

# The Effects of Theory-Based Intervention on Self-Care Ability and Complications in Female Patients with Cancer with Peripherally Inserted Central Catheters (PICCs)

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## Research Article

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# Abstract

**Purpose** To examine the effects of Orem's self-care theory-based continuous nursing intervention on self-care ability and PICC related complications and adverse events rates of female patients with cancer in the intermission of chemotherapy.

**Methods** A quasi-experimental study was adopted. Totally 130 female patients with cancer were recruited from October 2017 to March 2019 at a tertiary maternal hospital in Shanghai. They were randomly divided into the experimental group ( $n=65$ ) and the control group ( $n=65$ ). The experimental group accepted nursing intervention based on Orem's self-care theory, which had five sessions, while the control group accepted routine intervention. The exercise of self-care agency (ESCA) and the rates of PICC related complications and adverse events were compared by Chi square test and two-sample t test between two groups through IBM SPSS 20.0 statistics software.

**Results** The results showed that before the intervention, the baseline of two groups did not differ significantly. After the intervention, four dimensions and total scores of ESCA in the experimental group were significantly improved compared with those in the control group ( $p < 0.05$ ), and the rates of PICC related complications and adverse events were significantly decreased in the experimental group compared with those in the control group ( $p < 0.05$ ).

**Conclusions** Orem's self-care theory-based continuous nursing intervention was effective in improving self-care ability and decreasing the rates of PICC related complications and adverse events. Consequently, using the intervention program for patients with PICC during the intermission of chemotherapy is recommended.

## Introduction

Female malignancies including breast cancer, endometrial cancer, ovarian cancer and cervical cancer, which pose serious threat to women's health. Intravenous chemotherapy plays an important role in the comprehensive treatment of cancer patients. Peripherally inserted central catheters (PICCs) are vascular access devices that facilitate prolonged intravenous chemotherapy [1]. PICCs have become increasingly popular among cancer patients because of the simplicity, long indwelling time, high level of safety, and low cost [2]. And they also can solve the problems of vascular damage and repeated puncture during chemotherapy. These characteristics suggest that PICCs can be ideal tool for cancer patients [3].

PICCs have been widely used clinically, however the catheter related complication rate is approximately from 30–40% [4, 5]. A retrospective study found that 40.7% of PICC lines (11 out of 27) inserted in medical oncology patients developed complications requiring early removal [6]. Other published prospective study of predominantly solid tumor patients documented a rate of complications requiring line removal of 32.8%, with infection being the most common complication [7]. A Chinese study has found that the incidence of various complications in home care of cancer patients is 42.5%, and catheter-related infection rate is as high as 11.2%. Some patients need to reset catheter when they are hospitalized again, which increases the pain and economic burden of patients [8].

Patients generally lack the knowledge and awareness of catheter related daily maintenance, especially in the intermission of chemotherapy, increasing the incidences of PICC related complications and adverse events. Previous studies have shown that when patients return home with catheter during the intermission of chemotherapy, they may have catheter complications such as phlebitis, thrombosis, bleeding at the puncture site, hematoma, infection, rash and allergy, catheter tip heterotopia, broken catheter, or exfoliation, etc which is related to lacking self-care ability of PICC and the moderate level of healthy behavior [9]. It is also shown that patients' knowledge, attitude and practice status of daily self-care of PICC need to be further improved [4]. Safdar et al have shown that patients with PICC have little knowledge of catheter-related bloodstream infection (CRBSI), and even 50% of them lack awareness of CRBSI, a life-threatening catheter-related complication [10]. The above-mentioned complications reveal that nurses should provide continuous nursing to improve self-care ability of patients with cancer and promote patients' health behavior during the intermission of chemotherapy, which brings new challenges to nurses.

During the intermission of chemotherapy, the continuous nursing of PICC should not only focus on the threat and pain of complications to the patients, but also stimulate patients' motivation, improve patients' self-care ability and promote health behaviors. Orem's self-care theory is one of effective strategies which could support patients with chronic diseases after hospital discharge [11]. Olivella-Fernandez et al [12] showed that Orem's theory could help nurses improve patients' self-care ability. The main focus of the theory is on individual's health-maintenance and self-care abilities. According to this theory, most people have the potential for self-care. Similarly, individuals' self-care knowledge, skills and responsibility help them develop their self-care abilities. According to Orem's theory, when self-care needs exceed self-care ability—for example in case of patients with PICC, patients experience health deviation and require care. Accordingly, they need to fulfil their self-care needs either individually or by asking for others' help [13, 14]. When using this theory, a nurse assesses clients' self-care knowledge, motivation and skills and determines their self-care needs. Then, the nurse selects one of the nursing systems proposed by Orem—wholly compensatory system, partially compensatory system or supportive-educative system—to fulfil the clients' self-care needs [14].

This study attempts to apply Orem's self-care theory-based continuous nursing intervention program to the patients with PICC during the intermission of chemotherapy, so as to promote patients' health-maintenance, establish their health behavior, improve the self-care ability, reduce the incidence of complications and adverse events.

## **Materials And Methods**

### **Study design**

This was a quasi-experimental study that the intervention was evaluated before and after study with a control group.

### **Study setting**

This study was carried out on recruited patients with gynecologic cancer or breast cancer who were receiving chemotherapy in the GYN Department and Breast Department of a teaching tertiary specialized hospital with

800 beds in Shanghai.

## Study population

A convenience sample of 130 patients who had confirmed gynecologic cancer or breast cancer finished the final study. The patients receiving chemotherapy without radiotherapy were recruited from October 2017 to March 2019; then the patients were randomly and evenly divided into the experimental group ( $n=65$ ) and the control group ( $n=65$ ) (Figure 1). Patients were eligible to participate if they met the inclusion criteria: age  $\geq 18$  years, patients who were inserted, maintained and removed catheters in our hospital, patients who were finished the whole cycles of chemotherapy, patients who were provided informed consent and were willing to participate in this study, and mandarin speaking. The exclusion criteria: patients who were allergic to PICC, patients who were inserted PICC repeatedly, patients who had a history of mental illness, and patients who could not understand the contents or independently complete the questionnaire.

## Sample size

According to the literature [4,5], the rate of PICC related complications in cancer patients was around 40%, and this study expected it to drop to 15% after the intervention. According to the formula

$$n = \frac{[Z_{\alpha} \sqrt{2\bar{p}(1-\bar{p})} + Z_{\beta} \sqrt{p_1(1-p_1) + p_2(1-p_2)}]^2}{(p_1 - p_2)^2}$$
 using 80% power,  $\alpha=0.05$ ,  $Z_{0.05/2}=1.96$  and  $Z_{0.10}=1.282$ ,  $p_1$  was the incidence of the control group while  $p_2$  was the incidence of the experimental group, a sample size of 65 participants in each group was required. Accounting for a 10% loss to follow-up, 70 participants were required in each group.

## Randomisation

Participants were randomly assigned to experimental group or control group according to odd or even number from random number table in a sealed envelope. The participants who met the inclusion and exclusion criteria were given a sealed envelope according to the order of diagnosis. The consecutive envelope was based on the order of the random number table, and the odd or even number tickets were put in the envelope. The patients who got the odd number ticket entered the experimental group, while those who got the even number entered the control group.

## Interventions

### Continuous nursing intervention group

A PICC continuous nursing intervention group was established in this study. Two doctors, and eight nurses who obtained the qualification certificate of PICC specialist nurse from Shanghai Nursing Committee, participated in the group. The specialist nurses were required to receive unified PICC related knowledge and practice training, including establishment of PICC patient assessment files, humanistic care in nursing extension services, observation and judgment criteria of PICC complications, and management of WeChat, etc.

## Procedure

Both the experimental and control groups completed the pre-test questionnaires and researchers finished the patients' health records through the hospital network system, including general information, disease-related information, catheterization information, etc. During this study period, a routine intervention was conducted in the control group. The patients were placed with PICC by the continuous nursing group, and were educated the precautions after the placement. The patients were given immediate guidance according to their indwelling condition during the weekly catheter maintenance.

The patients of experimental group accepted Orem's theory-based intervention. Firstly, the researcher assessed the patients' needs and identified the universal and health deviation self-care requisites. Then, the researcher gave the intervention program of five sessions based on Orem's supportive educational nursing system. The content and time of intervention program were as follows:

- I. Face to face education: (i) A PICC specialist nurse of continuous nursing intervention group (hereinafter as "a PICC specialist nurse") explained the catheterization methods, advantages and purposes to improve the cognitive level of PICC catheterization before indwelling. (ii) And after indwelling, a PICC specialist nurse established patient health assessment files through the hospital network system, guided patients one-on-one, and demonstrated early functional exercise, explained the purpose, method, time, frequency arrangement and requirements of health follow-up during the intermission of chemotherapy with PICC to improve the patients' trust in nursing, relieve anxiety and fear of catheterization, and lay the foundation for later self-care activity. (iii) PICC continuing care health education manuals were sent to the patients, and a PICC specialist nurse explained basic knowledge of PICC, catheter maintenance knowledge, causes of complications and risk factors, to help patients understand their own unhealthy behaviors and the risk of complications caused by factors at discharge.
- II. WeChat platform: Within one month after catheterization, patients experienced a transition from passive acceptance to active learning. WeChat platform for PICC continuous nursing was built weekly for one month to push the self-care knowledge and skills to guide patients the catheter related self-care precautions and to identify the abnormal conditions related to PICC in daily life. The forms included videos, illustrated popular science essays, pictures, etc.
- III. Telephone visits: Supervise patients' implementation of self-care behavior, including understanding the related knowledge of catheter maintenance, daily activities, local skin condition of puncture point, whether the catheter is damaged or displaced, etc, judge the maintenance of PICC, answer the questions and encourage patients to actively participate in self-care activities weekly for one month.
- IV. PICC salon: Within one month after catheterization, invite patients who have no complications to share self-care experiences, to improve patients' confidence in keeping healthy behaviors. Invite patients' family members to participate in PICC salon, guide them to give support and care to patients so that patients have the confidence to adhere to self-care.
- V. Specialty clinic: Assess patients' difficulties in establishing health behaviors and help them solve existing or potential problems with PICCs when patients come to hospital for catheter maintenance weekly until extubation.

## Instruments

## **Socio-demographic information and clinical characteristics**

A standardized proforma questionnaire was applied to investigate the patients' socio-demographic information, including age, education level, marital status and income. The clinical characteristics, including diagnosis, vein, puncture site and chemotherapeutic regimens and cycles, etc were obtained from electronic patients' health records.

## **Self-care agency**

Self-care agency was assessed through using the Exercise of Self-care Agency (ESCA) Scale. This self-administered instrument was developed by Kearney and Fleischer based on Orem's self-care theory [15]. The scale has 43 items, which consists of four dimensions, including self-concept, motivation, knowledge and information seeking, and passivity. Each item is rated on a 5-point Likert scale. The total score of ESCA ranges from 0-172. The scale was translated into Chinese in the year 2000, and the Chinese version showed good validity and in the Chinese populations in Taiwan Province of China [16]. In this study, the content validity index (CVI) of the scale was 1.00, and Cronbach's coefficients was 0.811.

## **Complications and adverse events**

PICC related complications and adverse events include phlebitis, catheter-related bloodstream infection (CRBSI), thrombosis, rash, bleeding at the puncture site, breakage or damage of the external part of PICC, PICC exfoliation, and unplanned extubation.

## **Data collection**

Data were collected at two time points, including the baseline with socio-demographic information and clinical characteristics, and the ESCA scale (before intervention, within 24 hr of indwelling PICC, T0). The Orem's theory-based continuous nursing intervention lasts for a long time, and the self-care ability of patients may be affected. The second point we collected the ESCA scale, complications and adverse events rates (after the end of chemotherapy and extubation, T1).

## **Statistical analysis**

We used IBM SPSS statistics version 20.0 software to analyze the data. Values were expressed as frequencies, percentages, means and SDs. We employed the independent- and paired samples *t*-tests to compare the study groups in terms of self-care ability. Moreover, the Chi square test was to compare the complications and adverse events rates between two groups. The level of significance was set at below 0.05.

## **Results**

Totally 130 female patients with cancer, including 65 patients in each group completed the study. The results of the independent-samples *t* and Chi square tests revealed that before the intervention, there was no statistically significant difference between two groups while comparing age, marital status, education, income, diagnosis, vein, puncture site, chemotherapy, chemotherapy cycles, and duration of intubation ( Table 1,  $p>0.05$ ).

Table 1  
Baseline socio-demographic and clinical characteristics of participants

| Characteristics                     | Experimental group( <i>n</i> = 65) | Control group( <i>n</i> = 65) | Statistics         | <i>p</i> -value |
|-------------------------------------|------------------------------------|-------------------------------|--------------------|-----------------|
| Age ( year/ Mean ± SD)              | 51.11 ± 10.44                      | 51.69 ± 10.97                 | t = 0.311          | 0.756           |
| Marital status( <i>n</i> /%)        |                                    |                               | $\chi^2 = 1.281$   | 0.258           |
| Single                              | 5(7.7)                             | 9(13.8)                       |                    |                 |
| Married                             | 60(92.3)                           | 56(86.2)                      |                    |                 |
| Education( <i>n</i> /%)             |                                    |                               | $\chi^2 = 4.457$   | 0.108           |
| Secondary school                    | 25(38.5)                           | 34(52.3)                      |                    |                 |
| High school                         | 14(21.5)                           | 16(24.6)                      |                    |                 |
| Bachelor degree or above            | 26(40.0)                           | 15(23.1)                      |                    |                 |
| Monthly income(¥/yuan, <i>n</i> /%) |                                    |                               | $\chi^2 = 4.241$   | 0.237           |
| ≤ 2000                              | 17(26.2)                           | 22(33.8)                      |                    |                 |
| 2001 – 5000                         | 32(49.2)                           | 32(49.2)                      |                    |                 |
| 5001 – 10000                        | 11(16.9)                           | 4(6.2)                        |                    |                 |
| >10000                              | 5(7.7)                             | 7(10.8)                       |                    |                 |
| Diagnosis( <i>n</i> /%)             |                                    |                               | $\chi^2 = 0.031$   | 0.860           |
| Breast cancer                       | 30(46.2)                           | 29(44.6)                      |                    |                 |
| Genital malignancies                | 35(53.8)                           | 36(55.4)                      |                    |                 |
| Vein( <i>n</i> /%)                  |                                    |                               | $\chi^2 = 0.604^*$ | 0.437           |
| Basilic vein                        | 63(96.9)                           | 60(92.3)                      |                    |                 |
| Other vein                          | 2(3.0)                             | 5(7.7)                        |                    |                 |
| Puncture site( <i>n</i> /%)         |                                    |                               | $\chi^2 = 0.124$   | 0.725           |
| Left upper arm                      | 36(55.4)                           | 34(52.3)                      |                    |                 |
| Right upper arm                     | 29(44.6)                           | 31(47.7)                      |                    |                 |
| Chemotherapy( <i>n</i> /%)          |                                    |                               | $\chi^2 = 2.704$   | 0.609           |

| Characteristics                           | Experimental group( <i>n</i> = 65) | Control group( <i>n</i> = 65) | Statistics | <i>p</i> -value |
|---|------------------------------------|-------------------------------|------------|-----------------|
| Epirubicin + Cyclophosphamide             | 10(15.4)                           | 14(21.5)                      |            |                 |
| Docetaxel + Carboplatin                   | 11(16.9)                           | 10(15.4)                      |            |                 |
| Docetaxel + Cyclophosphamide              | 14(21.5)                           | 8(12.3)                       |            |                 |
| Docetaxel + Cisplatin                     | 25(38.5)                           | 26(40.0)                      |            |                 |
| Others                                    | 5(7.7)                             | 7(10.8)                       |            |                 |
| Chemotherapy cycles(times/Mean ± SD)      | 5.95 ± 1.59                        | 6.02 ± 1.53                   | t = 0.225  | 0.822           |
| Duration of intubation(d/ Mean ± SD)      | 122.32 ± 31.04                     | 126.25 ± 38.74                | t = 0.637  | 0.525           |
| <i>Note:</i> *means continuous correction |                                    |                               |            |                 |

The results of the paired-samples *t*-test showed that in the control group, the levels of self-care concept, motivation, passivity, knowledge, and total score did not change significantly after the intervention ( $p > 0.05$ ; Table 2). However, the results of this test revealed that in the experimental group, the levels of self-care concept, motivation, passivity, knowledge, and total score increased significantly after the intervention ( $p < 0.001$ ; Table 2).

Table 2

The difference between the groups and between the pre- and postintervention readings of self-concept, motivation, passivity, knowledge and information seeking and total score (the results of the Independent- and paired-samples *t*-test)

| Variables                         | Time point | Control group( <i>n</i> = 65) |                  |                  | Experimental group( <i>n</i> = 65) |                  |                  | <i>t</i> -Value <sup>#</sup> | <i>p</i> -Value <sup>#</sup> |
|-----------------------------------|------------|-------------------------------|------------------|------------------|------------------------------------|------------------|------------------|------------------------------|------------------------------|
|                                   |            | Mean ± SD                     | <i>t</i> -Value* | <i>p</i> -Value* | Mean ± SD                          | <i>t</i> -Value* | <i>p</i> -Value* |                              |                              |
| Self-concept                      | Before     | 15.65 ± 1.304                 | 0.076            | 0.940            | 15.46 ± 1.213                      | -18.540          | <0.001           | 0.836                        | 0.405                        |
|                                   | After      | 15.63 ± 1.306                 |                  |                  | 18.98 ± 1.709                      |                  |                  | 0.165                        | <0.001                       |
| Motivation                        | Before     | 17.68 ± 1.393                 | 0.143            | 0.887            | 17.57 ± 1.380                      | -7.103           | <0.001           | 0.443                        | 0.659                        |
|                                   | After      | 17.65 ± 1.408                 |                  |                  | 18.97 ± 1.323                      |                  |                  | -5.522                       | <0.001                       |
| Passivity                         | Before     | 28.66 ± 1.939                 | -1.735           | 0.088            | 28.68 ± 1.872                      | -21.388          | <0.001           | -0.046                       | 0.963                        |
|                                   | After      | 28.98 ± 1.606                 |                  |                  | 34.94 ± 2.061                      |                  |                  | -18.375                      | <0.001                       |
| knowledge and information seeking | Before     | 33.78 ± 1.386                 | -1.901           | 0.062            | 33.68 ± 1.404                      | -27.877          | <0.001           | 0.440                        | 0.661                        |
|                                   | After      | 34.11 ± 1.427                 |                  |                  | 40.85 ± 1.642                      |                  |                  | -24.980                      | <0.001                       |
| Total score                       | Before     | 95.77 ± 2.609                 | -1.813           | 0.075            | 95.42 ± 2.915                      | -41.673          | <0.001           | -0.729                       | 0.467                        |
|                                   | After      | 96.37 ± 2.601                 |                  |                  | 113.74 ± 3.788                     |                  |                  | -30.471                      | <0.001                       |

*Note:* \*The results of paired-samples *t* test.  
#The results of the independent samples *t*-test.

On the other hand, the results of the independent-samples *t*-test showed that there were no significant differences between two groups in the levels of self-care concept, motivation, passivity, knowledge, and total score before the intervention ( $p > 0.05$ ; Table 2). However, the results showed that the levels of self-care concept, motivation, passivity, knowledge, and total score in the experimental group were significantly improved compared to those in the control group after the intervention (Table 2,  $p < 0.001$ ).

Moreover, the results of Chi square test showed that the complication rates such as rash, bleeding at the puncture site, and the total complication rate of patients in the experimental group were significantly reduced composed to those in the control group ( $p < 0.05$ ; Table 3). And the rates of exfoliation and the total adverse events were significantly lower than those in the control group ( $p < 0.05$ ; Table 4).

Table 3  
Comparison of complications rates related to PICC of two groups (n, %)

| Group  | Complications |          |          |        |            |          |
|--|---------------|----------|----------|--------|------------|----------|
|  | Phlebitis     | Rash     | Bleeding | CRBSI  | Thrombosis | Total    |
| Experimental group (n = 65)                                | 0(0)          | 4(6.2)   | 5(7.7)   | 0(0)   | 0(0)       | 9(13.8)  |
| Control group (n = 65)                                     | 1(1.5)        | 19(29.2) | 13(20)   | 1(1.5) | 1(1.5)     | 35(53.8) |
| $\chi^2$   | 1.008         | 11.885   | 4.127    | 1.008  | 1.008      | 23.224   |
| p-Value  | 1.000         | 0.001    | 0.042    | 1.000  | 1.000      | 0.000    |
| <i>Note:</i> CRBSI, catheter-related bloodstream infection |               |          |          |        |            |          |

Table 4  
Comparison of adverse event rates to PICC of two groups (n, %)

| Group                       | Adverse events |             |                      |          |
|-----------------------------|----------------|-------------|----------------------|----------|
|                             | Breakage       | Exfoliation | Unplanned extubation | Total    |
| Experimental group (n = 65) | 1(1.5)         | 2(3.1)      | 1(1.5)               | 4(6.2)   |
| Control group (n = 65)      | 1(1.5)         | 8(12.3)     | 5(7.7)               | 14(21.5) |
| $\chi^2$                    | 0.000          | 3.900       | 1.573                | 6.448    |
| p-Value                     | 1.000          | 0.048       | 0.210                | 0.011    |

## Discussion

The aim of the study was to assess the effect of a continuous nursing intervention based on Orem's self-care theory on self-care ability and PICC related complications and adverse events rates of female patients with cancer. Due to the lack of professional guidance and self-care ability during the intermission of chemotherapy, the patients with PICC were at risk for ineffective self-care and prone to catheter related complications and adverse events which influenced the catheter retention time. Consequently, self-care education in these patients is of grave importance. Orem [11, 14] noted that patients who have low levels of self-care knowledge, motivation and skills experience self-care deficit and hence, require education.

The study results revealed that before the intervention, there were no significant differences between two groups in socio-demographic information, clinical characteristics, the level of four dimensions and total score of ESCA. The results showed that the variables of self-concept, motivation, knowledge and information

seeking, passivity did not differ significantly in the control group after the study. It indicates that education improves patients' self-care ability [11, 17]. The intermission of chemotherapy lasts for about three months, patients in the control group might not get continuous education and then neglect self-care. However, the level of self-concept, motivation, knowledge and information seeking, passivity, and total score of ESCA in the experimental group were significantly higher than those in the control group after the intervention. The finding implies that the continuous nursing intervention based on Orem's self-care theory was effective in improving the patients' self-care ability in the experimental group. Previous studies have reported Orem's theory-based interventions significantly improve self-care ability in other patients with chronic diseases. For example, Mohammadpour et al [11] reported that supportive educational intervention based on Orem's theory could improve self-care knowledge, motivation and skills in patients with myocardial infarction, Rostami et al reported that older patients' quality of life improved significantly after the implementation of a care plan based on Orem's theory [18]. In this study, a possible reason for the significant effect is that the intervention based on Orem's theory could motivate patient initiative, help patients identify the existing or potential problems of PICC and develop targeted interventions. On the other hand, some intervention strategies, such as face to face education, WeChat platform, telephone visits, PICC salon, and specialist clinic, might be helpful in supporting patients' individual care needs, motivating patient initiative and activity, and enhancing patient compliance with continuous nursing interventions, thereby improving patients' self-care ability. As Orem believed that the purpose of nursing practice is to support individuals and to help them develop their self-care ability [19].

Moreover, the results revealed that after the intervention, the rates of PICC related complications and adverse events in the experimental group decreased significantly than those in the control group. The finding implies that the continuous nursing intervention based on Orem's self-care theory was effective in decreasing the rates of PICC related complications and adverse events in the experimental group. This is in line with a Chinese research [20]. Orem defined human beings as a self-care agent [11, 21] who assumes responsibility for self-care and develops his/her self-care ability through learning, experiencing and communicating with others [22]. The intervention in this study enabled patients to master more professional PICC self-care knowledge and skills, so that individuals could actively prevent catheter related complications, have adaptive reactions, and effectively reduce the rates of complications and adverse events.

In conclusion, the results showed that applying Orem's self-care theory-based nursing intervention would be an efficient strategy for improving self-care ability, and preventing complications and adverse events of PICC among female patients with cancer. Consequently, the application of this theory in the nursing intervention programs of the health centers might lead to some alterations regarding the development of self-care ability and the change of patients' health behavior, all of which are promising of beneficial impacts in future [23].

## Study Limitations

Due to the long-time span of the sample, the study did not explore the time effect on the outcome of intervention. It is suggested that researchers can increase the intervention processing indexes, form more detailed PICC continuous nursing intervention strategies, and benefit more patients in the future study.

## Conclusion And Clinical Implications

Our findings suggested that Orem's self-care theory-based continuous nursing intervention was feasible and acceptable, and could improve self-care ability, decrease the complications and adverse events of PICC in female patients with cancer who were in the intermission of chemotherapy. Comprehensive continuous nursing intervention program are strongly recommended to assist patients in development of self-care ability effectively during the disease trajectory.

## Declarations

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### Conflicts of interest

The authors report no conflicts of interest.

### Availability of data and material

N/A

### Code availability

N/A

### Author's contributions

R. Huang and N. Wu—Conceptualization, acquisition of data, methodology and original draft. Y. Wang, L. Zhang and H. Wang—Acquisition of data and data analysis. H. Jiang—Project administration, supervision and review. All authors: Approval of the final version for submitting.

### Ethics approval

The study was approved by the participant hospital's ethics committee (Approval number KS1669), which was based on the principle that the investigation was voluntary, confidential, and harmless. The participants signed the informed consent prior to participation in the study.

### Consent to participate

Completion of the survey implied consent to participate. All data has been anonymized to protect the identities of subjects involved in the research.

## Consent for publication

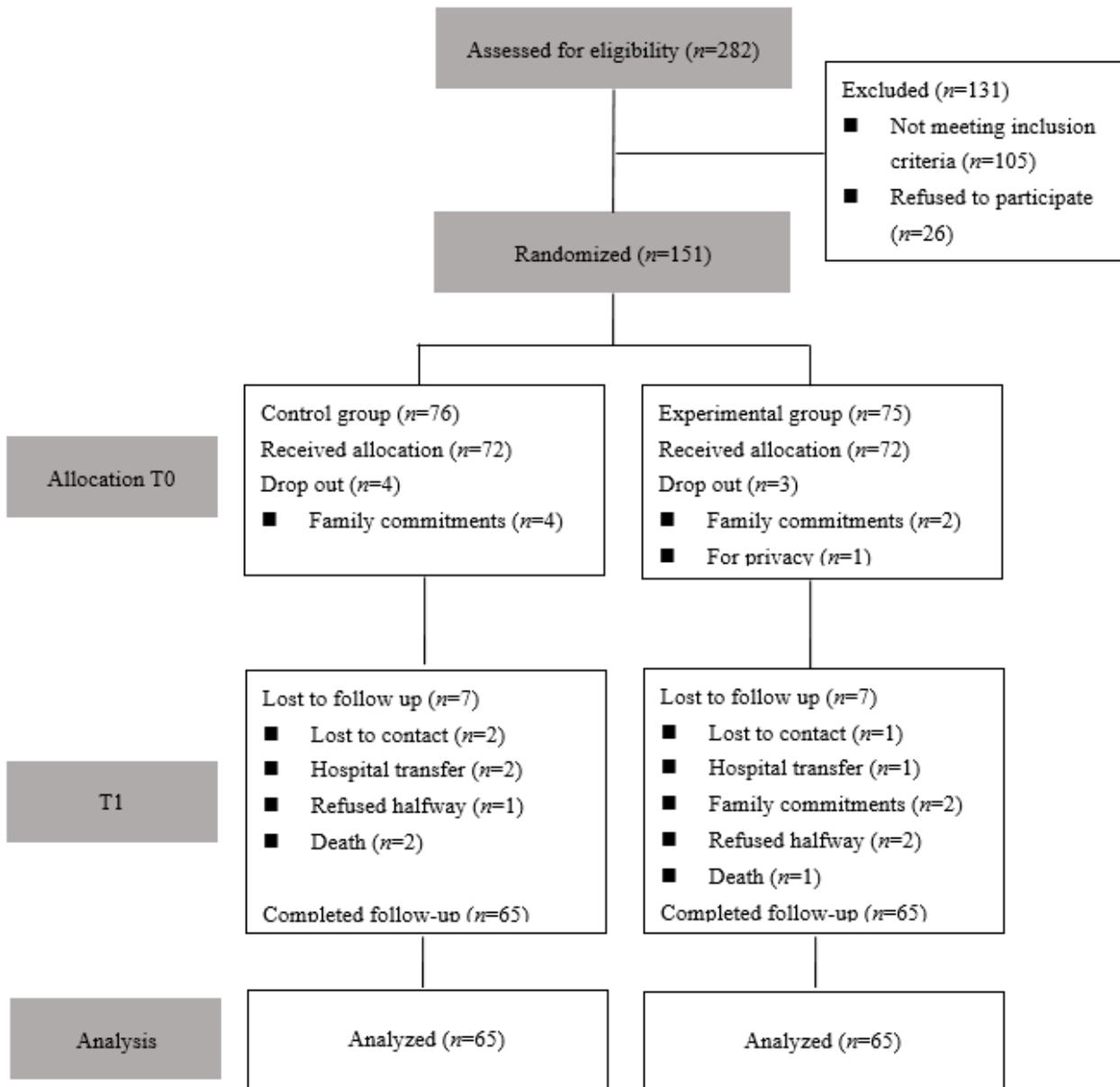
N/A

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## Figures



**Figure 1**

Flow diagram of the quasi-experimental study