RESULTS

The results of the study are presented in the following sequence of tables and graphs.

Part I. Socio-demographic characteristics of study subjects: Tables 1-2, Figures 1-3

Part II. Nurses' pre-program knowledge related to leukemia and its therapy : Tables 3-8.

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Part VI. Relation between nurses' knowledge and practice related to leukemia and its therapy and the associated factors : Tables 22 – 26.

Part I. Socio-demographic characteristics of study subjects.

Table 1. Socio – demographic characteristics of nurses in the study sample (n = 98).

	Frequency	Percent
Age (years):		
<20	20	20.4
20-	39	39.8
25+	39	39.8
Range	18.0 – 38.0	
Mean ± SD	24.2 ± 4.5	
Marital status :		
Married	69	70.4
Single	26	26.5
Divorced/widow	3	3.1
Nursing qualification:		
Diploma of secondary nursing school	53	54.1
Diploma of nursing technical institute	13	13.3
Diploma of secondary nursing school + pediatrics specially.	13	13.3
Bachelor of nursing	19	19.4
Experience (years):		
< 1	18	18.4
1-	35	35.7
5+	45	45.9
Range	<1-16	
Mean ± SD	5.0 ± 3.8	
Attended training course in care for children with leukemia:		
No	80	81.6
Yes	18	18.4
Course duration in days (n =18)		
1	9	50.0
7- < 14	8	44.4
14	1	5.6
Range	1-14	
Mean ± SD	4.3 ± 4.6	

Table 1 : describes the socio-demographic data of the study sample nurses. Their age ranged between 18 and 35 years , with a mean ± SD 24.2 ± 4.5 years . More than two thirds of the nurses (70. 4 %) were married.

As regards nursing qualification, more than half of them (54.1%) had a diploma of secondary nursing school, and only about one – fifth (19.4%) had a bachelor degree in nursing. Most of the nurses (45.9%) had five or more years experience, with a mean ± SD 5.0 ± 3.8 years. As for attending training courses in caring for children with leukemia, only 18.4% of them had attended such courses.

Table 2. Socio-demographic and types of therapy of children with leukemia observed by nurses in the study sample (n = 98).

	Frequency	Percent
Hospital :		
Benha specialized pediatric hospital	48	49.0
Benha university hospital	46	46.9
Outpatient clinics	4	4.1
Shift :		
Morning	67	68.4
Afternoon	29	29.6
Night	2	2.0
Child age (years):		
< 6	35	35.7
6 –	45	45.9
12 +	18	18.4
Range	1-15	
Mean ± SD	7.6 ± 3.6	
Gender:		
Male	64	65.3
Female	34	34.7
Diagnosis :		
Acute lymphatic leukemia (ALL)	57	58.2
Acute myeloid leukemia (AML)	20	20.4
Chronic myeloid leukemia (CML)	12	12.2
Chronic lymphatic leukemia (CLL)	9	9.2
Therapy:		
Chemotherapy	98	100.0
Radiotherapy	2	2.0
Supportive therapy		
Antibiotics	98	100.0
Blood transfusion	98	100.0
Sedatives	98	100.0
Corticosteroids	98	100.0

Table 2 presents the age, gender, and therapeutic modalities of children with leukemia in the study sample. As the table shows, the highest percentage (45.9%) was in the age group between 6 and less than 12 years old. The age ranged between one and 15 years, with a mean ± SD 7.6 ± 3.6 years. As for gender, about two – thirds (65.3%) were males. The table also shows that all studied children were under chemotherapy and had supportive therapy (100.0%). Only two of them (2.0%) had additional radiotherapy.

Fig. (1): Distribution of nurses in the study sample by working place

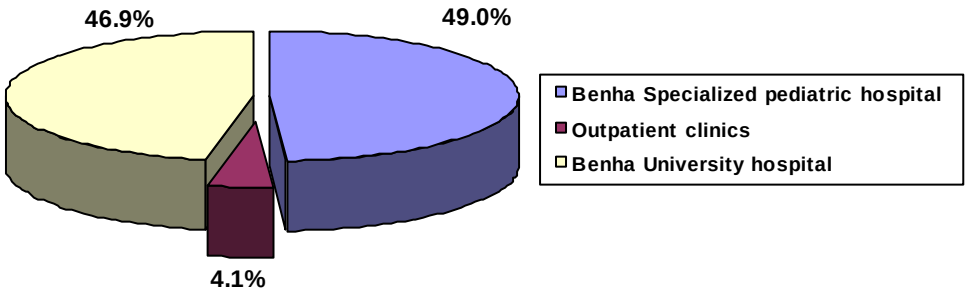


Fig. (2): Distribution of nurses in the study sample by working shift of observation

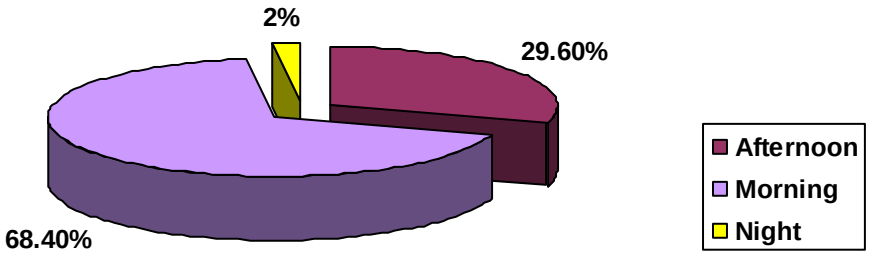
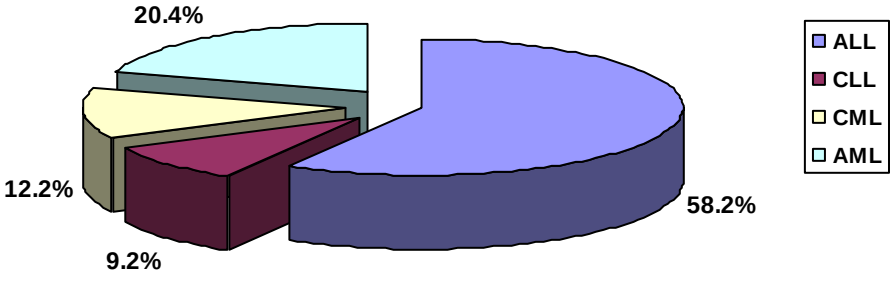


Fig. (3): Diagnosis of children with leukemia observed by nurses in the study sample (n=98)



Part II. Nurses' pre-program knowledge related to leukemia and its therapy.

Table 3. Pre-program knowledge about leukemia among nurses in the study sample (n = 98).

Knowledge about leukemia	Satisfactory Knowledge (60% +)	
	Frequency	**Percent**
Normal values of blood components	16	16.3
Definition of leukemia	5	5.1
Types of leukemia	10	10.2
Common types of leukemia in children	59	60.2
Proportion of leukemia to other neoplasm in children	0	0.0
Symptoms and signs	25	25.5
Diagnosis	19	19.4
Related infection control measures.	7	7.1
Role of the nurse in care for child with leukemia.	5	5.1
Role of the nurse in oral care for child with leukemia	9	9.2
Follow-up of child with leukemia	12	12.2

The pre-program knowledge about leukemia among nurses in the study sample is illustrated in table 3. It indicates that nurses' knowledge was very low in all areas, except for the common types of leukemia in children, which was correctly known by 60.2% of them. The lowest percentages of correct knowledge were related to definition of leukemia (5.1%) its proportion to other neoplasm in children (0.0%), related infection control measures (7.1%), role of the nurse in care for leukemia child (5.1%), and role of the nurse in oral care (9.2%).

Table 4. Pre-program knowledge of nurses in the study sample about chemotherapy (n=98).

Knowledge about treatment of child with leukemia	Satisfactory Knowledge (60% +)	
	Frequency	Percent
Chemotherapy:		
Definition	4	4.0
Calculation of dose	2	2.0
Routes	11	11.2
Precautions before IV administration	3	3.1
Nursing procedures before chemotherapy	2	2.0
Nursing procedures during chemotherapy	2	2.0
Nursing procedures after chemotherapy	4	4.1
Side effects and complications	15	15.3

Concerning pre-program nurses' knowledge about treatment of child with leukemia, Table 4 shows that only two nurses (2.0%) had correct knowledge about calculation of dose, and the nursing procedures before and during chemotherapy. The table also shows that the highest percentages of correct knowledge were related to routes (11.2%) and side effects and complications (15.3%) of therapy.

Table 5. Pre-program knowledge about supportive treatment of child with leukemia among nurses in the study sample (n = 98).

Knowledge about supportive treatment of child with leukemia	Satisfactory Knowledge (60% +)	
	Frequency	Percent
Blood transfusion :		
Aim	0	0.0
Blood components needed by child with leukemia.	73	74.5
Diseases transmitted by blood transfusion	4	4.1
Role of nurse in blood transfusion	8	8.2
Cortisone:		
Nature	1	1.0
Dosage	8	8.2
Side effects	7	7.1
Analgesics:		
Types	0	0.0
Indications	19	19.4
Radiotherapy:		
Definition	0	0.0
Side effects	2	2.0
Types	14	14.3
Bone marrow transplantation:		
Definition	0	0.0
Indications	0	0.0
Required investigations	18	18.4
Complications	0	0.0

The pre-program nurses' knowledge about supportive treatment of leukemia is presented in Table 5. The only item correctly known by most of the nurses (74.5%) was that of the blood components needed by child with leukemia. Conversely, none of nurses (0.0%) had correct knowledge the aim of blood transfusion, the types of analgesics, the definition of radiotherapy, and the definition, indications, and complications of bone marrow transplantation.

Table 6. Pre-program knowledge about nurse role in treatment of child with leukemia among nurses in the study sample (n = 98).

Knowledge about nurse role	Satisfactory Knowledge (60% +)	
	Frequency	**Percent**
Role in :		
Alopecia	0	0.0
Nutritional disorders	1	1.0
Pain	3	3.1
Fatigue	0	0.0
Skin disorders	1	1.0
Psychological disorders.	1	1.0
Fever	9	9.2
Infection	8	8.2
Identifying signs of infection	6	6.1

The pre-program knowledge about the role of the nurse in the treatment of child with leukemia among studied nurses is illustrated in Table 6. It indicates very low percentages of correct knowledge in all items. Thus, none of nurses (0.0%) had correct knowledge about the role of the nurse in alopecia, and fatigue, and only one nurse (1.0%) about role in nutritional, skin, and psychological disorders. The highest percentages of correct knowledge were related to nurse role in fever and infection, 9.2% and 8.2%, respectively.

Table 7. Pre-program total knowledge about leukemia among nurses in the study sample (n = 98).

Satisfactory knowledge (60%+) about	Frequency	Percent
Leukemia:		
Satisfactory (60%+)	10	10.2
Unsatisfactory (< 60%)	88	89.8
Treatment of leukemia :		
Satisfactory (60%+)	0	0.0
Unsatisfactory (< 60%)	98	100.0
Total knowledge :		
Satisfactory (60%+)	0	0.0
Unsatisfactory (< 60%)	98	100.0

Table 7 displays the total pre – program knowledge about leukemia and its treatment among nurses in the study sample. It shows that only about one – tenth of them (10.2%) had satisfactory knowledge about leukemia, while none (0.0%) had satisfactory knowledge about its treatment. Overall, none of the nurses (0.0%) had total satisfactory knowledge.

Table 8. Relations between pre-program nurses' knowledge scores about nursing care for child with leukemia and their socio-demographic characteristics.

Socio-demographic	Knowledge Score % (Mean	Mann Whitney Test	p-value
Age (years):			
< 20	22.6 ± 4.4		
20-	32.4 ± 5.7	H = 64.46	<0.001*
25 +	44.0 ± 7.4		
Marital status:			
Married	36.9 ± 9.5		
Unmarried	30.5 ± 10.8	9.70	0.002*
Nursing qualification:			
Bachelor	44.9 ± 9.4		
Diploma	32.6 ± 9.0	20.00	<0.001*
Experience (years):			
<1	23.9 ± 4.6		
1-	31.8 ± 7.8	H = 46.75	<0.001*
5+	41.9 ± 8.3		
Attended training courses			
No	32.6 ± 9.2		
Yes	45.5 ± 8.2	21.87	<0.001*

(*) Statistically significant at p < 0.05 (H) Kruskal Wallis test

The relation between pre-program nurses' knowledge scores about nursing care for child with leukemia and their socio-demographic characteristics is illustrated in Table 8. It demonstrates a statistically significant increasing trend of knowledge score with increasing nurse's age ($P < 0.001$) and experience years ($P < 0.001$). Also, the mean score of bachelor degree nurses was statistically significantly higher than that of diploma nurses, 44.9 ± 9.4 and 32.6 ± 9.0, respectively ($P < 0.001$). Similarly, nurses who had previously attended training courses had a statistically significantly higher mean score, compared to those who did not attend, 45.5 ± 8.2 and 32.6 ± 9.2, respectively ($P < 0.001$).

Part III. Nurses' knowledge related to leukemia and its therapy throughout program phases.

Table 9. Knowledge about leukemia among nurses in the study sample throughout study phases.

Satisfactory Knowledge (60%+) about	Study phases						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre (n = 98)		Post (n = 90)		Fu (n=90)			
	No.	%	No.	%	No.	%		
Normal values of blood components	16	16.3	63	70.0	30	33.3	55.47 (< 0.001*)	7.34 (0.007*)
Leukemia:								
Definition	5	5.1	82	91.1	52	57.8	139.60 (<0.001*)	61.62 (< 0.001*)
Types	10	10.2	89	98.9	59	65.6	148.01 (<0.001*)	61.87 (<0.001*)
Common types in children	59	60.2	87	96.7	75	83.3	35.95 (<0.001)	12.26 (< 0.001*)
Proportion of leukemia to other neoplasm	0	0.0	81	90.0	85	94.4	154.97 (<0.001*)	168.94 (<0.001*)
Symptoms and signs	25	25.5	90	100.0	89	98.9	109.60 (<0.001*)	105.84 (<0.001*)
Diagnosis	19	19.4	90	100.0	90	100.0	125.13 (<0.001*)	125.13 (<0.001*)
Related infection control measures	7	7.1	86	95.6	86	95.6	146.71 (<0.001*)	146.71 (<0.001*)
Role of the nurse in leukemia	5	5.1	88	97.8	89	98.9	161.20 (<0.001*)	165.06 (<0.001*)
Role of the nurse in oral care	9	9.2	86	95.6	84	93.3	140.01 (<0.001*)	132.90 (<0.001*)
Follow-up	12	12.2	81	90.0	89	98.9	113.47 (<0.001*)	141.67 (<0.001*)

(*) Statistically significant at P < 0.05

Table 9 illustrates the changes in nurses' knowledge about leukemia throughout the program phases. It indicates statistically significant improvements in all tested areas both at the post and follow-up phases ($P<0.001$). All nurses (100.0%) at the post-test had satisfactory knowledge about symptoms and signs and diagnosis. The follow-up knowledge has shown some declines in most areas, normal values of blood component and definition of leukemia (33.3% and 57.8% respectively). However, it was higher than post-test in some areas such as proportion of leukemia to other neoplasms in children, role of nurse in care for child with leukemia, and follow-up of child with leukemia. Also, all of them (100.0%) had satisfactory knowledge about diagnosis at the follow-up test.

Fig (4): Nurses knowledge about leukemia and its therapy throught program phases

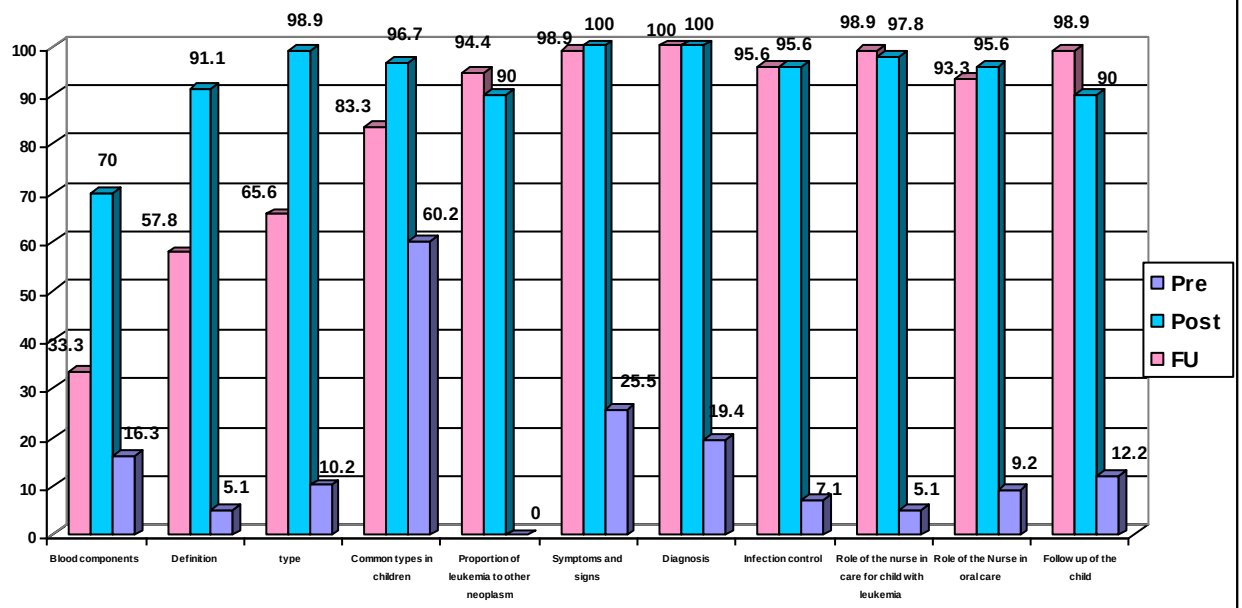


Table 10. Knowledge about leukemia chemotherapy among nurses in the study sample throughout study phases.

Satisfactory Knowledge (60%+) about leukemia therapy	Study phases						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre (n = 98)		Post (n = 90)		Fu (n=90)			
	No.	%	No.	%	No.	%		
Definition	4	4.1	74	82.2	16	17.8	118.00 (<0.001*)	9.26 (< 0.001*)
Calculation of dose	2	2.0	82	91.1	30	33.3	150.58 (<0.001*)	32.53 (<0.001*)
Routes	11	11.2	87	96.7	68	75.6	137.25 (<0.001*)	79.69 (<0.001*)
Precautions before IV administration	3	3.1	83	92.2	62	68.9	150.27 (<0.001*)	89.87 (<0.001*)
Nursing procedures before chemotherapy	2	2.0	79	87.8	58	64.4	140.64 (<0.001*)	84.08 (<0.001*)
Nursing procedures during chemotherapy	2	5.0	84	93.3	48	53.3	157.54 (<0.001*)	63.33 (<0.001*)
Nursing procedures after chemotherapy	4	4.1	82	91.1	40	44.4	143.17 (<0.001*)	42.64 (<0.001*)
Side effects and complications	15	15.3	90	100.0	90	100.0	136.48 (<0.001*)	136.4 (<0.001*)

(*) Statistically significant at $p < 0.05$

The change in nurses' knowledge about chemotherapy of leukemia throughout the program phases are displayed in Table 10. Statistically significant improvements were demonstrated in all tested areas both at the post and follow-up phases. This reached 100.0% for side effects and complications. However, great declines were shown in most areas at the follow-up phase, except for the area of side-effects. The highest declines were related to definition of chemotherapy and calculation of the dose, 17.8% and 33.3%, respectively. Nonetheless, the follow-up percentage of satisfactory knowledge were still significantly higher than the pre-program phase.

Fig.(5): Nurses' Knowledge about chemotherapy throughout study phases

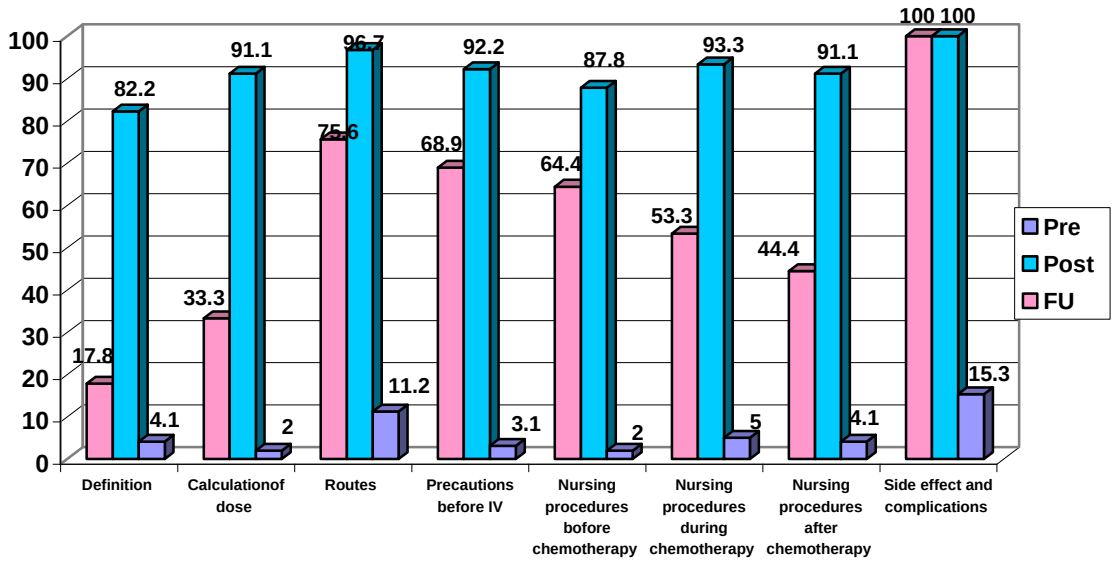


Table 11. Knowledge about supportive treatment of child with leukemia among nurses in the study sample throughout study phases.

Satisfactory Knowledge (60%+) about	Study phases						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre (n = 98)		Post (n = 90)		Fu (n=90)			
	No.	%	No.	%	No.	%		
Blood transfusion :								
Aim	0	0.0	27	30.0	13	14.4	34.33 (<0.001*)	15.21 (<0.001*)
Blood components needed by child with leukemia	73	74.5	90	100.0	90	100.0	26.48 (<0.001*)	26.48 (<0.001*)
Diseases transmitted by blood transfusion	4	4.1	82	91.1	49	54.4	143.17 (<0.001*)	58.78 (<0.001*)
Role of nurse in blood transfusion	8	8.2	79	87.8	46	51.1	119.61 (<0.001*)	42.27 (<0.001*)
Cortisone:								
Nature	1	1.0	35	38.9	0	0.0	43.45 (<0.001*)	Fisher (1.00)
Dosage	8	8.2	59	65.6	32	35.6	67.37 (<0.001*)	21.02 (<0.001*)
Side effects	7	7.1	71	78.9	27	30.0	99.48 (<0.001*)	16.55 (<0.001*)
Analgesics:								
Types	0	0.0	58	64.4	45	50.0	91.33 (<0.001*)	64.42 (<0.001*)
Indications	19	19.4	90	100.0	90	100.0	125.13 (<0.001*)	125.13 (<0.001*)
Radiotherapy :								
Definition	0	0.0	33	36.7	6	6.7	43.58 (<0.001*)	Fisher (0.01*)
Side effects	2	2.0	59	65.6	23	25.6	86.35 (<0.001*)	22.50 (<0.001*)
Types	14	14.3	86	95.6	90	100.0	124.45 (<0.001*)	139.45 (<0.001*)
Bone marrow transplantation								
Definition	0	0.0	3	3.3	0	0.0	Fisher (0.11)	0.00 (1.00)
Indications	0	0.0	77	85.6	85	94.4	142.01 (<0.001*)	168.94 (<0.001*)
Required investigations	18	18.4	90	100.0	90	100.0	127.89 (<0.001*)	127.89 (<0.001*)
Complications	0	0.0	53	58.9	17	18.9	80.37 (<0.001*)	20.35 (<0.001*)

(*) Statistically significant at $p<0.05$

Table 11 describes the changes in nurses' knowledge about supportive therapy of leukemia throughout the program phases. It indicates statistically significant improvements in almost all tested areas both at the post and follow-up phases. The only exceptions were related to the nature of cortisone, which declined to 0.0% at the follow-up phase, and the definition of bone marrow transplantation at both the post (3.3%) and follow-up (0.0%) phases. The improvements were however somewhat low at the post-test in relation to aim of blood transfusion (30.0%), nature of cortisone (38.9%), and complications of blood transfusion (58.9%). Nonetheless, all nurses (100.0%) had satisfactory knowledge about blood components needed for child with leukemia, indications of analgesics, and required investigations for bone marrow transplantation at both post and follow-up phases.

Table 12. Knowledge about nurse role in treatment of child with leukemia among nurses in the study sample throughout study phases.

Satisfactory Knowledge (60%+) about nurse role :	Study phases						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre (n = 98)		Post (n = 90)		Fu (n=90)			
	No.	%	No.	%	No.	%		
Role in :								
Alopecia	0	0.0	60	66.7	56	51.1	95.96 (<0.001*)	66.31 (<0.001*)
Nutritional disorders	1	1.0	45	50.0	44	48.9	60.90 (<0.001*)	59.04 (<0.001*)
Pain	3	3.1	46	51.1	37	41.1	56.21 (<0.001*)	40.55 (<0.001*)
Fatigue	0	0.0	39	43.3	33	36.7	53.58 (<0.001*)	43.58 (<0.001*)
Skin disorders	1	1.0	39	43.3	24	26.7	50.15 (<0.001*)	24.76 (<0.001*)
Psychological disorders	1	1.0	41	45.6	22	24.4	53.63 (<0.001*)	23.97 (<0.001*)
Fever	9	9.2	89	98.9	87	96.7	151.28 (<0.001*)	143.69 (<0.001*)
Infection	8	8.2	43	47.8	1	1.1	37.24 (<0.001*)	Fisher (0.04*)
Identifying signs of infection	6	6.1	80	88.9	66	73.3	129.49 (<0.001*)	89.68 (<0.001*)

(*) Statistically significant at $p < 0.05$

Concerning the changes in nurses' knowledge about nurse's role in chemotherapy of leukemia throughout the program phases, Table 12 points to statistically significant improvements in all tested areas both at the post and follow-up phases. The highest percentages in both post and follow-up phases were related to role of the nurse in fever, 98.9% and 96.7%, respectively. The table also shows some declines in most areas at the follow-up phase. However, the follow-up percentages of satisfactory knowledge were still significantly higher than the pre-program phase, with the exception of the role of the nurse in infection, which declined to a level lower than the pre-program phases, 1.1% and 8.2%, respectively.

Fig. (6): Nurses knowledge about nurse role in treatment of leukemic children

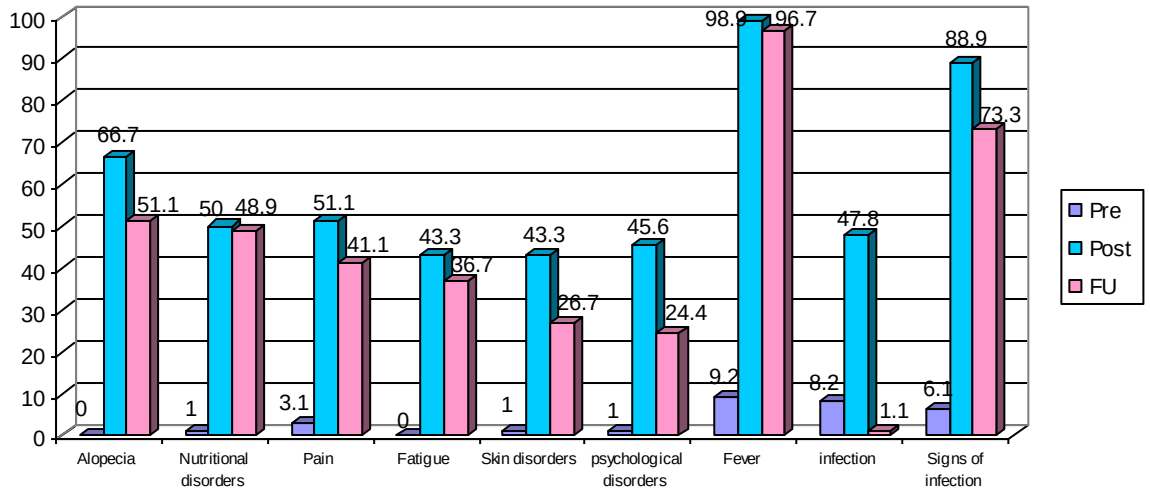
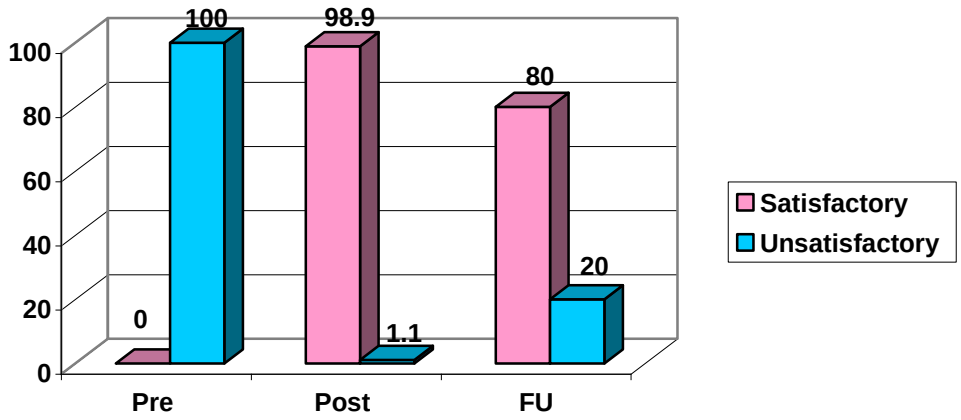


Table 13. Nurses' knowledge about nursing care for leukemic child throughout program phases.

Total knowledge about	Study phases						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre		Post		Fu			
	No.	%	No.	%	No.	%		
1- Leukemia								
- Satisfactory (60%+)	10	10.2	90	100.0	89	98.9	151.93	148.01
- Unsatisfactory (<60%)	88	89.8	0	0	1	1.1	(<0.001*)	(<0.001*)
2- Treatment								
-Satisfactory (60% +)	0	0	88	97.8	57	63.3	18.15	89.07
-unsatisfactory (<60%)	90	100	2	2.2	33	36.7	(<0.001*)	(<0.001*)
3- Total								
-Satisfactory (60% +)	0	0	89	98.9	72	80.0	184.03	127.06
-unsatisfactory (<60%)	98	100	1	1.1	18	20.0	(<0.001*)	(<0.001*)

Table 13 shows nurses total knowledge about nursing care for child with leukemia throughout program phases. It indicates that none of the nurses (0.0 %) had total satisfactory knowledge at the pre-program phase. At the post-program phase, almost all nurses had satisfactory knowledge (98.9%), with a statistically significant improvement (P<0.001). similarly, at the follow phase, the majority of the nurses had satisfactory knowledge (80.0%).

Fig. (7): Nurses' total knowledge about nursing care for child with leukemia throughout program phases



Part IV. Nurses pre- program practice related to leukemia and its therapy

Table 14: Pre-program practice of nursing care related to monitoring vital signs and anthropometric measurements. (n=98).

Practice of:	Adequate practice (60%+)	
	Frequency	Percent
Counting radial pulse	6	6.1
Counting respiration	12	12.2
Measuring blood pressure	33	33.7
Measuring body temperature (oral)	17	17.3
Measuring body temperature (axillary)	12	12.2
Measuring height	44	44.9
Measuring weight	41	41.8

Table 14 describes the practice of assessment of vital signs and anthropometric measurements in child with leukemia care at the pre-program phase. It indicates low percentages of adequate practice in all skills. This was particularly evident in relation to counting radial pulse (6.1%), counting respiration (12.2%), measuring axillary (12.2%) and oral (17.3%) body temperature.

Table 15: Pre-program practice of nursing care related to therapy of child with leukemia as observed among nurses in the study sample (n=98).

Practice of:	Adequate practice (60%+)	
	Frequency	Percent
Insertion of IV cannula	11	11.2
Care before chemotherapy	1	1.0
Care during chemotherapy	2	2.0
Care after chemotherapy	4	4.1
Blood transfusion	17	17.3

Concerning pre-program nurses practices related to therapy during care for child with leukemia the pre-program phase, Table 15 shows very low percentages of adequate practice. This was particularly evident in relation to care before, during and after chemotherapy, 1.0% , 2.0% and 4.1% respectively.

Table 16. Pre-program total practice of nursing care for leukemia child as observed among nurses in the study sample (n=98)

Total practice	Frequency	Percent
Adequate (60% +)	0	0.0
Inadequate (60% +)	98	100.0

Table 16 illustrates total nurses practice of nursing care for leukemia child at the pre-program phase. It indicates that none of them (0.0%) had adequate total practice.

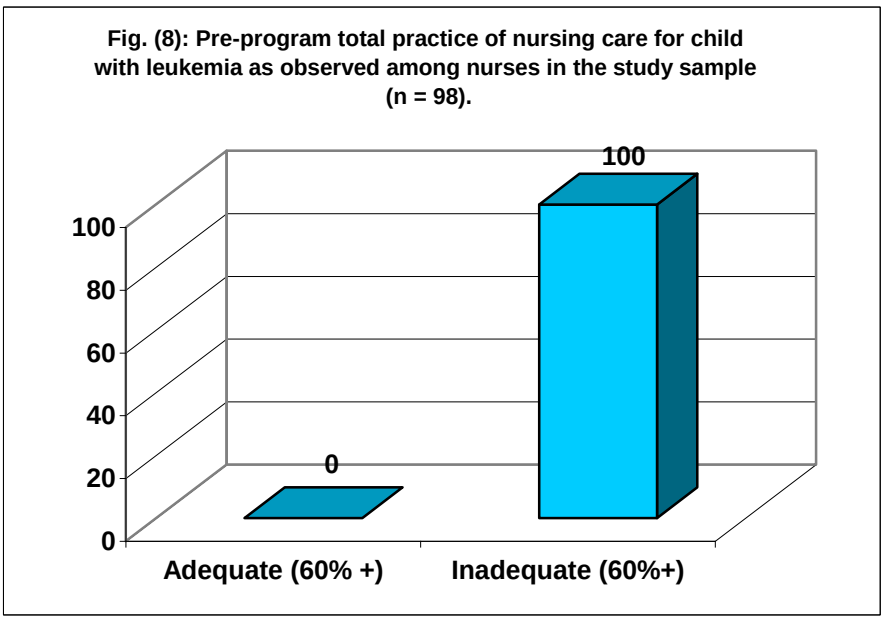


Table 17. Relation between pre-program nurses practice scores related to nursing care for child with leukemia and their socio-demographic characteristics.

	Practice score % (Mean ± SD)	Mann Whitney test	p-value
Age (years):			
<20	23.3 ± 8.7	H = 7.60	0.02*
20-	20.4 ± 8.6		
25+	27.8 ± 11.8		
Marital status:			
Married	24.4 ± 11.1	0.15	0.70
Unmarried	22.8 ± 8.9		
Nursing qualification:			
Bachelor	23.7 ± 13.9	0.35	0.57
Diploma	24.0 ± 8.9		
Experience (years):			
<1	21.7 ± 9.9	H = 3.42	0.18
1-	21.4 ± 9.5		
5+	26.8 ± 10.9		
Attended training course:			
No	22.7 ± 9.7	2.58	0.11
Yes	29.2 ± 12.2		

(*) Statistically significant at P < 0.05 (H) Kruskal Wallis test

The relation between pre-program nurses practice scores of nursing care for child with leukemia and their socio-demographic characteristics is presented in table 17. it is evident that all the mean scores wee much lower than 60%, the highest being 29.2. This means that none of the nurses had adequate practice. Meanwhile, the table shows that practice score were statistically significantly higher among older age nurses, 25 years old or more (p = 0.02). Although nurses with longer years of experience (5 or more), and those who had attended training courses had higher practice scores, the difference could not reach statistical significance.

Part V. Nurses practice related to leukemia and its therapy throughout program phases

Table 18. Comparison of nurse practice related to monitoring vital signs and anthropometric measurements for children with leukemia throughout program phases.

Practice	Study phase						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre- (n=98)		Post (n=90)		FU (n=90)			
	No.	%	No.	%	No.	%		
-Counting radial pulse								
Adequate	6	6.1	90	100	11	12.2	165.46	2.12
Inadequate	92	93.9	0	0	79	87.8	(< 0.001*)	(0.15)
-Counting respiration								
Adequate	12	12.2	90	100	11	12.2	145.57	0.00
Inadequate	86	87.8	0	0	.79	87.8	(< 0.001*)	(1.00)
-Measuring blood pressure								
Adequate	33	33.7	90	100	87	96.7	91.24	80.63
Inadequate	65	66.3	0	0	3	3.3	(< 0.001*)	(< 0.001*)
-Measuring body temperature (oral)	17	17.3	90	100	0	0	17.16	17.16
Adequate	81	82.7	0	0	90	100	(< 0.001*)	(< 0.001*)
Inadequate								
-Measuring body temperature (axillary)								
Adequate	12	12.2	90	100	10	11.1	145.57	0.06
Inadequate	86	78.8	0	0	80	88.9	(< 0.001*)	(0.81)
-Measuring height								
Adequate	44	44.9	90	100	90	100	69.58	69.58
Inadequate	54	55.1	0	0	0	0	(< 0.001*)	(< 0.001*)
-Measuring weight								
Adequate	41	41.8	90	100	89	98.9	75.12	71.58
Inadequate	57	58.2	0	0	1	1.1	(< 0.001*)	(< 0.001*)

(*) Statistically significant at $P < 0.05$

Table 18 describes nurses practices related to assessment of vital signs and anthropometric measurement of child with leukemia throughout the program phases. It is points to statistically significant improvements in all tested areas at the post – program phase ($P < 0.001$). at the follow – up phase, the percentage of adequate practice declined, and reached levels not significantly different from pre-program levels in relation to counting radial pulse (12.2%), counting respiration (12.2%), and measuring auxiliary body temperature (11.1%). Meanwhile some areas have demonstrated continuing improvement such height and weight 100.0% and 98.9% respectively.

Table 19 Nurses practice related to infection control procedures during care for child with leukemia throughout program phases.

Practice	Study phase						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre- (n=98)		Post (n=90)		FU (n=90)			
	No.	%	No.	%	No.	%		
-Hand washing								
Adequate	0	0	90	0	14	15.6	188.00	16.47
Inadequate	98	100	0	100	76	84.4	(< 0.001*)	(< 0.001*)
-Scrubbing								
Adequate	0	0	90	0	52	57.8	188.00	78.27
Inadequate	98	100	0	100	38	42.2	(< 0.001*)	(< 0.001*)
- Gowning								
Adequate	0	0	90	0	88	97.8	188.00	180.15
Inadequate	98	100	0	100	2	2.2	(< 0.001*)	(< 0.001*)
-Masking								
Adequate	0	0	90	0	80	88.9	188.00	151.64
Inadequate	98	100	0	100	10	11.1	(< 0.001*)	(< 0.001*)
-Gloving								
Adequate	0	0	90	0	81	90.0	188.00	154.97
Inadequate	98	100	0	100	9	10.0	(< 0.001*)	(< 0.001*)

Nurses practices related to infection control during care for child with leukemia throughout program phases are presented are presented in Table 19. As the table demonstrates, statistically significant improvements are noticed at both post and follow –up phases ($P < 0.001$). all nurses (100.0%) had adequate practice in all areas at the post – test. Although the percentage of adequate practice have slightly declined at the follow –up phase, they remained significantly higher than the pre-program levels ($p < 0.001$). the decline was highest for hand washing which was as low as 15.6% at the follow- up phase.

Table 20. Nurses practice related to therapy for child with leukemia throughout program phases.

Practice	Study phase						X^2 test (p-value) pre-post	X^2 test (p-value) pre-FU
	Pre- (n=98)		Post (n=90)		FU (n=90)			
	No.	%	No.	%	No.	%		
-Oral care								
Adequate	0	0	88	97.8	10	11.1	180.15	Fisher
Inadequate	98	100	2	2.2	80	88.9	(< 0.001*)	(< 0.001*)
-Insertion of IV								
Adequate	11	11.2	90	100	22	24.4	148.72	5.67
Inadequate	87	88.8	0	0	68	75.6	(< 0.001*)	(< 0.001*)
- Care before chemotherapy								
Adequate	1	1	87	96.7	13	14.4	172.38	12.27
Inadequate	97	99	3	3.3	77	85.6	(< 0.001*)	(< 0.001*)
-Care during chemotherapy								
Adequate	2	2	90	100	13	14.4	180.18	9.83
Inadequate	96	98	0	0	77	85.6	(< 0.001*)	(< 0.001*)
-Care during chemotherapy								
Adequate	4	4.1	89	98.9	16	17.8	168.70	9.26
Inadequate	94	95.9	1	1.1	74	82.2	(< 0.001*)	(< 0.001*)
-Blood transfusion								
Adequate	17	17.3	89	98.9	17	18.9	126.84	0.08
Inadequate	81	82.7	1	1.1	73	81.1	(< 0.001*)	(< 0.001*)

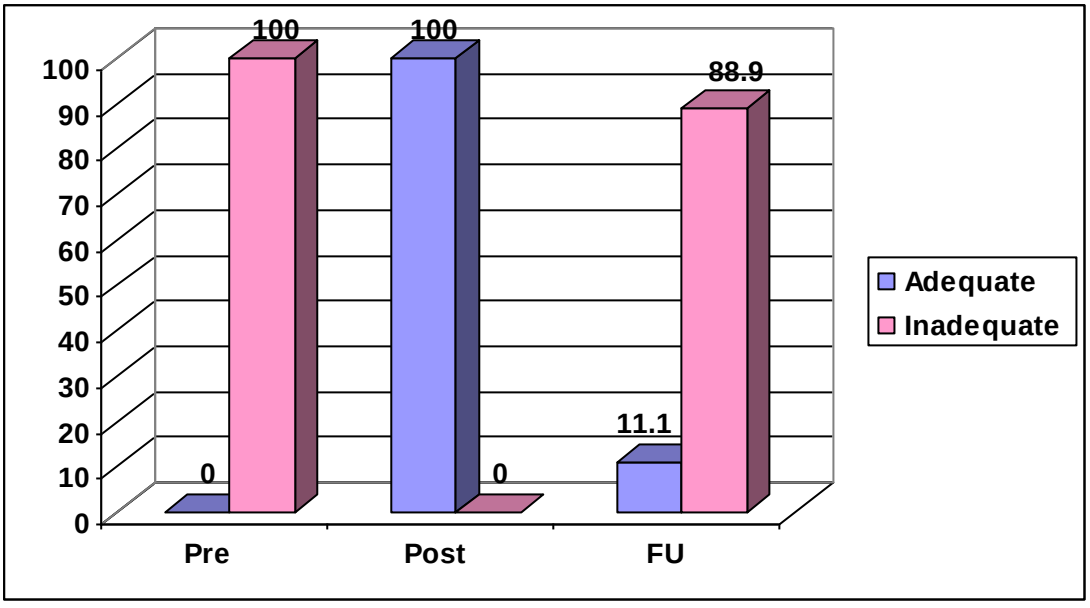
Table 20 illustrates nurses practices related to therapy of child with leukemia throughout the program phases. It points to statistically significant improvements in all practice at the post-program phase ($p<0.001$). the practice has reached 100.0% in relation to insertion of IV cannula and care during chemotherapy. The follow-up has demonstrated significant declines in the percentages of adequate practice. However, the levels still remained higher than the pre-program level. The only exception was related to blood transfusion, which declined to 18.9%, compared to 17.3% at the pre-program phase ($P = 0.78$).

Table 21. Comparison of nurses' total practice related to leukemia child in the pre, post, and follow-up phases of the study

Practice	Study phase						X2Test (p- value) pre-post	X2test (p-value) pre-FU
	Pre (n = 98)		Post (n = 90)		FU (n = 90			
	No.	%	No.	%	No.	%		
Total practice:								
Adequate	0	0	90	100	10	11.1	188.00	Fisher
Inadequate	98	100	0	0	80	88.9	(<0.001*)	(< 0.001*

(*) Statistically significant at P < 0.05

Table 21 illustrates nurse's total practice related to leukemic child care throughout the program phases. It indicated that none of them (0.0%) had adequate practice at the preprogram phase, whereas none of them (0.0%) had inadequate practice at the post-program phase, and the difference was statistically significant (P < 0.001). Although the percentage of nurses with adequate practice declined to 11.1 at the follow-up phase, this was still statistically significantly better than the pre-program phase (P > 0.001).



Part VI. Relation between nurses' knowledge and practice related to leukemia and its therapy and the associated factors

Table 22. Correlation between nurses' knowledge and practice about nursing care for child with leukemia and their socio-demographic characteristics at the various study phases.

	Pearson correlation coefficient					
	Pre (n = 98)		**Post (n = 90)**		**FU (n = 90)**	
	Knowledge	**Practice**	**Knowledge**	**Practice**	**Knowledge**	**Practice**
Practice	0.30**		- 0.14		0.396**	
Age (years)	0.79 **	0.33**	0.03	0.12	0.03	0.04
Nursing qualification (reference: diploma)@	0.61**	0.07	- 0.12	- 0.03	0.04	- 0.16
Experience (years)	0.64**	0.35**	0.04	0.13	0.04	0.11

(*) Statistically significant at P < 0.05 (@) Spearman rank correlation

Table 22 displays the correlations between nurses' knowledge and practice scores and their socio-demographic and job characteristics throughout program phases. It is evident that knowledge and practice scores had statistically significant positive correlations at the pre-program and the follow-up phases, r = 0.30 and r = 0.40, respectively. The table also shows moderate to strong statistically significant positive correlation between knowledge scores and nurse's age, qualification, and experience at the pre-program phase. Meanwhile, practice scores had weak statistically significant positive correlations with nurse's age and experience. No statistically significant positive correlations could be revealed at the post and follow-up phases.

Table 23. Best fitting multiple linear regression model for post-program knowledge score

	Coefficients			t-test	p-value
	Unstandardized coefficients		Standardized Coefficient		
	B	Std. Error	Beat		
Constant	12.391	2.825		4.386	< 0.001*
Age (years)	0.932	0.113	0.205	8.267	< 0001*
Program attendance (reference:Pre)	37.966	1.024	0.917	37.068	> 0.001*

r-square= 0.89
Model ANOVA: F = 724. 261, P < 0.001
Variables excluded by model: Marital status, nursing qualification, experience years, attendance of training courses.

The best fitting multiple linear regression model for nurses knowledge post-program score adjusted for various socio-demographic characteristics and program effect is presented in Table 23. It indicates that only nurses' age and program attendance were the statistically significant positive independent predictors of nurse's knowledge score. Meanwhile, marital status, nursing qualification, experience years and attendance of training courses had no relation to this score. As indicated from the value of r-square, the model explains 89% of the post-program knowledge score.

Table 24: Best fitting multiple linear regression model for Follow-up knowledge score

	Coefficients			t-test	p-value
	Unstandardized coefficients		Standardized Coefficient		
	B	Std. Error	Beat		
Constant	26.614	1.212		21.960	< 0.001*
Nursing qualification (reference: diploma)	2.327	0.437	0.164	5.328	< 0.001*
Experience (years)	0.755	0.139	0.167	5.431	< 0.001*
Program attendance (reference: Pre)	30.035	1.034	0.872	29.059	<0.001*

r-square= 0.83
Model ANOVA: F = 308.894, P < 0.001
Variables excluded by model: Marital status, attendance of training courses.

The best fitting multiple linear regression model for nurse's knowledge score at the follow-up phases in presented in Table 24 it shows that nurses' higher qualification, longer experience years, and program attendance were the statistically significant positive independent predictors of nurse's knowledge score at the follow-up. Meanwhile, nurse's age, marital status, and attendance of training courses had no relation to this score. As indicated from the value of r-square, the model explains 83% of nurse's knowledge score at the follow-up test.

Table 25. Best fitting multiple linear regression model for post-program practice score

	Coefficients			t-test	p-value
	Unstandardized coefficients		Standardized Coefficient		
	B	Std. Error	Beat		
Constant	9.541	3.283		2.906	< 0.004*
Age (years)	0.402	0.157	0.55	2.555	< 0011*
Knowledge (score)	0.191	0.77	0.119	2.467	> 0.015*
Program attendance (reference: pre)	57.429	3.129	0.864	18.354	< 0.001*

r-square= 0.95
Model ANOVA: F = 915.074, P < 0.001
Variables excluded by model: marital status, nursing qualification, experience years attendance of training courses.

Concerning nurse's post-program practice score, table 25 illustrates its best fitting multiple linear regressions model shows that nurse's age, knowledge score, and program attendance were the statistically significant positive independent predictors of nurse's practice score. Meanwhile, martial status, nursing qualification, experience years and attendance of training courses had no relation to this score. As indicated from the value of r-square, the model explains 95% of nurse's post-program practice score.

Table 26. Best fitting multiple linear regression model for follow-up practice score

	Coefficients			t-test	p-value
	Unstandardized coefficients		Standardized Coefficient		
	B	Std. Error	Beat		
Constant	2.128	4.852		0.439	0.661
Nursing qualification (reference: diploma)	- 2.770	0.807	- 0.182	3.434	< 0.001*
Knowledge (score)	0.485	0.112	0.451	4.315	< 0.001*
Program attendance (reference: pre)	14.315	3.723	0.387	3.845	< 0.001*

r-square= 0.66
Model ANOVA: F = 491, P < 0.001
Variables excluded by model: age, Marital status, experience years, attendance of training courses.

Table 26 presents the best fitting multiple linear regression model for nurse's practice score at follow-up phase. It indicates lower nurse's qualification, higher knowledge score, and program attendance were the statistically significant positive independent predictors of nurse's follow-up practice score. Meanwhile, age, marital status, experience years and attendance of training courses had nor relation to this score. As indicated from the value of re-square, the model explains 66% of nurse's practice score at the follow-up phase.