

## Effectiveness of Nurse-Led Intervention on Adults' Health Beliefs and Screening Behaviors Toward Colorectal Cancer

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### Abstract

**Background:** Colorectal cancer is common, the presenting symptoms are non-specific, and the stage of disease at diagnosis is closely related to survival. Regular screening reduces morbidity and mortality from this disease. The Health Belief Model posits that individuals are more likely to engage in preventive health behavior. **Aim:** to evaluate the effectiveness of nurse-led intervention on adults' health beliefs and screening behaviors toward colorectal cancer. **Design:** A quasi experimental design. **Setting:** This study was conducted in outpatients' clinics at Menoufia University hospital, Egypt. **Sample:** A purposive sample of 140 participants who were attended at pre-mentioned settings. **Instruments:** as following: I. Structured interviewing questionnaire, II: colorectal cancer awareness questionnaire. III: colorectal cancer Self-reported screening behavior questionnaire, IV: colorectal cancer Knowledge questionnaire. V: Health beliefs model questionnaire. **Results:** the mean age of the studied sample was  $54.27 \pm 7.271$  and  $52.129 \pm 6.324$  for study and control groups respectively. Regarding to risk factors assessment 55.7% of study group and 65.7% of the control group has Low-fiber, protein-rich, and high fats in their diet. 80.0% of the study group and 84.3% of control group had negative family history for CRC. There was statistical improvement of total awareness score among study group ( $9.39 \pm 4.31$ ) than those in control group ( $5.02 \pm 2.93$ ) at post-intervention. The mean total behavior scores were  $7.93 \pm 2.11$  and  $5.28 \pm 3.28$  for study and control group respectively at post-intervention. There were statistical significance differences in total mean score of health belief model variables among study group at post intervention in which p value = .000. **Conclusion:** Nurse led intervention had positive impact on adult health beliefs, screening behaviors also improving their knowledge and awareness regarding colorectal cancer. **Recommendations:** Designing effective nursing strategies to address barriers of CRC screening and improve CRC knowledge and awareness, which is critical to achieving greater screening compliance.

**Keywords:** Nurse-led Intervention, health belief, screening behaviors, colorectal cancer

### Introduction:

Colorectal cancer (CRC) screening is an effective way to prevent CRC, one of the most common cancers worldwide. (Soetal., 2019). Although CRC was being preventable; it is considered the third most common type of cancer in the United States. Greater than 90% of colorectal cancers occur in people more

than 50 and the average age of diagnosis is 72 years. Recently, incidence rates in adults younger than 50 years have been increasing (Siegel et al. 2017 and El-Bolkainy et al., 2005)

In Egypt, Colorectal Cancer (CRC) reports 6.5% of all cancers (Gado et al., 2014). Moreover, more than one-third of colorectal cancer (CRC) cases occur in

individuals aged 40 years and younger, and are diagnosed at advanced stages; currently, CRC screening is not done as a routine part of preventive care. Furthermore, CRC in Egypt was diagnosed in 14.0% of all patients who undergone colonoscopies (**Gado et al., 2014**). A population-based study in Garbiah, Egypt has shown high rates of CRC in patients aged 40 years and younger which were slightly higher than rates of the same age group in the United States (**Veruttipong et al., 2012**).

The major cause of death from CRC occurs in developing countries are due to poor awareness of its manifestations, late diagnosis, and little accessibility of screening tests. (**Siegel et al. 2017 and El-Bolkainy et al., 2005**). On the other hand, the greater part of CRC initiates as the consequence of possibly modifiable risk factors such as smoking, alcohol use, unhealthy diet (high fat, low fiber), obesity, lack of physical activity, and urban air pollution (**Atkin et al., 2017, Schreuders et al., 2015 & Deng, Y. (2017)**). Incidence of CRC raises in developing countries, which are frequently supplied with fewer resources, corresponding with high mortality rates. Consequently, it is predicted that its incidence will noticeably amplify over the next decade. Hence prevention of CRC is particularly important either by primary prevention including health education or secondary prevention as early diagnosis and rapid treatment, 90% of the patients can be treated after in time diagnosis (**Gholampour et al., 2018**).

Colorectal cancer have greater opportunity to heal if discovered early and treated efficiently but low people knowledge of its manifestation in addition to their negative behavior as fear about what physician might find and delays the asking for medical care increases the risk

of its complications. So that increasing population awareness of CRC warning signs and symptoms will reduce their delayed in CRC diagnosis and decrease its mortality (**Al-Azri et al., 2016 & (Schreuders et al., 2015)**).

Health care providers play a key role in the screening behavior process by increasing awareness about CRC and screening tests in participants, reducing perceived barriers and increasing perceived benefits of screening tests. Physician recommendation has shown a strong correlation with CRC screening behaviors across the studies (**Schreuders et al., 2015, Glanz et al., 2008 & Taylor et al., 1999**).

According to Taylor, Health Belief Model (HBM), which explains health behaviors and used in current study as theoretical framework, often applied to understand why individuals engage or do not engage in preventive services, including CRC screening can well justify the lack of participation in the screening process (**World Health Organization, 1998**). Based on this model, if people believe that they are susceptible to diseases such as cancer (perceived susceptibility); perceive the risk intensity of its various complications in their life (perceived severity); know about the required behaviors for reducing the risk or severity of the disease (perceived benefits); can overcome hindering factors such as cost and time (perceived barriers); and are assured of their abilities to behave in a way that achieves the desired result (perceived self-efficacy); then they will have a greater willingness to participate in health promotion behaviors, and probably will be screened for colorectal cancer (**Garvey et al., 2016**).

### **Significance of the problem**

According to statistics provided by the American Cancer Society (ACS), treatment options for CRC have greatly improved recently, resulting in more than 1 million CRC survivors in the US alone. Along with this development, early diagnosis through regular and timely screening can decrease CRC risk (Deng, Y. 2017). So; it is essential to enhance awareness of the target population about CRC and its screening to raise screening participation rates.

### **Aim of the study:**

To evaluate the effectiveness of nurse-led interventions on adult health beliefs and screening behaviors toward colorectal cancer.

### **Research hypothesis:**

The participants of the study group who will receive Nurse-led Intervention about colorectal cancer expected to have greater awareness corresponding to control group.

- The participants of the study group who will involved in Nurse-led Intervention about colorectal cancer expected to experience positive screening behaviors than those of control group.

- The participants in the study group who will follow Nurse-led Intervention about colorectal cancer expected to have improved health beliefs and higher knowledge score than those of control group.

### **Methods**

**Research design:** A quasi-experimental design was utilized. It involves the manipulation of an independent variable without the random assignment of participants to conditions.

**Setting:** The current study was conducted at outpatients' clinics (general medical, general surgical, orthopedic, vascular surgery, cardiac and chest clinics) at Menoufia University hospital, Egypt.

**Subjects:** A purposive sample of 140 adult participants were attended for medical advice or accompanied with their relatives during the period of data collection. They were divided alternatively and randomly into two equal groups, seventy for each group.

Group I: received nurse-led intervention regarding CRC using health belief model.

Group II: follow routine hospital care.

### **The subjects were selected according to the following criteria:**

- Age 45- 65 of both sexes. These age groups were highly risk for colorectal cancer.
- No colorectal cancer diagnosis or benign colon tumors
- Being physically and psychologically able to respond to questions as well as consent to participate in the study
- - Have no inflammatory bowel disease and intestinal polyps to avoid any chance of developing colorectal cancer during study.

### **Instruments:**

To achieve the aim of the study, five tools were developed and utilized by the researchers for data collection. These are as follow:

**Instrument I: Structured interviewing questionnaire:** It was developed by the researchers and divided into two parts as follow:

**(1): Sociodemographic characteristics:** to assess basic participants' data included questions about age, sex, educational level, marital status, family income and presence of chronic illness such as diabetes mellitus, hypertension, history of cancer exposure, liver diseases and or any other diseases.

**(2): Risk factors (RF) assessment of colorectal cancer:** to assess risk factors for CRC and consisted of six main questions about: Family history of cancer, Diet, Exercise, Cigarettes use, Alcohol use and Body mass index (BMI) category according to classification of obesity by (WHO,1998 & Garvey, Brett and Mechanick, 2016). Answers were; yes or no according to participants' each factor Responses. The yes response was given 1 score awhile no response was given 0score.

**Instrument II: Colorectal cancer awareness questionnaire:**It developed by researchers after reviewing of relevant literatures (Al-Azri et al., 2016, Garvey et al., 2016, & Imran et al., 2016)to assess the participants' awareness to CRC included 8 questions (risk factors for colon cancer, thoughts regarding prevention of CRC, thought about abdominal pain as one of the symptoms related to colon cancer, thoughts about fever and weight loss one of the symptoms that associated with colon cancer,thoughts about blood in stool as one of the symptoms related to colon cancer, hearing about colorectal polyp, hearing about fecal occult blood test, and hearing about colonoscopy.Score 0 was given to wrong or no answer, score 1 to correct incomplete answer and score 2 was given to correct answer.All scores were summed up to give total score ranged from 0 to 16which classified into unsatisfactory  $\leq 8$  degrees ( $\leq 50\%$ ) and satisfactory  $>8$  degree ( $>50\%$ ).

**Instrument III: Colorectal cancer Self-reported screening behavior questionnaire:** It developed by researchers after reviewing of related literatures (Al-Azri et al., 2016, Garvey et al., 2016, & Imran et al., 2016)to assess participant behavior regarding early detection of CRC. It consisted of 5 questions regarding talking with doctor about test of CRC, performance of fecal occult blood test (FOBT), recommendation of colonoscopy, performance of colonoscopy and willing to perform CRC testing within 6 months. Score 0 was given to wrong or no answer,score 1 to correct or incomplete answer and score 2 was given to correct answer; all scores were summed up to give total score ranged from 0 to 10 classified into unsatisfactory  $\leq 5$  degrees ( $\leq 50\%$ ) and satisfactory  $>5$  degree ( $>50\%$ ).

**Instrument IV: Colorectal cancer Knowledge questionnaire:** It developed by researchers after reviewing of relevant literatures (Al-Azri et al.2016, Garvey et al. 2016, & Imran et al.2016)to assess the participants' knowledge about CRC included 10 questions included: infection as a risk factor of CRC, family history influenced incidence of CRC, aging as a risk factors for colon cancer, obesity and lack of exercise, screening test for colon cancer, stool blood test, supposed age to start testing for CRC, time interval for performing stool blood test, time interval for performing colonoscopy, and highly incidence sex for CRC. Score 0 was given to wrong answer score 1 to correct incomplete answer and score 2 was given to correct answer; all scores were summed up to give total score ranged from 0 to 20 classified into unsatisfactory  $\leq 10$  degrees ( $\leq 50\%$ ) and satisfactory  $>10$  degree ( $>50\%$ ).

**Instrument V: Health beliefs model questionnaire.** :revised by

(Hazavehei et al., 2007) and modified by the researchers; which included six main items as the following:

- Perceived susceptibility: it was consisted of 3 questions to assess one's belief of the chances of getting a CRC (e.g. I have chance to get colon cancer, the chance of getting colon cancer is great, because my family history of cancer is negative so I don't have colon cancer in the future). Scoring: 3 points Likert scale 0=don't know, 1=not agree and 2= agree were used. Values were summed up to calculate Mean  $\pm$  SD for each item to be compared at pre and post intervention. Total score was 6 degree; < 3 (<50%) considered low perception of susceptibility to CRC and  $\geq 3$  ( $\geq 50\%$ ) considered high perception of susceptibility to CRC.

- Perceived Severity: it was contained 5 questions assessed one's belief of how serious a CRC and its consequences (e.g. colon cancer is serious disease, I became worry and afraid when I think in such disease, my life will be changed if I get CRC, I will be in bad state if I have such disease, my chance of survival will be decreased if I get CRC). Scoring: 3 points Likert scale 0=don't know, 1=not agree and 2= agree were used. Values were summed up to calculate Mean  $\pm$  SD for each item to be compared at pre and post intervention. Total score was 10 degree; < 5 (<50%) considered low perception of severity to CRC and  $\geq 5$  ( $\geq 50\%$ ) considered high perception of severity to CRC.

- Perceived Benefits: it was contained 5 questions reflected One's belief in the efficacy of the advised action to reduce risk or seriousness of impact (e.g. I think colon is vital organ in the body, I think it is important to do CRC screening regularly, CRC screening help in detect disease early, I think it is important for all persons over 45 years to do CRC screening regularly, I can fight

colon cancer if I get such disease). Scoring: 3 points Likert scale 0=don't know, 1=not agree and 2= agree were used. Values were summed up to calculate Mean  $\pm$  SD for each item to be compared at pre and post intervention. Total score was 10 degree; < 5 (<50%) considered low perception of benefits to CRC screening behaviors and  $\geq 5$  ( $\geq 50\%$ ) considered high perception of screening behaviors to CRC.

- Perceived Barriers: it was contained 10 questions to assess One's belief in the tangible and psychological costs of the advised behavior (I don't know about CRC, I don't know methods of screening, lack of time is cause of not doing screening tests, shaming of getting the test (segmoidoscopy), worry about the result, cost or financial reasons, fear of pain, forgiveness is reason of not having CRC screening, Belief of fate and destiny, feeling of shying). Scoring: 3 responses 0=neutral, 1=no, 2=yes were used. Values were summed up to calculate Mean  $\pm$  SD for each item to be compared at pre and post intervention. Total score was 20 degree; < 10 degree (<50%) considered low perception of barriers to CRC screening behaviors while  $\geq 10$  degree ( $\geq 50\%$ ) considered high perception of barriers to uptake screening behaviors of CRC.

- Cues to action: contained 5 questions regarding strategies to activate "readiness" (e.g. it is important to improve my health, I do all effort to enhance my health, seeking for all information to get informed about the disease, I do periodical checkup for detecting problem as early as possible, knowing about the problem motivate me to follow screening recommendations). Scoring: 3 points Likert scale 0=don't know, 1=not agree and 2= agree. Values were summed up to calculate Mean  $\pm$  SD for each item to be compared at pre and post intervention. Total score was 10

degree; < 5 (<50%) considered low cues of action to practice behaviors to detect CRC via screening behaviors and  $\geq 5$  ( $\geq 50\%$ ) considered high cues to take action.

- Self-Efficacy: contained 1 question to assess confidence in one's ability to

- Scoring of self-efficacy; two responses included: 1=not confident and 2= confident answer, values were summed up also to calculate Mean  $\pm$  SD to be compared at pre and post intervention. . Total score was 2 degree; 1 degree (50%) considered low self efficacy of practice screening behaviors to detect CRC and 2 degree (> 50%) considered high self efficacy.

### Method:

1.A **written permission** was obtained from the Faculty of Nursing was delivered to the responsible authorities of the hospital (the hospital's director and the head nurse of outpatient clinics) to conduct the study then a written approval was obtained after explaining the aim of study.

1- **Tools development:** all tools of present study were developed by researchers after extensive reviewing of relevant literatures. Content validity of the tools with peer review was conducted by a committee of experts; composed of three academic professors with experience in family and community health nursing, medical and surgical nursing and oncology medicine, to make significant relevance, comprehensiveness. Required modification was done as ordered.

2- **The reliability** was performed for testing internal consistency of the tools using Test-retest maneuver. It is the introduction of the same tool to the similar subjects under the similar conditions on more occasions. Results

from frequent testing were compared using Cronbach's co-efficiency Alpha. This turned to be R= 0.84, 95.1, 88.9 and 87.8 for tool I, II, III and IV respectively. The reliability of HBM questionnaire was a Cronbach's Alpha of 0.79.

3- **Pilot study** was done after developing the tools on 14 participants (10 % of the sample) who were not included to the total study sample. Based on the results of the pilot study; required modifications were done to ensure directness and unambiguousness.

4- **Administration and Ethical concern:** The proposal for the study was given to research ethics committee in the nursing colleague to be reviewed and evaluated. The present study satisfies the standards of ethics in research involving; protection of human rights. Administrative process and written agreement were taken to get permission for carrying out the study. Active informed consents prior to study enrolment were taken from the study participants. Current study was run with cautious attention to ethical principles.

### Procedure:

- The study was conducted through 6 months; from May to October 2019. Firstly, the studied participants were interviewed at outpatients' clinics. Active informed consent was taken from all subjects included; aim and expected duration of the study. Participants who were fulfilled the inclusion criteria included in the research study. Interviewing questionnaires were distributed on the participants. Data of pretest collected on three days a week about 5-6 participants per day; the tools take about 60 minutes to be filled in.

- Based on reviewing of relevant literature and findings linked to similar

researches, nursing intervention was given to study group based on HBM variables; immediately at the same day after collection of pretests. Furthermore, the nurse led interventions of recommended knowledge and preventive behaviors were provided to the studied participants. The studied participants were attended for 60 minutes educational sessions. The course was delivered in an interactive style, illustrative pictures about normal colon shape and colorectal cancer appearance. Handouts about the main topic of the study were offered. Nurse led Interventions sessions were included: magnitude of the problem, definition of colorectal cancer, risk factors, clinical manifestations, complications, diagnostic measures e.g. colonoscopy, fecal occult blood test (FOBT) and other laboratory tests and clinical examination and methods of treatment.

- Posttest was taken after finishing health education classes for the study group in order to identify the similarities, differences and areas of enhancement as well as weakness. Posttest had obtained directly after application of nursing intervention by 3 months.

### Statistical analysis

Data was entered and analyzed using Statistical Package for Social Science statistical package version 22 (SPSS) program. Graphics were done using Excel program.

### Results

**Table 1:** shows that the mean age of the studied sample was  $54.27 \pm 7.271$  and  $52.129 \pm 6.324$  among control group with no statistical significance difference in between. Regarding to sex, more than half of sample (57.1% and 62.9% of study and control group respectively) with no statistical significance difference in between. Concerning to educational level,

about 31.4% of study group was elementary education while, most of the control group 70.0% was secondary education with statistical significance difference p value .021. Regarding to marital status, about 72.9% were married among study as well as and control group with statistical significance difference p value .006. Finally, family income was inadequate 61.4% and 55.7% among study and control group respectively.

**Table 2:** shows that 55.7% of study group has low-fiber, protein-rich, fats in their diet and 65.7% among control group with no statistical significance difference between study and control group. Family history as a risk factor of CRC was 80.0% and 84.3% negative for both study and control group respectively, with no statistical significance difference. Regarding to practices of exercise; 38.6% and 47.1% of study and control group respectively don't practices exercise. Furthermore, 60.0% of study group have cigarettes smoking and 55.7% for control group with no statistical significance difference. 80.0% and 82.9% of study and control group respectively, don't consume alcohol intake with no statistical significance difference in between. Concerning to category of body mass index; about 34.9% of study group were overweight and 35.7 % of control group were also overweight with no statistical significance difference.

**Table 3:** there was a highly statistical significance difference between study and control group at pre intervention and post intervention regarding total awareness score. On the other hand, there were no statistical significance differences regarding reported behavior score and total knowledge score between study and control group about CRC at pre intervention p value = .911 and .781 respectively. While, there were highly

statistical significance differences between study and control group about total reported behavior score p value .000 and total knowledge score .000 regarding CRC at post intervention.

**Table 4:** there were statistically significant relation between educational level and mean total score of awareness about CRC among study group at pre (p value = 0.12) and post intervention (p value = .000). In addition, there was statistically significant relation between marital status and mean total score of awareness (p=.000) about CRC among study group at post intervention only.

**Table 5:** there was statistical significance relation between age group and mean score of total knowledge at post intervention (p value = .001) than pre intervention. Also, there was statistically significant relation between marital status and mean score of total knowledge at post intervention (p value = .000) than pre intervention.

**Table 6:** there were statistically significant relation between study group's sex, marital status and family income and mean score of total reported behavior only at pre intervention in which p value =0.46, .001, .000 respectively. On the other hand, there was statistically significant relation between age group and mean score of total reported behavior only at post intervention p value =.028.

**Table 7:** there were no statistical significant differences of total mean score of health beliefs model categories between study and control group at pre intervention except at perception of barriers and cues of action while there were statistical significant differences of total mean score of health beliefs model categories between study and control group at post intervention.

**Table 8:** there were statistical significance differences in total mean score of health belief model variables at post intervention in which p value =.000

**Table (1) distribution of socio-demographic characteristics among study and control group (n=140)**

Socio-demographic characteristics	Study (n=70)		Control (n=70)		t-test	P value
	No	%	No	%		
<b>Age</b>					1.180	.240
45 -	50	71.4	56	80.0		
56-65 years	20	28.6	14	20.0		
Mean ± SD	54.27± 7.271		52.129±6.324		1.86	0.65
<b>Sex</b>						
Male	40	57.1	44	62.9	.686	.494
Female	30	42.9	26	37.1		
<b>Educational level</b>						
Illiterate	12	17.1	4	5.7	-2.341	.021*
Elementary education	22	31.4	8	11.4		
Secondary education	21	30.0	49	70.0		
University education or higher	15	21.4	9	12.9		
<b>Marital status</b>						
Single	8	11.4	0	0.0	-2.777-	.006*
Married	51	72.9	51	72.9		
Other	11	15.7	19	27.1		
<b>Family income</b>					.683	.496
Adequate	27	38.6	31	44.3		
Not adequate	43	61.4	39	55.7		

**Table (2) distribution of colorectal cancer risk factors among study and control group (n=140)**

Risk factors variables	Study (n=70)		Control (n=70)		Test	P value
	No	%	No	%		
<b>Diet</b>					<b>ANOVA test</b>	
High-fiber, fruit, vegetables	20	28.6	12	17.1	1.306	.274 <sup>NS</sup>
Low-fiber, protein-rich and fatty diet	39	55.7	46	65.7		
Balanced fiber, protein and fats	11	15.7	12	17.1		
<b>Family history</b>					<b>Independent</b>	.511 <sup>NS</sup>
Positive	14	20.0	11	15.7	<b>t-test</b>	
Negative	56	80.0	59	84.3	-.658-	
<b>Practices of exercise</b>					<b>ANOVA test</b>	137 <sup>NS</sup>
None	27	38.6	33	47.1	<b>F=</b>	
Rare	26	37.1	22	31.4	2.234	
Frequently	3	4.3	11	15.7		
Regularly	14	20.0	4	5.7		
<b>Cigarettes use</b>					<b>Independent</b>	
Yes	42	60.0	39	55.7	<b>t-test</b>	.611 <sup>NS</sup>
No	28	40.0	31	44.3	.510	
<b>Alcohol use</b>					<b>Independent</b>	
Yes	14	20.0	12	17.1	<b>t-test</b>	.667 <sup>NS</sup>
No	56	80.0	58	82.9	.432	
<b>Body mass index category</b>					<b>ANOVA test</b>	
Under weigh less than 18	13	18.6	5	7.1	1.498	.218 <sup>NS</sup>
Normal weight 18-24.9	13	18.6	18	25.7		
Overweight 25- 29.9	24	34.3	25	35.7		
Obese 30 and over	20	28.6	22	31.4		
<b>Body mass index</b>	25.986±6.159		26.671±5.09		-.718-	.474 <sup>NS</sup>

**Table (3): Comparison between total mean score of awareness level, reported screening behaviors and total knowledge among study and control group at pre and post Nurse-led interventions**

Variables	Study (n=70)	Control (n=70)	T-test	P value	Study (n=67)	Control (n=65)	T-test	P value
<b>Total awareness score</b>	6.10±2.54	4.07±2.64	4.363*	.000	9.39±4.31	5.02±2.93	6.797*	.000
<b>Total reported screening behaviors score</b>	4.77±3.12	4.83±3.00	-.112-	.911	7.93±2.11	5.28±3.28	5.542*	.000
<b>Total knowledge score</b>	8.700±5.81	8.43±5.69	.279	.781	11.70±5.86	8.92±5.53	2.800*	.006

**Table (4): Relation between sociodemographic characteristics and level of awareness among study group at pre and post Nurse-led interventions**

Sociodemographic characteristics	Pre (n= (70) Mean ± SD	Mean score of total awareness Test / P -value	Post (n=67) Mean ± SD	Test / P -value
<b>Age group</b>				<b>X<sup>2</sup></b>
45 -Yrs	1.26± .443	-.034-	9.468±4.544	.109
56 - 65 Yrs	1.35 ±.489	.780 <sup>NS</sup>	9.20±3.806	.380 <sup>NS</sup>
<b>Sex</b>				<b>Mann-Whitney</b>
Male	1.35±.48	.153	8.622±3.982	458.000 <sup>NS</sup>
Female	1.20 ±.41	.205 <sup>NS</sup>	10.33±4.574	.21
<b>Educational level</b>		<b>Kruskal Wallis</b>		<b>Kruskal Wallis</b>
Illiterate	1.00±.000	11.032	6.08±.900	20.772
Elementary education	1.27±.455	.012 <sup>Sig</sup>	8.364±4.238	.000 <sup>Sig</sup>
Secondary education	1.52±.512		10.44±3.568	
University education or higher	1.20 ±.414		12.267±4.818	
<b>Marital status</b>		.044		<b>X<sup>2</sup></b>
Single	1.0000±.00000	.717 <sup>NS</sup>	4.875±2.100	.471
Married	1.3529±.48264		9.25±3.917	.000 <sup>Sig</sup>
Other	1.1818±.40452		13.273±3.797	
<b>Family income</b>		.490		<b>X<sup>2</sup></b>
Adequate	1.0741±.26688	.000 <sup>sig</sup>	9.154±4.929	.108
Not adequate	1.4186±.49917		9.537±3.925	.39 <sup>NS</sup>

**Table (5): Relation between sociodemographic characteristics and mean score of total knowledge among study group at pre and post Nurse-led interventions**

Sociodemographic characteristics	Pre (n= (70) Mean ± SD	Mean score of total knowledge		
		X <sup>2</sup> Test P -value	Post (n=67) Mean ± SD	X <sup>2</sup> Test P -value
<b>Age group</b>		.018		10.881
45 -Yrs	1.580 ±.499	.880 <sup>NS</sup>	1.702±.462	.001 <sup>sig</sup>
56 - 65 Yrs	1.600 ±.503		1.750±.444	
<b>Sex</b>				.731
Male	1.600±.496	-.033- .783 <sup>NS</sup>	1.73±.450	.392 <sup>NS</sup>
Female	1.567 ±.504		1.700±.466	
<b>Educational level</b>		.033		3.269
Illiterate	1.58±.515	.785 <sup>NS</sup>	1.833±.389	.352 <sup>NS</sup>
Elementary education	1.591 ±.503		1.727±.456	
Secondary education	1.523 ±.512		1.611±.502	
University education or higher	1.667 ±.488		1.733±.458	
<b>Marital status</b>		T-test		
Single	1.625 ±.518	.014	1.875±.354	44.448
Married	1.569 ±.500	.911 <sup>NS</sup>	1.688±.468	.000 <sup>sig</sup>
Other	1.636 ±.505		1.727±.467	
<b>Family income</b>		-.071-		3.358
Adequate	1.63 ±.492	.561 <sup>NS</sup>	1.808±.402	.067 <sup>NS</sup>
Not adequate	1.56 ±.502		1.659±.480	

**Table (6): Relation between sociodemographic characteristics and reported screening behavior among study group at pre and post Nurse-led interventions**

Sociodemographic characteristics	Pre (n= 70) Mean ± SD	Mean score of total reported behavior		
		Test / P -value	Post (n=67) Mean ± SD	Test / P -value
<b>Age group</b>				
45 -Yrs	1.46 ±.503	.036	2.00±.000	-.269*
56 - 65 Yrs	1.50 ±.513	.766 <sup>NS</sup>	1.90±.308	.028 sig
<b>Sex</b>				
Male	1.575 ±.501	-.240	1.97±.164	-.018-
Female	1.33 ±.479	.046 sig	1.967±.183	.882 <sup>NS</sup>
<b>Educational level</b>		Kruskal Wallis Test		
Illiterate	1.33±.492	4.713	2.00±.000	.006
Elementary education	1.409±.503	.194 <sup>NS</sup>	1.955±.213	.959 <sup>NS</sup>
Secondary education	1.67±.483		1.94±.236	
University education or higher	1.40±.507		2.00±.000	
<b>Marital status</b>		Kruskal Wallis Test		
Single	1.00±.000	14.437	2.00±.000	.015
Married	1.61±.49	.001 sig	1.96±.202	.905 <sup>NS</sup>
Other	1.18±.40		2.00±.000	
<b>Family income</b>				
Adequate	1.11±.320	.572	2.00±.000	-.140-
Not adequate	1.698±.465	.000 sig	1.95±.218	.260 <sup>NS</sup>

**Table (7): Health beliefs model total mean score of categories toward colorectal cancer among study and control group at pre and post Nurse-led interventions**

HBM variables	Study (n=70) Pre intervention	Control (n=70) Pre intervention	T- test / P value	Study (n=67) Post intervention	Control (n=65) Post intervention	T- test / P value
<b>Perceived susceptibility</b> (Low perception < 50%) (High perception ≥ 50%)	1.47 ±.50	1.6286 ±.48668	-1.879- .062 <sup>NS</sup>	1.8714 ±.33714	1.6129±. 49106	3.559 .001 <sup>sig</sup>
<b>Perceived severity</b> (Low perception < 50%) (High perception ≥ 50%)	1.4714 ±.50279	1.5000 ±.50361	-.336- .737 <sup>NS</sup>	2.0000 ±.00000	1.4355±. 49987	8.892 .000 <sup>sig</sup>
<b>Perceived benefits</b> (Low perception < 50%) (High perception ≥ 50%)	1.5286 ±.50279	1.4571 ±.50176	.841 .402 <sup>NS</sup>	1.9143 ±.28196	1.4194±. 49748	7.132 .000 <sup>sig</sup>
<b>Perceived barriers</b> (Low barriers < 50%) (High barriers ≥ 50%)	1.7143 ±.45502	2.0000 ±.0000	-5.254- .000 <sup>sig</sup>	1.4143±. 49615	1.8871±. 31906	- 6.418 - .000 <sup>sig</sup>
<b>Cues to action</b> (Low cues of action < 50%) (High cues of action ≥ 50%)	1.5143±.50 340	1.9000±.3021 7	-5.496- .000 <sup>sig</sup>	2.0000± 00000	1.7742±. 42153	4.484 .008 <sup>sig</sup>
<b>Perceived self-efficacy</b> (Low self efficacy < 50%) (High self efficacy ≥ 50%)	1.1286±.33 714	1.3143±.4675 8	-2.695- .171 <sup>NS</sup>	1.5857±. 49615	1.3548±. 48237	2.703 .000 <sup>sig</sup>

**Table (8): Health beliefs model total mean score variables toward colorectal cancer among study and control group at pre and post Nurse-led interventions**

Health belief model variables	Pre intervention n=(70) X ± SD	Post intervention n=(67) X ± SD	Paired t-test	P value
1. Perceived susceptibility	2.64±1.26	4.09±1.20	-8.320-	.000
2. Perceived seriousness	4.66±1.67	7.37±1.63	-10.079-	.000
3. Perceived benefits	4.457±1.96	7.086±1.939	-7.131-	.000
4. Perceived barriers	10.829±3.551	9.429±2.054	4.562	.000
5. Cues to action	4.757±1.148	6.77±1.14	-9.924-	.000
6. Perceived self-efficacy	1.129±.337	1.586±.496	-7.623-	.000

### Discussion

In the current study the participants had poor total knowledge score before intervention. These results were in line with the study conducted in Lebanon, **Nemer et al;2007**) reported more than half of respondents had lack of knowledge on CRC. Moreover; **Lee et al.,(2017)** found that majority of sample didn't know enough about CRC. But **Mhaidat, et al., (2018)** on his cross-sectional study among University Students in Jordan found that more than of subjects had fair knowledge to CRC. This contradiction might be attributed to respondent education because the author studied university students. In the present study there was highly statistically significant differences in total knowledge score between study and control group post-intervention. These findings were agreed with **King, A. (2017)** illustrated the training session were effective in increasing the knowledge of colorectal cancer screening

Regarding participant awareness, the current study showed that the mean scores of awareness were lower before the intervention in the experimental and control groups. However, 3 months after intervention, there was a significant increase in the mean scores of awareness for the experimental group, while the control group did not change significantly

in this regard. These findings were congruence with **Salimzadeh et al., (2016)** stated nearly three-fourth of individuals with an established elevated risk for CRC were not aware of their CRC risk and the significance of undergoing screening tests before intervention. Also **Fletcher et al., .2007)** over 50% were not aware that they should be screened at an early age compared with the moderate-risk people. **King, A. (2017)** illustrated Post-test findings suggest that the training session met the goal of increasing awareness for participants of early colorectal cancer detection. Also, **Briant et al., (2015)** educational intervention increased awareness of colorectal cancer screening.

In the present study the mean scores of behaviors were lower before the intervention in the experimental and control groups. However, 3 months after intervention, there was a significant increase in the mean scores of behaviors for the experimental group, while the control group did not change significantly in this regard. **Salimzadeh et al., (2016)** an overall poor uptake (11%) of CRC screening tests in our average-risk people. **Salimzadeh et al;(2012)** suggests that repeated invitation rounds and effective communication could translate into an increase in the uptake of screening colonoscopy as well, particularly among families with an increased risk for this malignancy who reject first screening

invitation. This agrees with previous reports which indicated that individuals with a greater knowledge would have favorable attitude towards CRC and its screening protocol.(Tfaily et al;2019).

The present study showed there were statistically significant relation between educational level and mean total score of awareness about CRC among study group at pre intervention. This result was in line with **Gede and Kiss (2018)** who reported the level of awareness was greater in the subjects who had a relatively high level of educational attainment. Moreover, **Bidouei et al., (2014)** showed that higher education affects awareness positively.

Regarding relation between sociodemographic data and total knowledge score, the present study illustrated there were no statistical significance relations between age group, sex, educational level, marital status and mean total knowledge score at pre intervention. But **Zubaidi, et al., (2015)** contradicted these findings and stated females, married, respondents above 50 years of age, and post-university educated respondents were more knowledgeable than the other respondents of the survey were.

Regarding health belief model in the present study, the mean scores of perceived susceptibility and perceived seriousness were significantly higher in the study group than that of the control group at post-intervention. In addition, the educational intervention makes participants in the study group sense further vulnerable and recognize the consequences and seriousness of the disease. There was no improvement regarding Health motivations and perceived barriers among the control group at pre and post- intervention. These findings agreed with the results of

(**Kouhpayeh et al., (2017)**) The mean score of perceived self-efficacy in the study group showed a significant increase after the intervention, **Moattar et al., (2014)** found that educational intervention increased the self-efficacy score for cancer screening.

Health Belief Model was used to develop the educational intervention for changing CRC attitudes, increasing knowledge, and behaviors of health care providers. The results are consistent with those of previous studies. The HBM was shown to be an effective guide in developing the presentation and pre-test and post-test. The findings of exposure to the educational session resulted in a significant increase in knowledge among the participants.

### **Conclusion:**

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The current study concluded that:Nurse led interventions had positive impact on adult health beliefs, screening behaviors also improving their knowledge and awareness regarding colorectal cancer.

### **Recommendation:**

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The current study recommended that:Designing effective nursing strategies to address barriers of CRC screening and improve CRC knowledge and awareness, which is critical to achieving greater screening compliance.

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### **Conflict of interest**

No

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