nursing science and that who were available during the study period.
Result: The study showed that percentage of nurse's knowledge regarding general information about CPR; The mean pretest of general information is (2.14) and Std (0.688) and direction of mean to Satisfied knowledge and the mean of posttest of general information is (1.2) and Std (0.40) and direction of mean to good knowledge and the mean pretest of nurses knowledge about assessment pre and during CPR is (2.26) and STD (0.69) and direction of mean to satisfied knowledge and the mean posttest of nurses knowledge about assessment pre and during CPR is (1.28) and STD (0.36) and direction of mean to good knowledge.
Conclusion: Based on the results of the current study, we concluded that most of the nurses had relatively poor knowledge and practices about aspects of cardiopulmonary resuscitation pretest.
Recommendation: Introducing cardiopulmonary resuscitation program to the curriculum of all nurses' staff in hospitals especially for new staff as well as to other paramedical and technical staff training institutes. Encourage the head nurses and hospital manger to foundation continues Provisional development (CPD) center in the hospital.
Keywords: Nurses' Performance; cardiopulmonary resuscitation; Advanced Cardiac Life Support (ACLS); Nursing Care; Return of spontaneous circulation (ROSC); Sudan.

INTRODUCTION

Around the world, there are >135 million cardiovascular passes every year, and the pervasiveness of coronary illness is increasing. All around, the occurrence of out-of-emergency clinic heart failure ranges from 20 to 140 for every 100 000 individuals and survival ranges from 2% to 11%.2 In the United States, >500 000 children and adults experience a cardiac arrest, and <15% survive. This establishes cardiac arrest as one of the most lethal public health problems in the United States. Cardiac arrest is one of the leading causes of death worldwide. It was estimated that the incidence of cardiac arrest between 50 to 100 per 100,000 in the general population. Thus, proper nursing care and knowledge about cardiopulmonary resuscitation performances are crucial. This study aimed to assess nurse's knowledge and practices of nursing staff regarding cardiopulmonary resuscitation (CPR) [1, 33, 34, 35].

Cardiopulmonary resuscitation or CPR is a rescuing emergency procedure performed in a heart attack or near drowning, in which someone's breathing or heartbeat has stopped. In North America and Europe incidence of cardiac arrest is estimated between 50 to 100 per 100,000 in the general population [1,2,3]. Another definition of cardiopulmonary resuscitation (CPR) is an emergency practice procedure done on patients with respiratory and cardiac arrest, but it is not successful in all patients. In statistics the prognosis of the patient has the main role to play in the effectiveness of CPR; there is a trust most be implemented for patients who have a high chance of survival. The training of CPR courses has been recommended in many studies for professional health care and most know about equipment and use of it [4, 5,11,12].

The nurses is the first one in medical team start CPR related to the near from patient in all cases of in-hospital cardiac arrest and have the main role in management. Nurses' staff should be willing and full knowledge about signs and symptoms of cardiac arrest and how to prevent patient but to date, randomized controlled studies addressing the impact of specific educational interventions are lacking. Various studies have emphasized when all nurses have certified in the applicable life support training courses clinical area that cardiac arrest performances better-quality, nurses correspondingly need to be trained in the automated external defibrillation procedure and should have access to such devices, as it will prevent delays in basic life support care in resuscitation. Unresponsive person, pulseless absent of breathing or only one of them, that is an indicator of cardiopulmonary arrest [1,2,6,7,8, 9,10,20,21].

Some equipment must be available when cardiac arrest happens in any place of the hospital the equipment include the: Arrest board, Oral airway, Bag, and mask device, I.V. setup, Defibrillator, Emergency cardiac drugs, Electrocardiograph (ECG) machine, many studies recommended and discus the Cardiopulmonary resuscitation should be started in any area in a hospital or out of the hospital because CPR is an emergency and the delay of preform lead for person death and no need for

specialized equipment [10, 11]. Cardiopulmonary resuscitation (CPR) should be performing urgent and effective is the importance for all arrested patients. The recommended number of compressions delivered at a rate of 100 to 120 per minute and the depth of compressions to at least 2 inches for the adult patient, the Standard universal compression to ventilation ratio of 30:2 is recommended [12, 13, 14, 15].

If the chest compressions have greater numbers without interruptions this leads for better chances to an arrested patient to a return of spontaneous circulation (ROSC) and survival with good neurologic function and the depth of compressions to at least 2 inches for the adult patient. (Studies are inconclusive regarding deeper compressions, the Standard universal compression to ventilation ratio of 30:2 is recommended. To decrease mortality and morbidity rates cardiopulmonary resuscitation should be done effectively and prevent the delay of CPR to decrease survival rates [12,13,16, 17].

If the staff untrained or unknown the guideline of CPR have many complications can happen to arrested patient Common complications due to CPR include rib fractures, sternal fractures, bleeding in the anterior mediastinum, heart contusion, hemopericardium, upper airway complications, damage to the abdominal viscous - lacerations of the liver and spleen, fat emboli, pulmonary complications - pneumothorax, hemothorax, lung contusions The rib fractures most common injuries sustained from CPR with literature suggesting an incidence between 13% and 97%, and sternal fractures, with an incidence between (1% to 43%) [18, 19, 20, 21, 22, 23].

Knowledge and practice about cardiopulmonary resuscitation is an essential part in save of life and treatment, however, there is still high mortality rate world widely and in our community among unknown about cardiopulmonary resuscitates so several studies show that medical and nurses staff lack knowledge and skills in acute care addition to the nurses play a key role in the management of in-hospital cardiac arrest. Often, they are first on the scene of an arrest--initiating cardiopulmonary resuscitation (CPR) as well as summoning assistance from the 'advanced life support'/'arrest' team. Thus, it is argued that nurses should be willing [1,7,8].

Table 1: Study group knowledge pre and posttest regarding general information about CPR

Item	**Pretest**									**Post-test**								
General information	Good		Satisfied		Poor		Not know		Total	Good		Satisfied		Poor		Not know		total
	F	P	F	P	F	P	F	P		F	P	F	p	F	P	F	P	
Meaning of CPR	38	38%	20	20%	31	31%	11	11%	100	87	87%	3	3%	10	10%	0	0%	100
Importance of CPR	33	33%	21	21%	31	31%	15	15%		77	77%	9	9%	12	12%	2	2%	
Indication of CPR	27	27%	29	29%	33	33%	11	11%		66	66%	18	18%	16	16%	0	0%	
Complication of CPR	33	33%	28	28%	24	24%	15	15%		87	87%	9	9%	4	4%	0	0%	
Sign and symptom of fracture rib	20	20%	20	20%	35	40%	25	25%		70	70%	15	15%	10	10%	5	5%	
Equipment need for CPR	48	48%	19	19%	20	20%	12	12%		82	82%	14	14%	4	4%	0	0%	
Mean	2.14									1.2								
Std	0.688									0.40								
Direction of Me	Satisfied									Good								

Table 2: Nurse's knowledge about assessment pre and during CPR

Test	**Pretest**									**Post-test**								
Nurse's assessment pre and during CPR	Good		Satisfied		Poor		Not know		Total	Good		Satisfied		Poor		Not know		Total
	F	P	F	P	F	P	F	P		F	p	F	P	F	P	F	p	
Assessment of arrested patient	52	52%	23	23%	20	20%	5	5%	100	83	83%	13	13%	4	4%	0	0%	100
Sign of effective CPR	36	36%	31	31%	22	22%	11	11%		88	88%	6	6%	5	5%	1	1%	
When to stop CPR	47	47%	22	22%	24	24%	7	7%		85	85%	8	8%	7	7%	0	0%	
Nurse's ability during CPR	39	39%	22	22%	15	15%	24	24%		89	89%	8	8%	3	3%	0	0%	
Mean	2.26									1.28								
Std	0.69									0.36								
Direction Me	Satisfied									Good								

MATERIALS AND METHODS

Study Design: This is a quasi-experimental hospital base study design; involves the systematic collection, analysis, and interpretation of data to give a clear picture of a particular situation.

Study Setting: This study was conducted in Al Gadarif locality in the west of Sudan. Have three hospitals in the Gadarif. specialized hospital for pediatric, Gadarif teaching hospital it provides most types of medical services (accidental and emergency, medicine, surgery, ICU and CCU) and the military hospital provides most types of medical services (medicine, surgery, ICU and ophthalmic) -

The quasi-experimental study was carried out in all three hospitals remember above which is located in Al Gadarif State north medicine and applied for college.

Study Population: The focused groups of the study were the nurses working in general medicine and surgical ward, ICU and CCU in three governmental hospitals in Al Gadarif city, and fulfill the following criteria: 60 nurses from Al Gadarif teaching hospital, 25 nurses from a military hospital, 15 nurses from the pediatric hospital.

The selected nurses are diploma, BSc, and master graduated and should have at least six months' experience.

Inclusion criteria: All nurses are work in general medicine and surgical ward, ICU, and CCU which found, selected for the study, and they are accepted to participate in the study and have a diploma, BSc, and master certificate.

Exclusion criteria: They do not accept to participate in the research. Nurses' do not attend at data collection time.

Sample size: Total coverage was taken during the study period at 25 nurses from military hospital ICU and CCU, total coverage was taken in Gadarif teaching hospital ICU and CCU and some nurses from general medicine and surgical ward were 60 nurses and total coverage was taken 15 nurses from pediatric hospital NICU.

Sample Technique: Total coverage sampling technique for nurses and hospital selection from the number of hospitals in Gadarif state we found the number of all nurses working in this ICU and CCU and some nurses from general medicine and surgical ward after that we calculate the samples.

Data collection tools: Interview questionnaire and observation checklist. Data collection technique Administrating written questionnaire and observation.

Data analysis: Data collected and coded then interred in (SPSS) program version 21 for analysis after that represented in figures and tables.

Ethical consideration: Approval was obtained from the author an ICU and CCU nurse's staff. The nurse's staff who were given information about the study and who accept to participate in the study were included. The privacy and dignity of a nurse are protected. The participants in this study were assured confidentiality through identification coding and reports of data, the name of participants in this study do not use in the questionnaire, the participants were notified by the aims, method, expected outcome, benefits, and the result of this study. Any participants have his right to ask, to discontinue, and to refuse to answer any question of the study. Written consent is taken from the nurses.

RESULTS

The current study was done in military hospital ICU and CCU, Gadarif teaching hospital ICU, and CCU, and some nurses from general medicine and surgical ward and pediatric hospital NICU. The sample size of 100 nurses were those of 20 males and 80 females. The mean age of the study sample is 30 years according to the qualification above half is the diploma certificate in nursing (76%). According to Experience years. (44%) have Experience years (5 -10) years according to the training course about CPR. (76%) have never attended the course. Table (1) clarified that good knowledge of the study group regarding the meaning of CPR increased from (38%) in pretest to (87%) after the intervention. The study group has poor knowledge (31 %) and (15 %) do not know the importance of CPR pretest where this percentage was decreased to (2%) after the intervention while a score of good knowledge raises from (33%) pretest to (77%) after the intervention.

Also concerning knowledge about the indication of CPR in the hospital the poor score improved from (33% to 16 %) after the intervention. Regarding knowledge about the complication of CPR good knowledge of study group increased from (33%) pretest to (87%) after the intervention, regarding signs and symptoms of fracture rib there was the improvement of good knowledge from (20%) pretest to (70%) after the intervention. Concerning knowledge about equipment needs during CPR, there was a decrease in poor knowledge from (20%) pretest to (4%) after the intervention. The mean pretest of general information is (2.14) and Std (0.688) and direction of mean to Satisfied knowledge and the mean of posttest of general information is (1.2) and Std (0.40) and direction of mean to good knowledge.

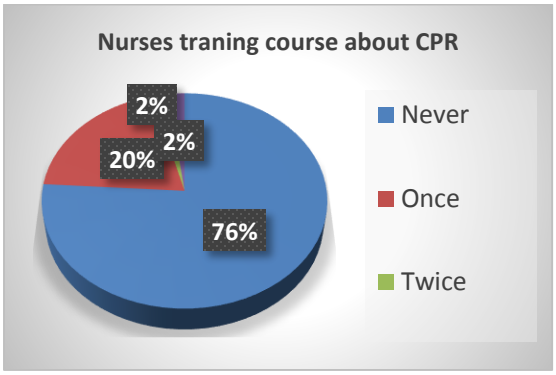

Figure 1. Distribution of the study samples according to their knowledge regarding Training courses. This figure represented that (20.%) of the study samples stated that they had to get once training courses about CPR and minority (2.8%) of the study sample stated that they had got twice training courses about CPR, and plenty (76%) of the study sample stated that they had never get courses about CPR.

Table (2) reflect that (20%) of the study group have poor knowledge about the assessment of the arrested patient before the implementation of program but this lack of knowledge decreased after the intervention to (4 %), regarding signs of effective CPR (36%) have a good knowledge before conducting the program which increased to (88%) after the intervention, while poor knowledge decreased from (24%) to (7%) after intervention in study group regarding of time to stop CPR with. While was found (24%) of the study group pretest did not know about nurse's ability during CPR it is decreased to (0%) after the intervention. The mean pretest of nurses knowledge about assessment pre and during CPR is (2.26) and STD (0.69) and direction of mean to satisfying knowledge and the mean posttest of nurse's knowledge about assessment pre and during CPR is (1.28) and STD (0.36) and direction of mean to good knowledge.

DISCUSSION

The study reveals their years of experience range between (5-10) years (44%), also the study indicated that (76%) of

the study group have never attended the CPR course before. And their qualification was a diploma and represented by (76%). These findings indicated that nurses were working for many years which provide them to be experts but they were not exposed to any training course to enhance their skills or provide them with new guidelines these Cleary affect their performance and lead to a poor outcome. Bearing in mind that providing a training course for nurse's staff is very important and useful for improving performance to perform urgent response and effective CPR for pt. with cardiac arrest [1,14,15].

Cardiopulmonary resuscitation has been practiced for many years, and many studies have shown that when resuscitation knowledge and skills are applied correctly, it can maintain perfusion until the return of spontaneous circulation [24]. The present study revealed an increase in different knowledge aspects, and it was obvious that there was an improvement in Nurse's knowledge in pre and posttest of Intervention CPR program. All the components of knowledge were significantly improved in the posttest compared with the pretest evaluation. The good knowledge about the meaning of CPR posttest significantly ($p<0.05$) increased compared to this attribute in the pretest. This finding was consistent with the previous research which reported that the continuous education of health care providers leads to improve their knowledge about the meaning of CPR [15,25].

Also, the nurses were not well aware of the importance of CPR in the pretest but after the intervention of the CPR program, they substantially became fully aware of the importance of CPR in the posttest. Following this result, a recent study stated that training is needed to improve the knowledge of nurses on the importance of CPR, especially for cardiac arrest. Furthermore, nurse knowledge about the indication of CPR significantly increased after the intervention of the program. This result recommended the importance of CPR training and education [26].

On the other hand, the intervention of the CPR program resulted in reducing the complication of CPR and ease recognition of signs and symptoms of a fractured rib. Lack of knowledge and practice about the proper position of chest compression results in fracture rib, therefore the CPR program intervention for nurses is highly recommended to reduce the complications of CPR in general and especially for fracture rib. In addition to that, the component of knowledge which represents the identification of necessary equipment of CPR was highly increased and the majority of nurses had good knowledge after the intervention of the majority. In the present study, it was clear that the identification of equipment by nurses is important. This result is in harmony with another researcher who reported that all clinical areas should have immediate access to resuscitation equipment and drugs to facilitate rapid resuscitation of the patient in cardiopulmonary arrest. On the contrary to this finding, recently a researcher pointed out that CPR, in its most basic form, can be performed anywhere without the need for specialized equipment. The assessment during CPR is an important role of nursing to be knowledgeable in our study found poor knowledge about the assessment during CPR but this result increase after intervention with highly significant (p-value = 0.000). It is important to know the signs of effective CPR so you can assess your efforts to resuscitate the patient [1, 7, 11, 27].

The AHA recommended the importance of knowing signs of effective CPR from this recommendation the result in our study about signs of effective CPR has sufficiency knowledge about it but this result increase after demonstrating the program. The decision to stop resuscitation efforts may be difficult Posner (2015) recommends considering the steps to stop CPR and clinical practice guidelines. The nurse play role in the decision to stop CPR the result in this study explains how to increase the knowledge after the intervention of the program with highly significant (p-value = 0.000) when to compere of poor knowledge pretest. The traditional roles of nurses during CPR which held them responsible for limited Duties, such as preparing the drugs administered and monitoring the patients' vital signs, have evolved; hence the nurse has become a more active member of the multidisciplinary team [28,30].

Nowadays the nurse has many roles during and after CPR As per the AHA's recommendations, nurses in healthcare settings should be certified in Basic Life Support, and critical care nurses need Advanced Cardiac Life Support (ACLS) status along with Basic. The nurses should be re-certified every two years [28].

CONCLUSION

Based on the results of the current study, we concluded that most of the nurses had an increase in mean of good knowledge about cardiopulmonary resuscitation concepts and steps after implementation of the program. There was an improvement in nurse's knowledge regarding clinical case identification and prevention of cardiopulmonary arrest. Nurses were concerned more about the indication of cardiopulmonary arrest in the hospital. Increased knowledge about the role of nurses during cardiopulmonary resuscitation and the intervention when found arrested patient. There was an improvement of knowledge regarding nurse's intervention when found arrested patient.

Recommendation: Introducing cardiopulmonary resuscitation program to the curriculum of all nurses' staff in hospital especially for new staff as well as to other paramedical and technical staff training institutes. Encourage the head nurses and hospital manger to foundation continues

Provisional development (CPD) center in the hospital. Provide training of staff, equipment, and poster about cardiopulmonary resuscitation in hospitals.

Ethical aspects and Conflict of interest Statement: The research team requested informed consent from all the participants and their confidentiality was preserved. The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

REFERENCES

1. American Heart Association states Guidelines 2015.
2. First aid - CPR". NHS. Retrieved 6 December 2014.
3. Pozner CN. Basic life support (BLS) in adults. 2014 Dec 17 [cited 2015 Mar 31].

4. Mogadasian S, Abdollahzadeh F, Rahmani A, et al. The attitude of Iranian nurses about do not resuscitate orders. Indian J Palliat Care. 2014; 20(1):21–25.
5. Yuen JK, Reid C, Fetters MD. Hospital do-not-resuscitate orders: why they have failed and how to fix them. J Gen Intern Med. 2011; 26(7):791–797.
6. Oermann, M. H., Kardong-Edgren, S., Odom & Smart, D. A. (2011). Deliberate practice of motor skills in nursing education: CPR as an exemplar. Nursing education perspectives, 32(5), 311 -315.
7. American Red Cross. Resuscitation Guidelines 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care.
8. Jasmeet Soar a, Jerry P. Nolan et al European Resuscitation Council guidelines for Resuscitation 2015 Section 3. Adult advanced life support.
9. Atkins, DL; Berger, et al (3 November 2015). "Part 11: Pediatric Basic Life Support and Cardiopulmonary Resuscitation Quality: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.". Circulation. 132 (18 Suppl 2): S519–25.
10. Sandra. Netting MSN-an.; Mills, Elizabeth Jacqueline, Lippincott Manual of Nursing Practice, 10 Edition (2014).
11. Cardiopulmonary Resuscitation (CPR) Author: Catharine A Bon, MD; Chief Editor: Kirsten A Bechtel, MD more...Updated: Nov 05, 2015.
12. Kleinman ME, et al. (2015). Part 5: Adult basic life support and cardiopulmonary resuscitation quality. 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care.
13. Berg RA, Hemphill R, Abella BS, Aufderheide TP, Cave DM, Hazinski MF, Lerner EB, Rea TD, Sayre MR, Swor RA (November 2010). "Part 5: adult basic life support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care". Circulation. 122 (18 Suppl 3): S685–705.
14. Choi HS, Lee DH, Kim CW, Kim SE, Oh JH. Peer-assisted learning to train high-school students to perform basic life-support. World J Emerg Med.2015; 6:186–90.
15. Krajina I, Kvolik S, Steiner R, Kovacevic K, Lovric I. Cardiopulmonary resuscitation, chest compression-only, and teamwork from the perspective of medical doctors, surgeons, and anesthesiologists. Iran Red Crescent Med J. 2015; 17:e18208.
16. Berg, R. A., Hemphill, R., et al. (2010). Part 5: Adult basic life support 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation, 122(18 suppl 3), S685-S705.
17. Nurses' Resuscitation Performance: Study on the Effectiveness of Training and Support at a Teaching Hospital in KSA International Journal of Cardiovascular and Cerebrovascular Disease 3(4): 21 -27, 2015
18. Myocardial contusion injury: redefining the diagnostic algorithm, M K Bansal, S Maraj, D Chewaproug, Amanullah. Emerg Med J 2005; 22:465- 469
19. Implication medico-legal in resuscitate cardio-respiratory, Aurel Mogoseanu.
20. AHA, The Textbook of Emergency Cardiovascular Care and CPR, page 541
21. Forensic Pathology: Principles and Practice, David Dolinak, Evan W. Matches, Emma O. Lew, page 322
22. AHA, Part 3: Adult Basic Life Support, s. org/content/102/suppl_1/I-22.full; Circulation. 2015; 102: I-22-I-59.
23. Hoke, Robert Sebastian; Chamberlain, Douglas (December 2004). "Skeletal chest injuries secondary to cardiopulmonary resuscitation". Resuscitation 63 (3): 327–338.
24. Carpico, B., & Jenkins, P. (2011). Resuscitation review to improve nursing performance during cardiac arrest. Journal for Nurses in Professional Development, 27(1), 7-12.
25. Sanchez GAB, Fernandez ALJ, Alonso PN, Hernandez HI, Navarro VR, Rosillo CD. Assessment of the knowledge level and its relevance in terms of CPR in medical personnel of the hospital emergency medical system of the Autonomous Community of the Region of Murcia. Enfermería Global. 2015; 39:246–60.
26. "Members of the public lack skills, the confidence necessary to save lives with CPR, research shows". November 12, 2011. Retrieved November 12, 2011.
27. Davies M, Couper K, Bradley J, et al. A simple solution for improving the reliability of cardiac arrest equipment provision in hospital. Resuscitation 2014; 85:1523–6.
28. Posner CN. (2015). Advanced cardiac life support (ACLS) in adults. Up-to-date. Retrieved from http://www.uptodate.com
29. Article, R. The role of nurses in the resuscitation of in-hospital cardiac arrests, (2011).
30. Van Hoeyweghen RJ, Bossaert LL, Mullie A, Calle P, Martens P, Buylaert WA, Delooz H (August 1993). "Quality and efficiency of bystander CPR. Belgian Cerebral Resuscitation Study Group". Resuscitation. 26 (1):47–52.
31. McNally B, Robb R, Mehta M, Vellano K, Valderrama AL, Yoon PW, et al. Out-of-hospital cardiac arrest surveillance-cardiac arrest registry to enhance survival (CARES), United States. MMWR Surveill Summ 2011; 60(SS08):1–19.
32. Park IS, Kim EJ, Sohn HS, Kang SH. Factors influencing the return of spontaneous circulation of patients with out-of-hospital cardiac arrest. J Digit Policy Manage@. 2013.11(9):229–238.
33. Ahern RM, Lozano R, Naghavi M, Foreman K, Gakidou E, Murray CJ. Improving the public health utility of global cardiovascular mortality data: the rise of ischemic heart disease. Popul Health Metr. 2011;9:8.
34. Nichol G, Thomas E, Callaway CW, Hedges J, Powell JL, Aufderheide TP, Rea T, Lowe R, Brown T, Dreyer J, Davis D, Idris A, Stiell I; Resuscitation Outcomes Consortium Investigators. Regional variation in out-of-hospital cardiac arrest incidence and outcome [published correction appears in JAMA. 2008;300:1763]. JAMA. 2008;300:1423–1431.
35. Merchant RM, Yang L, Becker LB, Berg RA, Nadkarni V, Nichol G, Carr BG, Mitra N, Bradley SM, Abella BS, Groeneveld PW; American Heart Association Get With The Guidelines-Resuscitation Investigators. Incidence of treated cardiac arrest in hospitalized patients in the United States. Crit Care Med. 2011;39:2401–2406.