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Educational intervention for enhancing primary health care nurses' knowledge about risk estimation and prevention of cardiovascular disease

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Abstract

Background: Cardiovascular disease is the main cause of morbidity, disability, and premature death. Globally, risk reduction is becoming a priority and primary care nurses are in prime position to provide lifestyle modification strategies for their patients. **Aim:** Evaluate the effectiveness of educational intervention on the level of primary care nurses' knowledge, concerning risk estimation and prevention of cardiovascular disease. **Design:** Quasi-experimental design. The study was conducted in Directorate of Health Affairs at Shebin El-Kom on a convenience sample of 357 nurses working in primary health care settings at Menoufia governorate, Egypt. Tools: Structured self-administered questionnaire included two parts. First was about nurse's socio-demographic data. The second was included five categories to assess nurse's knowledge about heart and blood vessels, cardiovascular risk factors, prevention strategies of cardiovascular diseases, nurses' role in the prevention of cardiovascular diseases and estimation of probable risk of developing cardiovascular diseases for 10 years based on Framingham scoring system. **Results:** All of the nurses (100%) had not received training about cardiovascular disease prevention. In pre-intervention, minority of nurses had good level of knowledge concerning heart and blood vessels, cardiovascular disease risk factors, prevention strategies and estimation of probable cardiovascular disease risk for 10 years and the percentage ranged from 0.0% to25.2% across all categories; 40.3% of nurses had correctly known their role in prevention of cardiovascular disease. The level of knowledge increased with years of experience and educational qualification. In post-intervention, the majority of nurses achieved good level of knowledge and the percentage ranged from 79.3% to 87.7% across all categories. The improvement in nurses' knowledge in post-intervention reflected the significant effect of the implemented intervention. **Conclusion:** The implemented educational intervention has a significant effect in improving primary care nurses' level of knowledge concerning risk estimation and prevention of cardiovascular disease.

Keywords: Cardiovascular disease, Disease prevention, Risk factors, Primary health care, Risk estimation, Primary care nurses.

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1. Introduction

Cardiovascular disease (CVD) is a group of diseases affecting the heart and blood vessels [1-3]. CVD is including heart attack, coronary artery disease, congestive heart failure, stroke, rheumatic heart disease, congenital heart disease, cardiac arrhythmias, coronary artery disease, cerebrovascular disease, diseases of the aorta and arteries, hypertension and peripheral vascular disease [2-5]. CVD is highly prevalent and remains a major worldwide killer disease [4, 5], causing more than 30% of all yearly deaths globally [4,7]. CVD is a leading cause of morbidity and premature death in both sex worldwide, affecting high, middle and low middle-income countries. About 80% all worldwide cardiovascular disease-related deaths occur in developing countries, [8-10].

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In Egypt 2010, ischemic heart disease was the first and stroke was the second cause of mortality; moreover, the mortality from CVD constituted 46% of total deaths for all ages and both sexes [11]. CVD occurs as a result of a combined group of risk factors. The uncontrollable the risk factors of CVD include genetic, age, and gender; while the controllable factors include unhealthy eating habits, smoking, sedentary living, obesity, diabetes, hypertension and dyslipidemia [12-14] Many individuals with increased risk of CVD are either unrecognized or untreated [6]. CVD can be prevented if risk factors are recognized and controlled [15]. Screening for CVD risk, informing at risk people and monitoring them are essential for protection from CVD. Early detection, diagnosis as well as treatment are essential for prevention of CVD [16]. Primary health care (PHC) services play an essential role in identifying, preventing and managing CVD risk factors [17]. Management of CVD and improving the survival of patients with CVD are becoming important challenges for primary care [18]. Nurses are expected to be oriented with the increasing health care needs of patients suffering from CVD and the increasing responsibilities in providing preventive health instruction and management of chronic disease [19]. Primary care nurses have effective role in the delivery of lifestyle interventions that affect positive changes on a variety of risk factors as weight, blood pressure, cholesterol, dietary and physical activity [20, 21]. Nurses should provide health promotion, case finding for early diagnosis and guidance for pharmacological and non-pharmacological management of the disease as well as motivating patients for adherence to treatment, self-care, and healthy lifestyle behaviors [22]. Thus, the present study was designed to enhance primary health care nurses' knowledge concerning risk factor estimation and prevention of cardiovascular diseases.

Aim of the study:

Evaluate the effectiveness of educational intervention on the level of primary care nurses' knowledge concerning risk estimation and prevention of CVD.

Research hypotheses:

1. Primary care nurses will have a significant increase in their level of knowledge concerning risk estimation of CVD after educational intervention compared to their current level of knowledge before the educational intervention**.**
2. Primary care nurses will have a significant increase in their level of knowledge concerning prevention of CVD after educational intervention compared to their current level of knowledge before the educational intervention**.**

2. Subjects and methods

Study design: Quasi-experimental research design (pre/post design) was utilized in this study.

Study setting: The study was conducted in Directorate of Health Affairs at Shebin El-Kom, Menoufia governorate, Egypt.

Subjects: A convenience sample of 357 nurses working in primary health care settings at menoufia governorate. The sample size was calculated based on the previous year census report of Directorate of Health Affairs, Shebein ElKoom, Menoufia Governorate in 11/ 2016. The total number of nurses working in primary care settings was 3302 nurses and the sample size was calculated using a simplified formula to calculate sample size ($n = N/1+Ne^2$), where: n = sample size, N = total population number (3302), e = margin error (0.05) [23].

Instrument of data collection: A structured self-administered questionnaire was used for data collection that developed by the researchers after reviewing the available related literature. The questionnaire was written in Arabic and comprised two main parts. The first part was a cover page that included 6 questions about nurse's socio-demographic data such as age, gender, level of education, years of experience, job title and previous in job training program concerning prevention of cardiovascular disease. The second part included 33 questions that concerned with the assessment of nurses' knowledge about cardiovascular disease, risk factors, and risk estimation and prevention strategies. This part was categorized into 5 sections. The first section included 5 questions and was concerned with nurse's general knowledge about heart and blood vessels (e.g. definition of the heart, arteries and veins, function and anatomy of the heart). The second section included 9 questions and was concerned with nurses' knowledge about the type of CVD, modifiable and non-modifiable risk factors of CVD. The third section included 12 questions and was concerned with nurses' knowledge about prevention strategies of CVD (proper nutrition, control of obesity, hypertension, blood cholesterol level, diabetes, practice physical exercise, smoking cessation, stress reduction, etc.). The fourth section included 1 question and was concerned with nurses' knowledge about their role in the prevention of CVD. The fifth section was concerned with nurse's knowledge about the estimation of probable risk of developing CVD for 10 years. It consisted of 6 questions. The estimation was carried out on a case study included in this part of the questionnaire. The calculation of the probable percentage of cardiovascular disease risk for 10 years was conducted by each participant for the given case study, based on Framingham scoring system for risk of developing cardiovascular disease. Framingham scoring system is a number of scores given to the person to estimate the probability of developing cardiovascular disease within a specific period of time usually 10 years. The risk estimation provides direction to health care providers to identify the individuals who in need medical treatment as well as preventive strategies directed for modifying lifestyle behaviors through client education for the purpose of reducing the risk of developing CVD [24].

To calculate the probability of developing cardiovascular disease certain variable should be considered and used including age, total cholesterol, high-density lipoprotein (HDL cholesterol), systolic blood pressure, smoking, and diabetes mellitus [24-26]. Table 1contians a set of scores used to calculate risk points for females and males, table 2 used to estimate risk percentage for females and males. Both tables based on Framingham risk score that adapted from [24-25].
The estimation of 10 years risk of developing CVD was carried out based on the following steps:

Step 1 was the calculation of risk points according to the following table:

Risk factor	Risk points	
Age		
Age groups	Female	Male
20 - 34	-7	-9
35 - 39	-3	-4
40 - 44	0	0
45 - 49	3	3
50 - 54	6	6
55 - 59	8	8
60 - 64	10	10
65 - 69	12	11
70 - 74	14	12
>75	16	13
Total cholesterol mg/dL		
Value	Female	Male
Age interval: 20 - 39		
<160	0	0
160 - 199	4	4
200 - 239	8	7
240 - 279	11	9
≥ 280	13	11
Age interval: 40 - 49		
<160	0	0
160 - 199	3	3
200 - 239	6	5
240 - 279	8	6
≥ 280	10	8
Age interval: 50 - 59		
<160	0	0
160 - 199	2	2
200 - 239	4	3
240 - 279	5	4
≥ 280	7	5
Age interval: 60 - 69		
<160	0	0
160 - 199	1	1
200 - 239	2	1
240 - 279	3	2
≥ 280	4	3
Age interval: >70		
<160	0	0
160 - 199	1	0
200 - 239	1	0
240 - 279	2	1
≥ 280	2	1

HDL cholesterol mg/dL		
Value	Female	Male
≥ 60	-1	-1
50 - 59	0	0
40 - 49	1	1
<40	2	2
Systolic blood pressure (mmHg) treated		
Value	Female	Male
<120	0	0
120 - 129	3	1
130 - 139	4	2
140 -159	5	2
≥ 160	6	3
Systolic blood pressure (mmHg) untreated		
Value	Female	Male
<120	0	0
120 - 129	1	0
130 - 139	2	1
140 -159	3	1
≥ 160	4	2
Smoking (if yes)		
	Female	Male
No	0	0
Yes-at age		
20 - 39	9	8
40 - 49	7	5
50 - 59	4	3
60 - 69	2	1
> 70	1	1
Diabetes		
	Female	Male
No	0	0
Yes	4	3

Step 2 was the calculation of risk percent for females and males according to the following table:

CVD Risk for females		CVD Risk for males	
Points	Risk %	Points	Risk %
≤ -2	<1	≤ -3	<1
- 1	1.0	-2	1.1
0	1.2	- 1	1.4
1	1.5	0	1.6
2	1.7	1	1.9
3	2.0	2	2.3
4	2.4	3	2.8
5	2.8	4	3.3
6	3.	5	3.9
7	3.9	6	4.7
8	4.5	7	5.6
9	5.3	8	6.7
10	63	9	7.9
11	7.3	10	9.4
12	8.6	11	11.2
13	10.0	12	13.2
14	11.7	13	15.6
15	13.7	14	18.4
16	15.9	15	21.6
17	18.5	16	25.3
18	21.5	17	29.4
19	24.8	18+	> 30
20	28.5		
21	> 30		

Step 3 was to determine the degree of 10 years risk of developing CVD

Female results		Male results	
Points	Risk percentage	Points	Risk percentage
<0	0	<0	0
0 - 8	<1	0	<1
9 - 12	1	1 - 4	1
13 - 14	2	5 - 6	2
15	3	7	3
16	4	8	4
17	5	9	5
18	6	10	6
19	8	11	8
20	11	12	10
21	14	13	12
22	17	14	16
23	22	15	20
24	27	16	25
≥ 25	>30	≥ 17	>30

Step 4 was risk categories, ≤ 10% low risk, 10-20%, intermediate risk and 20% or more high risk [24, 26].
Scoring system of nurse's knowledge was assessed by giving score 2 for the correct complete answer, 1 for the correct incomplete answer and zero for the wrong answer. The overall total score of knowledge ranged from 0 to 66. The total score of general knowledge about heart and blood

vessels was ranged from 0 to 10, the total score of nurse's knowledge about CVD risk factors ranged from 0 to 18, the total score of nurse's knowledge about prevention strategies of CVD ranged from 0 to 24, the total score of nurse's knowledge about the role of the nurse in prevention of CVD ranged from 0 to 2, and the score of nurse's estimation of the probable percentage of cardiovascular disease risk for 10 years ranged from 0 to 12. The total score of each section in the second part, as well as the overall total score of all sections, was calculated and categorized according to [27] as follow: Score less than 60% of the total score indicated poor knowledge, score from 60 % to 80 % of total scores indicated moderate knowledge and score greater than 80% of total scores indicated good knowledge.

Validity and reliability:

The structured self-administered questionnaire used in this study was tested for content validity by a panel of five experts in the field of community health nursing, medical-surgical nursing, and medicine from Faculty of Nursing and Faculty of Medicine, Menoufia University. The recommended modifications from the panel were done accordingly. The reliability of the questionnaire was tested using test-retest method and calculation of Cronbach's Alpha coefficients. Cronbach's Alpha of the questionnaire was 0.91 that indicated high reliability of the questionnaire.

Pilot study:

A pilot study was conducted prior to data collection on 10% (36 nurses) of study sample to test th**e** feasibility, clarity, and applicability of study instrument. The necessary modifications were done based on the results of the pilot study. The subjects of the pilot study were not included in the study sample.

Procedure of data collection:
Preparatory phase:

In this phase, tool development was carried out by the researchers after reviewing the available related literature. The educational intervention was developed after comprehensive reading of related information. It included detailed information about the flowing outlines: Significance of CVD, anatomy and function of the heart and blood vessels, blood circulation, types of CVD, modifiable and non- modifiable risk factors, at-risk population, strategies for prevention of CVD, control of diabetes, hypertension, blood lipid and determination and control of obesity, estimation of probable percentage of cardiovascular disease risk for 10 years and the role of primary care nurses in prevention of CVD. The methods of teaching used in the implementation of the educational intervention were lecture, group discussion, case study and demonstration of how to measure waist circumference. Power point presentation was used for implementation to enhance learning. Each participant was provided with handout after post-test assessment.

Administrative and ethical considerations:

An official permission to conduct the study was obtained by the researcher from the official authority of Directorate of Health Affairs at Menoufia governorate after detailed explaining of study purpose and data collection technique. The permission obtained also to gain their cooperation and support.
Nurses' agreement to participate in the study was obtained after explanation of the study purpose. They were reassured for confidentiality and privacy of their information and their right for withdrawing at any time was maintained.

Intervention phase

Data collection and implementation of educational intervention were carried out at Directorate of Health Affairs at shebien elkoom. Each implementation of educational intervention was provided to approximately 25-30 nurses from different primary health care settings who were permitted to participate in the study. The implementation was carried out approximately once or twice monthly. Each group of nurses took the educational intervention in one session from 10 Am to 1 Pm with 15 minutes break time. The researchers started each implementation by introducing themselves to the participants and provide a simple explanation about the aim of the study and assured them that their information will be used only for study purpose.

Evaluation phase:

The self-administered questionnaire was administered to the nurses twice. The first time was before the implementation of educational intervention (pre-intervention) to assess their baseline knowledge about anatomy and function of the heart and blood vessels, types of CVD, modifiable and non- modifiable risk factors, at-risk population, strategies for prevention of CVD, blood pressure, lipid profile, role of primary health care nurses and estimation of probable percentage of cardiovascular disease risk for the coming 10 years, general and central obesity through calculation of body mass index and waist circumference. The second time was immediately post intervention to assess the effectiveness of the educational intervention on the previously assessed knowledge (pre-intervention).

Study period:
The study was conducted over a period of approximately 9 months from December 2016 to August 2017.

Statistical analysis

The data of the current study were collected, tabulated and statistically analyzed by an IBM compatible personal computer with SPSS statistical package version 20.0. Descriptive statistics were presented in the form of number and percent for qualitative data; mean standard deviation and range for quantitative data. Paired samples t-test was applied for comparison between the normally distributed quantitative data of the same group. One way analysis of variance (ANOVA) was used to compare between more than two groups for quantitative variables. Comparison between data before and after the intervention was performed using Marginal homogeneity test for quantitative non-parametric categorical variables. Pearson correlation coefficient test (r) was used to study the correlation between quantitative variables, p-value <0.05 was considered statistically significant.

3. Results

Table no 1: Socio-demographic characteristics of studied nurses (N= 357)

Socio-Demographic characteristics	No.	%
Age(years):		
20 < 30	68	19.1
30 < 40	71	19.9
40 < 50	214	59.9
50 or more	4	1.1
Mean±SD Range	38.87±7.50 23.00–52.00	
Educational qualification:		
Nursing Diploma	301	84.3
Technical nurse	10	2.8
Bachelor nurse	42	11.8
Postgraduate nurse	4	1.1
Years of experience		
< 10 years	11	3.1
10 < 20	113	31.7
20 or more	233	65.2
Mean±SD Range	19.07±6.35 2.00–29.00	
Job title:		
Head nurse	46	12.9
Staff nurse	311	87.1
Attending training about prevention of cardiovascular disease		
Yes	0	0.0
No	357	100

Table 1shows that, the mean age of nurses sample was 38.87 ±7.50 years; more than half of them (59.9) were aged from 40 to > 50 years. Most of the nurses (84.3%) had diploma in nursing. Nurses' mean years of experience were 19.07±6.35. Most of the nurses (87.1) were staff nurses. All of the studied nurses did not receive any type of in job training or programs about prevention of cardiovascular disease.

Table no 2: Pre and post intervention nurses' knowledge about heart and blood vessels

Knowledge about heart and blood vessels	Pre-test		Post-test		Statistical test	P value
	No.	%	No.	%		
Definition of heart						
Wrong answer	65	18.2	0	0.0		
Correct incomplete answer	128	35.9	71	19.9	MH= 9.8	0.000
Correct complete answer	164	45.9	286	80.1		
The function of the heart:						
Wrong answer	12	3.3	0	0.0		
Correct incomplete answer	163	45.7	47	13.2	MH= 10.1	0.000
Correct complete answer	182	51.0	310	86.8		
Heart anatomy:						
Wrong answer	109	30.5	7	2.0		
Correct incomplete answer	131	36.7	39	10.9	MH= 12.9	0.000
Correct complete answer	117	32.8	311	87.1		
Definition of artery:						
Wrong answer	8	2.2	0	0.0		
Correct incomplete answer	133	37.3	35	9.8	MH= 8.8	0.000
Correct complete answer	216	60.5	322	90.2		
Definition of vein :						
Wrong answer	13	3.6	0	0.0		0.000
Correct incomplete answer	108	30.3	28	7.8	MH= 8.4	
Correct complete answer	236	66.1	329	92.2		
Total knowledge score of heart and blood vessels (10): Mean ± SD	6.9±1.85		9.35±0.79		t =28.42	0.000
Level of total knowledge score of heart and blood vessels						
Poor (<6)	83	23.2	0	0.0		
Fair (from 6 - 8)	184	51.5	44	12.3	MH=14.3	0.000
Good (>8)	90	25.2	313	87.7		

MH= Marginal homogeneity, t= Paired t-test

Table 2 indicates statistically significant differences between nurses' knowledge in pre and post-intervention, regarding the definition of heart, the function of the heart, heart anatomy, definition of artery and definition of the vein, with p-value <0.001. Moreover, the mean total score of knowledge was significantly increased in post-intervention test compared with pre-intervention test, mean knowledge score was 9.35±0.79 and 6.9±1.85 respectively, p was <0.001. This increase was due to the significant increase in the percentage of nurses who achieve good score of knowledge in post-intervention (87.7%) compared to pre-intervention (25.2 %), P <0.001.

Table no 3: Pre and post intervention nurses' knowledge about risk factors of CVD

Knowledge about CVD risk factors	Pre-test		Post-test		test	P value
	No.	%	No.	%		
Types of CVD:						
Wrong answer	43	12.0	29	8.1		
Correct incomplete answer	132	37.0	28	7.8	MH= 7.3	0.000
Correct complete answer	182	51.0	300	84.0		
Nonmodifiable risk factors of CVD:						
Wrong answer	24	6.7	21	5.9		
Correct incomplete answer	246	68.9	55	15.4	MH= 11.4	0.000
Correct complete answer	87	24.4	281	78.7		
Modifiable risk factors of CVD:						
Wrong answer	123	34.5	28	7.8		
Correct incomplete answer	108	30.3	53	14.8	MH= 11.1	0.000
Correct complete answer	126	35.3	276	77.3		
Elevated total cholesterol:						
Wrong answer	52	14.6	11	3.1		
Correct incomplete answer	232	65.0	65	18.2	MH= 12.9	0.000
Correct complete answer	73	20.4	281	78.7		
Abnormal High-Density Lipoprotein cholesterol (HDL)						
Wrong answer	261	73.1	8	2.2		
Correct incomplete answer	67	18.8	34	9.5	MH= 17.2	0.000
Correct complete answer	29	8.1	315	88.3		
Abnormal Low-density lipoprotein cholesterol (LDL)						
Wrong answer	149	41.7	7	2.0		
Correct incomplete answer	164	45.9	20	5.6	MH= 15.8	0.000
Correct complete answer	44	12.3	330	92.4		
High blood pressure:						
Wrong answer	30	8.4	0	0.0		
Correct incomplete answer	61	17.1	4	1.1	MH= 8.7	0.000
Correct complete answer	266	74.5	353	98.9		
High blood sugar:						
Wrong answer	49	13.7	0	0.0		
Correct incomplete answer	57	16.0	40	11.2	MH= 7.2	0.000
Correct complete answer	251	70.3	317	88.8		
Individuals in need for treatment to reduce CVD risk:						
Wrong answer	143	40.1	31	8.7		
Correct incomplete answer	140	39.2	48	13.4	MH= 12.7	0.000
Correct complete answer	74	20.7	278	77.9		
Total knowledge score of CVD risk factors (18): Mean ±SD	9.72±3.16		16.27±1.78		t= 42.7	0.000
Level of total knowledge score of CVD risk factors						
Poor (<10.8)	237	66.4	1	.3	MH= 17.4	0.000
Moderate (from 10.8 to 14.4)	86	24.1	56	15.7		
Good (>14.4)	34	9.5	300	84.0		

MH= Marginal homogeneity, t= Paired t-test

Table 3 reveals statistically significant differences between nurses' knowledge in pre and post-intervention test regarding types of cardiovascular disease, non-modifiable and modifiable risk factors of CVD, elevated total cholesterol, HDL, LDL, blood pressure, blood sugar level and the individuals in need for treatment to reduce CVD risk, P <0.001 for each; with significant improve in mean total score of knowledge from 9.72±3.16 in pre-intervention to16.27±1.78 in post-intervention, P <0.001. The majority of nurses (84.0%) achieved good level of knowledge in post-intervention compared to 9.5% of nurses in pre-intervention.

Table no 4: Nurses' knowledge in pre and post-intervention concerning prevention strategies of CVD.

Prevention strategies of CVD	Pre-test		Post test		test	P value
	No.	%	No.	%		
Proper nutrition:						
Wrong answer	7	2.0	0	0.0	MH= 10.1	0.000
Correct incomplete answer	143	40	26	7.3		
Correct complete answer	207	58.0	331	92.7		
Control obesity:						
Wrong answer	58	16.2	0	0.0	MH= 10.4	0.000
Correct incomplete answer	123	34.5	48	13.4		
Correct complete answer	176	49.3	309	86.6		
Control blood pressure						
Wrong answer	65	18.2	0	0.0	MH= 11.9	0.000
Correct incomplete answer	131	36.7	33	9.2		
Correct complete answer	161	45.1	324	90.8		
Practicing physical exercise						
Wrong answer	63	17.7	0	0.0	MH=10.5	0.000
Correct incomplete answer	144	40.3	68	19.0		
Correct complete answer	150	42.0	289	81.0		
Control elevated cholesterol level:						
Wrong answer	46	12.9	8	2.2	MH= 7.9	0.000
Correct incomplete answer	114	31.9	71	19.9		
Correct complete answer	197	55.2	278	77.9		
Control of diabetes:						
Wrong answer	63	17.6	19	5.3	MH= 8.9	0.000
Correct incomplete answer	138	38.7	50	14.0		
Correct complete answer	156	43.7	288	80.7		
Smoking cessation:						
Wrong answer	10	2.8	3	0.9	MH= 15.4	0.000
Correct incomplete answer	255	71.4	13	3.6		
Correct complete answer	92	25.8	341	95.5		
Stress management:						
Wrong answer	14	3.9	1	0.3	MH= 11.5	0.000
Correct incomplete answer	224	62.8	65	18.2		
Correct complete answer	119	33.3	291	81.5		
Getting adequate restful sleep:						
Wrong answer	80	22.4	0	0.0	MH= 11.2	0.000
Correct incomplete answer	147	41.2	82	23.0		
Correct complete answer	130	36.4	275	77.0		
Detection and treatment thyroid disturbance						
Wrong answer	38	10.6	10	2.8	MH= 8.6	0.000
Correct incomplete answer	163	45.7	95	26.6		
Correct complete answer	156	43.7	252	70.6		
Avoid alcohol intake:						
Wrong answer	81	22.7	43	12.1	MH= 10.6	0.000
Correct incomplete answer	188	52.7	68	19.0		
Correct complete answer	88	24.6	246	68.9		
Periodical follow up						
Wrong answer	72	20.2	15	4.2	MH= 6.7	0.000
Correct incomplete answer	64	17.9	53	14.8		
Correct complete answer	221	61.9	289	81.0		
Total knowledge Score (24):Mean ±SD	15.52±3.90		21.56±2.03		t= 33.6	0.000
Level of total knowledge score about CVD prevention strategies:						
Poor (less than 14.4)	143	40.1	2	0.5	MH=15.8	0.000
Moderate (from 14.4 to 19.2)	154	43.1	52	14.6		
Good (greater than 19.2)	60	16.8	303	84.9		

MH= Marginal homogeneity, t= Paired t-test

Table 4 reveal statistical significant differences between nurses, knowledge in pre and post-intervention concerning

prevention strategies of CVD (proper nutrition, control of obesity, control blood pressure, practices physical exercise, control elevated cholesterol level, control diabetes, smoking cessation, getting adequate restful sleep, detection and treatment thyroid disturbance, avoid alcohol intake, and periodically follow up), with p <0.001for each. In addition, a statistically significant increase in mean score of knowledge in post-intervention compared to mean score of knowledge in pre-intervention, the mean = 21.56±2.03 and 15.52±3.90 respectively, P <0.001. The majority nurses (84.9%) achieved good level of knowledge in post-intervention compared to 16.8% in pre-intervention.

Table no 5: Pre and post intervention nurses' knowledge regarding the estimation of probable CVD risk for 10 years

Knowledge about risk assessment of CVD	Pre-test		Post-test		Test	P
	No.	%	No.	%		
Measures to assess and calculate CVD risk:=						
Wrong answer	287	80.4	23	6.4		
Correct incomplete answer	70	19.6	81	22.7	MH=	0.000
Correct complete answer	0	0.0	253	70.9	16.9	
Steps of CVD risk assessment:						
Wrong answer	279	78.2	28	7.8		
Correct incomplete answer	78	21.8	63	17.6	MH= 16.8	0.000
Correct complete answer	0	0.0	266	74.5		
Individuals in need for cardiovascular health risk assessment:						
Wrong answer	62	17.4	9	2.5	MH= 15.2	0.000
Correct incomplete answer	268	75.1	64	17.9		
Correct complete answer	27	7.5	284	79.6		
Calculate the percentage of potential risk for CVD:						
Wrong answer	287	80.4	19	5.3		
Correct incomplete answer	70	19.6	67	18.8	MH= 17.4	0.000
Correct complete answer	0	0.00	271	75.9		
Calculate body mass index:						
Wrong answer	124	34.7	11	3.1		
Correct incomplete answer	191	53.5	31	8.7	MH= 15.6	0.000
Correct complete answer	42	11.8	315	88.2		
Determine obesity:						
Wrong answer	120	33.6	9	2.5		
Correct incomplete answer	212	59.4	56	15.7	MH= 15.7	0.000
Correct complete answer	25	7.0	292	81.8		
Total knowledge score of CVD risk estimation (12): Mean ±SD	3.02±1.74		10.43±1.54		t=70.4	0.000
Level of total knowledge score of CVD risk estimation:						
Poor (less than 7.2)	343	96.1	24	6.7	MH=17.8	0.000
Moderate (from 7.2 to 9.6)	14	3.9	50	14.0		
Good (greater than 9.6)	0	0.0	283	79.3		
Role of nurse in prevention of CVD:					MH= 11.7	0.000
Wrong answer	70	19.6	1	0.3		
Correct incomplete answer	143	40.1	46	12.9		
Correct complete answer	144	40.3	310	86.8		
Total knowledge Score (2): Mean ±SD	1.21 ±0.75		1.87±0.35		t = 14.9	0.000

Table 5 illustrates statistical significant differences between nurses' knowledge in pre and post-intervention regarding measures to assess and calculate CVD risk, steps of CVD risk assessment, individuals in need for cardiovascular health risk assessment, calculate the percentage of potential risk for CVD, calculate body mass index, and determine obesity, P <0.001for each. Moreover, significant improvement in mean total score of knowledge and the parentage of nurses who achieve good level of knowledge in post-intervention compared to pre-intervention. Regarding the role of the nurse in prevention of CVD, the majority of nurses (86.8%) achieved good score of knowledge in post-intervention compared to 40.3% in pre-intervention P <0.001.

Figure no1: Pre and post intervention overall mean score of nurses' knowledge about of CVD

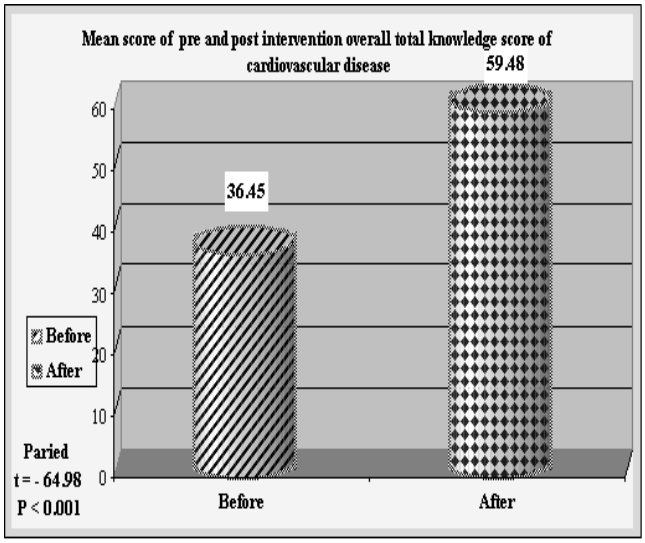


Figure 1 reveals a statistical significant increase in mean overall knowledge score concerning CVD in post-intervention compared to mean overall knowledge score, P-value <0.001. The significant improvement in nurses' mean score of knowledge in post-intervention in table 2, 3, 4, 5, and this figure provided support to research hypotheses

Figure no 2: Pre and post intervention levels of the overall total score of nurses' knowledge about CVD.

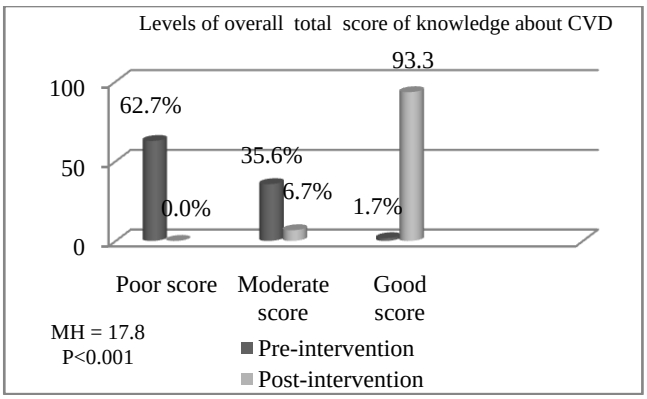
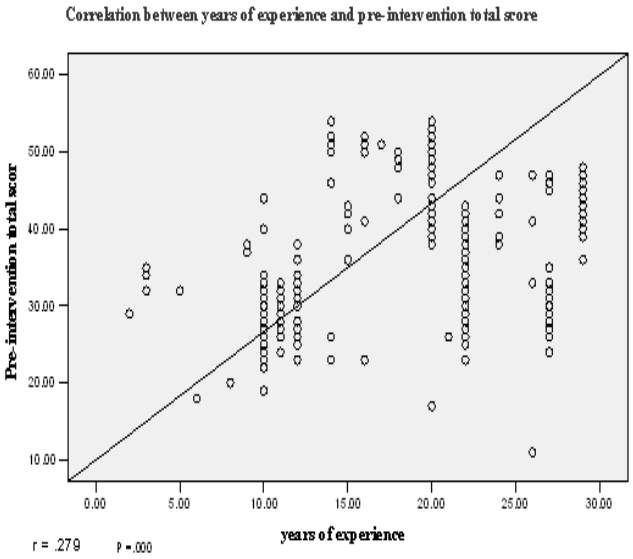


Figure 2 shows that most of the nurses (93.3%) achieved good level of knowledge in overall score in post-intervention compared to 0.0% in pre-intervention. This statistical significant improvement in nurses' level of knowledge in post-intervention supports the research hypothesis.

Figure no 3: Correlation between nurse's years of experience and pre-intervention overall score of nurses' knowledge about CVD.



r= Pearson correlation coefficient, correlation is significant at the 0.01 level (2-tailed).

Figure 3 shows statistical significance positive correlation between nurse's years of experience and pre-intervention total score of knowledge about CVD, r = 0.279, P= 0.000.

Table no 6: Relationship between the overall mean score of knowledge and nurses' educational qualification.

Degree of educational qualification	Pre-test total score Mean±SD	F	P	Post-test total score Mean±SD	F	P
Nursing Diploma	35.12±7.75	28.77	0.000	59.04±4.26	8.24	0.000
Technical nurses	33.10±5.78			61.60±2.91		
Bachelor nurses	45.24 ±6.35			61.60±3.12		
Postgraduate nurses	52.25±1.26			65.00±.82		

F= One way ANOVA

Table 6 illustrates that nurses with high educational qualification (bachelor nurse and postgraduate nurses) had statistically significant higher mean total score both in pre-intervention and post-intervention, p-value <0.001 for each.

4. Discussion

Cardiovascular disease is constantly increasing and causing more burdens on health care service, families, and communities. Many of the disorders associated with CVD are preventable. Screening for risk factors, increase patients' awareness of their condition, effective management of risk factors, and adherence to treatment are essential for effective prevention of CVD [28]. Lack of knowledge among health professionals in primary health care is the main barrier for CVD prevention [29]. The current study was carried out to evaluate the effectiveness of educational intervention on the level of primary care nurses' knowledge concerning risk estimation and prevention of CVD. The study findings indicated that the mean age of nurses was 38.87 ±7.50 years; most of the nurses had diploma in nursing and the mean years of experience were 19.07±6.35 years. Most of the nurses worked as a staff nurse.

One of the important findings that should be considered in this study was that all of the nurses had not received any in job training or program about CVD prevention or risk reduction, this finding in contradiction with some studies, [30] revealed that 86% of primary care nurses in the UK had some type of basic training about cardiovascular disease. Also [31] in Qatar reported that almost half of the nursing students had training on CVD risk calculators. Moreover [32] in China reported that 46% of staff nurses had continuing education about CVD preventive knowledge. The reported lack of training in this study setting might reflect that early detection and risk identification and risk management are given lower clinical value and the services directed to maternal-child health issues and infectious diseases are given priority.

Regarding the current level of knowledge (pre-intervention) of nurses about CVD, its risk factors, risk estimation and prevention strategies, the present study revealed that a minority of nurses had good knowledge about heart and blood vessels and about two-thirds of them had poor level of the total score of knowledge about CVD risk factors. This finding in contradiction with [32] in China, they found that most nurses could identify common risk factors for CVD. In addition, [31] reported that more than half of nursing students achieved the maximum score in identify the risk factors required for estimating absolute CVD risk. Moreover, [33] reported that nursing student in Hong Kong had good knowledge about the risk factors of cardiac diseases. This might be due to their samples included students that still studying and had fresh up to date knowledge and had training on CVD risk calculators.

The current study clarified that in pre-intervention, less than half of nurses had poor or moderate level of knowledge about prevention strategies of CVD and minority of them had good level of knowledge. These findings in contradiction with [32] in China who reported that more than half of staff nurses had correct answers about evidence-based recommendations for CVD risk reduction. Also, in this study ninety six percent of nurses had poor level of knowledge about CVD risk estimation in pre-intervention. This result in contradiction with [34] they evaluated the effect of Heart Truth Professional Education Campaign on health care providers' knowledge about CVD prevention in women in three states in the USA; they found that nurses had high baseline knowledge about the factors that increase the risk of CVD event among women. This could be explained that the majority of the subject of the mentioned studies had previous training about CVD risk factors and/or CVD prevention or risk calculation and estimation.

Concerning the role of primary care nurses in prevention of CVD, in pre-intervention less than half of the nurses had good level of knowledge about their role in the prevention of CVD. These finding in agreement with [32] in China; they reported that nursing professionals and students were lacked in the essential knowledge that helps in providing guidance to individuals with or at risk for CVD. Regarding the overall score of knowledge about prevention and risk estimation of CVD, the current study revealed that about two-thirds of nurses had poor level of knowledge in pre-intervention. This result in disagreement with the findings of [34] they found that nurses had intermediate total knowledge score in the pre-test.

With regard to nurses' level of knowledge in post-intervention, the majority of nurses achieve good level of knowledge about heart and blood vessels, risk factors of CVD, prevention strategies of CVD, CVD risk estimation and the role of the nurse in prevention of CVD. Also, the majority of nurses achieve good level of the overall total score of knowledge in post-intervention. These findings revealed significant improvement in nurses' level of knowledge score in post-intervention compared to pre-intervention, which indicating positive effect of the educational intervention in improving nurses' knowledge about risk estimation and prevention of CVD. These results are in agreement with the findings of many studies. [34], in three states in the USA; found that nurses were achieved significantly higher score (81%) after the educational lecture about CVD prevention in women compared to pre-test (55.8). [35] reported that clinical skills of eighty-five percent of student nurses in England had improved after training on CVD risk assessment. In São Paulo City-Brazil, [22] confirmed an increase in the knowledge of the nursing team, after educational interventions about arterial hypertension compared to their knowledge before the educational interventions. Moreover, [36] in India they illustrated that self-instructional educational module was significantly increased the staff nurses' knowledge about post-myocardial infarction rehabilitation, their mean in posttest was 23.18 ± 3.69 and pre-test score was 8.27 ± 4.40.

The current findings clarified that nurses with high educational qualification had significantly higher mean total score about CVD both in pre-and post-intervention. Similarly [37] in Istanbul, Turkey found that nursing student with increasing years of education had significant high level of knowledge about cardiovascular disease.

Moreover, [38] in Taiwan reported that Nurses with higher levels of education had fewer misconceptions about heart disease. In contradiction, [36] they reported that no association was revealed between professional education and nurses score about post-myocardial infarction rehabilitation in the pre-test. Also in the present study, nurses with more years of experience had higher total score of knowledge about CVD in pre-intervention. Similarly [39] found positive relationship between years of experience and nurses' knowledge about the care of acute myocardial infarction. While the present finding in contradiction with [36] they reported that no association was found between years of clinical experience and nurses' score about post-myocardial infarction rehabilitation in the pre-test.

Conclusion

Based on the present findings it can be concluded that, in post-intervention, the majority of nurses achieved good level of knowledge and the percentage ranged from 79.3% to 87.7% across all categories compared to the minority that ranged from 0.0% to 25.2% in pre-intervention. This indicated that the implemented educational intervention has a significant effect in increasing the level of knowledge of primary care nurses' concerning risk estimation and prevention of CVD.

Recommendation

Continuous up to date in job education and training are required to improve primary care nurses' knowledge and enhancing their role in risk estimation and management as well as prevention of CVD. Further researches are needed to give special emphasis on the role of primary care nurses in risk calculation and estimation.

Conflict of interests

The authors assert that there is no any source of conflict of interests.

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