

Application of PRECEDE-PROCEED Planning Model on Quality of Life among Children with Sickle Cell Anemia

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Abstract: Background: Children with Sickle Cell Anemia (SCA) undergo frequent hospitalization due to painful crises, this affects their quality of life also, and it has adverse social and economic consequences. **Purpose** was to examine the effect of application of the PRECEDE-PROCEED planning model on the quality of life for children with sickle cell anemia. **A Quasi experimental design** was utilized. **Setting:** It was conducted at Pediatric Hematology Unit and Pediatric Hematology Outpatient Clinic at EL-Menoufia University Hospital. **Sample** purposive sample included 31 children diagnosed with SCA at previously mentioned settings. **Two instruments used for data collection:** A structured interview Precede questionnaire sheet developed by the investigator and pediatric quality of Life Scales. **Results** of this study showed that, the majority of studied children had Poor quality of life on pretest meanwhile two thirds of them and three quarters respectively, had moderate quality of life on post and follow up tests. **Conclusion:** children with SCA who received PRECEDE-PROCEED planning model had better QOL on post and follow up tests. **Recommendation:** integrating of PRECEDE-PROCEED planning model into the daily routine care at all pediatric hematology units.

Keywords: Children, PRECEDE-PROCEED model, Quality of life, Sickle cell anemia.

Introduction

Sickle Cell Anemia (SCA) is inherited red blood cell disorders affecting the protein known as hemoglobin. Hemoglobin functions to move red blood cells through small blood vessels and carry oxygen from the lungs to various organs and tissues in the body. Children with SCA produce abnormal hemoglobin called hemoglobin S (HbS) or sickle hemoglobin. The hemoglobin S present in SCA causes red blood cells to become hard, sticky, and have a sickle shape under certain

conditions. Blood cells that block blood flow deprive the affected organ or tissue of oxygen causing pain and other serious complications (Oudat et al., 2021).

World Health Organization, (WHO, 2019) has recognized SCA as a global public health problem whereas some countries consider it as a rare disease. Sickle Cell Anemia affects about 20 – 25 million individuals worldwide mostly of African, South and Central American, Caribbean, Saudi Arabian,

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Indian and Mediterranean ancestry. It is most prevalent in sub Saharan Africa with an estimated 12 –15 million cases (Henrici et al., 2021).

Children with sickle cell anemia have vaso-occlusion, chronic hemolytic anemia and vasculopathy that cause both acute and chronic complications, which have a profound impact on the quality of life (Colombatti et al., 2021). Findings of many studies on children with SCA revealed that health related quality of life, in terms of pain, suffering and emotional functioning, significantly declined with increasing age of the child (CDC, 2020). However, communication abilities of the children with SCA improved significantly as they got older. Many socio-demographic factors were reported as predictors of Health related quality of life particularly age, family role, transport system and working status of the family. Also, this study indicated that SCA is associated with an increased financial and psychosocial burden for caregivers and families (Camanda, 2021).

Quality of Life (QoL) is defined as the individual's own subjective perception of aspects of life, directly related to the state of health. Therefore, this concept represents the satisfaction and wellbeing of an individual as concerns physical, psychological, social, economic and spiritual domains of his/her state of health. Combination of the state of health and the affective response to it (Fouda et al., 2021).

Furthermore quality of life of children with Sickle cell anemia is affected due to disease process from all dimensions (WHO, 2017). Physically includes diet, physical activity, rest, and sleep, management of pain, fever, and vaso-occlusive crisis. Besides, emotional condition of children could also, be affected due to body image disturbance, fear, anxiety about the

need for future treatment which interfere with daily living. Intellectual aspect also can be affected because of learning difficulties (Essawy et al., 2018).

One model that has successfully been implemented in studying the QoL in patients with various illnesses is the educational intervention program called the PRECEDE-PROCEED planning model. PRECEDE-PROCEED model is composed of eight phases or steps, it begins with the final consequences, works backwards to the causes and once the cause is known, an intervention can be designed to improve the QoL for individuals (Saulle et al., 2020).

Relevance to Clinical Practice, PRECEDE-PROCEED Model is a strong theoretical model that guides the development of realistic nursing led interventions. While applying this model, nursing is described as the process of assessing the children's needs, planning, develop and implement appropriate nursing care plan with continuous evaluation of implementation process and finally evaluate the children's quality of life. Based on this model, nurse assess the predisposing factors which include children's knowledge about disease, attitude toward healthy life style (healthy diet, dental care, sleep, exercise, follow up visits and effect of disease on children's self-actualization). In addition to assessment of reinforcing and enabling factors that affect behavior change and eventually affect QoL (Gorina et al., 2019). Therefore, the present research purpose is to examine the effect of an application of the PRECEDE PROCEED Planning Model to enhance quality of life of children with sickle cell anemia.

Purpose of the study

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The purpose of the current study was to examine the effect of application of the PRECEDE-PROCEED planning model on quality of life of children with sickle cell anemia.

Research Hypothesis

Children with sickle cell anemia who will receive the PRECEDE – PROCEED planning model are expected to have better quality of life posttest more than pretest.

Methods

Research Design:

A Quasi- experimental design was utilized for this study (pre, post and follow up tests).

Research Settings:

This study was conducted at Pediatric Hematology Unit and Pediatric Hematology out Patient Clinic at Menoufia University Hospital, Shebein El-Kom City, Menoufia Governorate, Egypt

Sampling:-

A purposive sample of 31 children who were diagnosed with SCA from the previous mentioned settings was included in the study

Inclusion criteria

- Children from both sexes (male and female), aged from 8-12 years old and who were diagnosed with SCA included.
- Children free from any other chronic diseases, developmental disorders, attention-deficit disorders, neurological, sensory (vision or hearing), or motor disorders.

Data collection instruments:

To achieve the purpose of the study, two instruments were utilized for data collection.

Instrument one: - A structured interview Precede questionnaire sheet. It was developed by the

researcher after reviewing related literature

This instrument was divided into four parts:

- **Part one:** Sociodemographic of studied children. It included data related to children `s age, sex and educational level
- **Part two:** Predisposing Factors Assessment Sheet. This part divided into two sub parts .
 - **Sub part 1:** Children Knowledge about SCA disease . It included 14 questions about: definition, causes ,symptoms...etc

Scoring System

The scoring system for children`s knowledge was as follow; one score was given for correct answer and zero for the incorrect. The scoring levels were arranged as follow; less than 50% for poor knowledge, from 50% to less than 75% for average knowledge and $\geq 75\%$ for good children`s knowledge.

- **Sub part 2:** children attitude regarding healthy life style that affect quality of life . It included 28 items about healthy food 8 items, dental care 6 items, sleep 4 items ,exercises 5 items ,follow up 3 items, self-actualization 2 items.

Scoring System

The scoring system for children`s attitudes was as follow; one score was given strongly disagree, two scores for disagree, three scores for sometimes agree, four scores for agree, five scores for strongly agree. The scoring levels were arranged as follow; less than 50% for negative attitude, from 50% to less than 75% for fair attitude and $\geq 75\%$ for Positive Attitude.

- **Part three:** Reinforcement factors assessment Sheet. It included five questions to measure The support, encouragement and the persons who

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reinforcing children for positive behavior such as (presence of friends support, satisfaction with friends' support, family encouragement to follow up, availability of care at the treatment facility...etc

- **Part four:** Enabling factors assessment Sheet. It included 11 items to measure the availability and accessibility of resources needed to enable behavior change such as informational resources, educational classes or counseling center to educate children about SCA such as (participation in sickle cell anemia awareness groups, participation in psychological support groups to fight sickle cell anemia, the hospital accessibility....etc

Scoring system

Scores of each item on enabling factors and reinforcement factors ranged from 0 to 1 point. The scoring levels were arranged as follow; less than 50% for weak, from 50% to less than 75% for moderate and $\geq 75\%$ for strong.

Reliability

Of the attitude scale confirmed with a Cronbach's alpha reliability coefficient of 0.71. Test- Retest method used for determining the reliability of predisposing, reinforcing, and, enabling questionnaires in the pilot sample, it has been achieved with a correlation coefficient of 0.75, 0.80 and 0.77, respectively.

Instrument 2: Pediatric Quality of Life Scales

It Developed by Varni, (2006), to assess Health-related quality of life (HRQOL) for children with acute and chronic health conditions and adopted by the researcher and divided into two parts:

- **Part one:** Pediatric Quality of Life Initiative (PEDS QL) version 4.0 Generic Core Scale. It included 23 items regarding children's: Physical activities (8 items), Feelings (5 items), Social Functioning (5 items) and School Functioning (5 items).
- **Part two:** Pediatric Quality of Life (PedsQL) version 3.0 Sickle Cell Disease Module. It Developed by James, (1998), to assess Health-related quality of life (HRQOL) in children with SCD. It was modified by the researcher to include only subscale of Treatment (7 items), communication (6 items).

Scoring system:

The children's responses were scored on a 5-point Likert - style scale. Items were reversed-scored and converted to a 100-point scale (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0) (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0) with less than 50% indicating poor quality of life, from 50% to less than 75% for fair quality of life, and $\geq 75\%$ for good quality of life. Scale Scores are computed as the sum of the items divided by the number of items answered (this accounts for missing data). If more than 50% of the items in the scale are missing, the Scale Score is not computed.

Reliability of tool two:

The internal consistency of the questionnaires was calculated using Cronbach's alpha coefficients. Test-retest was used. The Cronbach's alpha of the questionnaire was 0.88.

Validity

For validity assurance, the three instruments were submitted to a jury of three experts including two professors of pediatric nursing and one professors of community health nursing to modify any required items of the instruments. The modifications were done to

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ascertain their relevance and completeness.

Pilot study

It was carried out on 4 children (10% of the sample) after the instruments were developed and before starting the data collection to test the practicability, applicability and to estimate the needed time to fill the instruments. No necessary modifications were done. Therefore, the pilot study was included in the total sample.

Ethical considerations

An official approval was obtained from the Ethical Research Committee in the Faculty of Nursing, Menoufia University.

Oral consent was obtained from children and their parent who participated in the study.

An initial interview was done to inform participants about the purpose, benefits of the study and explain that participation in the study was voluntary and the participants could withdraw from the study at any time without penalty.

Procedure:

- Prior to data collection, a written permission to carry out the study was obtained from the director of the unit after submitting an official letter from the Dean of the faculty of Nursing at Menoufia University explaining the purpose of the study and methods of data collection.
- Data collection for this study was conducted for a period of 9 months extending from the 1st January to the end of September 2021.
- The researcher introduced herself to children who shared in the study, explained the purpose of the study and methods of data collection.
- Model was applied based on its steps (eight steps) the first four steps were the precede, and the last four steps were the proceed.

Procede steps had four assessment

Phases:

- **Phase one:** Social assessment: In this phase, assessment of the socio-demographic data of children (instrument one part one) and quality of life in children with SCA (instrument two) was done by the researcher by used face to face interviews (pretest).
- **Phase two:** Behavioral and Environmental assessment was done by the researcher. In this phase, the researcher assessed children's attitude regarding healthy life style with SCA by using instrument one part two. Then assessed behavioral and environmental factors that usually affect QOL of children with SCA were done by using instrument one part three.
- **Phase three:** educational and ecological Assessments, In this phase the researcher assessed the predisposing, reinforcing and enabling factors that lead to behavioral change to improve QOL of children with SCA by using instrument one.
- **Phase four:** Administrative and Policy Assessments, During this phase, the researcher assessed all of the polices and organizational supports and resources needed for implementation and evaluation of the program. The researcher selected the program component and priorities of change that previously identified. This was achieved by assessing the place, identifying time table, resources, budgeting, barriers, facilities, and coordination required to implement the interventions.
- The researcher depends on the results of all the previous assessments in determining the children' needs. Finally the objective, the content and the

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materials of the intervention was determined and ready for implementation.

- Finally, after the four-phase assessment of the model, the educational intervention components were determined. Educational objectives, contents and materials were developed through review the scientific resources.

Procede phases had the second four step of model:

- **Phase five** Implementation phase: After planning the intervention, the educational intervention was implemented. The main objective of the educational intervention was modify predisposing factors (knowledge – attitude), Reinforcing factors, and Enabling factors to improve QOL for children with SCA and achieve this, the children received the educational intervention in 4 sessions based on the precede – proceed planning model, each session lasting 45 minutes using booklet, pamphlets, questions and answers to help children better understanding of content, in addition to face to face small group discussion as follows:

- The study sample included 31 children. Those children were divided into six smallgroups; each group included five children except one group included 6 children.
- According to hospital policy, every Monday from each week, the children were admitted at the Pediatrics’ Hematology Unit and Pediatric out Patient Clinic for admission or follow up visits. Every Monday at 9 am the researcher held meeting session with each group and each session lasting 45 minutes.
- First session focused on providing adequate and most important knowledge about disease

(Predisposing factors): Children received brief explanations with pictures about Sickle Cell anemia definition, causes, signs, symptoms, complications, treatment, prevention of pain crises and how to manage it.

- Second session focused on changing Attitude toward healthy life style (Predisposing factors): Children received general information supported with pictures about healthy food habits regarding importance of different nutrients as vitamin B, C and folic acids for those children, in addition to explain to children types of foods and drinks to avoid and importance of increase fluid intake to prevent dehydration. Children also received general information supported with pictures about Dental care and how to prevent tooth decays. Regarding activities practice, children received brief explanations about importance of exercises practice, examples of sports allow to practice it. Children received brief explanations about the ways help to get comfort continuous Sleep hours and ways to deal with insomnia. Also, Children were advice about importance of regular Follow up visits. Academic achievement, ways to deal with school absenteeism was also explained.
- Third session was about to modify reinforcing factors through encourage child to be familiar with health care staff and other who complain from the same disease. Participate in collective activities. Advice parents to give positive re-enforcement for the child when adhere to health behaviors.
- Fourth session was about to promote enabling factors through provide information about crises prevention, stress management,

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relaxation skills and giving educational resources as pamphlets and booklet.

- **Phase six:** Process evaluation: In this study, process evaluation included evaluating the program component, methods and material used.
- **Phase seven:** Impact Evaluation: reassessment of children's changes in predisposing, reinforcing and enabling factors immediately after intervention activities through analysis of the questionnaires and meeting with children to ensure availability of positive Enabling and Reinforcing factors (Post and follow up test using instrument one)
- **Phase eight:** outcome evaluation: reassessment of children's changes in predisposing, reinforcing, and enabling factors and quality of Life (Post and follow up test using instrument two).

Statistical Analysis:

Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 23. Graphics were done using Excel program.

Quantitative data were expressed as mean & standard deviation ($X \pm SD$) and analyzed by using paired sample t-test for comparison between two means pre and post intervention. While ANOVA test was used for comparison between more than two means

Qualitative data were presented in the form of frequency distribution tables, number and percentage (No. & %). It was analyzed by chi-square (χ^2) test. Level of significance was set as P value < 0.05 for all significant tests.

N.B: The total sample size was used for data analysis and there were no missing data or cases

Results

Table 1 & Figure 1: Shows characteristics of studied children. It

was obvious from this table that more than a third of the studied children (35.5%) were aged 8 years with a mean of 9.29 ± 1.3 years and two thirds (61%) were diagnosed with sickle cell anemia at 6 months of age with a mean of 5.25 ± 2.38 months. In addition third of them (35.5 %) were in the third grade of primary school. Moreover, the families of all the children in the study (100%) were second-degree relatives and they had less than one quarter (16%) other children suffering from sickle cell anemia. Also, more than half of studied children (54.8 %) were boys.

Figure 2: Shows percent distribution of levels of studied children knowledge on pre, post and follow up tests. This figure shows that all studied children had poor knowledge on pretest. Meanwhile, the majority of them (93.5%) had good knowledge on post and follow up tests. For this reason there were very highly statistical significant differences between children's knowledge on pre, post and follow up tests ($P < 0.001$).

Figure 3: Shows percent distribution of levels of studied children's attitudes on pre, post and follow up tests. This figure revealed that almost half of studied children (48.4%) had negative attitude on pretest meanwhile the majority of them (93.5% and 80.6% respectively) had Positive attitude on post and follow up. For this reason there were very highly statistical significant differences between children's attitude on pre, post and follow up tests ($P < 0.001$).

Figure 4: Displays levels of intensity of predisposing factors, reinforcing, and enabling factors for studied children on pre, post and follow up tests. This figure revealed that almost all studied children (93.5%) had weak factors on pretest meanwhile most of them (80.6%) had strong factors on

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post and follow up tests. For this reason, there were very highly statistically significant differences between children`s predisposing factors, reinforcing, and enabling factors on pre, post and follow up tests (P<0.001).

Figure 5: Shows percent distribution of levels of studied children`s quality of life regarding pediatric quality of life initiative generic core scale on pre, post and follow up tests. The finding revealed that majority of studied children (93.5%) had Poor quality of life on pretest meanwhile two thirds of them (61.3% and 74.2% respectively) had moderate quality of life on post and follow up tests. For this reason there were very highly statistical significant differences between children`s quality of life regarding pediatric quality of life initiative generic core scale on pre, post and follow up tests (P<0.001).

Figure 6: Shows percent distribution of levels of children`s quality of life (treatment and communication) regarding pediatric quality of life sickle cell disease module scale on pre, post and follow up tests. The finding

revealed that all children had poor quality of life on pretest while two thirds of children (61.3%) had Moderate quality of life on post and follow up tests. For this reason, there were very highly statistically significant differences between children`s quality of life (treatment and communication) regarding pediatric quality of life sickle cell disease module scale on pre, post and follow up tests (P<0.001)

Figure 7: shows Pearson correlation between total score of Precede tool and total score of quality of Life among studied children. It reflected that there was a positive highly statistical significant correlation between total score of total precedes tool and total score of quality of life at the 0.01 level.

Figure 8 and 9: shows Pearson correlation between grand total score of knowledge, Attitude and Precede tool and grand total score of quality of Life among studied children. This table illustrated that there were positive correlation between total of quality of Life among studied children and total knowledge, attitude and Precede tool.

Results

Table (1): Distribution of studied children according to their characteristics (n=31).

Characteristics		No = 31	%
Current age of the child	8: 9 years	20	64.5
	10:11 years	8	25.8
	12 years	3	9.7
Mean ± SD	5.25 ± 2.38 month		
Age of the child when diagnosed Mean ± SD	5.25 ± 2.38 months		
School year of the child:	Grade 3	11	35.5
	Grade 4	10	32.3
	Grade 5	7	22.6
	Grade 6	3	9.7
Parents' kinship	Relative	31	100
Grade of kinship	second grade	31	100
Are there other sickle cell children in the family	No	26	83.9
	Yes	5	16.1

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Figure 1 Shows percent distribution of gender of studied children

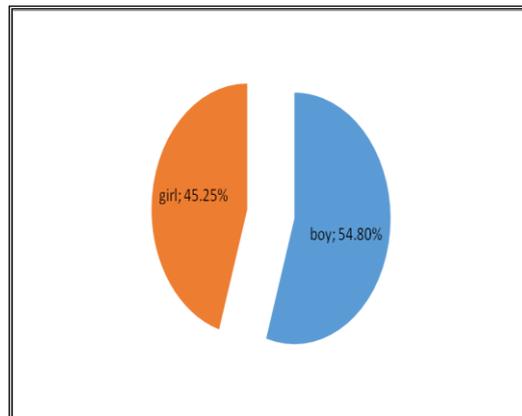


Figure (2): Percent distribution of levels of studied children knowledge on pre, post and follow up tests

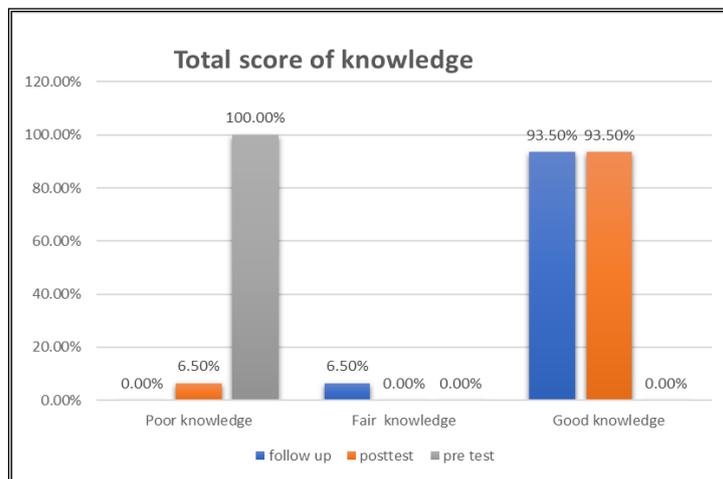


Figure (3) Percent distribution of levels of studied children's attitudes on pre, post and follow up tests

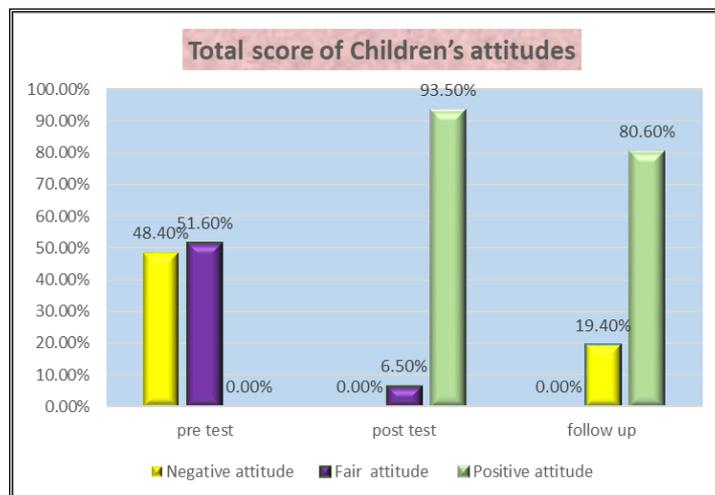


Figure (4): Levels of intensity of predisposing factors, reinforcing, and enabling factors for studied children on pre, post and follow up tests.

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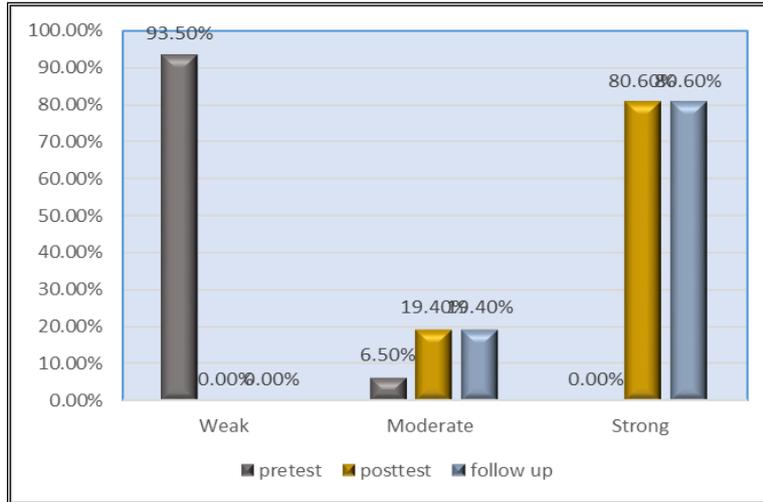


Figure (5):Percent distribution of levels of studied children's quality of life regarding pediatric quality of life initiative generic core scale on pre, post and follow up tests.

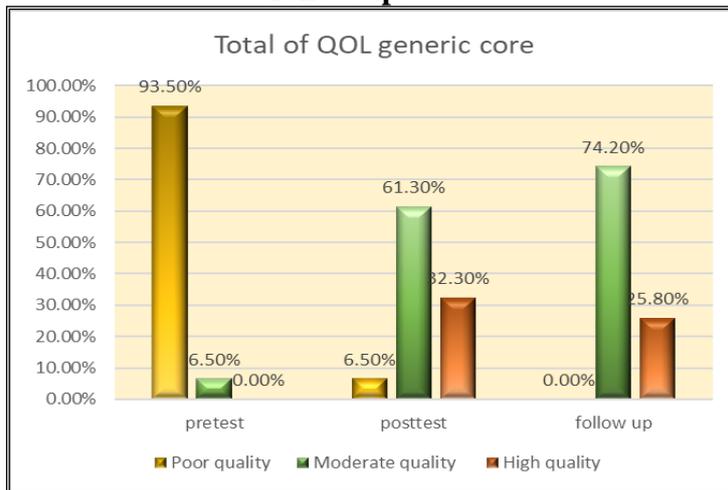


Figure (6) Percent distribution of levels of children's quality of life (treatment and communication) regarding pediatric quality of life sickle cell disease module scale on pre, post and follow up tests (n = 31)

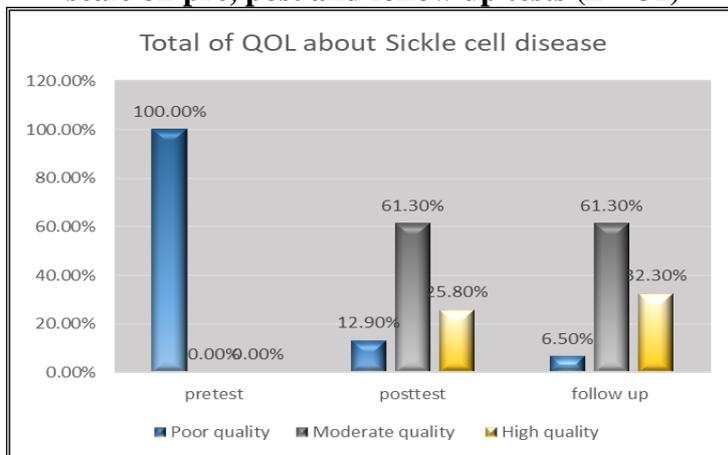


Figure (7): Pearson correlation between grand total score of Precede tool and grand total score of quality of Life among studied children with regression line

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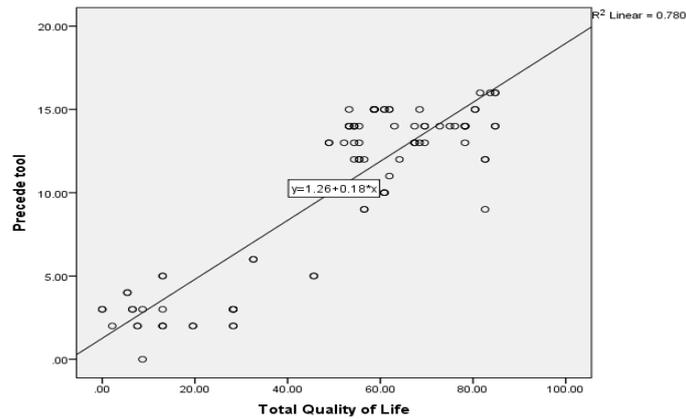


Figure (8): Pearson correlation between grand total score of knowledge and grand total score of quality of Life among studied children.

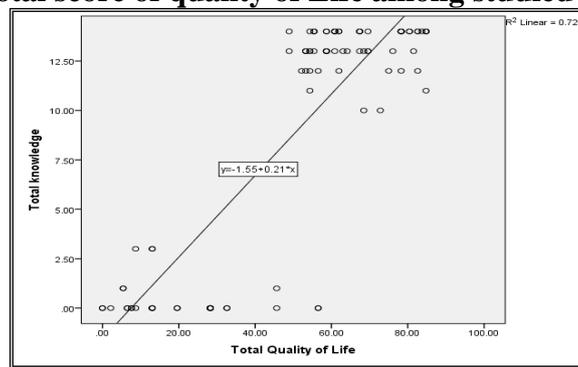
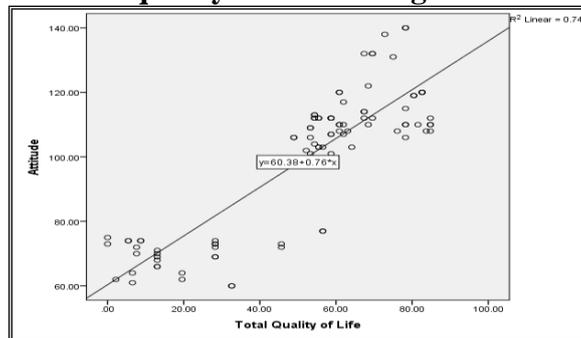


Figure (9): Pearson correlation between grand total score of Attitude and grand total score of quality of Life among studied children



DISCUSSION

Sickle cell anemia (SCA) threatens the health of million people globally. Sickle cell anemia (SCA) is an autosomal recessive disorder characterized by abnormal hemoglobin S production caused by the presence of a mutated form of hemoglobin. Red blood cells live for 90 –120 days on average, but sickle cells only live for 10 –20 days. Episodes of hemolytic crises can be life-threatening and affect their health and their QoL (Alzahran et al., 2021). Quality of life is commonly

defined as the child's physical, emotional, and social wellbeing, as reported by the caregiver or by the child directly. The measurement of quality of life in children with sickle cell anemia is an alternative method to assess the impact of the disease on the child (Pandarakutty et al., 2019).

Regarding the age of studied children, the current study illustrated that mean age of studied children was 9.29 ± 1.3 years. This result disagreed with Nafee et al., (2019) who conducted a study

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about “Effect of Structured Sickle Cell Anemia Health Care Intervention Package on the Quality of Life of Sickled Children” and illustrated that the average age of sickled children was 10.2 with SD ± 0.9 . Also, Chikani et al., (2021) who conducted a study about “The effect of sickle cell anemia on the linear growth of Nigerian children” and revealed that the mean age of the participants was 11.04 ± 5.56 years. This might be due to difference in the sample this may be due to different age group .

Regarding age of child at diagnosis, the current study revealed that more than one half of studied children were diagnosed at 6 months of age. This result goes in line with Alanazi et al., (2021) who conducted a study about “Impact of Sickle Cell Anemia on children growth and clinical parameters in Al-Ahsa region of Saudi Arabia” and concluded that most of the children (58.6 %) diagnosed with SCA belonged to age group 0-6 months.

This result disagreed with Hussein et al.,(2019) who conducted a study about “Determination of daily living activities of school age children with sickle cell anemia in Al Nasiriya City” and revealed that (70%) of studied children were first diagnosed above one year of age. This might be due to the time when child show clinical manifestations through visit health clinic or hospital.

Moreover, the families of all the children in the present study were second-degree relatives. This is due to consanguineous marriages as reported in Daak et al., (2016) who conducted a study about “Sickle cell disease in western Sudan: genetic epidemiology and predictors of knowledge attitude and practices” who revealed that the highest percentage of homozygous SCA was due to consanguineous marriages.

Regarding the gender of studied children, this study illustrated that more than half of children were boys. This result was nearly agreed with Ragab et al., (2021) who conducted a study about "Evaluation of Sickle Cell Module for Quality of Life in Egyptian Children and Adolescents Patients" who reported that 55% were males.

Concerning studied children's knowledge about Sickle Cell Anemia. The findings of the current study showed that the lowest level of children's knowledge was on pretest. This result was consistent with Ezenwosu et al., (2021) who conducted a study about “ Effect of health education on knowledge and awareness of sickle cell disease among adolescents “ and found that only a few of the respondents to the pretested sickle cell knowledge assessment questionnaire demonstrated comprehensive knowledge of mode of inheritance, symptoms and management of disease.

In the same context Shahine et al., (2015) who conducted a study about “Educational intervention to improve the health outcomes of children with sickle cell disease” and concluded that pre intervention, study participants had low level of knowledge about disease causes, symptoms, and management. This might be due to that the participants in the present study didn't engage in any health educational program. Therefore, health promotion and educational program are needed to improve studied children awareness on SCA to promote their quality of life.

The present study illustrated that, there was significant improvement in overall knowledge about SCA on post and follow up tests than on pretest. This result came in line with Asnani et al., (2016) who conducted a study about “Interventions for patients and caregivers to improve knowledge of

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sickle cell disease and recognition of its related complications” and concluded that statistically significant improvements were seen in knowledge of SCD in children who received the intervention. In the same context Kotb et al., (2019) who conduct a study about “Effect of health education program on the knowledge of and attitude about sickle cell anemia among male secondary school students in the Jazan Region of Saudi Arabia” and concluded that post intervention assessment showed significant improvement in the knowledge scores. From the researcher’s perspective, this could be interpreted as all children didn’t take any previous educational programs about sickle cell anemia. Also, this could be due to the researcher’s simple method of teaching by using colorful, attractive picture to facilitate communication with children in addition to oral explanation and feedback. Also, may refer this to the effectiveness of model-based intervention program which in turn helped children to acquire and improve their knowledge about sickle cell anemia.

The findings of the current study revealed that most children had higher positive attitude about activity practice on post and follow up tests than on pretest. This result goes in line with the results of study conducted by Rezapour et al., (2016) who conducted a study about "School-based PRECEDE-PROCEED-Model intervention to promote physical activity in the high school students in Iran " and revealed that school-based health education programs based on PPM interventions focusing on increasing physical activity are ideally suited to reach the goals of increased attitude of physical activity. This could be attributed to the effect of the intervention program in clarifying the importance of practicing

physical activity. In addition to strengthening the information about types of sports allowed and prohibited for those children. Also, the precautions that children must follow during exercise practicing.

Concerning children's attitude regarding follow up schedule visits, the present study revealed that more than half of studied children wasn't follow the regular follow up schedule as set by the physician. This result goes in line with Cronin et al., (2018) who conducted a study about “Modifying factors of the health belief model associated with missed clinic appointments among individuals with sickle cell disease” and reported that (65%) of children reported that they missed a clinic appointment. This may be due to forgetness, neglect from child or care giver, difficult access to the clinic, financial causes, and work overload of care giver.

Also, on post and follow up tests most children had higher positive attitude regarding follow up schedule visits. This result goes in line with Cronin et al., (2018) who illustrated that after intervention the studied subjects were keeping clinic appointments. This might be because of intervention in clarifying the time and the importance of following follow up schedule visits in determining progress in child condition and early detection of complications.

Regarding to children's reinforcing factors on pre, post and follow up tests, this finding revealed that majority of children had strong reinforcing factors on post and follow up tests than on pretest. This result consistent with Omidi et al. (2016) they conducted a study about "The effect of educational intervention based on PRECEDE-PROCEED model on promoting traffic safety behaviors in primary schools’ students of Tabriz" and showed that

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after the educational intervention, statistically significant differences were observed in the reinforcement factors in the experimental group compared to the control group. This could be attributed to the effect of the educational intervention based on Precede model in clarifying to children the value of their friends and their role as a strong source of support in their lives.

In relation to children's enabling factors on pre , post and follow up tests, the current findings revealed that the majority of children had strong enabling factor on post and follow up tests than on pretest. This result came in line with the findings of the study conducted by Hosseini et al. (2014) who conducted a study about "The impact of an educational intervention based on PRECEDE-PROCEED model on lifestyle changes among hypertension patients". Who showed that designing and implementing a training program based on the PRECEDE-PROCEED model was effective in enhancing predisposing factors (knowledge and attitude), reinforcing factors, and enabling factors in hypertension patients. In this experimental study, 40 patients were in the intervention group and 40 patients in the control group. Educational intervention was designed based on PRECEDE – PROCEED model and implemented on the intervention group. After the intervention, the intervention group than the control group scores of predisposing factors (knowledge and attitudes), reinforcing factors and enabling factors increased significantly among intervention group ($p < 0.05$).

The current study revealed that the lowest level of children's quality of life regarding overall domains was on pretest. This result was consistent with Pandarakutty et al., (2020) who

conducted a study about " Health-Related Quality of Life of Children and Adolescents with Sickle Cell Disease in the Middle East and North Africa Region" who showed that HRQOL scores were low in the physical functioning, emotional functioning, and academic functioning domains.

This result came in line with Al-Azri et al., (2016). Who conduct a study about "Knowledge and health beliefs regarding sickle cell disease among Omanis in a primary healthcare setting" and concluded that quality of life among children with SCA remains poor mainly due to lack of awareness about the disease. In addition to Alharbi et al., (2016) who illustrated that SCA significantly affected most HRQOL domains, including physical, social, emotional, and academic wellbeing domains.

In the same context Issa et al., (2020) who conducted a study about "Quality of life assessments in a cohort of Mozambican children with sickle cell disease", concluded that SCA has a negative impact on QOL domains. From the researcher's perspectives, poor QoL outcomes among children with SCA may be linked with Lack of awareness of the disease.

This is contrary to previous research conducted by Constantinou et al., (2015) who conducted a study about "Assessing the quality of life of children with sickle cell anemia using self, parent-proxy, and health care professional-proxy reports" and found that children with SCA did not report a lower QoL than healthy children. This may be due to the researchers using of generic QoL assessment tool but in current study the researcher used age specific version of sickle cell model disease QoL assessment tool in addition to generic core scale.

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Also, the findings of the current study clarified that children had higher levels of quality of life regarding overall domains on post and follow up tests than on pretest. From the researcher's perspective, this could be attributed to the educational program based on the precede proceed planning model which in turn helped children to acquire and improve their knowledge and attitude (predisposing factors) about Sickle Cell Anemia. Also helping child to identify and modify reinforcing and enabling factors has positive affect on children's thus improve their Quality of Life.

This result came in line with Bazpour et al., (2019) who conducted a study about " The effect of a training program based on the PRECEDE-PROCEED model on lifestyle of adolescents with beta-thalassemia: a randomized controlled clinical trial" who revealed that the intervention based on the precede proceed model had improve the adolescent's awareness and attitude of healthy lifestyle. Also the theory based intervention had significantly positive effect on predisposing, enabling and reinforcing factors immediately and a month after the intervention ($P < 0.05$). In the same context Fouda et al., (2021) who conducted a study about "Effect of Self-Learning Guidelines on Quality of Life and Self-Care Reported Practice of Adolescents with Sickle Cell Anemia" and concluded that there was a statistical significant difference observed between the total score quality of life for the studied subjects at post compared to pre self-learning guidelines implementation. Also, Badawy et al., (2017) who concluded a study about "Barriers to Hydroxyurea Adherence and Health-Related Quality of Life in Adolescents and Young Adults with Sickle Cell Disease" and revealed that, children

had better HRQoL due to the impact of a disease modifying therapy and regular follow up.

The present study reflected that there was a positive correlation between total score of total precedes tool and total score of quality of life. This could be because of application of the Precede proceed planning model that focus on changing predisposing, reinforcing, and enabling factors thus improve quality of life. This result goes in line with Bazpour et al., (2019) who concluded that there was a positive correlation between application of precede tool and lifestyle of adolescents with beta-thalassemia that result in improved their quality of life.

CONCLUSION

Based on the findings of the present study and the hypothesis, it was concluded that Children with sickle cell anemia who received the PRECEDE - PROCEED planning model based intervention had better QOL on post and follow up test than pretest.

RECOMMENDATIONS

Based on the previous findings and conclusion, the following recommendations suggested:

- Integrating of PRECEDE-PROCEED planning model into the daily routine care at all pediatric hematology units.
- Simple written guidelines about SCA disease, should be available at all hematology units for parents of children Advanced booklet regarding promoting QOL for SCA should be available at each hematology units
- In service educational training program should be developed and provided for nurses and children with SCA and their parents.

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- Application of the further study on a large sample size and for a long period of time to ensure the generalization of the results.

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