Prevalence of Dental Caries and its Impact on Quality of Life (QoL) among HIV-infected Children in Kenya

Masiga MA* / M'Imunya JM**

Aim: *To determine the prevalence of dental caries and its impact on QoL among HIV-infected children in Kenya.* ***Study design***: *Cross-sectional survey of HIV-positive children aged 3-15 years.* ***Method***: *Two hundred and twenty participants were selected by consecutive sampling. Dental examination was undertaken to determine the presence of dental caries among the children using the dmft/DMFT indices. The children's perceived QoL in the domains of oral symptoms, functional limitations, emotional and social wellbeing was assessed using the WHO Simplified Oral Health Questionnaires for children.* ***Results***: *The overall prevalence of dental caries was 65% whence the prevalence in the deciduous dentition was 50% while that of the permanent dentition was 30.9%. The mean dmft and DMFT scores were 1.75 and 1.08 respectively. Children with high dmft manifested negative impacts on appearance, chewing, biting hard foods and missing school on account of toothache and discomfort, while in the permanent dentition children with high DMFT had a negative impact on biting hard foods.* ***Conclusion***: *A high caries experience had significant negative impacts on the children's QoL, especially in the primary dentition.*

Keywords: *Dental caries, QoL, HIV-positive children, children.*

INTRODUCTION

Over two decades since the first Acquired Immunodeficiency Syndrome (AIDS) case was described in Kenya in 1984, HIV/AIDS still remains a challenge for the country. The Kenya Demographic and Health Survey (KDHS)[1] estimates that about 7% of adults in Kenya are infected with HIV; the number of people living with HIV being about 1.1 million adults of ages between 15-49 years, another 60,000 aged 50 years and above, and approximately 120,000 children. Urban populations have a higher HIV prevalence (10%) compared with the rural population (6%), while the rates in women nearly double that of males. The vast majority of children have acquired the infection through mother-to-child transmission.

Dental caries is the single most common chronic childhood disease; it is said to be 5 times more common than asthma, 7 times more common than hay fever, and 14 times more common than chronic bronchitis.[2] Many industrialized countries have experienced a decline in dental caries prevalence over the past several decades ascribed to improved oral hygiene, a more sensible approach to sugar consumption and effective use of fluorides.[3] However, among HIV-infected children caries prevalence is reported to remain high in both developing and developed countries.[4-9] In one of the studies the high prevalence of caries was attributed to the children's consumption of non-milk extrinsic sugar at night, use of sugar-based medication, low fluoride intake, late commencement of toothbrushing and poor dental attendance.[8] Recently, however, caries experience is thought to be more directly linked with immunosuppression. There is evidence that demonstrates a correlation of caries experience with the immune status of the patient; caries experience being reported to increase with decreasing CD4+ cell counts and with moderate to severe immunosuppression.[10,11]

The burden of dental caries in children is multifaceted; the consequences of Early Childhood Caries (ECC), for example, include a higher risk of new carious lesions,[12,13] hospitalizations and emergency room visits,[14-16] increased treatment cost and time,[17,18] delayed or insufficient physical development (especially in the child's height and/or weight),[19,20] loss of school days and increased days with restricted activity,[21,22] and a diminished ability to learn.[23]

More recently, research has started to demonstrate the impact of severe dental caries on a child's quality of life (QoL) in terms of growth and general well-being. In 1999, Low *et al* showed the effect of severe caries on the QoL in young children as assessed by the child's parent/guardian.[24] Acs *et al* studied the perceived outcomes and parental satisfaction following dental rehabilitation of children with caries under general anesthesia.[25] Both studies showed an improvement in the child's QoL following comprehensive dental rehabilitation. The improvements pertained to the child having less pain and improved abilities to eat and sleep. The consideration on oral health impacts on daily life of an identifiable group of medically compromised children is the basis of this study.

The purpose of this study was to determine the impact of dental caries experience on the QoL among 3-15-year-old HIV-infected children attending an outpatient comprehensive health care facility in Nairobi, Kenya. The children's perceived QoL in the domains of

* Masiga Mary Atieno, BDS, MSc, Senior Lecturer, Department of Paediatric Dentistry & Orthodontics, School of Dental Sciences, University of Nairobi.

** M'Imunya James Machoki, MBChB M.Med (O/G) M.Med (Anthrop) Deputy Director UNITID and associate professor of obstretics and Gynaecology..

Send all correspondence to: Dr Masiga Mary Atieno, School of Dental Sciences, University of Nairobi, P.O. Box 19676-00200, Nairobi.

E-mail: ati_masiga@yahoo.com
mary.masiga@uonbi.ac.ke

oral symptoms, functional limitations, emotional and social well-being was assessed through reporting by their parents/guardians.

MATERIALS AND METHOD

Participant recruitment

The cross-sectional survey was carried out over a 3-month period, whence it employed a standardized epidemiological dental examination of 220 HIV-positive children aged 3-15- years attending the Kenyatta National Hospital-Comprehensive Care Centre (KNH-CCC). The sample size calculation was done using the WHO recommended formula on sample size determination, based on the estimated prevalence of dental caries among HIV-positive children from a previous Kenyan study. The inclusion criteria were children aged 3-15-years (both ages inclusive), who were enrolled at the center, did not suffer any other disabilities and whose primary caregiver was a biological parent, kin or foster parent living with the child. The children who met the inclusion criteria were selected consecutively as they presented day-to-day until the calculated sample size of 220 children was achieved. The name of the selected participant was confirmed at the center's registry and each was assigned a numerical code in order of participation. No record was kept of the link between numerical codes and patient identity. An informed written consent was obtained from the caregivers of participating children and confidentiality was assured. Ethical approval to conduct the study was obtained from the Kenyatta National Hospital & University of Nairobi Ethical Review Committee (KNH-UON ERC).

Data on the QoL of the participants were collected using the WHO Simplified Oral Health Questionnaires for Children[26] which had previously been piloted on a similar child population at the University of Nairobi Dental Hospital, to improve its readability. The questionnaires ascertained each child's socio-demographic data and description of their oral health; the accompanying parent/guardian being the key informant for all children below 8-years of age. The specified variables on QoL included general assessment of own health of teeth and gums, satisfaction with appearance of teeth, avoiding smiling and laughing because of teeth, other children making fun of their teeth, toothache or discomfort caused by teeth making them miss school, discomfort on chewing and difficulty in chewing solid foods. All interviews were conducted by the principal investigator (PI).

Clinical Examination

An intraoral examination was carried out on each child to determine their caries status. This was done within the office setting at the Center with the child seated on an ordinary chair and using natural light. The teeth were dried using gauze prior to the examination. The WHO periodontal probe was used to examine for caries. Dental caries was scored using the dmft/DMFT index, the PI having been calibrated by a pediatric dental specialist in accordance with the Dental Caries Index.[27] Ten children were examined for the calibration exercise and an inter-examiner variable of 0.92 was achieved. Each tooth was recorded as decayed (D/d), Missing (M/m) or Filled (F/f). Teeth that were missing were confirmed from the child and caregiver as having been extracted due to dental caries. Standard interviewing and clinical examination procedures were employed for all participants. Every tenth child was re-examined to test for diagnostic consistency in clinical examination for which a Kappa value of 0.97 was obtained.

The data were analyzed using the SPSS version 14.0 software. Frequencies, descriptive, univariate and bivariate analyses were carried out whence appropriate statistical inferences were made. Chi-square tests were used to examine the categorical data and the student't' tests were applied for analysis of mean dmft and DMFT scores. Results were considered significant when the p value was ≤ 0.05.

RESULTS

Sociodemographic characteristics

The study comprised 112 (51%) male and 108 (49%) female participants with a mean age of 8.36 ± 3.48 years SD. Males were marginally older (8.57 ± 3.48 years SD) than females (8.14 ± 3.48 years SD). The difference was not statistically significant (T=0.37 p=0.36). The participants were stratified into four age-groups according to their dentition status as follows; deciduous dentition 3-5 years 58 (26.3%); early mixed dentition 6-8 years 54 (24.5%); late mixed dentition 9-11 years 65 (29.6%) and permanent dentition 12-15 years 43(19.6%). Figure 1 illustrates the distribution of participants according to age group and gender.

Ninety-six (43.6%) children had both parents alive and living together, 33 (15%) had parents alive but who lived separately, while 91 (41.3%) children were orphaned (one or both parents deceased). The children were mostly (61%) accompanied to hospital by their mothers. Eighty-five (38.6%) children lived in homes that were headed by females. Of the 135 (61.4%) children who lived in households headed by male adults, 43(31.9%) males adults had primary level education, 71(52.6%) had secondary level education while only 21 (15.6%) had attained some form of tertiary education.

Majority 179 (81.4%) of the children had neither attended nor received any form of dental care. The main reason that was given for the low uptake of dental services by the parents and caregivers was that dental pain had not been severe enough to warrant seeking of treatment.

Self-reporting of QoL

Overall, 79 (35.9%) of the children described the health of their teeth as having been good, 9 (4.1%) as very good 60 (27.3%) as average, and 71(32.3%) as poor. Twenty-nine (13.2%) children reported having ever experienced severe toothache, while 25% had suffered toothache occasionally. One hundred and ninety-seven (89.5%) children reported satisfaction with the appearance of their teeth, 20 (9.1%) avoided smiling and laughing on account of their teeth, while 13 (5.9%) had other children often make fun of their teeth. Four children (1.8%) were not sure on what to report. On functionality and social activity, 17 (7.7%) children reported discomfort in chewing food, 61 (27.7%) had difficulties in biting hard foods while 22 (10%) children had missed school on account of toothache and discomfort.

Dental caries prevalence and its impact on QoL

The overall dental caries prevalence was 65%. The prevalence of caries in the primary dentition was 50% while that of the permanent dentition was 30.9%. The dmft and DMFT scores were 1.75 and 1.08 respectively. The highest component of the dmft and DMFT indices in both dentitions was decayed teeth. There was minimal evidence of dental restorations having been carried out (2.8% filled teeth) in the permanent teeth, and none in the deciduous teeth. In the permanent dentition the mean decay was 1.04, missing 0.01 and filled 0.03, while in the deciduous dentition the mean decay was 1.63, missing 0.12 and filled 0.00.

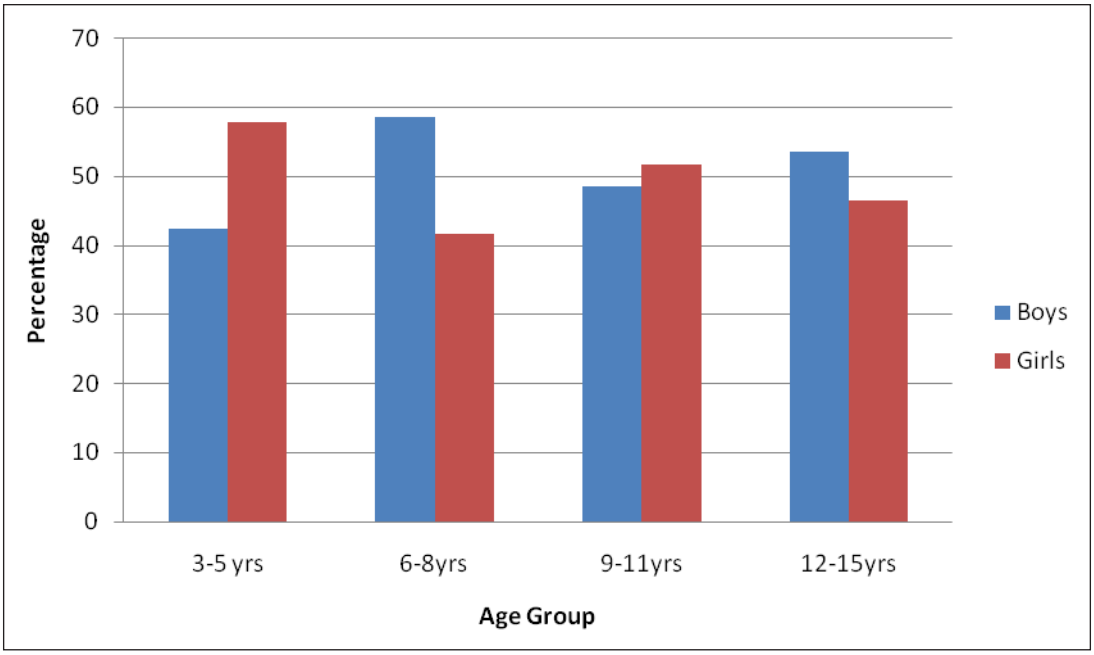

Figure 1: Distribution of study participants by age-group and gender.

Table 1. Caries experience with the domains of OHRQoL

	Mean DMFT			Mean dmft		
	Yes	No	P-value	Yes	No	P-value
I am satisfied with appearance of my teeth	1.08	1.13	0.91	1.57	3.30	0.01
I often avoid smiling and laughing	1.40	1.05	0.47	2.90	1.64	0.27
Other children make fun of my teeth	1.23	1.63	0.79	3.30	1.60	0.12
Toothache & discomfort forced to miss class	2.23	0.94	0.60	3.36	1.51	0.00
I have difficulty in chewing	2.23	0.99	0.17	3.29	1.60	0.01
I have difficulty in biting hard foods	1.74	0.83	0.03	3.50	1.08	0.00

Data relating caries experience with the various domains of QoL for both the primary and permanent dentitions are summarized in Table 1. The results were found to have been significant with regard to certain parameters of wellbeing. There were significant differences in the manifestation of negative impacts when correlated with the dmft/DMFT scores where the children who had high dmft scores registered negative impacts with regards to their perceived appearance (F=10.86 p=0.01), chewing (F=7.77 p=0.01), biting hard foods (F=53.10 p=0.00) and toothache and discomfort having forced the child to miss school (F=13.01 p=0.00). Children with high DMF scores registered negative impacts with regards to biting hard foods (F=8.77 p=0.03).

DISCUSSION

Children who are HIV-positive have been reported to suffer from a high prevalence of dental caries compared to those in the general population.[4-9] In the current study, almost two-thirds (65%) of the children had past and present evidence of having been affected by the disease and at least half of the children (50%) in their primary dentition. The design of the study did not incorporate a control group, therefore, comparative inferences cannot be drawn from a complimentary cohort of children who have no HIV infection. Another limitation is that there hasn't been a National oral health survey carried out in Kenya so the precise magnitude of dental caries disease among children in the general population is unknown. However, there are a few sporadic epidemiological studies which form the backbone evidence on the dental health status of children in Kenya. The studies report the prevalence of dental caries in the deciduous dentition to range between 55-63.5%,[28-30] while in the permanent dentition the prevalence ranges between 22.6-50%.[31-34] In this regard, the caries prevalence reportedly observed in the current study may be said to be comparable to that of children in the general population. However, since the study designs and inclusion criteria were all different, only subjective inferences can be made.

Little is known about the functional, emotional and social consequences of poor oral health among children with HIV-infection. Questions about self-perceived health are a useful resource that is now being used with increasing frequencies in oral health surveys and clinical trials, intended to supplement clinical indicators and thus provide the full impact of an oral disorder within populations.

In this study, discrepant results were obtained. The question on overall perception of oral health revealed a low prejudicial impact, whereas caries experience itself was found to correlate with negative impacts, especially among the younger children. An explanation for this may be the fact that these data were collected at one particular point in the child's life when the acute painful stage was already

past, caries being dynamic in nature; a tooth may have been hurting one week earlier, whence the tooth becomes necrotic or creates a fistula through the bone relieving the pressure and pain at the time of questioning, or caries become arrested where favourable oral conditions exist.. When children live with chronic pain, they may describe a tooth that is only slightly uncomfortable as not painful. An additional reason that may apply specifically among this group of children may be that dental illness assumes a low priority within the context of a morbid condition of HIV-infection that comes with a myriad of other health problems.

The question may also arise as to whether the methodological strategy that was used in the study, where the parents/guardians of the younger children were used as proxy could have influenced the outcome on perception. Eider and Morse[35] suggested that measurement difficulties encountered due to the nature and developmental changes in children can be minimized by having a proxy, a parent, guardian or other primary caregiver to report on the child's quality of life, the consideration being whether young children can themselves communicate their own wellbeing validly. Some parents, it is reported may have limited knowledge about their children's QoL, particularly on social and emotional wellbeing.[36] Child advocates argue that only children themselves can provide a subjective perspective of their health and their feelings about their heath.[37,38] Filstrup *et al* showed that indeed children as young as 3-years of age are able to communicate their oral health and QoL in a valid manner.[39] Nonetheless they advocated the use of a parent/guardian scale that could also be used as a communication tool to alert parent/guardians on their child's need for dental care. The use of parent-proxy method is well supported in literature as a reliable and valid measurement instrument which is necessary where the patient is either unable or unwilling to complete the QoL measure,[39-41] thereby giving acceptance to its use in this study.

Children in most cases are not in a position to refer themselves for treatment, even when they are experiencing powerful symptoms and pain. Ultimately, it is the parent/guardian's perceptions of their child's QoL that may decide whether care will be sought for their children.[42] This was well demonstrated in the present study; the outstanding reason for not seeking dental treatment among the children being the self-confessed perception of their parents/guardian's that their (child's) dental pain was not severe enough to warrant seeking dental treatment.

CONCLUSION

Dental caries experience was found to correlate with QoL among 3-15-year old HIV-positive children attending the Kenyatta National Hospital in Nairobi, Kenya. A high caries experience had significant negative impacts predominately in the primary dentitions. The study recommends that a pediatric dentist be included in a multidisciplinary approach to provide dental care for children with HIV-infection to improve their oral health related quality of life.

ACKNOWLEDGMENTS

We would like to thank the administration of the Kenyatta National Hospital for granting us permission to conduct the study and the Ethical Reviews Committee of Kenyatta National Hospital and the University of Nairobi for clearance of the study proposal. We appreciate the assistance of Professor ML Chindia in preparation of the manuscript. We gratefully acknowledge financial support from UNITID.

REFERENCES

1. Kenya National Bureau of Statistics (KNBS) and ICF Macro.2010. Kenya Demographic and Health Survey 2008-2009. Calverton, Maryland: KNBS and ICF Macro.
2. US Dept of Health and Human Services. *Oral Health in America: A Report of the Surgeon General*. NIH Publication 00-4713.NIDCR.NIH: 2007:7.
3. Marthalar TM. Changes in dental caries 1953-2003. *Caries Res 2004; 38*:173-81.
4. Howell RB, Jadinski J, Palumbo P et.al. Dental caries in HIV-infected children. *Paediatr Dent; 14* (6): 370-371. 1992.
5. Valdez IH, Pizzo PS, Atkinson JC. Oral health of Pediatric AIDS patients: a hospital based study. *ASDC J Dent Child; 61* (2): 114-118. 1994.
6. Madigan A, Murray P A, Houpt M et al. Caries experience and cariogenic markers in HIV- positive children and their siblings. *Pediatr Dent.; 18*(2):129-136. 1996.
7. Pongsiriwet S, Imaroon A, Kanjanavant S, et.al. Oral lesions and dental caries status in perinatally HIV-infected children in Northern Thailand. *Int J Paediatr Dent.2003 13*(3); 180-5.
8. Eldridge K, Gallagher JE. Dental caries prevalence and dental health behaviours in HIV-infected children. *Int. J. of Paediatric Dentistry; 10*; 19-26. 2000.
9. Anver M, Opinya GN, Abdulhalim H. Oral health status and HIV-related oral manifestations of children and adolescents living with HIV/AIDS aged 2-5 years in Nairobi and Mombasa. *JKDA 2010; 1*(4): 93-97.
10. Hicks MJ, Flaitz CM, Carter AB, et al. Dental caries in HIV-infected children: a longitudinal study. *Paediatr Dent; 22*(5): 359-364. 2000.
11. Beena JP. Prevalence of dental caries and its correlation with the immunological profile in HIV-infected children on antiretroviral therapy. *Eur J Pediatr Dent.; 12*(2):87-90. 2011.
12. O'Sullivan DM, Tinanoff N. The association of early dental caries patterns with caries incidence in preschool children. *J Public Health Dent.; 56*:81-83.1996.
13. Al-Shalan TA, Erickson PR, Hardie NA. Primary incisor decay before age 4 as a risk factor for future dental caries. *Pediatr Dent. 19*:37-41. 1997.
14. Fleming P, Gregg TA, Saunders ID. Analysis of an emergency dental service provided at a children's hospital. *Int J Paediatr Dent;1*:25-30. 1991.
15. Schwartz S. A 1-year statistical analysis of dental emergencies in a pediatric hospital. *J Can Dent Assoc.; 60*:959-968. 1994.
16. Sheller B, Williams BJ, Lombardi SM. Diagnosis and treatment of dental caries-related emergencies in a children's hospital. *Pediatr Dent; 19*:470-475. 1997.
17. Griffin SO, Gooch BF, Beltran E, Sutherland JN, Barsley R. Dental services, costs, and factors associated with hospitalization for Medicaid-eligible children, Lousiana 1996-97. *J Public Health Dent; 60*:21-7. 2000.
18. Ramos-Gomez FJ. Huang GF, Masouredis CM, Braham RL. Prevalence and treatment costs of infant caries in Northern California. *J Dent Child.;63*:108-112. 1996.
19. Acs G, Lodolini G, Kaminski S, Cisneros GJ. Effect of nursing caries on body weight in a pediatric population. *Pediatr Dent. 14*: 302-05. 1992.
20. Ayhan H. Suskan E, Yildirim S. The effect of nursing or rampant caries on height, body weight, and head circumference. *J Clin Pediatr Dent; 20* 209-12. 1996.
21. Reisine ST. Dental health and public policy; the social impact of disease. *Am J Public Health; 75*:27-30. 1985.
22. Gift HC. Reisine ST, Larach DC. The social impact of dental problems and visits. *Am J Public Health.; 82*:1663-68. 1992.
23. Ramaj S. The impact of dental disease on school performance. *J Southeastern Society of Ped Dent. 6*:16. 2000.
24. Low W, Tan S, Schwartz S. The effect of severe caries on the quality of life in young children. *Pediatr Dent; 21*:325-6. . 1999.
25. Acs G. Pretzer S, Foley M, Ng MW. Perceived outcomes and parental satisfaction following dental rehabilitation under general anesthesia. *Paediatr Dent.; 23*: 419-423. 2001.
26. WHO Oral Health Surveys- Basic Methods. 4th Edition.1997. WHO Geneva.
27. Soben Peter. *Indices used in Dental Epidemiology. Essentials of Preventive and Community Dentistry.* Arya (Medi) Publishing House, New Delhi, 2009; pp 343-345. .

28. Masiga MA, Holt RD. The prevalence of dental caries, gingivitis and their relationship to social class amongst nursery-school children in Nairobi, Kenya. Int J Paed Dent. 1993; 135-140.
29. Ngatia EM, Imungi JW, Ng'ang'a PM. Dietary patterns and dental caries in nursery school children in Nairobi, Kenya. East Afri Med J. 2001; 78(2) 673-77.
30. Njoroge N, Kemoli AM, Gathece L. Prevalence and pattern of Early Childhood Caries among 3-5-year olds in Kiambaa, Kenya. East Afri Med J 2010; 87(3):134-7.
31. Manji F. Gingivitis, dental fluorosis and dental caries in primary school children in Nairobi, Kenya. East Afri Med J. 1984; 6(7) 524-532.
32. Ng'ang'a PM, Valderhaug J. Dental caries in primary school children in Nairobi, Kenya. Acta.odontol Scand. 1992; 50: 269-72.
33. Manji F, Mosha H, Frenken J. The pattern of dental caries among 12-year-old children in Kenya and Tanzania. East Afri Med J. 1988; 65:753-8.
34. Owino RO, Masiga MA, Ng'ang'a PM, Macigo FG. Dental caries,gingivitis and treatment needs among 12-year-old children in Kitale, Trans-Nzoia District, Kenya. East Afri Med J. 2010; 87(1):25-31.
35. Eiser C, Morse R. Can parents rate their child's health-related quality of life. Results of a systematic review. *Qual Life Res; 10*(4):347-357. 2001.
36. Jokovic A, Locker D, Guyatt G. How well do parents know their children? Implications for proxy reporting of child health-related quality of life. *Qual Life Res; 13*(7):297-307. 2004.
37. Parsons SK, Barlow SE, Levy SL, Supran SE, Kaplan SH. Health-related quality of life in pediatric bone marrow transplant survivors: according to whom? *Int J Cancer Suppl.; 12*:46-51. 1999.
38. Theunissen NC, Vogels TG, Koopman HM, Verrips GH, Zwinderman KH, Verloove-Vanhoric SP, Wit JM. The proxy problem: child report versus parent report in health –related quality of life research. *Qual Life Res; 7*(5):387-397. 1998.
39. Filstrup SL, Briskie D, de Fonseca M, Lawrence L, Wandera A, Inglehart MR. Early Childhood Caries and Quality of Life: Child and Parent Perspectives. *Pediatr Dent; 25*(5); 431-440. 2003.
40. Seid M, Varni JW, Rode CA, Katz ER. The pediatric cancer quality of life inventory: a modular approach to measuring health-related quality of life in children with cancer. *Int J Cancer Suppl.;12*: 71-76. 1999.
41. Varni JW, Lumber CA, Burwinkle TM. Parent proxy report of their children's health-related Quality of Life: an analysis of 13,578 parents' reliability and validity across age sub-groups using the Peds QL 4.0 Generic Core Scales. *Health & Quality of Life Outcomes;5*:2. 2007.
42. Varni JW, Seid M, Kurtin PS. Pediatric Health-related Quality of Life Measurement Technology. A Guide for Health Decision Makers. *JCOM; 6*(4): 33-40. 1999.