

Application of Self-Regulation Model for Management of Fatigue and Anemia among Cancer Patients undergoing Chemotherapy

Yasmine E. El Sayed^{1,2}, Seham A. Abd El-Hay³, Lamiss M. Abd El Aziz⁴, Fatma Mohmmmed Abouelala⁵

¹Demonstrator in Medical Surgical Nursing, Faculty of Nursing, Kafrelshikh University, Egypt.

²Master student of Medical Surgical Nursing, Faculty of Nursing, Tanta University, Egypt.

³Professor of Medical Surgical Nursing, Faculty of Nursing, Tanta University, Egypt.

⁴ Professor of Clinical Oncology, Faculty of Medicine, Tanta University. Egypt.

⁵Assistant Professor of Medical Surgical Nursing, Faculty of Nursing, Kafrelshikh University, Egypt.

Corresponding author: Yasmine E. El Sayed

Email: yasmineaboemail55@gmail.com

Abstract

Background: Cancer related fatigue and anemia are prevalent distressing symptoms among cancer patients which significantly impacting their daily life and treatment outcomes, the information provided by the self-regulation model helps patients to maintain their coping skills, improve their ability to manage their signs and symptoms, and moreover, adapt to the healthcare event. **Aim:** the aim of this study was to evaluate the effect of the application of Self-regulation model for management of fatigue and anemia among cancer patients undergoing chemotherapy. **Subjects and method:** A Purposive sample of (60) adult patients who were followed up at the oncology department and its related outpatient's clinic of Tanta Main University Hospital. **Tools: tool (I)** Cancer Patients` Bio- Socio-demographic Data. **Tool (II)** Fatigue Symptom Inventory. **Tool (III)** Functional Assessment of Cancer Therapy – Anemia. **Tool (IV)** Self-Regulation Questionnaire. **Results:** the main findings showed that cancer patients` level of fatigue, physical wellbeing, emotional wellbeing, social wellbeing, functional wellbeing and self-regulation had all significant improvement in the study group since P value was ≤ 0.05 post implementation of the Self-regulation model. **Conclusion and recommendation:** implementation of Self-regulation model had significant effect on management of cancer related fatigue and anemia. Self-regulation model has shown that emotional and cognitive regulation affect health related behaviors, which in turn impacts how patients manage and control their health threat. It was recommended that Self-regulation model would be incorporated into the nursing curriculum and health education.

Keywords: Anemia, Cancer, Chemotherapy, Fatigue, Self-Regulation Mode.

Introduction

Cancer is a large group of diseases characterized by uncontrolled abnormal cell growth and spread to other parts of the body (**Tuveson and Clevers, 2019**). Many cancer cells eventually form a lump or mass which called a tumor and are named for the part of the body where the tumor originates. It is a challenge that faces the entire world population and more than just one disease (**Dai, et al., 2021**).

Controlling the progression of the tumor and enhancing the quality of life for patients are the major goals of cancer treatment (**Sciacovelli, Schmidt, Maher & Frezza, 2020**). Psychological support as well as supportive or palliative treatment can help achieve it. There are many treatment options for cancer including; surgery, chemotherapy, radiation therapy, hormonal therapy, targeted therapy and palliative care (**Garsa, et al., 2021**).

One of the main options for cancer treatment is chemotherapy. It is also referred to as antineoplastic, cytotoxic, or anticancer drugs/agents which are working by interrupting the cell cycle and killing dividing cancer cells and control cancer progress (**Zavala, et al., 2021**).

However, this type of treatment has its own set of adverse effects, such as fever, nausea, vomiting, fatigue, anemia, diarrhea or constipation, pain, hair loss, sleep disorders, easy bruising, bleeding and other conditions (**Rico, et al., 2020**). The majority of cancer patients have anemia and fatigue while undergoing active treatment of chemotherapy which

affects patients' general health and quality of life (**Jones, et al., 2023**).

Cancer related fatigue (CRF) is one of the most common and distressing symptoms in cancer patients and it is worse than feeling exhausted (**Rodgers and Gilreath, 2019**). This persistent fatigue had an adverse impact on cancer patients' moods, daily activities, and social relationships, in addition to lowering their confidence in their ability to survive the disease. Moreover, CRF can act as a barrier for cancer survivors trying to resume their work, placing a huge burden on society. Consequently, there is a crucial and urgent need to provide effective management and interventions for cancer patients (**Liu, et al., 2023**).

Moreover anemia is another symptom that are encountered during CRF and can influence the patient's general health and quality of life. It is a complex and multifaceted problem that can occur as a result of tumor itself cancer related anemia (CRA) or a chemotherapeutic agent adverse reaction which called chemotherapy-induced anemia (CIA). Anemia incidences in cancer patients are influenced by the type and stage of the tumor (**Madeddu et al., 2021**).

As illness management moves away from inpatient care and patients become more responsible for their care. Therefore, the ability of patients to regulate their treatment plans is becoming more and more important for the successful treatment of diseases and health conditions. This in turn, self-regulation is considered one of the key capabilities of patients (**Yeom, Park &**

Lim, 2022; Papadakos, et al., 2022). The Self-regulation model (SRM) also known as common sense model has been used in a variety of ways to develop interventions to enhance coping with anemia and fatigue related to cancer (**Liddelow, Mullan & Boyes, 2021**).

The SRM is a system of conscious personal management that involves controlling one's own emotions, thoughts, and behaviors in order to achieve specific goals (**Hagger and Orbell, 2022**). The SRM outlines how illness gives rise to cognitive and emotional responses together 'illness perceptions', which subsequently determine coping behavior (**Matsuda, et al., 2021**). Perceptions of illness and coping strategies affect outcomes operationalized, including visiting a medical doctor, taking medications, 'quality of life', or developing self-management skills. So, nursing interventions should be based on self-regulation theory to aim at replacing maladaptive illness coping behaviors with constructive, adaptive illness coping behaviors (**Zhang, et al., 2023**).

Significance of the study

Cancer accounted for 13% of all deaths in Egypt by 2019, reflecting a significant economic burden on the healthcare system (**Siddiqui, et al., 2021**). Cancer-related anemia and fatigue significantly burden patients' daily lives, impacting their quality of life and treatment adherence. The SRM theory suggests that individuals search to understand their illness threat by developing an understanding of what the

illness is, what it means, it's causes, it's consequences, how long it will last, and whether it can be cured or controlled. This understanding formulated from personal experience from physical symptoms and emotions, social influences, or interaction with healthcare providers. Individuals are thought to reduce their health risk or change their health behavior in ways consistent with this illness representation (**Hagger and Orbell, 2022**).

Aim of the study

Evaluate the effect of the application of self-regulation model for management of fatigue and anemia among cancer patients undergoing chemotherapy.

Research hypotheses

- Oncology patients are expected to have no or minimal cancer related fatigue and anemia post application of SRM.
- Patients' Self-Regulation is expected to be improved post implementation of SRM.

Subjects and Method:

Research design

Quasi- experimental research design was used in the present study.

Setting

The study was conducted at the oncology department and its related outpatient's clinic of Tanta Main University Hospital.

Subjects

A Purposive sampling of (60) adult patients who were followed up at the above mentioned setting to receive their chemotherapy treatment. The sample size calculated based on Epidemiological Information Program, considering the total patients per year

according to review of Tanta Main University Hospital Statistical Records by using the following parameters: Total target population size = 200 per year, Confidence level=99.9%, Expected frequency=50%, Accepted error = 5% (0.05), Confidence coefficient=95%

Inclusion criteria

- Conscious cancer patients.
- Age ranged between 21-60 years.
- Both genders.
- Able to communicate verbally.
- Newly diagnosed and planned to receive chemotherapy.

Exclusion criteria

- Previous history of chemotherapy.
- Previous history of anemia.
- Chronic renal insufficiency.
- Severe disabilities of musculoskeletal system
- Previous history of fatigue.

Tools of the study

The following four tools were used in order to collect the required data:

Tool (I): Cancer Patients` Bio-Sociodemographic Data: it was consisted of two parts:

Part (1); Patients` socio-demographic characteristics: It included: age, sex, occupation, level of education, marital status, and residence.

Part (2): Patients` clinical data: It included: chief complaint, type of cancer, duration of disease, treatment received, family history of cancer, presence of chronic illness, smoking, daily activity, weight, height, Body mass index and patient`s tests which included: lab investigation such as complete blood count (CBC) which included red blood cell count, hemoglobin level, Hematocrit

proportion, white blood cell count and platelets count.

Tool (II): Fatigue Symptom Inventory (FSI): It was developed by (Hann, et al., 1998) and was modified by (Hann, Denniston and Baker, 2000) also, it adopted by the researcher and translated into Arabic to assess the degree of fatigue by asking the patient 13 questions related to fatigue during the past week.

Scoring system

Questions from 1 to 11 plus question 13 had possible range of scores from 0 to 10 and one question number 12 ranging from 0 to 7. Total score of 127 and the final scores was interpreted as the following: Score 0 (No fatigue), 1 - 32 (Mild fatigue), 33- 65 (Moderate fatigue), 66 - 98 (Sever fatigue), > 98(Excessive fatigue).

Tool (III): Functional Assessment of Cancer Therapy - Anemia (FACT-An):

It is designed by (Casadevall et al., 2004; Greenberg et al., 1996; Mesa et al., 2007; Pinchon, Stanworth, Dorée, Brunskill & Norfolk 2009; Spiriti et al., 2005), and was modified by the researcher to assess how anemia impacts different aspects of cancer patients' quality of life included four dimensions of well-being: physical, functional, social, and emotional.

The scoring system

Each of the 27 items of the tool was recorded in a 5-points Likert scale (ranged from 0 to 4). Score 4 means very much, Score 3 means quite a bit, Score 2 means some-what, Score 1 means a little bit, Score 0 means not at all. Physical wellbeing and emotional

wellbeing items except the second item of emotional (patient's satisfaction with how coping with illness) had reversed score. Total score of the questionnaire was the sum of the score of individual items and ranged from 0 to 108. The scores of the domains as well as the total score was expressed as mean \pm SD.

Tool (IV): Self-Regulation Questionnaire

The Self-Regulation Questionnaire (SRQ); was developed by (Brown, Miller & Lawendowski, 1999; Aubrey, Brown & Miller 1994; Brown, 1998) and was modified by the researcher based on literature review (Carey, Neal & Collins, 2004). It is a 30 -item self-report questionnaire measured the ability of the patients to regulate behavior in order to achieve goals.

Scoring system

Each item using a 5-point Likert scale: 1= (Strongly Disagree), 2= (Disagree), 3= (Uncertain or Unsure), 4= (Agree), 5= (Strongly Agree). There were items scored at reverse scaled as 1=5, 2=4, 3=3, 4=2 and 5=1. The total score of the questionnaire was the result of the sum of the scores of the individual items with a possible range from 30 to 150. It categorized into Bad self-regulation (score from 30 to 101, i.e. <60%). Good self-regulation (scores from 102 to 150, i.e. \geq 60%).

Method:

Ethical consideration

Official letters from the faculty of nursing were delivered to the appropriate authorities in the selected area to conduct the study. An official

Permission to carry out the study was obtained from the directors of the Clinical Oncology and Nuclear Medicine Department, Tanta Main University Hospital. Nature of the study did not cause any harm or pain to the entire subjects. Patients' written informed consent to participate in this study was obtained after explaining the aim of the study. All participants was informed about the purpose of the study, confidentiality of information, benefits and right to withdraw from the study at any time if desired. Confidentiality and privacy were taken into account regarding data collection.

Methods of data collection

- The content validity of the developed tools was tested for clarity and applicability by seven experts in medical surgical nursing to ensure their validity and modifications was done.
- The reliability for the study tools was calculated by Cronbach's Alpha test, it was 0.832 for tool (I), 0.862 for tool (II), 0.755 for tool (III) and 0.785 for tool (IV).
- A pilot study: was carried out on 10% of the study sample from the previously mentioned setting to test the feasibility and applicability, relevance and organization of the tools and to determine any obstacles that may be encountered during the period of data collection. Pilot study was excluded from the study sample.
- The collection of the data for this study was carried out within the period from the beginning of July 2023 to the end of March 2024.

-The current study was carried out through four phases (Assessment, planning, Implementation and evaluation) and following up patients after 2weeks and one month.

I. Assessment phase

Assessment of the baseline data for chemotherapeutic patients' was carried out by the researcher immediately once within admission to the department by using Tool (I) to collect baseline data before implementation of the program. Tool II , Tool III and Tool IV was used for both study and control group before application of the self-regulation model to assess patients' degree of fatigue, functional assessment of cancer therapy - Anemia and self-regulation scale and to determine the patient`s needs related to management behavior before application of intervention.

II. Planning phase

Strategies to manage fatigue and anemia signs and symptoms by self-regulation model were determined which includes; improve activities of daily living with balance between rest and activities, keep a regular sleep schedule and maintain strategies to improve sleep behavior, management practices information related to diet rich iron, balanced nutrition and drink plenty of fluids, medication information, practice an activity that patients like for a few minutes about 2 to 3 times a week, included plans of task, sets goals, and creates a schedule for the task, and maintain skills of self-regulatory improvement.

An illustrative structured colored booklet was prepared and written in

simple Arabic language with the use of illustrative pictures as a guide for the study group to meet the implementation of the process of self-regulation model, and different methods were used as video and group discussion. While, the control group were received routine hospital nursing care.

III. Implementation phase

Application of SRM was implemented for the study group by the researcher throughout three basic sessions individually for every patient during follow up periods in the morning shifts, it was provided three days a week.

The First session included; provoking patients' stimulus to aggravate their reactions about the health threat cognitively through understanding it or emotionally through feeling it. The researcher met the studied cancer patients to give them knowledge about their health threat, increasing patients' awareness about complaints associated with cancer related fatigue and anemia which are facing their new reality so he need to know the importance of changing their behavior. The session lasted from 1 to 1 and half hour.

The second session included; enhancing studied cancer patients' cognitive representation for their problems by encouraging them to write down their complaints, speak with nurses, friends, or family, and recall a friend who had a similar experience with cancer-related fatigue and anemia. Additionally, the session intended to improve the patients' emotional representation toward their problems by teaching them how to express their

feelings, worry about their health and life, and convey anxiety about how much their life will change, and show fear of what will happen and how life will change. The session lasted from thirty minutes to one hour

The third session: included; helping patients in making decisions (coping response) regarding their plan of care and modifications to their lifestyles, they decided on a new, healthier behavior regarding fatigue and anemia as follow: plan of balanced nutrition of iron and folic acid rich food and vitamins rich food , plan of physical exercise with balance between activity and rest and maintaining strategies for balancing activities with rest, keep a regular sleep schedule in addition to take of some a day naps maintaining relationships like visit or invite friends to visit, being close to family and partner, practice hobbies, adherence to prescribed medication, routine follow up. Moreover, the researcher educate the studied cancer patients skills and strategies to improve their self-regulation and work on keeping the potential consequences of not staying healthy in mind in addition to evaluate their representations, coping responses, and outcomes to assess how well their actions align with their desired future. The session lasted from one hour to two hours.

IV. Evaluation phase

The studied cancer patients were evaluated by Tool II, Tool III and Tool IV in the follow up period after two weeks and a month from application of the self-regulation model to collect patients' degree of

fatigue, functional wellbeing and self-regulation scale in addition to evaluate the self-regulation model's effectiveness in helping cancer patients controlling their anemia and fatigue.

Methods of data analysis

SPSS software, or statistical computer package version 26, was used to arrange, tabulate, and statistically analyze the data that had been gathered. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, comparison was done using Chi-square test (χ^2). T-test for independent samples was used to compare the means of the variables for the two groups. Pre- and post-intervention variable means for each group were compared using the paired samples T-test. The analysis of variance (ANOVA) F-value was computed for comparing means for variables over intervention periods in a group or for more than two variables. The Pearson and Spearman's correlation coefficients, abbreviated as r, were used to assess the correlation between the variables. A significance threshold of $P < 0.05$ was used.

Results

Table (1): Illustrates the distribution of the studied cancer patients regarding their socio-demographic characteristics, as regard to age, the mean age for study and control group was (38.70 ± 8.457 , 41.07 ± 10.735) respectively. Regarding to gender, more than half of the study and control group were female (63.33% , 56.67%) respectively. Additionally, In relation to marital status, the majority

of the study and control group were married. As regard residence more than half (53.33%) of the study group were residents of urban areas while in the control group were residents of rural. Concerning level of education nearly two third of the study group (60%) had secondary education and (40%) were university graduates for the control group. Moreover, more than one third of both study and control group not working.

Table (2): shows the distribution of the studied cancer patients regarding their clinical data, in reference to type of cancer of the studied patients, breast cancer is the highest percent for both study and control group (36.67%, 40%) respectively. In addition the majority of the studied groups (70.00 %, 83.33 %) had duration of disease less than three months. Concerning chief complaint, all studied groups suffering from fatigue and anemia previous implementation of SRM. Additionally, In relation to family history of cancer, (70% and 60%) for study and control group respectively didn't have family history of cancer. Moreover the majority of the studied cancer patients (86.67 %, 90.0%) had no chronic illness respectively. Concerning the study group the table revealed that (60% and 26.67%) of the patients had intravenous and oral chemotherapy respectively, meanwhile less than one quarter (13.33%) had both chemotherapy. On the other hand with regard to a control group for about (66.67%) had taken intravenous chemotherapy. All the studied cancer patients were no smoker. In relation to

activity of daily living, the majority of the studied groups (96.67% - 90%) were in-dependent respectively.

Table (3): Illustrates the distribution of the studied cancer patients regarding their total FSI level throughout period of the study, there were a statistically significant differences between study and control group regarding total mean \pm SD of FSI pre-implementation of the SRM, two weeks and one month later where P value at (0.000, 0.000) respectively. Also, it showed that there were (60%) of the patients of the study group had sever fatigue pre implementation of SRM. After two weeks post implementation it was found that (43.33%) of the study group patients had sever fatigue, (33.33%) had moderate fatigue and (13.33%) had mild fatigue. Then after one month, this percentage increased to reach more than half (56.67%) had mild fatigue and (36.67%) had moderate fatigue. Conversely, after a month in the control group it was evident that mild fatigue decreased to (0.00%) sever fatigue and excessive fatigue increased to (36.67%, 46.67%) respectively.

Table (4): clarifies the distribution of the studied cancer patients regarding their total level of FACT-An, it revealed that there were a statistically significant differences between study and control group regarding total mean \pm SD of FACT-An pre implementation of SRM, two weeks and one month later where P at (0.000, 0.586) respectively. In reference to overall FACT-An subscales, this table showed significant improvement of the mean percent score

of the study group for about (57.27±14.002), (58.57±11.904) and (74.37±11.740) at pre, post two weeks, and one month later respectively.

Table (5): summarizes the level of cancer patients` self-regulation throughout period of the study, the table revealed that there were statistical significant improvement of the mean percent score of the study group (99.30±14.29), (100.17±12.43) and (103.27±6.38) at pre, post two weeks, and one month later respectively where P value (0.000). Conversely to control group it was obvious that the mean percent score deteriorate (89.30±11.54), (80.90±9.74), (77.20±8.95) at pre, post two weeks, and one month later respectively.

Table (6): reflects the correlation between level of FACT-An and self-regulation among the studied cancer patients pre and post implementation of SRM. According to this table there was a statistically significant positive correlation between self-regulation level of the study group patients and their level of FACT-An post a month of intervention where r (0.441) and p (0.015*).

Table (1): Distribution of the studied cancer patients regarding their socio-demographic characteristics.

Characteristics	The studied cancer patients (n=60)				χ^2 P
	Study group (n=30)		Control group (n=30)		
	N	%	N	%	
Age (in years)					
(21-<30)	4	13.33	4	13.33	1.613 0.657
(30-<40)	13	43.33	9	30.00	
(40-<50)	9	30.00	10	33.33	
(50-60)	4	13.33	7	23.33	
Range	(20-54)		(21-60)		t=0.900 P=0.347
Mean \pm SD	38.70\pm8.457		41.07\pm10.735		
Gender					
Male	11	36.67	13	43.33	FE 0.792
Female	19	63.33	17	56.67	
Marital status					
Married	26	86.67	24	80.00	FE 0.731
Not married	4	13.33	6	20.00	
Residence					
Rural	14	46.67	16	53.33	FE 0.797
Urban	16	53.33	14	46.67	
Educational level					
Illiteracy	1	3.33	4	13.33	8.398 0.038*
Read and write	2	6.67	6	20.00	
Secondary education	18	60.00	8	26.67	
University	9	30.00	12	40.00	
Occupation					
Office work	7	23.33	6	20.00	0.117 0.943
Manual work	11	36.67	11	36.67	
Not work	12	40.00	13	43.33	

FE: Fisher' Exact test*** Significant at level P<0.05**

Table (2): Distribution of the studied cancer patients regarding their clinical data.

Clinical data	The studied cancer patients (n=60)				χ^2 P
	Study group (n=30)		Control group (n=30)		
	N	%	N	%	
Type of cancer					
Breast cancer	11	36.67	12	40.00	2.468 0.781
Head and neck	2	6.67	2	6.67	
Prostate cancer	1	3.33	2	6.67	
GIT cancer	8	26.67	8	26.67	
Hematology	8	26.67	5	16.67	
Others	0	0.00	1	3.33	
Duration (in months)					
< 3	21	70.00	25	83.33	FE 0.360
(3-<6)	9	30.00	5	16.67	
# Chief complaint					
Fatigue	30	100.00	30	100.00	0.071 0.791
Anemia	30	100.00	30	100.00	
Dyspnea	1	3.33	1	3.33	
Nausea	16	53.33	12	40.00	
Loss of appetite	17	56.67	23	76.67	
Vomiting	9	30.00	8	26.67	
Pain	22	73.33	18	60.00	
Dizziness	20	66.67	17	56.67	
Anxiety	17	56.67	9	30.00	
Family history of cancer					
None	21	70.00	18	60.00	8.660 0.278
Bone cancer	0	0.00	1	3.33	
Breast Cancer	4	13.33	5	16.67	
Gastric cancer	1	3.33	0	0.00	
Hepatocellular carcinoma	0	0.00	3	10.00	
Leukemia	1	3.33	0	0.00	
Lung Cancer	2	6.67	2	6.67	
Pancreatic Cancer	1	3.33	1	3.33	
Presence of chronic illness					
None	26	86.67	27	90.00	1.071 0.301
Diabetes	1	3.33	2	6.67	
Hypertension	3	10.00	1	3.33	
Type of present chemotherapy treatment					
Oral					0.915 0.633
Intravenous	8	26.67	5	16.67	
Both	18	60.00	20	66.67	
	4	13.33	5	16.67	
Presence of smoking					
No	30	100.00	30	100.00	-

Activity of daily living					
Independent	29	96.67	27	90.00	FE
Semi-dependent	1	3.33	3	10.00	0.612
Hemoglobin level (HB)	10.21±1.209		10.34±1.044		P=0.666
Red blood cell counts (RBCs)	4.01±0.638		3.97±0.695		P=0.826
Hematocrit (HCT)	33.13±4.929		34.96±5.272		P=0.171
Weight (in Kg)					
Range	(54-110)		(59-102)		t=0.362
Mean ± SD	81.57±14.224		79.47±12.757		P=0.550
Height (in cm)					
Range	(160-185)		(159-187)		t=0.003
Mean ± SD	170.80±6.446		170.70±7.269		P=0.955
Body mass index					
Ideal weight	7	23.33	10	33.33	0.742
Overweight	15	50.00	13	43.33	0.690
Obesity	8	26.67	7	23.33	
Range	(20.32-37.62)		(20.05-36.73)		t=0.284
Mean ± SD	27.86±4.071		27.29±4.179		P=0.596

More than one answer was chosen

FE: Fisher' Exact test

* Significant at level P<0.05

χ²: Chi square test

Table (3): Distribution of the studied cancer patients regarding total FSI level throughout period of the study.

Total FSI level	The studied cancer patients (n=60)													
	Study group (n=30)						χ^2 P	Control group (n=30)						χ^2 P
	Pre		Post 2 weeks		Post a month			Pre		Post 2 weeks		Post a month		
	N	%	N	%	N	%		N	%	N	%	N	%	
No fatigue	0	0.00	0	0.00	0	0.00	34.19 0.000*	2	6.67	0	0.00	0	0.00	81.46 0.000*
Mild fatigue	4	13.33	4	13.33	17	56.67		16	53.33	0	0.00	0	0.00	
Moderate fatigue	7	23.33	10	33.33	11	36.67		10	33.33	8	26.67	5	16.67	
Sever fatigue	18	60.00	13	43.33	1	3.33		2	6.67	20	66.67	11	36.67	
Excessive fatigue	1	3.33	3	10.00	1	3.33		0	0.00	2	6.67	14	46.67	
Range	(17-100)		(24-107)		(12-101)		F=16.13 P=0.000*	(0-70)		(33-109)		(34-110)		F=73.12 P=0.000*
Mean ± SD	67.87±		66.33±		36.57±			28.67±		76.77±		88.43±		
	26.737		23.719		21.447			19.791		20.216		20.855		

-(0) No fatigue

-(1-32) Mild fatigue

-(33-65) Moderate fatigue

-(66-98) Sever fatigue

->98 Excessive fatigue

Table (4): Distribution of the studied cancer patients regarding their total level of FACT-An throughout period of the study.

Total level of functional assessment of cancer therapy - anemia	The studied cancer patients (n=60)													
	Study group (n=30)						χ^2 P	Control group (n=30)						χ^2 P
	Pre		Post 2 weeks		Post a month			Pre		Post 2 weeks		Post a month		
	N	%	N	%	N	%		N	%	N	%	N	%	
-Poor	21	70.00	19	63.33	8	26.67	13.49 0.001*	10	33.33	11	36.67	13	43.33	0.85 0.653
-Good	9	30.00	11	36.67	22	73.33		20	66.67	19	63.33	17	56.67	
Range	(30-96)		(40-82)		(57-97)		F=17.15 P=0.000*	(52-83)		(38-80)		(43-85)		F=0.54 P=0.586
Mean ± SD	57.27±		58.57±		74.37±			67.97±		66.80±		65.47±		
	14.002		11.904		11.740			7.837		9.485		10.520		

-<60% Poor

-≥60% Good

* Significant at level P<0.05

Table (5): Distribution of the studied cancer patients regarding total self-regulation level throughout period of the study.

Total Self-regulation level	The studied cancer patients (n=60)													
	Study group (n=30)						χ^2 P	Control group (n=30)						χ^2 P
	Pre		Post 2 weeks		Post a month			Pre		Post 2 weeks		Post a month		
	N	%	N	%	N	%		N	%	N	%	N	%	
Bad	18	60.00	16	53.33	9	30.00	6.11	26	86.67	29	96.67	30	100.00	6.29 0.043*
Good	12	40.00	14	46.67	21	70.00	0.047*	4	13.33	1	3.33	0	0.00	
Range	(77-136)		(70-128)		(89-120)		F=11.16	(70-113)		(63-103)		(63-95)		F=11.23
Mean ± SD	99.30±14.29		100.17±12.43		103.27±6.38		P=0.000*	89.30±11.54		80.90±9.74		77.20±8.95		P=0.000*

-<60% Bad

->60% Good

* Significant at level P<0.05

 χ^2 : Chi square test

Table (6): Comparison and correlation between level of FACT-An of the studied cancer patients and their self-regulation level throughout the study:

Level of functional assessment of cancer therapy-anemia	The studied cancer patients (n=60) Self-regulation level									
	Study group (n=30)				χ^2 P	Control group (n=30)				χ^2 P
	Bad		Good			Bad		Good		
	N	%	N	%	N	%	N	%		
Pre										
-Poor	11	36.67	10	33.33	FE	12	40.00	1	3.33	FE
-Good	7	23.33	2	6.67	0.249	14	46.67	3	10.00	0.613
r , P	0.202 , 0.283					0.025 , 0.896				
Post 2 weeks										
-Poor	10	33.33	9	30.00	FE	10	33.33	0	0.00	FE
-Good	6	20.00	5	16.67	1.00	19	63.33	1	3.33	1.00
r , P	0.206 , 0.274					0.094 , 0.620				
Post a month										
-Poor	2	6.67	6	20.00	FE	10	33.33	0	0.00	-
-Good	7	23.33	15	50.00	1.00	20	66.67	0	0.00	
r , P	0.441 , 0.015*					0.035 , 0.854				

r: Pearson' correlation coefficient

*** Significant at level P<0.05**

χ^2 : Chi square test

Discussion

Cancer chemotherapy frequently induces fatigue and anemia, significantly impacting patients' quality of life. Furthermore, research indicates that self-regulation strategies have a crucial role in managing these symptoms. For instance, one study emphasizes that patient who actively engages in self-regulation techniques report better management of fatigue and anemia, implying that these strategies empower patients to take control over their health outcomes **Lin**

et al., (2024). Another research study highlights the importance of psychological support and self-management interventions for alleviating fatigue and anemia and improving overall well-being during chemotherapy. Taking this into account, the effectiveness of these self-regulation strategies which can vary based on individual differences and the severity of symptoms **Erickson, Tokarek & Swartz, (2021)**.

Thereby strengthening self-regulation seems to be effective approach in enhancing patient`s coping mechanisms toward the challenges posed by chemotherapy-induced fatigue and anemia. So the aim of this study to evaluate the effect of the application of self-regulation model for management of fatigue and anemia among cancer patients undergoing chemotherapy.

The results of this research showed that theory-based intervention utilizing the SRM directly enhanced fatigue and anemia among cancer patients undergoing chemotherapy. In the previous study by **Yao et al., (2024)** showed that Self-regulation self-disclosure were found to significantly improve patients' quality of life, indicating their effectiveness in promoting well-being during cancer treatment suggesting that emotional expression plays a crucial role in health outcomes. Also, **Gao and Li (2022)** research about SRM assumes that patients' coping behaviors are influenced by illness representations which shaped by external information and personal experiences. In addition **Fernandes, (2020)** mentioned that illness perceptions and emotions were found to be significant predictors of coping strategies, confirming the model's relevance in psychosocial adjustment in breast cancer patients with supporting SRM and demonstrating that both emotional adjustment and illness representations are essential in determining how patients cope with their illness.

Although limited studies have used self-regulating model in research on cancer patients with fatigue and anemia, our results are consistent with the effects of similar programs based on self-management concepts.

The results of the present study revealed that there were no statistically significant differences in socio-demographic and clinical data between the study and control groups which included age, gender, marital status, residence, level of education, occupation, type of cancer, duration of illness, chief complaint, family history, presence of chronic illness and type of current chemotherapy treatment. These findings roll out the extraneous factors that might confuse the effect of SRM on management of fatigue and anemia among cancer patients undergoing chemotherapy.

In relation to Fatigue Symptom Inventory scale which assessed the studied cancer patients` degree of fatigue during the past week included level of fatigue, interference with the patient`s activity, work, concentration , mood, human relations and enjoyment, the days which patient felt fatigued and the average that patient felt fatigued, there was statistically significant improvement of all items of fatigue subscales post implementation of self-regulation model in the study group in contrast to the control group, their levels of fatigue deteriorated from pre implementation until post the completion of the study. Furthermore, in the follow up period of the study

group, a significance difference was noted between two weeks and one month and between pre-implementation and one month after. This significant could be linked to the fact that information management enhancing cognitive representation of a problem and encourage the patients to express their feelings and coping with it are essential part in controlling cancer related fatigue which consequently reflecting more self-regulation and better management of the disease.

In the same context these results were in the same line with **Agbejule, Hart, Ekberg & Chan (2024)**, who established a framework for self-management practices that emphasizes the importance of self-regulation in managing CRF, providing clinicians with a consensus-based approach to support cancer patients undergoing chemotherapy. Another study by **Mehl et al., (2020)**, who found that multimodal therapies, which enhance self-regulation, were superior in improving CRF compared to standard aerobic training, indicating that self-regulation can be positively influenced through structured interventions. In accordance to the study conducted by **Jun et al, (2020)** which concluded that self-care education programs enhanced quality of life and decreased fatigue levels in gastrointestinal cancer patients undergoing chemotherapy, indicating the potential benefits of self-regulation models for cancer-related fatigue.

The present study in agreement with **Mohamed & Abd El-Hay, (2019)**, who found that self-regulation model effectively, reduces physical, affective, and cognitive fatigue in cancer patients undergoing chemotherapy, enhancing their ability to manage and control fatigue distress. Moreover the findings also are in the line with **Chiba, Sasahara & Mizuno (2019)**, who reported that CRF self-management behaviors like physical activity, rest, sleep and nutritional choices in chemotherapy outpatients, aiding in symptom control and coping strategies during the treatment. Also the study conducted by **Corbett, Groarke, Walsh & McGuire, (2016)**, who mentioned that in their study, the SRM aids in understanding and managing CRF post-treatment, but its specific impact on patients receiving chemotherapy is not addressed.

Concerning to overall functional assessment of cancer therapy - anemia scores the present study revealed a statistically significant differences between study and control group total mean \pm SD with significant increase in the mean percentage in overall subscales in the study group. In contrast, the control group's mean percent score was nearly the same with no improvement pre, after two weeks and one month. Good level of FACT-An was found in less than half of the control group after one month, counter to the study group, it was present in nearly three quarters of the studied cancer patients at one month post implementation of SRM. This

improvement may be attributed to the effect of Self-regulation strategies which can enhance patients' coping abilities and lead to better emotional and cognitive coping so potentially decrease the adverse effects of anemia and improve cancer patients' quality of life. In current study, intervention included individual face-to-face sessions delivered by researcher and using illustrative structured colored booklet discussed information about cancer related anemia, healthy diet rich in iron and vitamins plus regular physical activity according to patient needs, these may have contributed to the positive outcomes observed.

The results of the present study was in the same line with **Mazzoni, Brooke Berntsen, Nordin & Demmelmaier (2021)**, who clarified that interventions based on self-regulatory behavior change had been shown to increase physical activity levels among cancer patients, which is crucial for improving overall well-being and combating anemia. Another study conducted by **Natalucci et al., (2021)**, who illustrated that a comprehensive approach combining nutritional strategies, exercise, and self-regulation can optimize iron utilization and mitigate inflammation, further supporting cancer related anemia management with focuses on providing a comprehensive overview of the complexities surrounding cancer-related anemia and suggests a multifaceted approach that includes dietary changes, exercise, and an understanding of the biological

mechanisms involved in iron metabolism.

The similar results were clarified by **Mandy Ho et al., (2020)**, who highpoint the effect of dietary and physical activity interventions on health-related quality of life in colorectal cancer survivors by using functional assessment of cancer therapy-general FACT-G score evaluating physical social/family emotional and functional well-being plus specific items, and concluded greater improvement after receiving the dietary intervention.

For instance, study by **Barahoui, Kiyani, Lashkari & Tasbandi (2020)** showed that implementing nursing interventions for cancer patients receiving iron supplementation on drug compliance can have a positive effect on anemia and patients' fatigue, also discussed anemia related fatigue and reported significant reduction in fatigue severity. Another study by **Khozimeh, Navidian, Sasanpour & Kiani, (2019)** showed that the use of energy-saving strategies significantly reduced the patient's fatigue with improvement in the level of caring self-efficacy compared to the control group. Their main energy-saving strategy was to create a balance between the rest and activity to manage fatigue induced by the disease.

Conclusion:

The SRM implementation significantly enhanced the management of cancer related anemia and fatigue. Additionally, it proved

how healthy behaviors and coping strategies are influenced by cognitive and emotional regulation, which in turn impacts the patient's management and control of their health. Moreover, SRM enables patients to act in goal-directed behaviors that, in turn, influence their health and may be incorporated into rehabilitation programs and applied to all types of cancer and chronic diseases.

Recommendations

-Oncology patients undergoing chemotherapy should be encouraged to attend training teaching program about chemotherapy and its side effects.

-Oncology patients undergoing chemotherapy should be informed about the importance of self-management and periodical follow-up.

-Oncology patients undergoing chemotherapy should be encouraged to attend educational programs and periodic workshops about self-management of disease and good quality of life.

-Further research of this study in different oncology centers over all Egypt to explore individual differences in patient responses and optimize interventions for diverse populations.

- Further research with specific type of cancer, large sample size and qualitative design.

References

Agbejule, O. A., Hart, N. H., Ekberg, S., & Chan, R. J. (2024). Development of a self-management support practice framework for

addressing cancer-related fatigue: a modified Delphi study. *Journal of Cancer Survivorship*, 18(3), 972-982. <https://doi.org/10.1007/s11764-023-01348-7>.

Aubrey, L. L., Brown, J. M., & Miller, W. R. (1994). Psychometric properties of a self-regulation questionnaire (SRQ). *Alcoholism: Clinical & Experimental Research*, 18(2), 420-525.

Barahoui, Z., Kiyani, F., Lashkari, T., & Tasbandi, M. (2020). The Effectiveness of a Nursing Care Program Supplemented with Iron Intake on Anemia and Fatigue in Cancer Patients Undergoing Chemotherapy. *Medical-Surgical Nursing Journal*, 9(3). <https://doi.org/10.5812/msnj.111464>.

Brown J. Miller W. Lawendowski L (1999). The Self-Regulation Questionnaire, Innovations in clinical practice: A source book; 17: 281-89.

Brown, J. M. (1998). Self-regulation and the addictive behaviors. In W. R. Miller & N. Heather (Eds.), *Treating addictive behaviors* (2nd ed., pp. 61–73). Plenum Press.

https://doi.org/10.1007/978-1-4899-1934-2_5

Carey, K. B., Neal, D. J., & Collins, S. E. (2004). A psychometric analysis of the self-regulation questionnaire. *Addictive behaviors*, 29(2), 253-260. <https://doi.org/10.1016/j.addbeh.2003.08.001>

Casadevall, N., Durieux, P., Dubois, S., Hemery, F., Lepage, E., Quarré, M. C., & Groupe Francais des Myelodysplasies. (2004). Health,

- economic, and quality-of-life effects of erythropoietin and granulocyte colony-stimulating factor for the treatment of myelodysplastic syndromes: a randomized, controlled trial. *Blood*, 104(2), 321-327. <https://doi.org/10.1182/blood-2003-07-2252>.
- Chiba, I., Sasahara, T., & Mizuno, M. (2019).** Factors in cancer-related fatigue self-management behaviors of outpatients undergoing chemotherapy. *Asia-Pacific Journal of Oncology Nursing*, 6(3), 209-211.
- Corbett, T., Groarke, A., Walsh, J. C., & McGuire, B. E. (2016).** Cancer-related fatigue in post-treatment cancer survivors: application of the common sense model of illness representations. *BMC cancer*, 16, 1-17. <https://doi.org/10.1186/s12885-016-2907-8>
- Dai, H., Shen, Q., Shao, J., Wang, W., Gao, F., & Dong, X. (2021).** Small molecular NIR-II fluorophores for cancer phototheranostics. *The Innovation*, 2(1).
- Erickson, J. M., Tokarek, N., Ke, W., & Swartz, A. (2021).** A randomized controlled trial of a physical activity intervention for self-management of fatigue in adolescents and young adults with cancer. *Cancer nursing*, 44(4), 263-271. DOI: 10.1097/NCC.0000000000000834
- Fernandes, S. (2020).** The Leventhal's Self-regulatory Model in Breast Cancer. *Análise Psicológica*, 38(1), 51-63.
- Gao, H. S., & Li, C. C. (2022).** Application of self-regulation model in endometrial cancer. *The Journal of Nursing*, 69(5), 104-110. https://doi.org/10.6224/jn.202210_69
- Garsa, A., Jang, J. K., Baxi, S., Chen, C., Akinniranye, O., Hall, O., ... & Hempel, S. (2021).** Radiation therapy for brain metastases: A systematic review. *Practical radiation oncology*, 11(5), 354-365. <https://doi.org/10.1016/j.prro.2021.04.002>
- Greenberg, P. L., Sun, Z., Miller, K. B., Bennett, J. M., Tallman, M. S., Dewald, G., ... & Rowe, J. M. (2009).** Treatment of myelodysplastic syndrome patients with erythropoietin with or without granulocyte colony-stimulating factor: results of a prospective randomized phase 3 trial by the Eastern Cooperative Oncology Group (E1996). *Blood, The Journal of the American Society of Hematology*, 114(12), 2393-2400. <https://doi.org/10.1182/blood-2009-03-211797>.
- Hagger, M. S., & Orbell, S. (2022).** The common sense model of illness self-regulation: A conceptual review and proposed extended model. *Health psychology review*, 16(3), 347-377. <https://doi.org/10.1080/17437199.2021.1878050>
- Hann, D. M., Denniston, M. M., & Baker, F. (2000).** Measurement of fatigue in cancer patients: further validation of the Fatigue Symptom Inventory. *Quality of Life Research*, 9, 847-854.

- Doi:<https://doi.org/10.1023/A:1008900413113>.
- Hann, D. M., Jacobsen, P. B., Azzarello, L. M., Martin, S. C., Curran, S. L., Fields, K. K., ... & Lyman, G. (1998).** Measurement of fatigue in cancer patients: development and validation of the Fatigue Symptom Inventory. *Quality of Life research*, 7, 301-310. <https://doi.org/10.1023/A:1024929829627>.
- Ho, M., Ho, J. W., Fong, D. Y., Lee, C. F., Macfarlane, D. J., Cerin, E., ... & Cheng, K. K. (2020).** Effects of dietary and physical activity interventions on generic and cancer-specific health-related quality of life, anxiety, and depression in colorectal cancer survivors: a randomized controlled trial. *Journal of Cancer Survivorship*, 14, 424-433. <https://doi.org/10.1007/s11764-020-00864-0>
- Jones, J. M., Howell, D., Longo, C., Olson, K., Bedard, P., Amir, E., & Avery, L. (2023).** The association of cancer-related fatigue on the social, vocational and healthcare-related dimensions of cancer survivorship. *Journal of Cancer Survivorship*, 1-12.
- Jun, Xie., Tingli, Zhu., Lu, Qun., Xiaomin, Xu., Cai, Yinghua., Zhenghong, Xu. (2020).** The effects of add-on self-care education on quality of life and fatigue in gastrointestinal cancer patients undergoing chemotherapy. doi: 10.1186/S12906-019-2800-5.
- Khozimeh, F. S., Navidian, A., Sasanpour, P., & Kiani, F. (2019).** The Effect of Training on Energy Conservation Strategies, Fatigue, and Self-Caring among Women with Breast Cancer Undergoing Chemotherapy in Zahedan Medical Sciences Hospitals in 2018-2019. *Journal of Evolution of Medical and Dental Sciences*, 8(49), 3661-3667.
- Liddelow, C., Mullan, B., & Boyes, M. (2021).** Understanding the predictors of medication adherence: Applying temporal self-regulation theory. *Psychology & Health*, 36(5), 529-548. <https://doi.org/10.1080/08870446.2020.1788715>
- Lin, C., Zhang, F., Yang, F., Lin, Y., Tian, T., Shi, K., ... & Li, X. (2024).** Factors influencing self-regulatory fatigue in patients undergoing chemotherapy for gynecologic cancer: a cross-sectional study. *Frontiers in Psychiatry*, 15. <https://doi.org/10.3389/fpsy.2024.1273151>
- Liu, Q., Zhan, L., Yan, X., Li, Y., & Wei, S. (2023).** Clinical effects of Baduanjin qigong exercise on cancer-related fatigue: A systematic review and meta-analysis. *European Journal of Integrative Medicine*, 102283. <https://doi.org/10.1016/j.eujim.2023.102283>
- Madeddu, C., Neri, M., Sanna, E., Oppi, S., & Macciò, A. (2021).** Experimental drugs for chemotherapy- and cancer-related anemia. *Journal of Experimental Pharmacology*, 593-611. <https://doi.org/10.2147/JEP.S262349>

- Matsuda, A., Kobayashi, K., Kubota, K., Tsubata, Y., Inoue, K., Ramai, R., & Yamaoka, K. (2021).** Quality of life and its associations with illness perceptions over a 3-month follow-up period in patients with non-small cell lung cancer: A prospective longitudinal study. *World Academy of Sciences Journal*, 3(6), 1-7.
<https://doi.org/10.3892/wasj.2021.126>
- Mazzoni, A.- S., Brooke, H. L., Berntsen, S., Nordin, K. & Demmelmaier, I. (2021).** Effect of self-regulatory behaviour change techniques and predictors of physical activity maintenance in cancer survivors: a 12-month follow-up of the Phys-Can RCT. *BMC cancer*, 21, 1-12.
<https://doi.org/10.1186/s12885-021-08996-x>
- Mehl, A., Reif, M., Zerm, R., Pranga, D., Friemel, D., Berger, B., ... & Kröz, M. (2020).** Impact of a multimodal and combination therapy on self-regulation and internal coherence in German breast cancer survivors with chronic cancer-related fatigue: A Mixed-method comprehensive cohort design study. *Integrative Cancer Therapies*, 19, 1534735420935618.
- Mesa, R. A., Niblack, J., Wadleigh, M., Verstovsek, S., Camoriano, J., Barnes, S., ... & Tefferi, A. (2007).** The burden of fatigue and quality of life in myeloproliferative disorders (MPDs) An international internet-based survey of 1179 MPD patients. *Cancer*, 109(1), 68-76.
- Mohamed, H. F., & Abd El-Hay, S. A. (2019).** From Theory to Practice: Application of Self-Regulation Model for the Management of Fatigue among Cancer Patients Receiving Chemotherapy. DOI: 10.7176/JHMN
- Natalucci, V., Virgili, E., Calcagnoli, F., Valli, G., Agostini, D., Zeppa, S. D., ... & Emili, R. (2021).** Cancer related anemia: an integrated multitarget approach and lifestyle interventions. *Nutrients*, 13(2), 482.
<https://doi.org/10.3390/nu13020482>
- Papadakos, J., Barnsley, J., Berta, W., Rowlands, G., Samoil, D., & Howell, D. (2022).** The association of self-efficacy and health literacy to chemotherapy self-management behaviors and health service utilization. *Supportive Care in Cancer*, 30, 603-613.
- Pinchon, D. J., Stanworth, S. J., Dorée, C., Brunskill, S., & Norfolk, D. R. (2009).** Quality of life and use of red cell transfusion in patients with myelodysplastic syndromes. A systematic review. *American journal of hematology*, 84(10), 671-677.
- Rico, T. M., dos Santos Machado, K., Fernandes, V. P., Madruga, S. W., Santin, M. M., Petrarca, C. R., & Dumith, S. C. (2020).** Use of text messaging (SMS) for the management of side effects in cancer patients undergoing chemotherapy treatment: a randomized controlled trial. *Journal of medical systems*, 44, 1-12.
- Rodgers, G. M., & Gilreath, J. A. (2019).** The role of intravenous iron in the treatment of anemia associated with cancer and chemotherapy. *Acta*

- haematologica*, 142(1), 13-20.
<https://doi.org/10.1159/000496967>
- Sciacovelli, M., Schmidt, C., Maher, E. R., & Frezza, C. (2020).** Metabolic drivers in hereditary cancer syndromes. *Annual Review of Cancer Biology*, 4, 77-97.
<https://doi.org/10.1146/annurev-cancerbio-030419-033612>
- Siddiqui, A. A., Amin, J., Alshammary, F., Afroze, E., Shaikh, S., Rathore, H. A., & Khan, R. (2021).** Burden of cancer in the Arab world. *Handbook of healthcare in the Arab world*, 495-519.
doi.org/10.1007/978-3-030-36811-1_182
- Spiriti, M. A., Latagliata, R., Niscola, P., Cortelezzi, A., Francesconi, M., Ferrari, D., ... & Petti, M. C. (2005).** Impact of a new dosing regimen of epoetin alfa on quality of life and anemia in patients with low-risk myelodysplastic syndrome. *Annals of Hematology*, 84, 167-176.
<https://doi.org/10.1007/s00277-004-0961-9>
- Tuveson, D., & Clevers, H. (2019).** Cancer modeling meets human organoid technology. *Science*, 364(6444), 952-955. DOI: 10.1126/science.aaw6985
- Yao, T., Li, J., Su, W., Li, X., Liu, C., & Chen, M. (2024).** The effects of different themes of self-disclosure on health outcomes in cancer patients—A meta-analysis. *International Journal of Psychology*, 59(2), 267-278.
<https://doi.org/10.1002/ijop.13091>
- Yeom, J. W., Yeom, I. S., Park, H. Y., & Lim, S. H. (2022).** Cultural factors affecting the self-care of cancer survivors: An integrative review. *European Journal of Oncology Nursing*, 59, 102165.
<https://doi.org/10.1016/j.ejon.2022.102165>
- Zavala, V. A., Bracci, P. M., Carethers, J. M., Carvajal-Carmona, L., Coggins, N. B., Cruz-Correa, M. R., ... & Fejerman, L. (2021).** Cancer health disparities in racial/ethnic minorities in the United States. *British journal of cancer*, 124(2), 315-332.
- Zhang, H., Chen, D., Zou, P., Shao, J., Wu, J., Cui, N., & Ye, Z. (2023).** The integrated common-sense model of illness self-regulation: predicting healthy eating, exercise behaviors, and health among individuals at risk of metabolic syndrome. *BMC Public Health*, 23(1), 1486.