

Picc line home care knowledge and practices: primary and secondary effects of an information booklet

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ABSTRACT

Peripherally Inserted Central Catheters (PICCs) are widely used in cancer patients requiring long-term intravenous therapy, particularly for the administration of chemotherapy. Although PICCs provide safe and reliable vascular access, improper home care can result in complications such as infections, thrombosis, catheter occlusion, and accidental dislodgement. As most patients are discharged with the catheter in place, adequate knowledge and appropriate self-care practices are essential for preventing complications and ensuring successful catheter maintenance. Therefore, educating patients regarding PICC line home care is an important component of comprehensive cancer care. The present study was conducted to assess the effectiveness of an information booklet on knowledge and self-reported practices regarding PICC line home care among cancer patients discharged with a PICC line and to determine the association of baseline knowledge and practice scores with selected demographic and clinical variables.

A quantitative pre-experimental one-group pre-test post-test design was adopted for the study. The study was conducted among 51 cancer patients discharged with a PICC line from BRAIRCH, AIIMS, New Delhi. Participants were selected using a non-probability convenience sampling technique. Baseline assessment of knowledge and self-reported practices regarding PICC line home care was carried out using a structured knowledge questionnaire and a self-reported practice questionnaire. Following the pre-test, a validated information booklet on PICC line home care was administered along with individual instruction and clarification of doubts. Post-test assessments were conducted on the 7th and 14th day after the intervention. Data were analyzed using descriptive and inferential statistics, including Repeated Measures ANOVA, Bonferroni post-hoc test, Chi-square test, and Fisher's exact test.

The findings revealed a statistically significant improvement in both knowledge and practice scores following the intervention. The mean knowledge score increased from 16.01 ± 4.36 during the pre-test to 20.31 ± 3.18 on Day 7 and remained significantly higher at 19.60 ± 2.24 on Day 14 ($p < 0.001$). Similarly, the mean practice score improved from 31.33 ± 3.78 at baseline to 34.78 ± 2.75 on Day 7 and 33.58 ± 3.56 on Day 14 ($p < 0.001$). The proportion of participants with adequate knowledge increased from 19.6% at baseline to 72.5% and 60.8% during the first and second post-tests respectively. Likewise, adequate practice levels improved from 39.2% at baseline to 88.3% and 74.5% during the subsequent assessments. No significant association was found between baseline knowledge and practice scores and selected demographic or clinical variables.

The study concluded that the information booklet was an effective educational intervention for improving and sustaining knowledge and self-reported practices related to PICC line home care among cancer patients. The findings support the integration of structured educational materials into routine discharge planning to promote safe home management of PICC lines, enhance patient confidence in self-care, and reduce the risk of catheter-related complications.

Keywords: PICC line, home care, information booklet, knowledge, practice, cancer patients, patient education.

INTRODUCTION

According to the statistical reports approximately 2.25 million people are presently living with the deadly disease of cancer. Every year around 11.5 lakhs new cancer cases are registered.¹ This disease can be treated by a number of treatment modalities including surgery, chemotherapy, radiation therapy, hormonal therapy, targeted therapy and synthetic therapy. Out of this chemotherapy is the most common and most important treatment modality demanding infusions for long time and in multiple cycles.

Obtaining venous access in the inpatient and outpatient setting is one of the most pivotal factors for many diagnostic and remedial interventions. It is especially important for cases taking frequent and long-term drug administration. In such cases venous access can be attained through peripherally inserted central catheters (PICCs).

National cancer institute defines PICC as a thin, flexible tube that is fitted into the veins of the upper arm and then guided (threaded) into a large vein above the right side of the heart called the superior vena cava. The right basilic vein is the vein of choice for PICC insertion as it is large size and superficially located. Additionally, it has the straightest route, as it courses through the axillary vein, also through the subclavian, and eventually, settles in the superior vena cava. Other factors that have been allowed to make the basilic vein the superior choice for PICC lines are that it has the least number of valves, better hemodilution capabilities and has a shallower angle of insertion compared to other modes. **(India Against Cancer, 2022)**

PICC line has many functions including giving intravenous fluids, blood transfusions, chemotherapy, and other medicines. It is also used for taking blood samples. A PICC line may stay in place for weeks or months and help both the patient and health care providers to avoid the need for repeated needle sticks.

PICC are generally used in cancer cases for administration of chemotherapy due to low threat of insertion related trauma, blood stream infection and suitable for being used in outpatient department settings when compared with central venous catheter. **(Kang et al., 2017)**

PICC line home care includes the recognition of any complications, the handling of line, and assessment of the line and movements of the PICC in the indwelling arm, but it does not include catheter maintenance (i.e., dressing changes and flushing of the line).

Background of study

Due to innovations in medical technology, models of care and evidence-based practices, the average length of stay in hospitals is decreasing and more people are opting for day care services which allow them to undergo the medical procedures in the hospital and go back to their homes once they finish. While this gives the benefit of avoiding hospital admission, shorter length of stay and reduced cost, it possesses a significant problem in front of the health care providers who need to monitor the patient's conditions at home. **(Varney et al., 2014)**

Central venous lines are essential in the care of patients with severe diseases treated in surgical, intensive care and oncological/hematological units. The placement of these lines carries a significant risk for serious complications, e.g. pneumothorax, arterial puncture, hemothorax, stroke, arrhythmias and nerve damage. Furthermore, a central venous line may affect the patient's well-being in other respects, as it may be inconvenient and painful, leading to restrictions in daily activities and a change in body image.⁵ Peripherally inserted central venous catheter (PICC) was introduced into practice as an alternative to the traditional central venous line and has since gained increasing popularity.

PICCs are very popular among cancer patients because of their simplicity, long indwelling time, high level of safety, and low cost. PICCs avoid many of the iatrogenic, mechanical complications (eg, pneumothorax) associated with traditional

central venous catheter placement. Although patients must regularly maintain the catheter after discharge, most patients are not able to maintain their PICC at home, which is related to low education levels, lack of awareness regarding the importance of regular PICC maintenance, economic difficulties, and unevenly developed medical conditions in various areas. This highlights the importance of continuous monitoring and follow-up by nurses via text message, telephone, family visits, and outpatient department visits. **(Ma et al., 2018)**

When examining risk of central line-associated bloodstream infection by device type, Maki et al found that rates of PICC-associated bloodstream infection were lower than those reported with traditional, non-tunneled central venous devices. **(Maki et al., 2006)**

The risk of developing these infections is even higher when a patient has existing chronic or acute illnesses along with cancer. In a study it was found that clinically sicker patients, such as those with congestive heart failure, intra-abdominal perforation, infections, and tracheostomy were more likely to develop PICC-bloodstream infection. **(Pongruangporn et al., 2013)**

A study done to assess the level of distress, perceived pain and associated complications revealed that most patients report no or very little distress and pain during and after the procedure. **(Bortolussi et al., 2015)**

An instrument was developed by which the patients can independently assess the condition of their PICC insertion site which was found to be effective in clinical monitoring and follow up of the patients after they are discharged from the hospital. It was found to be an effective method in identifying potential signs of infection and other complications and facilitating early and timely interventions. **(Webster et al., 2018)**

According to IHI (Institute of health care improvement) approximately 90% of all central line associated blood stream infection occurs due to central venous catheter use. It has been estimated that between 500 to 4000 patients die annually from blood stream infections related to central venous catheter used. **(Johnston & Conly, 2005)**

However, there are number of studies done which showed the high incidence of complications associated with PICC which can occur any time during the indwelling period. Common complications include upper extremity deep vein thrombosis (UEDVT), venous thrombosis (VT), central line associate bloodstream infection (CLABSI), phlebitis, catheter occlusion, accidental withdrawal, breakage and skin allergy. These infections result in increased lengths of stay, increased cost and higher mortality rate. Thus, preventing PICC-related complication is a challenge for nurses. **(Kang et al., 2017)**

Administering chemotherapy, long term antibiotic therapy or parenteral therapy through PICC line is associated with rates of failure due to occlusion, thrombosis, accidental removal, suspected blood stream infection which can be as high as 15%. Patients receiving such therapies need constant follow up and monitoring of the insertion site. For cancer patients, who are immune compromised due to their chemotherapy and disease condition, such monitoring is particularly important. As a result of which patients have to usually visit the hospital on frequent basis for assessment, causing financial, physical and social burden. One solution for long-term catheter-related follow-up would be patient-reported outcomes. **(Webster et al., 2018)**

Need for study

PICCs are widely used in cancer patients for long durations. Patients must live with it and carry out their daily activities with PICC lines in place. Moreover, chemotherapeutic drugs weaken the immune system of cancer patients and increase their risk of developing infections. Assessing patients' knowledge and how they care for PICCs at home is fundamental to developing a health education plan for these patients. Study findings have shown that knowledge, attitude and practice status towards daily management is not optimistic and needs to be further improved. Attention should be paid to the individualized health education approach. **(Chen et al., 2018)**

Most PICC-line patients adapt well with minimal disruption to daily life. However major concerns are regarding coping at home with a PICC-line, dealing with complex information and the responsibility of patients/carers regarding PICC-line management. Therefore, individual needs for discharge education should be met appropriately, which can only be done after a thorough assessment of patient's existing knowledge and practices. **(Molloy et al., 2008)**

Majority of the patients who have a PICC line inserted are outpatient and have to visit the hospital every week for dressing change and insertion site assessment. So, to reduce the burden of hospital visits, patients can be empowered to care for PICC line at home by teaching them how to do self-assessment of PICC line and how to safely and correctly handle the line.

In a recent systematic review and meta-analysis of 23 studies and 57,250 patients, PICCs placed in hospitalized patients were associated with infection rates that were statistically similar to those related to other central venous catheters. **(Chopra et al., 2013)** Despite the important roles served by PICCs, PICC-associated bloodstream infection is a serious and often common complication that offsets many of the benefits offered by these vascular access devices.

Hypothesis

H1: There will be significant difference between pre & posttest knowledge scores regarding PICC line home care in patients discharged with PICC line as measured by structured questionnaire at $p \leq 0.05$ level of significance.

H2: There will be significant difference between pre & post-test practice scores regarding PICC line home care in patients discharged with PICC line as measured by structured questionnaire at $p \leq 0.05$ level of significance

Assumption

- Information provided by the participants will be truthful.
- Patients have some knowledge related to the PICC line home care, which is being practiced by them in caring for PICC at home

REVIEW OF LITERATURE

Reviewing literature is one of the most crucial steps in the development of research study. It helped with understanding and facilitated developing an insight into the problem. It also helped in the development of the

information booklet, tools, choosing research methodology for data collection and analysis and broad conceptual context into which the problem fits.

The review of literature is arranged in chronological order and divided into following sections.

Section A: Review of literature related to need for PICC line home care **Section B:** Review of literature related to knowledge about PICC

Section C: Review of literature related to PICC line and its complications **Section D:** Effectiveness of information booklet

Section A: Need for PICC Line Home Care in Patients with PICC

- **(Jiang et al., 2022):** Conducted an RCT on 90 haematological malignancy patients to evaluate a self-management education model based on protective motivation theory. The experimental group showed significantly higher scores in self-care responsibility, self-nursing skills, and health knowledge ($p < 0.05$), along with lower complication rates, proving the model highly salutary for patient self-management.
- **(Yi et al., 2022):** Evaluated an information-grounded nursing quality model in an outpatient department with 465 participants. The observation group demonstrated significantly increased PICC health knowledge, higher compliance scores, longer catheter placement times, and reduced complication rates (such as catheter slipping).
- **(Liu et al., 2021):** Studied risk factors for PICC-associated infections in 159 chemotherapy patients. Prolonged indwelling time, low WBC count, history of diabetes, and poor immunity were significantly related to infections ($P < 0.05$). A self-efficacy intervention significantly reduced complications like blockage and displacement.
- **(Liu et al., 2021):** Conducted a qualitative, phenomenological study on 18 outpatient cancer victims. Emerging themes showed that while living with a catheter presents lifestyle variations, utmost patients considered the PICC line a highly positive experience that did not diminish their overall quality of life.
- **(Parás-Bravo et al., 2018):** Conducted a systematic review of 36 reports and concluded that structured WeChat application follow-ups significantly improve patient satisfaction, PICC maintenance dependence, and self-care ability while reducing overall complications.
- **(Nicholson & Davies, 2013):** A qualitative study assessing lived experiences of day-care patients following PICC insertion. Key emerging themes highlighted pre-procedural anxiety, management strategies, and the critical need for robust information delivery by healthcare providers to alleviate patient distress.
- **(Molloy et al., 2008):** Surveyed ambulatory colorectal cancer patients and found that while the majority held favourable views towards PICC lines, significant concerns remained regarding coping at home, managing complex clinical information, and care responsibility.

Section B: Review of Literature Related to Knowledge About PICC Line

- **(Xu et al., 2020):** Surveyed 4,110 registered nurses across 91 hospitals regarding PICC sustenance knowledge. The mean score was 72.86 ± 14.86 , indicating a medium degree of knowledge. Factors such as age, professional title, and former history of specific training heavily impacted scores, highlighting the need for multi-channel education.
- **(Rani & Kaur, 2020):** Assessed 55 primary caregivers using a structured questionnaire. The majority (56.47%) possessed average knowledge, 38.18% had good knowledge, and 5.35% scored below average, demonstrating an urgent need for descriptive informational booklets for home care.
- **(Chen et al., 2018):** Investigated the Knowledge, Attitude, and Practice (KAP) status of 152 critically ill cancer patients discharged from ICUs. Results indicated that daily management KAP scores were not optimistic and were heavily influenced by patient age, residence, educational degree, and indwelling time.
- **(Souza et al., 2016):** Conducted a qualitative study with 9 neonatal ICU nurses. The findings concluded that while PICC lines are vital in neonatology, nurses must continually consolidate their technical knowledge through institutional protocols to ensure ethical and safe handling.
- **(Mou et al., 2015):** Evaluated KAP scores among 650 cancer patients. While overall KAP levels were adequate, occupation was significantly related to catheter knowledge, gender and insertion site affected clinical practice, and comorbidities influenced patient attitudes.

Section C: Review of Literature Related to PICC Line and its Complications.

- **(Liu et al., 2023):** A meta-analysis of 11 studies (1,919 subjects) showed that structured exercise remedies significantly increased venous blood flow velocity and decreased the prevalence of PICC-associated venous thromboembolism (VTE) for both short-term (<4 weeks) and long-term (4 weeks)

- interventions ($p < 0.00001$).
- **(Mitbander et al., 2022):** A retrospective cohort study tracking 3,235 solid tumor patients across 50 hospitals. Major PICC-related complications occurred in 15.2% of cases, with catheter occlusion being the most prevalent (10.0%), followed by DVT (3.6%) and CLABSI (2.5%).
 - **(Qian et al., 2021):** Evaluated bundle nursing care in 370 non-Hodgkin lymphoma (NHL) patients. Bundle nursing significantly reduced upper extremity deep venous thrombosis (UEDVT) rates to 9.73% compared to 18.92% in standard care ($P < 0.05$), while significantly improving nursing satisfaction.
 - **(Bessis et al., 2020):** Conducted a 7-year retrospective study of 11,334 hospital stays. PICC-associated bacteremia occurred in 2.27% of cases (highest in hematology and oncology units), leading to an alarming 22.09% mortality rate by Day 30 compared to 11.83% in the control group ($P < .05$).
 - **(Kramer et al., 2017):** A meta-analysis of 8 studies (12,879 subjects) revealed that antimicrobial-coated PICCs significantly reduced CLABSI incidence to 0.2% compared to 5.3% in non-antimicrobial catheters, establishing a strong protective effect for high-risk groups.
 - **(Kang et al., 2017):** Tracked 477 cancer patients and found that 17.0% developed PICC complications, translating to an incidence rate of 1.59 per 1,000 catheter days, with a median onset time of 38 days post-insertion.
 - **(Yamaguchi et al., 2017):** A multicentre study analysing 1,660 central lines in critically ill children. Central venous catheters (CVCs) carried a significantly higher risk of bloodstream infections compared to PICCs ($p = 0.037$), rendering PICCs a superior alternative for infection prevention.
 - **(Bortolussi et al., 2015):** Examined 48 patients and reported that distress and pain during PICC positioning were exceptionally low or null in over 93% of subjects. Weekly monitoring revealed minimal complications, and patients experienced a significantly improved quality of life.
 - **(Pongruangporn et al., 2013):** A nested case-control study identified key independent risk factors for PICC bloodstream infections, including congestive heart failure ($P = .003$), multi-lumen catheters ($P < .01$), and active chemotherapy ($P = .03$).

Section D: Effectiveness of Information Booklet

- **(Schmidt et al., 2022):** Examined 50 cancer patients and noted that 56.4% felt inadequately informed about fatigue at baseline. Following the introduction of a brief, accessible 9-page informational booklet, significant longitudinal advancements in patient knowledge and attitudes were recorded.
- **(Schiller et al., 2014):** Tested the utility of an educational booklet among 628 students using a pre-post-follow-up design. The low-threshold approach significantly enhanced condition-specific knowledge, helping individuals recognize symptoms and reducing barriers to seeking treatment.
- **(Petti & Scully, 2007):** Conducted a controlled study on oral cancer awareness using an informational leaflet. One-year post-intervention, the intervention group displayed significantly increased post-test knowledge scores, proving leaflets to be highly effective tools for long-term retention.

METHODOLOGY

This chapter outlines the methodology adopted to assess the effectiveness of an information booklet on the knowledge and practice of Peripherally Inserted Central Catheter (PICC) line home care among cancer patients discharged from BRAIRCH, AIIMS, New Delhi.

1. Research Approach and Design

A quantitative research approach utilizing a **pre-experimental one-group, pretest-post-test design** was adopted for this study. The structural representation of the design is illustrated below:

Day 1 (Pre-Test: K, P) → Day 1 (Intervention: X) → Day 7 (Post-Test I: K_I, P_I) → Day 14 (Post-Test II: K_{II}, P_{II})

- **K / P:** Baseline assessment of PICC line home care knowledge (K) and practice (P).
- **X:** Administration of a structured information booklet on PICC line home care (20-minute explanation and doubt clarification).
- **K_I / P_I:** First post-test assessment conducted 7 days post-intervention.
- **K_{II} / P_{II}:** Second post-test assessment conducted 14 days post-intervention.

2. Variables

- **Dependent Variables:** Knowledge and self-reported practice scores of patients regarding PICC line home care.
- **Independent Variable:** The validated Information Booklet on PICC line home care.
- **Demographic Variables:** Age, gender, family type, residence, marital status, religion, relationship with head of family, occupation, education, income, and health insurance.

- **Clinical Variables:** Primary diagnosis, stage of cancer, illness duration, history of previous PICC, PICC indwelling time, and ECOG performance status score.

3. Study Setting and Population

- **Setting:** Outpatient Department (OPD) and Day Care facility at B.R.A.I.R.C.H, All India Institute of Medical Sciences (AIIMS), New Delhi.
- **Target Population:** Cancer patients discharged with an indwelling PICC line from BRAIRCH, AIIMS.

4. Sample, Size, and Sampling Technique

- **Sampling Technique:** Non-probability convenience sampling.
- **Sample Size: 51 participants.** (Calculated with 95% power, 5% alpha error based on a 15-sample pilot study, accounting for a 10% attrition rate).
- **Inclusion Criteria:** 1. Diagnosed with an oncological disease and receiving outpatient treatment.

2. Discharged with a PICC line having an indwelling time of < 3 months.

3. Age > 18 years, able to understand Hindi or English, and consenting to participate.

- **Exclusion Criteria:** Uncooperative patients or individuals with a documented pre-existing psychiatric illness.

5. Ethical Considerations

- Approved by the Institutional Ethics Committee (IEC), AIIMS.
- Registered with the Clinical Trials Registry - India (**CTRI Number: CTRI/2022/12/047887**).
- Written informed consent and participant information sheets were administered. Confidentiality and anonymity were strictly maintained.

6. Data Collection Tools

All tools were developed by the researcher, translated into Hindi, and reverse-translated to ensure original conceptual meaning.

- **Tool 1: Socio-Demographic & Clinical Profile:** Captures 11 demographic and 6 clinical parameters (including ECOG performance status scale 0-5). Content validity index (**CVI = 1.0**) was established via medical and nursing experts. Test-retest reliability yielded a Pearson correlation of **r = 0.83**.
- **Tool 2: Structured Knowledge Questionnaire:** A 25-item multiple-choice questionnaire spanning three categories: General PICC knowledge, Care at home, and Complications. Correct responses score 1, incorrect score 0. Categorized using Bloom's cut-off point (**Tekle et al., 2020**): *Adequate (20-25)*, *Moderately Adequate (15-19)*, and *Inadequate (0-14)*. Validated with **CVI = 0.95** and test-retest reliability of **r = 0.81**.

Table 1: Blueprint of Knowledge Questionnaire

S.No.	Component	Item Number	Total Items	Percentage
1	Knowledge	2, 6, 8, 9, 12, 17, 22, 23	8	32%
2	Comprehension	1, 4, 7, 11, 19	5	20%
3	Application	10, 14, 18, 21	4	16%
4	Analysis	3, 5, 13, 24	4	16%
5	Evaluation / Synthesis	15, 16, 20, 25	4	16%
	Total		25 items	100%

Tool 3: Self-Reported Practice Questionnaire: A 10-item tool utilizing a 4-point Likert scale (1-Never, 2-Sometimes, 3-Often, 4-Always). Score range: 4–40. Bloom's classification: *Adequate* (32-40), *Moderately Adequate* (24-31), and *Inadequate* (4-23). Validated with **CVI = 1.0** and reliability of **r = 0.76**.

Table 2: Blueprint of Practice Questionnaire

S.No.	Component	Item Number	Total Items	Percentage
1	Preventing Infections	1, 4, 8, 10	4	40%
2	PICC Line Assessment	2	1	10%
3	Protection of PICC Line	3, 5, 6, 7, 9	5	50%
	Total		100%	

7. Pilot Study & Intervention Description

A pilot study on 15 eligible patients confirmed methodology feasibility.

- **The Intervention (Information Booklet):** Formulated through systematic literature review and oncology expert consultation. It covers PICC definitions, parts, indications, home care hygiene, infection control, flushing, dressing protocols, complication management, and an arm-assessment checklist (redness, swelling, numbness). Content layout was finalized by the Centre for Medical Education and Technology (CMET). Administered via a 20-minute one-to-one instructional session per participant.

8. Data Collection Procedure

Data was collected between September 2022 and December 2022.

1. **Day 1:** Screening, consent acquisition, demographic profiling, and baseline administration of the Knowledge Questionnaire and Self-Reported Practice Questionnaire (Pre-test).
2. **Day 1 (Immediate Post-test):** Individualized 20-minute explanation of the validated Information Booklet with doubt clarification. Patients retained copies for home reference.
3. **Day 7 (post-test I):** Re-assessment of knowledge and practice variables via direct interview/questionnaire completion.
4. **Day 14 (Post-test II):** Final follow-up assessment of knowledge and practice variables using identical metrics.

9. Data Analysis Plan

Data handling was implemented via SPSS Version 26.

- **Descriptive Statistics:** Frequency, percentage, mean, and standard deviation distributions. Data normality was confirmed using histograms.
- **Inferential Statistics:** Chi-square and Fisher's exact tests were executed to assess associations with categorical demographic profiles. Repeated Measures ANOVA with Bonferroni corrections was conducted to compare longitudinal mean scores across the time points. Statistical significance was designated at $p < 0.05$.

ANALYSIS AND INTERPRETATION

This chapter delineates with the results of the present study “A study to assess the effectiveness of an information booklet on knowledge and practice of PICC line home care in patients discharged with a PICC line at BRAIRCH, AIIMS New Delhi.” The results are based on the data collected from the subjects. All data were coded and entered in the master data sheet. After that data were analyzed based on the objectives of the study.

The objectives of the study are:

To evaluate the effectiveness of an information booklet on knowledge and practice regarding PICC line home care in patients discharged with PICC line. To seek association of pre-test knowledge and practice with selected demographic and clinical variables the data analyzed are organized based on the objectives of the study.

Section I: Demographic and clinical characteristics of patients with PICC line.

Section II: Effect of information booklet on knowledge of the patients regarding PICC line home care.

Section III: Effect of information booklet on self-reported practice of the patients regarding PICC line home care.

Section IV: Association of knowledge and practice with selected demographic and clinical variables.

Section I: This section deals with the demographic and clinical characteristics of the patients with PICC line

Table 4: Demographic variables of the patients

Demographic variables		Frequency (%)
Age (years)	19-40	24 (47.1)
	41-60	19 (37.2)
	>60	8 (15.7)
	Mean $\pm$ S.D	43 $\pm$ 15.96
	Range	19 -74
Gender	Male	25 (49.1)
	Female	26 (50.9)
Type of family	Nuclear	24 (47.1)
	Joint	27 (52.9)
Area of residence	Rural	20 (39.2)
	Urban	31 (60.8)
Religion	Hindu	45 (88.3)
	Muslim	4 (7.8)
	Other	2 (3.9)
Marital status	Married	34 (66.7)
	Unmarried	13 (25.5)
	Widowed	4 (7.8)
Patient relationship with caregiver	Self	5 (9.8)
	Husband/ wife	22 (43.2)
	Son/ daughter	10 (19.6)
	Others	14 (27.5)
Education	Primary school or below	5 (9.8)
	Middle school	10 (19.6)
	High school	15 (29.4)
	Diploma	1 (1.9)
	Graduate	14 (27.5)
	Postgraduate	6 (11.7)
Current occupational status	Employed	8 (15.7)
	Unemployed (health reasons)	15 (29.4)
	Unemployed (another purpose)	28 (54.9)
Occupation	Government job	5 (9.8)
	Private job	15 (29.4)
	Home makers	22 (43.2)
	Student	6 (11.7)
	Own business	3 (5.8)
Monthly salary (Rs)	<10,000	15 (29.4)
	10,000-30,000	20 (39.2)
	>30,000	16 (31.4)
Health insurance	Yes	10 (19.6)
	No	41 (80.4)

Out of 51 participants, the majority were aged 19–40 years (47.1%; Mean $\pm$ SD: 43 $\pm$ 15.96, Range: 19–74), females (50.9%), married (66.7%), and resided in urban areas (60.8%). Sociodemographically, most identified as Hindu (88.3%), lived in nuclear families (52.9%), and relied on a spouse as the primary caregiver (43.2%). Educational profiles showed a majority with high school qualifications (29.4%). Additionally, 54.9% were

unemployed (including 43.2% homemakers), 39.2% fell within the monthly income bracket of ₹10,000–30,000, and a substantial majority lacked health insurance (80.4%).

Table 5: Clinical variables of the patient

Clinical variables		Frequency (%)
Duration of illness (months)		10.33 ± 10.17* 8 (3-12) [#]
Co morbidity	Co morbid disease	15 (29.4)
	No co morbid disease	36 (70.6)
PICC indwelling time (days)		32.62 ± 23.45* 30 (11 – 60) [#]
Previous PICC line	Yes	14 (27.5)
	No	37 (72.5)
ECOG performance status scale	0	9 (39.2)
	1	20 (33.3)
	2	17 (33.3)
	3	5 (9.8)

*(Mean + SD), [#]median (25th percentile- 75th percentile)

Clinical profiling of the 51 participants revealed a mean illness duration of 10.33 ± 10.17 months and a mean PICC indwelling time of 32.62 ± 23.45 days. Most patients had no associated comorbidities (70.6%) and no history of a previous PICC line (72.5%). Regarding functional capacity, most of the participants presented with an ECOG performance status score of 0 (39.3%), indicating they were fully active.

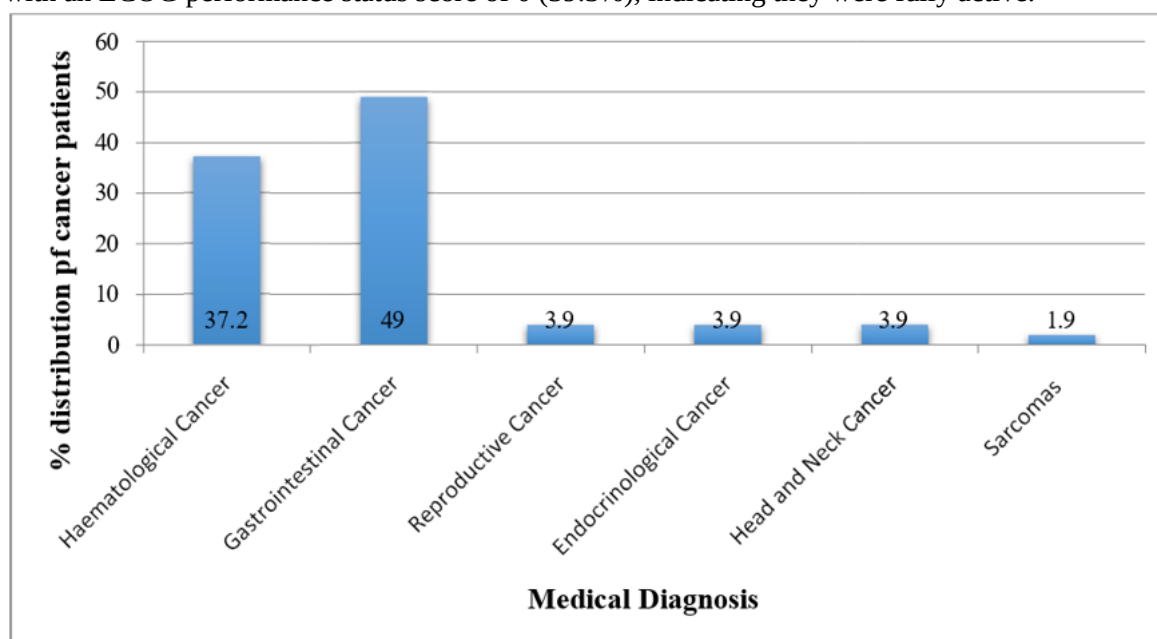


Figure 3: Diagnosis wise distribution of the patients

Regarding medical diagnoses (n=51), nearly half of the participants presented with gastrointestinal cancers (49.0%), followed by haematological malignancies (37.2%). Reproductive, endocrinological, and head and neck cancers accounted for 3.9% each, while sarcomas constituted the lowest proportion at 1.9%.

Table 6: Stage wise distribution of the patients

Stage of cancer		f	%
Solid tumors	Stage I	2	3.9
	Stage II	17	33.3
	Stage III	6	11.7
	Stage IV	10	19.6
Hematological cancers		16	31.4

Stage-wise distribution indicates that among patients with solid tumors, the majority presented with Stage II disease (33.3%), while the lowest proportion was diagnosed with Stage I (3.9%). Additionally, 31.4% of the participants had hematological malignancies for which traditional staging is not applicable.

Table 7: PICC indwelling time in patients

S.no.	Duration of PICC	f	%
1	<30 days	32	62.7
2	30-60 days	17	33.3
3	61-90 days	2	3.9

Regarding catheter longevity (n=51), the majority of the participants had a PICC indwelling time of less than 30 days (62.7%). This was followed by 33.3% of patients who maintained the PICC line for 30 to 60 days, while the lowest proportion (3.9%) retained it for 61 to 90 days.

Section II: Effect of information booklet on knowledge of the patients regarding PICC line home care.

This section addresses the primary objective of the study, evaluating the longitudinal impact of the validated information booklet on patients' knowledge scores regarding PICC line home care across the distinct testing intervals.

Table 8: Effectiveness of information booklet on knowledge of patients regarding PICC line home care

Scores	Mean $\pm$ SD			p-value	Mean difference with 95% CI	
	Pre-test	Post test - I	Post test- II		Pre-test & Post-test I	Pre-test & post II
Knowledge scores	16.01 $\pm$ 4.36	20.31 $\pm$ 3.18	19.60 $\pm$ 2.24	<0.001*	4.29 (3.79-4.79), p<0.001 [#]	3.58 (2.76-4.40), p<0.001 [#]
Repeated measure ANOVA* followed by Bonferroni [#] correction						

Longitudinal analysis of participants' knowledge scores (n=51) demonstrated significant enhancement across the testing intervals. Baseline pre-test knowledge scores (16.01 $\pm$ 4.36) increased significantly to 20.31 $\pm$ 3.18 at post-test I (Day 7) and sustained at 19.60 $\pm$ 2.24 at Post-test II (Day 14). Repeated Measures ANOVA confirmed a highly statistically significant difference across these three time points (p < 0.001).

Post-hoc analysis using Bonferroni correction revealed a significant mean increase of 4.29 (95% CI: 3.79–4.79; p < 0.001) from pre-test to post-test I, and a sustained significant mean increase of 3.58 (95% CI: 2.76–4.40; p < 0.001) from pre-test to post-test.

Consequently, the null hypothesis (H₀₁) was rejected, validating the alternative hypothesis (H₁). These findings conclusively prove that the structured information booklet is highly effective in systematically improving and maintaining patients' knowledge regarding PICC line home care.

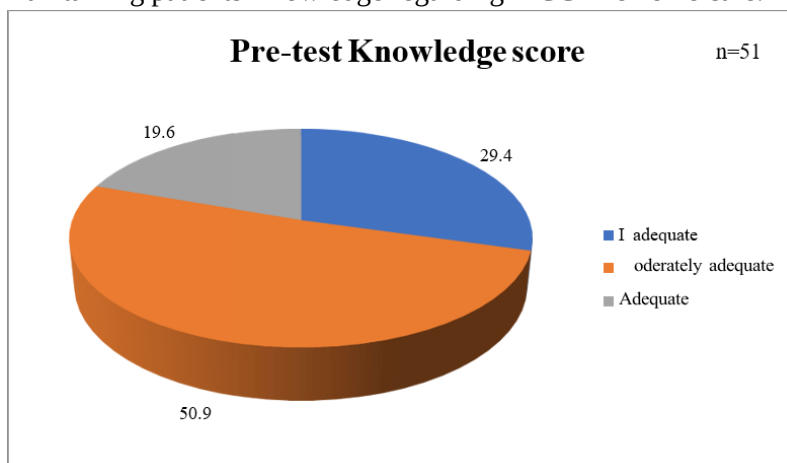


Figure 4: Percentage distribution of patients based on pre-test knowledge score

Baseline assessment (n=51) of pre-test knowledge scores regarding PICC line home care showed that over half of the participants possessed moderately adequate knowledge (50.9%), followed by 29.4% with inadequate knowledge, while only 19.6% demonstrated adequate knowledge

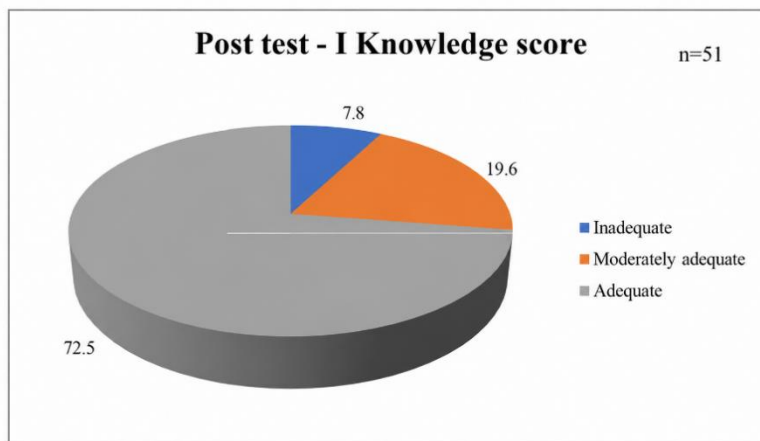


Figure 5: Percentage distribution of patients based on posttest I knowledge score

One-week post-intervention (n=51), the first post-test assessment demonstrated a substantial increase in proficiency, with the clear majority of participants achieving adequate knowledge scores (72.5%). Meanwhile, 19.6% demonstrated moderately adequate knowledge, and only a minimal proportion (7.8%) remained with inadequate knowledge.

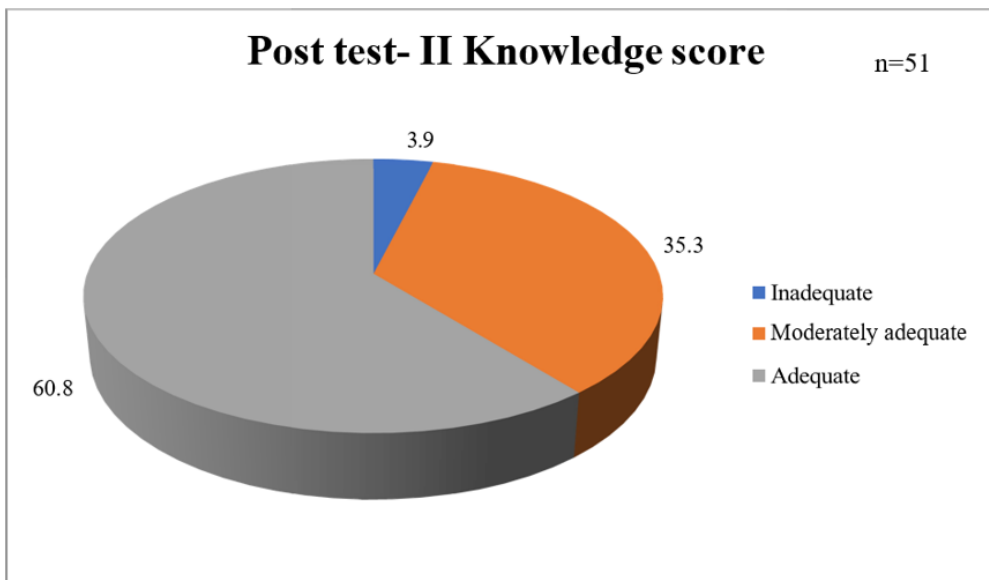


Figure 6: Percentage distribution of patients based on post-test II knowledge score

Figure 6 shows the percentage distribution of patients based on post-test II knowledge score. Majority of the patients had adequate knowledge (60.8%) regarding the PICC line home care two weeks after the intervention and 35.3% had moderately adequate knowledge. Only 3.9% had inadequate knowledge.

It is concluded that an information booklet is an effective method to increase the level of knowledge related to PICC line home care among the patients.

Section III: Effect of information booklet on practice of the patients regarding PICC line home care.

This section deals with the primary objective of the study, i.e. the effect of information booklet on practice regarding PICC line home care among patients discharged with PICC.

Table 9: Effectiveness of information booklet on self-reported practice of patients regarding PICC line home care

Scores	Mean $\pm$ SD			p value	Mean difference with 95% CI	
	Pre-test	Post test - I	Post test- II		Pre-test & posttest I	Pre-test & post II
Practice scores	31.33 $\pm$ 3.78	34.78 $\pm$ 2.75	33.58 $\pm$ 3.56	<0.001*	3.45 (2.78-4.11) p<0.001 [#]	2.25 (1.35-3.15) p<0.001 [#]
Repeated measure ANOVA* followed by Bonferroni [#] correction						

Table 9 shows that the patients mean practice scores of pre-tests, posttest- I, posttest- II. The mean pre-test, post-test- I, post-test- II practice scores were 31.33 ± 3.78 , 34.78 ± 2.75 and 33.58 ± 3.56 respectively. A statistically significant difference was found between the group means at three time points at $p\text{-value} < 0.001$ by using repeated measure ANOVA. Then to see mean at which two time points are statistically different Bonferroni correction is used. A statistically significant difference was found between the pre-test and post-test I with a mean difference of

3.45 (2.78-4.11) at $p < 0.001$. The mean practice score of pre-test & post II was also found to be statistically significant ($p < 0.001$) with a mean difference of 2.25 (1.35-3.15).

H2: There will be significant difference between pre & posttest practice scores regarding PICC line home care in patients discharged with PICC line as measured by structured questionnaire at $p \leq 0.05$ level of significance.

H0₂: There will be no significant difference between pre & posttest practice scores regarding PICC line home care in patients discharged with PICC line as measured by structured questionnaire at $p \leq 0.05$ level of significance

With regards to the above findings in table 9 the null hypothesis was rejected. It was concluded that an information booklet on PICC line home care is effective in improving the practice of PICC line patients one week after the intervention and 2 weeks after the intervention.

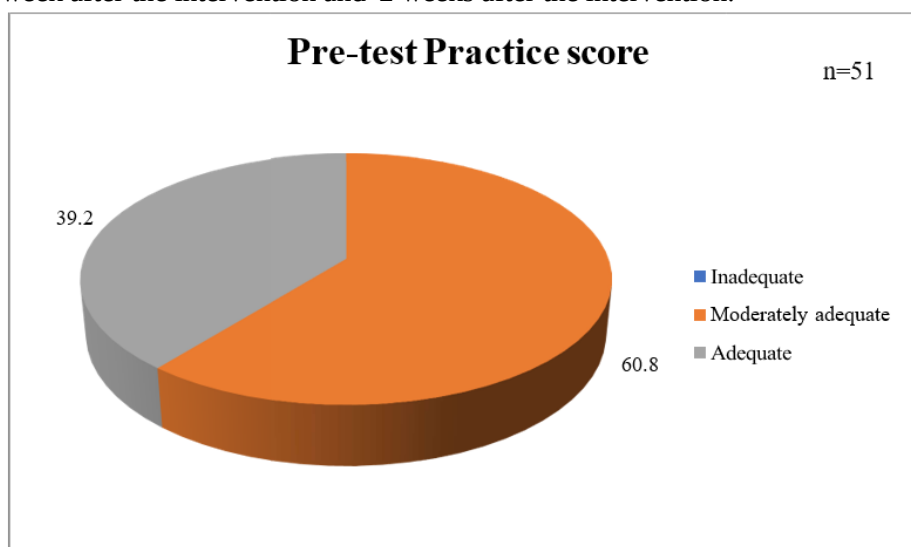


Figure 7: Percentage distribution of patients based on pre-test practice score

Figure 7 shows the percentage distribution of patients based on pre-test practice score. None of the patients had inadequate practice (0%) regarding PICC line home care before the intervention and 60.8% had moderately adequate practice. While 39.2% had adequate practice.

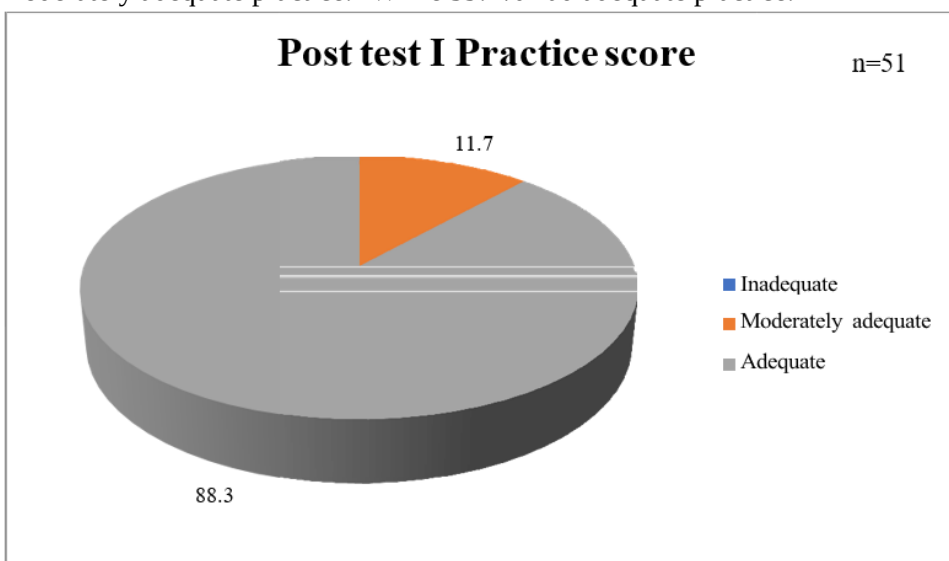


Figure 8: Percentage distribution of patients based on post-test I practice score

Figure 8 shows the Percentage distribution of patients based on post-test I Practice scores. Majority of the patients had adequate practice (88.3%) regarding PICC line home care one week after the intervention and 11.7% had moderately adequate practice. None of the patients had inadequate practice (0%).

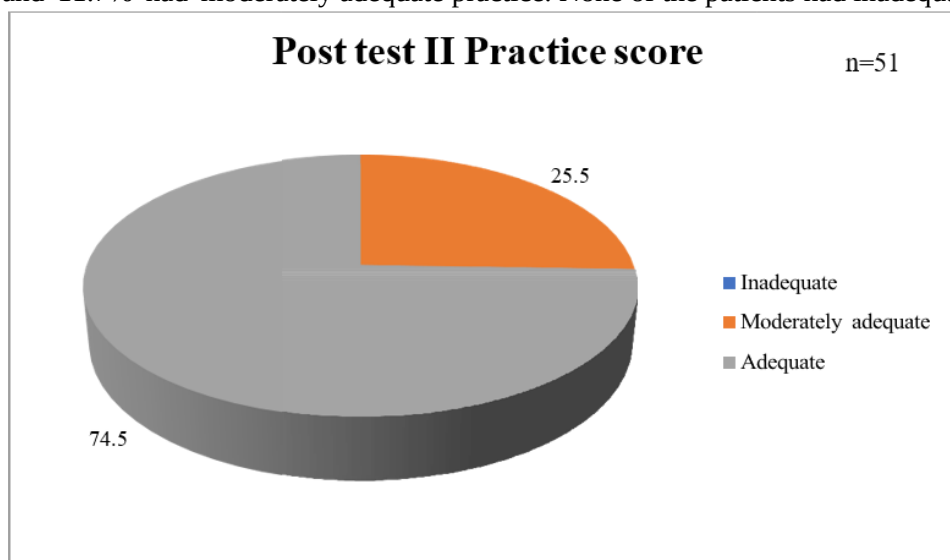


Figure 9: Percentage distribution of patients based on post-test II practice score

Figure 9 shows the percentage distribution of patients based on post-test II practice score. Majority of the patients had adequate practice (74.5%) regarding the PICC line home care two weeks after the intervention and 25.5% had moderately adequate knowledge. None of the patients had inadequate practice (0%).

It is concluded that an information booklet is an effective method to improve the practices of the patients related to PICC line home care.

Section IV: Association of knowledge and practice with selected demographic and clinical variables.

Section IV deals with the secondary objective of the study i.e. association of pre-test knowledge and practice with selected demographic and clinical variables

Table 10: Association of baseline knowledge and selected demographic and clinical variables

Demographic variable		Level of knowledge f (%)			p value
		Poor	Moderate	Good	
Age (years)	18-40 years	9 (37.50)	11 (45.83)	4 (16.67)	0.604
	41-60 years	5 (26.32)	9 (47.37)	5 (26.32)	
	>60 years	1 (12.50)	6 (75)	1 (12.50)	
Gender	Male	8 (32)	13 (52)	4 (16)	0.869
	Female	7 (26.92)	13 (50)	6 (23.08)	
Area of residence	Rural	8 (40)	10 (50)	2 (10)	0.264
	Urban	7 (22.58)	16 (51.61)	8 (25.81)	
Education	Primary school or below	3 (60)	1 (20)	1 (20)	0.093
	Middle school	2 (20)	4 (40)	4 (40)	
	High school	6 (40)	9 (60)	0 (0)	
	Diploma	1 (100)	0 (0)	0 (0)	
	Graduate	2 (14.29)	9 (64.29)	3 (21.43)	
	Postgraduate	1 (16.67)	3 (50)	2 (33.33)	
Occupation	Government job	0 (0)	4 (80)	1 (20)	0.476
	Private job	6 (40)	7 (46.67)	2 (13.33)	
	Home makers	5 (22.73)	12 (54.55)	5 (22.73)	

	Student	3 (50)	1 (16.67)	2 (33.33)	
	Own business	1 (33.33)	2 (66.67)	0 (0)	
Co morbidity	No Co morbid disease	13 (36.11)	16 (44.44)	7 (19.44)	0.327
	Co morbid disease	2 (13.33)	10 (66.66)	3 (20)	
Previous PICC line	Yes	5 (35.71)	7 (50)	2 (14.29)	0.842
	No	10 (27.03)	19 (51.35)	8 (21.62)	

*p value<0.05

Table 10 shows the association of pre-test knowledge and selected demographic and clinical variables such as age, gender, area of residence, education, occupation, co morbidity and previous PICC line. None of the variables were found to have any significant association with the pre-test knowledge of the patients.

Table 11: Association of baseline practice and selected demographic and clinical variables

Demographic variable		Level of practice f (%)		p value
		Moderate	Good	
Age (years)	18-40 years	17 (70.83)	7 (29.17)	0.459
	41-60 years	10 (52.63)	9 (47.37)	
	>60 years	4 (50)	4 (50)	
Gender	Male	15 (60)	10 (40)	0.910
	Female	16 (61.54)	10 (38.46)	
Area of residence	Rural	11 (55)	9 (45)	0.349
	Urban	20 (64.52)	11 (35.48)	
Education	Primary school or below	4 (80)	1 (20)	0.554
	Middle school	5 (50)	5 (50)	
	High school	11 (73.33)	4 (26.67)	
	Diploma	1 (100)	0 (0)	
	Graduate	7 (50)	7 (50)	
	Postgraduate	3 (50)	3 (50)	
Occupation	Government job	4 (80)	1 (20)	0.749
	Private job	10 (66.67)	5 (33.33)	
	Home makers	11 (50)	11 (50)	
	Student	4 (66.67)	2 (33.33)	
	Own business	2 (66.67)	1 (33.33)	
Co morbidity	No Co morbid disease	22 (61.11)	14 (38.89)	0.535
	Co morbid disease	9 (60)	6 (40)	
Previous PICC line	Yes	8 (57.14)	6 (42.86)	0.493
	No	23 (62.16)	14 (37.84)	
ECOG performance status scale	0	5 (55.56)	4 (35)	0.769
	1	13 (65)	7 (35)	
	2	11 (64.71)	6 (35.29)	
	3	2 (50)	2 (50)	
	4	0 (0)	1 (100)	

*p value<0.05

Table 11 shows the association of pre-test practice and selected demographic and clinical variables such as age, gender, area of residence, education, occupation, co morbidity, previous PICC line and ECOG

performance status. None of the variables were found to have any significant association with the pre-test practice of the patients.

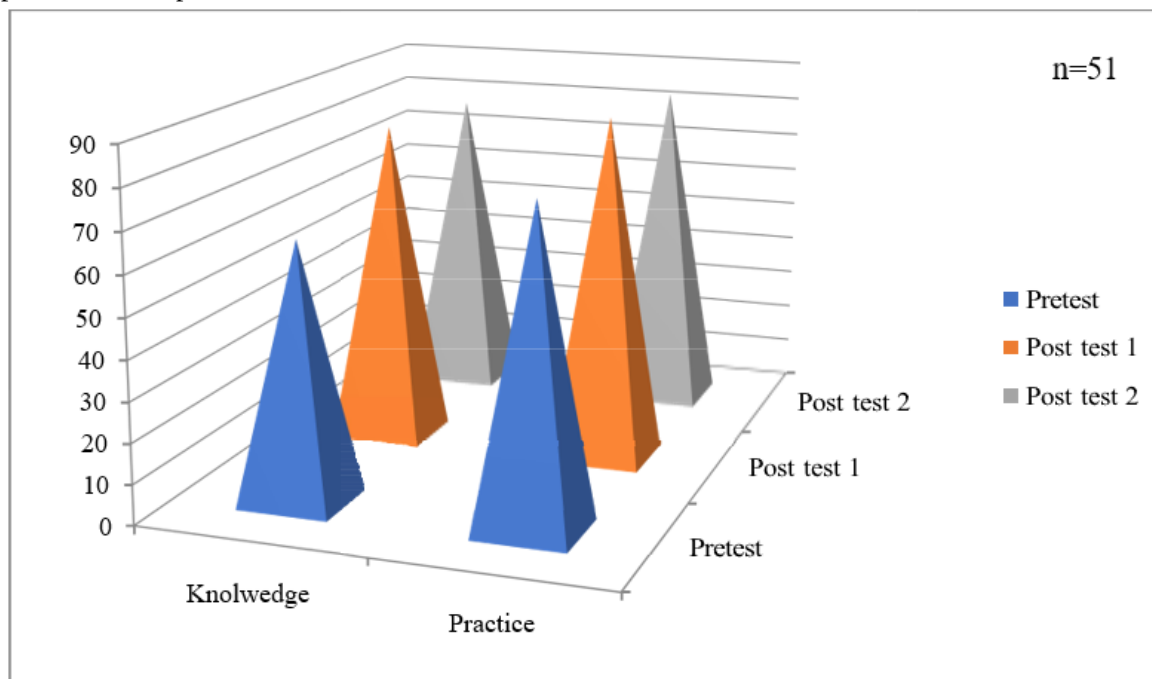


Figure 10: Effect of information booklet on patient's knowledge and self-reported practice

Figure 10 shows the effect of information booklet on patient's knowledge and practice level. The pre-test knowledge score of the patients was 64.4% and the pre-test practice score was 78.2%. The post-test knowledge score of the patients increased to 81.2% and post-test practice score increased to 87% one week after the intervention. The post-test knowledge score of the patients was 78.4% and post-test practice score was 84% two weeks after the intervention which is higher than the pre-test score but lower than post-test I score.

It is concluded that an information booklet is an effective teaching method to increase the knowledge of PICC line patients, who implement the knowledge in caring of their PICC lines at home thereby improving the practice of the patients one week and two weeks after the intervention.

This chapter dealt with the objective wise analysis and interpretation of the data. The study findings denoted that the information booklet on PICC line home care among PICC line patients increases the knowledge one week and two weeks after the intervention which facilitates implementing that knowledge in their daily home care thereby it improves the practice of the patients one week and two weeks after the intervention.

DISCUSSION

This study evaluated the longitudinal effectiveness of a structured informational booklet on the knowledge and self-reported practices regarding Peripherally Inserted Central Catheter (PICC) line home care among cancer patients discharged from BRAIRCH, AIIMS, New Delhi.

1. Baseline Assessment of Knowledge and Practice

At baseline, the mean pre-test knowledge score of the participants was 16.01 ± 4.36 , with the majority (50.9%) presenting with moderately adequate knowledge and 29.4% presenting with inadequate knowledge. This clinical deficit indicates a substantial gap in formal discharge education.

This baseline finding strongly aligns with the study by (Rani & Kaur, 2020) who assessed primary caregivers of patients with PICC lines and reported that the majority possessed only average baseline knowledge. They conceptualized that while patients or caregivers acquire elementary familiarity by observing clinical nurses practicing catheter care in hospital wards, it lacks the technical depth required for independent home management. Similarly, the initial moderate proficiency observed in this cohort is highly consistent with the findings of (Chen et al., 2018), who demonstrated that the overall Knowledge, Attitude, and Practice (KAP) matrix regarding daily PICC maintenance in critically ill oncology patients remains at a medium, non-optimistic level, leaving immense room for structured educational programs.

Regarding baseline clinical status, most participants (72.5%) had no prior experience with a PICC line. This clinical profile is heavily corroborated by (Molloy et al., 2008), who established that for most ambulatory oncology cohorts, navigating a PICC line is an entirely novel and anxiety-inducing experience. Furthermore, it supports the epidemiological data presented by (Parás-Bravo et al., 2018), where 77.8% of the subjects were handling a central venous access device for the first time, underscoring the acute necessity for early

instructional aids prior to hospital discharge.

2. Effectiveness of the Information Booklet on Knowledge Enhancement

Following the implementation of the validated informational booklet, a profound longitudinal escalation in knowledge metrics was recorded. The mean knowledge scores significantly advanced from a baseline of 16.01 ± 4.36 to 20.31 ± 3.18 at post-test I (Day 7), stabilizing at 19.60 ± 2.24 at Post-test II (Day 14) ($p < 0.001$).

This notable expansion in clinical understanding confirms that targeted educational materials are robust drivers of cognitive retention. These results match the observations of (Pushpakala & Ravinath, 2014), who demonstrated that structured training modules and instructional materials regarding central venous catheter care yield massive improvements in standardized knowledge scores. Additionally, the sustained efficacy observed between Day 7 and Day 14 mirrors the experimental patterns documented by (Schmidt et al., 2022), who highlighted that low-threshold, highly accessible information booklets systematically enhance patient knowledge and structural empowerment over extended longitudinal intervals (from baseline across subsequent monthly evaluations).

3. Impact of the Information Booklet on Clinical Practice and Future Implications

Parallel to knowledge progression, the cohort's self-reported practice scores exhibited an exceptional shift. The baseline practice mean of 31.33 ± 3.78 increased significantly to 34.78 ± 2.75 at post-test I, with 88.3% of participants attaining excellent, adequate practice levels ($p < 0.001$). At Post-test II (Day 14), proficiency remained highly significant at 33.58 ± 3.56 ($p < 0.001$). No significant statistical associations were observed between pre-test scores and any demographic or clinical variables, indicating that the baseline knowledge deficits and subsequent behavioural improvements were uniform across the entire sample size ($n=51$).

However, an important clinical trend was identified: both knowledge and practice scores experienced a minor statistical decline at Post-test II (Day 14) when cross-examined against the peak values achieved at post-test I (Day 7). This marginal regression over time reveals a crucial behavioural insight: while a single administration of an informational booklet is highly powerful in initiating safe self-care actions, cognitive decay can occur. Consequently, these findings highlight a vital clinical need for continuous reinforcement and structured counselling sessions during routine OPD follow-ups to permanently anchor safe PICC line practices, minimize late-stage complications, and ensure long-term catheter preservation at home.

4. Strengths, Limitations and Recommendations of the study

4.1 Strengths of the Study

- **Pioneering Clinical Research:** This study stands out as a pioneering clinical research effort, as it is the very first to systematically assess and document the effectiveness of a structured information booklet on Peripherally Inserted Central Catheter (PICC) line home care specifically tailored for cancer outpatients within an Indian clinical setting.
- **Addressing a Literature Gap:** Up to the present time, a rigorous review of literature revealed no similar published research reports or structured educational protocols regarding this crucial outpatient safety topic within India, making this study highly valuable for local oncology care.

4.2 Limitations of the Study

- **Single-Center Setting Constraints:** A primary methodological limitation is that this investigation was conducted as a single-setting study localized within a single tertiary care oncology department (BRAIRCH, AIIMS, New Delhi). Consequently, the findings might have geographical limitations and may not be fully generalized to diverse community hospitals or varying socio-cultural patient populations across the country.
- **Potential Self-Reported Practice Bias:** The evaluation of post-intervention behavioral changes relied entirely on the patients' self-reported practices. Because actual daily maintenance routines and aseptic techniques could not be directly observed or audited in real-time within the private households of the participants, this data-gathering approach might have introduced a certain degree of response, recall, or social desirability bias to some extent.

4.3 Recommendations for Future Research

- **Multicentre Collaborative Studies:** It is highly recommended that similar multi-centre collaborative research studies be initiated across diverse private and government oncology settings, utilizing a significantly larger and more diverse sample size to achieve broader generalizability and validate these educational outcomes on a national scale.
- **Qualitative and Mixed-Method Investigations:** Future qualitative or mixed-method studies should be conducted to deeply explore the psychological aspects of living with an indwelling catheter, specifically evaluating how PICC line home care impacts patient anxiety, caregiver burden, and the overall emotional well-being of oncology families.

- **Longitudinal Evaluation of Knowledge Retention:** Future researchers should design longitudinal studies spanning a longer duration that incorporate multiple interactive teaching reinforcement sessions and structured long-term follow-ups. This will allow for a more precise assessment of the exact timeline of knowledge decay and the long-term retention of safe home care practices over extended chemotherapy courses.

5. Implications of the study

5.1 Implications for Nursing Practice

- **Standardizing Outpatient Discharge Education:** Clinical nurses serve as the primary cornerstone in providing health education to vulnerable patient populations. The validated information booklet developed in this study provides clinical oncology nurses with a standardized, evidence-based instructional tool to confidently teach cancer patients who are being discharged with a PICC line from outpatient department (OPD) and day-care settings regarding the critical nuances of home care.
- **Implementation of Continuous Reinforcement:** To proactively combat natural cognitive decay and sustain high practice compliance over time, bedside and OPD nurses must deliver continuous verbal reinforcement and micro-counselling sessions during every routine follow-up or flushing visit. This regular reinforcement is essential to facilitate the long-term retention of knowledge and prevent late-stage line complications.

5.2 Implications for Nursing Education

- **Academic Aid for Clinical Training:** The developed information booklet can serve as an excellent institutional educational aid within nursing colleges. Nursing educators can integrate this specialized module into classroom and clinical teaching to train nursing students on the practical and technical aspects of PICC line home care, thereby preparing them to become competent educators before they enter professional practice.
- **Structured In-Service Education Programs:** Continuous professional development is vital to maintain high standards of patient safety. Hospital nursing service administrations should regularly conduct structured in-service education programs and hands-on workshops regarding vascular access device care to constantly update the technical knowledge, clinical skills, and counselling capabilities of working clinical nurses.

5.3 Implications for Nursing Administration

- **Institutional Resource Allocation:** Nursing administrative leaders should take proactive measures to ensure that this verified information booklet is printed in local languages and made actively available as a standard resource across all oncology wards, day-care units, and Outpatient Departments (OPDs). This will empower both nursing and medical personnel to utilize uniform, high-quality material for comprehensive discharge teaching.
- **Mandating Clinical Intervention Protocols:** Hospital administrators should facilitate the early development, official approval, and clinical implementation of structured, uniform intervention protocols for PICC line home care across all Day care units, OPDs, and clinical wards. Establishing these standard clinical pathways on an early basis will reduce practice variations, enhance institutional quality metrics, and safeguard patient outcomes.

CONCLUSION

The present study was conducted to assess the effectiveness of an information booklet on knowledge and self-reported practices regarding PICC line home care among cancer patients discharged with a PICC line from BRAIRCH, AIIMS, New Delhi. The findings demonstrated that the educational intervention significantly improved both knowledge and practice scores among participants.

The baseline assessment revealed that many patients possessed only moderate knowledge and practice regarding PICC line home care, indicating the need for structured educational support before discharge. Following the administration of the information booklet, a statistically significant improvement was observed in knowledge scores at both one-week and two-week follow-up assessments. Similarly, self-reported practice scores showed significant enhancement after the intervention, reflecting improved patient confidence and adherence to recommended PICC line care practices.

Although a slight decline in scores was observed between the first and second post-tests, both knowledge and practice levels remained significantly higher than baseline values, indicating sustained benefits of the intervention. Furthermore, no significant association was found between baseline knowledge and practice scores and selected demographic or clinical variables, suggesting that the educational booklet was beneficial across different patient groups.

Based on these findings, it can be concluded that a structured information booklet is an effective, simple, and cost-efficient educational strategy for improving knowledge and promoting safe PICC line home care practices

among cancer patients. Incorporating such educational materials into routine discharge planning and reinforcing the information during follow-up visits may contribute to better patient outcomes, reduced complications, and enhanced quality of care.

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