ORAL HYGIENE AND DENTAL CARIES AMONG CHILDREN WITH HEART DEFECTS AND CAREGIVERS' ORAL HEALTHCARE KNOWLEDGE, ATTITUDES AND PRACTICES

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DECLARATION

I declare that this thesis is my original work and has not been presented for the award of a degree in any other university.

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DEDICATION

This thesis is dedicated to my wife Maureen Ambani-Kemei, my daughters Nicole Cherono and Cindy Chemutai, and my mum Sarah Chepkwony for their understanding and support throughout my studies

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LIST OF ACRONYMS

ASD	Atrial septal defect
AHD	Acyanotic heart heart disease
BDS	Bachelor of Dental surgery
CHD	Cyanotic heart disease
dmft	decayed ,missing ,filled deciduous teeth
DMFT	decayed, missing, filled permanent teeth
GGCH	Gertrude's Garden Children Hospital
IE	Infective endocarditis
INR	International Normalised Ratio
KNH	Kenyatta National Hospital
MDS	Master of Dental Surgery
MSc	Master of Science
MOH	Ministry of Health
UON	University of Nairobi
PS	Plaque score
SBE	Sub acute bacterial endocarditis
VSD	Ventricular septal defect
UNDH	University of Nairobi Dental Hospital
RHD	Rheumatic heart disease
WHO	World Health Organization

DEFINITION OF TERMS

Child with heart Disease:

This refers to any child aged between 3 and 12 years with a definitive diagnosis of cardiopathy attending paediatric cardiology clinic at the KNH, GCHH and the Mater Hospital.

Dental Caries:

For the purposes of this study, a tooth was considered carious if the dental probe stuck on light probing or when carious lesion was visible. Filled or sealed teeth with caries were included but early white patches were not considered.

Dental caries experience

This refers to the presence of untreated dental caries, missing teeth due to dental caries and filled teeth as measured by mean dmft and DMFT scores.

Prevalence of dental caries

This refers to the total number of patients who had carious teeth at the time of data collection.

Oral hygiene status:

Oral hygiene status referred to plaque scores as measured using plaque index (PI) of Silness & Löe (1964).

Caregiver:

The term caregiver refers to the parents or guardians who accompanied the children with heart disease to the clinic and who usually takes care of child.

ABSTRACT

Background: Children with a medical disability are those whose medical condition puts their general health further at risk if they suffer dental disease. Because of this risk to health, or even to life, their dental care is of vital importance. The dental caries experience and the oral hygiene status among these children in Kenya and other developing countries has not been extensively investigated. In addition, the caregivers' knowledge, attitudes and practices of oral healthcare for these children remains unknown.

Objective: The present study was to determine dental caries experience and oral health hygiene status among children with heart disease and their caregiver's knowledge, attitude and practices in Nairobi

Materials and methods

Setting: Three paediatric cardiology clinics in Nairobi, Kenya: the KNH, GGCH and Mater Hospital.

Study design: This was a descriptive cross-sectional study

Data analysis: The data was coded and analyzed using SPSS version 12.0 and the results presented in the form of frequency diagrams, tables and pie charts.

RESULTS:

A total of 81 children were examined and the parents/guardians who accompanied them were interviewed. The mean age of the children was 8.16±2.81 years; males were 44(54.3%) while females were 37(45.7%). The prevalence of dental caries in the deciduous teeth was 65.57%, and in permanent teeth it was 40%. The mean dmft was 2.85±3.45 (n=61) and the mean DMFT was 0.95±1.55 (n=64). The mean decayed untreated carious teeth was d=2.65±3.37 (n=61) in deciduous teeth and D=0.81±1.39 (n=64) in permanent teeth.

The oral hygiene status was poor with mean plaque score of 1.72±0.59 (n=81). Except for one child with excellent OH; 7 had good OH; 37(45.7%) had fair oral hygiene; and 36(44.4%) had poor oral hygiene.

The knowledge on the causes and prevention of dental diseases was generally good. However, the knowledge on oral healthcare for a child with heart disease was poor with only a third of the caregivers knowing the importance of maintaining good oral health as a preventive measure for complications arising from dental diseases. In addition, 57(70%) caregivers had never received any professional advice on the dental care of a child with heart disease

Majority of the caregivers 80% (n=65) generally had positive attitudes while only 20% (n=16) caregivers had negative attitudes. There was no statistically significant relationship between the caregivers attitudes and the dental caries experience and

the oral hygiene status among the children with respective p values of p=0.697 and p=0.234($p \leq 0.05$)

With regard to oral healthcare practices, 68 (84%) of the caregivers displayed unfavourable practices compared to 13(16%) who categorized as displaying favourable oral healthcare practices for their children. Only 22(27.2%) of the children had seen a dentist, with hardly any preventive dental treatment done. Despite 75(93%) of the children claiming that they clean teeth, only 33(44%) cleaned at least twice a day; and 62(83%) cleaned their teeth without the caregivers' supervision.

There was significant relationship between the caregivers' oral healthcare knowledge and the oral hygiene status among the children with mann witney u test Z= -2.090 p=0.039($p \leq 0.05$). However, there was no significant relationship between the caregivers oral healthcare practices and the dental caries experience and the oral hygiene status among the children with respective p=0.197and p=0.160($p \leq 0.05$)

Conclusion:

The prevalence of dental caries was high. Most of the children cleaned their teeth though inappropriately and majority of them had never been to a dentist for any preventive oral health measure. The oral hygiene of the children and the caregivers' oral healthcare knowledge for children with heart disease was poor.

CHAPTER 1

1.0 INTRODUCTION AND LITERATURE REVIEW

Diagnostic advances, neonatal care, and surgical interventions have increased the survival rate of children with heart defects and those that develop acquired heart diseases[1]. With this increase in survival comes an increased burden of complexity when managing these children's oral health and disease.[2] The importance of achieving and maintaining oral health for individuals with heart disease has been highlighted recently by much debate around changes in guidelines relating to prophylaxis against infective endocarditis.[3,4] Regardless of which guidelines are in use, one thing has not changed: the dental team is charged with guiding the child with heart disease towards enjoying a lifetime of optimum oral health.

While oral problems may have a considerable impact on the general health status and quality of life of otherwise healthy children, their effect on those with acute and chronic illness can be more serious.[5], Children with cardiac defects and diseases are at increased risk of sometimes life-threatening complications. [6] Because of this risk, preventive dental healthcare is of vital importance[7] These are children who require the highest priority for comprehensive, preventive dental care from early age to avoid their susceptibility to infective endocarditis; risks associated with management of the diseases under general anaesthesia, and the risk of prolonged bleeding from warfarin medication often taken by most of these children.[7,8,9] Poor dental health also gives an increased risk of bacteraemia that may lead to infective endocarditis.[10] Of major significance is the fact that untreated caries can be a contra-indication for heart

surgery, it is particularly important that scheduled surgery does not have to be postponed because of dental disease.[10]

The role of dental procedures in the causation of infective endocarditis has probably been overestimated in relation to oral health conditions. Poor oral hygiene may give rise to a frequent bacteraemia under normal physiological conditions, leading to a permanent risk of developing the disease.[11] Individuals with risk conditions should therefore establish and maintain the best possible oral health habits in order to reduce the potential of bacteraemias.[12, 13, 14.]

Past studies have reported great improvements in the oral health of populations in developed countries with decline in the incidence of dental caries; but the situation is the opposite in developing countries considering this is a population of socially, economically and medically disadvantaged people. In spite of the two major diseases, namely periodontal and dental caries being preventable, the prevalence of these diseases is still high in Kenya. [15,16] The severity and magnitude of these oral diseases is thought to be higher in children with heart disease probably as a result of preoccupation with the principal medical condition often results in neglect of other facets of the child's total health. [17]

1.1 CLASSIFICATION OF HEART DISEASES

Heart diseases can be congenital or acquired [17]. Congenital heart defects can be due to an aberrant embryonic development of a normal structure with failure to

progress beyond an early stage of embryonic development[17]. Congenital heart disease can be further classified as cyanotic or acyanotic. Acquired heart diseases are those heart conditions that occur at any age after birth[17]. They include rheumatic fever and infective bacterial endocarditis

1.1.1 Congenital heart disease

Congenital heart disease affects 1% of live births. It is the commonest cause of childhood disease in the developed countries[17]. It can be classified into acyanotic heart defects and cyanotic heart defects. Acyanotic heart defects are those heart lesions which are not associated with cyanosis. It consists of two different categories, the first consisting of defects that cause left to right shunting of blood within the heart (atrial septal defects, ASD and ventricular septal defects, VSD). The second category consists of defects that cause obstruction (aortic stenosis ,coarctation of the aorta). Clinical manifestation of the A.S.D includes congestive heart failure, pulmonary congestion, laboured breathing and cardiomegally. In cyanotic congenital heart condition, cyanosis is present on minimum exertion due to right-to-left shunting of blood within the heart, (tetralogy of Fallot, transposition of great vessels, pulmonary stenosis, and tricuspid atresia). Clinical manifestation can include cyanosis, hypoxic spells, poor physical development, heart murmurs and clubbing of fingers and toes.

Valvular heart diseases can be grouped into left heart valvular disease (mitral stenosis, mitral regurgitation, aortic stenosis, and aortic regurgitation) and right heart valvular disease (tricuspid stenosis, tricuspid regurgitation). Patients with mechanical

prosthesis require anticoagulation and lifelong treatment is necessary for patients with prosthetic valves: warfarin anticoagulant with INR kept at between 2.5 and 4.0. Patients with atrial fibrillation also need anticoagulation

1.1.2 Acquired heart disease

Rheumatic fever is a multisystem inflammatory disease which occurs as delayed sequelae to pharyngeal infection with group A streptococcus (*s. pyogenes*) [17]. The infection can involve the heart, joints, skin, central nervous system and subcutaneous tissue. Cardiac involvement is the most significant pathologic sequelae of rheumatic fever [17]. Carditis develops in approximately 50% of patients. This can occur at any age but commonly it appears between 6 and 15 years of age. The condition can be fatal in the acute stage or can result in a chronic rheumatic heart disease as a result of scaring, fibrosis and distortion of the heart valves. The risks of infective endocarditis are further exaggerated in the event of prosthetic valve replacement to the damaged valves [17].

Infective endocarditis is a caused by a microbial infection of the endocardium, including the cardiac valves (prosthetic or native) [17, 18].Two forms are present, the acute and sub-acute forms. The acute form is a fulminant disease that occurs as a result of infection with highly virulent micro-organisms like staphylococcus, group A *streptococcus* and *pneumococcus*, the sub-acute variety develops in individuals who already have an existing congenital cardiac disease or rheumatic valvular lesions caused by *viridans streptococci* (commonly found in the oral cavity). Although

infective endocarditis is a rare condition in the population in general, it continues to be a serious complication, mainly in patients who possess susceptible cardiac conditions. [18]

1.2 EPIDEMIOLOGY OF PAEDIATRIC HEART DISEASE

CHD occurs in about 1% live births.[17] The incidence is higher in still born (3-4%) and abortuses (10 – 25%). Congenital cardiac defects have a wide spectrum of severity in infants. With advances in both palliative and corrective surgery, the number of children with congenital heart defects surviving to adulthood has increased dramatically.[17]

In the developing countries, the annual incidence of acute rheumatic fever is currently as high as 282 per 100,000 population. Worldwide, rheumatic heart disease remains the most common form of acquired valvular heart disease in all age groups, accounting for as much as 50% of all cardiac admissions in many hospitals.[17, 18] There has been a decline in the incidence of rheumatic heart disease in industrialized countries since the introduction of antibiotics and due to improvements in living conditions with reduction in crowding, poverty which contributes to the spread of group A streptococcal infections. The incidence of both initial attacks and recurrences of rheumatic fever peaks in children aged 5 – 15 years, the age of greatest risk for group A streptococcal pharyngitis. [17]

1.3 DENTAL DISEASES IN CHILDREN

A lot of research and documentation on dental caries done in developed countries have documented the decline[19,20]. Murray *et al* [21] reported dmft values of eleven developed countries to range from 1.3 to 2.1, with 55-72% of the children being caries free. The national health and nutrition examinations surveys (NHANES) in the United States were carried out in the 1970, 1980 and 1990 and the reported that the dft values 2- 10 year-olds reduced from 2.29 in 1970's to 1.38 in the 1990's[22].

In Africa, children of a mean age of 7.3 years from Cameroon had dmft values of 1.9 in 1989 while during the same period; pre-scholars from Ibadan Nigeria had a dmft of 1.9 and 46% were caries free [22]. In Madagascar, 24% children were reported caries free and had dmft of 4.6 [22]. In Tanzania, 62% of 5-7 years old urban children were found to have caries in 1989 while in 1986 children from Dar es Salaam, Tanzanian aged 3-8 years had dmft of 2.6. [22,23]

In Uganda 65% 6-years old children in Kampala had dental caries while 59% of 5 year old and 45% of 3 year olds had caries[22]. Earlier reports from a National survey in Uganda in 1987 showed that 35% of six year old were caries free[22,23]. According to the Kenya National Oral Health policy document, the dmft value for Kenyan 5-year old children as at 2002 was 1.5±2.2, while 43% of 6-8 year old children had caries[15]. The prevalence of dental caries of Kenyan urban and rural 12-13 year old children in 1996 was found to have been 27% (DMFT=0.71) respectively . The urban children were from a population surrounding Nairobi.[24]

1.4 ORAL HEALTH OF CHILDREN WITH HEART DISEASE

The highest risk for developing dental disease is seen in children from low-income or under-represented minority families, and in those with special health care [9,13]. The American Heart Association recognizes that achieving and maintaining good oral health may reduce the incidence of some cardiac abnormalities, such as infective endocarditis[13]. Its guidelines published in 2007 recommend dental evaluations and treatment prior to cardiac valvular surgery, or repair of congenital defects in order to decrease the risk of infective endocarditis.[25]

There is little information available in the literature on the oral health of children with heart disease. However, some studies have reported that these children suffer poorer oral health compared to a control group.[26] There are several reasons for this: chronic intake of sugared medicines [27, 28]; increased tooth susceptibility from developmental enamel defects [26]; greater consumption of sweets in compensation and negligence of oral hygiene as a result of a greater concern with the cardiac disease [26,29,30]. These children often receive extensive medical and surgical treatment and have shorter or longer stays in hospitals during their first years of life.[31,32]

The American Heart Association has recommended a high standard of oral health for patients with heart disease yet studies with children at risk for infective endocarditis have reported poorer oral health compared healthy children[25]. Silva, et

al in Brazil found out that, 98% of the patients presented visible plaque and 99% presented spontaneous or provoked bleeding in one or more examined surfaces[29]. The caries experience using dmft and DMFT was 2.62 and 3.97 respectively. A controlled study by Hallet *et al* on the oral health of 39 children with congenital cardiac diseases (CCD) reported children with CCD had significantly more teeth with untreated dental decay (mean dmft 4.2 vs 2.3), and more endodontically treated teeth, and less than optimal professional and home dental-care[26]. Furthermore, significantly fewer CCD children had parental help with tooth brushing compared to control children[26].

Lower frequencies of regular dental care were displayed in children with heart disease Northern Sweden.[33] Though children with CHD had been offered more caries intervention than healthy children, the care had been given when caries was already present. The study established that children with heart diseases do not turn up at early dental check-ups because of illness or because they ar e in hospitals or because of ignorance by the parents.

In the USA, Fonseca *et al* 2009 [5] reported caries prevalence of 17 % among 12 to 71 months old children with cardiac disease compared to 13% for the control group, with mean dmft 1.03±1.85. The same study also established that half of those with cardiac disease had never seen a dentist; compared to 35% of the control subjects. In Saudi Arabia, Brown et al. [6] reported high caries prevalence of 79%, with mean dmft of 9.91 among children with chronic medical illness including cardiac diseases.

The mothers were reported to have a low level of dental knowledge and their children had poor oral hygiene, as well as repeated exposure to sugary foods and drinks.

Dentists should give priority to medically handicapped patients yet a lower frequency of regular dental care has been reported for children with heart defects compared to healthy groups[33, 34] Closer consultations between paediatric cardiologists and paediatric dentists could help improve dental care for these children particularly in the prevention of the diseases and maintenance of excellent oral health. Children with severe disease should be referred to a paediatric dentist before they are 1 year old[35]. An individual treatment plan to maintain oral health, based on risk assessment, should be established for all children with cardiac disease.[36] The focus should be on caries prevention and include dietary counseling, oral hygiene, and fluoride supplements if necessary. The demanding situation for the parents and families of the patients with cardiac disease should be acknowledged and understood[36].

1.5 CAREGIVERS' KNOWLEDGE, ATTITUDES AND PRACTICES ON ORAL HEALTHCARE FOR THE CHILDREN WITH HEART DISEASE

Studies have reported that the knowledge on oral health is poor. In a Kenyan study, only 12.4 % of the urban population and 9.2% of the peri-urban population knew that dental caries is preventable [37]. With poor knowledge on oral diseases, the oral hygiene status is likely to be poor. Poor oral hygiene has been identified as a risk factor for poor dental health among medically compromised patients [38]. Oral health

seeking behaviour and utilization of dental services by children is dictated by parents/guardians who have been shown to have poor knowledge on preventive oral healthcare [37]. These children might, therefore, not seek oral healthcare resulting in poor oral health.

Studies done in the past reported that the dental knowledge, attitude and preventive practices among parents of children with heart diseases is poor. Saunders *et al* studied 60 children with severe congenital cardiac disease and assessed their parents' attitude, knowledge, and dental health practices[35]. The cardiac group had significantly poorer dental health practices than the healthy group with 18% of the cardiac group having never visited the dentist compared with only 3% for the healthy group.

Balmer *et al* [33] examined the degree to which children, considered to be at risk from infective endocarditis, had received professional education and preventive procedures in regard to dental health, and to evaluate the knowledge of their parents of the link between oral health and infective endocarditis and established that 64% of parents were aware of the link between the oral health of their children and infective endocarditis and that parent of children who were registered with a dentist were more likely to be aware of this link than parents of children who were not registered.

A Study in Brazil *on the knowledge, attitudes and the status of oral health* among children at risk of infective endocarditis concluded that the guardians' knowledge

and attitudes about oral health was not good [26]. They reported percentage of guardians who understood the meaning of 'heart infection' was 9·6%, who knew the possibility of heart disease caused by dental procedures was 60·6%, who understood the requirement for antibiotic cover before dental treatment was 72·1%, and who understood the importance of good oral health to prevent infective endocarditis was 41·3%. As regards oral health behaviors, 46·1% of children brushed their teeth three times or more a day, 28·8% had never visited a dentist before, and only 24·3% attended the dentist for prevention.

1.6 FACTORS AFFECTING ACCESSIBILITY AND UTILIZATION OF ORAL HEALTH SERVICES

Populations with chronic medical illness or other disabilities have the most unmet need for oral health services[39]. The nature of heart diseases necessitates regular dental check-ups and maintenance of meticulous oral hygiene. They have significantly higher rates of poor oral hygiene and an increased caries experience than the general population. To a socio-economically disadvantaged family, a child with heart disease means an added economic burden in an already difficult situation[40].

1.7 STATEMENT OF THE PROBLEM

Children with chronic medical illness like heart diseases have been shown to suffer poorer oral health compared to the 'normal' population. Poor dental health gives an increased risk of bacteraemia that may lead to infective endocarditis and untreated caries can be a contra-indication for heart surgery [10]. Clinicians in primary dental care, including dental hygienists, general dentists, and paediatric dentists, are faced

with a number of challenges when caring for a child with heart disease. These challenges may be directly or indirectly related to the child's medical condition and achievement of adequate oral hygiene.

In many cases, the entire family may have a low level of awareness of the importance of oral health in general, and may be completely unaware of the link between the mouth and the heart [6]. In addition; the priority placed on oral care may be low, especially when the child's clinical situation has been complex and at times life-threatening. Medications may produce changes in saliva, and an association between the use of digoxin and dental caries has been made.[28] Digoxin is only available in a sucrose-based suspension. Psychosocial issues and a child's fear of medical treatment may prevent parents from bringing their child for dental care, and access to care may be limited by a lack of dental staff able and confident to provide appropriate care. [34]

1.8 JUSTIFICATION OF THE RESEARCH

There is little available information in the literature on the oral health of children with heart disease and especially in developing countries like Kenya. In addition, the guardian's knowledge, attitudes and practices regarding the oral healthcare of these children is unknown in Kenya. Considering all these aspects, the importance of evaluating the dental caries experience and the oral hygiene status of children with heart disease, and the need to discover their caregivers' knowledge, attitudes and practices on the oral healthcare of these children can be of great importance to these children.

The findings from the study collected shall be useful in advocacy and informing policy makers on the magnitude of dental problems among children with chronic medical illness like heart diseases. Results of this study shall also provide baseline data for future studies and shall sensitize the need for improvement of oral health education to promote preventive oral health among the medically compromised children and the need for multidisciplinary management in the comprehensive management of children with chronic illnesses.

1.9 OBJECTIVES

1.9.1 BROAD OBJECTIVE

To determine the dental caries experience and oral hygiene status among the children with heart disease attending cardiology clinics in Nairobi and their caregiver's oral healthcare knowledge, attitude and practices.

1.9.2 SPECIFIC OBJECTIVES

1. To determine the dental caries experience among the 3-12 year-olds with heart disease
2. To determine the oral hygiene status among the 3-12 year olds with heart disease
3. To determine the caregivers' knowledge on oral healthcare of children with heart disease.

4. To determine the caregivers' attitudes on oral healthcare of children with heart disease.
5. To determine the caregivers' practices on oral healthcare of children with heart disease
6. To relate the oral hygiene status and dental caries experience among the 3-12 year-old children with heart disease to the caregiver's knowledge, attitudes and practices on their children's oral health.

1.91 NULL HYPOTHESIS

1. There is no relationship between the dental caries experience of children with heart disease and the caregiver's knowledge on oral healthcare.
2. There is no relationship between the dental caries experience of children with heart disease and the caregivers attitudes on oral healthcare
3. There is no relationship between the dental caries experience of children with heart disease and the caregivers practices on oral healthcare
4. There is no relationship between the oral hygiene status of children with heart diseases and the caregiver's knowledge on oral healthcare
5. There is no relationship between the oral hygiene status of children with heart diseases and the caregiver's attitudes on oral healthcare
6. There is no relationship between the oral hygiene status of children with heart diseases and the caregiver's practices on oral healthcare

1.92 STUDY VARIABLES

Socio-demographic variables:

- Age of the child.
- Caregiver's age and level of education.
- Caregiver's occupation
- Diagnosis and duration since heart disease was diagnosed
- Residence

Dependent variables:

- Dental caries experience
- Oral hygiene status

Independent variable:

- Caregiver's knowledge on causes and prevention of dental disease.
- Caregiver's attitudes on oral health of children with heart disease.
- Caregiver's practices on oral health of children with heart disease, including utilization of oral health services.

CHAPTER 2

2.0 MATERIALS AND METHODS

2.1 STUDY DESIGN

This was a descriptive cross-sectional study to investigate the oral health status among 3-12year old children with heart disease attending cardiology clinics, and their caregivers' knowledge, attitude and practices on oral healthcare.

2.2 STUDY AREA

The research was carried out in 3 selected cardiology clinics in Nairobi city in Kenya. Nairobi is the capital city of Kenya with a population of 2,143, 254 according to the 1999 census among whom males constitute 1,153, 828 and females 989,426. Pediatric cardiology services are offered at few hospitals in Nairobi, these include KNH, Mater hospital, GGCH, Aga khan hospital and Nairobi hospital. The patients attending these hospitals are referrals from various parts of the country, and even the from Eastern Africa region. The KNH is a teaching hospital for the University of Nairobi and is also the major referral hospital for all pediatric patients in Kenya. Majority of the patients with heart disease seek treatment at this institution. Children admitted to the KNH are referrals from district, provincial, mission and private hospitals.

The Mater hospital is a mission hospital actively involved in organizing pediatric heart surgeries and management of cases in conjunction with the "Mater-heart run

foundation". Gertrude's Garden Children's Hospital is a major paediatric hospital with a number of pediatric cardiology patients being managed. The other hospitals attend to very few cardiac patients.

2.3 STUDY POPULATION

A convenient sample of all children aged between 3 and 12 years with cardiac disease attending paediatric cardiology clinics. The 3 hospitals were selected based on the large number of patients attending the paediatric cardiology clinics.

2.3 SAMPLING AND SAMPLE SIZE DETERMINATION

Taking the proportion of children with heart disease with untreated or treated dental problems to be 58% (Balmer et al.2005), the following formula was be used to determine the sample size:

$N=Z^2 P (1-P)/d^2$

Where N= the desired sample size (where population >10,000)

P= reported prevalence of untreated and treated dental problems among children with heart disease

Z= standard normal deviate, usually set at 1.96 corresponding to 95% confidence level.

D=degree of precision, usually set at 0.05

$$N= \frac{1.96X1.96X0.58(1-0.58)}{0.05 X 005}$$

N= 375

For a population < 10,000

$$nf = \frac{N}{1+N/n}$$

Where 100 is the average number of total patients recorded in the clinic attendance registers at the selected hospitals within 3 months,

$$\frac{374}{1+374/100}$$

=Minimum of 79 patients

The minimum sample size calculated was 79 children.

Purposive sampling was used to select study hospitals. The KNH, the Mater Hospital and GGCH were selected from the hospitals offering cardiology services due to the considerable large number of patients seeking treatment at these institutions.

Sampling method: All the patients aged 3 to 12 years attending paediatric cardiology clinics at the selected hospitals during the period of October and November 2008 were eligible for the study.

2.4 INCLUSION CRITERIA

- Children between 3 and 12 years with a confirmed diagnosis of either acquired or congenital heart disease.
- Children whose parents or guardians consent to the study.
- Children who assent to the study

2.5 EXCLUSION CRITERIA

- Children who were too sick to participate in examination.
- Children who did not cooperate for the examination.

2.6 CALIBRATION

Prior to commencement of the study, calibration was done by one of the supervisors at the department of paediatric Dentistry and Orthodontics, School of Dental Sciences and repeated also in the field. Calibration was done for dental caries examination and plaque score

2.7 DATA COLLECTION INSTRUMENTS AND TECHNIQUES

2.7.1 Data collection instruments

The following data collection instruments were used

I. Clinical examination was done to record the oral health status among the children as they waited to consult the cardiologist. The examination was conducted under natural light using sterile mouth mirrors, probes or wooden spatulas for retraction, with participants seated on a chair next to a window. Data sheets were used to score for dental caries and plaque. There was no periodontal probing since no antibiotic prophylaxis was given for the study. Caries presence was determined in all the deciduous teeth and permanent teeth present. The following indices were used to assess the oral health status:

Table of indices used

Index	Oral condition(s)
DMF(T)	Caries experience in permanent teeth
dmf(t)	Caries experience in deciduous teeth
Loe and silness (1964)	Plaque score

II. Semi-structured questionnaire was used to collect information on the socio-demographic characteristics of the child and the parent/guardian; knowledge, attitudes and practices on preventive oral healthcare

III. Information regarding the diagnosis and the treatment was obtained from the patients' medical records at the respective hospitals.

2.7.2 Validity and reliability

The use of a structured questionnaire and standard examination procedure was employed for all participants. All the data collection tools were pre-tested before being used. The supervisors calibrated the investigator and a Cohen's kappa index score of 0.87 and 0.85 (n=10) was obtained for dental caries and plaque score respectively. A duplicate clinical examination was performed on every 7th subject

and Cohen's kappa index score of 0.91 and 0.86 (n=12) was obtained for dental caries and plaque score which showed good consistency

2.7.3 Data Analysis and Presentation

Data was coded and analyzed using SPSS version 12.00 software from SPSS inc. IL. Descriptive analysis was done. Data was presented using frequency diagrams, tables and pie charts.

2.7.4 Minimization of errors and biases

The study population was restricted to those meeting the inclusion criteria. Pre-testing of the questionnaires was done prior to being used in the study. All instruments used were calibrated. The investigator carried out all the examinations and the assistant recorded the findings in the recording schedule.

2.7.5 Ethical Consideration

I. Approval to carry out research was obtained from the Kenyatta national hospital and university of Nairobi Ethics, Research and standards committee; Mater hospital and GGCH Ethics, Research and standards committees.

II. Informed consent was obtained from the parents and guardians.

III. Confidentiality was maintained and information obtained has used for the purpose of the study and for the benefit of the community.

IV. Patients requiring emergency dental treatment were referred to the KNH dental clinic or UNDH or a clinic of their choice.

V. During the study period, the children received free dental consultation while the parents or guardians were educated on the importance of oral health.

VI. Permission to carry out the investigation was sought from the relevant authorities

CHAPTER THREE

3.0 RESULTS

3.1 DEMOGRAPHIC CHARACTERISTICS

3.1.1 Children

A total of eighty one children were recruited into the study with 44 (54.3%) being males and 37 (45.7%) were females. Their ages ranged between 3-12 years with a mean age of 8.16 years (± 2.81 SD). The males were younger with a mean age of 7.93 years (± 2.79 SD) compared to the females who had a mean age of 8.72 years (±2.59 SD), however the difference was not statistically significant (P>0.05). When the study population was grouped into age groups as shown in table 1, the 6-9-year-olds accounted for a larger proportion of 33 (40.7%) while the 3-5 year-olds were 16(19.8%), though there was no statistically significant difference in relation to age and gender with Pearson Chi χ^2 =1.287, 2 df , p=0.525(p≤0.05)

Table 1: Distribution of children in relation to age and gender

Age group	Male	Female	Total	p≤0.05
3-5 years	10	6	16 (19.8%)	χ^2 =1.287, 2 df
6-9 years	19	14	33 (40.7%)	, p=0.525
10-12 years	15	17	17 (39.5%)	
Total	44 (54.3%)	37 (45.7%)	81 (100%)	

When the children were distributed according to the type of heart disease, RHD accounted for 36(44.5%) while IE were 4(4.9%) as shown in table 2. The duration since diagnosis of the cardiopathy ranged from less than 1 year to 12 years with a mean duration of 3.53±3.43 years. Nearly half of the children, 40 (49%) had been diagnosed with the disease for a duration of between 1 to 5 years, while those who had been diagnosed more than 5 years and those less than 1 year accounted for 30% and 21% respectively. Table 2 also illustrates that 37(46%) were from rural areas, 28(34%) were from Nairobi, and 16(20%) were from other urban centres other than Nairobi.

Table 2: Distribution of children according to the heart disease and the duration since diagnosis of the heart disease

Characteristic	Frequency	%
Heart disease		
CHD	23	28.5%
AHD	18	22%
RHD	36	44.5%
	4	5%
agnosis		
	17	21%
	40	49%
	24	30%

3.1.2 Caregivers

A total of eighty one parents/guardians who accompanied the children were interviewed. Their ages ranged from 21 to 67 years with a mean of 36.52 years (±8.62 SD) with a bigger proportion, 38 (47%) aged between 30-40 years, 22 (27%) were below 30 years of age, and 21(26%) were over 40 years of age. Amongst those who accompanied the children, 44 (54%) were mothers while guardians were only 14 (18%) as highlighted in Fig. 1

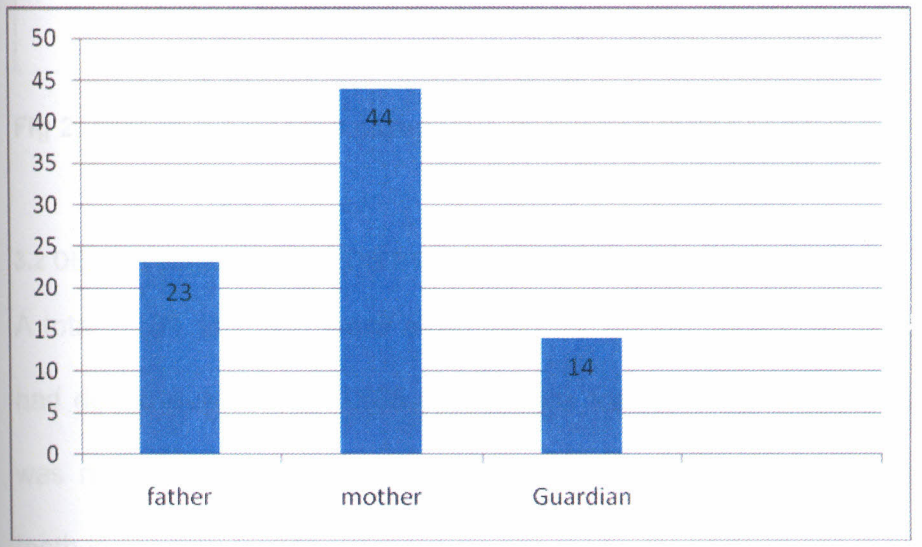

Fig 1: Caregivers' distribution according to the relationship to the child

Distribution of the caregivers in relation to the level of education as shown in figure 2 illustrates that 36 (44%) had primary level of education while 5 (6%) had no formal education. A larger proportion of the caregivers, 53(65.4%) were in non-formal employment, followed by those who were unemployed 15(18.5%) and least at 13(16%) were in formal employment.

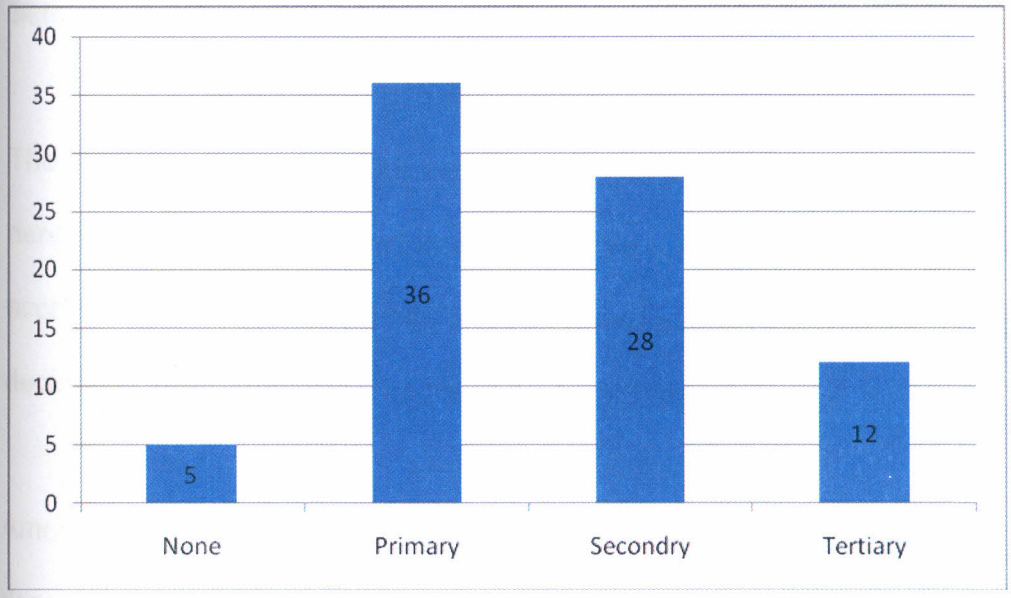

Fig 2: Distribution of the caregivers in relation to the level of education

3.2 DENTAL CARIES EXPERIENCE

A total of 81 children were examined for dental caries. Among the 61 children who had deciduous teeth, 40(65.57%) were found to have dental caries. Though there was no statistically significant difference in dental caries distribution in deciduous teeth in relation to age, caries was present among 16(75%) 3-5-year olds; 21(63.6%) among 6-9-year olds and 7(58.3%) among 10-12-year olds with Pearson χ^2=0.963, d.f 2 and p=0.618 ($p \leq 0.05$). Among the children who had permanent dentition, caries was present in 23 (40%) out of 64 children.

The mean dmft of the 61 children examined was 2.85 (±3.45 SD). The mean decayed, missing, and filled deciduous teeth among the 61 children with deciduous teeth was d=2.65±3.37; m=0.18 and f=0.17 respectively while the mean DMFT in 64

children was 0.95±1.55 with mean Decayed, Missing, and Filled permanent teeth being D=0.81±1.39; M=0.13; and F=0.02 respectively.

The total number of deciduous teeth examined was 839. Out of these, untreated dental caries was observed in 227 (27.05%), and teeth missing due to dental caries accounted for 28 (2.5%) while filled teeth was only one (0.1%). The number of sound deciduous teeth was 590, accounting for 70.3%.

Among the permanent teeth, the total number examined was 1113, out of which decayed teeth were 79 (7.1%); teeth missing due to dental caries were 21 (2.5%) while filled teeth were 8 (0.7%) and sound permanent teeth were 1024 (92%)

3.2.1 Dental caries experience in relation to demographic characteristics

Though there was no statistically significant difference in dental caries experience in relation to age, males had a higher dmft of 3.11±3.93 (n=35), compared to a dmft of 2.5±2.71 (n=26) among the females, with p=0.732 (p≤0.05).in the permanent dentition, females had higher DMFT of 1.23±1.86 compared to a DMFT of 0.69±1.47 among the male with p=0.068 (p≤0.05 as shown in table 3

Table 3: Distribution of dmft/DMFT in relation to the gender of the children

Variable	(N)	Decayed Mean	Missing Mean	Filled mean	dmft mean	Mann Whitney U Test (p≤0.05)
Gender						
Male	35	2.86	0.26	0	3.11	Z=-0.342
Female	26	2.38	0.77	0.40	2.50	p=0.732
Total	61	2.66	0.18	0.17	2.85	
Variable	(N)	Decayed Mean	Missing Mean	Filled mean	DMFTmean	Mann Whitney U Test
Gender						
Male	33	0.48	0.21	0	0.70±1.47	Z=-1.827
Female	31	1.16	0.03	0.03	1.23±1.61	P=0.068
Total	64	0.81±1.9	0.13	0.02	0.95±1.55	

Dental caries experience in deciduous teeth decreased significantly with age among 3-5; 6-9 and 10-12-year-olds as shown in table 4 with a χ^2=10.9 :P=0.004 (p≤0.05). In the permanent dentition, though there was no statistical difference in DMFT in relation to age with a χ2=2.36 2df p=0.124 (p≤0.05) , the mean DMFT increased with age among the 6-9-year and the 10-12-year olds as illustrated in table 4.

Table 4: Distribution of dmft/DMFT according to children's age

Variable	(N)	decayed mean	Missing mean	Filled Mean	dmft mean	Kruskal Wallis Test p≤0.05
Age						
3-5 yrs	16	4.13	0	0	4.13	
6-9 yrs	33	2.55	0.13	0.03	2.70	χ^2=10.9
10-12yr	12	1.00	0.58	0	1.58	p=0.004
Total	61	2.66	0.18	0.02	2.85	
Variable	(N)	Decayed Mean	Missing Mean	Filled Mean	DMFT mean	Kruskal Wallis Test p≤0.05
Age						
6-9 yrs	32	0.50	0.06	0.32	0.59	
10-12yr	32	1.13	0.19	0	1.31	χ2=2.36
Total	64	0.81	0.13	0.16	0.95	p=0.124

3.2.2: Dental caries distribution in relation to residence

The mean dmft varied significantly in relation to the child's residence in the last 2 years as illustrated in table 5. Children from Nairobi had the highest mean dmft of 4.09±3.70 and the least mean dmft of 1.30±1.57 was found among children from rural areas with $\chi 2 = 8.477$: 2df: :P=0.014($p \leq 0.05$). The mean DMFT also varied according to the area of residence, with children from Nairobi having highest DMFT of 1.42±1.71; and those from rural areas having least mean DMFT of 0.62±1.36, however, these were not statistically significant with ÷2 =3.545: 2df: p=0.170 ($p \leq 0.05$)

Table 5: Distribution of DMFT/ dmft according to area of residence

Variable	*Mean dmft*	*N*	*Kruskal wallis P≤0.05*
Geographical residence			
Nairobi	*4.09±3.70*	*22*	*χ2 = 8.477: 2df: :p=0.014*
Semi-urban	*2.45±3.50*	*10*	
Rural	*1.30±1.57*	*29*	
Geographical residence	*Mean DMFT*	*N*	*p≤0.05*
	1.42±1.71	*19*	
Nairobi	*0.82±1.51*	*29*	*χ2=3.545:*
Semi-urban	*0.62±1.36*	*16*	
Rural			*2df: :P=0.170*

3.2.3: Dental caries distribution according to the type of heart disease and the duration since diagnosis

Table 6 illustrates that dental caries experience was highest among children with cyanotic heart diseases (CHD) with dmft of 4.05±4.76 and least among children with rheumatic heart disease (RHD) with dmft of 1.95±2.53 although these was not a statistically significant difference with p=0.650 (p≤0.05). In the permanent dentition, the mean DMFT was highest among the CHD group having DMFT 1.69±2.06 and IE had the least mean DMFT of 0, with P=0.504, (p≤0.05)

The mean dmft increased with the duration since the heart disease was diagnosed as illustrated in table 6. The children who had been diagnosed with the heart disease for a period more than 5 years had the highest dmft of 4.79±4.33 while the children who had been diagnosed in a duration of less than a year had the least dmft of 1.29±1.33. These differences were statistically significant with $\chi 2 = 6.09$: 2df: :p=0.047. The same trend was also observed in the permanent dentition, with higher DMFT of 1.27±1.67 among those diagnosed for more than 5 years and lower DMFT of 0.60±1.40 for those diagnosed in less than one year (table 6). However this was not statistically different with $\chi 2 = 2.879$: 2df: : p=0.237.

Table 6: Distribution of dmft/DMFT in relation to the type of heart disease

Characteristic	***Mean dmft***	***Frequency***	Kruskal Wallis ***p≤0.05***
Heart disease			
CHD	*4.05±4.76*	*18*	χ2 = 0.86: 2df:
AHD	*2.93±3.08*	*15*	:P=0.650
RHD	*1.95±2.53*	*24*	
IE	*2.50±1.30*	*4*	
Heart disease	*Mean DMFT*	*frequency*	
CHD	*1.69*	*16*	χ2 = 2.347:
AHD	*0.79*	*14*	3df: :P=0.504
RHD	*0.72*	*32*	
IE	*0.0*	*2*	
Duration			
< 1 years	*0.60±1.40*	*15*	χ2 = 2.879:
1 yr-5 years	*0.89±1.53*	*27*	2df: :p= 0.237
>5 years	*1.27±1.67*	*22*	
Duration	*Mean dmft*	*frequency*	
< 1 years	*1.29±1.33*	*14*	χ2 = 6.09: 2df:
1 yr-5 years	*2.69±3.36*	*33*	:p=0.047
>5 years	*4.79±4.33*	*14*	

3.2.2 Caries experience dmft in relation to the caregivers' socio-demographic characteristics

Dental caries experience as illustrated in table 7 was highest among the children whose caregivers were > 41 years with dmft of 3.07±4.4 and lower among those children whose caregivers were less than 30 years with mean dmft of 2.79±2.79 though there was no statistical significance between the caregivers age and the dmft and DMFT with $\chi 2 = 0.352$: 2df: :p=0.84 for dmft and with ÷2 = 1.332: 2df: :p= 0.512 respectively.

Caries experience in relation to the level of education of the caregiver was not statistically significant as shown in table 7. Children whose guardians had primary level of education had a higher dmft of 3.14 while those who had no formal education had least dmft of 1.6 with $\chi 2 = 1.74$: 3df: :p=0.627 and DMFT with $\chi 2 = 0.654$: 3df: :p=0.884 ($p \leq 0.05$)

Table 7: Distribution of dmft/DMFT in relation to the caregivers' age and level of education

Variable	*Mean dmft*	*N*	*SD*	*p≤0.05*
Caregivers' age				
<30 years	*2.79*	*19*	*3.73*	*χ2 = 0.352:*
31- 40 yrs	*2.79*	*28*	*2.89*	*2df: :p= 0.84*
>41 years	*3.07*	*14*	*4.41*	
Caregivers' age	***DMFT***	***N***	***SD***	
< 30 years	*1.13*	*15*	*1.41*	*χ2= 1.332:*
31 to 40 yrs	*0.97*	*29*	*1.59*	*2df: :p=*
>41 years	*0.80*	*20*	*1.64*	*0.512*
Variable	***dmft/DMFT***	***N***	***SD***	***K. wallis***
Level of education				
None	*1.6*	*5*	*2.61*	*χ2 = 1.74:*
Primary	*3.14*	*29*	*3.67*	*3df: :P*
Secondary	*2.76*	*17*	*2.33*	*=0.627*
Tertiary	*2.80*	*10*	*4.87*	
None	*0.80*	*5*	*1.09*	
Primary	*1.2*	*24*	*1.89*	*χ2 = 0.654:*
Secondary	*0.88*	*26*	*1.48*	*3df:*
Tertiary	*0.55*	*9*	*0.88*	*:P=0.884*

3.3 ORAL HYGIENE STATUS AMONG THE CHILDREN

The children were examined for plaque based on loe and silness plaque index. The average plaque score was 1.72±0.59 and varied according to the socio-demographic characteristics of the child and the caregivers. The children were grouped according to the severity of plaque as per the loe and silness index. Majority of the children had fair oral hygiene 37(45.7%); and poor oral hygiene 36(44.4%) as illustrated in figure 3.

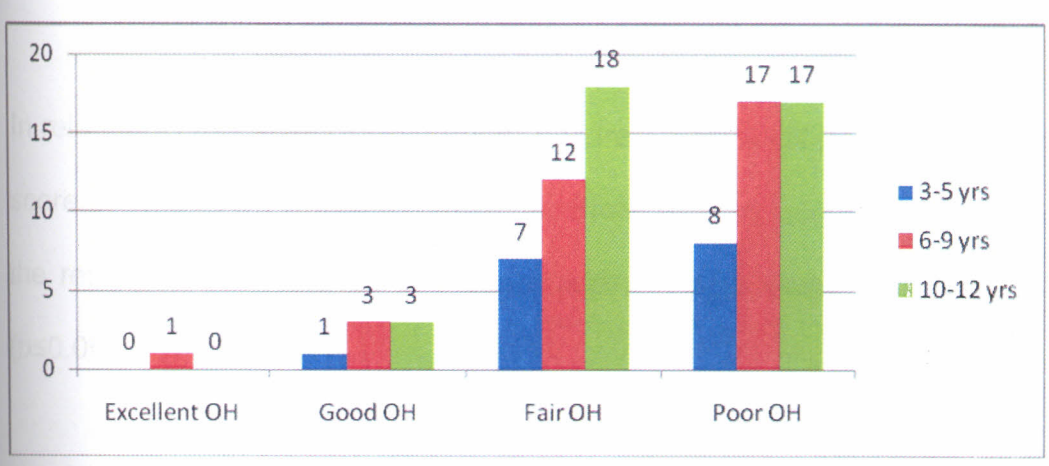

Figure 3: Distribution of oral hygiene status among the children

3.3.1 Plaque score distribution in relation to the socio-demographic characteristics of the children

Male children had a higher plaque scores of 1.76±0.58 compared to the females who had a plaque score of 1.68±0.60, although this was not statistical significant as illustrated in table 8. The plaque score levels gradually reduced with the children's age with the 3-5 year olds having highest plaque score of 1.85±0.42. However,

these differences were not statistically significant with Kruskal wallis $\chi 2 = 2.768$: 2df: :p= 0.251 ($p \leq 0.05$)

With regard to the different heart disease 33 children who had RHD had a higher plaque score of 1.82±0.56 (table 8). However, there were no significant differences in the plaque scores among the children in relation to the different heart disease. The children who had been diagnosed with the heart disease for a period of between 1-5 years had higher plaque scores of 1.79±0.58 (table 7) with Kruskal Wallis $\chi 2 = 0.964$: 2df: :p= 0.617

In relation to the area of residence, children from rural areas had the highest plaque score of 1.82±0.53 (table 8).However, there were no significant relationship between the residence and the plaque score with Kruskal wallis $\chi 2 = 2.893$: 2df: :p=0.617 ($p \leq 0.05$)

Table 8: Distribution of plaque score in relation to demographic characteristics

Characteristic	PS	N	SD	p≤0.05
Gender				Mann Witney
Male	1.76	44	0.58	Z=-0.703:
Female	1.68	33	0.60	p=0.482
Age in yrs				Kruskal Wallis
3-5	1.85	16	0.43	$\chi 2$ = 2.768:
6-9	1.73	33	0.63	2df: :p=0.251
10-12	1.64	32	0.61	
Heart disease				
CHD	1.70	23	0.62	Kruskal Wallis
AHD	1.53	18	0.57	$\chi 2$ = 3.234:
RHD	1.82	36	0.56	3df: :p=0.357
IE	1.79	4	0.65	
Duration since diagnosis				
< 1 year	1.67	17	0.57	Kruskal Wallis
1-5 yrs	1.79	40	0.58	$\chi 2$ = 0.964:
> 5 years	1.63	24	0.61	2df: :p=0.617
Geographical residence				Kruskal Wallis
Nairobi	1.64	28	0.67	$\chi 2$ = 2.893:
Other urban centres	1.61	16	0.53	2df: :p=0.617
Rural	1.82	37	0.54	

3.3.2 Plaque score in relation to the demographic characteristics of the caregivers

The oral hygiene among the children was better among the children whose caregivers were below 30 years with plaque as shown in table 9. However there was no statistical difference with $\chi 2 = 1.978$: 2df: :p= 0.372 ($p \leq 0.05$). With regard to the caregivers level of education, the children whose parents had secondary education had the least mean PS of 1.42±0.64; and those with no formal education had a higher PS of 1.93; $\chi 2 = 9.272$: 3df: :p= 0.025, ($p \leq 0.05$)

Table 9: Distribution of plaque score in relation to caregivers' characteristics

Characteristics	Plaque score	N	SD	K. wallis P≤0.05
Caregivers' age group				
< 30 years	1.61	22	0.47	$\chi 2 = 1.978$:
31-40 years	1.71	38	0.63	2df:
Above 41 years	1.86	21	0.59	:p=0.372
Level of education				
None	1.93	5	0.30	$\chi 2 = 9.272$:
Primary	1.88	36	0.46	3df: :p=
Secondary	1.42	28	0.64	0.025
Tertiary	1.58	12	0.66	

3.4 CAREGIVER'S KNOWLEDGE ON ORAL HEALTHCARE

3.4.1 Knowledge on causes and prevention of Dental caries

Majority of the caregivers interviewed were knowledgeable on the causes and prevention of dental caries with 67(83%) responding that dental caries is caused by frequent intake of sugary foods as shown in figure 4. In addition, 64(79%) caregivers knew that dental caries can be prevented by limiting the frequent intake of sugary foods, or by carrying out proper oral hygiene practices while 17(21%) of the caregivers did not know how the disease can be prevented.

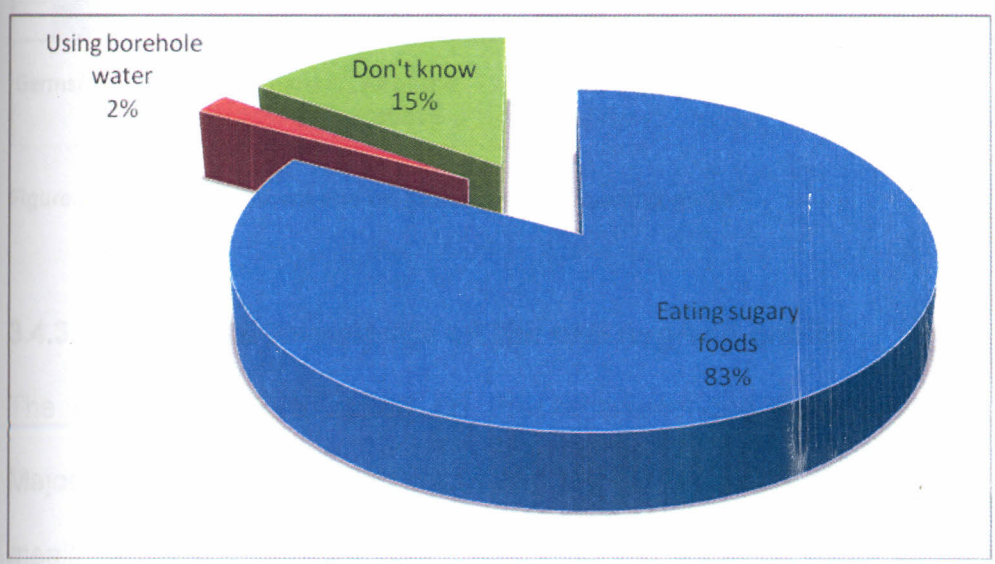

Figure 4: caregivers' knowledge on causes of dental caries

3.4.2 Caregivers' knowledge on the causes and prevention of bleeding gums

As shown in figure 5, bigger proportions (67%) of the caregivers were knowledgeable on the causes of bleeding gums while 33% were not. In addition, 75% of the respondents knew that bleeding gums could be prevented by either brushing teeth regularly; visiting a dentist regularly or by using mouth rinses while 25% did not know how to prevent.

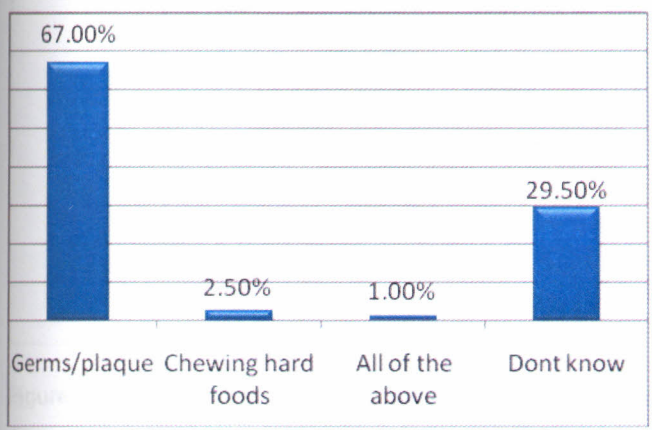

Figure 5: Caregivers knowledge on the causes of bleeding gums

3.4.3. Caregivers' knowledge on the oral hygiene habits

The caregivers were asked on the recommended frequency of cleaning teeth. Majority (88.9%) responded that teeth should be cleaned at least twice a day after meals, while 3.9 % responded that it should be done at least twice a day before meals, 4.5% once a day, and 2.4 % respondent that brushing should be done once in a while

3.4.4 Caregiver's knowledge on the dental healthcare of a child with heart disease

Only 24 (30%) of the caregivers had ever received professional advice, while 57 (70%) of the caregivers had never received any advice regarding the dental healthcare of the affected children. The source of the advice among the 24 who had received is as shown in figure 6.

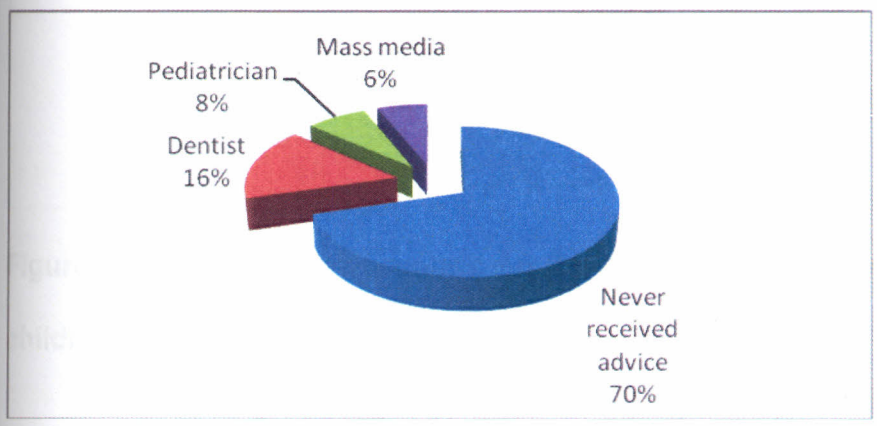

Figure 6: distribution of the caregivers' sources of dental healthcare advice

3.4.5. Caregivers awareness on the need for special dental attention for children with heart disease

Majority of the caregivers were not aware that the dental healthcare and dental treatment for children with heart disease was very important when compared to the general population as shown in figure 6. Only 31(38%) of the caregivers found their child's dental health important while 50 (62%) did not find any importance compared to the 'normal' children. Among the 31 caregivers who understood that dental care for children with heart disease was important, 18 argued that the heart disease can affect teeth; 12 believed that heart disease can be worsened by dirty/decayed teeth

while 2 responded that the children with heart disease are unable to brush their teeth.

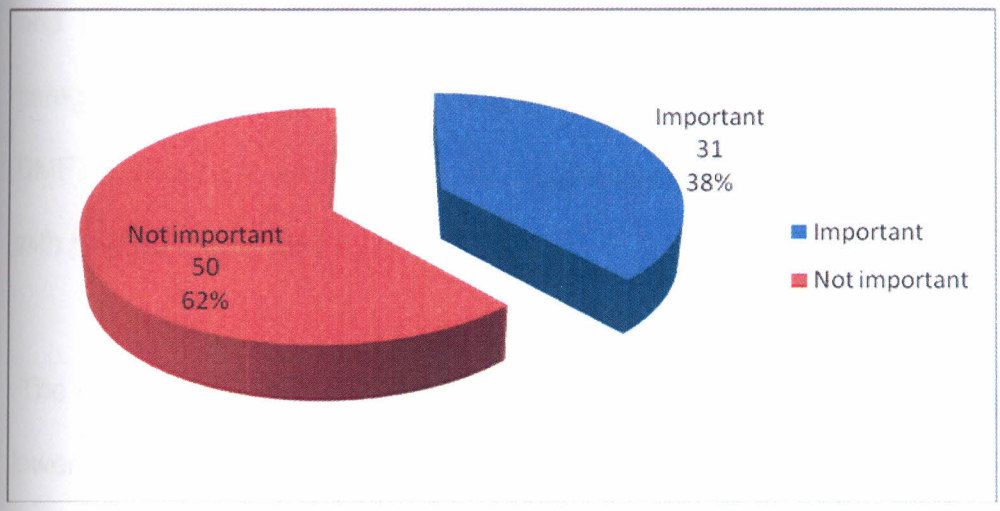

Figure 7: caregivers' awareness on the importance of good oral health among children with heart diseases

3.5 CAREGIVER'S KNOWLEDGE AND THE CARIES EXPERIENCE AMONG THE CHILDREN

3.5.1. Relationship between caregivers' knowledge on dental caries, oral hygiene and the dental caries experience among the children

Dental caries experience among the children with deciduous teeth whose caregivers' were knowledgeable on the causes and prevention of dental caries was lower with mean dmft of 2.84±3.60 and 2.82±3.68 respectively compared to higher dmft values of 2.91±2.88 and 2.93±2.76 among the children whose caregivers' were not knowledgeable on the causes and prevention of dental caries respectively as shown in table 10. However, this was not statistically significant with mann witney u test Z= -0.432: p=0.666 ($p \leq 0.05$).

The caries experience in permanent teeth among the children whose caregivers' were knowledgeable on the causes and prevention of caries had DMFT of 0.89±1.52 and 0.92±1.51 respectively and was lower compared to those children whose caregivers' were not knowledgeable on the causes and prevention of dental caries DMFT 0.92±1.71 and 1.08±1.79 respectively. This was not statistically significant with $p=0.601$ ($p \leq 0.05$)

The children whose caregivers were knowledgeable on the oral hygiene habits had lower values dmft and DMFT at 2.83±3.25; and 0.91±1.55 respectively compared to dmft and DMFT of 3.00±4.69 and 1.33±1.63 respectively among the children whose caregivers were not knowledgeable as reflected in table 10. However, none of these was statistically significant with respective p values of $p=0.546$, and 0.426 ($p \leq 0.05$)

Table 10: Relationship between the caregivers' knowledge on dental caries and oral hygiene habits and the caries experience among the children

	N	Dmft	SD	M. witney p≤0.05
Causes of caries				Z= -0.432:
knowledgeable	50	2.84	3.60	p=0.666
Poor knowledge	11	2.91	2.88	
Prevention of caries				Z= -0.523:
knowledgeable	46	2.82	3.68	p=0.601
Poor knowledge	15	2.93	2.76	
	N	DMFT	SD	p≤0.05
Prevention of caries				Z= -0.321:
Knowledgeable	52	0.92	1.51	p=0.748
Poor knowledge	12	1.08	1.79	
	N	**Dmft**	**Std dev**	**P≤0.05**
Oral hygiene habits				Z=
Knowledgeable	52	2.83	3.25	0.604: p=
Not knowledgeable	9	3.00	4.69	0.546
	N	**DMFT**	**Std dev**	**p≤0.05**
Oral hygiene habits				Z= -0.793:
Knowledgeable	58	0.91	1.55	p=0.428
Not knowledgeable	6	1.33	1.63	

3.5.3. Relationship between caregivers' knowledge on the oral healthcare of a child with heart disease and the dental caries experience among the children

The children whose caregivers had received professional advice on the dental care of a child for a child with heart disease had higher DMFT of 1.55±1.95 compared to DMFT 0.64±1.21 and higher dmft of 3.60±4.45 compared to 2.61±3.08 as shown in table 11. However, there was no statistically significant difference in the caries experience in relation to the caregivers' receipt of professional advice for both the dmft and the DMFT with the respective p values of 0.051 and p=0.643($p \leq 0.05$)

The children whose caregivers were aware of the need for special dental attention among the children with heart disease had higher DMFT 1.07±1.55 compared to DMFT of 0.86±1.57; and higher dmft of 3.41±4.49 compared to 2.54±2.72 as shown in table 11. However, these differences were not statistically significant for both dmft and DMFT with the respective p=0.366 and 0.800 ($p \leq 0.05$)

Table 11: Relationship between the caregivers' knowledge on the oral healthcare of a child with heart disease and the dental caries experience of the child

Professional advice	**N**	**DMFT**	**Std deviation**	**P≤0.05**
• Yes	15	1.55	1.95	Z= -1.955: p=0.051
• No	46	0.64	1.21	
Professional advice	**N**	**Dmft**	**Std deviation**	**p≤0.05**
• Yes	15	3.60	4.45	Z= -0.468: p=0.643
• No	46	2.61	3.08	
Awareness about special oral health attention	**N**	**DMFT**	**Std. deviation**	**Man Whitney U test p≤0.05**
• Knowledgeable	27	1.07	1.55	Z= -0.905: p=0.366
• Poor knowledge	37	0.86	1.57	
Awareness about special oral health attention	**N**	**Dmft**	**Std. deviation**	
• Knowledgeable	22	3.41	4.49	Z= -0.254:
• Poor knowledge	39	2.54	2.72	p=0.800

3.5.5 Caregivers' aggregate oral healthcare knowledge and the dental caries experience among the children

The caregivers were classified into two categories depending on the number of the correct responses on the oral healthcare knowledge: the knowledgeable group who answered more than 75% of the responses correctly and the less knowledgeable group who answered less than 74% of the responses correctly (refer table 12). Mann witney u test Z=-0.670, p=0.947($p \leq 0.05$) shows that there was no significant statistical difference in dental caries experience among the children whose caregivers were knowledgeable on oral healthcare from those children whose caregivers were not knowledgeable on the oral healthcare of a child with heart disease. Therefore the null hypothesis that there is no relationship between the dental caries experience among the children with heart diseases and the caregivers' knowledge on oral healthcare is accepted.

Table 12: Summary of the caregivers' aggregate oral healthcare knowledge and the dental caries experience among the children

Caregivers' knowledge	No	Dmft	SD	Mann witney $p \leq 0.05$
Not knowledgeable	27	3.03	3.61	Z= -0.670
knowledgeable	34	2.71	3.37	p=0.947
Total	61	2.85	3.45	

3.6 CAREGIVER'S ORAL HEALTHCARE KNOWLEDGE AND ORAL HYGIENE STATUS AMONG THE CHILDREN

3.6.1 Relationship between caregivers' Knowledge on the causes and prevention of bleeding gums and the Childs' oral hygiene level

There was statistically significant difference in the oral hygiene status in relation to the caregivers knowledge on the causes and prevention of bleeding gums as illustrated in table 13, with the children whose caregivers were knowledgeable on the causes of bleeding gums having lower plaque scores of 1.63±0.56 compared to higher plaque score of 1.91±0.60 among the children whose caregivers were not knowledgeable on the matter with $p=0.032$ ($p\leq0.05$). In addition, children whose caregivers were knowledgeable on the prevention of bleeding gums had significantly lower plaque score of 1.63±0.60 compared to higher PS of 1.98±0.44 among the children whose caregivers' were not knowledgeable with mann witney u test $Z= -2.321$: $p=0.020$ ($p\leq0.05$).

Table 13: Relationship between the caregivers' knowledge on the causes of bleeding gums and the children's plaque scores

Caregiver's knowledge	N	Plaque score	Std deviation	Mann witney Test. p≤0.05
Causes of bleeding gums				
• Knowledgeable	54	1.63	0.56	Z= -2.143:
• Not knowledgeable	27	1.91	0.60	p=0.032
Prevention of bleeding gums				Z= -2.321:
• Knowledgeable	61	1.63	0.60	p=0.020
• Not knowledgeable	20	1.98	0.44	

3.6.2 Relationship between caregivers' knowledge on oral hygiene habits and the oral hygiene status among the children

Table 14 shows that the children whose caregivers were knowledgeable on the oral hygiene habits had lower plaque score of 1.69±0.61 compared to 1.91±0.31 among the children whose caregivers were not knowledgeable. However, this was not statistically significant with p=0.383 (p≤0.05)

Caregivers were asked whether they had received any professional advice on the dental care of a child with heart disease. The children whose caregivers had received professional advice had lower plaque scores of 1.68±0.60 compared to 1.74±0.58 among those who had never received any advice as shown in table 14.

However, there were no statistically significant differences with p=0.383, (p≤0.05). In addition, the children whose caregivers were aware of the need for special dental attention among children with heart disease had lower plaque score of 1.75±0.47 compared to 1.66±0.64; however, these differences were not statistically significant with mann witney u test Z= -0.956: p=0.339 (p≤0.05)

Table 14: Relationship between the caregivers' knowledge and the child's plaque scores

Oral hygiene habits	**N**	**Plaque Score**	**Std Deviation**	**p≤0.05**
• Knowledgeable	72	1.69	0.61	Z= -0.872: p=0.383
• Not knowledgeable	9	1.91	0.31	
Professional advice	**N**	**Plaque score**	**Std. deviation**	**p≤0.05**
• Yes	24	1.68	0.60	Z= -0.872: p=0.383
• No	57	1.74	0.58	
Awareness about special oral health attention	N	**Plaque score**	**Std. deviation**	**p≤0.05**
• Knowledgeable	31	1.75	0.47	Z= -0.956: p=0.339
• Poor knowledge	50	1.66	0.64	

3.6.5 Summary of the relationship between the caregivers' oral healthcare knowledge and the mean PS among the children

The caregivers were classified into two categories depending on the number of the correct responses on the oral healthcare knowledge: the knowledgeable group who answered more than 75% of the responses correctly and the less knowledgeable group who answered less than 74% of the responses correctly. Table 15 illustrates that slightly more than half the number of the respondents were knowledgeable on oral healthcare among children with cardiac disease while 34(42%) were not knowledgeable.

The 47(58%) children whose caregivers were knowledgeable on the oral healthcare had lower plaque scores of 1.62±0.57, compared to higher plaque scores of 1.86±0.59, among the 34 (42%) children whose caregivers were not knowledgeable with mann witney u test, Z= -2.090 P=0.037. Therefore the null hypothesis that there is no relationship between the caregivers' oral healthcare knowledge and the oral hygiene status among the children is rejected.

Table 15: Relationship between the caregivers' oral healthcare knowledge and the Plaque score among the children

	N	Mean PS	SD	Mann witney P≤0.05
Not knowledgeable	34 (42%)	1.86	0.59	Z= -2.090
Knowledgeable	47(58%)	1.62	0.57	P=0.037
Total	81	1.72	0.58	

3.7 ATTITUDES TOWARDS ORAL HEALTHCARE

This study established that 80 (99%) of the caregivers had positive attitude towards the importance of deciduous teeth, 76(94%) had positive attitude towards the importance of brushing child's teeth, 69 (85%) argued that regular dental visits are important and 59% would visit a dentist regularly as illustrated in table 16. When the caregivers were asked whether children with heart diseases required special attention with regard to dental treatment compared to the normal population, 50 (62%) responded negatively while 31(38%) believed that they required special attention.

Table 16: Caregivers' Attitudes towards oral healthcare of the children

	Positive attitudes		Negative attitude	
Caregiver's attitudes	**N**	**Percentage**	**N**	**Percentage**
Importance of deciduous teeth	80	99	1	1
Brushing teeth	76	94	5	6
Regular dental check-up	69	85	12	15
Dental attention	31	38	50	62

3.8 CAREGIVERS' ATTITUDES AND THE ORAL HYGIENE STATUS AMONG THE CHILDREN

Table 17 summarizes the relationship between the caregivers' attitudes towards oral healthcare and the oral hygiene status (mean PS) among the children. There was a higher plaque score of 1.74±0.55 among the children whose caregivers' had positive attitudes towards the importance of deciduous teeth compared to PS of 0.60 in the child whose caregiver had negative attitude towards deciduous teeth, however there was no statistical difference with mann witney u test $p=0.08$ ($p\leq0.05$).

The plaque score was lower among the children whose caregivers had positive attitudes towards the importance of brushing teeth and the importance of regular

dental check-up, with PS of 1.69±0.59 and 1.68±0.65 respectively compared to PS of 2.03±0.52 and 1.98±0.58 among the children whose caregivers had negative attitudes towards the same matter, however none of these differences was statistically significant with respective p=0.102 and p=0.153 (p≤0.05)

Those children whose caregivers had positive attitudes towards the need for special dental attention for the children with heart disease had lower mean PS of 1.66±0.51 compared to mean PS of 1.82±0.54 among the children whose caregivers displayed negative attitudes towards the same matter, however, there was no statistical difference with mann witney u test p=0.084(p≤0.05)

Table 17: Relationship between the caregivers' attitudes on oral healthcare and the oral hygiene status of the children

Caregiver's attitudes	POSITIVE			NEGATIVE			Man witney p≤0.05
	N	Mean PS	SD	N	Mean PS	SD	
Importance of deciduous teeth	80	1.74	0.55	1	0.60	-	p=0.08
Importance of brushing teeth	76	1.69	0.59	4	2.03	0.52	p=0.102
Importance of regular dental check-ups	69	1.68	0.65	12	1.98	0.58	p=0.153
Special dental attention to a cardiac child	31	1.66	0.51	50	1.82	0.54	p=0.084

3.8.1 Relationship between aggregate attitude among the caregivers and the oral hygiene status (PS) among the children

The caregivers' responses regarding the oral healthcare attitudes were ranked and an aggregate score was calculated as a percentage of the positive options. The caregivers were classified into two categories: those having positive attitudes if the score was more than 75%; or negative attitudes if the score was less than 75% of the positive responses on oral healthcare of a child with cardiac disease.

Those caregivers' who were considered to have an overall positive attitudes towards the oral healthcare of the children with heart diseases were 65(80%) and those classified as having negative attitudes were 16(20%). Table 18 shows that the oral hygiene status (mean PS) was better with mean PS of 1.69±0.55 compared to mean PS of 1.83±0.66 among those children whose caregivers were classified as having negative attitudes. However, the differences were not statistically significant with mann witney u test $Z=-1.91$, $p=0.234(p\leq0.05)$. Therefore the null hypothesis which stated that there is no relationship between the caregivers' oral healthcare attitudes and the oral hygiene status among the children was accepted.

Table 18: Relationship between the caregivers' aggregate oral healthcare attitude and the oral hygiene status among the children

Caregivers' attitude	No	Mean PS	SD	Mann witney P≤0.05
Negative	16	1.83	0.66	Z= -1.191
Positive	65	1.69	0.55	
Total	81	1.72	0.59	P=0.234

3.9 CAREGIVER'S ATTITUDES AND THE CARIES EXPERIENCE AMONG THE CHILDREN

Table 19 shows the relationship between the various parameters used to test the caregivers' attitudes towards oral healthcare and the dental caries experience among the children. The one child whose caregiver had negative attitudes towards importance of deciduous teeth had higher dmft of 8.0 compared to dmft of 2.77±3.42 among 80 children whose caregivers had positive attitudes, though there was no statistical difference with p=0.138(p≤0.05). With regard to the attitudes on the importance of brushing teeth, children whose caregivers had positive attitudes had lower dmft of 2.75±3.52 compared to higher dmft of 2.89±2.75 among the children whose caregivers had negative attitudes, though there was no statistical difference with p=0.811(p≤0.05).

Table 19: Relationship between the caregivers' attitudes towards oral healthcare and the caries experience among the children

	POSITIVE			NEGATIVE			p≤0.05
	N	Dmft	SD	N	Dmft	SD	
Importance of deciduous teeth	60	2.77	2.95	1	8.0	-	Mann witney **p=0.138**
Importance of brushing teeth	57	2.86		4	2.75		Mann witney **p=0.811**
Importance of regular dental check-ups	52	2.88	3.51	9	2.98	2.67	Mann witney **p=0.677**
When to visit a dentist	Regular 52	2.83	3.78	Mobile teeth	0.9	1.10	Kruskal wallis $\chi 2$ = 6.499: 3df: :P >0.05 **p=0.09**
				Paining tooth	5.25	2.22	
				'Holes' no pain	2.68	2.98	
Special dental attention for a cardiac pt	22	3.41	4.49	39	2.54	2.72	**p=0.800**

Fifty two Children whose caregivers' had positive attitudes towards the importance of regular dental check-ups had lower dmft of 2.88±3.51 compared to dmft of 2.98±3.32 among the 9 children whose caregivers had negative attitudes, though this was not statistically significant with p=0.667(p≤0.05). The dmft for the 4 children whose caregivers would seek treatment for them whenever there was an 'asymptomatic tooth crack' was the highest at 5.25±2.22 followed by 36 who would attend regularly with dmft of 2.83±3.78; and 4 who would see a dentist because of symptomatic caries had dmft 0.9±1.10. However, none of these differences was statistically significant with p=0.09(p≤0.05) as illustrated in table 19

With regard to the caregivers' attitudes on the need to prioritize dental care for a child with heart disease as compared to the "normal" child, 22 (36%) of the caregivers had positive attitudes, while 39(64%) had negative attitudes. The dmft was lower at 2.54±4.49 among those children whose caregivers had positive attitudes compared to higher dmft of 3.51±2.72 among the children whose caregivers had negative attitudes, however, these differences were not statistically different, with p=0.800(p≤0.05).

3.9.1. Caregivers' aggregate oral healthcare attitude score in relation to the caries experience among the children

The caregivers were classified into two groups: those with positive attitudes and those with negative attitudes, depending on the percentage of the responses which were considered to reflect positive attitudes about oral healthcare. Those whose positive responses were more than 75% were classified as having positive attitudes

while those with less than 75% were classified as having negative attitudes. Table 20 illustrates that more of the parents, 39(64%) were classified as having negative attitudes, while 22(36%) were classified as having positive attitudes. The dmft was found to be lower at dmft 2.54±4.49 among the children whose caregivers had positive attitudes while higher dmft at 3.41±2.72 among the children whose caregivers had negative attitudes. However, none of these differences were statistically significant with mann witney u test Z= -0.670, p=0.697(p≤0.05). Therefore, the null hypothesis stating that there was no relationship between the dental caries experience among the children and the caregivers' oral healthcare attitudes is accepted.

Table 20: Relationship between the caregivers' oral healthcare attitudes and the dental caries experience among the children

Caregivers attitude	N	Dmft	SD	Mann witney P≤0.05
Negative	39(64%)	3.41	2.72	Z= -0.670
Positive	22 (36%)	2.54	4.49	P=0.697
Total	61(100%)	2.85	3.45	

3.10 CAREGIVERS' ORAL HEALTHCARE PRACTICES

3.10.1 Oral hygiene practices

Information regarding Oral hygiene practices was inquired from the caregiver. These included whether and how the child's teeth are brushed; the frequency of brushing; and whether tooth cleaning is supervised.

It was established that 75(93%) cleaned their teeth while 6(7%) responded that the teeth are not cleaned. Of the group that cleaned their teeth, 33(44%) cleaned twice a day, 29(39%) did so once a day while 16% responded that the child's teeth were "cleaned once in a while/occasionally". In relation to supervision, 62 (83%) reported cleaning their teeth without supervision while 13 were assisted by the caregivers.

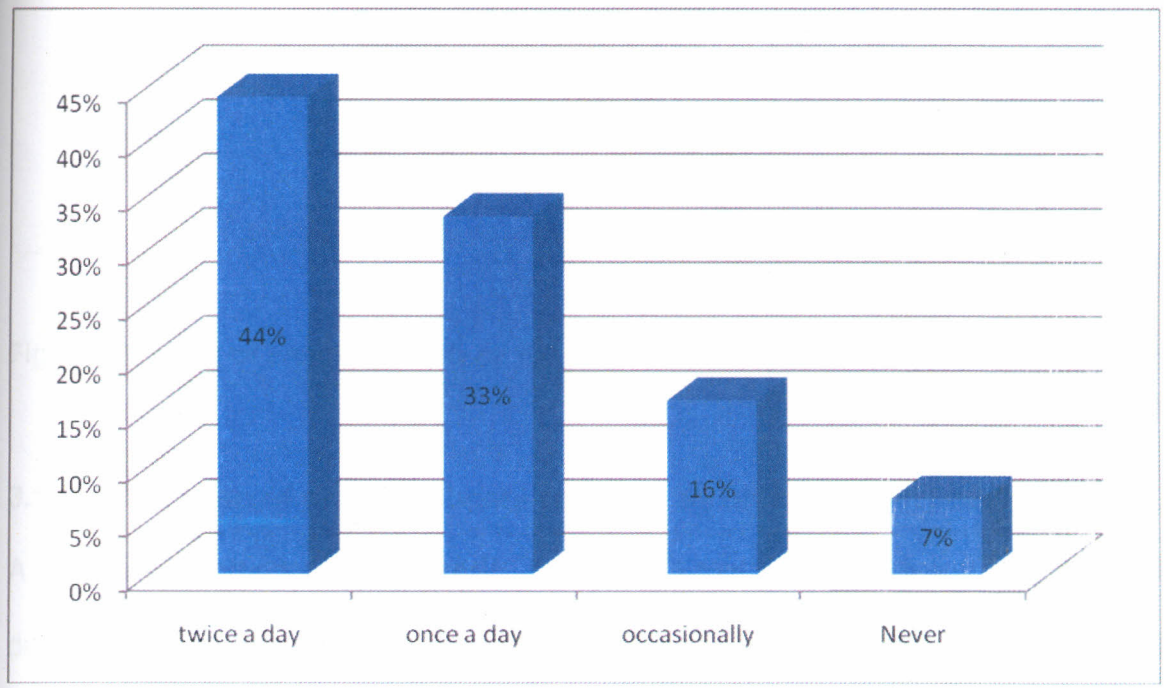

Fig 8: Frequency of cleaning teeth

3.10.2 Ways of cleaning the child's teeth

Three quarters (61) of the children used toothbrush; 14(17%) used a chewing stick; and 6 (8%) never cleaned their teeth. The children who used toothpaste were 59 (79%) while 16 (21%) never use.

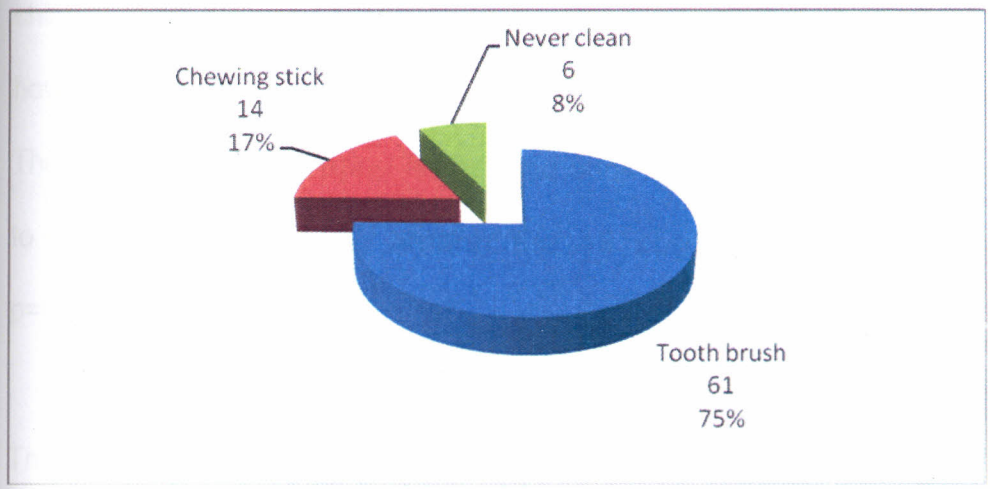

Figure 13: ways of cleaning teeth by the children

3.10.3 Utilization of oral healthcare services by children with heart diseases

A greater proportion of the children, 59 (72.8%) had never visited a dentist or utilize dental services. Among the 22 (27.2%) children who had been to a dentist, the treatment received in the last appointment included extraction in 10(12.3%) of the children; cleaning/prophylaxis in 1(1.2%); consultation and check-up in 9(11.1%) and 2(2.5%) had fillings done.

3.11 CAREGIVER'S ORAL HEALTHCARE PRACTICES AND THE DENTAL CARIES EXPERIENCE

The five children who never cleaned their teeth had a higher dmft of 2.93±2.50 compared to a lower dmft of 2.89 ±3.54 among the 56 children who cleaned their teeth. However, these differences were not statistically significant, with p=0.957($p \leq 0.05$). With regard to the frequency of tooth cleaning, the eleven children who cleaned their teeth once in a while had a higher dmft of 3.36±5.29 and the 23 children who cleaned twice a day had lower dmft of 2.68±2.77 as shown in table 21, however these differences were not statistically significant with p=0.936($p \leq 0.05$). The 10 children who used a chewing stick had a lower dmft of 1.40±2.98 compared to a dmft of 3.22±3.59 among the 46 children who used the toothbrush, with p=0.024($p \leq 0.05$).

Those children who had visited a dentist apparently had a higher caries experience with dmft of 4.18±4.13 and DMFT of 1.16±1.92 compared to lower dmft of 1.89±2.88; and DMFT of 0.36±1.0 among the children who had never visited a dentist. These differences was statistically significant with p=0.008($p \leq 0.05$)

Table 21: Relationship between caregivers' practices and the dental caries experience

Practice	N	Dmft	Std deviation	P≤0.05
Cleaning of Childs' teeth				Z= -0.54:
• Yes	56	2.89	3.54	p=0.957
• No	5	2.93	2.50	
Frequency of cleaning				
• Once a day	22	2.87	2.77	$\chi 2$ =0.007:
• Twice a day	23	2.68	3.33	1df: :p= 0.936
• Sometimes	11	3.36	5.29	
Means of cleaning teeth				Z= -2.251:
• Toothbrush	46	3.22	3.59	p=0.024
• Chewing stick	10	1.40	2.98	
Dental visits	N	Dmft	Std deviation	p≤0.05
Yes	15	4.73	4.08	
				Z= -2.641:
Never	46	2.24	3.03	p=0.008

3.11.3. Relationship between the caregivers' aggregate oral healthcare practices and the dmft among the children

The caregivers were classified into two groups depending on the responses about the oral healthcare practices. One was considered as having favourable practices if more than 75% of the responses were considered to be positive, or was considered as unfavourable practices if the responses were less than 75% of those considered favorable towards maintenance of oral healthcare. Table 22 shows that 53 (86%) caregivers were classified to be having unfavourable oral healthcare practices in relation to oral healthcare of the children. Fifty three children whose caregivers displayed unfavourable practices had a higher dmft of 3.62±3.54 compared to dmft of 2.74±2.85 among the 8 children whose caregivers displayed favourable oral healthcare practices. However, none of these differences were statistically significant with mann witney u test $Z= -1.297$, $p=0.197(p\leq0.05)$, therefore the null hypothesis that there is no relationship between the dental caries experience among the children and the caregivers' oral healthcare practices is accepted.

Table 22: Summary of the relationship between the caregivers' oral healthcare practices and the children's dental caries experience

Caregivers' practices	No	Mean dmft	SD	Mann Witney test, p≤0.05
Unfavorable	53	3.62	3.54	Z= -1.297
Favorable	8	2.74	2.85	
Total	61	2.85	3.45	p=0.197

3.12 CAREGIVERS' ORAL HEALTHCARE PRACTICES AND THE ORAL HYGIENE AMONG THE CHILDREN

3.12.2 Relationship between the oral healthcare practices and the plaque scores among the children

The mean plaque score was significantly lower among the 75 children who reported to cleaning their teeth with mean PS of 1.68±0.58 compared to a higher mean PS of 2.28±0.40 among the 6 children who never cleaned their teeth with p=0.009(p≤0.05). Those children who used the toothbrush had lower mean PS of 1.64±0.61 as illustrated in table 22. The children who cleaned more than twice a day had the lowest mean PS of 1.55±0.63; and those who cleaned their teeth occasionally had the highest mean PS of 1.99±0.41, though these differences were not statistically significant (table 23) with $\chi 2$ =0.067: 1df: :p =0.936 (p≤0.05)

The mean PS among the 22 (27%) children who had been to a dentist was mean PS of 1.68±0.55 compared to higher plaque score of 1.83±0.61 among the 59 (73%)

children who had never been to a dentist (table 23). However, the difference was not significant, with p=0.422 (p≤0.05)

Table 23: Relationship between oral hygiene practices and the oral hygiene levels

Practice	N	Plaque score	Std deviation	P≤0.05
Cleaning of Childs' teeth				Z= -2.611:
• Yes	75	1.68	0.58	P<0.05
• No	6	2.28	0.40	(0.009)
Frequency of cleaning				$\chi 2$ =0.067:
• Once a day	29	1.66	0.53	1df: :P >0.05
• Twice a day	33	1.55	0.63	(0.936)
• Sometimes	13	1.99	0.41	
Means of cleaning teeth				Z= -0.966:
• Toothbrush	61	1.64	0.61	P>0.05
• Chewing stick	14	1.82	0.40	(0.334)
Dental visits				
• Yes	22	1.68	0.55	P=0.422
• No	59	1.83	0.61	

3.12.3 Relationship between the caregivers' oral healthcare practices and the oral hygiene status of the children

The caregivers were classified into two categories, one with favourable practices and another with unfavourable practices, depending on the number of the responses which were considered to be favourable with regards to maintenance of good oral hygiene. Those who scored more than 75% were classified to be in favourable practice group, while those whose responses were less than 75% of the favourable options were classified as having unfavourable practices as shown in table 24

Sixty eight (84%) caregivers displayed unfavourable oral healthcare practices as compared to 13 (16%) caregivers with favourable oral healthcare practices among their children. The oral hygiene among those children whose caregivers displayed favourable practices was better compared to among the children whose caregivers displayed unfavourable practices as illustrated in table 24, however, the differences were not statistically significant with mann witney u test $Z= -1.305$, $p=0.160(p\leq0.05)$, therefore the null hypothesis stating that there is no relationship between the oral hygiene status among the children and the caregivers oral healthcare practices is accepted.

Table 24: Relationship between the caregivers' aggregate oral healthcare practices and the oral hygiene status among the children

Caregivers' practices	N	Mean PS	SD	Mann Witney test, P≤0.05
Unfavorable	68	1.73	0.59	Z= -1.305
Favorable	13	1.69	0.54	
Total	81	1.72	0.58	P=0.160

CHAPTER 4

DISCUSSION

4.1 DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION.

Among the 81 children examined, the age range was from 3 years to 12 years, with mean age of 8.16 years (± 2.81 SD) which was similar to a study by Hallet et al [26]. The age range of the study group was similar to the study population by Berger et al. [40] and different from study population in studies by Silva et al. 2002 [29] who examined 2-17 year-olds; Pollard et al. 1992 [32] and Saunders et al. 1997[35] who examined 2 to16 year-olds; Fonseca et al. 2009[5] who examined 12 months to 71 months-old; Hallet et al [26] who examined 2-15 year olds and Smith et al[11] who examined adults. The age range of 3-12 years was chosen since these were the children who were attending the paediatric cardiology units at the selected clinics, with those beyond this age bracket attending the general cardiology clinics together with the adults.

The boys to girls ratio for the children was approximately 1:1 which is similar to previous Kenyan studies by Ngatia et al. 2001 and Njoroge et al. 2007 on normal pre-school children [41,42]. This could be a reflection of the Kenyan population where the ratio of male to female is approximately 1:1 as is reflected in the 2006 Kenya Bureau of Statistics report.[43] The same pattern has also been reported among the past studies by silva et al and Fonseca et al. 2009 since heart diseases affects both male and females equally [5, 29].

The children examined were suffering from various types of congenital and acquired heart diseases. This was an attempt to include all the types of heart diseases compared to most of the past studies that have been examined children with congenital heart diseases only [5,35,39,40]

The duration since diagnosis of the cardiopathy ranged from less than 1 year to 12 years with a mean duration of 3.53±3.43 years. Nearly half of the children, (40, 49%) had been diagnosed with the disease for a duration of between 1 to 5 years, while those who had been diagnosed more than 5 years and those less than 1 year accounted for 30% and 21% respectively. The children who had been diagnosed for a period of 1-5 years were many because they were awaiting surgeries or were undergoing post-operative reviews.

Although the study did not establish if the caregiver who had accompanied the child on the examination day has been the one consistently accompanying the child, mothers were 44 (54%), fathers were 23 (28%) while guardians were 14 (18%). This was a reflection that most children are usually accompanied by their mothers in seeking for healthcare, and that home based oral healthcare supervision for the child is frequently done by the mothers.

The level of education among the caregivers who accompanied the child in this study was relatively low, with 36 (44%) having primary level of education as the

highest level attained; followed by those with secondary level 28 (35%); then tertiary level 12 (15%) and 5 (6%) had no formal education. This level of education is nearly similar to that reported by the Kenya Demographic and Health Survey.[44] but lower than 51.2% of mothers and 49.1% of fathers having attained secondary education as found by Gichu et al.2009.[45]

4.2 DENTAL CARIES EXPERIENCE

The mean dmft in this study was found to be 2.85±3.45 and the DMFT was 0.95±1.55. The mean dmft was close to the findings by Silva et al. 2002 [29] and Fonseca et al. 2009.[5] Higher dmft values than in this study have been demonstrated by Hallet *et al* [26]; Brown *et al.*[6] in Saudi Arabia; and Stecksen-Blicks *et al* [39] in Sweden. These studies were conducted in dental clinics on those children who had been referred by their primary physician for dental review. In addition, bitewing radiographs were used to detect inter-proximal caries therefore higher values of dmft/s were established. It is possible that the dmft values could probably have been higher if radiographic examination was carried out in these children. Nonetheless, dmft values in this study were still higher compared to previous studies among "normal" school children in developing countries with dmft value of 1.9 in Cameroon [23]; dmft of 1.95 in Ibadan [23]; dmft of 4.6 in Madagascar [23]; dmft of 2.6 in Tanzania[23] and the dmft value of 1.5±2.2 among Kenyan 5- year old children as at 2002 was according to the Kenya National Oral Health policy document[15].

The mean DMFT of 0.95 ±1.55 in this study was similar to that by Hallet et al. 1992[26] who established DMFT of 0.9; and by Stecksens-Blicks et al. 2004[39] who established mean DMFS 0.9±1.9 among the children with heart disease and Owino et al who established DMFT of 0.92±1.36 among 12 year-old school going children in Kitale. The DMFT in this study however is lower compared to the mean DMFT of 3.97±4.10 reported by Silva et al. 2002[26] in Brazil. The higher DMFT values could probably be because older children up to 17 years were included in those studies and radiographs were used to diagnose interproximal carious lesions.

Although the total number of deciduous teeth with untreated dental caries was 227 (27.05%); missing teeth due to dental caries accounting for 28 (2.5%) with hardly any filled teeth (0.1%) and the total number of permanent teeth with dental caries being 79 (7.1%); while those missing due to dental caries totaling to 21 (2.5%); the number of children with deciduous teeth who had dental caries was 40 (65.6%) while those with permanent teeth were 23 (40%). These suggest that these children have a higher caries experience and fall under high caries risk group. These findings are similar to those of studies by Hallet et al. 1992 and silva et al 2002 who reported prevalence of 70% and 72.1% respectively in deciduous teeth among children with heart disease[26,29].

The 40% prevalence of dental caries in permanent teeth was higher than the prevalence of 27% (DMFT=0.71) reported among Kenyan urban and rural 12-13

year old children in 1996 by Dattani [24] and prevalence of 22.6% among 12 year olds by Manji (1988).

Lower prevalence of dental caries among the children with heart disease have been reported by Fonseca et al[5] who reported prevalence of 17% and Pollard et al 2002[32] who reported prevalence of 44% in the USA and the UK respectively. These differences can be attributed to the reported decline in dental caries in developed countries because of the emphasis on caries preventive measures and better healthcare facilities as compared to increasing dental caries trends in developing countries because of the emphasis on curative services, assimilation of western type of diet, and less emphasis on caries preventive measures.[23]

Higher prevalence of caries than in this study has been reported by Brown et al[6] in the Middle East with prevalence of 97.3% among the children with heart diseases. This difference is attributed to the differences in the study methodology and also to the regional differences in caries trends with reports of higher caries experience in Islamic countries due to the cariogenic nature of the diets in those countries.

The significant difference in caries experience, dmft with age, from 4.13±4.03 among the 3-5 year-olds; 2.70 among the 6-9 year-olds and 1.58±2.06 among the 10-12 year-old children could be attributed to the reduction in the number of deciduous teeth due to natural exfoliation, and also could be explained by the fact that older children are able to brush their teeth compared to younger children who

are dependent on the parents to maintain their oral hygiene, thus are more prone to early childhood caries. In addition; most of the older children had acquired heart diseases, especially RHD and therefore their duration of exposure to sweetened medications; and dental neglect due to emphasis on other medical aspects of life by the parent was for a shorter period compared to younger children with congenital heart diseases who were exposed to risks of caries at a very tender age. This can be explained by the fact that children with cyanotic heart disease had a higher dmft of 4.05±4.76 compared to 1.95±2.53 among the children with RHD. Similar trend of reduction in dmft with age was established by Silva et al. 2002 [26]. The findings in this study are however different from those found by Pollard et al. 1992[32] who found mean dmft among 2-4 year-olds to be 1.81±4.07 while the 5-9 year-olds were found to have dmft of 4.32±2.97.

There was significant relationship between the mean dmft scores and the duration since diagnosis of the heart disease, with the children who had lived with the disease for longer periods having dmft of 4.79 ±4.33 compared to 1.29±1.33 among the children who had been on treatment for less than 1 year with $p=0.047(p\leq0.05)$. In a similar trend children with cyanotic heart disease had the highest dmft of 4.05±4.76, followed by those with acyanotic heart disease dmft of 2.93±3.08, I.E dmft of 2.50±1.30 and those with RHD had the least dmft of 1.95±2.53. This trend has been reported by studies by Stecksen-Blicks [39] who reported dmfs of 10.1±8.5 among children who had been treated for congenital heart disease for longer duration and had used digoxin medication (contains glucose) for up to 87 months.

Today, sucrose is avoided as a sweetener in most medicines because it is widely accepted that sugar-containing medicines are a cause of dental caries in chronically sick children.[28] Other reasons for the more caries experience could be because of the longer duration of dental neglect due to attention to the heart ailment, and the longer exposure to cariogenic snacks as a consolation for the chronic illness.[30]

This study established that there were differences in caries experience in relation to area of residence, with higher dmft of 4.09±3.70 among the children from Nairobi while the rest from outside Nairobi and rural areas had lower dmft and lower caries experience with $p=0.014(p\leq0.05)$. This could be as a result to ease of access of easily fermentable carbohydrates among the children in urban areas compared to children from rural areas.

The study findings suggest that the caregivers' age and the level of education do not influence the oral health status of the children, since the caries experience was nearly well distributed among the children in relation to the caregivers' level of education and the ages. The differences, though not statistically significant could have been by chance.

4.3 ORAL HYGIENE STATUS AMONG THE CHILDREN WITH HEART DISEASE

The mean plaque score in this study was 1.72±0.59, corresponding to fair oral hygiene. The proportion of children who had visible plaque was 98 % (n=80). These are similar to the findings by Silva et al 2002[29] who found plaque to be present

among 98% of the children examined. Hallet et al. 1992[26] found higher plaque scores of 0.65±0.22, though different plaque index had been used to check for the presence or absence of plaque. Ober et al[48] in their study on children with cerebral palsy found mean plaque score of 1.56±0.87. Other studies, though they have not mentioned the specific plaque scores, have reported higher plaque scores and poor oral hygiene among children with cardiac disease [11, 32, 40]

The high proportion of children with visible plaque, and the higher plaque scores among the children with heart disease is a worrying trend, since it is recommended that patients at risk for infective endocarditis should maintain a high standard of oral health[25]. Though periodontal probing was not done because antibiotic prophylaxis had not been offered, gingivitis in childhood, when not diagnosed and eliminated, follows the individual until adult life, and may evolve into periodontitis.[30]

The differences in plaque score in relation to age and gender of the children could be because girls are more conscious of their appearance and therefore are more likely to clean their teeth thus having lower plaque scores than boys. However, the differences were b not statistically significant. Similar findings have been reported by Musera et al and Owino et al [37,47]. The improvement of oral hygiene with age of the child could be a reflection of the better plaque control among the older children who have better manual dexterity in brushing teeth compared to younger children who rely on the parents to clean their teeth. This can be confirmed by the small proportion of the children who were supervised during brushing.

The variation in plaque score levels in relation to the duration since diagnosis, the different heart disease and the geographical residence within the last 2 years could have been a chance finding since there was no statistically significant difference. Alternatively, the difference could be influenced by ease of access and use of toothbrushes and dentifrices as reflected by the better oral hygiene among the Nairobi residents compared to those children from the rural areas

The influence of the level of education of the caregiver was significant, with higher plaque score of 1.93±0.30 among those children whose caregivers had no formal education and least with 1.42±0.64 among those children whose caregivers had secondary school education, this could probably be because the caregivers were aware of the importance of oral hygiene care among these children and could also be because these caregivers' could afford to avail essential tooth cleaning aids resulting in better oral hygiene practices.

4.4 CAREGIVERS' KNOWLEDGE ON ORAL HEALTHCARE OF THE CHILDREN WITH HEART DISEASE

Although the caregivers' knowledge on the general oral healthcare was generally good, with 67(83%) knowing the causes of dental caries; 64(79%) knowing how dental caries can be prevented; 66.7% knowing the causes of bleeding gums; and 75% having knowledge on how the bleeding gums could be prevented; it was worrying that the knowledge on the oral care in a child with heart disease was poor. In this study, only a third of the respondents had knowledge about the importance of maintaining good oral health as a preventive measure for complications arising from

dental diseases. Similar findings have been reported by Silva *et al* [29] who established that 41.3% of the guardians understood the importance of good oral health to prevent infective endocarditis; Hallet et al[26] found that 31% of the responses about knowledge were affirmative, while studies with adults found percentages of 21% and 66%. However, Fonseca et al[5] in their study found that 80% of the guardians knew that oral health was important for the heart. The poor knowledge among the caregivers on the importance of maintaining a good oral health to prevent dental diseases could be because probably be because of the limited sources of oral healthcare advice from the pediatrician or their primary physicians who interact with these patients frequently.

The high number of the caregivers who had never received dental advice for their child was worrying, with 57(70%) of the respondents reporting that they had never received any professional advice on the dental care of a child with heart disease. In this category, the dentist was the leading professional who had offered advice, followed by paediatrician in 8%; and the mass media among 6% of the cases. Other studies in developed countries have established that up to 79% of the parents had received dental health information and advice mainly from a dentist or a physician.[6] This trend is worrying since sensitization of the caregivers on the oral healthcare of these children could result in prevention of most of the complications which can arise as a result of poor oral health. Pediatricians need to be advised on the need to educate these patients on oral healthcare since they are at a better position to interact with these patients. The role of the mass media in communicating preventive

oral healthcare information cannot be overlooked, especially the use of posters displayed in the waiting rooms of the various cardiology units.

4.5 CAREGIVERS' ORAL HEALTHCARE KNOWLEDGE AND THE DENTAL CARIES EXPERIENCE AMONG THE CHILDREN

Although the dental caries experience (dmft and DMFT) among the children whose caregivers were classified as being "knowledgeable" was lower compared to those children whose caregivers were classified as being "not knowledgeable" on the oral healthcare the difference was not statistical significant. The difference in caries experience can be explained by the fact that dental caries is multi-factorial disease and many other factors can play a role. The presence of adequate knowledge on oral care among patients has been argued to lead to prevention of the disease, however with negative attitudes, these is not always the case.

4.6 CAREGIVERS' ORAL HEALTHCARE KNOWLEDGE AND THE ORAL HYGIENE STATUS AMONG THE CHILDREN WITH HEART DISEASE

The knowledge on the causes and prevention on bleeding gums was good, with more than three quarters of the caregivers knowing the causes and prevention of gum disease. There were significantly lower plaque scores (1.63±0.56) among the children whose caregivers were knowledgeable on the causes of bleeding gums than among those children whose caregivers were not knowledgeable (1.91±0.60). The same difference was also noticed between the plaque scores among the children whose caregivers were knowledgeable on the prevention of bleeding gums

compared to their counterparts (plaque score of 1.63±0.60 and 1.98±0.60 respectively)

The statistical tests conducted in this study demonstrated that there was a significant relationship between the caregivers' oral healthcare knowledge and the oral hygiene status among the children; with those children whose caregivers were more knowledgeable having lower plaque scores. These could be because maintenance of oral care depends on the knowledge on the causes, presentation and prevention of dental diseases. Mechanical plaque control through cleaning of teeth can only be done when a parent is aware of the consequences of not cleaning teeth; and is motivated to practice oral hygiene practices

4.7 CAREGIVER'S ATTITUDES ON THE ORAL HEALTHCARE OF CHILDREN WITH HEALTH DISEASE

In this study, a bigger proportion of the caregivers had positive attitudes towards the importance of deciduous teeth (98.8%); brushing of teeth (93.8%); and the importance of regular dental checkups (85%). However, a bigger proportion (62%) though did not find preventive dental attention for the children with heart disease to be more important compared to that of a normal child. This could be because of the ignorance and lack of motivation depicted by most of the caregivers on the importance of preventive dental health care among the children with special needs. In addition, most of the caregivers had not been sensitized by their primary doctor on the consequences of poor oral health among this group of children.

4.8 CAREGIVERS' PRACTICES ON THE ORAL HEALTHCARE OF CHILDREN WITH HEART DISEASE

Despite 75(93%) of the respondents reporting that their children cleaned their teeth, only 33(44%) of these children cleaned their teeth at least twice a day and that a bigger proportion; 62(83%) of the children cleaned their teeth under no supervision by the caregivers, despite the fact these younger children have poor manual dexterity. Worrying still were the 7% who never had their teeth cleaned and those who cleaned occasionally since they were at risk of developing early childhood caries, gingivitis and poor oral health which may give rise to a frequent bacteraemia under physiological conditions. Other studies among children with heart diseases have reported that 55 % of the children brushed their teeth twice a day[35] and that 46.1% of the children brushed three times a day[29]. Owino et al[48] reported that 67.5% of the 12-year-old children in a peri-urban area brushed their teeth.

Franco et al.[30] in their study considered as disappointing the percentage of children with congenital heart disease who had never visited a dentist. Silva et al[29] also reported 28.8% of the children in their study had never seen a dentist, while Saunders et al[35] reported 18% of the children in their study had never visited a dentist. Fonseca et al[5] reported that 50% of the 11-71 months-old children with cardiac disease had never seen a dentist. In this study, very high percentage of the children examined had never seen a dentist. Only 22(27.2%) of the children examined had been to a dentist and shocking still was the fact that most of the

treatment which had been offered was extractions with hardly any of the children receiving any preventive treatment or restorative treatment. The same trend has been reported by Ober et al[47] who established that only 26.9% of the children with cerebral palsy in Nairobi had been to a dentist. This is alarming since the American heart Association recommends that children with heart disease should visit a dentist for institution of preventive measures.[25]

The lower frequency of dental visits in this study compared to other studies in developed countries could be because of the following reasons: first, most of the caregivers are ignorant on the importance of preventive dental care among the children with heart disease; also that most of the patients examined were of lower socio-economic status therefore could not afford the treatment. In addition; the dental facilities in Kenya are limited, inaccessible and most lack skilled dental personnel who are well trained in offering treatment to children with special needs.

The use of other tooth cleaning devices like the chewing stick was illustrated in this study. Majority of the children who were using this device mostly were from rural areas. There outstanding fact was that the children examined were from different residential backgrounds; therefore the children who used the chewing sticks were mostly from the rural set-ups where other tooth cleaning aids might not have been available.

4.9 CAREGIVERS' ORAL HEALTHCARE PRACTICES AND THE CARIES EXPERIENCE AMONG THE CHILDREN

This study illustrated that the caregivers' aggregate oral healthcare practices did not significantly influence the dental caries experience among the children. Those children whose caregivers were classified as portraying "unfavorable practices" had higher caries experience with mean dmft of 3.62±3.54 (n=53) compared to 2.74±2.85 (n=8) among the children whose caregivers reported "unfavourable practices" on oral care.

The children who had been to a dentist apparently had a higher dmft than those children who had never been to a dentist. This finding illustrates that children visit a dentist when dental disease dental caries has already occurred, and that the majority of the treatment offered is curative to relieve the symptoms, with little or no emphasis on preventive oral care. This is further illustrated by the high proportion of active, untreated caries component of dmft compared to filled or extracted teeth.

The patients who used chewing stick in this study had significantly lower dental caries experience than those who use the toothbrush. This could probably be explained by the fact most of the children who used the chewing stick were from rural areas where the dental caries experience was shown to be lower compared to urban centres possibly because of the difference in the diet. In addition, some studies have demonstrated the cariostatic and bacteriostatic properties of some

specific species of trees which are used as chewing sticks. It is also possible that the high caries experience illustrated among the children who were using the brush could have been skewed by a few children who started to use the brush late in life after severe early childhood caries had been established.

4.10 CAREGIVERS' ORAL HEALTHCARE PRACTICES AND THE ORAL HYGIENE STATUS AMONG THE CHILDREN WITH HEART DISEASE

In this study, there was no significant relationship between the caregivers' aggregate oral health care practices and the oral hygiene status among the children ($P>0.05$), however, those children whose caregivers reported "favourable practices" had lower plaque scores of 1.69 ±0.54 (n=13) compared to plaque scores of 1.73±0.59 (n=68) among the children whose caregivers reported "favourable practices." The children who cleaned their teeth had significantly lower plaque score compared to those children who never cleaned their teeth because mechanical plaque control through tooth cleaning of is more important in elimination of plaque. In addition, the toothbrushes were more effective in control of plaque compared to the use of chewing sticks, though there was no significant difference between the two groups.

The results of these study shows that children who had been to a dentist displayed better oral hygiene than those children who had never been to a dentist , though there was no statistical difference. This perhaps indicates that oral hygiene instructions could have been offered by the dentist visited previously.

preventive services rendered. Although this study did not establish the factors hindering utilization of dental services, the findings are contrary to the American Academy of Paediatric Dentists (AAPD) which requires that children with special needs should be examined within the first year of life and later, annually by a paediatric dentist.

LIMITATIONS OF THE STUDY

This study was conducted among children attending paediatric cardiology clinics in Nairobi in the months of October, November and part of December 2008. Though the children were from different parts of the country, only 81 examined with age range of 3 years to 12 years might not be representative of the dental caries and oral hygiene status among all the children with heart diseases in Kenya. In addition, most children attend the clinics once or twice per year once the heart condition had been stabilized and therefore making it difficult to conduct a study in few months.

The questions to assess the caregivers' attitudes might not have been exhaustive due to absence of a standard questionnaire to assess oral healthcare attitudes; therefore the caregivers' attitudes might not have been elaborately measured.

RECOMMENDATIONS

1. Since there is high dental caries experience and the poor oral status among the chidren with heart disease, there is need for integration of oral health education programmes with the medical education programmes especially to target those patients with "special needs" as displayed by the poor knowledge among the caregivers on the importance of oral healthcare and of the possible consequences of the poor oral health among the children with heart diseases.
2. There is need to sensitize healthcare providers, especially the paediatricians and the nurses on the oral healthcare for children with chronic medical illnesses like heart diseases and the need for multi-disciplinary management
3. Audio-visual aids like posters and charts displayed at the reception in the various special clinics caring for children with chronic medical illnesses can be used to improve the caregivers' knowledge and practices on oral care for the children
4. Further studies needs to be conducted to assess the factors hindering utilization of dental services among children with heart diseases and also to compare the oral health of children with "chronic medical illnesses" and "normal children.

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Appendix I: consent form

The purpose of the study

I, Dr. Daniel K Kemei from the University of Nairobi would like to seek your consent for your child's participation in a study aimed at determining the oral health status and oral health service utilization among children with heart diseases in Nairobi and caregiver's knowledge, attitudes and practices on oral healthcare. The information I get is part of my research for a thesis as a partial fulfillment for the degree of master of dental surgery in paediatric dentistry.

How do you participate?

I shall ask some questions about your child's past and present dental treatment and the oral hygiene practices. I shall look into your child's mouth and record some observations. The examinations shall be carried out using clean (sterile) instruments and no invasive procedures shall be performed.

Voluntary participation

Your child's participation in the study is voluntary. You can terminate his/her participation in the study at will without any consequences. Also understand that the participation in the study does not entail financial benefit.

Anticipated risk

No risk is anticipated for participating in the study

Confidentiality

The information given to the researcher will be kept in strict confidence. No information by which your identity can be revealed, will be be released or published

If you are satisfied with my explanation and you are willing to have your child participate, please sign the consent form

Consent form

I_____of_____

Having understood the nature of study as explained to me by Dr. Daniel K Kemei of University of Nairobi, is willing to have my child to participate in the study

Name _____signed _____Date_____

Patient

I confirm that I have explained the nature of the study to the patient.

Name _____Signed _____Date____

Investigator

APPENDIX II: QUESTIONNAIRE

edical details from patient's file and treatment sheets

Diagnosis_____

Date when first diagnosed_____

indly fill the right choice in the box next to the question.

1. Patient/ child identification _____
2. Age of child _____
3. Sex of child: male _____ Female_____
4. Position of the child in the family_____
5. What is your relationship with the child?
   - A. Mother
   - B. Father
   - C. Aunt/uncle

   ☐
6. Parent's occupation
   - A. Unemployed
   - B. Petty trader
   - C. Unskilled worker/labor ☐
   - D. Skilled worker
   - E. Farmer
   - F. Professional
   - G. Businessman

7. Age of the parent/Guardian in years_____

8. The highest level of school completed by the parent/Guardian_____

9. Where do you reside (for at least the last 2 years)_____

The following relates to oral healthcare knowledge

10. Dental caries is

A. The name for the disease which causes holes in the tooth surface

B. The name of an instrument used in the dental clinic ☐

C. All the above

D. Do not know

11. Tooth decay/ dental caries is caused by

A. Germs destroying the tooth surface

B. eating too much spicy food ☐

C. Borehole water

D. Do not know

12. Tooth decay can be prevented by

A. Limiting the amount of sugary foods eaten

B. Carrying out a proper oral hygiene ☐

C. All of the above

D. Do not know

13. Bleeding gums is commonly caused by

    A. Germs/plaque present near the gums

    B. Eating too hard foods

    C. All the above

    D. Do not know

14. Bleeding gums can be prevented by

    A. Brushing teeth daily with tooth paste

    B. Visiting a dentist to have your teeth cleaned and for advice

    C. Rinsing the mouth with a mouth wash

    D. Do not know.

15. Do you know if there is a relationship between some heart diseases and your *child's dental health?*

    A. Yes

    B. No

16. Where did you get such advice?

    A. From the pediatrician/physician

    B. From the dentist

    C. From internet

    D. Others, specify_____

The following relates to oral healthcare practices

17. Are your child's teeth cleaned?

    A. Yes

    B. No (go to question 22)

18. Who cleans your child's teeth?

    A. Child

    B. Parent/guardian

    C. House help

19. How often are the child's teeth cleaned?

    A. Once a day

    B. Twice a day

    C. Don't know

    D. sometimes

    E. Never

20. What is used to clean the child's teeth?

    A. A toothbrush

    B. A chewing stick

    C. Others ,specify_____

21. Is toothpaste used to clean the teeth?

    A. Yes

    B. No

    C. I do not know

22. Has the child ever been to a dentist?

    A. Yes ☐

    B. No

23. What kind of treatment was offered to the child?

    A. Filling

    B. Extraction ☐

    C. Cleaning

    D. Consultation and check-up.

24. Do you know if there is a relationship between some heart diseases and your child's dental health?

    A. Yes ☐

    B. No

25. Where did you get such advice?

    A. From the pediatrician/physician

    B. From the dentist ☐

    C. From internet

    D. Others, specify_____

The following questions are related to oral healthcare attitudes

26. Are your child's teeth important?

    A. Yes ☐

    B. No

27. Is it necessary to clean your child's teeth?

A. Yes

B. No ☐

28. Do you think it is important for the child to visit a dentist regularly?

A. Yes

B. No ☐

29. If yes in Q 28 above, how important is it?

A. Very important

B. Important

C. Not Important ☐

D. Don't know

30. When do you consider it necessary for the child to visit a dentist?

A. Regularly

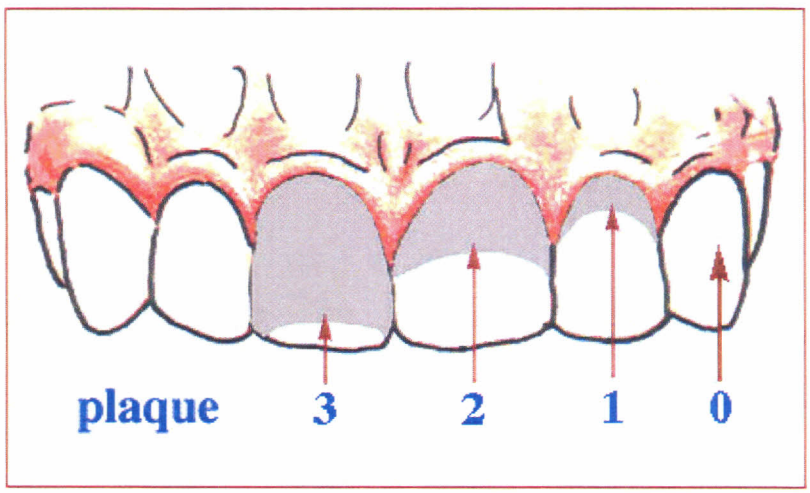
B. Shaking teeth ☐

C. Cracked teeth without pain

D. Cracked teeth with pain

APPENDIX III: DATA COLLECTION FORM

Plaque index: (loe and silness)



GUIDE

0=No plaque 1= Material removed by probe from gingival 1/3

2=Visible plaque 3=Tooth covered with abundant plaque

Permanent teeth

16(B)	11(B)	26(B)
46(L)	31(L)	36(L)

Deciduous teeth

55(B)	51(B)	65(B)
85(L)	31(L)	75(L)

Examination of Dental Caries (dmft/DMFT) Distribution Table

	55	54	53	52	51	61	62	63	64	65		
16	15	14	13	12	11	21	22	23	24	25	26	

	85	84	83	82	81	71	72	73	74	75		
46	45	44	43	42	41	31	32	33	34	35	36	

Tooth status	Code (Permanent)	Code (deciduous)
Sound tooth	0	5
Decayed	1	6
Filled, intact	2	7
Filled with decay	3	8
Missing due to caries	4	9

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31st July 2008

Dr. Kemei D.K.
Dept. of Pediatric Dentistry and Orthodontics
School of Dental Sciences
University of Nairobi

Dear Dr. Kemei

RESEARCH PROPOSAL: "ORAL HEALTH STATUS AMONG 3-12 YEAR-OLD CHILDREN WITH ACQUIRED OR CONGENITAL HEART DISEASE IN 3 SELECTED HOSPITALS IN NAIROBI AND THEIR CAREGIVERS KNOWLEDGE, ATTITUDES AND PRACTICES OF ORAL HEALTHCARE OF THESE CHILDREN" (P108/05/2008)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and approved your above cited research proposal for the period 31st July 2008 – 30th July 2009.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF A.N GUANTAI
SECRETARY, KNH/UON-ERC

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC
The Deputy Director CS, KNH
The Dean, School of Dental Sciences, UON
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