Effect of Tele Nursing on Health Outcomes of Children with Rheumatic Arthritis and Satisfaction of Their Caregivers during Covid-19 Pandemic

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Abstract

Rheumatoid arthritis (RA) is autoimmune illness which mostly affects the joints. Access to care and rheumatic arthritis outcomes and satisfaction may be improved by utilizing the tele-nursing especially during the outbreak of COVID-19. **Aim**: To investigate the effect of tele nursing on health outcomes of children with rheumatic arthritis and satisfaction of their caregivers during Covid 19 pandemic. **Design**: A quasi experimental research design. **Setting**: Three out patients' clinics of rheumatology were selected from; Menoufia University hospital, Teaching hospital and school health insurance clinics. **Subjects**: A purposive sample of 120 students were selected and divided equally to study and control group. **Instruments:** Data was collected using The Arabic form of The Juvenile Arthritis Multidimensional Assessment Report & Client Satisfaction Questionnaire-8. **Results**:The health outcomes of children with RA, including functional abilities, pain intensity, joint pain and swelling, joint stiffness, medication adherence, disease status and disease course, and general well-being, showed statistically significant differences between the study group and control group following the intervention. Moreover, there was a significance improvement in the levels of the quality of life (physical and psychological) on post intervention among study group than control group. Additionally, for the study group, there was a statistically significant improvement in the caregivers' satisfaction with the health services they received. **Conclusion**: Tele-nursing intervention is a significant method of health care delivery and has a positive impact on health outcomes of children with RA and increases the caregivers' satisfaction especially after arising the era of COVID 19 Pandemic. **Recommendations**: High-quality researches incorporating other undiscovered health outcomes and satisfaction are required to establish the benefit of tele-nursing in enhancing patient care.

Keywords: Caregivers' satisfaction, children rheumatic arthritis, Covid 19 pandemic, health outcome, and tele-nursing.

Introduction

Rheumatic arthritis (RA) is one of the most common kinds of arthritis. Presently, RA has become one of the main worldwide public health problems, which affects nearly 1% of the global population **(Myasoedova et al., 2020).** RA is an autoimmune disorder which characterized by inflammation in the synovial and joints damage. As a consequence, RA is marked by progressive disability over time and is linked to an increased risk of mortality as compared to the over-all population **(Bullock et al., 2018 &Kowalski et al., 2022).**

The causes of rheumatic arthritis diseases are still unknown but epidemiological studies show that genetic and environmental predisposing factors for these diseases, as well as virus or bacterial infection from etiological factors for this illness **(Safiri et al., 2019).** The manifestation of RA can differ from, such as pain, stiffness and swelling up to sever joint disabilities. Extra–articular manifestations may be life- threatening (Abuhelwa et al., 2020). Rheumatic arthritis reduces function, which resulting issues with performing activities of daily living (ADL) and has a detrimental influence on psychosocial aspects (**Chancay et al., 2019).**

Children with rheumatic arthritis have frequently continuous pain, poor ability to function, compromised bodily development, reduced sense of well-being and health related quality of life, and significant societal and school performance comparable to children with good health. Children and their caretakers struggle with the lack of therapy and the strenuous treatments using medicines such anti-inflammatory medications **(Ramelet et al., 2017).**

The outbreak of the Corona virus disease 2019 (COVID-19) pandemic elicited a global call for physical distancing, which inadequate patients' access to healthcare in several nations. As a result, healthcare providers revealed that the tele-nursing is a substitute or complementary way of providing nursing care **(Koonin, 2020 &Schwamm, 2020).** Children with chronic illnesses, including rheumatic arthritis; due to the nature of their underlying diseases and treatment with immunosuppressive drugs, they require ongoing medical and nursing advices **(Koonin, 2020 &Schwamm, 2020).**

This is particularly essential in children with rheumatologic disease, especially those receiving immunosuppressant medication, are potentially more likely to be more susceptible to COVID-19 morbidity and developing the severe consequences of the illness. So, these children were advised to protection during the pandemic **(Kirby, 2020).**

Children with persistent rheumatic disease require interdisciplinary care. In addition to providing medical concern, nurses take part in assisting the specialized team thoughtful for these sick children by identifying disease management issues and the need for action modifications, as well as by educating patients on their treatment options and where to get further assistance. The connection between patients, doctors, other healthcare providers, families, and caregivers is also maintained by nurses. These nursing services can be provided over the phone, or tele-nursing **(Ramelet et al., 2017).**

Nurses can use innovative approaches and tele-nursing to deliver remote nursing care with supervision, patient's education, patient status monitoring, data gathering, remote interventions, and pain management, they can support the children's caregivers to cope properly (Bashir, Bastola, 2018 & Liu et al., 2020). Tele-nursing (TN) might be the best resolution in COVID-19 condition. Nurses have deficient make contact directly to meet the children and their families. Nevertheless, it should be highlighted the using of technology to bring the elevated efficient nursing care is only feasible in COVID-19. The foundation of tele-nursing practice is communication. Consequently, it's essential that nurses and families, children and caregivers have a therapeutic connection **(Zhang, 2020).**

Tele-nursing is a substitute plan for delivering nursing care as a replacement for the individualized manner, providing care and nursing practice **(Pepito & Locsin, 2019 & Yu, 2019)**.It has been broadly used in healthcare for patients with chronic situations needing recurrent follow-up visits (Ferro et al., 2021). TN has assisted the continuity of care to children with rheumatic arthritis while lowering the risk of transmission of COVID-19 between healthcare providers, patients, and caregivers **(Goh et al., 2021).**

Client satisfaction in healthcare has been demonstrated to be closely correlated with improved patient and their caregivers' engagement and treatment compliance for multiple different chronic and acute healthcare situations **(Orlando et al., 2019).** Caregiver satisfaction and feedback is toughly taken into consideration for future development of tele-nursing technology equipment, to make ensure patient and provider relationships needs are addressed **(Kruse et al., 2017).** Interestingly, presented that nurse-led clinics have mainly exposed positive influence on patient outcomes, caregiver satisfaction, access to care and mixed findings on cost-effectiveness **(Randall et al., 2017).**

The utilization of tele-nursing strengths the discussion, instruction, supervision and assessment of medical and health care results of treatment beside, its impact on the satisfaction of both services and children's health status **(Chaupi, 2017 & Yu, 2019).**The use of smart phones and tablets makes actual time audiovisual communication widely accessible to both nurses and their patients. Yet, the application of TN can be limited by broadband access in rural and underserved societies **(Ansell & Mullins, 2021).**

Significance of the study:

Rheumatoid arthritis is the most prevalent chronic rheumatic disease in children and a significant reason of both short-term and long-term disability that impair the normal child life. Studies in developed countries have stated a prevalence that differ between 16 and 150 per

100 000. Globally, about 3 million children and young adults are estimated to suffer from rheumatic arthritis. Girls were constantly found to be at a higher risk than boys **(Dave, Rankin, Pearce & Foster, 2020).**

According to the most current WHO data published in 2018, that Egypt has a 0.5% prevalence of rheumatoid arthritis, with 78% of those affected being female, a mean age of 5,6, and a seven-years disease duration (**WHO**,**2018**).The point prevalence of RA was 3.43 per 100,000 (95 % CI 3.1–4.3). The prevalence of RA in boys was 2.58 per 100,000 and in girls was 4.33 per 100,000. Girls outnumbered boys (81/51) and presented a relative risk of developing RA of 1.68 **(El-Soud, El-Najjar, El-Shahawy et al., 2013).**

There are insufficient studies in Egypt that use tele-nursing to provide pediatric nursing care, and AbuSaad and Sarhan's study from 2016 recommend for applying tele-nursing to facilitate connection of children with their doctors and nurses when they call for. Additionally, there is a necessitate to direct the light on the applying of tele-nursing as a means for providing care for the children and their caregivers who care for them to overcome as well as to decrease the needs of children to visit to outpatients to lower the exposure to COVID-19 pandemic (Mohamed & Mahmoud, 2021). Hence, the current research was conducted to investigate the effected of tele nursing intervention on health outcomes and satisfaction of children with rheumatic arthritis and their caregivers through Covid 19 pandemic.

Operational definition:

- Tele-nursing means; using information technology to perform nursing care when there is a physical distance between the family **(Kord, et al., 2021).**
- Health outcomes are health changes and improvement in the children health conditions as a result of nursing actions or healthcare interventions (Lukewich et al., 2022). In the present study these health changes included: improving of functional abilities, pain intensity, joint pain and swelling, joint stiffness, medication adherence, disease status and disease course, general well-being and children quality of life (physical and psychological quality).
- Satisfaction is a key indicator of the quality of healthcare since it reveals whether the children or their caregivers are approved on and fulfilled with the provided health care services **(Akinyinka, Oluwole & Odusanya, 2020).**

Aim of the study:

To investigate the effect of tele nursing on health outcomes of children with rheumatic arthritis and satisfaction of their caregivers during Covid 19 pandemic. This aim will be achieved through the subsequent objectives:

a. Improve the functional abilities and decrease pain intensity of study group,
b. Decrease of joint pain and swelling, joint stiffness and increase of the medication adherence of study group,
c. Enhance disease status and disease course as well as, improve the general well-being and get better quality of life (physical and psychological) of study group and
d. Increase the satisfaction level of caregivers among the study group.

Methods

Hypothesis:

1. Children in the study group, who will receive tele-nursing, will have improved health outcomes compared to children in control group who will receive only routine care.
2. Caregivers of children in the study group, who will receive tele-nursing, will have improved level of satisfaction than the caregivers of children in the control group who will receive only routine care.

Design:

A quasi-experimental design was used to conduct the current study (study and control group).

Setting:

This study was conducted in three out patients' clinics of rheumatology. These clinics affiliated Menoufia University Hospital, Teaching hospital and school health insurance at Shebin El-Kom City. These clinics provide medical examination and follow-up of patient including children with rheumatic diseases, as well as giving health education services. Each clinic have certain work days (two days per week).

Subject:

A purposive sample of 120 children with inflammatory rheumatic arthritis and their caregivers divided to 60 children in study group (receiving tele nursing intervention for a period of 9 months one time a month and 60 children in control group (receiving usual outpatient care).They were enrolled from the previously mentioned setting in this study. A simple random sample was used to assign the children into study and control group according to the following **Inclusion Criteria:** children from 6-17 years old of both sexes, children who have recently been diagnosed with inflammatory rheumatic arthritis (within six months of the enrollment date) and who have registered as outpatients with the rheumatology clinic and children's caregivers at any age of both sexes who agreed to participate and were provided a satisfaction rating for the child's status over the course of the research. **Exclusion Criteria:** children who have any chronic condition other than RA and children and caregivers who have no access to smart phone or any social media or platform (e.g. Microsoft Teams, WhatsApp).

Sample size: based on reviewing of literature and medical records for the children rate of flow on rheumatology outpatient clinics, Menoufia governorate, Egypt. The needed sample was obtained at level 95% CI based on the subsequent formula:

$$\text{Sample size} = \frac{2SD^2(Z_{\alpha/2} + Z_\beta)^2}{d^2}$$

Here,

SD = Standard deviation (it can be calculated after pilot study or can be taken from previous related studies)

$Z_{\alpha/2} = Z_{0.05/2} = 1.96$ *(Type I error at 0.95 level)*

$Z_\beta = Z_{\beta 0.20} = 0.842$ (80% power, from Z table)

d = Effect size (difference between means of experimental and control groups)

$$n = \frac{2(1.03)2X(1.96 + 0.842)2}{(0.38)2} = 115.68 \text{ children}$$

Thus, a sample size of $120\ children$ would be necessary for conducting the study.

Instrument: Structured interviewing questionnaire was utilized for data collection including main three parts:

I: Socio-demographic characteristics of rheumatoid arthritis children and their caregivers. It included child's age, sex and education level and caregiver's age, sex, educational level, work status and family income.

II: The Arabic Version of The Juvenile Arthritis Multidimensional Assessment Report (JAMAR) adapted from (Al-Mayouf, 2018) and was used by the researchers to include the following nine sections:

1. Functional Ability. It includes 15-items of activities which specify only the difficulties or restrictions caused by the illness and express the child ability to perform the physical activities during the past four weeks. The child's ability to carry out each task is graded as the following score: 0= without difficulty, 1= with some difficulty, 2=with much difficulty, 3=unable to do and not applicable. The total score of functional ability ranged from 0 to 45, and categorized as the following 1.00 = "mild functional ability (0-15)", 2.00 = "moderate functional ability (16-30)" and 3.00 = "high functional ability (31-45)"
2. Pain Intensity: the child's scoring the force of pain on a 21-numbered encircles visual analogue scale. The child or their caregiver asked to choose the most accurate score describe how much pain have been had as a an effect from the illness over the previous week according to the following category:

NO PAIN																			EXTREME PAIN
0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

3. Joint pain presence: An evaluation of the presence or absence of joint pain or swelling is performed for each body joint. The responses were scored as: 1.00 = "present" and 2.00 = "absent".
4. Pain associated symptoms (morning stiffness): Assessment of morning stiffness (present/absent). The child asked to designate if he had joint stiffness upon waking up throughout the previous week. The responses were scored as: 1.00 = "no" and 2.00 = "yes".
5. Assessment of medication adherence: It was concerned with determine if the child taking medications regularly (as prescribed by the doctor) at home. The responses were scored as: 1.00 = "no" and 2.00 = "yes".
6. Disease course at the time of the visit: It was concerned with scoring of disease severity at the time of the visit in which the child or their caregiver asked to evaluate the current state of the illness. The responses were categorized according to the presence or absence of the symptoms: 1.00 ="(remission of the symptoms)", 2.00= "(persistent activity of the disease)", 3.00 = "Recurrence of symptoms after a period of complete well-being (relapse)".
7. Disease course from previous visit: Rating of disease course from previous visit. The child or their caregiver asked to Compared the course of the illness from the last visit. The responses were scored like: 1.00 = "Much improved", 2.00 = "slightly improved", 3.00 = "Stable/unchanged", 4.00 = "slightly worsened" and 5.00 = "Much worsened" .
8. Health Related Quality of Life (HRQoL): Assessment of HRQoL through the physical and psychosocial health subscales (5 items each). Likert scale with 4 point were addressed to the prior month are ‘never’ (score=0), ‘sometimes’ (score=1), ‘most of the time’ (score=2) and ‘all the time’ (score=3). The total score extended from 0 to 30.It is scored to higher and lower quality of life; the higher score indicates worse HRQoL.
9. Child’s overall well-being: assessment of the child’s overall well-being on a 21-numbered circle visual analog scale from 0 to10. The child or their caregiver asked to choose the most accurate score and what was he felt at the moment of the visit. The higher indicate very poorly (more than half 5.5 score).

VERY WELL VERY POORLY

0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

Reliability

Reliability of the (JAMAR) instrument was assessed to examine the degree to which the tool's items were related to one another, by Cronbach's co-efficiency α (a=0.82) for all items with the exception of HRQoL was (a=0.84). The instrument items were checked for the internal consistency by Pearson correlation (r=0.93).

III: Client Satisfaction Questionnaire-8 (CSQ-8). It was developed by Larsen et al., (1979) and retested for its validity and psychometric properties of the Castilian Spanish Version by Vázquez et al., (2019). It contained of 8 items and was rated on a 4-point Likert-type. It designed to appraise the caregiver satisfaction in delivered services and program appraisal. Total scores for CSQ-8 are 32, which the higher degree indicating greater satisfaction (17-32 score) and the lower degree (1-16) means lower satisfaction.

Reliability

The reliability of the (CSQ-8) instrument was examined to measures how closely items in a tool are related to one another by Cronbach's co-efficiency α (a=.0.97). The instrument items were checked for the internal consistency by Pearson correlation (r=0.98).

The validity

The validity assurance for instrument of data collection were submitted to a jury of five expertise in the fields of pediatric and community health nursing, (2 Prof. in the Medical field and 3 assist Prof in the Nursing field).

Ethical Considerations

The official approval was obtained from the research and ethics committee of the faculty of nursing to conduct the research. Oral consent approval was obtained from the participated children and their caregivers after

being informed that the study was safe, voluntary, and that responses would be kept confidential. All children and their caregivers had the full rights to decline and leave at the time they want.

Pilot Study

Once the tools were established and before the data collection began, 10% of the total sample (12 caregivers and their children) was conducted a pilot of study, in order to assess the tools' applicability, practicability, consistency, clarity, and feasibility, as well as to determine how long it would take to complete them.

Procedure

- The study was conducted over a period of nine months from the start of March to the end of November 2021.The selection of the subjects and baseline data (pretest) was collected over a period of one month and the tele-nursing intervention was provided over a period of six months. Then the posttest taken after two months from the TN intervention.
- The tele-nursing intervention that used in the current study is based on Cox's Model of Client Health Behavior Interaction (CMCHBI). This paradigm was established to deliver and record nurse care and assessment. Also, it provides the best opportunity for the nurse to interrelate with the child and their caregivers to achieve the positive health outcomes. It is based on three fundamental conceptual axes: client singularity (individuals' traits), client-professional interaction, and health outcome. (Fig 1). In addition, TN intervention is designed to help the nurse to provide the health service to the child and their caregivers.

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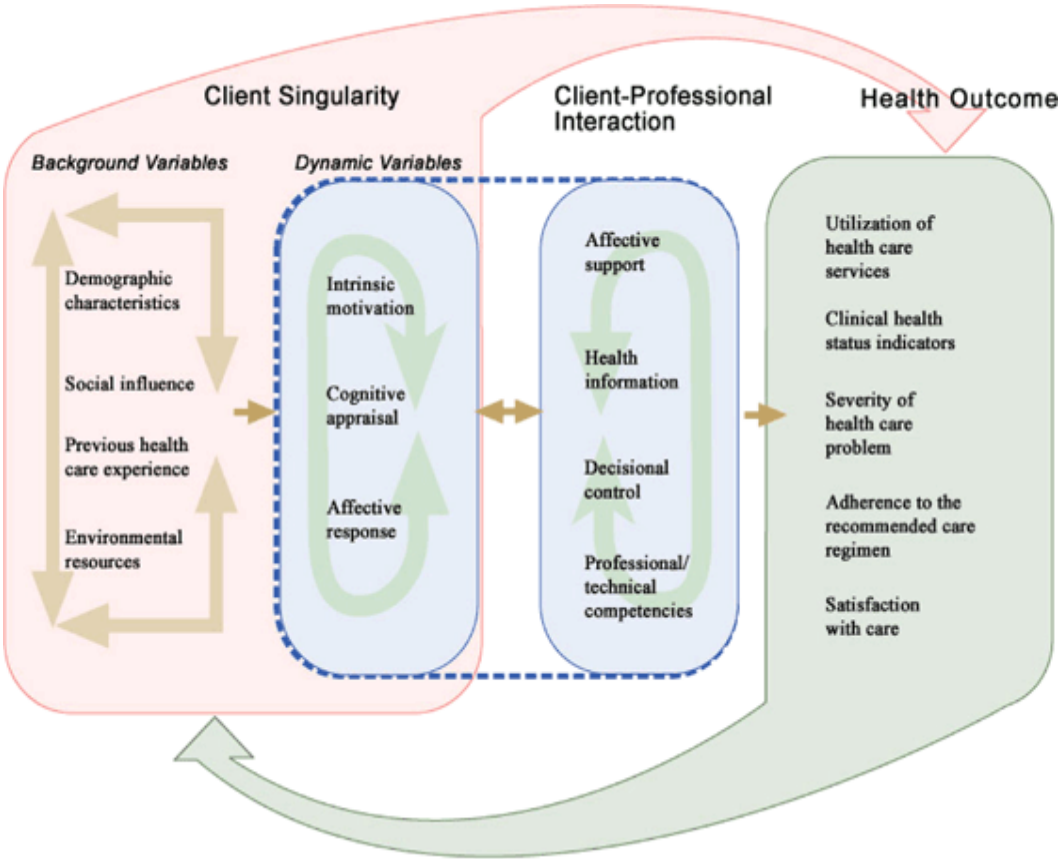

Mathews, S. K., Secrest, J., &Muirhead, L. (2008). The interaction model of client health behavior: A model for advanced practice nurses. *Journal of the American Association of Nurse Practitioners*, *20*(8), 415-422.

- The formal consent to apply the study was taken from the directors of the chosen settings. Meetings were first held with the directors of the settings to get permission for undertaking the research and to describe the objectives, expected results, and the data gathering techniques.
- Following selecting the subjects, the data was collected from the two groups (study-control) of children and their caregivers. The face-to-face meeting involves the identification between the TN nurse, children, and their caregivers. The TN nurse also familiarized herself with every child's clinical, social, and family conditions. The base line assessment data was obtained from all participants using the data collection instruments (pre test).
- Children who were able to judge or decide on their health status asked to fill out the pretest tool collaboratively with caregivers and others who had not, asked their caregiver to rate the child's health. Then the participants were divided randomly to study and control group.

Study group: the participants in the study group attended a face-to-face meeting with the TN nurse for the first time. In addition, during this meeting the TN nurse informed the caregivers of the study group that they will receive a monthly meeting during the last week of each month on Microsoft team or any other social media according the preference of the study group also, the telephone number to call when necessary and for the purpose of follow up was available. Then, the children and their caregivers received a monthly meeting on Microsoft team for six months. Also,TN nurse gave them health education on Corona virus pandemic and how to prevent it.

- The monthly meeting intervention included a comprehensive, systemic appraisal of the participant's needs as well as a detailed explanation of the children's symptoms and problems.
- Following this appraisal, a plan of care was collaboratively developed. Subsequently, the TN nurse implemented the plan of care to meet families' needs by providing the nursing instructions which included: *health information, affective support and assistance with decision-making*.

- *Health information*: The TN nurse provided clear information about the child's health condition and explains the importance of treatments & medications including the side effect of the medication and how to manage it. Also, explain tests, physical activity, and symptoms management including pain management as relaxation & distraction techniques and guided imagery. For joint swelling at the morning apply warm compresses and make arrange of motion exercises for this joint. Besides medical and nursing information, the TN nurse provided information regarding psychological health, rehabilitation facilities and interaction with other children. In addition, the TN nurse refers the children or their caregivers to the specialist at any time of intervention once they had any problem related to the disease process which unable to control.
- *Affective support:* The TN nurse gave the parent and child time to speak, express their feeling and she listened attentively to their concerns. Then, TN nurse provided psychological support through calming their fears and meeting their needs.
- *Assistance with decision-making:* The TN nurse encouraged caregivers' participation in decision-making by updating them on the status of their child's care and providing them with the various options that are most likely to meet their requirements and alleviate their problems.

- **Control group:** during the intervention of TN for the study group the control group received only usual outpatient routine care that was available at this period (during the pandemic of COVID 19) which included: follow up in the rheumatology clinic as much as possible and got up their medication. Moreover, the outpatient clinic's nurse gave them health education on Corona virus pandemic and how to prevent it.
- The posttest was applied for re-evaluating the effect of the intervention on the health

outcomes, quality of life and caregivers' satisfaction of the study group and to compare between the study and control group.

Statistical Analysis

- Statistical Package for Social Science (SPSS), edition 23 to enter and analyze the data and excel program to create the graphics were applied.
- Quantitative information was presented as mean and standard deviation and evaluated using a paired sample t-test to compare two means before and after the intervention.
- Tables of frequency distributions, numbers, and percentages (No.&%) were used to present qualitative data. Chi-square ($\chi 2$) test was used to examine it. P value < 0.05 was chosen as the level of significance for all significant tests.

Results

Table 1: shows sociodemographic characteristics of studied children. As indicated in the table, 41.7% of studied children in the study group are between 10-13 years and 36.7% of the children in the control group are between 6-13 years old. According to child sex, 73.3% of studied children in the study and control groups are females. In relation to child's educational grade, 61.7% of the studied children in study and control groups are in the primary educational grade.

Table 2: clarifies that, the mean age of caregivers in the study and control groups are (34.27±7.15&35.08±7.60) respectively. Regarding to the educational level, 55% of study group caregivers and 61.7% of control caregivers of studied children had secondary education. Concerning to work status, more than three quarters of caregivers of both study and control groups are working (75.0% &76.7%), respectively. In relation to family income, 68.3% and 83.3% of caregivers of studied children in the study and control groups have no enough income.

Table 3: clarifies that, total mean score of functional abilities in study and control groups are 22.82±9.16 and 23.38±7.19 respectively in pre intervention. Meanwhile in post intervention, total mean score of functional abilities in study is 29.32±8.43 compared to 22.10±4.47 in the control group. Therefore, a highly statistically significant difference between study and control groups in post intervention is found.

Concerning to mean total score of pain intensity among children with rheumatic arthritis in study and control groups in pre intervention are 5.767± 2.257 & 5.117±2.067 respectively. On the other hand, on post intervention, mean score of pain intensity of studied children in study and control groups are 4.07±1.75&5.00±1.93 respectively. Additionally, on post intervention a significant improvement (P< .001) between the study and control groups is observed.

Figure 1: shows that, children in study group had high functional ability on post intervention (43.3%) compared to 16.7% pre intervention and to 11.7% in the control group post intervention.

Table 4: shows distribution of studied children according to feeling of joints' pain and swelling, joints' stiffness and medication adherence in the study and control groups on pre and post intervention. It is obvious from this table that, there is a significant improvement regarding feeling of joints' pain and swelling, stiffness and medication adherence of studied children in study group on post intervention than on pre intervention. Therefore, statistical significant differences between study and control groups are found.

Figure 2: clarifies that, there are significant improvement in the children rating of the disease status at the time of the visit among study group more than control group. As shown in the figure; 5% of study group are rating complete absence of disease (remission) at the time of the visit on pre intervention improved to 48.3% on post intervention.

Also, 56.7% of study group are rating the disease status at the time of the visit as continuing presence of symptoms (persistent activity) on pre intervention decreased to 38.3% on post intervention. In addition, 38.3% of study group are rating the disease status as recurrence of symptoms after a period of complete well-being (relapse) on pre

intervention decreased to 13.4% on post intervention.

Figure 3: shows that, 43.3% and 48.3% of the studied children in the study and control groups respectively have the disease course slightly worsened in pre intervention. Meanwhile, in post intervention; there is an improvement in rating of disease course from previous visit in study group than in the control group. As shown, 1.7% of the studied children in the study group in pre intervention rating the disease course; much improved which increased to 10.0 % in post intervention.

Table 5: shows that, the total score of quality of physical health in study and control children 9.23±3.596, 9.93±3.23 respectively on pre intervention with no statistical significance difference. Meanwhile on post intervention, it is decreased to 4.87±2.38 in study group with statistical significance improvement. Additionally, the total score of the quality of psychological health in study group decreased from 9.88±2.83 on pre intervention to 7.30±2.189 on post intervention.

Furthermore, the total score of health related quality of life in study group lowered from 19.03±5.207 on pre intervention to 12.167±3.232 on post intervention. Finally, there are statistical significance improvements between study and control groups on post intervention corresponding to pre intervention regarding to the total mean score of health related quality of life.

Figure 4: illustrates that, on pre intervention, 75.0% and 65.0% of the studied children in the study and control groups respectively have lower level of quality of life. Although on post intervention, 80.0% of the study group has higher level of quality of life. So, it is obvious that, there is a significant improvement in the levels of the quality of life in study group on post intervention than on pre intervention compared to control group.

Table 6 & Figure 5: clarifies that, total mean score of overall well-being of the studied children decreased from 7.217±1.03 on pre intervention to 3.68±1.142 on post intervention. In addition, there is statistical significance difference between pre and post intervention regarding to total mean score of overall well-being of the studied children or their caregivers in the study group ($p<0.001$).

Table 7: illustrates that, there are no statistical significance differences in the levels of caregivers' satisfaction about provided health services between study and control group on pre intervention. While, on post **intervention**, there is statistical significance differences in the levels of satisfaction about provided health services between study and control groups. Also, this table represents that, there are significant improvement in the total score of client satisfaction about provided health services in which total score of study group 15.48 ± 2.22 on pre intervention improved to 21.18±3.53 on post intervention.

Table (1): Sociodemographic characteristics of study and control groups of studied children (n=120).

Sociodemographic characteristics	Study group (n=60)		Control group (n=60)		X^2	P value
	No.	%	No.	%		
Child age /year:					.785^{NS}	.675
6-9	23	38.3	22	36.7		
10-13	25	41.7	22	36.7		
14-17	12	20.0	16	26.7		
Child sex:					.000^{NS}	1.000
Male	16	26.7	16	26.7		
Female	44	73.3	44	73.3		
Child's educational grade:					.789^{NS}	.674
Primary	37	61.7	37	61.7		
preparatory	14	23.3	11	18.3		
Secondary	9	15.0	12	20.0		
Total	60	100.0	60	100.0		

NB: NS: Not significant (p>.05)

Table (2): Sociodemographic characteristics of the study and control groups of children's caregivers (n=120).

Sociodemographic characteristics of studied children 's caregivers	Study group (n=60)		Control group (n=60)		X^2	P value
Mean age	34.27±7.15		35.08±7.60		t-test .606^{ns}	.546
	No.	**%**	**No.**	**%**		
Sex:						
-Male	21	35.0	18	30.0	2.685^{NS}	.078
-Female	39	65.0	42	70.0		
Educational level:						
- Basic education	7	11.7	8	13.3	3.28^{NS}	.069
-Secondary education	33	55.0	37	61.7		
-University or above	20	33.3	15	25.0		
Work status:						
-Working	45	75.0	46	76.7	.045^{NS}	.831
-Not working	15	25.0	14	23.3		
Family income						
- Enough	19	31.7	10	16.7	3.683^{NS}	.055
- Not enough	41	68.3	50	83.3		
Total	60	100.0	60	100.0		

NB: NS: Not significant (p>.05)

Answering hypothesis 1

Table (3): Distribution of total mean score of functional abilities and pain intensity of studied children among study and control groups in pre and post intervention

Variables	Pre intervention			Post intervention		
	Study group X ± SD	Control group X ± SD	T- test P value	Study group X ± SD	Control group X ± SD	T- test P value
Functional abilities	22.82±9.16	23.38±7.19	.377 ^{NS} .707	29.32±8.43	22.10±4.47	**5.26^{HS} <.001**
Pain intensity	5.77± 2.26	5.117±2.067	.198^{NS} .843	4.067±1.75	5.000±1.93	**4.175 ^{HS} <.001**

NB: HS: High significant (p<.001) NS: Not significant (p>.05)

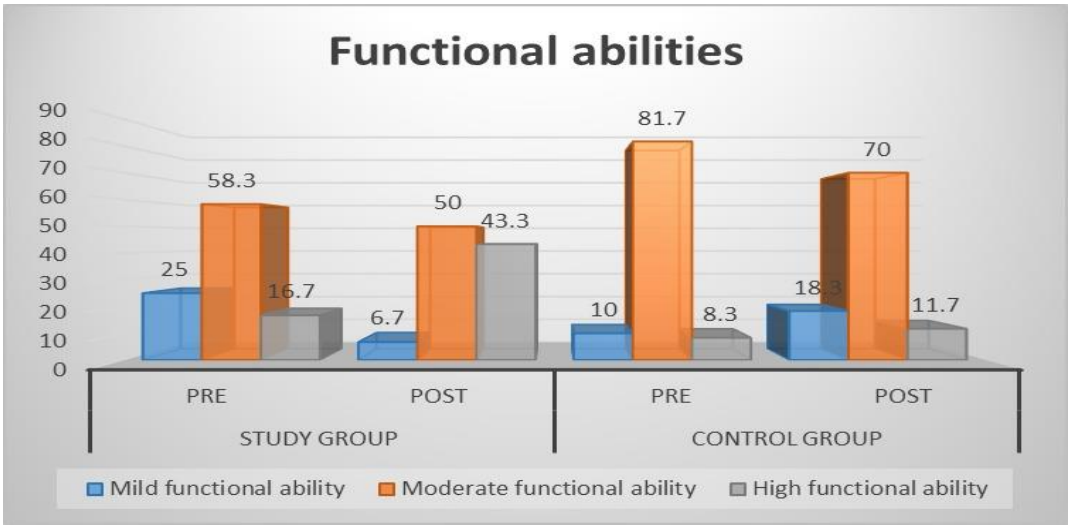

Figure (1): Distribution of studied children according to their levels of functional abilities among study and control groups on pre and post intervention

Table (4): Distribution of studied children according to feeling of joints' pain and swelling, joints' stiffness and medication adherence among study and control groups on pre- post intervention (n=120).

Variables	Pre intervention					Post intervention				
	Study group		Control group		X^2 1 P1	Study group		Control group		$X^2$2 P2
	No.	%	No.	%		No.	%	No.	%	
Feeling of joints' pain and swelling: Present	53	88.3	57	95.0	.823^{NS} .364	17	28.3	54	90.0	**23.35^{HS} <.001**
Absent	7	11.7	3	5.0		43	71.7	6	10.0	
Occurrence of joints' stiffness: Present	41	68.3	39	65.0	.150^{NS} .699	21	35.0	39	65.0	**10.85^{HS} .001**
Absent	19	31.7	21	35.0		39	65.0	21	35.0	
Taking medications regularly (as prescribed by the doctor) at home:					.000^{NS} 1.000					**50.71^{HS} <.001**
Yes	10	16.7	10	16.7		50	83.3	11	18.3	
No	50	83.3	50	83.3		10	16.7	49	81.7	

NB: HS: High significant (p<.001) NS: Not significant (p>.05)

$X^2$1 &P1: *comparison between study and control groups on pre intervention.*

$X^2$2 &P2: *comparison between study and control groups on post intervention.*

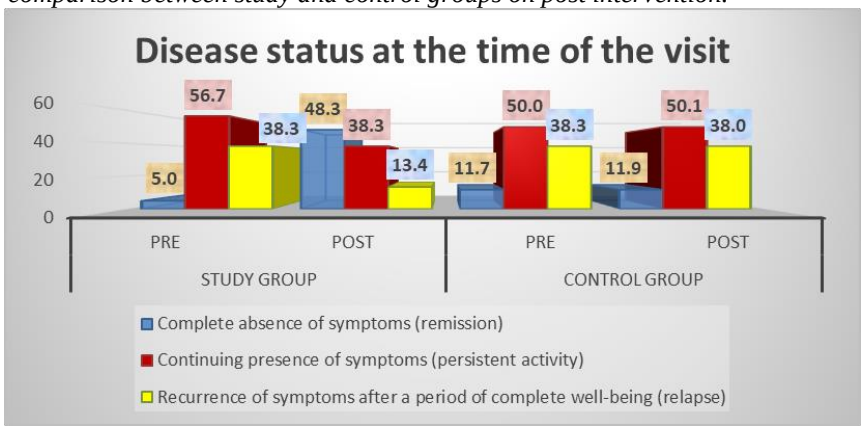

Figure (2): Distribution of children according to rating of disease status at the time of the visit in study and control group on pre and post intervention

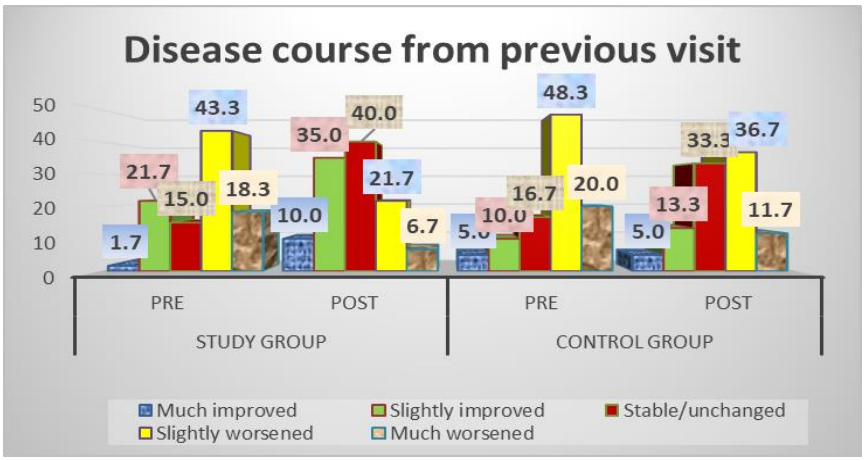

Figure (3): Distribution of studied children according to rating of disease course from previous visit among study and control groups on pre and post intervention

Table (5): Distribution of total mean score of physical, psychological and total score of health related quality of life among study and control groups of children in pre and post intervention

Health related to quality-of-life items	Pre intervention			Post intervention		
	Study group	Control group	t test (p)	Study group	Control group	t test (p)
	X±SD	X±SD		X±SD	X±SD	
Physical health	9.23±3.596	9.93±3.23	-1.122-^{NS} (.264)	4.87±2.38	9.90±3.23	**-9.78^{HS} (<.001)**
Psychological health	9.88±2.83	8.18±4.22	2.59^{s} (.011)	7.30±2.19	8.11±4.22	**-10.44 ^{HS} (<.001)**
Total mean score of health-related quality of life	19.03±5.21	17.98±6.09	1.02^{NS} (.312)	12.17±3.23	17.67±6.01	**-6.53 ^{HS} (<.001)**

NB: HS: High significant (p<.001) NS: Not significant (p>.05)

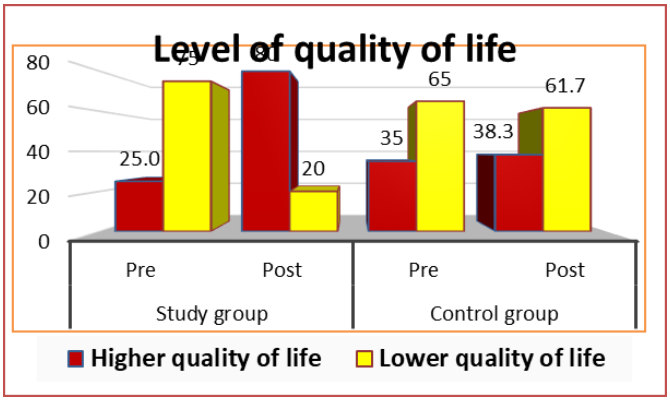

Figure (4): Distribution of studied children according to levels of quality of life in study and control groups on pre and post intervention.

Table (6): Mean total score of studied children's rating of overall well-being in study and control groups on pre and post intervention

Mean total score children's overall well-being	Pre intervention				Post intervention			
	Study	Control	T test	P value	Study	Control	T test	P value
	X±SD	X±SD			X±SD	X±SD		
	7.217±1.03	7.483±.948	-1.06-^{NS}	.095	3.68±1.142	7.217±.954	-13.925-^{HS}	**<.001**

NB: HS: High significant (p<.001) NS: Not significant (p>.05)

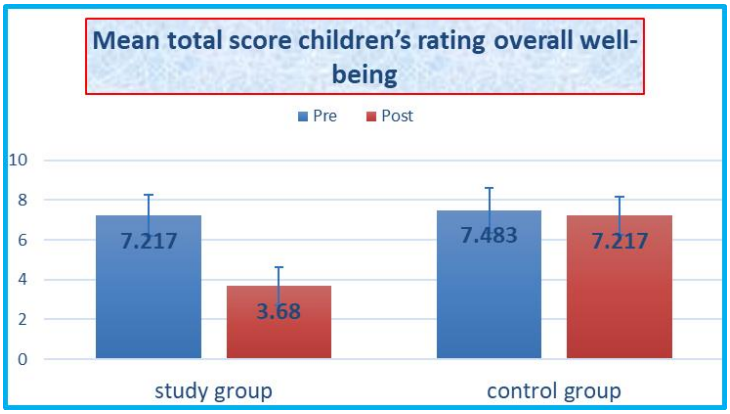

Figure (5): Mean total score of studied children overall well-being in study and control groups on pre and post intervention

II- Answering hypothesis 2

Table (7): Distribution of the levels and mean total score of satisfaction about provided health services among studied caregivers in the study and control groups on pre and post intervention

Levels of caregivers' satisfaction about provided health services	Pre intervention					Post intervention				
	Study		Control		X^2 1 P1	Study		Control		$X^2$2 P2
	No.	%	No.	%		No.	%	No.	%	
- Lower satisfaction (1-16)	45	75.0	42	70.0	2.13^{NS} (.144)	9	15.0	41	68.3	**19.54 ^{HS}(<.001)**
- Greater satisfaction (17-32)	15	25.0	18	30.0		51	85.0	19	31.7	
Total score of caregivers' satisfaction about provided health services (total 32)	**X±SD**		**X±SD**		**t test (p)**	**X±SD**		**X±SD**		**t test (p)**
	15.48±2.22		16.00±2.05		-1.32^{NS} (.118)	21.18±3.53		16.17±1.81		**9.79 ^{HS} (<.001)**

**** NB:*** HS: High significant (p<.001) NS: Not significant (p>.05)

$X^2$1 &P1: *comparison between study and control groups on pre intervention.*

$X^2$2 &P2: *comparison between study and control groups on post intervention.*

Discussion

Rheumatoid arthritis is a chronic condition that can cause joint damage because of the pain and stiffness it causes in the joints. To promote the greatest potential health results, the care of a child with rheumatoid arthritis should require a collaborative effort over an extended period of time (Goh et al., 2021).Because of the Covid-19 epidemic, there is a greater need for tele-health nursing **(Elsharkawy, Saber &Abouheiba, 2022).**

Tele-nursing has been demonstrated to increase accessibility to healthcare services as well as the effectiveness, timeliness, and quality of healthcare service delivery (Kennedy et al., 2017). So, the present study was carried out to ascertain the effect of tele nursing intervention on health outcomes and satisfaction of children with rheumatic arthritis and their caregivers during COVID 19 pandemic**.**

Tele-nursing intervention and Health Outcomes of the children with RA

Regarding to the total mean score of functional abilities among children with RA, the present study findings showed no statistical significance differences on pre intervention between study(receive TN intervention) group and control (receive routine care)group. While on post intervention; there was a highly statistical significance improvement in study group corresponding to control group ($p < 0.05$). Additionally, the levels of functional abilities increased to forty three percent of children in study group on post intervention compared to about seventeen percent on pre intervention. These results were consistent with **Ramelet et al., (2017).** They found that seventy one percent of participants in study group had no difficulties in their functional capacity compared to thirty eight of participants in control group.

Furthermore, this result came in agreement with **Moon & Jeon (2018).** They discovered that the program of their study was effective to boost patients' ability to control their own care. These consistencies may be due to that, continuous encouragement and motivation achieved by TN method could be enhance the functional abilities or physical activities of children with RA.

Concerning to the mean total score of pain intensity among children with rheumatic arthritis in study and control group; the current study showed the tele-nursing be successful tool to help children with RA and their care providers; how to properly manage and reduce pain intensity compared to control group (P<.001).This outcome was constant with **Ramelet et al., (2017).** They found the majority of participants in study group had no pain compared to fifty percent of the participants in control group.

Additionally this result was congruent with **Richardson et al.,(2021).** They found significant differences in pain intensity between groups were examined. These consistencies may be due to that, using TN could help in reducing pain intensity by

educating the children and their caregivers about measures used to manage pain and follow up care.

Regarding to the children' feeling of joints' pain and swelling among the study and control group on pre and post intervention. The present study revealed that, there was a considerable improvement in the feeling of joints' pain and swelling in study group compare to control group in post intervention than in pre intervention. The present study was agreed with a study conducted by **Kennedy et al., (2017).** They concluded that, the utilization of telemedicine technology provides ability for the collections of people existing in far areas to have contact to inter-professional programs.

Furthermore, the results of present study supported by the study conducted by **Gudnadottir et al., (2021)** and concluded that, the nurse follow up by telephone may have a supportive effect on children's improvement. These consistencies may be due to that, using TN through providing health information could be effective method to help the children and their caregivers in managing joint pain and swelling.

Regarding to the occurrence of joints' stiffness among the study and control children on pre and post intervention. The present study revealed that, there was an improvement in the occurrence of joints' stiffness in study group compared to control group on post intervention. These findings came on the same line with **Ramelet et al., (2014).** They reported that eighty percent of participants in study group had no stiffness compared to sixty percent of participants in control group.

Moreover, these results came agreed with **Goh et al., (2021),** they stated that, telemedicine is a means in the management of the rheumatic diseases among children to facilitate access-ability of families and their children in searching for care supply in any geographic location.

These agreements may be due to that, nursing intervention e.g. range of motion exercise could help in dealing with joint stiffness especially at morning and many of children under the study approved on TN as appropriate method of obtaining proper nursing care.

As regarding to the effect of tele nursing on children' medication adherence between the two groups on pre-post intervention, the present study revealed that, there was a significant increasing in the percentage of the medication adherence in study group than in control group on post intervention. This result supported by the study conducted by **Seraj et al., (2020)** who carried out the study on" effect of tele-nursing on adherence to treatment in adolescents undergoing cardiac surgery. They found that, the mean score of adherence to treatment in the case and control group has changed after intervention and found to be highly significant between the groups.

This similarity may be due to that, during the course of the TN nurse provided clear health information about the child's health condition and explains the importance of treatments & medications adherence including the adverse effects of the drug and how to deal with it.

In relation to rating of the disease status during the time of visit among children in pre-post intervention between study and control group, the current study illustrated that, five percent of study group were rating complete absence of disease (remission) at the time of the visit in pre intervention which improved to about fifty percent in post intervention. In addition, statistical significance differences were found between both groups in relation to their rating of the disease status at the time of visit ($p < 0.05$). This result agreed with **Ramelet et al., (2017).** They found that, participants in study group had improvement in rating of disease status (complete absence of symptoms (remission) compared to participants in control group.

Furthermore, this result came in agreement with **Moon& Jeon (2018)** who conducted a study on" effect of a telephone-based self-management program led by nurses on self-care behavior, biological index for cardiac function, and depression in ambulatory patients with heart failure ". They concluded that, the telephone-based self management intervention was aconsiderable interference to

enhance self management in patients with cardiac failure.

These similarities interpreted the importance of the TN in providing clear information about the health status and assist in raising the awareness of both children and their caregivers.

Regarding to the rating of disease course from previous visit among children in pre- post intervention; the finding of the existing study clarified that," much" enhancement in disease status from previous visit among study group compared to control group were obtained. Also, a statistical difference between study and control group regarding to rating of disease course from previous visit among children in post intervention were found. This result was consistent with Ramelet et al., (2014).They found "much" improvement in disease status from previous visit among participants in case group than in control group.

This result was also consistent with **Hosseini & ZiaeiRad (2016).** They found that tele-nursing session was effective in improving the self- efficacy and manage of weight in heamodialysis patients.

In addition, the results of current study were congruent with the findings of the study conducted by **Keshavaraz et al., (2020),** they clarified that, a statistical significant difference between the groups was found after the TN conduction and they concluded that tele nursing could be helpful in the adherence of the treatment and supports self-efficacy of patients. As a result, these consistencies among the findings could be attributed to the use of tele-nursing which might produce better outcome on disease course among children with RA.

In relation to physical and psychological health related to quality of life of children in pre-post intervention between study and control group, the current study highlighted that, a statistical significance difference between study and control group regarding the total score of physical, psychological and total score of quality of life of children ($p<0.05$) was found. This result was similar to the finding of **Ramelet et al., (2017)** who found that the participants in the study group had no difficulty in physical quality of life comparable with the participants in the control group. Also, the studied participants had no difficulty in psychosocial quality of life when compared to control group.

Furthermore, this result came in agreement with **Sato, (2020)** who conducted a study on the effectiveness of tele-nursing on the post-operative complications in patients suffering from prostate cancer". He found that a tele-nursing method using information and communication technology (ICT) was successful in improving postoperative complications and quality of life in patients with cancer prostate.

In addition, this result agreed with **Rezaei et al., (2020)** who conducted a study about "Effect of tele-nursing and face-to-face training techniques on quality of life (QoL) in burnt patients". They reported that, the educational sessions in the form of tele-nursing and face to face teaching were successful and enhance QOL in burn injuries survivors. This harmony may be due to that, affective support given by the TN method in which the nurse gave the caregiver and the child time to speak, express their feeling and she listened attentively to their concerns. Then, TN nurse provided psychological support through calming their fears and meeting their needs.

Regarding to the effect of tele-nursing on total mean score of overall well-being of the studied children /caregivers; the result of current study revealed that, there was a significant improvement in study group when compared with control group between pre and post intervention ($p=0.000$). This finding seems to be consistent with the study' finding conducted by **Ferro et al., (2021).** They illustrated that focused telemedicine (tele-visits), tele-health, and tele-monitoring have illustrated to decrease the unexpected hospital admission and visits, reduce the whole costs for families and healthcare services, enhance satisfaction and family and child overall health and well-being.

These similarities clarified that, besides medical and nursing care, the TN nurse provides information regarding the psychological health, rehabilitation facilities and interaction with other children; which help in improving the child and his caregiver sense of control over health and improve general wellbeing.

Tele-nursing intervention and the satisfaction level on health services.

Regarding to the caregivers' satisfaction on children's condition and provided services for the next few months on pre and post intervention between study group and control group. The current study findings clarified that, the statistical significance improvement in the satisfaction levels between the study and control group on post intervention ($p<0.05$) and this evidenced by; about one third of study group in pre intervention were satisfied on children's condition and provided services; improved to two thirds in post intervention. This result came in agreement with **Ramelet et al., (2017).** They represented that, the satisfaction level was greater at the last part of the TN period than standard care.

Moreover the current study finding of supported by the finding conducted by Ferro et al., (2021).They illustrated that, focused tele medicine (tele-visits), tele health, and tele monitoring have illustrated to decrease the unexpected hospital admission and visits, reduce the whole costs for families and health care services, enhance satisfaction of family on child overall health and well-being. In addition the current study findings approved by **Bassi et al., (2022).** They found that the most of the population was very satisfied with the quality of the provided services.

This can be attributed to providing the subjects in the study group with modified, individualized, emotional care, healthy information and assist in making decisions by tele-nursing that support in improving their level of satisfaction and completely impact on their symptoms. Also, their families were approving on the support and information provided through TN nurse.

On the contrary, the result of current study was incongruent with **Linda et al., (2019).** They found that users using videophones expressed more satisfaction with the hardware and guidance. Sessions conducted through videophone were substantially more beneficial than those conducted over the phone only.

Limitation of the study:

The basic limitation of the current study was the shortage numbers of research articles at this field which enforced the researchers to discuss and compare the results of their study with other studies not specific to the same subjects.

Conclusion:

Tele-nursing intervention is a significant method of health care delivery and has positive impact on health outcomes of children with RA and increases the caregivers' satisfaction especially after arising the era of COVID 19 Pandemic.

Recommendation:

- High-quality researches incorporating other undiscovered health outcomes and satisfaction are required to establish the benefit of tele-nursing in enhancing patient care.
- Use tele-nursing systems as a routine method of delivering nursing care to all patient populations, especially to those who have severe chronic health issues.
- The recent COVID-19 pandemic has highlighted the urgent obligation for healthcare services to advance the practice of TN on a worldwide degree.

Implications for Nursing Practice

Use of tele-nursing seems to be suitable system that assists in improving health outcomes of children with rheumatic arthritis and increase caregivers' satisfaction on provided care. Besides, it is expected to help in reducing the unplanned hospital admitting, healthcare service costs, nursing errors and economic burden for families.

Implications for Future Research

Future or upcoming researches are needed to evaluate the sustainability and long-term usefulness of tele-nursing programs targeting children and their caregivers.

Conflict of interest:

There are no declared conflicts of interest by the authors.

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