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Knowledge, Attitudes, and Practices (KAP) Assessment Regarding the Home Storage and Use of Oral Chemotherapy Drugs Among Parents of Children with Cancer

Sara Jahangiri[1], Mohammad Reza Mosaddegh[2]*, Omid Arasteh[3], and Azam Shamekhi[1]

[1] Master of Nursing, Dr. Sheikh Children's Hospital, Mashhad University of Medical Sciences, Iran.
[2] Nursing Manager, Dr. Sheikh Children's Hospital, Mashhad University of Medical Sciences, Iran.
[3] Department of Clinical Pharmacy, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran.

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ABSTRACT

Childhood cancer treatment often includes prolonged home-based maintenance therapy, during which parents administer oral chemotherapeutics such as 6-mercaptopurine (6-MP) and methotrexate. Safe storage, handling, and administration are essential, yet caregivers may face knowledge gaps, stress, and practical barriers. This study assessed parents' knowledge, attitudes, and practices (KAP) regarding home storage and use of oral chemotherapy and examined factors associated with safe practice. This descriptive cross-sectional study was conducted in the outpatient chemotherapy department of Dr. Sheikh Hospital, Mashhad. Ninety-two parents of children with cancer completed a researcher-made questionnaire covering demographics, KAP, information sources, and educational needs. Data were analyzed using SPSS version 24 with descriptive statistics and non-parametric tests at a 0.05 significance level. Parents demonstrated moderate knowledge, positive attitudes, and high practice scores. Knowledge was positively correlated with practice ($r = 0.362$, $p < 0.001$) and was the only significant predictor ($B = 1.079$, $p < 0.001$). Attitude was not significantly associated with knowledge or practice, and KAP scores did not differ significantly by gender or education (all $p > 0.05$). These findings support structured, timely, and standardized caregiver education.

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Corresponding Author: Mohammad Reza Mosaddegh
Nursing Manager, Dr. Sheikh Children's Hospital, Mashhad University of Medical Sciences, Iran; mosaddeghmr1@gmail.com

INTRODUCTION

Although childhood cancers account for only about 1% of all cancer cases, they contribute significantly to disease-related mortality in this age group [1]–[3]. The most common types of these cancers include leukemia, brain and central nervous system tumors, lymphomas, and solid tumors such as neuroblastoma [4], [5]. Among these, leukemia alone constitutes approximately 25-35% of all childhood cancers, and its standard treatment is based on combination chemotherapy regimens [1].

Successful treatment does not end with pharmacological intervention in the hospital; a major part of it involves a long-term maintenance and monitoring phase conducted at home. During this phase, the role of the child's primary caregivers, predominantly parents, as executors of the treatment plan at home becomes crucial. These parents not only shoulder the heavy responsibilities associated with the disease, including managing side effects and monitoring symptoms, but also bear the burden of the child's daily care [6]–[8]. This situation is psychologically draining, and stress and depression are more prevalent among these parents [9]–[11].

Nowadays, with treatment paradigms shifting towards increased use of oral medications, a significant portion of the responsibility for administering chemotherapy drugs has been transferred to parents. For instance, the standard treatment for Acute Lymphoblastic Leukemia (ALL) requires two years of drug therapy, with its 70-week maintenance phase relying primarily on oral drugs such as 6-Mercaptopurine (6MP) and Methotrexate (MTX) [12]. During this phase, parents are responsible for the correct and continuous administration of these drugs at home [13], [14]. Studies show that adherence of less than 95% to 6MP is associated with a 3.1-fold increased risk of disease relapse; nevertheless, approximately 30% of children are non-adherent to the prescribed dosage [15]. Medication administration errors have also been reported in 10-40% of children receiving oral chemotherapy at home [13].

Adherence to the care plan is a complex behavior influenced by multiple factors. For parents, the precise implementation of the medication schedule during the maintenance phase can face significant practical challenges due to reasons such as lack of child cooperation, difficult dosage preparation, the need to alter daily routines, and the occurrence of side effects like nausea [16], [17]. Since patient visits to the clinic decrease during this phase, healthcare professionals may not be fully aware of the extent of these problems at home and, consequently, may not provide the necessary interventions to facilitate adherence [17].

In this complex context, assessing the Knowledge, Attitude, and Practice of parents is of fundamental importance. Accurate knowledge empowers parents to understand treatment options and manage drug effects, a positive attitude provides

essential emotional support, and correct practice ensures the effective implementation of the treatment plan [18], [19]. However, the key challenge remains: Are parents adequately informed about the various aspects of oral chemotherapy, from storage and safe handling precautions to managing side effects and drug interactions [20]? Often, education is provided during the short initial hospitalization, and parents facing everyday realities at home may encounter conflicting or insufficient information, leading them to seek answers from unverified sources like the internet or other parents. This underscores the increasing need to receive correct, timely, and individually tailored information [9], [21]–[23].

Although previous studies have examined adherence to oral chemotherapy and parents' general information needs [13], [16], [20], the specific knowledge gap addressed in this study remains twofold. First, most existing research has focused on adherence to 6-MP and MTX rather than on the practical competencies of home storage, safe handling, and disposal of oral chemotherapeutics, which are distinct and equally safety-critical behaviors. Second, evidence on parents' KAP in this domain is scarce in Middle Eastern and low-resource settings, where cultural, educational, and logistical factors may shape caregiving practices differently from high-income contexts. As a result, it remains unclear whether parents possess adequate knowledge, hold positive attitudes, and perform safe practices regarding home storage and administration, and which of these factors most strongly determines safe practice. This study was therefore designed to address this gap by determining the level of knowledge, attitude, and practice of parents of children with cancer regarding the home storage and administration of oral chemotherapy drugs, and by identifying the determinants of safe practice. The findings can provide the necessary basis for designing targeted, context-appropriate educational interventions and supporting families, ultimately enhancing the quality of care and treatment outcomes for these children.

METHOD

Study design: This study was designed as a descriptive-cross-sectional investigation with the primary aim of assessing the knowledge, attitude, and practice of parents of children with cancer regarding the storage and administration of oral chemotherapy drugs at home. The research was conducted during the three last months of 2025 in the outpatient chemotherapy department of Dr. Sheikh Hospital in Mashhad. The study population consisted of all parents of children under 18 years of age diagnosed with cancer and undergoing treatment with oral chemotherapy drugs at this center.

Inclusion criteria: (1) being a parent or legal guardian of a child under 18 years diagnosed with cancer; (2) the child was receiving at least one oral chemotherapy drug; (3) the parent was the primary person responsible for managing the medication at home; and (4) at least one month had elapsed since the start of oral chemotherapy.

Exclusion criteria: (1) withdrawal from continued participation; (2) the parent had a severe neuropsychological disorder affecting comprehension or responsiveness; and (3) incomplete questionnaire responses (more than 20% of items unanswered).

Sample Size: The sample size was calculated using the formula for estimating a single proportion in descriptive studies:

$$n = (Z^2 \times p \times (1 - p)) / d^2$$

where $Z = 1.96$ (95% confidence level), $p = 0.5$ (assumed proportion, used to maximize sample size), and $d = 0.05$ (margin of error). Substitution yielded $n = 384$. Because the study population (parents of children receiving oral chemotherapy at this center) was limited, the finite population correction was applied using $N \approx 110$ eligible parents, yielding an adjusted sample of approximately 76 participants. Accounting for an anticipated 20% non-response rate, the final target sample size was set at 92 parents.

Sampling method: Participants were recruited using convenience sampling. During the study period, all parents of children receiving oral chemotherapy who attended the outpatient oncology clinic and met the inclusion criteria were approached. Parents who were available during the data collection period, met the eligibility criteria, and agreed to participate were enrolled consecutively until the target sample size (n = 92) was reached. This sampling approach was chosen because the study population was limited and the clinic setting allowed direct, consecutive access to eligible caregivers.

Data collection tool: It was a researcher-made questionnaire comprising five main sections: demographic information, knowledge assessment (10 questions), attitude assessment (3 questions), practice assessment (8 questions), and evaluation of information sources and educational needs.

Validity and reliability: Content and face validity were established by a panel of five experts (one clinical pharmacologist, the head nurse of the pediatric oncology department, two ward nurses, and one nursing faculty member). Items were reviewed for relevance, clarity, and cultural appropriateness, and minor revisions were made accordingly. Reliability was assessed using the test-retest method: the questionnaire was administered to 15 parents on two occasions, two weeks apart, and the consistency of responses across the two administrations was examined. The test-retest results

indicated acceptable reliability of the instrument. The final questionnaire was thus considered valid and reliable for the purpose of this study.

Scoring: The knowledge subscale comprised 10 items, each scored 1 for a correct response and 0 for an incorrect or "don't know" response (total range 0–10). The attitude subscale comprised 3 items and the practice subscale comprised 8 items, each rated on a 5-point Likert scale (1–5), yielding total ranges of 3–15 and 8–40, respectively. Higher scores indicate more favorable knowledge, attitude, and practice.

Ethical considerations: The study protocol was reviewed and approved by the Research Committee of Dr. Sheikh Pediatric Super-Specialty Hospital. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. All parents were informed about the purpose and procedures of the study, and written informed consent was obtained from each participant before data collection. Participation was voluntary, and parents could withdraw at any time without affecting their child's care. All data were kept confidential and used solely for research purposes.

Analytical methods: The collected data were analyzed using SPSS version 24 at a significance level of 0.05. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize the data. Non-parametric tests were used in the analytical statistics section.

RESULT AND DISCUSSION

Result

A total of 92 parents of children with cancer participated in the study. The demographic and background characteristics of the participants are summarized in Table 1. The majority were mothers (71.7%), lived in urban areas (77.8%), and held a high school diploma (44.9%). The most common sources of information reported by caregivers were physicians (68.5%), followed by nurses (40.4%). Only a small proportion used brochures (9.0%), the internet (11.2%), or pharmacists (3.4%). Regarding educational needs, the topics most frequently identified as requiring further education were side-effect management (45.5%), drug interactions (36.4%), and safe disposal of medication (17.0%).

Table 1. Demographic and Background Characteristics of Participants (N = 92)

Characteristic	Category	n	%
Gender	Male	26	28.3
	Female	66	71.7
Education	Illiterate	2	2.2
	Less than high school	23	25.8
	High school diploma	40	44.9

Characteristic	Category	n	%
	Associate/Bachelor's degree	19	21.3
	Master's degree and above	5	5.6
Relationship to child	Father	26	28.3
	Mother	66	71.7
Place of residence	City	70	77.8
	Village	20	22.2
Main information source*	Physician	61	68.5
Main information source*	Nurse	36	40.4
Main information source*	Pharmacist	3	3.4
Main information source*	Brochure	8	9
Main information source*	Internet	10	11.2
Main information source*	Other	3	3.4
Topics of educational needs*	Medicine storage	36	40.9
Topics of educational needs*	Preparation and administration of medication	20	22.7
Topics of educational needs*	Safe disposal of medication	15	17
Topics of educational needs*	Side effects	40	45.5
Topics of educational needs*	Drug interactions	32	36.4
Topics of educational needs*	Other	5	5.7

Note. *Multiple responses were allowed; therefore, percentages may sum to more than 100%. Percentages are based on N = 92. Percentages for education may not sum exactly to 100% due to rounding.

Descriptive statistics for the main study variables are presented in Table 2. The mean knowledge score was 5.57 (SD = 2.03) out of a possible 0–10, the mean attitude score was 10.66 (SD = 2.11) out of 3–15, and the mean practice score was 33.61 (SD = 3.99) out of 8–40. Although 92 parents returned the questionnaire, the number of analyzable responses varied slightly across subscales (knowledge: n = 91; attitude: n = 91; practice: n = 90) owing to missing responses to individual items; similarly, missing data for some background variables (e.g., parent age, child age, time since diagnosis, and duration of medication) reduced the analyzable sample for those items. These missing values were handled by available-case analysis, and no imputation was performed.

Table 2. Descriptive Statistics of Quantitative Variables

Variable	N	Min	Max	Mean	SD
Parent Age (years)	80	21.00	57.00	35.19	6.62
Child Age (years)	87	1.50	18.00	7.07	3.75
Time since diagnosis (months)	84	1.00	84.00	17.85	14.99
Duration of medication (months)	55	0.25	60.00	13.43	13.79
Knowledge score (range 0–10)	91	0.00	9.00	5.57	2.03
Attitude score (range 3–15)	91	5.00	15.00	10.66	2.11
Practice score (range 8–40)	90	20.00	40.00	33.61	3.99

Note. N varies across variables because of missing responses to individual items (available-case analysis; no imputation). Possible score ranges are shown in parentheses for the KAP subscales.

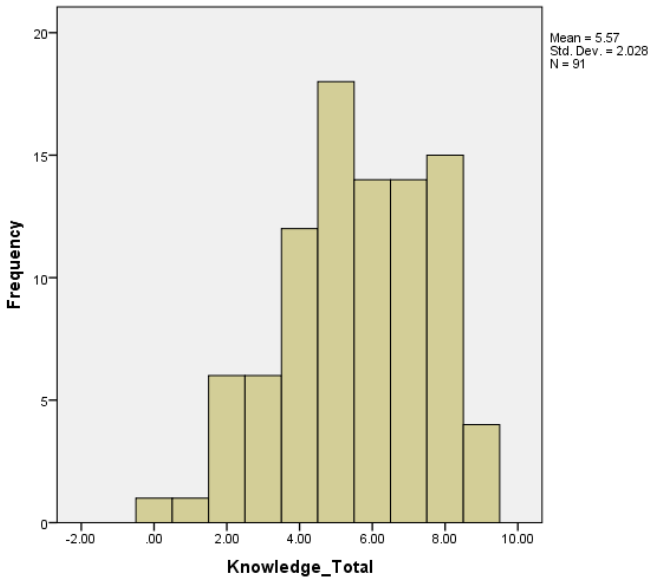


Figure 1. Histogram of total knowledge scores among parents of children with cancer (N = 91).

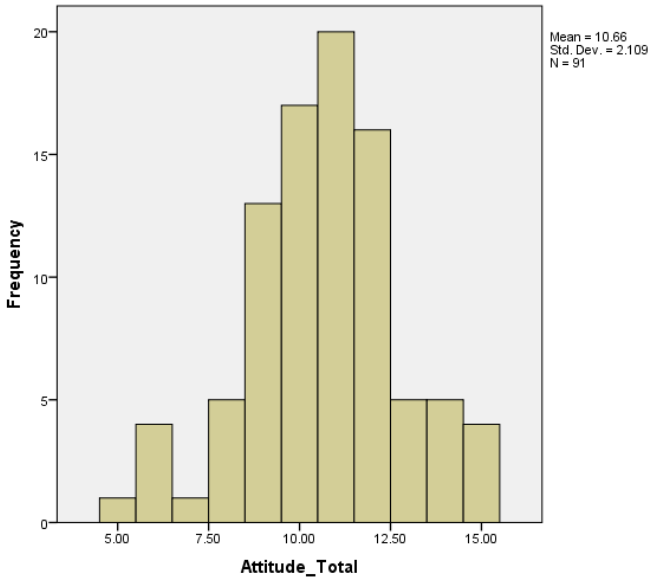


Figure 2. Histogram of total attitude scores among parents of children with cancer (N = 91).

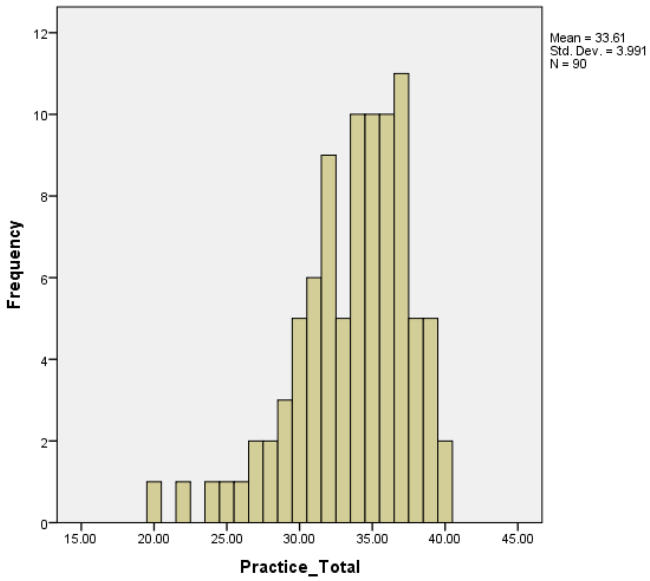


Figure 3. Histogram of total practice scores among parents of children with cancer (N = 90).

Correlations Between Knowledge, Attitude, and Practice

Spearman's correlation analysis revealed a statistically significant positive correlation between knowledge and practice scores ($r = 0.362$, $p < 0.001$). No significant correlations were found between attitude and knowledge ($r = 0.023$, $p = 0.829$) or between attitude and practice ($r = 0.106$, $p = 0.324$).

Table 3. Spearman Correlations Between Knowledge, Attitude, and Practice Scores

Variable	Knowledge	Attitude	Practice
Knowledge	1.000	0.023	0.362**
Attitude	0.023	1.000	0.106
Practice	0.362**	0.106	1.000

Note. **p < 0.01.

Group Differences

Gender Differences

Mann–Whitney U tests were conducted to examine differences in knowledge, attitude, and practice scores between male and female caregivers. No statistically significant differences were found in knowledge ($U = 810.00$, $p = 0.893$), attitude ($U = 733.50$, $p = 0.410$), or practice scores ($U = 682.50$, $p = 0.240$) based on parent gender.

Education Level Differences

Kruskal–Wallis tests indicated no significant differences in knowledge ($\chi^2(4) = 1.237$, $p = 0.872$), attitude ($\chi^2(4) = 6.964$, $p = 0.138$), or practice scores ($\chi^2(4) = 2.019$, $p = 0.732$) across different levels of parental education (illiterate to master's degree and above).

Regression Analysis Results

A multiple linear regression analysis was conducted to identify predictors of parental practice regarding the safe use and handling of oral chemotherapy medications. The model included parental knowledge, attitude, education level, gender, and age as independent variables.

The results showed that parental knowledge was the only significant predictor of practice ($B = 1.079$, $\beta = 0.541$, $t = 5.482$, $p < 0.001$). This indicates that for each one-unit increase in the knowledge score, the practice score increases by approximately 1.08 units, reflecting a substantial positive effect.

In contrast, attitude ($B = 0.094$, $\beta = 0.051$, $p = 0.606$), education level ($B = -0.092$, $\beta = -0.020$, $p = 0.837$), gender ($B = 1.751$, $\beta = 0.192$, $p = 0.075$), and age ($B = 0.050$, $\beta = 0.082$, $p = 0.443$) were not statistically significant predictors of practice.

Discussion

The present study examined the knowledge, attitudes, and practices of parents of children with cancer regarding the safe storage and use of oral chemotherapy medications at home. Based on the scoring structure of the instrument (knowledge: 0–10; attitude: 3–15; practice: 8–40), the mean scores indicate moderate knowledge (mean 5.57), relatively positive attitudes (mean 10.66), and generally good practice (mean 33.61). These interpretations are meaningful only in relation to the potential score ranges: a knowledge score of 5.57 out of 10 suggests that although parents possess a basic understanding of chemotherapy safety, substantial knowledge gaps remain-particularly regarding side-effect management, drug interactions, and safe disposal, which were the most frequently reported educational needs. In contrast, the high practice score, close to the upper end of the 8–40 range, indicates that parents often engage in appropriate behaviors despite limitations in their knowledge.

A notable and somewhat counterintuitive finding is the coexistence of moderate knowledge with high practice. Several explanations may account for this discrepancy. First, practice items may capture routine, instructed behaviors (e.g., administering the drug at the prescribed time) that parents perform habitually, whereas knowledge items probe deeper understanding (e.g., why a drug must be stored at a specific temperature or why interactions matter) that is less frequently reinforced during brief clinical encounters. Second, parents may follow provider instructions without fully internalizing the underlying rationale, a pattern consistent with the "knowledge–practice gap" described in caregiver literature [13], [20]. Third, social desirability may inflate self-reported practice scores, as parents may over-report adherence to expected behaviors. These possibilities underscore that high self-reported practice should not be equated with adequate competence, and that structured education targeting conceptual understanding—not merely behavioral instruction—is needed.

Our findings align with previous research emphasizing the critical role of healthcare providers in supporting parents of children undergoing oral chemotherapy. Consistent with Akkawi El Edelbi et al. [9], parents in our study demonstrated limited or inconsistent knowledge while still attempting to follow appropriate medication-handling practices at home; as those authors noted, parents may receive insufficient or contradictory information from different providers, contributing to confusion and uncertainty. Similarly, Christiansen et al. [20] reported that although parents generally recognize the importance of oral chemotherapy, gaps persist in safe handling and administration at home. Kahn et al. [13] identified physicians and nurses as the main sources of information-a pattern mirrored in our sample (68.5% and 40.4%, respectively)-underscoring the pivotal role of provider-led education. Studies by Yang et al. [1] and Priya et al. [24] further support our finding that parental knowledge directly influences practice, whereas attitude alone may not predict safe medication management.

The clinical significance of these gaps is substantial. Non-adherence to oral 6-MP of less than 95% has been associated with a 3.1-fold increased risk of relapse [15], and medication administration errors have been reported in 10–40% of children receiving oral chemotherapy at home [13]. Given that knowledge was the only significant predictor of practice in our regression model ($B = 1.079$, $p < 0.001$), interventions that strengthen parental knowledge may directly contribute to safer home-based care and improved treatment outcomes.

Although our study focused on home-based management of oral chemotherapy for children with cancer, findings from Suzuki et al. [25] indicate that brief, online educational interventions can influence parents' willingness to act, albeit with variable persistence. Both studies highlight the importance of providing timely, clear, and tailored information. The difference in intervention format and target behavior underscores that educational strategies should consider context, content, and parental characteristics to effectively support safe and informed caregiving [25].

IMPLICATION FOR PRACTICE

The findings have several practical implications. First, because physicians and nurses were the dominant information sources, provider-led, structured education should be institutionalized at the point of discharge and during maintenance visits, rather than delivered ad hoc. Second, education should explicitly target the three areas most frequently identified as unmet needs-side-effect management, drug interactions, and safe disposal-using standardized, written, and culturally adapted materials. Third, given that knowledge was the strongest determinant of practice, periodic knowledge assessments (e.g., at each clinic visit) could help identify caregivers requiring reinforcement. Finally, involving pharmacists in caregiver education may

address the currently underutilized role of pharmacy services (only 3.4% of parents cited pharmacists as an information source).

CONCLUSION

The findings of this study indicate that parents of children undergoing oral chemotherapy generally demonstrate moderate knowledge, positive attitudes, and relatively high self-reported practice regarding medication management at home. Knowledge was significantly associated with practice and was the only significant predictor in the regression model; however, given the cross-sectional design, this association should be interpreted as correlational rather than causal. These results underscore the need for structured, tailored, and continuous educational interventions-particularly addressing side-effect management, drug interactions, and safe disposal-to support parents, enhance their competence in home-based care, and ultimately improve treatment outcomes and quality of life for children with cancer.

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