Mobile Health Based Self-management and its Effect on Fatigue among Patients with Advanced Cancer

Nabila Elsayed Sabola[1], **Naser Mohamed Abdelbary** [2], **Heba Abo Elazm Ebrahim**[3] **Hanady Sh. Shehata**[4]
[1] Professor of Family and Community Health Nursing Faculty of Nursing- Menoufia University. [2] Professor of Oncology and Nuclear Medicine Faculty of Medicine Menoufia University. [3]Assistant lecturer of Family and Community Health Nursing Faculty of Nursing- Menoufia University. [4]Assist.prof of Family and Community Health Nursing Faculty of Nursing - Menoufia University.

Abstract

Background: Mobile health is a technology-based nursing service that was created to provide convenience health services for all patients with chronic diseases including advanced cancer patients. **The purpose of the study** was to evaluate the effect of mobile health based self- management on fatigue among patients with advanced cancer. **Design:** A quasi-experimental (study and control groups) with pre- and post-research design was used. **Setting:** This study was conducted at outpatient clinics, oncology department at Menoufia University hospital, Shebin Elkom city, Egypt. **Sample:** A purposive sample of 150 patients with advanced cancer who were randomly assigned into two equal groups (study group and control group, 75 patients in each group). **Instruments for data collection:** I- A structured interviewing questionnaire that included, socio-demographic data of studied patients and Medical history of studied patients. II-Fatigue assessment instruments that included, fatigue intensity rating scale, functional assessment of chronic illness therapy fatigue scale and the fatigue barriers scale. **Results:** There was a significant decrease in mean score and level of fatigue post intervention among study group compared to control group ($P<0.0001$).**Conclusion:** Application of mobile health based self-management intervention for 16 weeks period lowered the level of fatigue among study group compared to control group post intervention. **Recommendation:** Integrating mobile health based practice in providing continuous care and follow-ups for patients with advanced cancer.

Keywords: Advanced cancer, Fatigue, Mobile health, Self –management intervention.

Introduction

Cancer is the second-leading cause of death in the world. Cancer rate is increasing rapidly because of ageing and expanding populations. **(Romero et al., 2025).**Worldwide, most of advanced cancer patients experience high symptoms burden as fatigue, pain, loss of appetite, loss weight, shortness of breath, and changes in bowel or bladder habits. The majority of these symptoms are distressing and negatively impact patient's quality of life (QoL) such as decreasing daily living activities, limiting work socializing, and limiting relationships with others **(Asakitogum, 2024).**

Globally, there were an estimated 20 million new cases of cancer and 9.7 million deaths from cancer in 2022. The cancer burden will increase by about 77% by 2050, further straining health systems, people and communities. Globally, the most common cancers are breast, lung, colon and rectum, and prostate cancer. In 2020, breast cancer was the most prevalent cancer globally, while lung cancer led to the highest number of deaths (**WHO, 2022**). In Egypt cancer remains a significant public health concern. Breast cancer is the most prevalent cancer among females, while liver cancer is the most common among males. (**El-Kassas et al., 2025).**

Cancer related fatigue (CRF) is the most common symptom, accounting for 52.07%–62.1% of patients, including all cancer types. CRF a persistent, distressing and subjective feeling of exhaustion associated with cancer and it's treatment, which can persist for over five years after cancer treatment completion (Asefa et al., 2024). Compared with other adverse clinical manifestation in cancer patients, like depression and anxiety, CRF exerts stronger damage on quality of life (QOL). Physical activity, psychological interventions and management of concurrent symptoms have been shown to be effective in reducing CRF (**Li et al., 2024**).

Self-management is one component of self-care which involves a process of maintaining health through positive health practices and the managing illness and disease. Self-management refers to the individual behaviors intended to maintain or improve health and prevent exacerbation (**Shi et al., 2024**). Regarding self-management patients also responsible for monitoring and responding to change in their health status and daily life, maintain their general health and avoid risk factors for other illness such as eating healthy diet and practicing regular exercise. The key feature of self- management of chronic illness is that people participate effectively in managing their own health care on an ongoing basis (**Abedin et al., 2024**)

Mobile based intervention is one of tele-health methods that depend on information technology. Worldwide, understaffed wards, increased prevalence of chronic diseases and population aging, long distance from health facilities and changes in health policies have induced popularity of healthcare at home and mobile health to shift healthcare from hospital centered to community-centered care and from care centered to patient-centered care (**Tremblay et al., 2025**). Mobile devices and other wireless devices are recently used to improve health outcomes, health care quality, sustain health equity, decrease use of health resources, allow

patients to feel connected to health professionals and assist in treatment; symptom monitoring and lifestyle management (**Bhattacharjee, 2024**).

Community nurses can provide many services through mobile including patient triage, symptom management, education, counseling, control of using care tools, monitoring of patients and review laboratory findings related to cancer patient. Continuity of care is one of the important duties of nurses that may be facilitated through tele- nursing. Mobile heath based follow-ups are an important aspect of continuity of care that can be effective in facilitating treatment process **(Cheung, 2024).** Thus, the purpose of the present study was to examine effect of mobile health based self-management on fatigue among patients with advanced cancer.

Significance of the study

Cancer constitutes the second leading cause of death in developing countries. The burden of cancer is increasing in economically developing countries as a result of population aging and growth, an adoption of cancer-associated lifestyle choices. Cancer is not only catastrophic to individual health and well-being but also a significant challenge for families and societies at large **(Roheel et al., 2023).** Cancer has a significant economic cost to the health system, as well as to the wider economy through reduced productivity in the labor market, because it causes the premature death of people still in their productive years. This dramatically hinders sustainable development **(Mohamed et al., 2023)**

In the Eastern Mediterranean Region alone, more than 788. 000 people were diagnosed with cancer in 2022. This number is projected to double to reach 1.57 million cases by 2045, because of population growth and, more importantly, the high prevalence of cancer risk factors in the Region– such as tobacco use, obesity/overweight, physical inactivity, unhealthy diets and air pollution **(Zhao et al., 2023).** Cancer can also develop as a result of some infections, including hepatitis B and C (which affect the liver) or human papillomavirus (HPV, which affects the uterus). These infections are still very much present in the Eastern Mediterranean Region, even though hepatitis B and HPV can be easily prevented through vaccination **(Bandi et al., 2025).**

In Egypt, Age-standardized incidence rates per 100,000 population were 166.6 (both sexes), 175.9 (males), and 157.0 (females). The most common sites were liver (23.8%), breast (15.4%), and bladder (6.9%) (both sexes): liver (33.6%) and bladder (10.7%) among men, and breast (32.0%) and liver (13.5%) among women. By 2050, cancer cases are expected to increase three-folds compared to 2013 (Wahab et al., 2025).

Nowadays with up to 94% of people having access to the internet or possessing a smartphone, technology use is increasing. There is growing interest in using technology-based interventions in healthcare to improve care and access to health information, encourage healthy behavior and increase patient's participation in management (**Abdelaleem et al., 2023**). Consequently engaging advanced cancer patients and improving their health habits and outcomes making it necessary to find novel and efficient approaches to supplement routine care the world (**Kim et al., 2025**). Thus, the purpose of the present study was to examine effect of mobile health based self- management on fatigue, self -efficacy and quality of life among patients with advanced cancer.

Purpose of the study

The purpose of the study was to evaluate the effect of mobile health based self- management on fatigue among patients with advanced cancer.

Operational definition

- **Mobile health (mHealth)**: in the current study it was used as mobile phone for delivering self –management instructions to patients with advanced cancer through what's app.
- **Self-management (SM)** : in the current study it was used as giving patient series of sessions about health related guidelines and instructions about cancer, medication management, management of medication side effects, management of psychological problems, life style, social and spiritual support and communication.
- **Fatigue**: in the current study it was used as a state of tiredness, exhaustion or loss of energy resulting from disease (cancer) or disease treatment that interferes with patient activity of daily living.

Hypotheses

Patients with advanced cancer who receive mobile health based self- management (study group) will have lower cancer related fatigue score compared to control group post intervention.

Methods

Research design:

A quasi-experimental research design (study and control group) with pre and post-test intervention was utilized to achieve the purpose of the study.

Research Setting:

The study was conducted at outpatient clinics, oncology department at Menoufia university hospital, Shebin Elkom city, Egypt.

Sample:

A Purposive sample of 150 patients with advanced cancer admitted to outpatient clinics of previously mentioned setting were recruited and assigned into two equal groups (study group and control group). Each group was composed of 75 advanced cancer patients; study group received mobile health based self-

management intervention along with routine hospital care while control group received routine hospital care only.

A)

Inclusion criteria:

- Patient with advanced cancer (stage IV).
- Patients above 19 years old.
- Patients who have the ability to read and write, use the internet and mobile phones by themselves or by family members.
- Independent patients who do their daily living activity without assistance.

Sample size and power analysis of the study:

In order to calculate the required sample size, Case-Control Study approach of Epi website (Open Source Statistics for Public Health 2021)* was used, with the equation, Sample size (**n) = [DEFF*Np (1-p)] / [(d2/Z21-α/2*(N-1)+p*(1p)]**

Where: N = Population size, **DEFF** = Design effect=1, **P** = % frequency of patients with advanced cancer, **d** = Confidence limits as % of 100 (absolute +/- %) (d) = 5%,

Z= 1.96, and **α** = 0.05. The assumptions were:

1. A two sided confidence level of 95% = (1- α).
2. A power (1- β) or (% chance of detecting) = 80%.
3. Ratio of sample size, unexposed (control)/ exposed (study group) =1
4. % of unexposed (control) (with outcome (hope) (= 27%)
5. One of two parameters was entered which was % of exposed (mobile health based self -management) = 47% (from a pilot study), and the other parameter, Odd's Ratio (OR) would be calculated by the Epi website program.

Instruments of the study

The instruments that was used for data collection included the following:

I-A structured interviewing questionnaire:

- Part1: Socio-demographic data of studied patients including age, educational level, marital status, employment status, residence, family income and telephone number of patients with advanced cancer.
- Part2: Medical history of studied patients including questions related to cancer type, date of cancer diagnosis, received treatments, frequency of admission to hospital and follow up regimen.

II- Fatigue assessment scales:

The fatigue intensity rating scale that was designed by Schwartz, et al., (2002). This instrument is one-dimensional tool consists of 11 – item numeric rating scale which measures patients fatigue level.

Scoring system

The fatigue intensity rating scale: one-dimensional tool consists of 11 – item numeric rating scale which measures patients fatigue on a 0 (no fatigue) to 10 (overwhelming fatigue) scale. This instrument measures severity of fatigue reported by patients. A score 1- 3 indicated mild fatigue, a score of 4 -6 indicated moderate fatigue, and a score of 7 -10 indicated sever fatigue.

B) Functional assessment of chronic illness therapy fatigue scale (The FACIT – F scale) that was designed by Smith, (2010) to assess the patients' level of fatigue through their regular daily activities at the previous week and it consist of 13 items.

Scoring system

Functional assessment of chronic illness therapy fatigue scale (The FACIT – F scale): which assess the patients' level of fatigue through their regular daily activities at the previous week, and it consist of 13 items, each item is a five – point Likert Scale used to assess the fatigue level with zero indicated very much fatigued and four stands for not all fatigued, **EXCEPT** items 7 and 8 which are reversed the score. Score is ranged from 0-52. A score of less than 30 indicates severe fatigue. A score of 30 - 39 indicates moderate fatigue. A score of 40 – 47 indicates mild fatigue. A score of 48 – 52 indicates no fatigue.

C) The Fatigue Barriers Scale (FBS) that was designed by Passik et al., (2002) to assess barriers to fatigue management and included 28 items, it contains 10 subscales named treatment futility, fear of disease progression, concern of being a good patient, fear of distraction the doctor, lack of concern, fear of stigma, general medication concern, preference of non-medication intervention, fear of jeopardizing cancer treatment and lack of communication. Each subscale involved 2 items **expect** concern of being a good patient, lack of concern; general medication concern and treatment futility involved 4 items.

Scoring system

The Fatigue Barriers Scale (FBS): It consisted of 28 items, each was five points Liker scale (0 – 4) as (0) for strongly disagree, (1) for disagree, (2) for neutral, (3) for agree, and (4) for strongly agree. The total score of FBS was calculated by adding sum of all the 28 items, and it was ranged between 0 – 112. Advanced cancer patients who had a total score from 0 - >38 points, were considered as "low FBS", those who had 38 - >74 points were considered as "Moderate FBS", those who had 75-112 were considered as" Sever FBS".

Validity of data collection instruments: -

Validity of the study instruments was determined using content validity by three panels of experts in the field of community and family health nursing. The relevancy, clarity, fluency, and simplicity of each component in the questionnaire were examined by the Experts and changes were made in response to the panel's suggestions regarding accuracy of the statements and the relevance of the contents.

Reliability of data collection instruments: -

Reliability was applied by the researcher for testing internal consistency of its questions. Test-retest reliability was done using 10 subjects during pilot study with two weeks apart between them and correlation coefficient (Cronbach's alpha) was calculated between the two scores.

Regarding reliability of fatigue intensity scale the cronbach's alpha coefficient test for was 0.93 that indicated the instrument was reliable. Functional assessment of chronic illness therapy fatigue scale cronbach's alpha coefficient test was 0.90 that indicated the instrument was reliable. Fatigue barriers scale cronbach's alpha coefficient test was 0.85 that indicated the instrument was reliable.

Ethical consideration: -

- A written approval of Ethical and Research Committee of Faculty of Nursing, Menoufia University was obtained.
- Written informed consent was obtained from the studied patients. The subjects who agreed to participate in the study were assured about confidentiality by coding number and anonymity of the study. They were informed about their right to withdraw from the study at any time without giving a reason. The purpose of the study was clarified for the studied patients by the researcher and any needed clarifications were done.

Pilot study: -

Before starting data collection, a pilot study was conducted on 10% of the total sample (15 patients) to assess the feasibility of the study as well as clarity, applicability, feasibility, objectivity of the instruments and time needed to fill the each instrument. The needed modifications were done as revealed from the pilot study. The subjects who included in the pilot study were excluded from the study sample.

Procedure for data collection

- The conduction of the current study takes nine months while data were collected throughout four months starting in September and completed in December 2024.
- The study instruments were prepared based on literature that involves all aspect of the problem via periodic papers, books and internet sources for cancer.
- An official letter was obtained from Dean Faculty of Nursing Menoufia University directed to director of oncology department at Menoufia university hospital to get his permission and support to conduct the study. It included the purpose of the study and methods of data collection.
- After obtaining written and informed consent from director of oncology department at Menoufia university hospital to conduct the study, the researcher made formal contact with head nurse of outpatient clinic to identify days of follow up of advanced cancer patients and time suitable to meet them.
- The study subjects were selected according to inclusion criteria then were assigned randomly to the study and control group according to their education level, the researcher met with the study subjects face to face and gave them a brief summary of the study purpose and procedure for data collection.
- During pre-phase of the study, data collection were extended from the beginning of September to the middle of September, 2024, from the control group, while from the middle of September to the beginning of October, 2024, from the study group.
- The researcher met with the study subjects three days per week the average number of the subjects from which data are collected each time was an average 10-15 subjects, the average time taken for completing questionnaire was about 20-25 minute, the data obtained during the pre – phase were used as the base line assessment.
- The researcher began to contact with the study group online through WhatsApp and assigned them to five groups on WhatsApp, each group included fifteen subjects. Also caregivers were included in WhatsApp group so when the patient cannot listen the session on the WhatsApp group, the caregiver will explain it to him later.
- The educational intervention was developed by the researcher based on findings obtained from pre-test assessment that revealed that advanced cancer patients had high fatigue level and aimed to improve fatigue of patients with advanced cancer
- The researcher sent soft copy of the illustrative booklet to the study group as a guide including six main parts; knowledge about cancer, life style for advanced cancer patients, medication adherence, management of medication side effect, management of psychological problems, social support, spiritual support and communication.
- The educational intervention through WhatsApp was undertaken through three sessions per week for two weeks with an average time for each session of 20-30 minutes and the subjects were allowed to send any question throughout the day following the session, thus offering them a great flexibility.

- Each week, three elements were discussed based on priority of the subjects, need, during first week, knowledge about cancer, life style of advanced cancer patients and medication adherence were discussed.

- During second week, side effects of medications and its management, management of psychological problems, social support, spiritual support and communication were discussed.

- Before any session, the researcher sent recorded and attractively presented power point presentation that related to defined element followed by audio recordings and text messages to clarify content of power point.

- 1st session was about knowledge about cancer including definition of disease, causes and risk factors, sign and symptoms, high risk groups, types of tumors, stages of cancer, diagnosis of cancer and treatment.

- 2nd session was about life style modification as diet, exercise, smoking, sleep and factors that strength immune system and avoided actions that lower body immunity.

- 3rd session was about medication adherence including medications important for advanced cancer patients and type of cancer medications.

- 4th session was about medications side effects and how to manage these side effects.

- 5th session was about psychological problems management including measures that help advanced cancer patients get rid of worry, fear and depression resulting from disease.

- 6th session was about spiritual support and communication including measures that help advanced cancer patients to have good communication, social and spiritual support.

- The researcher conducted regular follow-ups with the study group until the end of the study period.

- The control group not received any instructions during data collection period but received routine care at oncology department at Menoufia university hospital.

- After four months from the initial assessment, the study and control groups completed the data collection questionnaire used in the pre-test for posttest.

- For ethical consideration the researcher provided the control group with the educational booklet at the end of the study.

Statistical analysis

- Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program, and both scatter plots between any two quantitative variables as well as graphic with mean ± SD bars of gender, were done by SPSS program.

- Quantitative data were presented by mean (X) and standard deviation (± SD). It was analyzed using independent sample t- test for comparison between two means. Pearson correlation coefficient (r) was used for testing the correlation between two quantitative data. Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square (χ^2) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used(if the table was 4 cells) , or Likelihood Ratio (LR) test (if the table was more than 4 cells). Level of significance was set as P value <0.05 for all significant tests.

Table 1 shows that, majority of the studied patients with advanced cancer aged between 41 to 50 years (45.3% for control group, and 41.3% for study group), with mean of 45.8 ± 9.8 Y (range: 30 – 65 years) for control group, and a mean of 46.6 ± 7.3 years (33 – 65 years) for study group. Majority of them were illiterate/ R&W with (42.7%) among control group, and 58.7% among study group, while approximately one quarter (25.3%) of control group had secondary education. As regards Job, more than two thirds were working (66.7%) among control group, and 56% among study group were working. Majority of them have enough income per month (46.7% among control, and 54.7% among study group. There was no significant difference between control and study groups regarding each item in the socio-demographic characters (p> 0.05 for each item).

Table 2 shows distribution of the studied patients with advanced cancer according to their Medical history. Asking about how did he/she discovered that they had cancer demonstrated that majority of patients discovered this illness through conducting some medical laboratory tests (41.3% among study group, and 33.3% among control group). Asking about duration of suffering from cancer they had cancer demonstrated that majority of patients suffered from cancer 10-15 years (48 among study group, and 45.3% among control group). Asking about frequency of going to hospital to receive the treatment demonstrated that majority of patients went every two weeks (50.7among study group, and 54.7% among control group).There was no significant difference between control and study groups regarding each item in the medical data of studied patients with advanced cancer (p> 0.05 for each item).

Figure 1 shows that more than two thirds of the control group (42.7) and more than half of the study group (58.7) are illiterate.

Table 3 reveal that, the 18.7% of the study group, demonstrated light fatigue, while 62.6% had moderate fatigue, and 18.7 % showed sever fatigue post-intervention. On the other hand, the control group showed that approximately three quarters of patients of control group presented sever fatigue 73.3% post-intervention. Using Independent sample t test to compare between mean total score of fatigue severity scale among control and study groups post-intervention, approved the efficacy of receiving mobile health based self-management on

lowering the mean score of fatigue severity scale from 9.13 ± 0.77 pre intervention to 3.13± 0.77 post intervention (ts=10.86,p<0.0001 HS). In addition, the mean score of fatigue severity scale among study group post intervention was also **lower than** the mean score of fatigue severity scale among control group (3.13± 0.77 vr 8.49±0.89* respectively), and the difference was highly significant statistically ts=12.4,p<0.0001 HS). Again this result approved the first hypothesis of this study which stated: "Patients with advanced cancer who receive mobile health based self- management (study group) will have lower cancer related fatigue score compared to control group.

Table 4 reveals that, more than two thirds of the study group, post-intervention, demonstrated moderate fatigue (62.6%), while (24%) had mild fatigue, and (13.3 %) showed sever fatigue. On the other hand, the control group showed that in post intervention, (80%) of them presented sever fatigue,(16%) presented moderate fatigue and only (4%) presented mild fatigue . Using Likelihood Ratio for comparison between fatigue functional assessment levels of study and control groups post-intervention showed a high significant difference between them(LR2=34.9,ps<0.0001 High significant). Among study group, patients suffering from severe fatigue were 72% pre-intervention, and this percentage decreased to 13.3% post intervention. Also patients in study group suffered from mild fatigue were 12 % pre intervention and increased to 24% post intervention. Patients in study group suffered from moderate fatigue were 16% pre intervention and increased to 62.7% post intervention. Moreover, using Independent sample t test to compare between mean total score of Functional assessment of chronic illness therapy fatigue scale among control and study groups post-intervention, approved the efficacy of receiving mobile health based self-management on improving the mean score of Functional assessment of chronic illness therapy fatigue scale from 7.4 ± 1.9 pre intervention to 35.1± 4.3 post intervention (ts=34.9,p<0.0001 HS).(Improvement in functional assessment of chronic illness therapy fatigue scale, will lead to lower the fatigue suffered by the patients, that is why the total mean score of fatigue functional assessment is larger in post intervention than pre-intervention).

Figure 2 shows that, most of the study group, post-intervention, demonstrated mild fatigue barriers (76%), while (20%) had moderate fatigue barriers, and (4 %) showed sever fatigue. On the other hand, the control group showed that two thirds of patients had sever fatigue (60%), (32%) had moderate fatigue and (8%) had mild fatigue and the difference was highly significant statistically p<0.0001 HS.

Table 5 represents effect of receiving mobile health based self-management on arithmetic means of total Subdomains of Fatigue barriers as well as grand total Fatigue barrier scale, among study and control groups of patients with advanced cancer pre and post interventions (N=150). Pre-intervention, there was no significant difference between study and control groups regarding means of total Subdomains of Fatigue barriers (p >0.05 for each subdomain). Similar result was observed regarding grand total Fatigue barrier scale (28 items) where there was no significant difference between study and control groups pre-intervention.(t1 =1.35,p1=0.18).On the other hand, post-intervention results approved that the effect of receiving mobile health based self-management on arithmetic means of total Subdomains of Fatigue barriers as well as grand total Fatigue barrier scale, among study and control groups of patients with advanced cancer, where post intervention, the difference was highly significant between study and control groups (N=150) either for each individual subdomains as well as grand total fatigue barrier scale (28 items) (p <0.0001 for each).

Table (1): Socio -demographic characteristics of the studied patients with advanced cancer (N = 150)

Socio –demographic data	Control group		Study group		Test of significant	P- value
	No.	%	No.	%		
Age groups:					LR=1.1	P=0.7 NS
30> 40 years (n=13)	13	17.3	18	24		
40 > 50 years (n=34)	34	45.3	31	41.3		
50 -65 years (n=28)	28	37.4	26	34.7		
Mean ± SD (Range)	45.8 ± 9.8 Y (30-65 Years)		46.6 ± 7.3 Y (33-65 years)		t=1.12	P=0.09 NS
Education:					LR=4.8	P=0.31 NS
Illiterate / R&W	32	42.7	44	58.7		
Basic education	15	20	9	12		
Secondary education	19	25.3	15	20		
University	9	12	7	9.3		
Job: Working	50	66.7	42	56	x^2 = 1.8	P=0.38 NS
Not work	25	33.3	33	44		
Marital status:					LR=0.81	P=0.84 NS
Single	4	5.3	3	4		
Married	32	42.7	29	38.7		
Widower	23	30.7	28	37.3		
Divorced	16	21.3	15	20		
Income:					LR=6.7	P=0.08 NS
Enough &save	13	17.3	11	14.7		
Enough	35	46.7	41	54.7		
Not enough	27	36	23	30.6		
Total	**75**	**100**	**75**	**100**		

NS:-Non significant LR:- Likelihood ratio

Fig.1: Education of studied patients with advanced cancer (N=150)

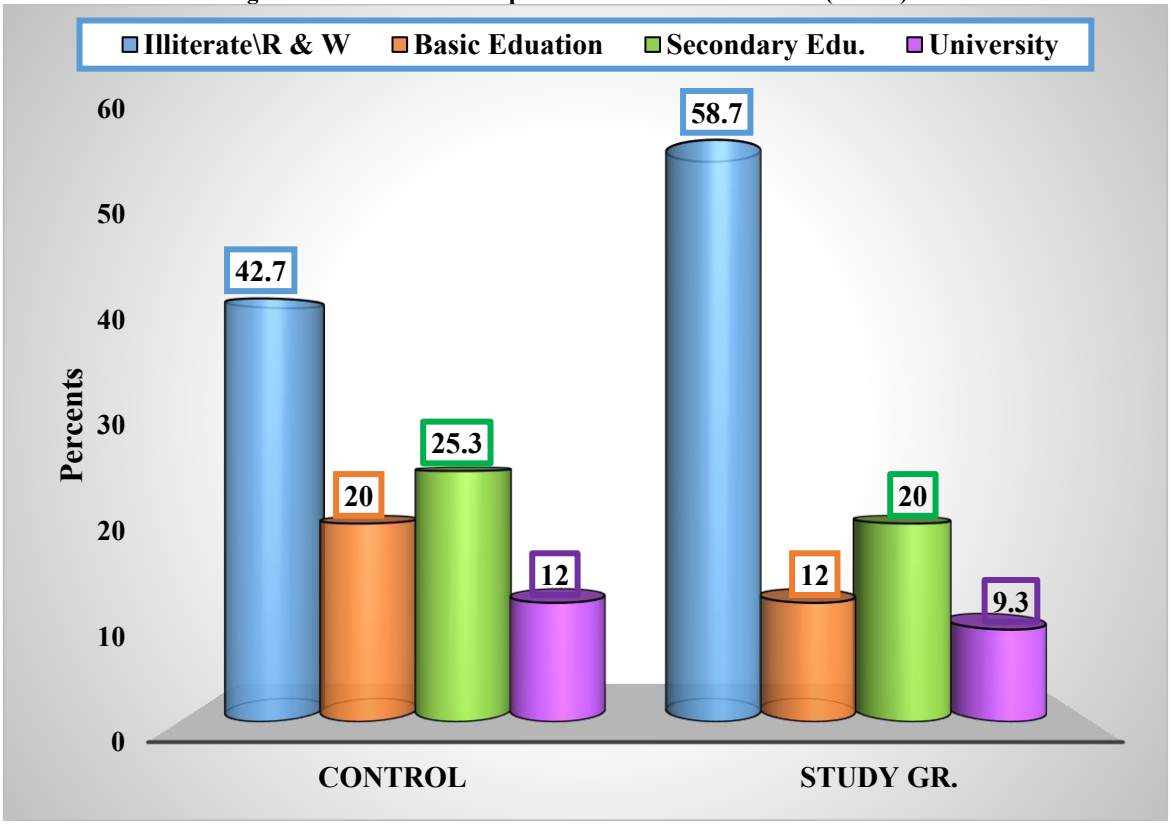

Table 2: Medical data of studied patients with advanced cancer (N=150)

Medical history	Control group		Study group		Test of significant	P value
	No.	%	No.	%		
Patient discovered he had cancer:						
During medical Exam.	5	6.7	5	6.7	χ^2=2.2	P=0.52 NS
Conducting laboratory tests.	25	33.3	31	41.3		
Appearance of certain symptoms.	23	30.7	23	30.7		
Feeling severe pain in an area.	22	29.3	16	21.3		
Duration of suffering from cancer:						
5 - < 10 years	9	12	13	17.3	χ^2=1.4	P=0.49 NS
10 – 15 years	34	45.3	36	48		
>15 years	32	42.7	26	34.7		
What is your treatment protocol:						
Chemotherapy	23	30.7	26	34.7	χ^2=10.5	<0.01
Radiotherapy	43	57.3	31	41.3		
Hormonal therapy	7	9.3	5	6.7		
Palliative therapy	2	2.7	13	17.3		
Frequency of going to hospital to receive the treatment					x^2= 3.06	P=0.07 NS
Every week	4	5.3	1	1.3		
Every two weeks	41	54.7	38	50.7		
Every one month	30	40	36	48		
Total	**75**	**100**	**75**	**100**		

Table (3): Effect of receiving mobile health based self-management on fatigue severity scale levels, among study and control groups of patients with advanced cancer (N=150).

Fatigue severity scale	Pre intervention				Post intervention				Test of significant		P1 Value	P2 value
	Control group		Study group		Control group		Study group		LR_1	LR_2		
	No.	%	No.	%	No.	%	No.	%				
No fatigue	0	0	0	0	0	0	0	0				
Mild fatigue (1 – 3)	10	13.3	7	9.3	8	10.7	14	18.7	1.34	207.9	0.42 NS	<0.0001 HS
Moderate fatigue (4-6)	15	20	8	10.7	12	16	47	62.6				
Sever fatigue (7- 10)	50	66.7	60	80	55	73.3	14	18.7				
Mean ± SD	8.89±0.79*		9.13 ± 0.77		8.49±0.89*		3.13± 0.77		t1=1.34	t2=10.86	P1=0.42	P2<0.0001 HS
Total	**75**	**100**	**75**	**100**	**75**	**100**	**75**	**100**				

LR1=Likelihood Ratio for comparison between fatigue severity levels of control and study groups pre-intervention (LR1=1.34, p1=0.42 Not significant). **$LR_{2=}$** Likelihood Ratio for comparison between fatigue severity levels of control and study groups post-intervention **(LR2=207.9, p2 <0.0001 High significant). P1=**Independent sample t test for comparison between mean total score of fatigue severity scale of control and study groups pre-intervention (**t1**=1.34, **p1**=0.42 NS).

P2= Independent sample t test for comparison between mean total score of fatigue severity scale of control and study groups post intervention (t2 =10.86, p<0.0001 HS).

Table 4: Effect of receiving mobile health based self-management on Functional assessment of chronic illness therapy fatigue scale, among study and control groups of patients with advanced cancer (N=150).

Functional assessment of chronic illness therapy fatigue scale levels	Pre intervention				Post intervention				Test of significant		P1 value	P2 value
	Control group		Study group		Control group		Study group		LR_1	LR_2		
	No.	%	No.	%	No.	%	No.	%				
Sever fatigue (<30)	51	68	54	72	49	65.3	10	13.3	0.73	34.9	0.68 NS	<0.0001 HS
Moderate fatigue (30 -39)	15	20	12	16	18	24	47	62.7				
Mild fatigue (40- 47)	9	12	9	12	8	10.7	18	24				
No Fatigue (48 -52)	0	0	0	0	0	0	0	0				
Mean ± SD	8.13± 0.77		7.4 ± 1.9		8.09±0.89		35.1± 4.3				Ps<0.0001 HS	
Test of significant	t1=1.14, p1=0.35 NS				t2= 51.6 p2<0.0001 HS							
Total	75	100	75	100	75	100	75	100				

LR1 =Likelihood Ratio for comparison between fatigue functional assessment levels of control and study groups pre intervention (LR1=0.73,p1=0.68 Not significant). $LR_{2=}$ Likelihood Ratio for comparison between fatigue functional assessment levels of study and control groups post-intervention (LR2=34.9,ps <0.0001 High significant). t1=Independent t test for comparison between mean total score of fatigue functional assessment scale of control and study groups pre intervention(t1=1.14,p=0.35 NS). t2=Independent t test for comparison between mean total score of fatigue functional assessment scale of control and study groups post intervention(t2=51.6,p<0.0001 HS).

Fig. 2: Effect of receiving mobile health based self-management on Total Fatigue barriers scale levels, among study and control groups of patients with advanced cancer, pre and post intervention(N=150)

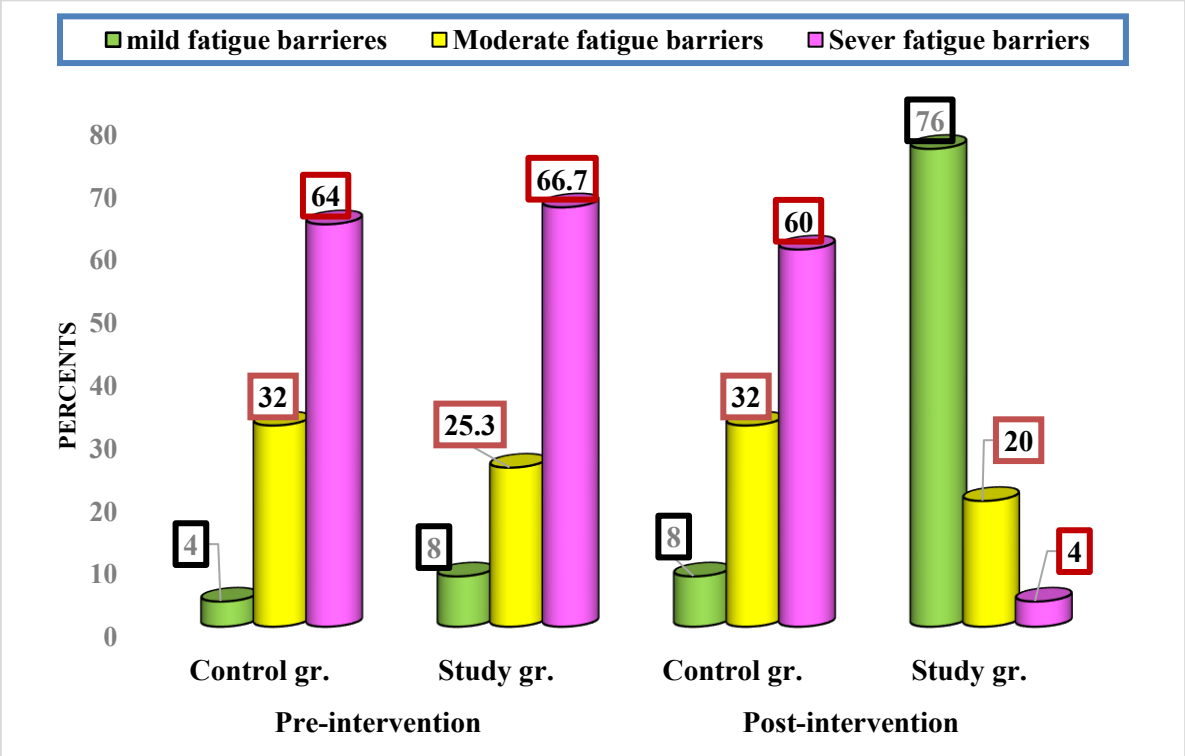

Table 5: Effect of receiving mobile health based self-management on arithmetic means of total Subdomains of Fatigue barriers as well as grand total Fatigue barrier scale, among study and control groups of patients with advanced cancer pre and post interventions (N=150).

Subdomains of Fatigue barriers scal levels	Pre intervention				Post intervention				Test of significant			
	Control group		Study group		Control group		Study group		T1	P1 value	t2	P 2 Value
	Mean	± SD	Mean	± SD	Mean	± SD	Mean	± SD				
Subdomain1: (4 items):									0.26	0.79 NS	36.1	<0.0001 HS
Treatment futility	14.5 ± 0.91		14.0 ± 0.97		14.7 ± 0.92		5.21 ± 1.2					
Subdomain2: (2 items):									0.19	0.84 NS	28.2	<0.0001 HS
Fear of disease progression	7.1 ± 0.85		7.3 ± 0.83		7.24 ± 0.97		2.40 ± 1.11					
Subdomain 3: (4 items)									0.37	0.68 NS	47.7	<0.0001 HS
Concern of being a good patient	14.3 ± 0.91		14.8 ± 1.0		14.2 ± 0.94		5.14 ± 1.35					
Subdomain 4: (2 items)									0.48	0.63 NS	31.7	<0.0001 HS
Fear of distracting doctor	7.2 ± 0.64		7.3 ± 0.70		7.31 ± 0.69		2.68 ± 1.05					
Subdomain5: (4 items):									0.27	0.78 NS	43.6	<0.0001 HS
Lack of concern	14.4 ± 0.88		14.3 ± 0.84		14.27 ± 1.8		5.18 ± 1.6					
Subdomain 6: (2 items)									1.7	0.09 NS	9.1	<0.0001 HS
Fear of stigma	8.8 ± 1.6		7.2 ± 0.60		7.8 ± 2.4		2.8 ± 0.94					
Subdomain 7: (4 items)									1.13	0.25 NS	44.8	<0.0001HS
General medication concerns	15.3 ± 1.6		14.4 ± 1.1		14.2 ± 1.3		4.9 ± 1.4					
Subdomain 8: (2 items)									0.36	0.66 NS	33.3	<0.0001HS
Preference of non-medication interventions	7.3 ± 0.56		7.2 ± 0.55		7.2 ±0.58		2.4 ± 0.91					
Subdomain 9: (2iems)									0.56	0.57 NS	30.6	<0.0001HS
Fear of jeopardizing cancer treatment	7.1 ± 0.90		7.2 ± 0.82		7.4 ± 0.9		2.6 ± 0.8					
Subdomain 10: (2 items)												
Lack of communication	6.9 ± 0.92		6.8 ±0.95		6.8 ±1.4		2.6 ± 0.97		0.26	0.79 NS	25.6	<0.0001 HS
Grand total Fatigue barrier scale (28 items)	103.4 ± 14.8		100.9 ±5.3		100.7 ± 7.4		35.9 ± 7.6		1.35	0.18 NS	52.3	<0.0001 HS
Total	75	100	75	100	75	100	75	100				

t1=Independent sample t test for comparison between mean of each total of sub-domain, as well as Grand total score of fatigue barrier scale of control and study groups pre-intervention (t1 =1.35,p1=0.18 NS),t2=Independent sample t test for comparison between mean of total of each sub-domain, as well as Grand total score of fatigue barrier scale of control and study groups post-intervention (t2=52.3,p<0.0001 HS).

Discussion

Cancer poses a significant global health challenge, being a leading cause of death worldwide. While many tumors are treatable if identified early, the disease and its therapies can cause a variety of side effects, including pain, fatigue, and difficulty breathing (**Cui et al., 2024**). Mobile based self- management may improve access of care for patients in their homes or from remote facilities leading to improvement in the patients' competency and ability to function (**Shi et al., 2024**). Thus, the purpose of the current study was to evaluate the effect of mobile health based self- management on fatigue among patients with advanced cancer.

Pertaining to medical history of the studied patients with advanced cancer, the current study finding revealed that majority of advanced cancer patients had physical, psychological, social and sexual complications. The current study finding came in agreement with the study finding conducted in Spain **by Mihic-Gongora et al., (2024)** who studied " Physical Activity in Patients

with Advanced Cancer: Socio-demographic, Clinical, and Psychological Correlates" showed that most of patients had physical, psychological and social complications. Also, the current study finding was consistent with the study finding conducted in India by **Menon et al., (2025)** who studied " Psychological Distress and Sexual Dysfunction in Cancer Patients: Need for Psychological Intervention" showed that most of patients had sexual complications. This was attributed to disease symptoms and medication side effects.

Regarding socio-demographic characteristics of the studied patients with advanced cancer, the current study findings revealed that majority of the studied patients with advanced cancer aged between 41 to 50 years, majority of them have enough income per month and majority of them were illiterate. These findings were supported by the study findings conducted in china by **Luo et al., (2022)** who studied "Effectiveness of mobile health based self -management interventions in breast cancer patients." They reported that majority of the studied patients with advanced cancer aged between 39 to 51 years, majority of them have enough income per month and majority of them were illiterate.

Regarding fatigue of patients with advanced cancer the current study findings approved the efficacy of receiving mobile health based self-management among the study group compared to control group, the total mean score of fatigue severity scale among study group decreased from 9.13 ± 0.77 pre intervention to 3.13± 0.77 post intervention, the difference was highly statistically significant. These findings were consistent with the study conducted in **China by Huang et al., (2020)** who studied " The effectiveness of the Internet-based self-management program for cancer-related fatigue patients " They found that the Internet-based self-management interventions are better than general care in ameliorating fatigue for cancer patients. This consistency was attributed to internet-based self-management program that help patients to care with themselves, change their life style to another healthy one and manage medication side effects.

Also, these findings were in agreement with the study finding conducted in South Korea by Shi et al., (2024) who studied " Feasibility of a mobile health app-based self-management program for Chinese patients with breast cancer receiving chemotherapy: A randomized controlled pilot study" revealed that the total mean score of fatigue severity scale decreased from 8.19 ± 0.73 pre intervention to 2.13± 0.73 post intervention, the difference was highly statistically significant. This consistency was attributed to effectiveness of mobile based self -management for cancer patients due to its' availability and accessibility that reduce effort and costs of transportation.

Moreover, the current study findings were in the same line with study findings conducted in Australia by **Franzoi et al., (2025)** who examined " The effectiveness and implementation of a STEpwise Program to Promote INGeniouS ONline supportive solutions for self-management of cancer-related fatigue: The STEPPING-STONe digitally enabled randomized trial" they reported that post intervention the level of fatigue decreased than pre-intervention among study group compared with control group ($p<0.0001$). This was attributed to effectiveness of mobile app-based self- management in helping cancer patient to manage their disease that helped in decreasing fatigue intensity.

Regarding functional assessment of chronic illness therapy scale that reflects on the level of fatigue and the effect of applying mobile health based self-management on fatigue. This study found that the mean score of functional assessment of chronic illness therapy scale increased post intervention among study group compared with control group (Improvement in functional assessment of chronic illness therapy fatigue scale leads to lowering the fatigue suffered by the patients), so the level of fatigue decreased post intervention than pre-intervention among study group compared with control group. This findings was consistent with the study findings conducted in Iran by **Agbejule et al., (2024**) who studied " Development of a self-management support practice framework for addressing cancer-related fatigue: a modified Delphi study" reported that total fatigue mean score was decreased in the study group after intervention compared to the control group ($p<0.0001$). This was attributed to the improvement in sleep quality and ability to practice activities of daily living that improve patient function and decrease fatigue level.

Also, the study findings came in agreement with the study finding conducted in United States by **Chan et al., (2023)** who examined " Cancer-related fatigue self-management: a MASCC-endorsed practice framework for healthcare professionals to optimally support cancer survivors" revealed that fatigue total mean score decreased after intervention compared to control group score. Furthermore, the current study findings matched up with the study finding conducted in England by **Campbell et al., (2025)** who assessed "Co-designing a web-based intervention (RESTORE) to support self-management of cancer-related fatigue in people living with a brain tumor" and showed that the total mean score of fatigue decreased after intervention for the study group compared with control group. This consistency was attributed to applying web-based intervention to support self-management that helps in improving patient function and decreasing level of fatigue.

Moreover, the current study revealed that there was no -significant difference between control and study groups regarding total mean score of fatigue barrier scale before intervention, while after intervention “receiving mobile health based self-management” for study group the difference was high significantly ($p<0.0001$).This findings where consistent with study findings conducted in Taiwan by **Greeley (2024)** who studied " Addressing fatigue in cancer survivors using cognitive behavioral therapy for insomnia: a secondary analysis of a randomized controlled trial" reported that there was a significant decrease in fatigue barrier total mean score of the study group after intervention compared with control group. This was attributed to behaviors such as healthy

life style, medication adherence and social support that helped in decreasing fatigue barriers.

Also, the current study findings supported by the study finding conducted in China **by Li et al., (2024)** who studied "Various interventions for cancer-related fatigue in patients with breast cancer: " showed that there was significant decrease in total mean score of fatigue barrier scale among study group post intervention compared with control group. Additionally, the current study findings supported by the study finding conducted in California by **Atreya et al., (2024)** who studied " Integrative Oncology: Incorporating Evidence-Based Approaches for Patients With GI Cancers" They reported that there was statistically significant decrease in fatigue level after intervention among the study group compared to the control group P<0.0001.This was attributed to the effect of mobile based self-management that helped patients to manage medication side effects and adapting healthy life style thus decreasing fatigue.

Conclusion

Based on the findings of the current study it was concluded that:

Application of mobile health based self-management intervention for 16 weeks period lowered the level of fatigue among study group compared to control group post intervention.

Recommendations

Based on the study findings, the following important recommendations are proposed:

- Integrating mobile health based practice in providing continuous care and follow up for patients with advanced cancer.
- Providing patients with advanced cancer with necessary knowledge and skills to improve their knowledge and adherence with therapeutic regimen.
- Designing mobile application for patients with advanced cancer.
- Empowering nurse practitioners with tele-nursing (mobile health) knowledge and hands on skills through training programs.

References

Abdelaleem, M. F. (2023). Telehealth and Digital Technology: Challenges and Opportunities in Cancer Care. International Journal, 10(4), 1963-1968.

Abedin, K., Lean, Q. Y., & Wheelwright, S. (2024). Nutritional self-management in colorectal cancer patients and survivors: A scoping review. Colorectal Disease, 26(9), 1662-1679.

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.

Asakitogum, D. A. (2024). Evaluation of Inter-individual Differences in Fatigue and Energy Levels and their Relationships with Other Common Symptoms and Quality of Life Outcomes in Patients with Gynecologic Cancers (Doctoral dissertation, UCSF).

Asefa, T., Bitew, G., Tezera, H., & Tesfaye, W. (2024). Prevalence of cancer-related fatigue, associated factors and adult cancer patients' experiences at Hawassa University Comprehensive Specialized Hospital in Ethiopia: a mixed methods study. Frontiers in Oncology, 14, 1480246.

Atreya, C. E., Leach, H., Asiimwe, E., Bahri, N., Le, B. K., Macaire, G., ... & Lee, R. T. (2025). Integrative Oncology: Incorporating Evidence-Based Approaches for Patients With GI Cancers. American Society of Clinical Oncology Educational Book, 45(1), e471734

Bandi, P., Star, J., Mazzitelli, N., Nargis, N., Islami, F., Siegel, R. L., ... & Jemal, A. (2025). Prevalence and review of major modifiable cancer risk factors, HPV vaccination, and cancer screenings in the United States: 2025 update. Cancer Epidemiology, Biomarkers & Prevention, 34(6), 836-849.

Bhattacharjee, B. (2024). Evaluating Telehealth Efficacy in Kern County: Exploring for Strategies for Improvement (Master's thesis, California State University, Bakersfield).

Campbell, R., Shaw, J. M., Banks, H., Carlick, T., Faris, M. M., Jeon, M. S., ... & Dhillon, H. M. (2025). Co-designing a web-based intervention (RESTORE) to support self-management of cancer-related fatigue in people living with a brain tumour. Supportive Care in Cancer, 33(5), 1-14.

Chan, R. J., Agbejule, O. A., Ekberg, S., Ashbury, F. D., Kleckner, A. S., & Hart, N. H. (2023). Cancer-related fatigue self-management: a MASCC-endorsed practice framework for healthcare professionals to optimally support cancer survivors. Supportive Care in Cancer, 31(11), 666.

Cheung, T. T. W. (2024). The role of telehealth in improving access to care for rural oncology patients: An integrative review (Doctoral dissertation, University of Otago).

Cui, P., Yang, M., Hu, H., Cheng, C., Chen, X., Shi, J., ... & Zhang, H. (2024). The impact of caregiver burden on quality of life in family caregivers of patients with advanced cancer: a moderated mediation analysis of the role of psychological distress and family resilience. BMC Public Health, 24(1), 817.

El-Kassas, M., Ezzat, R., Shousha, H., Bosson-Amedenu, S., & Ouerfelli, N. (2025). Mapping cancer in Egypt: a model to predict future cancer situation using

estimates from GLOBOCAN 2020. The Egyptian Journal of Internal Medicine, 37(1), 31.

Franzoi, M. A., Pages, A., Charles, C., Debiasi, M., Gillanders, E., Ferreira, A., ... & Vaz-Luis, I. (2025). The effectiveness and implementation of a STEpwise program to promote INGeniouS ONline supportive solutions for self-management of cancer-related fatigue: The STEPPING-STONe digitally enabled randomized trial. Contemporary Clinical Trials, 107993.

Greer, J. A., Temel, J. S., El-Jawahri, A., Rinaldi, S., Kamdar, M., Park, E. R., ... & REACH PC Investigators. (2024). Telehealth vs in-person early palliative care for patients with advanced lung cancer: a multisite randomized clinical trial. JAMA, 332(14), 1153-1164.

Huang, J., Han, Y., Wei, J., Liu, X., Du, Y., Yang, L., ... & Wang, R. (2020). The effectiveness of the Internet-based self-management program for cancer-related fatigue patients. Clinical Rehabilitation, 34(3), 287-298.

Kim, S. M., Kim, D. S., Jang, Y., Kim, M. K., Yu, E. S., Han, D. H., & Kim, H. J. (2025). Evaluating the effectiveness of a mobile app for breast cancer self-management on self-efficacy: nonrandomized intervention trial. JMIR mHealth and uHealth, 13, e63989.

Li, Y., Gao, L., Chao, Y., Lan, T., Zhang, J., Li, R., ... & Chen, X. (2024). Various interventions for cancer-related fatigue in patients with breast cancer. Frontiers in Oncology, 14, 1341927.

Menon, B., & Gadiraju, P. (2025). Psychological Distress and Sexual Dysfunction in Cancer Patients: Need for Psychological Intervention. Journal of Psychosexual Health, 26318318241312317.

Mihic-Gongora, L., Jimenez-Fonseca, P., Coca-Membribes, S., Cruz-Castellanos, P., Galan-Moral, R., Asensio-Martinez, E., ... & Calderon, C. (2024). Physical activity in patients with advanced Cancer: sociodemographic, clinical, and psychological correlates. Brain Sciences, 14(6), 573.

Mohamed, K., Abarikwu, S. O., Mmema, L., Jibril, A. T., Rahmah, L., Ivanovska, M., ... & Rezaei, N. (2023). A Global Perspective of Cancer Prevalence: The Causative Agent, the Environment, or the Genes?. In Handbook of Cancer and Immunology (pp. 1-21). Cham: Springer International Publishing.

Passik, S. D., Kirsh, K. L., Donaghy, K., Holtsclaw, E., Theobald, D., Cella, D., & Breitbart, W. (2002). Patient-related barriers to fatigue communication: initial validation of the fatigue management barriers questionnaire. Journal of pain and symptom management, 24(5), 481-493.

Roheel, A., Khan, A., Anwar, F., Akbar, Z., Akhtar, M. F., Imran Khan, M., ... & Ahmad, R. (2023). Global epidemiology of breast cancer based on risk factors: a systematic review. Frontiers in Oncology, 13, 1240098.

Schwartz, A. L., Meek, P. M., Nail, L. M., Fargo, J., Lundquist, M., Donofrio, M., ... & Mateo, M. (2002). Measurement of fatigue: determining minimally important clinical differences. Journal of clinical epidemiology, 55(3), 239-244.

Shi, N., Ching Wong, A. K., Yuet Wong, F. K., Zhang, N., Zhu, W., Shen, K., ... & Dong, X. (2024). Feasibility of a mobile health app-based self-management program for Chinese patients with breast cancer receiving chemotherapy: A randomized controlled pilot study. Digital health, 10, 20552076241231560.

Smith, E., Lai, J. S., & Cella, D. (2010). Building a measure of fatigue: the functional assessment of Chronic Illness Therapy Fatigue Scale. PM&R, 2(5), 359- 363.

World Health Organizatization. (2022). Available at: https://www.emro.who.int/media/news/world-cancer-day-2024.html

Zhao, J., Xu, L., Sun, J., Song, M., Wang, L., Yuan, S., ... & Li, X. (2023). Global trends in incidence, death, burden and risk factors of early-onset cancer from 1990 to 2019. BMJ oncology, 2(1), e000049.