EFFECT OF POSTERS AND MOBILE-HEALTH EDUCATION STRATEGIES ON TEETHING BELIEFS AND ORAL HEALTH KNOWLEDGE AMONG MOTHERS IN NAIROBI.

DR. REGINA MUTAVE JAMES

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Department of Periodontology/Community and Preventive Dentistry

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DECLARATION:

I, Regina Mutave James hereby declare that this is my original work and that it has not been submitted by any other person for research purpose, degree or otherwise in any other university or institution.

Signed ……. Date …….

Regina Mutave James

SUPERVISORS' DECLARATION

This research thesis has been submitted for the fulfillment of the requirement for the award of PhD in Community and Preventive Dentistry with our approval as supervisors.

Supervisors:

Signed ……..Date…….

Prof. Loice W. Gathece BDS., MPH., PhD(Nbi).

Department of Periodontology/ Community and Preventive Dentistry, University of Nairobi.

Signed ……..Date…….

Prof. Arthur M. Kemoli BDS (Nbi)., MSc (UvA)., PhD (UvA).

Department of Pediatric Dentistry and Orthodontics, University of Nairobi.

DEDICATION

To the Almighty, for His unending Grace!

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ABBREVIATIONS

3G and 4G –Third and fourth generation mobile telecommunication systems

AAPD – American Academy of Pediatric Dentistry

ANCOVA – Analysis of Covariance

ANOVA – Analysis of Variance

BCG – Bacillus Calmette-Guerin tuberculosis vaccine

BDS – Bachelor of Dental Surgery

CBC – Communication Behaviour Change

CCK – Communication Commission of Kenya

dmft – Decayed, Missing or Filled deciduous teeth due to caries

DPT-Hep B – Diptheria, pertussis, tetanus and Hepatitis B vaccine

ECC – Early Childhood Caries

GPRS – General Packet Radio Services

GPS – Global Positioning System

HIV/AIDS – Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome

HLOC – Health Locus of Control

IBM® SPSS® Statistics – Statistical Package for Social Sciences

ICT – Information Communication Technology

IOM – Infant Oral Mutilation

KNBS – Kenya National Bureau of Statistics

MCH – Maternal Child Health

MOH – Ministry of Health

MS – Mutans Streptococci

MSc – Master of Science

Nbi - Nairobi

PDAs – Personal Digital Assistants

PhD – Doctor of Philosophy

SMS – Short Text Message

TFI – Thystrup Fejerskov Index

UN – United Nations

UNICEF – United Nations Children's Education Fund

UvA – University of Amsterdam

WHO – World Health Organization

DEFINITION OF TERMS

Electronic Health (ehealth) - The delivery of clinical information, care and services using Information Communication Technology (ICT), electronic processes and communication[2].

Health Education - Opportunities created for learning specifically aimed at producing a health- related goal[1].

Mobile-Health (mhealth) - Medical and public health practice supported by mobile devices, such as mobile phones, tablet computers, patient monitoring devices, personal digital assistants, and other wireless devices.

Teething – Refers to the physiological process when teeth advance axially from their developmental position in the alveolar bone to cut through the gumpads and appear in the oral cavity.

Teething beliefs – The various myths and perceptions held by different communities pertaining to the developing deciduous teeth in infants and young children.

ABSTRACT

Health education describes any combination of learning opportunities designed to equip the individual and/or community with appropriate knowledge, attitudes and skills to maintain and improve their health. Mobile health or mhealth is defined as *'medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices'*. Kenya has in the recent past recorded exponential growth in mobile telephone and internet use. This development has led some researchers to recognize an opportunity for health education using such electronic platforms.

Objective: To evaluate the effect of health education messages using posters and mhealth approaches on teething beliefs and oral health knowledge among mothers attending two health centres in Nairobi.

Research Design*:* This was quasi-experimental intervention study

Study Area: The study was conducted in two level 3 Health Centres in Nairobi

Study Population: Mothers presenting babies aged 0-3 months for growth monitoring and immunization programs at two conveniently selected level 3 Health Centres were sequentially recruited into the study.

Study Procedure: Baseline data was collected among consenting mothers following which they were allocated to either the mhealth or the poster education groups according to their health centre. All mothers were followed over a period of six months with health messages and were contacted using their mobile phones for final data collection.

Data collection tools: Pre-tested researcher-administered questionnaires were used to collect both pre- and post-intervention data among consenting mothers.

Allocation to Intervention Group: The two participating health centres were allocated to either poster group or mhealth education group randomly.

Intervention: Posters containing oral health messages were put up in the 'poster' intervention clinic and changed monthly to ensure adequate coverage of the intended health messages. The mhealth intervention group received short text messages send to their mobile phones every month to ensure equal coverage of content as contained in one poster message within the month.

Data Analysis and Management: Data was coded and entered into Statistical Package for Social Sciences (IBM® SPSS® Statistics) computer software Version 20. Descriptive statistics were generated on demographic characteristics, living conditions, personal experiences with child's teething and management of teething-related symptoms. Comparison of pre- and post-intervention scores for oral health knowledge and association of teething with childhood illnesses for mothers was done using the McNemars test for significance for the poster and mhealth groups.

Results: A total of 399 mothers were sampled for baseline data. There were 200 mothers from Westlands Health Centre and 199 mothers were from Makadara Health Centre. Mothers' age ranged from 19 to 48 years (Mean 28.25, SD 4.587). Majority of mothers had inadequate knowledge regarding the association of fever 288(76.4%) and diarrhea

278(73.9%) with teething. About a third (n=122) of mothers regarded vomiting to be associated with teething.

After the six-month education period, the post-intervention response rate was recorded at 52%, and 102 mothers from the mhealth and poster groups were successfully contacted on phone. There was improvement in mothers knowlegde on association of teething with childhood illnesses using both the posters and mhealth education approaches. The proportion of mothers associating teething with diarrhea decreased from 53.8% to 47.1% for the mhealth group, and from 78.0% to 36.7% for the poster group. Similarly, there was a decrease in the number of mothers associating vomiting with teething from 36.5% to 18.8% for the mhealth group and 52.5% to 12.9% for the poster group. Association of local symptoms with teething increased for itchiness of gums from 50% to 83.9% for poster group, and from 36.5% to 82.4% for the mhealth group. The mean score for knowledge on risk factors for ECC increased from 3.32(SD 1.6) to 4.17(SD 1.2) for the mhealth group, and from 2.43(SD1.3) to 3.73(SD 1.5) for the poster group. Improvements in mean scores were also recorded for knowledge on prevention of ECC and dental fluorosis for the two groups. Mothers with good oral health knowledge increased for both poster and mhealth groups by an average of 41.4% points from the baseline. The proportion of mothers with good knowledge increased by 38.8% points for the poster group and 29.8% points for those who received mhealth education.

Using ANCOVA to control for mothers differences at baseline, there was no statistically significant difference noted in the performance of posters and mhealth for the post-intervention scores (p=0.584).

Conclusion: Overall, both poster and mhealth health education strategies were effective in improving knowledge on association of teething with childhood illnesses and oral health literacy. Oral health education should be delivered in programmes targeting maternal child health welfare to improve oral health outcomes.

CHAPTER 1

1.0 INTRODUCTION

1.1 Physiological teething process

Teething in children describes the period when deciduous teeth cut through the gum pads to appear in the oral cavity. Deciduous teeth start developing during the fourth to sixth week intra-uterine life and mineralization begins in the fourteenth week *in utero*. The eruption process forms part of tooth development, and has been shown to be a source of inflammatory mediators including eicosanoids, cytokines and other growth factors[3]. The presence of inflammatory mediators during tooth eruption has been thought to cause local disturbances in children including low grade fever, drooling of saliva, itchiness of gums, poor appetite and restlessness/disturbance of sleep[3,4]. Tooth eruption differs according to genetic factors, gender, race, nutritional status, gestational age of child, and birth weight[4]. The appearance of the first deciduous tooth in the oral cavity occurs approximately between six to twelve months after birth. Nonetheless, a better prediction of the sequence of tooth eruption can be related to the time when individual teeth appear in the oral cavity[4]. Typically, the mandibular central incisors are the first teeth to erupt.

There is contradicting evidence on the association of teething with systemic illnesses but some cohort studies failed to established any evidence to link teething with systemic conditions [5,6]. However, findings from other studies conducted among different populations have revealed that many communities[7-10] attribute a wide range of systemic illnesses in childhood such as diarrhea, vomiting, fever, rashes and ear infection to teething. Associating

teething with systemic illnesses poses a real risk of delay in seeking required medical treatment and could lead to high infant fatalities.

Many communities especially in Africa have long engaged in traditional practices among them canine toothbud enucleation, lacing of gums, and a variety of herbal treatment for management of 'teething associated ailments'. The practice of canine toothbud enucleation involves the gouging of the developing deciduous canine tooth bud often in all four quantrants using crude, unsterilized items and without anaesthesia: The practice has rightfully been termed Infant Oral Mutilation (IOM) and has in some instances been associated with severe adverse outcomes including hemorrhage, sepsis and death[9,11-13]. IOM and others practices that disturb the tooth germ of the developing permanent teeth may impact negatively on the subsequent development of the entire dentition. Furthermore, it could also lead to poor development of the alveolar bone resulting in crowding in the permanent dentition. Perhaps appropriate health education could be used as a tool to improve the knowledge and understanding on teeth development and some common oral health conditions with the intention of preventing such practices.

The present study compares the effectiveness of health education using traditional poster method and mobile phone technology to pass appropriate messages that could influence teething beliefs and knowledge on selected oral health topics among mothers who attended two Maternal Child Health (MCH) clinics in Nairobi. Findings from this study could be used to plan population-wide oral health education programs to improve oral health literacy.

1.2 Health education

Health education has been defined as "any combination of learning opportunities designed to facilitate voluntary adaptation of behaviour that are conducive to health"[14]. The goal of health education is to equip the individual and/or the community with appropriate knowledge, attitudes and skills to maintain and improve their health as encompassed in the WHO's health education definition of "opportunities created for learning specifically aimed at producing a health related goal"[1].

The broad educational objectives of health education include the provision of knowledge and information to the learner to impact on attitudes, beliefs, values and opinions, as wells as to develop skills and actions[15]. Traditional dental health education assumes that knowledge acquisition should lead to change in attitudes which in turn should lead to behaviour change[14,16]. However, victim blaming results when practitioners educate patients, and minimum change is achieved. A wider view of the interplay between behaviour and individuals' social and environmental factors is thus more accepted in current practices of health education and several theories have been developed to explain individual behaviour[15-17].

The Heath Locus of Control (HLOC) model recognizes the contribution of 'the powerful others' in an individuals behaviour, while the Communication-Behaviour Change (CBC) model has strong emphasis on the message context and form in influencing behaviour change[15,18]. Bandura's social theory also cautions that the professional office environment may not be conducive for learning and maintaining good health behaviour, and individuals may prefer home, work or other community setting for learning that may bring about

sustainable behaviour change[14]. The mode of communication of a health message is therefore important for sustainable behaviour change. Individuals/communities will analyse a health message for its credibility and clarity while the medium of communication should be selected to ensure the message reaches the intended audience [15,19].

Health education communication media that have been utilized in the traditional set up include both mass and print media. While mass media is capable of reaching large populations, its ability to influence behaviour change is limited, and evaluation of its effectiveness as a health education tool is difficult[14-16]. Print media may be in the form of posters, leaflets, brochures, newspaper articles among many others. The development of mobile telephone and internet and their rapid penetration in the communities has led to some researchers' belief in an opportunity in the utilization of these electronic platforms.

1.3 Electronic-health and mobile-health communication strategies

Electronic–health (ehealth) is defined as the delivery of clinical information, care and services using Information Communication Technology (ICT)[2]. Information technology can be used to empower patients to take control of their own health by ensuring easy access to comprehensive and trusted health information. Access to information is free for persons with access to internet connectivity, thus, facilitating community health workers to access information on-the-go. This is a move in Kenya that is supported by the Ministry of Health[2]. Mobile health or mhealth forms a major component of ehealth and has been defined as 'medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices'[20]. mhealth involves the use of software applications or programmes available in mobile

handheld devices for functions ranging from voice and short messaging service (SMS), general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G) systems, global positioning system (GPS), and Bluetooth technology. mhealth has the potential to improve health outcomes through its capacity to enhance access to timely emergency and general health services as well as the adherence to treatment for disease conditions like malaria, HIV/AIDS and tuberculosis[21-23]. Other areas of healthcare where mhealth appears to have great potential include dissemination of information for health promotion, management of drug stock levels and the enhancement of clinical diagnosis[24].

The International Telecommunication Union (ITU) estimates that there are close to 5 billion mobile phone subscriptions in the world, with over 85% of the world's population now covered by a commercial wireless signal[25]. The penetration of mobile phone networks in many low- and middle-income countries has undergone rapid expansion compared to other infrastructure such as paved roads and electricity, fixed telephone and internet connections. Kenya has made considerable strides in the information technology sphere. In the 2009 population census, the percentage of the Kenyan population with access to a mobile phone was reported at 88% while the use of internet was reported to be increasing rapidly. In Nairobi, the percentage of her population with ownership of mobile telephones was recorded at 84% and was expected to increase[26].

1.4 Common Risk Factor approach in health promotion

The common risk factor approach on diseases sharing risks has been utilized to reduce not only the cost, but also to improve the benefits derived from a single contact within the targeted population[27,28]. Management of infant teething beliefs could therefore be packaged

alongside prevention of ECC and other conditions sharing common risk factors like diet, safe drinking water and hygiene[17,27]. Information about the causes of dental fluorosis and its possible prevention may also be provided to the mothers through the same system. In the long term, this integrated approach would be more cost-effective compared to the conventional oral health education approach.

Dental caries is a common infectious, contagious and multifactorial disease affecting dental hard tissues. Three main etiological factors are recognized in caries occurrence, namely: cariogenic micro-organisms, fermentable carbohydrates and susceptible tooth surface. Caries process is dynamic, with periods of demineralization and remineralization occurring depending on the pH changes at the enamel/biofilm interface. *Mutans streptococcal* (MS) species of bacteria have been shown to cause dental caries. Other bacteria that have been associated with dental caries are *Streptococcus sobrinus* and *Lactobacilli*[29,30]. Early Childhood Caries (ECC) has become a challenge in the both developed and developing countries with failure to institute oral hygiene measures early and dietary practices forming part of the blame for the rising disease levels. Besides causing pain and discomfort ECC presents challenges in its management since the affected children are often too young and afraid to undergo treatment under local anaesthesia, leading to very high cost of treatment under sedation and general anaesthesia and the associated dangers associated.

Dental fluorosis results from the ingestion of water with high amounts of Fluoride during the period of tooth mineralization. According to WHO guidelines, the highest recommended amount of Fluoride in drinking water is set at 1.5mg/l, a value which varies with climatic conditions, altitude and presence of other sources of fluoride to affected communities[31].

Fluoride concentrations in the range of 3-6mg/l are associated with skeletal fluorosis, while values in excess of 6mg/l could lead to crippling skeletal fluorosis[32].

The impact of high fluoride in drinking water is mottled teeth with increased porosity which in its severe forms may cause enamel breakdown with total loss of tooth morphology. Esthetically, unacceptable staining commonly accompanies dental fluorosis. Due to the rough surface associated with pitting of enamel in severe fluorosis, a high prevalence of caries has been associated with the teeth in individuals with severe dental fluorosis [33].

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Developmental Milestones in Children

By about the sixth month of age, mothers' mediated immunity for the baby begins to wane, as the baby's own immune system develops[3,34]. It is therefore common to have babies experiencing frequent bouts of fever amongst other symptoms of infections including loose stools. This stage in a childs' development has also been named the 'mouthy' stage as babies muscular system develops and the ability to grasp on items with their hands increases[3,35]. Children develop the tendency of picking up items around them and putting them into their mouths, a fact that has been linked to frequent episodes of diarrhea if children are exposed to poor sanitary conditions.

2.2 Determinants of Early Childhood Illnesses

2.2.1 Immunization and Growth Monitoring Clinics

During the first year of a child's life, various vaccines are administered including BCG, polio and measles in a free-at-point of consumption arrangement organized by the Ministry of Health in collaboration with the Kenya Expanded Program for Immunization (KEPI). The approved KEPI schedule for administration of vaccines to children from birth requires that each child receive a dose of BCG and polio vaccines at birth (Or at the earliest time of reporting to a health facility); the second polio and the first pentavalent (DPT-Hep B) vaccines at six weeks; and at ten weeks the third polio and the second pentavalent vaccines; at fourteen weeks the third pentavalent vaccines and at nine months, the measles vaccine[36,37].

A spot check at MCH clinics indicates that most mothers attend the well-baby clinics for growth monitoring as well as for vaccination until the measles vaccine has been administered. This window of contact between mothers and the healthcare system provides a valuable opportunity to impart knowledge and competencies about the child's oral health and dental developmental milestones including their signs and symptoms.

2.2.2 Exclusive Breastfeeding Practices

It is recommended that mothers undertake exclusive breastfeeding for their infants until the age of 6 months[37]. However, this is not always adhered to and studies have shown wide variations in the periods of exclusive breastfeeding as practiced across different countries[38-40]. A report by the World Health Organization (2010) indicated that the percentage of Kenyan mothers who practiced exclusive breastfeeding in the time period 2000-2009 was only 32%[41]. This was an improvement from the reported 13% of infants under six months receiving exclusive breastfeeding in the period 1993-2003[39].

2.2.3 Weaning Practices

Weaning practices for babies is an important event in a childs life, especially since the majority of babies are weaned before reaching their sixth month of life. Working mothers, especially from low-socio-economic communities may resume work early forcing them to wean off their babies before adequate development of the digestive system[42-44]. This may cause levels of intolerance for foods that the baby is being weaned on with the resultant loose stools. Cow milk which is often the easily available substitute for mothers breast milk has been shown to poorly tolerated by some children due to lactose intolerance[43].

2.2.4 Access to Safe Drinking Water

According to United Nations (UN) report on the status of the Millenium Development Goals indicators in 2012, 59% of Kenyans were rated to have access to improved drinking water source in 2010[45]. Provision of safe drinking water to the Kenyan population was identified as one of the key social strategies for the transformation of the Kenyan society towards achieving Vision 2030[46]. The most accessible water supply for domestic consumption is underground water and families settling in regions devoid of piped drinking water often result to shallow wells or boreholes for their daily supply.

2.3 Leading Diseases in Early Childhood

2.3.1 Fever in Early Childhood

The leading causes of death for children under five years in Kenya for the period 2000-2003 were pneumonia (20%), diarrhoeal diseases (16%), neonatal diseases (24%), HIV/AIDS (15%) and malaria (14%)[47]. The main symptom recognizable in the presentation of both pneumonia and malaria is fever. Studies have indicated that although parents perceive fever as dangerous, majority have poor knowledge on recognition of fever, and are not able to accurately measure fever[48]. Unrealistic fear of fever which causes panic when children are feverish has been documented[48]. Kenya has malaria endemic zones and prompt treatment with effective anti-malaria drugs for children with fever in malaria risk areas has been advocated as a key intervention in reducing child mortality[41]. During the time period 2000-2004, the number of children in Kenya under five who presented with fever and were treated with any antimalarial drug constituted 27% of the children, which reduced to 24% for the period 2005-2009[41]. Febrile diseases in childhood tend to easily lead to fatality if untreated.

Parents associating fever with teething may fail to take their children to health facilities for diagnosis and management, thus resulting in possible consequences.

2.3.2 Diarrhoea in Early Childhood

Diarrhoea is often linked with poor sanitary conditions and lack of safe drinking water. However, loose stools in infants can also be associated with introduction of foods before the infant's digestive system is adequately developed. Diarrhoeal disease are responsible for about 1.8 Million child-deaths annually worldwide[41]. The Global Strategy for Infant and Young Child Feeding developed jointly by WHO and United Nations Children's Education Fund (UNICEF) recommends exclusive breastfeeding of infants for the first six months of life without receiving any solids or liquids except vitamins, minerals, or medicines[37,38].

Recognition of the influence of safe-drinking water in the treatment outcome of HIV infection has led to its inclusion in the Basic Care Package (BCP) for those infected[49]. Although campaigns for uptake and correct utilization of oral rehydration therapy receive a lot of attention, such emphasis has not been placed on the provision of clean drinking water for children under the age of five years. Just as several hand-washing campaigns driven by anti-bacterial soap manufacturers appear to target mainly school-going children due to the ease of reaching large numbers, similar campaigns should be introduced targeting mothers to enhance under-five child survival.

2.4 Development of Deciduous Dentition

Following the development of the fetal maxilla and mandible from the first pharyngeal arch processes, deciduous tooth germs develop by about the sixth week in utero[34]. By the fourteenth week intrauterine, mineralization of the deciduous tooth germs begins after

differentiation of cells to mineral laying ameloblasts. At birth, all crowns of the deciduous teeth are fully formed and root formation is ongoing. The teeth advance axially towards their erupted position and may present as obvious bulges within the gumpads. The tooth follicle is a source of eicosanoids, cytokines and growth factors which aid in tooth eruption and have also been linked to the occurrence of localized symptoms related to the teething period among them; low-grade fever, drooling of saliva and itchiness of gums. Studies indicate that such symptoms can be relieved by massaging the gums, biting on teething rings, as well as administering of gels or powders with soothing effects on the gums[6]. Most teething gels contain benzocaine, a topical anaesthetic agent with soothing effect to gums, while others contain choline salicylate which acts topically to relieve pain[50]. Chronic use of choline salicylate may induce intoxication and has also been associated with methemoglobinemia, a rare but serious condition[51].

2.5 Cultural Beliefs and Teething

A wide range of conditions have been attributed to teething by different global communities, and they include diarrhea, fever, vomiting, convulsions, coughing, ear infection, sleep disturbance among many others[3,9,52]. The exact origin of the traditional beliefs and practices about teething is not known, but studies have reported that during the nineteenth century, records of cause of death for 12% of all children younger than four years in England were attributed to teething, while in France of 50% of all infants deaths from the sixteenth to nineteenth century had teething as their cause[3]. More recent studies from Australia, America and many parts of Africa have reported that high numbers of mothers and even healthcare workers attribute common childhood illnesses to teething[5,8-10,51-54]. A study conducted among mothers in Nairobi revealed that up to 98% of mothers expected their children to

suffer from systemic illnesses during teething, with 93% mentioning diarrhea[55]. In their study conducted among mothers from an urban slum in Lagos state in Nigeria, Uti et al[56] found that 95.2% of mothers perceived teething to be associated with various symptoms. The study did not show any significant differences in relation to mothers' age, occupation, education, socioeconomic status and ethnic background.

Traditional practices about teething have also been documented among many communities. IOM is a practice common in parts of Eastern Africa and researchers have reported the barbaric practice in parts of Sudan, Tanzania, Uganda and in Kenya especially among the Maasai community[9,11,12,55,57,58]. The practice of canine tooth bud enucleation was found to be deeply rooted. For instance, migrant Ethiopian Jews and Somalis have been reported to propagate the practice in their new countries of settlement[59-61]. Some other traditional practices include lacing of gums with hot metals, rubbing of herbal preparations over the tooth follicle area as well as myriad of over-the counter medications usually analgesic gels and topical anaesthetic agents[62]. Some traditional mixtures, known to be preparations of bicarbonate soda mixed with local herbs, have been said to soothe the children's gums. Practices about teething by mothers have been linked to delays in seeking health care for disease conditions that mothers often wrongfully associate with teething[48,54]. Additionally, some studies have documented deaths due to infections and haemorrhage associated with infant oral mutilation practiced in a variety of forms[11].

2.6 Common Remedies Used During the Teething Period

The perception that teething causes pain and discomfort is shared by both mothers/caregivers and medical personnel[6-8,10,61]. Confusion on this matter is further

complicated because the child cannot express itself verbally, and those around it are left to interpret the non-verbal communication. Teething pain may be a manifestation of inflammatory mediators in the crevicular fluid surrounding the erupting tooth[6].

Teething remedies used for the management of pain or perceived discomfort are often not prescribed by the dental practitioners; rather many are over-the–counter medications, while other preparations including herbal therapies are passed down generations. Teething remedies can largely be classified as either pharmacological or non-pharmacological. Some of the non-pharmacological include practices like teething rings, necklaces, frozen peas, gingival massage among others, and are mainly associated with cultural practices[6]. The pharmacological remedies are mainly practiced by child-care-givers who lean towards biomedical methods to address perceived 'teething' pain and/or discomfort[62]. Most pharmacological therapies aim at achieving analgesia or local anaesthesia. Preparations of analgesic gels containing paracetamol, ibuprofen and choline salicylate have been applied topically[62]. Other preparations with anaesthetic combinations like benzocaine and lignocaine are also applied topically. Evidence for the effectiveness of these analgesics and anaesthetic preparations is weak and some adverse reactions associated with them have been reported in literature[6,62].

The age of the caregivers has been shown to influence the choice of the home remedies used for teething-related illnesses, while other studies report that the caregivers level of education has no association with the caregivers home remedy use[62-65].

2.7 Health Education Communication Strategies

2.7.1 Health Promotion – The approach to health education

Teething beliefs and practices around teething by many communities have the potential to negatively influence the overall health of the child. Typical messages that are commonly used in the oral health area emphasize reduced sugar diet for the prevention of dental caries, frequent tooth brushing using fluoridated toothpaste and regular dental attendance for early detection and management of oral diseases[14,16]. These messages are targeted at the older children and parents, and do nothing to offer guidance to the community during the teething period.

Measuring the effectiveness of health education in general is a daunting task[16]. Any intervention that results in improved awareness, significant gain in knowledge and understanding of both causes of dental diseases and their prevention is a worthwhile investment[14]. The choice of the channel of communication should be done to maximize the reach to the target population as well as ensure clarity of the message while exercising due consideration for the existing framework of the attitudes and interests of the people[14,19]. A population-wide approach as advocated by Watt[17] and Sheiham[27] has been proposed since identification of 'high-risk' groups presents real challenges.

2.7.2 Communication Strategies in Oral Health Education

There is paucity of information concerning the effectiveness of different techniques in oral health education. The oral health education field is dominated by the biomedical and behavioural approaches used by professionals with mostly a focus on the individual patient's education needs[14,15,19]. In the community targeted health education, mass media is seen as an

effective tool of transmitting simple and consistent messages[19,66]. The value of mass media in influencing long-term oral health behaviour is however limited[14]. In a Nigerian study, Bankole[67] evaluated photo-posters on nurses perception of teething problems and recommended that for behaviour change, a constant stimulus with frequent monitoring may offer better outcomes. Successful health education strategy should embody the basic principles of education by ensuring the subject matter is of interest to the audience, and a level of participation by the learner is allowed[66]. Clarity of message ensures full comprehension while to ensure long-term retention of the message, it should be easily recalled. Pictorial messages used in posters may enhance this recall quality, while the mobile phone is seen as being capable of storage and retrieval of messages.

2.7.3 Posters as health education tools

The use of posters is recognized as one of the methods of passing health messages to individuals visiting targeted sites[15,66]. Research indicates that 'more than 80% of patients notice posters and read them while waiting for treatment'[65]. For effectiveness of posters in health education, the message should be short, catchy and with clarity as to what it purports to communicate. The poster visibility and duration at same location have an impact on the overall success of uptake of the message[67].

Posters also suffer diminished visual quality when displayed over long periods of time without being changed[67]. The preferred location of posters should be chosen carefully to ensure patients notice them. Some of the boards for poster display may be too clogged up with both current and old outdated materials, thus obscuring the current messages[67]. A

clearly displayed poster can act as a constant reminder and a stimulus for mothers attending clinics every month for growth monitoring and immunization programs for their children.

2.7.4 MHealth and Health Care

Mobile technology has been associated with enhanced doctor-patient communication. Research by the California Healthcare Foundation indicated its use was beneficial in the management of chronic diseases among them control of Cholesterol and Glucose levels as well as systolic blood pressure[68].

While patients are very keen to accessing online information from their physicians about their healthcare, doctors have lagged behind in providing online information. A study by the Optum Institute indicated that only 40% of physicians had the ability of giving patients online access to health records, while 75% of patients were interested in accessing online records[68]. Mobile technologies have proved very useful in reporting adverse events timely while ICT has revolutionalised records management and improved diagnostic capability for many diseases[69].

Kenya is among world markets with the fastest growing mobile phone market. Recent estimates indicate a 74% mobile network penetration of the country, with 29.2 million registered mobile phone subscribers as at March 31st 2012 with internet users recorded at 6.4 million subscribers[70]. According to the communication-behaviour model of health promotion, both the content and form of health message does have influence in the manner that the targeted audience responds[15,17].

Mhealth which is the method of enhancing health information sharing by use of mobile handheld information technology devices can be used to reach a wide audience in the Kenyan population. The SMS mobile phone service allows for short, clear messages to be transmitted to individuals' phone, which can be stored and referred to as required, improving information memorization and recall and is thus seen as a viable tool for decision-making and behaviour change. Mixed results have been obtained in a South Africa study seeking to use cellphone technology for HIV/AIDS behaviour change communications[22]. Research done so far on HIV/AIDS testing uptake and drug adherence has reported positive feedback although some challenges citing confidentiality have been reported[22,23]. There is however inconclusive evidence about the effectiveness of different mhealth approaches and more research is advocated in this area[24].

2.8 Common Risk Factor Approach

The Common Risk Factor strategy can be defined as an approach to disease prevention and health promotion by focusing on identified shared risk factors to package solutions that are integrated in nature[27]. For example a target population would access service for tuberculosis at the same time that they are being attended for HIV because TB has been shown to affect many persons living with HIV/AIDS.

Infant teething has been associated with poor sanitary environments, poor dietary and weaning practices both of which may also be causes for diarrhea. Lack of safe drinking water has been cited as worsening the diarrheal experiences of populations exposed to contaminated water[45]. Although the role of malnutrition in delayed deciduous tooth eruption still remains controversial, malnutrition in early childhood may result in enamel hypoplasia

and reduced salivary flow; factors which may result in increased early childhood caries (ECC) experience for the affected children later in life[71,73]. Besides, malnutrition would predispose the child to lowered immunity and concomitant infections.

Some communities gouge out developing canine toothbuds which compromises the future dentition of the affected child resulting in malocclusion, missing teeth and poorly developed jaw bone. The disturbance of the permanent dentition through IOM may also lead to enamel hypoplasia, a condition which predisposes the teeth to high caries experience. Shared non-sterile crude instruments used for enucleation of the canine toothbuds or gum lacing has been associated with severe haemorrhage, spread of infectious diseases like HIV, severe sepsis with reports of mortality[11,13]. In addition, some of the over-the-counter preparations available for teething-related symptoms have been demonstrated to cause serious adverse reactions[6,62].

There has been an advocated shift from prevention of oral diseases, oral conditions and promotion of oral health towards an integrated approach which utilizes a common risk factor approach[17,27,74,75]. Nutritional and feeding practices impact on both the general health and the oral health of the child and are important determinants in early childhood illnesses that mothers commonly associate with teething. Feeding practices and oral hygiene practices are predictors of Early Childhood Caries (ECC).

2.8.1 Early Childhood Caries

The American Academy of Pediatric Dentistry (AAPD) defines ECC as *'the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger'*[73]. Previously, ECC

was known by a variety of names including: bottle-feeding caries and nursing baby caries, all which were based on the assumption that caries in very young children had a single aetiological factor[71]. There is evidence indicating that in countries with public water fluoridation, there has been substantial reduction of caries in the permanent dentition[76-81]. However, many such countries continue to witness an increasing trend in ECC. Furthermore, ECC appears to follow the same patterns of variation across socio-economic and demographic determinants like many other diseases[17].

2.8.2 Trends of Early Childhood Caries

In a national survey of children aged 2-5 years in the US covering the period 1988-1994 out of the total prevalence of ECC of 23.7%, the untreated caries accounted for 18.7%[79,80]. The report showed higher levels of caries experience as well as severity as measured by decayed, missing and filled teeth due to caries (dmf) score consistently for children from socially disadvantaged backgrounds. A second survey for the same group of 2-5 year old children in the US in 1999-2004 revealed a 15.2% increase in the prevalence of dental caries[80].

The prevalence of ECC among 1-3 year old children in Iran ranged between 3-33% depending on age group. Among 26-36 month old children, the prevalence of ECC was 33%, while that for severe-ECC was 27%. Visible plaque was present in 75% of the children aged 26-36 months[82]. In another study conducted in Brazil, the prevalence of ECC among children aged 0-36 months was 41.6% with a mean dmf of 1.7 (±2.5). This study did not reveal any association of ECC with the parents' socioeconomic status, a factor which was explained by the population studied being relatively homogenous in this aspect[76]. In yet another study in Karnataka, India, Mahejabeen et al[83] recorded a prevalence of ECC of

54.1% among 3-5 year old children. The prevalence of dental caries increased with increasing age with 3 year olds recording 42.6%, 4 year olds 50.7% while 5 year olds recoded 60.9%. This study utilized the WHO caries diagnostic criteria and the mean dmf was 2.7 (±3.57)[83].

Literature in the African region on prevalence of oral disease is not comprehensive, yet oral diseases have been reported to affect 60-90% of school going children[74,75,84,85]. According to the WHO report released in 2003, it was anticipated that oral disease would increase in this region owing to the changing lifestyle and dietary patterns[84]. Moreover, 90% of dental caries in African populations remains untreated[31,74,84]. In Kenya, ECC has been reported to affect between 40-63.5% of children in studies done targeting both urban and rural populations[86-88.]

2.8.3 Determinants of Early Childhood Caries

Disparities in general and oral health have been observed across gender, age, ethnicity, socioeconomic status, educational level, attitude, geographical and environmental factors. Both deciduous and permanent teeth are much more susceptible to caries soon after their eruption. With the knowledge that deciduous teeth development commences from about the sixth week intrauterine, any factors affecting the mother's health could have an impact on the developing dentition. Singled out among the factors that could affect the developing teeth during pregnancy is deficiency of Vitamins A and E, and protein energy malnutrition which could potentially lead to hypoplasia of the enamel in the primary dentition[31,71,73].

Mutans Steptococcal (MS) colonization has been shown to occur in babies even before they develop their deciduous dentition mainly through acquisition from the primary carers of the

children[30,89-91]. Mothers who have high caries experience may therefore pass the trend to their children very early in life[89,91]. Closely associated with the presence of MS is previous caries experience as displayed through either missing teeth due to caries or the presence of filled teeth and/or retained roots. Although malnutrition in childhood is thought to play a role in caries development, the mode of action remains unclear with studies suggesting that malnutrition especially lack of vitamin A and protein energy malnutrition may lead to salivary gland atropy, thus affecting the quantity and composition of saliva produced; a key determinant in caries development[71,73].

Parents' beliefs and practices with regard to oral health have been associated with different experiences of oral disease. Failure by parents/carers to start cleaning babies teeth soon after eruption leads to plaque accumulation, that may build to high levels, a predictor of ECC[72,80,90,91]. Parents' beliefs and practices have an influence on the oral health seeking behaviors and uptake of preventive practices. Poor knowledge on the association between diet, feeding practices and the occurrence of dental caries has also been implicated. Mothers exposing their children to frequent consumption of sugars, on-demand breastfeeding and bottle feeding with contents high in sugars especially at night when there is reduced salivary flow have long been blamed for ECC[73,74,89,92].

While some studies have reported children born of persons from minority ethnic groups as being at risk of high levels of ECC, other studies have identified parents from low socioeconomic class and those with low-level of education to be among the risk factors for ECC[93-96]. This has been linked to inability to access both preventive and curative services owing to inability to meet the cost of treatment, any dental insurance as well as lack of

awareness[30,93-96]. In developing countries poverty has been singled out as a major risk factor for ECC owing to the competition for meager resources posed with a huge burden of infectious diseases like malaria, HIV and tuberculosis[84,95]. Families unable to afford their basic needs are likely to give oral health low priority, and will likely have a large percentage of untreated dental caries. Awareness about oral diseases can be created by integrating oral health education in MCH clinics.

2.8.4 Dental Fluorosis

Waters with high fluoride concentrations occur in large and extensive geographical belts associated with volcanic rocks. The most well-known and documented area associated with volcanic activity follows the East African Rift system from the Jordan valley down through Sudan, Ethiopia, Uganda, Kenya and the United Republic of Tanzania. Many of the lakes of the Rift Valley system, especially the soda lakes, have extremely high fluoride concentrations; 1,640 mg/l and 2,800 mg/l respectively, in the Kenyan Lakes Elementaita and Nakuru[97]. In Kenya, a detailed survey of fluoride in groundwater was undertaken by Nair *et al*[97] in 1984. Of over 1,000 groundwater samples taken nationally, 61 per cent exceeded 1 mg/l, almost 20 per cent exceeded 5 mg/l and 12 per cent exceeded 8 mg/l. Most of the sampled wells and boreholes were providing drinking-water. Prevalence of dental fluorosis was high with some areas having 100% of sampled populations displaying moderate to severe forms of dental fluorosis[98]. Similar studies undertaken in neighboring Republic of Tanzania revealed high levels of fluoride in drinking water above the WHO guideline of 1.5 mgf/l with high prevalence of dental and skeletal fluorosis[99]. Kenya, and especially the Rift Valley area is therefore an endemic flourosis zone[97,98,100]. Nairobi metropolis in which this study was conducted lies in this belt.

Dental fluorosis is the most visible evidence of high fluoride concentration in drinking water sources. Severe forms of skeletal fluorosis may be crippling, but these are rare and are associated with water Fluoride levels in excess of 6mgF/L[1,32]. The WHO guidelines set the upper limit for fluoride in drinking water at 1.5mgF/L, although to avoid developing dental fluorosis, the maximum fluoride concentration in drinking water for populations in the tropics has been suggested at between 0.4-0.8mgF/L from studies undertaken in Ghana, and Pakistan and Senegal[101-103]. The United States of America revised its maximum allowable level of fluoride in drinking water downwards from 1.2mgF/L to 0.7mgF/L[102].

Although the manifestations of dental fluorosis are visible and easy to detect, research done in Njoro area of Nakuru reported that the populations affected could not relate the browning of teeth with the local drinking water[104]. This may be partly explained by the fact that dental fluorosis of the permanent teeth results from consumption of water containing high levels of fluoride between the ages 1-6 years. The population may therefore fail to link the manifestation of fluorosis when it occurs years later from the exposure period.

Ng'ang'a et al[105] investigated the prevalence of dental fluorosis among children in Nairobi and revealed that 76% of children aged 13-15years had dental fluososis in the permanent dentition, with 40% of the examined teeth having Thystrup Fejerskov Index (TFI) scores ≥5. A more recent study conducted in Kajiado district recorded that 60% of the children aged 13-15 years experienced varying degrees of dental fluorosis[33]. With the foregoing, dental fluorosis should be prioritized as a public health problem and awareness creation with advise for use of alternative water sources including rain water harvesting explored.

CHAPTER 3

3.0 PROBLEM STATEMENT, JUSTIFICATION AND OBJECTIVES

3.1 Problem Statement

Poor knowledge of the teething process and cultural beliefs about teething by mothers, community and even some healthcare workers can lead to failure to seek appropriate treatment for common childhood illnesses, resulting in high infant morbidity and mortality. Traditional oral health education approaches including professional health education at the dental office setting and mass media campaigns have done little to alter the society beliefs about teething. Mhealth approach is one method that could be employed in evaluating the effect of health messages targeted to mothers with a view to imparting knowledge and understanding of both the physiological teething process and the relationship of teething with common childhood illnesses. The environment and setting where health education is conducted has been shown to influence behaviour change. Mothers can receive health education messages at the MCH clinics to maximize the benefits of their visit using the common risk factor approach and the intervention group can also be reached within their homes.

3.2 Justification

Mobile phones have reached more populations in developing countries than any other single infrastructure development including piped water, paved roads and electricity. mhealth approach could therefore help reach more mothers and carers to impart knowledge and

influence the beliefs and practice about teething. Provision of an interactive opportunity could reduce the fear factor that mothers experience when their children have fever as well as other symptoms noted during the teething period. Information provided through both posters and mhealth could empower mothers with knowledge and support them to adopt better oral health practices.

3.3 Objectives

3.3.1 Broad Objective: To evaluate the effect of health education messages using posters and mhealth approaches on teething beliefs and oral health knowledge among mothers attending two health centres in Nairobi.

3.3.2 Specific Objectives

1. To determine the effect of oral health education messages delivered through posters on the beliefs about teething among mothers attending two health centres in Nairobi
2. To determine the effect of oral health education messages delivered through posters on oral health knowledge among mothers attending two health centres in Nairobi
3. To determine the effect of oral health education messages delivered through mhealth on the beliefs about teething among mothers attending two health centres in Nairobi.
4. To determine the effect of oral health education messages delivered through mhealth on oral health knowledge among mothers attending two health centres in Nairobi.
5. To compare the effectiveness of poster and mhealth approaches of delivering oral health messages.

3.4 Hypothesis

Null hypothesis:

1. There is no difference in beliefs about teething among mothers who receive health education through posters and those who receive health education through the mhealth approach.

2. There is no difference in oral health knowledge among mothers who receive health education through posters and those who receive health education through the mhealth approach.

3.5 Conceptual Framework

Ethnicity is closely related with teething beliefs since most of the perceptions about teething are culturally acquired. Age of the mother may be related to previous experiences, which may shape the mothers knowledge and influence practices. Socioeconomic status and education are strong predictors of health care utilisation and may also be related with better hygiene practices by mothers (Fig 3.1).

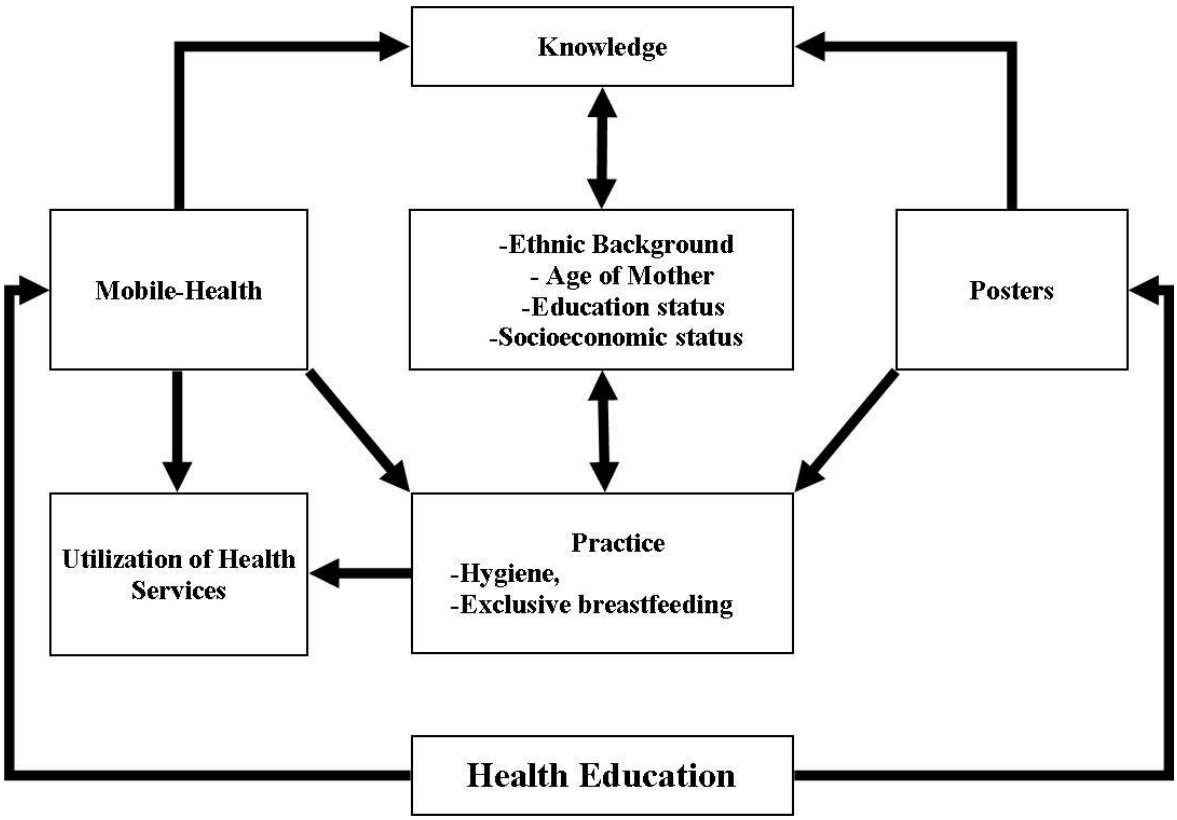

Figure 3.1: Model adapted for the relationship between Health education and key parameters that determine beliefs about teething and oral health knowledge of mothers

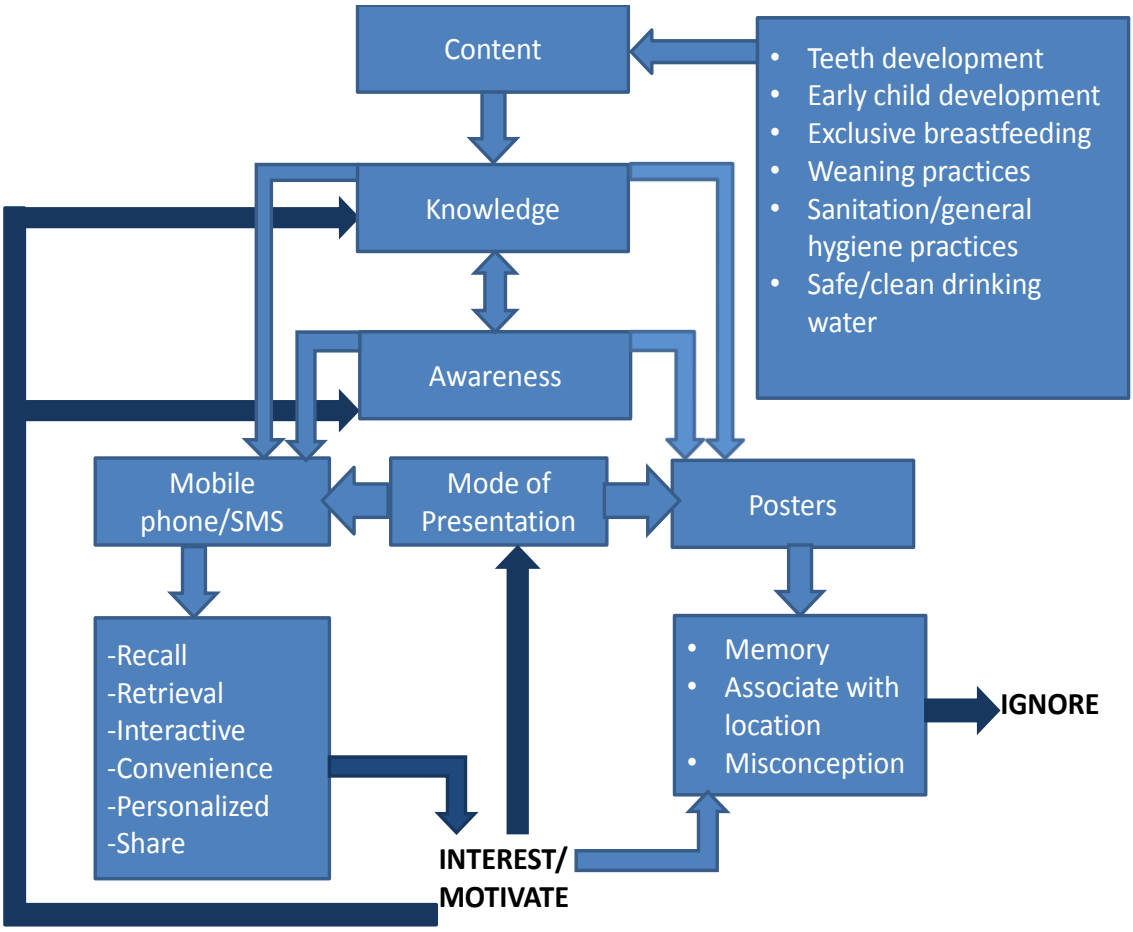

Figure 3.2: Model adapted for the comparison of health education using poster and mhealth strategies

3.6 Study Variables

Variable	Type	Measurement
Effect of mhealth and poster in health education	Intervention	% change in teething beliefs % change in practices about teething % change in oral health knowledge
Teething beliefs	Dependent	% Associating systemic illnesses with teething – diarrhoea, vomiting, fever % recognizing local symptoms associated with teething- drooling of saliva, itchiness of gums % Utilising traditional practices for 'teething-related' symptoms
Oral Health Knowledge	Dependent	% with correct knowledge on influence of diet on ECC % with correct knowledge on transmission of cariogenic bacteria and ECC % with correct knowledge on prevention of ECC % with correct knowledge on the cause of dental fluorosis
Socio-demographic and Health-related practices	Independent	Age, ethnicity, level of education, socio-economic status(housing, sanitation, health insurance), immunization status, weaning practices, exclusive breastfeeding
Health status of baby	Confounders	Underweight, frequent illnesses (Experience of fever, diarrhea, vomiting)

CHAPTER 4

4.0 METHODS AND MATERIALS

This chapter describes the study population and sites, sampling and data collection tools. Health education intervention methodologies and the measures of outcome are described in detail. The chapter also details measures to ensure compliance with ethical standards of research in human subjects, and data management procedures.

4.1 Research Design

This was an intervention study comparing the effectiveness of two health education strategies; posters and mhealth approach.

4.2 Study Area and Study Sites

The study was carried out in Nairobi, which is located geographically at 1°17'S 36°49'E, and enjoys a subtropical highland climate and occupies a total area of 696 square Kilometres. During the 2009 Kenya population and household census, Nairobi's population was estimated to be 3 million residents with a population density of about 4,509per square kilometre[26]. Nairobi is both a commercial centre and an industrial town.

Nairobi's slow infrastructure development, coupled with poorly planned settlements has seen a mushrooming of informal settlements, the largest of them being Kibera which is the second largest slum in Africa, with an estimated population of 170,000[26]. Many more informal settlements are located near Nairobi's industrial area, and along the railway line where the railway reserve land has been invaded. Between 40-60% of Nairobi's population lives in informal settlements, or areas devoid of infrastructural facilities like clean water,

sanitary waste disposal, access roads, drainage, health and educational services, decency and privacy[39,106].

The government of Kenya provides through the Ministry of Health (MOH) highly subsidized healthcare services at dispensaries (Level 2) and Health Centres (Level 3). Children under the age of 5 years access services without payments at these primary healthcare facilities which provide a wide range of services including well-baby growth monitoring and immunization services. They are thus the preferred healthcare providers for mothers with young children in the city, especially from the low-socioeconomic status groups. Within the current framework, dispensaries target to provide basic preventive health services and have limited capacity to offer curative services. The city of Nairobi recorded a 57% immunization completion as per the 2008/09 Kenya Demographic and Health Survey, a figure far below the national average recorded in the same survey of 68.3%[40].

A total of 470 health facilities serve the population of Nairobi including private, Non-Governmental, Parastatal, County, and Ministry of Health operated facilities[107]. Due to the nature of the current study, only County and Ministry of Health operated facilities were targeted. A total of 84 facilities operate under the Local Authority and Ministry of Health. The study targeted primary healthcare level of service delivery. Level 3 facilities were chosen to represent this cadre, giving a total of 17 facilities spread across the city of Nairobi. Five of the Health Centres are located within the camps of disciplined forces like the General Service Unit (GSU), the Administrative Police training camps as well as within Prisons' premises and are not freely accessible to the public due to the perceived restricted

access and were excluded during sampling of clinics to be visited during the study. Only twelve Level 3 Health Centres were therefore eligible to be included in the study.

4.3 Study Population

The study was conducted among mothers who presented with their babies for growth monitoring and immunization programs at two conveniently selected level 3 Health Centres.

4.4 Sample Size Determination

The sample for the baseline survey was based on fisher et al formula. The study assumed that the percentage of mothers associating teething with childhood diarrhea was unknown, therefore 50% prevalence used.

The sample size was calculated using the following formula:

Sample size: $N = \frac{Z^2 P(1-P)}{C^2}$

Where:

N= Study population

Z value= 1.96

Prevalence is 50 (0.5)

C= Confidence level

95%(0.95)

$N = \frac{(1.96)^2 \, 0.5(1-0.5)}{(1-0.95)^2}$

384.16

N=385

Sample size for the intervention groups was calculated using the comparison of two proportions according to Bland[108] and the desired power of the study fixed at 80% and the level of significance at 95%. The sample size was calculated as follows:

$$n = \frac{f(\alpha,P)\{p_1(1-p_1)+p_2(1-p_2)\}}{(p_1-p_2)^2}$$

Where $f(\alpha,P)$ = the factor for $\alpha = 0.05$, Power =80%

P_1 = estimate of proportion of mothers associating diarrhea with teething at start

P_2 = Estimate of proportion of mothers associating diarrhea with teething at end of project.

A survey in a Ugandan population using SMS for HIV/AIDS education and testing campaign recorded high knowledge on HIV/AIDS of 74% of the participants compared with the level of knowledge obtained from a domestic and household survey obtained in the same population of 28% among women[21]. Using the same estimates for change in knowledge about teething and association with childhood illnesses, the sample size calculated was 48 per group. Factoring 30% non-response rate, and 40% loss to follow up due to the prospective nature of the study will give 83 mothers for the intervention group and similar number of controls.

4.5 Sampling Method

A List of all Level III facilities was computer generated and facilities compared in terms of their operating hours, and number of beds available. Two facilities that operated 24 hours, were open during the weekend, and had 20 bed-capacity each were selected (Appendix 3).

The two Health Centres offering very similar range of services judging by the available facilities were Westlands Health Centre and Makadara Health centre, which are administered by the Nairobi County Health Management Board. The two facilities were included in the study due to their similarity in services offered to minimize bias in mothers attending the facilities. A toss of coin was used to decide the health centre to be allocated to mhealth or poster intervention group. Westlands health centre was allocated to the poster education group while Makadara Health Centre was allocated to the mhealth group.

Mothers presenting to these Health Centres with babies between ages 0-3 Months were recruited sequentially upon satisfying the inclusion criteria and consenting procedures until the desired sample size per study centre was obtained. The requirement of ownership of mobile phones was applied to both intervention groups to ensure no bias along socio-economic characteristics is inherent in the study sample. Selection of mothers to participate in a Focus Group Discussion was done randomly from amongst the selected sample and participants were contacted by phone. Each centre had eight mothers selected using their participant identification number during a simple random exercise for participants of Focus Group discussions. The eight selected mothers were thereafter requested to consent for audio-recording of the focus group discussion sessions. Mothers who did not consent were replaced by drawing other random participant identification numbers for each centre until the desired number was attained. The focus group discussions were held in a neutral venue identified and within close proximity to the health centre where the participants were drawn from. All focus group discussions were held in the morning hours and before noon of each day. Focus group discussions were held for the intervention and control groups for baseline

data, and after the six months of intervention. A research assistant with at least a basic secondary school education was employed to assist with the audio recording and other group logistics.

4.6 Inclusion Criteria

- Consenting mother with infants from birth to three months old, who were routinely resident in Nairobi.
- Mothers with a previous surviving child.
- Mothers should have had access to mobile phones.
- Eligible mothers must be able to read short text messages send to their phone.
- Inclusion to focus group discussion required additional consent for audio taping of the conversations.

4.7 Exclusion Criteria

- Mothers not normally residents of Nairobi.
- Mothers having their first babies.
- Mothers who do not possess mobile phones.
- Mothers who were illiterate and could not read short text messages.

4.8 Data Collection Procedure

An interviewer administered questionnaire was developed and pre-tested among ten mothers in Kibera Health Centre. The questionnaire was used to collect both baseline data and end-evaluation data among consenting mothers. A coin was tossed to randomly allocate the two

selected Health Centres to either poster group or mhealth education groups. Mothers attending the health centre automatically belonged to their Health Centres' health education intervention group. In addition, all mothers were required to fill in a data capture card to capture important health-related practices including exclusive breastfeeding, weaning and immunization records as well as the health status (weight gain, illness records) of the baby throughout the study period. Baseline focus group discussions was held before the start of the health education messages.

Final data was collected using interviewer administered questionnaire and focus group discussions at the end of six months from the date of commencement of health education. The data capture card was also collected during the end-evaluation interview.

4.9 Intervention

Health education materials with emphasis on early dentition development, the relationship of teething and common childhood illnesses, and selected oral health diseases and conditions was developed. The mhealth group had short text messages send to their mobile phones monthly using bulk-SMS software (FrontlineSMS 1.6.16.1) and were encouraged to report any adverse events their babies experience during teething using a data entry card that was provided. The poster group had posters put up in two Notice boards of Westlands Health Centre. Posters were changed monthly to ensure visibility and to cultivate interest among those visiting the health centre. Mothers were provided with a small data entry card for recording any adverse events experienced by their babies during teething. Information contained in one poster was translated to fit into one or several short text messages according to the complexity of the topic. A total of fifteen short text messages were send to

the mhealth group during the study period. All mothers who were recruited to the intervention were contacted using mobile telephone numbers that they provided during baseline interviews for evaluation.

4.10 Study Outcome

Key outcome indicators included the ability of mothers/carers to distinguish localized symptoms linked to erupting teeth and systemic symptoms of common childhood illnesses like diarrhea, malaria, pneumonia amongst others and their appropriate management. Mothers management of babies teething period are compared with the management reported for their previous baby. Oral health knowledge on selected topics was recorded and a comparison of pre-intervention and post-intervention results done.

4.11 Ethical Considerations

The research proposal was submitted to the Kenyatta National Hospital and University of Nairobi ethics committee for approval. Permission was sought from the Nairobi County Health Department who are responsible for the management of Health Centres. Permission was also sought from the District Medical officers of Health in whose district the selected Health Centres are located, as well as the Nursing officer In-charge of the Health Centre. Individual informed consent was sought from mothers who present to the clinic and fulfill the inclusion criteria during the participant recruitment period. Personal identifiable details were not stored with the main questionnaire, and identification codes were used where possible. Data collected from mothers was securely stored and utilized for the purposes of this study only including the audio tapes for focus group discussions which will be destroyed at the completion of the study.

4.12 Data Analysis and Management

Data was coded and entered into IBM® SPSS® Statistics Version 20. Descriptive statistics were generated on demographic characteristics, living conditions, personal experiences with child's teething and management of teething-related symptoms. Comparison is made of before and after health education measures for mothers using the McNemars test for significance and multivariate analysis undertaken for the poster health education and mhealth groups. During multivariate analysis, independent variables responsible for difference in the two study groups including ethnicity, age, parity, socio-economic status and mothers' level of education were studied. McNemars test was used to study the change in before and after intervention values of knowledge of mothers on teething, ECC and dental fluorosis.

Qualitative data was analysed to pick out the themes and factors associated with mothers' beliefs about infant teething as well as mother's awareness of the risk factors associated with ECC. Mothers views on the delivery of health education using mobile devices and posters was also discussed

CHAPTER 5

5.0 RESULTS

This chapter presents the study findings starting with the demographic characteristics of the study population. Descriptive statistics are presented for baseline data and post-intervention data according to the objectives. Comparison of pre-intervention responses/scores was done using the paired t-test for continuous variables, McNemar test and mixed between-within ANOVA for categorical variables. All statistical tests have been carried out at the 95% confidence level (α=0.05).

5.1 Socio-demographic characteristics

A total of 399 mothers were sampled for baseline data. There were 200 mothers from Westlands Health Centre and 199 mothers were from Makadara Health Centre. Mothers' age ranged from 19 to 48 years (Mean 28.25, SD 4.587). There was no statistically significant difference between the ages of mothers from Westlands and Makadara health centres using the independent t-test (t=0.541, df=391, p=0.589). Table 5.1 summarizes other socio-demographic characteristics of mothers.

Table 5.1 Socio-demographic Characteristics of Mothers

Characteristic	n	Category	Westlands HC n(%)	Makadara HC n(%)	X^2	p-value
Mothers Age	**393**	≤24 years	45(23.2)	38(19.1)	4.445, df=2	0.108
		25-34 years	127(65.5)	148(74.4)		
		≥35 years	22(11.3)	13(6.5)		
Highest education level attained	**399**	None	3(1.5)	1(0.5)	7.186, df=3	0.059#
		Primary	81(40.5)	60(30.2)		
		Secondary	83(41.5)	90(45.2)		
		Tertiary	33(16.5)	48(24.1)		
Marital status	**399**	Married	196(98.0)	188(94.5)	3.437, df=2	0.196#
		Single	3(1.5)	8(4.0)		
		Divorced/Widowed	1(0.5)	3(1.5)		
Employment status	**398**	Not employed	117(58.5)	87(43.9)	8.569, df=2	**0.036***
		Formal employment	30(15.0)	38(19.2)		
		Self employed	53(26.5)	73(36.9)		
Family Monthly Income	**384**	Less than 5000	77(41.2)	95(48.2)	9.920, df=3	**0.014#***
		5000 - 20000	82 (43.9)	80(40.9)		
		20001 - 50000	26(13.9)	20(10.2)		
		More than 50000	2(1.1)	2(0.8)		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.2 Factors that could influence utilization of health services

Overall, more than half 207(51.9%) of mothers did not have any insurance cover, while mothers who had insurance cover from the National Health Insurance Fund (NHIF) accounted for 186(46.6%). A small number 6(1.5%) of mothers had health insurance cover from other private insurance companies. There was no significant difference between the groups from the two health centres with regard to insurance cover (p=0.511).

The distance to the nearest health centre differed significantly between the two health centres (p=0.000). Although more mothers 50 (25.3%) from Makadara health centre lived less than 1km form the health centre, one third of mothers 64 (32.3%) from the same health centre lived more than 5 km from the health centre. Only 12.5% of mothers from Westlands health centre lived more than 5 km from the health facility (Table 5.2). There was no difference observed between the child's illness experience in the preceding two weeks for the two health centres (p=0.411)

Table 5.2 Factors that could influence utilization of health services

Characteristic	n	Category	Westlands HC n(%)	Makadara HC n(%)	X^2	p-value
Distance to nearest Health Centre	**398**	Less than 1 Kilometre	19(9.5)	50(25.3	55.053, df=3	**0.000***
		Between 1-3 Kilometres	77(38.5)	45(22.7)		
		Between 3-5 Kilometres	79(39.5)	39(19.7)		
		More than 5 Kilometres	25(12.5)	64(32.3)		
Illness experience of child in preceding two weeks	**395**	Yes	38(19.1)	44(22.4)	0.675, df=1	0.411
		No	161(80.9)	152(77.6)		
Health Insurance	**399**	NHIF	90(45.0)	96(48.2)	1.249, df=2	0.511#
		Private insurance	2(1.0)	4(2.0)		
		None	108(54.0)	99(49.7)		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.3 Mothers' source of water and general living conditions

More mothers from Makadara 59(29.8%) bought water from vendors compared to those who obtained water from vendors from Westlands 20(10%). There were more mothers getting water from boreholes in Westlands 14(7.0%) when compared to those getting water from boreholes from Makadara 1(0.5%). The difference for source of water for domestic use was statistically significant (X^2=44.055, df=3, p=0.000) (Table 5.3).

Overall, majority of mothers (70.5%) lived in single/double rooms where washrooms were shared with other families and only 29.5% lived in houses where washrooms were located

within their house (Table 5.3). There was no statistically significant difference with regard to size of living houses between the groups of mothers from the two health centres (X=0.268, df=1, p=0.604).

Table 5.3 Mothers' source of water, size of dwelling house and sanitary conditions

Characteristic	n	Category	Westlands HC n(%)	Makadara HC n(%)	X^2	p-value
Size of dwelling house	**398**	Single/double room with shared washrooms	142(71.7)	138(69.3)	0.268, df=1	0.604
		Single/double rooms with own washrooms	56(28.3)	61(30.7)		
Childs' exposure to stagnant water and open drainage/ sewer	**395**	Yes	66(33.5)	54(27.3)	1.812, df=1	0.178
		No	131(66.5)	144(72.7)		
Source of water for domestic use	**398**	Buy from vendors	20(10.0)	59(29.8)		
		Piped in plot	137(68.5)	91(46)	44.055	**0.000**$^{\#*}$
		Piped into house	29(14.5)	47(23.7)	df=3	
		Borehole	14(7.0)	1(0.5)		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.4 Mothers Ethnic Background

Mothers ethnicity across the two health centres differed significantly (p=0.000). There were more Kamba (28.8%) mothers in Makadara while the Luhya (34.6%) mothers were more in Westlands (Table 5.4).

Table 5.4 Mothers ethnic background

Characteristic	n	Category	Westlands HC n(%)	Makadara HC n(%)	X^2	p-value
Ethnic Background	**389**	Kalenjin	4(2.1)	2(1.0)	30.012, df=6	**0.000**$^{\#*}$
		Kamba	21(11.0)	57(28.8)		
		Kikuyu	64(33.5)	57(28.8)		
		Luhya	66(34.60	37(18.7)		
		Luo	13(6.8)	21(10.6)		
		Kisii	19(9.9)	15(7.6)		
		Others	4(2.1)	9(4.5)		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.5 Children characteristics

A total of 195 (49.1%) of children were male, while 202 (50.9%) were female. Babies birth weight ranged from 1.5kilograms to 7 kilograms and a majority 379 (96.7%) were born with a normal range of birth weight (2.5 – 4.9 Kilograms). Three percent (n=11) of babies were born underweight (<2.5kg), while only one baby was born overweight (>5.0 Kg). There was no statistically significant difference between the mean birth weights of babies from Westlands and those from Makadara health centres using the independent t-test (t=1.268, df=390, p=0.206). Table 5.5 summarises the childrens' characteristics.

Table 5.5 Childrens' birth weight and age at baseline

Characteristic	n	Mean birth weight (Kg)	n	Mean age (Months)
Westlands	194	3.31 (0.55)	198	2.03(1.39)
Makadara	198	3.24(0.53)	198	2.01(0.92)
t-test (p-value)	1.268(0.206)		0.191 (0.849)	

5.6 Health seeking behavior

Most mothers 316 (79.4%) had visited the health centre for childs immunization or routine growth monitoring. A total of 82 (20.8%) of children had experienced illness in the preceding two weeks. Thirty children (7.6%) had diarrhea, while 32 (8.8%) had experienced fever. More than half 17(55.2%) of mothers whose children had experienced diarrhea sought treatment, while slightly below half 14(44.8%) of mothers whose children experienced fever sought treatment. Management for children who had suffered diarrhea or fever in the preceding two weeks is summarized in Table 5.6

Table 5.6 Mothers health seeking behavior

Characteristic	n	category	Westlands	Makadara	X^2	p-value
Reason for current visit to health centre	398	Immunization/ Growth monitoring	159(79.9)	157(78.9)	5.193, df=2	0.075
		Seek Medical care	12(6.0)	23(11.6)		
		Other	28(14.1)	19(9.5)		
Management of Diarrhea in the preceding two weeks	20	ORS/Oralite	7(70.0)	10(100)	-----	-----
		Home-made sugar-salt solution	1(10.0)	0(0)		
		Other- Home made	2(20.0)	0(0)		
Management of Fever in the preceding two weeks	28	Anti-Malarials	1(11.1)	3(15.8)	1.753, df=2	0.464#
		Antibiotics	1(11.1)	6(31.6)		
		Anti-pyretics	7(77.8)	10(52.6)		

---- *No X^2 value as some cells have 0 scores.*

5.7 Association of teething with common childhood illnesses

Knowledge on association of common childhood symptoms like fever, vomiting, diarrhea was coded as either inadequate or good knowledge. Majority of mothers had inadequate knowledge regarding the association of fever 288 (76.4%) and diarrhea 278 (73.9%) with teething. About a third (n=122) of mothers regarded vomiting to be associated with teething (Table 5.7).

Table 5.7 Mothers knowledge on symptoms associated with teething

Variable	n	Categories	Westlands n(%)	Makadara n(%)	X^2 (df=1)	p-value
Fever	377	Good knowledge	44(24.7)	45(22.6)	0.231	0.631
		Inadequate knowledge	134(75.3)	154(77.4)		
Diarrhea	376	Good knowledge	39(22.0)	59(29.6)	2.818	0.093
		Inadequate knowledge	138(78.0)	140(70.4)		
Vomiting	371	Good knowledge	109(62.6)	140(71.1)	2.970	0.085
		Inadequate knowledge	65(37.4)	57(28.9)		
Loss of appetite	375	Good knowledge	89(50.6)	77(38.7)	5.338	**0.021***
		Inadequate knowledge	87(49.4)	122(61.3)		
Constipation	373	Good knowledge	167(94.4)	193(98.5)	4.691	**0.030***
		Inadequate knowledge	10(5.6)	3(1.5)		
Drooling of saliva	371	Good knowledge	47(27.3)	98(49.2)	18.620	**0.000***
		Inadequate knowledge	125(72.7)	101(50.8)		
Itchiness of gums	376	Good knowledge	99(55.9)	123(61.8)	1.338	0.247
		Inadequate knowledge	78(44.1)	76(38.2)		

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.8 Effect of mothers' level of education, employment status and income on association of teething with diarrhea

The association of teething with diarrhea was significantly related to mothers level of education (p=0.048) and employment status (p=0.015). Other than mothers with no formal education who were only 3 in number, good knowledge increased with the increase in level

of education (Table 5.8). There was no statistically significant relationship between mothers' association of teething with diarrhea and family monthly income (p=0.304).

Table 5.8 Relationship between mothers' level of education, employment status and income with association of teething with diarrhea

Variable	Categories	Inadequate knowledge n (%)	Good knowledge n (%)	X^2	p-value
Highest level of education attained by mother	No formal education	1(33.3)	2(66.7)	X=7.927, df=3	**0.050#***
	Primary	105(78.90	28(21.1)		
	Secondary	123(75.0)	41(25.0)		
	Tertiary	49(64.5)	27(35.5)		
Family monthly income (Ksh)	<5,000	133(77.8)	38(22.2)	X=3.633, df=3	0.304#
	5,000-20,000	107(70.9)	44(29.1)		
	20,001-50,000	24(64.9)	1335.1)		
	>50,000	2(66.7)	1(33.3)		
Mothers' employment status (n=375)	Not employed	156(80.8)	37(19.2)	X=10.497, df=3	**0.013***
	Formal employment	45(71.4)	18(28.6)		
	Self-employed	76(65.0)	41(35.0)		
	Other	1(50)	1(50)		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.9 Effect of mothers' level of education, employment status and income on association of teething with fever

There was no statistically significant relationship between the association with fever with teething according to mothers level of education (p=0.737), family income (p=0.146) and employment status (p=0.721) (Table 5.9).

Table 5.9 Relationship between mothers' level of education employment status and income with association of fever with teething

Variable	Categories	Inadequate knowledge n (%)	Good knowledge n (%)	X^2	p-value
Highest level of education attained by mother (n=377)	No formal education	2(66.7)	1(33.3)	X=1.359, df=3	0.737#
	Primary	105(78.9)	28(21.1)		
	Secondary	121(73.8)	43(26.2)		
	Tertiary	60(77.9)	17(22.1)		
Family monthly income (Ksh) (n=363)	<5,000	137(79.7)	35(20.3)	X=5.198, df=3	0.146#
	5,000-20,000	112(74.2)	39(25.8)		
	20,001-50,000	26(70.3)	11(29.7)		
	>50,000	1(33.3)	2(66.7)		
Mothers' employment status n=(376)	Not employed	151(78.2)	42(21.8)	X=1.406, df=3	0.721#
	Formal employment	49(76.6)	15(23.4)		
	Self-employed	87(74.4)	30(25.6)		
	Other	1(50)	1(50)		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.10 Effect of mothers' level of education, employment status and income on association of teething with vomiting

There was no statistically significant difference between mothers with regards to associating vomiting with teething with regard to their level of education (p=0.067) (Table 5.10).

Table 5.10 Relationship between mothers' level of education, employment status and income with association of vomiting with teething

Variable	Categories	Inadequate knowledge n (%)	Good knowledge n (%)	X^2	p-value
Highest level of education attained by mother (n=371)	No formal education	1(33.3)	2(66.7)	X^2=7.067, df=3	0.067#
	Primary	51(38.6)	81(61.4)		
	Secondary	55(33.7)	108(66.3)		
	Tertiary	15(20.5)	58(79.5)		
Family monthly income (Ksh) (n=357)	<5,000	42(24.9)	127(75.1)	--------	-------
	5,000-20,000	67(44.7)	83(55.3)		
	20,001-50,000	10(27.8)	26(72.2)		
	>50,000	0(0)	2(100)		
Mothers' employment status (n=370)	Not employed	65(34.2)	125(65.8)	---------	--------
	Formal employment	17(27.4)	45(72.6)		
	Self-employed	40(34.5)	76(65.5)		
	Other	0(0)	2(100)		

---- No X^2 value as some cells have 0 scores, # Fishers Exact statistic reported

5.11 Association of teething with oral symptoms

5.11.1 Association of itchiness of gums with teething

Mothers' level of education (p=0.242) and family income (0.175) were not statistically significantly associated with mother's association of teething with itchiness of gums of their babies (Table 5.11).

Table 5.11 Relationship between mothers' level of education, employment status and income with association of itchiness of gums with teething

Variable	Categories	Inadequate knowledge n (%)	Good knowledge n (%)	X^2	p-value
Highest level of education attained by mother (n=376)	No formal education	1(33.3)	2(66.7)	X^2=4.306, df=3	0.242#
	Primary	74(55.6)	59(44.4)		
	Secondary	95(57.9)	69(42.1)		
	Tertiary	52(68.4)	24(31.6)		
Family monthly income (Ksh) (n=362)	<5,000	106(61.6)	66(38.4)	X^2=4.974, df=3	0.175#
	5,000-20,000	87(57.6)	64(42.4)		
	20,001-50,000	15(41.7)	21(58.3)		
	>50,000	2(66.7)	1(33.3)		
Mothers' employment status (n=375)	Not employed	118(61.1)	75(38.9)	---------	--------
	Formal employment	37(58.7)	26(41.3)		
	Self-employed	67(57.3)	50(42.7)		
	Other	0(0)	2(100)		

---- No X^2 value as some cells have 0 scores, # Fishers Exact statistic reported

5.11.2 Association of drooling of saliva with teething

There was a statistically significant relationship between mothers family income and their association of teething with drooling of saliva (p=0.030). Good knowledge increased with increasing level of family monthly income (Table 5.12).

Table 5.12 Relationship between mothers' level of education, employment status and income with association of drooling of saliva with teething

Variable	Categories	Inadequate knowledge n (%)	Good knowledge n (%)	X^2	p-value
Highest level of education attained by mother (n=371)	No formal education	1(33.3)	2(66.7)	X^2=3.223, df=3	0.358#
	Primary	49(37.7)	81(62.3)		
	Secondary	59(36.2)	104963.8)		
	Tertiary	36(48.0)	39(52.0)		
Family monthly income (Ksh) (n=357)	<5,000	76(45.2)	92(54.8)	X^2=8.472, df=3	**0.030#***
	5,000-20,000	46(30.9)	103(69.1)		
	20,001-50,000	12(32.4)	25(67.6)		
	>50,000	2(66.7)	1(33.3)		
Mothers' employment status (n=370)	Not employed	81(42.6)	109(57.4)	---------	--------
	Formal employment	22(35.5)	40(64.5)		
	Self-employed	42(36.2)	74(63.8)		
	Other	0(0)	2(100)		

---- No X^2 value as some cells have 0 scores, # Fishers Exact statistic reported Indicates result is statistically significant at α≤0.05*

5.12 Practices about teething for older child

Majority 152 (67%) of mothers indicated that they consulted the nurse at the Maternal Child Health clinic for advice. About one-third 70 (34.5%) of mothers made use of teething gels/ powders while a small minority resulted to traditional practitioners for various remedies (Table 5.13). There was significant difference between mothers from the two health centres with regards to the practice of consulting the health clinic nurse (p=0.000) when their children experienced teething-related symptoms (Table 5.13).

Table 5.13 Mothers health seeking practices for teething-related symptoms for older child

Variable	Group	Frequency (%)		X^2	p-value
		Yes	No		
Consulted the Nurse at Health clinic (n=227)	Westlands n=114	67(58.7)	47(41.3)	49.715	0.000*
	Makadara n=114	85(74.6)	29(25.4)		
	Total	**152 (67)**	**75 (33)**		
Consulted a pediatrician (n=196)	Westlands n=113	6(5.3)	107(94.7)	4.344	0.227
	Makadara n=83	3(3.6)	80(96.4)		
	Total	**9 (4.6%)**	**186 (95.4)**		
Applied commercial teething powder/gel (n=203)	Westlands n=115	41(35.6)	74(64.4)	0.627	0.731
	Makadara n=88	29(32.9)	59(67.1)		
	Total	**70(34.5)**	**133 (65.5)**		
Applied traditional teething powders (n=198)	Westlands n=113	8(7)	105(93)	4.252	0.119
	Makadara n=85	1(1.2)	84(98.8)		
	Total	**9 (4.5)**	**189 (95.5)**		
Consulted an oral health	Westlands n=113	9(8.1)	102(91.9)	4.828	0.089

practitioner (n=193)	Makadara n=85	3(3.6)	80(96.4)		
	Total	**10 (5.2)**	**183 (94.8)**		
Visited traditional practitioner for gum incision (n=197)	Westlands n=113	1(0.9)	112(99.1)	4.815	0.090
	Makadara n=84	3(3.6)	81(96.4)		
	Total	**4 (2)**	**193 (98)**		
Visited traditional practitioner for plastic teeth removal (n-198)	Westlands n=113	1(0.9)	112(99.1)	0.041	0.839
	Makadara n=85	1(1.2)	84(98.8)		
	Total	**2 (1)**	**196 (99)**		

*# Fishers Exact statistic reported, * Indicates result is statistically significant at α≤0.05*

5.13 Self-reported oral disease experience of mothers

About half 204 (51.5%) of mothers reported to have suffered from tooth decay, 141 (35.6%) bleeding gums while 40 (10.2%) suffered from dental fluorosis. Self-reported oral disease experiences were not significantly different for groups from Westlands and Makadara health centres (Table 5.14).

Table 5.14 Mothers self-reported oral disease experience

Variable	n	Categories	Total n(%)	Westlands n(%)	Makadara n(%)	X^2	p-value
Tooth decay	396	Yes	204(51.5)	99(50)	105(53.0)	0.364	0.546
		No	192(48.5)	99(50)	93(47.0)		
Bleeding gums	396	Yes	141(35.6)	76(38.4)	65(32.8)	1.333	0.248
		No	255(64.4)	122(61.6)	133(67.2)		
Dental fluorosis	392	Yes	40(10.2)	17(8.7)	23(11.7)	0.935	0.333
		No	352(89.8)	178(91.3)	174(88.3)		

5.14 Mothers' knowledge on risk factors for dental caries and prevention of dental fluorosis

5.14.1 Mothers' knowledge on risk factors for ECC

There was statistically significant difference between mothers from Westlands and Makadara health centres with regard to knowledge on all the listed risk factors associated with Early Childhood Caries (ECC) (p=0.000).More mothers from Makadara were knowledgeable of risk factors for ECC compared to their Westlands counterparts (Table 5.15).

Table 5.15 Mothers knowledge on risk factors for ECC

Variable	n	Categories	Total n(%)	Westlands n(%)	Makadara n(%)	X^2 (df=2)	p-value
Bacteria passed from parent/carer	387	Yes	131(33.9)	30(15.5)	101(52.3)	68.768	0.000*
		No	94(24.3)	48(24.7)	46(23.8)		
		Not sure	162(41.9)	116(59.8)	46(23.8)		
Feeding baby with sweetened fruit juices	393	Yes	226(57.7)	84(42.6)	142(72.8)	73.715,	0.000*
		No	60(15.3)	22(11.2)	38(19.5)		
		Not sure	105(27.1)	91(46.2)	15(7.7)		
Adding sugar in baby milk/food	391	Yes	258(66.0)	104(52.8)	154(79.4)	77.789,	0.000*
		No	53(13.6)	22(11.2)	31(16.0)		
		Not sure	80(20.5)	71(36.0)	9(4.6)		
Bottle-feeding baby at night with sweetened drinks	389	Yes	156(40.1)	62(31.8)	94(48.5)	24.483,	0.000*
		No	88(22.6)	37(19.0)	51(26.3)		
		Not sure	145(37.3)	96(49.2)	49(25.3)		
Breast feeding baby for a long period	393	Yes	56(14.3)	9(4.5)	47(24.2)	77.789	0.000*
		No	197(50.3)	80(40.4)	117(60.3)		
		Not sure	139(35.5)	109(55.0)	30(15.5)		

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.14.2 Mothers knowledge on prevention of ECC

Majority of mothers 259 (65.9%) were aware of the need for tooth cleaning and also the association of sugar 239(61%) and dental caries. The responses provided by mother from

Westlands and Makadara health centres on all questions listed on prevention for ECC differed significantly (p=0.000). More mothers from Makadara health centre were more knowledgeable on the prevention of ECC (Table 5.16).

Table 5.16 Mothers knowledge on prevention for ECC

Variable	n	Categories	Total n(%)	Westlands n(%)	Makadara n(%)	X^2 (df=1)	p-value
Cleaning baby teeth soon after their eruption	393	Yes	259(65.9)	111(56.1)	148(65.9)	43.327	0.000*
		No	58(14.8)	23(11.6)	58(14.8)		
		Not sure	76(19.3)	64(32.3)	76(19.3)		
Delay introducing sugar in baby food for first year	392	Yes	239(61.0)	107(54.0)	132(68.0)	52.197	0.000*
		No	55(14.0)	13(6.6)	42(21.6)		
		Not sure	98(25.0)	78(39.4)	20(10.3)		
Making a baby feeding schedule	388	Yes	187(48.2)	88(45.4)	99(51.0)	64.056	0.000*
		No	65(16.8)	8(4.1)	57(29.4)		
		Not sure	136(35.1)	98(50.5)	38(19.6)		
Avoid bottle-feeding at night with sweetened drinks	391	Yes	225(57.7)	93(47.0)	132(68.8)	63.018	0.000*
		No	57(14.6)	16(8.1)	41(21.4)		
		Not sure	108(27.7)	89(44.9)	19(9.9)		
Arranging for dental visit when baby turns one year	391	Yes	254(65.0)	114(57.9)	140(72.2)	42.549	0.000*
		No	52(13.3)	15(7.6)	37(19.1)		
		Not sure	85(21.7)	68(34.5)	17(8.8)		

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.14.3 Mothers knowledge on prevention of dental fluorosis

Knowledge on the causes of dental fluorosis was rated as inadequate with majority of mothers 227(58.5%) regarding the discolorarion as failure to brush teeth properly. About half of mothers however identified use of water with high fluoride as the cause for dental fluorosis. There was a significant difference in knowledge on prevention of dental fluorosis between mother at Westlands and Makadara health centres with regards to all questions with on prevention of dental fluorosis (p=0.000). More mothers from Makadara were

knowledgeable on the prevention of dental fluorosis compared to those from Westlands (Table 5.17)

Table 5.17 Mothers knowledge on prevention of dental fluorosis

Variable	n	Categories	Total n(%)	Westlands n(%)	Makadara n(%)	X^2 (df=1)	p-value
Failure to brush teeth properly	388	Yes	227(58.5)	77(39.3)	150(78.1)	64.957	0.000*
		No	81(20.9)	53(27.0)	28(14.6)		
		Not sure	80(20.6)	66(33.7)	14(7.3)		
Drinking water with high fluoride at age 1-6 years	393	Yes	217(55.2)	57(28.8)	160(82.1)	130.566	0.000*
		No	23(5.9)	9(4.5)	14(7.2)		
		Not sure	153(39.0)	131(66.2)	21(10.8)		
Drinking water with high fluoride at age 6-10 years	393	Yes	195(49.7)	41(20.8)	154(79.0)	162.690	0.000*
		No	25(6.4)	7(3.6)	18(9.2)		
		Not sure	172(43.6)	148(75.1)	23(11.8)		
Drinking water with high salt content at age 1-6 years	392	Yes	197(50.3)	59(29.9)	138(70.8)	73.487	0.000*
		No	41(10.5)	21(10.7)	20(10.3)		
		Not sure	154(39.3)	117(59.4)	37(19.00		
Drinking water with high salt content at age 6-10 years	391	Yes	195(49.9)	57(28.9)	138(71.1)	79.073	0.000*
		No	40(10.2)	20(10.2)	20(10.3)		
		Not sure	156(39.9)	119(60.4)	36(18.6)		

** Indicates result is statistically significant at $\alpha \leq 0.05$*

A majority of mothers interviewed 266(67.7%) thought that it was possible to prevent the development of dental fluorosis in their children.

5.15 Health education Intervention

Only the last 100 mothers to be interviewed for each health centre were included in the intervention. After the six months intervention duration, all mothers were contacted using

mobile phones that they provided during baseline data collection. The response rate for Makadara (mhealth group) was 53%, with 53 mothers responding to telephone calls and attending for interviews. Westlands (Poster group) had a response rate of 49%.

5.15.1 Health education intervention materials: Posters and SMS

A toal of six posters were displayed at the clinic with both Engliah and Kiswahili translations for each poster, and changed monthly. The space for poster display was next to the customer care desk positioned just outside the pharmacy waiting area, while the main area where mothers routinely weighted their infants upon arrival at the clinic received the second set of posters (Figure 5.1). Eight short text messages were send over a period of six months. All SMSs were in Kiswahili and delivery reports were received indicating that messages were delivered to 98 mothers. A total of ten SMSs failed to be delivered when mothers from the two groups were being alerted of the phone call to arrange for post-intervention data collection. Six of these were for the poster group while four were for the mHealth group.

Figure 5.1 Selected sample poster displays at Westlands Health Centre

5.16 Child health indicators

Ninety nine mothers responded to the question on exclusive breast feeding. Majority 73(71.7%) of children were exclusively breast-fed to six months, while the rest were weaned at various times; the earliest child was weaned at 2 months. There was no statistically significant difference in the practices of exclusive breast feeding between the mhealth and poster intervention groups (X^2=1.361, df=2, p=0.506). All children 101(99%) except one were fully immunized for their age, and had normal weight for age. A total of 27(26.5%) children had experienced some illness in the preceding two-week period, and this was not statistically different when the mhealth and poster education groups were compared (X^2=0.645, df=1, p=0.422). Twenty eight mothers introduced their children to various foods

before the Kenyan recommended age of weaning of six months. Several types of foods were introduced during weaning, and mothers were asked to state which food they first introduced. A summary of the timing for weaning and type of weaning food is provided in Figure 5.2.

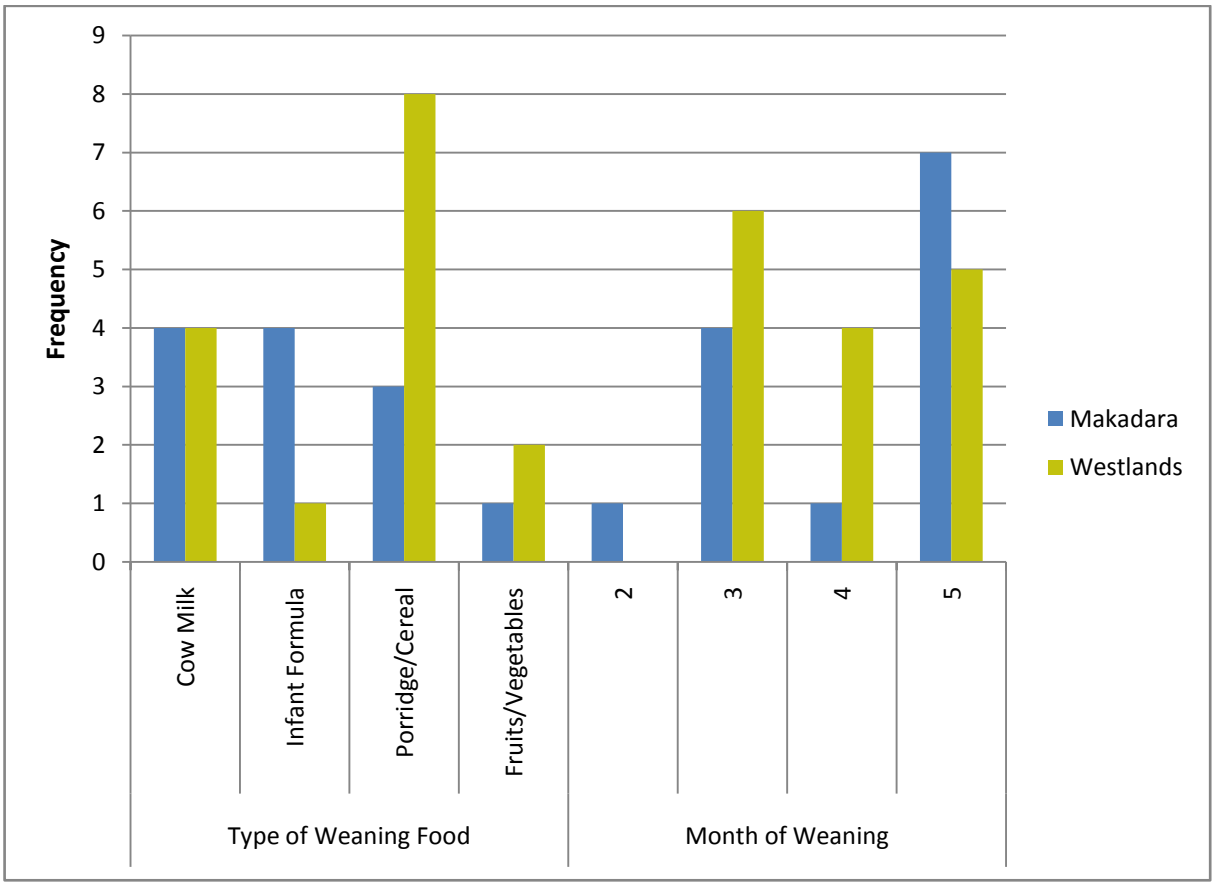

Figure 5.2 Age of weaning and type of weaning foods introduced

Most mothers weaned their babies on porridge, while there were two notable periods when most mothers weaned their children; about the 3rd month and during the 5th month.

5.17 Eruption of first deciduous tooth

A total of 68 children had at least one deciduous tooth erupted by the time of post-intervention data collection. The mean age of tooth eruption for males was 7.23 months (SD 1.21) while the one for females was 6.45 months (SD 1.67). This difference was statistically significant using the independent sample t-test with p=0.037 (Levene's test for equality of variances was violated, p=0.030; reported p value does not assume equal variance).

5.18 Oral Health Knowledge

5.18.1 Effect of health education on mothers' teething beliefs using mhealth education

Table 5.18 presents the mhealth group performance on pre-intervention and post-intervention scores for symptoms associated with teething by mothers. There were significant differences between the pre-intervention and post-intervention scores for experience of itchiness of gums during teething (p=0.000).

Table 5.18 Effect of health education messages delivered using mhealth method on teething beliefs among mothers at Makadara Health Centre

Variable	Pre-intervention		Post-intervention		McNemar test (P value)
Reported Childs' experience during teething	Good Knowledge n(%)	Inadequate knowledge n(%)	Good Knowledge n(%)	Inadequate knowledge n(%)	
Fever	19(36.5)	33(63.5)	13(38.2)	21(61.8)	1.0
Diarrhea	24(46.2)	28(53.8)	18(52.9)	16(47.1)	0.791
Vomiting	33(63.5)	19(36.5)	26(81.2)	6(18.8)	0.508
Drooling of saliva	14(26.9)	38(73.1)	10(30.3)	23(69.7)	1.0
Itchiness of gums	19(36.5)	33(63.5)	28(82.4)	6(17.6)	**0.000***

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.18.2 Effect of health education on mothers' teething beliefs and oral health knowledge using posters

When posters were used to deliver health education, there were statistically significant differences between the pre-intervention and post-intervention parameters. There was significant reduction in the proportion of mothers who associated teething with fever (p=0.035), diarrhea (p=0.001) and vomiting (p=0.000) (Table 5.19).

Table 5.19 Effect of health education messages delivered using posters on teething beliefs among mothers at Westlands health centre (n=49)

Variable	Pre-intervention		Post-intervention		McNemar test
Childs' experience during teething	Good Knowledge n(%)	Inadequate knowledge n(%)	Good Knowledge n(%)	Inadequate knowledge n(%)	**(P-value)**
Fever	7(17.1)	34(82.9)	17(56.7)	13(43.3)	**0.035***
Diarrhea	9(22.0)	32(78.0)	19(63.3)	11(36.7)	**0.001***
Vomiting	19(47.5)	21(52.5)	27(87.1)	4(12.9)	**0.000***
Drooling of saliva	13(31.7)	28(68.3)	18(60.0)	12(40.0)	0.22
Itchiness of gums	20(50)	20(50)	26(83.9)	5(16.1)	0.22

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.18.3 Effect of health education on mothers' oral health knowledge using mhealth education

Table 5.20 presents the pre-intervention and post-intervention scores for oral health knowledge among mothers in the mhealth group (Makadara Health Centre). There was improved oral health knowledge scores when pre-intervention and post-intervention knowledge on risk factors for ECC (p=0.001) and prevention of dental fluorosis (p=0.000) were considered.

Table 5.20 Effect of health education using mhealth on oral health knowledge among mothers at Makadara Health Centre (n=53)

Variable	Pre-intervention mean score(SD)	Post-intervention mean score(SD)	Paired t-test	P-value
Knowledge on risk factors for ECC	3.32(1.6)	4.17(1.2)	3.47	**0.001***
Knowledge on prevention of ECC	3.00(1.0)	3.15(1.8)	0.596	0.554
Knowledge on prevention of dental fluorosis	1.42(0.75)	3.11(2.0)	5.261	**0.000***

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.18.4 Effect of health education on mothers' oral health knowledge using posters

Scores for knowledge on oral health questions relating to determinants of ECC (p=0.000), prevention of ECC (0.052) and prevention of dental fluorosis (p=0.000) improved significantly from baseline scores for the poster group (Table 5.21)

Table 5.21 Effect of health education using posters on oral health knowledge among mothers at Westlands health centre(n=49)

Variable	Pre-intervention mean score(SD)	Post-intervention mean score(SD)	Paired t-test	P-value
Knowledge on risk factors for ECC	2.43(1.3)	3.73(1.5)	4.615	**0.000***
Knowledge on prevention of ECC	3.04(1.3)	3.57(1.5)	1.996	**0.052***
Knowledge on prevention of dental fluorosis	1.06(1.2)	3.04(1.7)	6.98	**0.000***

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.19 Comparison of effectiveness of posters and mHealth for oral health education

5.19.1 Comparison of effect of health education using mhealth and posters on mothers' oral health knowledge

The overall knowledge was graded as inadequate, average or good, and this was significantly different for baseline and post-intervention scores for mothers on mhealth and poster groups combined (p=0.0001). The poster group had significant difference for pre-intervention and post-intervention oral health knowledge grades (p=0.001), and similar results were obtained for the mhealth group (p=0.009). (Table 5.22).

Table 5.22 Comparison of the effect of health education intervention on the oral health knowledge of mothers using mhealth and posters

Group	Characteristic	Pre-intervention n (%)	Post-intervention n (%)	Change % Points	McNemar-Bowker significance test
Overall for both mhealth and poster groups	Inadequate knowledge	214 (53.6)	21 (20.8)	-32.8	26.33, **p=0.000***
	Average Knowledge	145 (36.3)	28 (27.7)	-8.6	
	Good Knowledge	40 (10.1)	52 (51.5)	+41.4	
Westlands (Poster group)	Good Knowledge	7(14.3)	26(53.1)	+38.8	15.71, **P=0.001***
	Average Knowledge	19(38.8)	11(22.4)	-16.4	
	Inadequate knowledge	23(46.9)	12(24.5)	-22.4	
Makadara (mhealth group)	Good Knowledge	11(21.2)	26(51.0)	+29.8	11.66, **P=0.009***
	Average Knowledge	22(42.3)	16(31.4)	-10.9	
	Inadequate knowledge	19(36.5)	9(17.6)	-18.9	

** Indicates result is statistically significant at $\alpha \leq 0.05$*

5.19.2 Comparison between outcome using mhealth and poster health education

Mothers scores on oral health knowledge were subjected to mixed between-within groups ANOVA to explore if differences existed with regard to those mothers who received health education through posters and those who were on mhealth. Tests were performed for knowledge on determinants of ECC, prevention of ECC, prevention of dental fluorosis and the overall mean score before intervention and after intervention. Table 5.23 summarizes this analysis. Knowledge on determinants of ECC, prevention of dental fluorosis and the overall knowledge score reflected significant change between the pre-intervention and post-

intervention scores. They also had large effect sizes recorded at 0.251, 0.769 and 0.306 respectively. Knowledge on prevention of ECC did not have a significant change between the pre-intervention and post-intervention periods, and the effect size was rated as moderate.

Table 5.23 Mixed between-within ANOVA for change in oral health knowledge

Variable	**Health Centre (n)**	**Mean Score**		**Wilks' Lambda (Partial Eta Squared[#])**	**p-value**
		Pre-Intervention (SD)	Post-Intervention (SD)		
Knowledge of Determinants of ECC	Westlands (49)	2.43 (1.3)	3.73 (1.5)	0.749 (0.251)	**0.000***
	Makadara (53)	3.32 (1.6)	4.17 (1.2)		
Knowledge on Prevention of ECC	Westlands (49)	3.04 (1.3)	3.57 (1.5)	0.967 (0.033)	0.66
	Makadara (53)	3.00 (1.0)	3.15 (1.8)		
Knowledge on Prevention of Dental Fluorosis	Westlands (49)	1.06 (1.2)	3.04 (1.7)	0.231 (0.769)	**0.000***
	Makadara (53)	1.42 (0.8)	3.11 (2.0)		
Overall Knowledge mean score	Westlands (49)	2.35 (1.0)	3.27 (1.1)	0.694 (0.306)	**0.000***
	Makadara (53)	2.63 (1.0)	3.43 (0.92)		

** Indicates result is statistically significant at α≤0.05*

Partial Eta Squared[#] interpreted according to guidelines proposed by Cohen (1988) where 0.01=small effect, 0.06=moderate effect and 0.14=large effect.

5.19.3 Profile plots for Mixed between-within ANOVA Tests

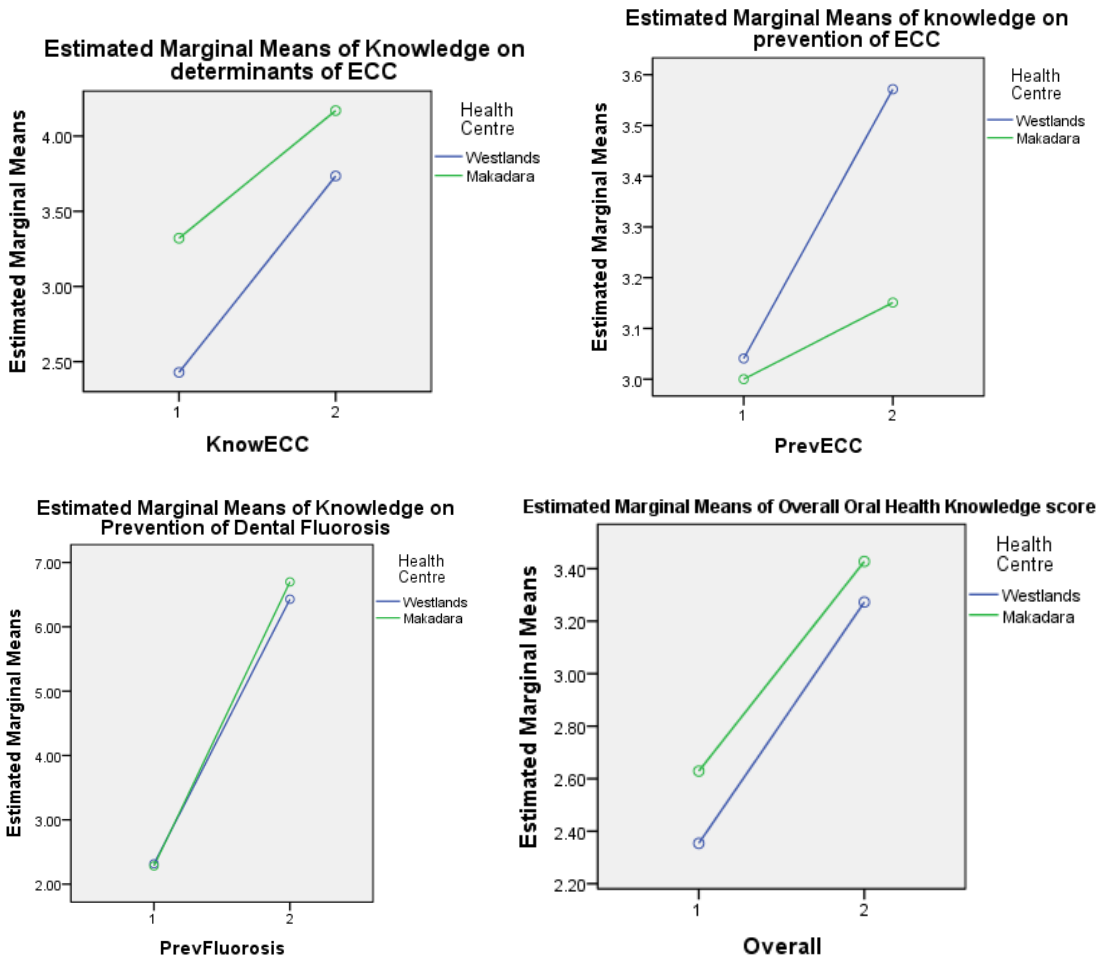

Figure 5.3 Profile plots for Mixed between-within ANOVA Tests

5.19.4 Univariate analysis of variance (ANCOVA)

Due to the quasi-experimental study design, Analysis of Covariance was undertaken in order to control for possible group differences at baseline. Post-intervention oral health knowledge scores were thus investigated for differences between the poster and mHealth groups while controlling for pre-intervention scores. The sum of scores for the three questions on oral

health knowledge was used. Figure 5.3 represents the linear relationships between the oral health knowledge scores.

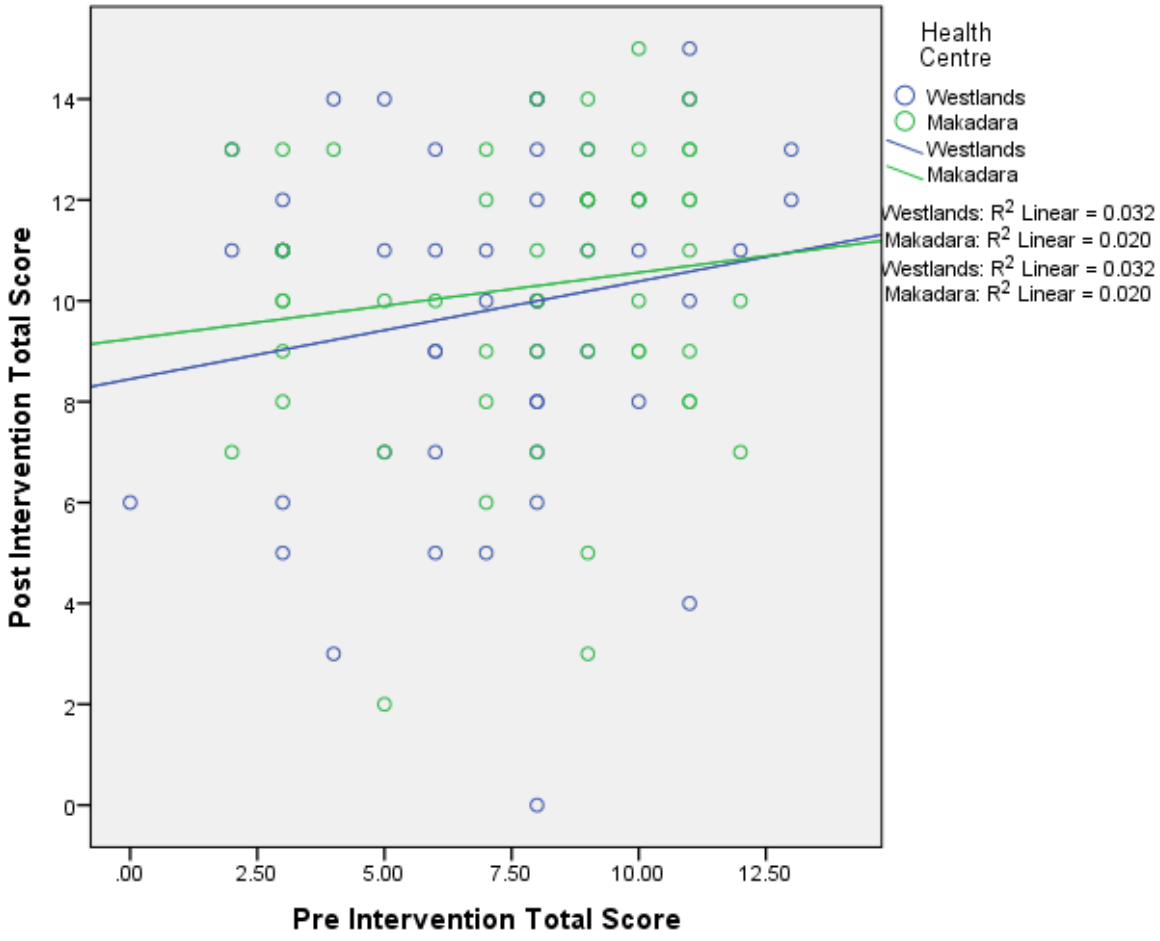

Figure 5.4: Relationship between pre-intervention and post-intervention scores for oral health knowledge.

The pre-intervention scores and post-intervention scores had a weak correlation with R^2 of 0.032 (accounting for 3.2% of the variance in the covariate) and 0.020 (accounting for 2.0% of the variance of the covariate) for Westlands and Makadara groups respectively.

The ANCOVA compared the effectiveness of mHealth and posters health education strategies using the post-intervention scores as the dependent variable. Mothers' baseline oral health knowledge scores were used as the covariates during the analysis. Preliminary checks on the data included tests for normality, linearity and homogeneity of variances. After adjusting for pre-intervention scores on oral health knowledge, there was no significant difference between the effect of posters and mHealth on oral health knowledge F(1,99)=0.302, p=0.584, eta squared=0.003. There was a weak relationship between the pre-intervention and post-intervention scores on oral health knowledge, partial eta squared=0.026.

5.20 Qualitative data

A total of eight focus group discussions (FGDs) were held, four for each health centre. Fifty three mothers participated in the FGDs. Three themes emerged from these discussions namel; Access to health services, infant teething and oral health information.

5.20.1 Access to health services

Mothers indicated that child health services were available from health centres within reach. Some mothers however indicated that there the health centres are convenient, and most of the times they get their children's vaccinations done at the scheduled dates.

A mother from Makadara health centre reported *"The clinic is very close to where I live. I don't have to bother with 'matatus'* (Referring to common mode of public transport in

Kenya) *as I can just walk. I have a smaller dispensary near the house, but there is never the necessary vaccines when you take your baby. I walk longer distance here".*

Mothers also reported most drugs for treatment of common childrens illnesses were not available in the health centre most of the times. They reported buying analgesics, anti-pyretics and antibiotics after obtaining prescriptions at the health centres.

5.20.2 Infant teething

The issue of infant teething presented the largest challenge to the mothers. Most of them reported that they had persons close to them with varying versions of what should be done during infant teething.

One mother from Makadara reported, *"After I got home from hospital with the baby, my neighbor looked into her mouth and said, 'the baby has plastic teeth; this one will really bother the baby'. I didn't know what to do but I consulted my mother-in-law. She told me she had seen babies like that in their family. But after today's session, I now feel ok".*

Another mother from Westlands said, *"In our community, you have to make sure the baby doesn't have false teeth. It's a sign of bad omen for the family and some old people may report it and your baby is in danger, even when doctors say it is ok. So I look in the mouth when the baby is born and make sure there is nothing there"*

Another mother in Makadara also reported, *"It would make trouble in the home if the baby has false teeth. They make the baby very sick with diarrhea and vomiting and the baby can die. They have to be taken out by special community people who do it all the time. There are long queues at their (Traditional doctors) place".*

5.20.3 Access to oral health information

Oral health information was not accessed from the health facilities by many mothers. Mothers reported that they obtained oral health information from relatives, reading magazines and the internet. Some thought the information was both conflicting and difficult to validate.

A mother from Westlands health centre had this to say *"Issues of teeth are not covered in the clinic (Referring to health centre). You talk to one person and they say one thing, the next person a different thing, so I ask my mother also".*

Some of the health messages though were not easily assimilated and one mother from Makadara

"We share som much with my baby. It is not possible to harm him. I don't think it can cause harm if I feed him using my spoon" in response to the question on whether bacteria responsible for transmission of ECC can be possibly passed on from mother to child through sharing spoons and other utensisl that allow contamination with saliva.

Both poster and mhealth groups thought they had gained so much oral health knowledge and were better prepared to address infant teething as a result.

"The messages I received helped me a lot. I even talked with my neighbor who also had a young child. It was very good. I began to watch my baby more and saw that they could get diarrhea when they started picking all things and putting in their mouth. I gave them a clean carrot to play with".

"I saw the message at the clinic, and I didn't know my baby's teeth could rot if i gave them fruit juices in a bottle. My older daughter has bad teeth and she is only three years. I will be careful with this one. It gives us sleepless nights when she has a tooth paining".

Overall, most mothers reported that they had gained from the education sessions and were of the opinion that such information should be made available to whole populations as there were lots of misconceptions surrounding oral health.

5.21 Decision on the Null Hypothesis

Mothers from the poster group recorded higher improvements in oral health knowledge as well as higher percentage point reductions in mothers possessing inadequate knowledge on the association of childhood illnesses with infant teething. Afer controlling for the baseline characteristics of mothers at the two health centres using ANCOVA, there was no statistically significant difference in post-intervention scores using either mhealth or posters ($p=0.584$). The Null Hypothesis was thus not rejected.

CHAPTER 6

6.0 DISCUSSION

6.1 Study methods

6.1.1 Study design

The current study used a prospective quasi-experimental study design to compare two strategies of delivering oral health education. This research involved mothers living within communities in Nairobi. While it would have been desirable to have conducted an experimental study to be able to determine the outcome as a result of the intervention, such a study was not feasible due to the settings and the population of mothers studied. This study used pre-existing groups of mothers; those mothers that visited the selected health centres. No randomization of the intervention was possible. Placing posters at the two health centres and randomly assigning the mothers to the intervention would have resulted in sample contamination. The study thus used one health centre for the poster (Westlands), and the other health centre for mhealth (Makadara). The physical separation of these two health facilities reduced the chance of contamination.

Use of posters to communicate brief health messages has been employed in different settings[15,66,67]. However, there is dearth of information concerning their effectiveness. mhealth for health education has not been widely used, with most studies reporting use of mhealth focusing on timely access to emergency care services, and adherence to treatment[21,23]. The effectiveness of mhealth for delivering health education messages has not been evaluated in previous studies. Both mhealth and poster use in delivering health education messages have the potential for reaching large populations. Posters may enhance

the uptake and recall of information by use of attractive pictorials[67], while mhealth may have an added benefit of convenience.

Mothers were conveniently assigned to the study groups according to the health centre that they attended. This mode of assigning mothers could essentially result in bias due to differences in knowledge of health service providers at the health facilities and other background characteristics of mothers who are likely to attend the particular health centre. In order to address such bias, comparisons have been made for mothers responses before and after the intervention.

6.1.2 Study population

The study involved multi-parity mothers who attended the selected health centres with babies aged 0-3months. Targeting mothers during the period before the deciduous teeth eruption is a good strategy as knowledge impacted could be applied immediately. Most health education interventions targeting oral health literacy tend to be delivered through school programs. While schools present good opportunities to reach many children at a relatively low cost, ECC has been increasing and begins before the child attains school going age. Targeting mothers with oral health knowledge has also been demonstrated to result in improved oral health outcomes for children and the mothers as well[109]. Studies conducted by different researchers in Kenya have documented the prevalence of ECC to range from 45-63.5%[86-88]. The trend of ECC in many developing countries is increasing[81,83,84]. Targeting mothers could be a useful stage towards integrating oral health

messages in the maternal child health clinics and to ensure a common risk approach targeting dental diseases and common infectious diseases in childhood.

6.1.3 Sampling

The selection of health centre for inclusion in this study was done through matching the range of services provided at the health centre. However, selection of mothers was not randomized due to the nature of the inclusion criteria. Lack of randomized assignment to study groups could introduce a systematic bias and confers cautious approach in the interpretation of the results.

6.1.4 Ethical considerations

Use of personal phone contacts raises issues of confidentiality. Mothers in this study provided their personal mobile phone contacts which were used to pass short text messages for the mhealth group, and to contact them for the final interview. There is rapid growth in the mobile telephony industry in Kenya and this had accorded most of the population an opportunity to have access to a mobile phone. According to Communications Authority of Kenya (CAK), the mobile phone penetration reached 78% in march 2014, with a subscription base of 32.2million[110]. While the possibility of misuse of mobile phones exists, the study employed additional caution in the consenting procedures and storage of the phone contact data base and only the researcher made calls to mothers. This is important to maintain the confidence of the study participants.

Ten (9.8%) of phones were not in use by the time the post-intervention data collection was conducted. This may be as a result of common practices among populations world over

where subscribers may have more than one SIM-card[110]. This practice posed a challenge and may have resulted in low response rates when compared to conventional approaches in data collection.

6.2 Study instruments

6.2.1 Data collection tools

An interviewer administered questionnaire to evaluate mothers association of teething with both systemic illnesses and localized symptoms while a 15 questions tool were used to measure oral health knowledge. The questions covered knowledge on risk factors for ECC, prevention of ECC and prevention of dental fluorosis, which is a common dental condition in Kenya. Mean scores for each category were calculated, and an overall mean score reported. The study did not use the oral health literacy measuring tool, the Rapid Estimate of Adult Literacy in Dentistry (REALD-30) as this study instrument has only been validated for English speaking populations[111.] Future studies may be designed to embrace the use of the REALD-30 to assess oral health literacy in the Kenya population so that results can be comparable with findings elsewhere.

6.2.2 Posters

One of the key challenges when using posters in public places is dimished visual quality and visibility.This was encountered as most of the provided poster display space had some old poster material. This was circumvented by ensuring attractive colours of oral health education posters, as well as frequent change to capture and maintain interest of mothers visiting the health centre. Althoug no survey was undertaken to establish the number of

mothers who noticed the posters, it would be fare to assume the same rate as that reported by Bankole in 2007[67] 80% of nurses noticed photo-posters.

6.2.3 mHealth short text messaging

Mobile telephone connectivity has grown exponentially in Kenya. The use of mobile phones has also diversified from the initial voice, short text messaging to data and money transfers. More applications related to the use of mobile phones continue to be developed daily. Some of the accepted use of mobile phones in health care has been to enhance adherence during treatment and to offer support for community health care workers through consultations with medical specialists[112]. All mothers who participated in the intervention phase of this study were conducted by phone for post-intervention data collection. Use of mobile phones in resource poor settings may be faced with several challenges including irregular mobile connectivity due to limited availability of electricity for keeping the phones charged and network coverage[110,112]. This may have led to low response rate of 51% for the whole group. All calls that were not responded to, or were not within the network were repeated three times before being declared non-responsive. Oteri et al[110] notes that large urban settlements may suffer poor connectivity due to storied buildings while also indicating that the mobile signal strength may need boosting for indoor coverage.

6.3 Baseline Study findings

6.3.1 Socio-demographic characteristics of mothers

Mothers who participated in this study were literate as 254 (63.7%) had completed high school level of education. General average adult literacy levels in Kenya have been recorded

at 66.4%[26]. This group of relatively young mother was thus comparable to the Kenyan population average literacy levels. Low literacy levels have been associated with low health literacy scores, and impact negatively on oral health behavior and health seeking behaviors[111, 113].

High unemployment status continues to be a challenge for the country. About half 204(51.5%) of all mothers interviewed were not engaged in any form of employment prior to the delivery of the current child. This is inconsistent with the unemployment rates in Kenya of where female unemployment rate has been reported at 10.5% in 2012[114]. The family income levels for 172(44.8%) of mothers was less than two dollars a day, indicative of high poverty levels. Kenya's population below poverty line stood at 43.4% in country statistics released in 2012[115]. Informal settlements in Nairobi have been reported to have 60% of the resident populations dwelling in one-room dwelling units, and with 85-90% with no access to safe sanitation[106]. Living conditions which exposed children to stagnant water and open sewers was reported by 120 (30.4%) of mothers. Poor sanitary conditions have been blamed for the frequent reported diarrheal episodes in young children[45]. The source of water could also be a source of contamination resulting in higher incidences of childhood diseases.

Majority of mothers 309(77.6%) lived within a radius of 5 kilometres from a health facility, and this was corroborated during focus group discussions. Just below half of mothers 192(48.1%) had access to any form of health insurance. Both accessibility and economic ability to pay for health services influence health care utilization. There appears to be a definite effort on the part of the government to have health facilities distributed close to the

settlement areas in the urban areas. However, health insurance coverage is still reported to be very low despite several drives by the NHIF to include the majority of the population in the insurance bracket.

6.3.2Association of teething with childhood illnesses by mothers

Mothers in this study associated teething with fever 288(76.4%) and diarrhea 278(73.9%). This compares closely with findings of a study involving pediatricians, pediatric dentists and parents in Iowa, where 74.6% associated fever with teething while 56.7% associated teething with diarrhea[8]. In a different study conducted among parents attending maternity and child health clinics in Jordan, 84.9% of them associated fever with teething while 71.8% associated diarrhea with teething[52]. Studies that have utilized prospective study designs of children during the eruption period of deciduous dentition and those that have reviewed records of illnesses during the period of deciduous teeth eruption have reported fewer cases of diarrhea and fever during the teething period[5, 116]. In the current study, 68 children had at least one erupted deciduous tooth by the time of post-intervention data collection. Half of the mothers 34(50%) reported that their children experienced fever, and 27(39.7%) experienced diarrhea during the period of deciduous teeth eruption. These findings compare very closely to those reported by Wake et al[5] who observed that 48% of children suffered low-grade fever, and 33% had diarrhea during deciduous teeth eruption. A different study by Cunha et al[116] reported similar findings too with 46% of children reporting fever, while 35% had diarrhea.

6.3.3 Oral health knowledge of mothers

One third of mothers 131(33.9%) were aware that bacteria responsible for dental caries could be passed to their babies through saliva, but the role of sugar in the causation of dental caries was acknowledged by 258(66%) of mothers. Mothers literacy on the relationship of bottle feeding at night with sweetened drinks was also inadequate with 156(40.1%) indicating that they understood that it was a risk factor for ECC. In their study on mothers in Saudi, Kamil et al[117] reported that mothers were knowledgeable about the risk that sugar consumption posed in the aetiology of dental caries. Mothers did not seem to be knowledgeable in the modes of caries transmission, nor practices that could aid in caries prevention. This finding could further be explained by the frequency of oral health messages that emphasize on sugar consumption as a risk factor for dental caries. Mothers' oral health knowledge is a very important asset since they are solely responsible for their childrens' oral health behavior until the child is old enough to undertake their own oral hygiene measures[118]. Lack of awareness in oral health knowledge is associated with poor oral health outcomes including increased prevalence for ECC, and poor health seeking behavior. This study found that 40.1% of mothers thought feeding child at night with bottle of sweetened drink could cause dental caries. The study among Saudi mothers reported very high level of knowledge on this item with 82.6% of mothers indicating the practice contributes to caries development.

Generally, low literacy is associated with adverse health outcomes including more outpatient visits, higher hospitalization rates, poor adherence to treatment, poor health behaviours and higher medical costs[119]. The findings of a study among female caregivers by Vann et al

concluded that irrespective of education, race, age and number of children, low knowledge was associated with worse oral health status[111].

6.4 Analysis of effectiveness of mHealth and posters in oral health education

6.4.1 Posters and mobile phones in oral health education

There was improvement in mothers knowlegde association of teething with childhood illnesses using both the posters and mhealth education approaches. The proportion of mothers associating teething with diarrhea decreased from 53.8% to 47.1% for the mhealth group, and from 78.0% to 36.7% for the poster group. Similarly, there was a decrease in the number of mothers associating vomiting with teething from 36.5% to 18.8% for the mhealth group and 52.5% to 12.9% for the poster group. Association of local symptoms with teething increased for itchiness of gums from 50% to 83.9% for poster group, and from 36.5% to 82.4% for the mhealth group.

Use of posters and mhealth education strategies produced positive results with overall improvement in oral health literacy. The study thus registered success when measured using definitions provided for oral health education[14,20]. More learning opportunities need to be explored along the health service provision continuum as well as community based strategies to provide oral health information to counter misconceptions.

While there was remarkable increase in the numbers of mothers possessing correct information with regard to infant teething, it was not possible to establish whether such knowledge would result in long term behavior change. Traditional knowledge and practices

about infant teething are often shaped by strong cultural influences, and older persons in the family like the child's grandparents and in-laws can exert influence on what a mother finally practices. Issue involving culture a more complex to change in most societies and cautious approach may be required when dealing with infant teething.

6.4.2 Effect of posters and mhealth on oral health knowledge

The mean score for knowledge on risk factors for ECC increased from 3.32(SD 1.6) to 4.17(SD 1.2) for the mhealth group, and from 2.43(SD1.3) to 3.73(SD 1.5) for the poster group. Improvements in mean scores were also recorded for knowledge on prevention of ECC and dental fluorosis for the two groups. Mothers with good oral health knowledge for both poster and mhealth increased by an average of 41.4% points from the baseline. The proportion of mothers with good knowledge increased by 38.8% points for the poster group and 29.8% points for those who received mhealth education. This difference may be explained because use of mobile phones for health education is not a traditional method. Posters have become an acceptable tool for passing health messages and boards for putting them up are located in very key areas of most health facilities; at waiting areas, corridors and other bays where mothers are likely to notice them[66,67]. Posters at the Westlands health centre were placed next to baby-weighing area and the pharmacy waiting area. This was likely to lead to high visibility. The difference noted could also arise since short text messages were received by mothers away from the health facility, and they therefore had no opportunity to consult the health care worker for clarification. Reinforcement of the message is an important component in health education, and messages printed on poster at the health facility may also be deemed as more credible by the study population[19]. The study did not assess the existing interests of the studied population and attitudes towards use of their

mobile phones for health education, a factor which could also affect the outcome[14,19]. The poster group had also pictorial illustrations, thereby improving their comprehension.

6.4.3 Comparing the effectiveness of posters and mhealth in oral health education

The proportion of mothers associating teething with diarrhea decreased from 53.8% to 47.1% for the mhealth group, and from 78.0% to 36.7% for the poster group. There was also decrease in the number of mothers associating vomiting with teething from 36.5% to 18.8% for the mhealth group and 52.5% to 12.9% for the poster group. Association of local symptoms with teething increased for itchiness of gums from 50% to 83.9% for poster group, and from 36.5% to 82.4% for the mhealth group.

The mean score for knowledge on risk factors for ECC increased from 3.32(SD 1.6) to 4.17(SD 1.2) for the mhealth group, and from 2.43(SD1.3) to 3.73(SD 1.5) for the poster group.Oral health education using posters and mobile phones was effective in improving the oral health knowledge of mothers by an average of 41.4% points from the baseline. Mothers who received oral health education using posters recorded improvement of good knowledge by 38.8% points while those who received health education through mobile phones improved by 29.8% points.

However, when ANCOVA was done controlling for mothers pre-intervention oral health knowledge, there was no statistically significant difference between the performance of either posters or mhealth in improving oral health knowledge (p=0.584).

6.5 Study Limitations

Recall bias could result since mothers were expected to record management of teething in their older child. Similarly, data from this study may not be representative of all mothers in Nairobi as the participating clinics were selected based on the developed inclusion criteria to ensure they offered a comparable range of services. Influence of ethnicity on teething beliefs may not have been fully captured since there were low numbers of different ethnic groups enrolled in the study which could not support robust statistical testing.

CHAPTER 7

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

This study evaluated the effect of health education using mhealth and posters on oral health knowledge of mothers at two health centres in Nairobi. Based on the study findings, it can be concluded that:

1. Mothers attending Westlands and Makadara health centres in Nairobi have misconceptions about the association of teething with common childhood illnesses including fever, diarrhea and vomiting. Mothers had an average level of knowledge relating to determinants and prevention of ECC, and dental fluorosis.
2. The use of poster and mhealth to provide oral health education was effective and resulted in reduction in the proportion of mothers associating teething with fever, diarrhea, vomiting and most of the systemic childhood illnesses. Health education too increased the proportion of mothers possessing correct knowlege on localized signs and symptoms associated with erupting deciduous teeth. Focus group discussions indicated that oral health information is not readily available at the lower levels (health centres) of the health care system.
3. Overall, both poster and mhealth health education strategies were effective in improving knowledge on association of teething with childhood illnesses and oral health literacy with regard to ECC and dental fluorosis. There was no statistically significant difference between the effectiveness of posters and mhealth in improving oral health knowledge for the mothers studied.

7.2 RECOMMENDATIONS

1. Oral health education should be delivered in programmes targeting maternal child welfare to improve oral health outcomes Posters and mhealth could be utilized in appropriate settings as they both have the potential to influence the populations' health knowledge.
2. The software used for this study did not have features to enable mothers to interact with the research by sending toll-free messages. It would therefore be useful to explore opportunities to partner with mobile-phone service providers to sponsor health education initiatives to ensure such messages can reach a great number of communities.
3. Mothers indicated that there was absence of oral health trained personnel at the health centres, and that the information provided was not always collorborated by other health service providers. There is thus need to ensure consistent oral health information, in line with other health messages, is available to all non-oral health providers. Introduction of oral health education in the curricula of other healthcare training programs would play a crucial role in raising awareness to support oral health information dissemination at various levels including health centres.

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APPENDIX1: Questionnaire

PARTICIPANT IDENTIFICATION NUMBER

EVALUATING THE EFFECT OF HEALTH EDUCATION ON KNOWLEDGE ON TEETHING AND ORAL DISEASES/CONDITIONS AMONG MOTHERS IN NAIROBI.

Kindly give us details requested below.

Background information:

1. Childs' Gender:
   Male=1;
   Female=2 ☐
2. Age of child in Months:_____
3. What was the birth weight of the child? (Kilograms) _____
4. Age of Mother in years (at the birth of this child)_____
5. What is the highest level of education you have attained?
   Primary =1
   Secondary =2 ☐
   Tertiary =3

6 What is your marital status?

Married =1

Single =2 ☐

Divorced /widowed =3

Other (specify) =4 _____

7 Who is currently employed in the family?

Mother only=1

Father only= 2 ☐

Both =3

None =4

8 Who normally takes care of the child?

Mother/Self =1

Father = 2 ☐

Househelp/ayah =3

Other =4 _____

9 What is the reason for today's visit to the health facility?

Immunisation(specify).....1

Medical care(Specify).....2 ☐

Other(Specify).....3

10 Please indicate the ethnic community where you come from_____

11 What is the size of the house you currently live in?

Single room with shared toilet=1

Single room with own toilet =2 ☐

Double rooms with shared toilet =3

Double rooms or more with own toilet =4

12 Do you have hand wash taps near the toilets?

Yes= 1 ☐

No = 2

13 Would you say that your child is exposed to open sewers and/ drainage systems?

Yes= 1 ☐

No= 2

14 Indicate your source of water

Buy from water vendors =1

Have a tap in the plot =2

Have a tap in the house =3

Other source (specify)_____

15. What is the approximate distance to the nearest health centre?

Within one Kilometre =1

Between 1-3 Kilometres=2

Between 3-5 kilometres =3

More than 5 kilometres =4

16. Do you own health insurance?

Yes, NHIF =1

Yes, Private Health insurance =2

Yes, Other (specify)=3

No, I don't have any =4

17. Who is responsible for making the decision to take the child to hospital incase of sickness?

Myself =1

Myself in consultation with baby's father =2

Father = 3

Others (Child's grandmother, aunt, etc = 4

18. On average, how long does it take for you to take the child to hospital upon noticing sickness symptoms?

One day =1

Two days =2

Three days =3

More than three days=4

19. Apart from taking the child to hospital, which other methods do you regularly use in case of illness?

Consult Traditional Medical practitioner= 1

Use herbal medicine=2

Buy drugs from chemist over the counter=3

Prayers= 4

Others (Specify).....

Please answer these questions about teething in children

20. Do you expect your child to experience any illnesses during teething?

Yes =1

No=2

21. Which of the problems listed below did your older child suffer from during 'teething'? (You may tick all the illnesses that your older child experienced).

Symptom	To a great extend	To some extend	Not at al
High temperature/fever			
Diarrhoea			
Vomiting			
Restlessness			
Drooling of saliva			
Itchiness of gums			
Loss of appetite			
Ear infection			
Sleep disturbance			
constipation			
Swollen gums			
Others (please list)			

22. When your older child suffered from some 'teething-related' problems, what action did you take?

Treatment	Mostly	Sometimes	Not at al
Applied commercially available teething powders/gel			
Applied traditionally prepared home powders			
Took child for incision of gums by traditional healer			
Took child for removal of offending 'plastic teeth' by traditional healer			
Visited and consulted an oral health practitioner			
Visited and consulted the health clinic nurse/personnel			
Visited and consulted a paediatrician			
Other (please specify)			

Please answer the following questions about experiences of your young child.

23. Has you child suffered from diarrhoea in the last two weeks (14 days)?

Yes=1 ☐

No=2

24. If yes to No.25 above, was there any blood in the stools?

Yes=1 ☐

No=2

25. Did you seek any treatment or advice for the diarrhoea?

Yes=1 ☐

No=2

26. If yes to Q. 27 above, please state where treatment was sought _____

27. Did you give any of the following when the child had diarrhoea?

ORS or Oralite=1

Home-made sugar-salt solution=2

Other homemade solutions (specify) _____

28. Has your child had fever in the last two weeks (14 days)?

Yes=1

No=2

29. Did you seek any advice or treatment for the fever?

Yes=1

No=2

30. During the child's experience of fever, did you give them any of these drugs?

Anti-Malarials (Fansidar, Chloroquine, Amodiaquine, Quinine, Coartem) =1

Antibiotics =2

Anti-Pyretics (Aspirin, paracetamol, Ibuprofen, Acetaminophen)=3

31. How long after onset of symptoms was the child started on medication?

Within 1 day =1

Within 2 days =2

Within 3 days =3

More than 3 days=4

General questions about oral health: Please circle your chosen answer

(For questions 36,37 &38 during analysis, 4-5 correct answers will be good knowledge, 3= average, 2 and below will be considered inadequate knowledge)

32. Have you suffered from any of the following diseases or conditions?

Tooth Decay	Yes	No
Bleeding Gums	Yes	No
Brown discolouration of teeth	Yes	No

33. Which of the factors listed below contribute to the development of tooth decay in a young child?

Bacteria passed from parents/carers by sharing of spoons	Yes	No
Introducing fruit juices in baby food	Yes	No
Introducing sugar in baby food	Yes	No
Breast feeding baby for long period	Yes	No
Bottle feeding baby at night with sweetened food	Yes	No

34. Which of the factors listed can help prevent tooth decay in young children

Starting brushing/ cleaning babies teeth as soon as they grow	Yes	No
Making a visit to the dentist at age of one year	Yes	No
Not feeding baby on bottle at night containing sweetened drinks	Yes	No
Not introducing sugar in babies food within the first year	Yes	No
Making a clear baby feeding schedule to avoid frequent snacking	Yes	No

35. What do you think is the cause of brown disclouration of permanent teeth?

Failure to brush teeth properly	Yes	No
Drinking water with high fluoride mineral content at age 1 -6 years	Yes	No
Drinking water with high fluoride mineral content at age 6-10 years	Yes	No
Drinking water with high salt content at 1-6 years	Yes	No
Drinking water with high salt content at age 6-10 years	Yes	No

36. Do you think the development of tooth with permanent brown stains can be prevented?

Yes =1

No =2

☐

END – THANK YOU!

FOMU YA KUKUSANYA MAWAIDHA YA UTAFITI

NAMBARI YA KUJITABULISHA YA MHUSIKA

Tafadhali peana maelezo yafuatayo

Habari za kutabulisha

1. Jinsia: msichana
   mvulana
2. Umri wa mtoto (miezi)_____
3. Umri wa mama (wakati wa kuzaliwa mtoto) miaka_____
4. Uzito wa mtoto wakati wa kuzaliwa (gramu)_____
5. Kiwango cha juu zaidi cha masomo ulicho hitimu …….
   shule ya msingi=1
   shule ya upili=2
   masomo ya taasisi=3
6. Je hali yako ya ndoa ni……
   Nimeolewa=1
   Sijaolewa=2
   Talaka=3
   Mjane=4
7. Ni nani anaye fanya kazi katika familia…….
   Baba=1
   Mama=2
   Baba na mama=3
   Hakuna=4
8. Ni nani humtunza mto huyu kwa kawaida…….
   Mimi=1
   Baba =2
   Aya =3
   Mtu mwingine(taja)=4
9. Je, Sababu ya kumleta mtoto kliniki lea ni nini?
   Kupewa chanjo=1
   Kutibiwa ugonjwa=2
   Sababu Nyingine(taja)=3
10. Je unatoka kwa kabila gani _____

11. Ukubwa wa nyumba unayoishi ndani kwa wakati huu……

chumba kimoja na choo tunayoitumia na majirani=1
chumba kimoja na choo yako pekee yako=2 ☐
vyumba viwili na choo inayotumika na majirani=3
vyumba viwili au zaidi na choo yako pekee yako=4

12. Kuna mfereji ya maji karibu na mahali palipo na choo?

Ndio=1
La=2 ☐

13. Unaweza kusema mtoto wako anacheza karibu na pahali pa mitaru ya maji taka ama maji machafu ya choo?

Ndio=1
La=2 ☐

14. Je wewe hutoa maji ya matumizi wapi……

huyanunua kwa wachuuzi wa maji=1
kuna mfereji kwenye ploti=2 ☐
kuna mfereji nyumbani=3
sehemu nyingine(zitaje)=4

15. Je unaishi umbali gani kutoka kwenye kituo cha afya kilicho karibu?…….

Chini ya kilomita moja=1
Kati ya kilomita 1 na 3=2
kati ya kilomita 3 na 5=3 ☐
zaidi ya kilomita 5=4

16. Je una bima ya afya?……..

Ndio NHIF=1 ☐
Ndio ya kibinafsi=2
Ndio(nyingine)=3
Hapana =4

17. Je, wakati mtoto wako anapougua, ni nani ako na jukumu la kuamua apelekwe kupokea matibabu ?

Mimi (Mama) =1
Mimi nikiwasiliana na babake =2 ☐
Babake =3
Wengine (kama nyanyake, shangazi, na kadhalika) =4

18. Kwa kawaida mtoto wako anapokuwa mgonjwa, wewe huchukua muda gani kabla ya kumpeleka kwa kliniki kwa matibabu?

Muda wa siku moja =1
Muda wa siku mbili =2 ☐
Muda wa siku tatu =3
Muda zaidi ya siku tatu =4

19. Mbali na kumpeleka mtoto wako hospitali, ni njia nyingini gani ambayo kwa kawaida unaitumia wakati mtoto anapokuwa mgonjwa?

Kununua dawa kutoka duka ya madawa =1
Kutumia dawa za kienyeji =2 ☐
Kumpeleka mtoto kwa daktari ambaye hutumia dawa za kienyeji =3
Maombi =4
Njia nyingine (Taja) _____

Maswali yafuatayo yahisiana na kuota meno

20. Jee, kawaida kuna magonjwa unayoyatarajia mtoto wako anapo ota meno?

Ndio=1
La=2 ☐

21. Je, mtoto aliyemtangulia huyu aliugua magonjwa yapi wakati meno zake zikiota? (unaweza kuchugua jibu zaidi ya moja)

Dalili/ugonjwa	Mara nyingi	Kwa kiwango cha kadri	La
Joto jingi mwilini			
Kuhara			
Kutapika			
kutotulia			
Kutokwa na mate nyingi			
Kuwashwa na fizi			
Kupoteza hamu ya chakula			
Kugonjeka masikio			
Kukosa usingizi			
Kukosa kufanya choo kwa urahisi			
Kufura fizi			
Nyingine (Taja)			

22. Je mtoto wako aliyemtangulia huyu alipougua wakati akiota meno ulichukua hatua ipi?

Aina ya Matibabu	Mara nyingi	Wakati mwingine	La
Kuweka dawa ya unga au mafuta inayo uzwa dukani			
Kupaka Dawa ya unga ya kienyeji			
Kupeleka mtoto kukatwa na daktari wa kienyeji			
Kupeleka mtoto kutolewa jino la plastiki na mjuzi wa kitamaduni			
Kutembelea mtaalamu wa afya ya mdomo			
Kutembele muuguzi au afisa katika kituo cha afya			

Kumuona daktari wa watoto			
Nyingine(Taja)			

Maswali yanaofuatia ni kuhusu hali ya motto wako. Tafadhali jibu yote.

23. Mtoto wako amaukuwa na maradhi ya kuhara katika wiki mbili silizopita (siku 14)?
    Ndio=1 ☐
    La =2

Kama jibu lako ni ndio, endelea na swali no. 26. Kama jibu lako ni La endelea na swali na. 30

24. Kama jibu lako ni Ndio kwa swali no. 25, choo cha mtoto kilionyesha kuwa na damu?
    Ndio=1 ☐
    La =2

25. Je, Ulitafuta matibabu au mawaidha yoyote wakati mtoto alishikwa na kuhara?
    Ndio=1 ☐
    La =2

26. Kama jibu lako kwa swali no. 27 ni ndio, je, ulitafuta matibabu au mawaidha katika wapi _____

27. Wakati mtoto alishikwa na kuhara, ulimpea moja wapo ya dawa hizi?
    ORS ama Oralite=1 ☐
    Mchanganyiko wa chumvi na sukari unaotengenezewa nyumbani =2
    Mchanganyiko mwingine wa kutengenezea nyumbani (Elezea)
    _____

28. Mtoto wako amekuwa na joto jingi katika wiki mbili silizopita (siku 14)?
    Ndio=1 ☐
    La =2

29. Ulitafuta matibabu au mawaidha wakati mtoto wako alipokuwa na joto jingi?
    Ndio=1 ☐
    La =2

30. Wakati mtoto wako alipokuwa na joto jingi mwilini, je, ulimpa dawa hizi?
    Dawa za kutibu Malaria =1
    Dawa za antibiotiki =2 ☐
    Dawa za maumivi na kupunguza joto mwilini =3

31. Je, ilichukua muda gani kutoka wakati mtoto alianza kuwa na joto hadi pale ulianza kumpa madawa?

    Muda wa siku moja =1
    Muda wa siku mbili =2 ☐
    Muda wa siku tatu =3
    Zaidi ya siku tatu =4

Maswali yafuatayo yanahusu afya ya meno

32. Umewahi kuugua magonjwa yafuatayo

Kuoza meno	Ndio	La
Kutokwa na damu kwenye ufizi	Ndio	La
Kuota meno ya rangi ya hudhurungi (Brown)	Ndio	La

33. Gani katika mambo yameorodheshwa husababisha kuoza kwa meno ya watoto wachanga?

Bakteria kutoka kwa wazazi/walezi kupitia vyombo vya kulia kama vijiko	Ndio	La
Kuanza kumpa mtoto maji ya matunda yaliyotiwa sukari kwa chakula chake	Ndio	La
Kuanza kumpa mtoto vyakula vilivyoengezewa sukari	Ndio	La
Kumnyonyesha mtoto kwa muda mrefu	Ndio	La
Kumpa mtoto vyakula vilivyotiwa sukari kwa chupa nyakati za usiku anapolala	Ndio	La

34. Gani katika mabo ambayo yameorodheshwa yanaweza saidia kutooza kwa meno ya watoto wachanga?

Kuanza kusafisha menya watoto mara yanapomea.	Ndio	La
Kumtembelea daktari wa meno mtoto akiwa na umri wa mwaka mmoja.	Ndio	La
Kutompa mtoto vyakula vilivyoongezewa sukari kwa kutumia chupa nyakati za usiku.	Ndio	La
Kutompa mtotovyakula vilivyoongezewa sukari kabla hajafikisha umri wa mwaka mmoja.	Ndio	La
Kuwa na mpango maalum wa kumlisha mtoto ili kuepuka kulakula kila wakati.	Ndio	La

35. Kwa maoni yako,ni nini chanzo cha meno ya watu wazima kuwa rangi ya hudhurungi(brown)?

Kutosafisha meno vizuri.	Ndio	La
Kunywa maji yenye madini mengi ya fluoride mtu akiwa kati ya miaka 1 hadi 6	Ndio	La
Kunywa maji yenye madini mengi ya fluoride		

mtu akiwa kati ya miaka 6 hadi 10	Ndio	La
Kunywa maji yenye chumvi mingi mtu akiwa kati ya miaka 1 hadi 6	Ndio	La
Kunywa maji yenye chumvi mingi mtu akiwa kati ya miaka 6 hadi 10	Ndio	La

36. Je,unadhani kumea kwa meno ya watu wazima yenye rangi ya hudhurundi kunaweza zuiwa?

    Ndio=1

    La =2 

Shukrani

APPENDIX 2: Participant Information and Consent Form

EVALUATING THE EFFECT OF HEALTH EDUCATION ON KNOWLEDGE ON TEETHING AND ORAL DISEASES/CONDITIONS AMONG MOTHERS ATTENDING WELL-BABY CLINICS IN NAIROBI.

GENERAL INTRODUCTION TO PARTICIPANT.

My name is Dr. Regina Mutave, a PhD student in the Department of Periodontology/ Community and Preventive Dentistry, School of Dental Sciences, College Of Health Sciences, University of Nairobi. I would like to seek your consent to participate in a study I am undertaking titled "**evaluating the effect of health education on knowledge on teething and oral diseases/ conditions among mothers attending well-baby clinics in Nairobi.***"* aimed at determining the effect of educating mothers with young children using either posters or mobile phone communication.

The study has been authorized by the Kenyatta National Hospital/ University of Nairobi ethics and research committee (**Ref: P677/12/2012**).

The study does not involve any procedures/examination of babies, or the mother. During the study, I will ask questions about your personal details and those of your child such as age, birth weight, place of residence, immunisation status. You will be allocated to one of the two groups to receive health education through either SMS to your mobile phone or posters put up at your local clinic. You will be followed up for six months during which time you will be expected to record your child's experience during teething in a specially designed card. After six months another questionnaire will be used to collect more information from you. The results obtained will inform health care workers and communities about the most effective communication method to educate mothers on various topics in oral health.

No additional cost will be incurred by you; neither will there be any direct payment to you. Participation is voluntary, and you are free to decline or withdraw at any stage without any consequences. The findings from this study may be published in scientific journals. Confidentiality will be maintained for all information provided to me, and any identifiable records will be removed and replaced with anonymised codes. There are no anticipated

direct risks as a result of your participation in this study. Potential benefits to you include the provision of useful health education during your participation in the study.

In case you want to obtain further information on the ethics clearance of this study you can write to: KNH/UON-ERC, email: uonknh_erc@uonbi.ac.ke or call 2726300 ext. 44355

Thank you for considering participation in this study.

Dr. Regina Mutave

P.O Box 2383 -00202 Nairobi. Mobile phone: 0722754481

MAELEZO KWA MHUSIKA NA KIBALI CHA UTAFITI

UCHUNGUZI KIHUSU NAMNA ELIMU HUKUZA UJUZI JUU YA MASWALA YA UOTAJI MEMO KWA WATOTO WACHANGA NA MAGONJWA YA MENO KATIKA KINA MAMA WANAOTUMIA KLINIKI ZA WATOTO JIJINI NAIROBI.

MAELEZO KWA MHUSIKA

Jina langu ni daktari Regina Mutave. Ninasomea masomo ya daktari wa Philosophia katika chuo kikuu cha Nairobi, shule ya Sayansi ya meno. Ningependa kukuomba ushiriki katika utafiti ninaoufanya kuhusu namna masomo hukuza ujuzi juu ya maswada ya uotaji meno kwa watoto wadogo, na magonjwa ya meno katika kina mama wanaotumia kliniki za watoto jijini Nairobi.

Utafiti huu umeidhinishwa na kamati ya maswala ya utafiti yanayohusiana na binadamu ya KNH/UON na nambari yake ni P 677/12/2012.

Huu utafiti hauhitaji upasuaji wa aina yeyote. Nitauliza maswali kuhusiana na wewe na mtoto wako kama umri, uzito, mahali pa kuishi, chanjo na mengineo. Baadaye utawekwa katika moja ya vikundi viwili kupokea masomo aidha kupitia kwa vibandiko kwa kliniki au ujumbe mfupi kutumiwa kwa simu yaka ya rununu. Utapewa kadi ndogo ya kujaza yanayojili kwa mtoto wako kwa miezi sita ifuatayo. Maelezo zaidi itakusanywa baada ya miezi sita. Utafiti huu utasaidia wahudumu wa sekta ya afya kujua njia mwafaka ya kuelimisha watu juu ya maswala haya yanayohusiana na meno.

Hautahitajika kulipa malipo yoyote wala hautalipwa kushiriki. Kushiriki ni jambo la kujitolea na unaweza kukataa, au kukomeza kushiriki wakati wowote ule na haitahadhiri chochote. Matokeo ya huu utafiti yanaweza kuchapishwa kwa vitabu vya sayansi.

Hata hivyo, mimi nitahakikisha maelezo yote unayotoa yamelindwa dhidi ya kutolewa kwa uma. Recodi ninazotumia hazitakuwa na majina ya kutabulika. Nitatumia kinasa sauti kwa idhini yako nah ii recodi pia italindwa na kuaribiwa mara tu utafiti utakapomalizika. Sioni utata wowote unaoweza kutokana na kushiriki kwa huu utafiti. Utapata faida ya kupata maelezo juu ya maswada ya meno.

Ukiwa unataka maelezo zaidi unaweza kufika kitengo cha sayansi cha KNH/UON kwa anwani ifuatayo: KNH/UON – ERC; Barua pepe uonknh_erc@uonbi.ac.ke ama piga nambari ya simu 2726300 kitengo 44355.

Ahsante kwa uamuzi wako wa kushiriki kwa utafiti huu.

Mimi

Daktari Regina Mutave.
S.L.P 2383 -00202, Nairobi. Simu ya rununu: 0722754481

Consent Form

I, …….**.....** Mobile telephone Number …… do hereby give my consent to participate in the study/ participate in a taped conversation aimed at determining 'evaluating the effect of health education on knowledge on teething and oral health diseases among mothers attending well-baby clinics in Nairobi'**.**

I do confirm that the nature of the study has been explained to me by.....…… and at no time have I been coerced to participate in the study.

Signed : …….**.....**(PARENT/GUARDIAN)

I. .....…… hereby confirm that I have explained the nature and purpose of the study to the participant, and I have responded to any questions raised regarding participation in this study.

Signed : …….**.....**(INVESTIGATOR)

KIBALI CHA UTAFITI

Mimi…… Nambari ya simu ……ninakubali kuhusika katika utafiti wa kuchunguza 'Namna masomo kwa wahudumu wa afya yanavypweza kuchangia afya ya watoto wakati wa kuota meno'.

Nina hakikisha yakwamba nimeelezewa kikamilifu kuhusu utafiti huu na .....…….. na hakuna malipo yoyote nimeahidiwa kwa kuhusika katika utafiti huu.

Sahihi ……(MZAZI/MSIMAMIZI)

Mimi, ...……, na hakikisha yakwamba, nimemuelezea mama/msimamizi kikamilifu juu ya utafiti huu.

Sahihi ……...(MTAFITI)

APPENDIX 3: Focus Group Discussion Guide

Research title: Evaluating the effect of health education on knowledge on teething and oral diseases/conditions among mothers attending well-baby clinics in Nairobi.

Baseline

1. Welcome and introductions
2. Discuss the general perception about infant teething. What diseases are commonly associated with teething in babies? How is teething managed? How can teething be better managed? What causes dental caries and fluorosis? How can they be prevented?

End-evaluation

1. Welcome and introductions
2. Discuss the general perception about infant teething. What diseases are commonly associated with teething in babies? How is teething managed? How can teething be better managed? What causes dental caries and fluorosis? How can they be prevented?
3. Discuss in broad terms: What are the perceptions about the use of posters and/ or mobile phones for passing health messages?
4. Discuss challenges experienced with:
    a. posters
    b. mobile phones
5. What lessons have we learnt?
6. What is the way forward for posters and mobile phone use in health related education exercises?

END – THANK YOU

APPENDIX 4: Data capture card

Participant Identification_____Start Date _____

Gender of child_____ Age at start_____

Immunization History

Up to date with vaccination schedule Yes No

Weight record

Birth weight Kg	
Last clinic attendance age (Months)	
Weight at last clinic attendance (Kg)	

Feeding practices

Exclusively breastfed to 6 months Yes No

Food introduction for baby if not exclusively breastfed.

Age of baby (Months)	Food started	Did baby have hard or loose stools Yes or No

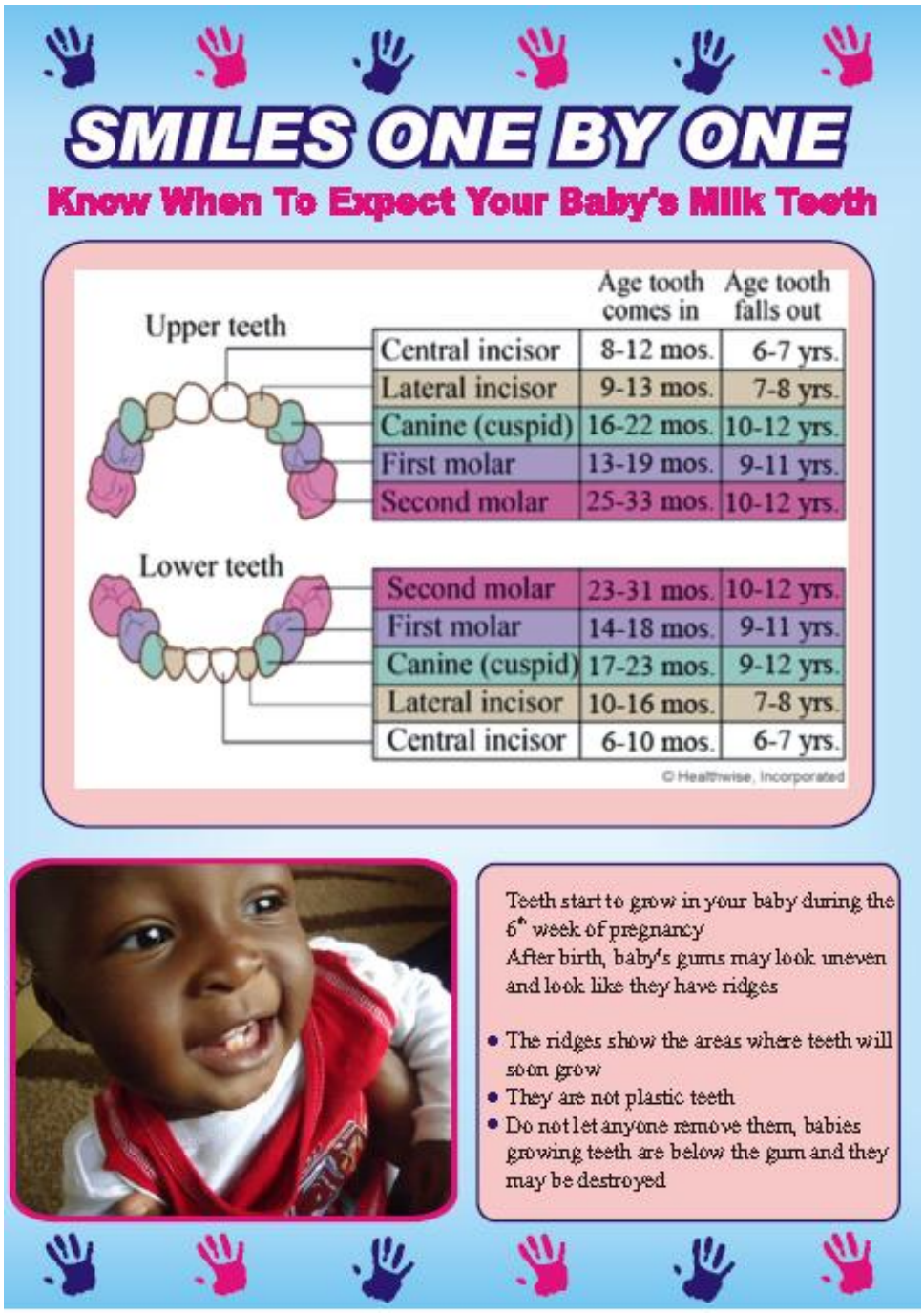
Date/ Month of noticing first tooth _____

APPENDIX 5: List of Level 3 Health Facilities in Nairobi

Facility Cc	Facility Name	Division	KEPH Level	Open 24 H	Open Wee	Beds
12935	Embakasi Health Centre	Embakasi	Level 3	0	0	0
13015	Kayole I Health Centre	Embakasi	Level 3	0	0	24
13016	Kayole II Sub-District Hospital	Embakasi	Level 3	1	1	24
13056	Makadara Health Centre	Makadara	Level 3	1	1	20
13240	Umoja Health Centre	Embakasi	Level 3	0	0	0
12930	Eastleigh Health Centre	Pumwani	Level 3	0	0	24
12997	Kahawa West Health Centre	Kasarani	Level 3	0	0	24
13077	Mathare North Health Centre	Kasarani	Level 3	0	0	24
13122	Ngara Health centre(City Counc	Central	Level 3	1	1	24
13041	Langata Health Centre	Lang'ata	Level 3	0	0	20
13249	Waithaka Health Centre	Dagoretti	Level 3	1	1	10
13258	Westlands Health Centre	Parklands	Level 3	1	1	20
12962	GSU Training School	Embakasi	Level 3	0	0	0
12996	Kahawa Garrison Health Centre	Kasarani	Level 3	0	0	
13127	NSIS Health Centre (Ruaraka)	Kasarani	Level 3	0	0	
13153	PSTC Health Centre	Kasarani	Level 3	0	0	
13160	Redemeed Health Centre	Kasarani	Level 3	0	0	

Source: Ministry of Public Health and Sanitation – Kenya Health Facilities 2009.

APPENDIX 6: Samples of health education materials



ENEZA TABASAMU

Jua Wakati Wa Kutarajia Kuota Kwa Meno Ya Mtoto Wako

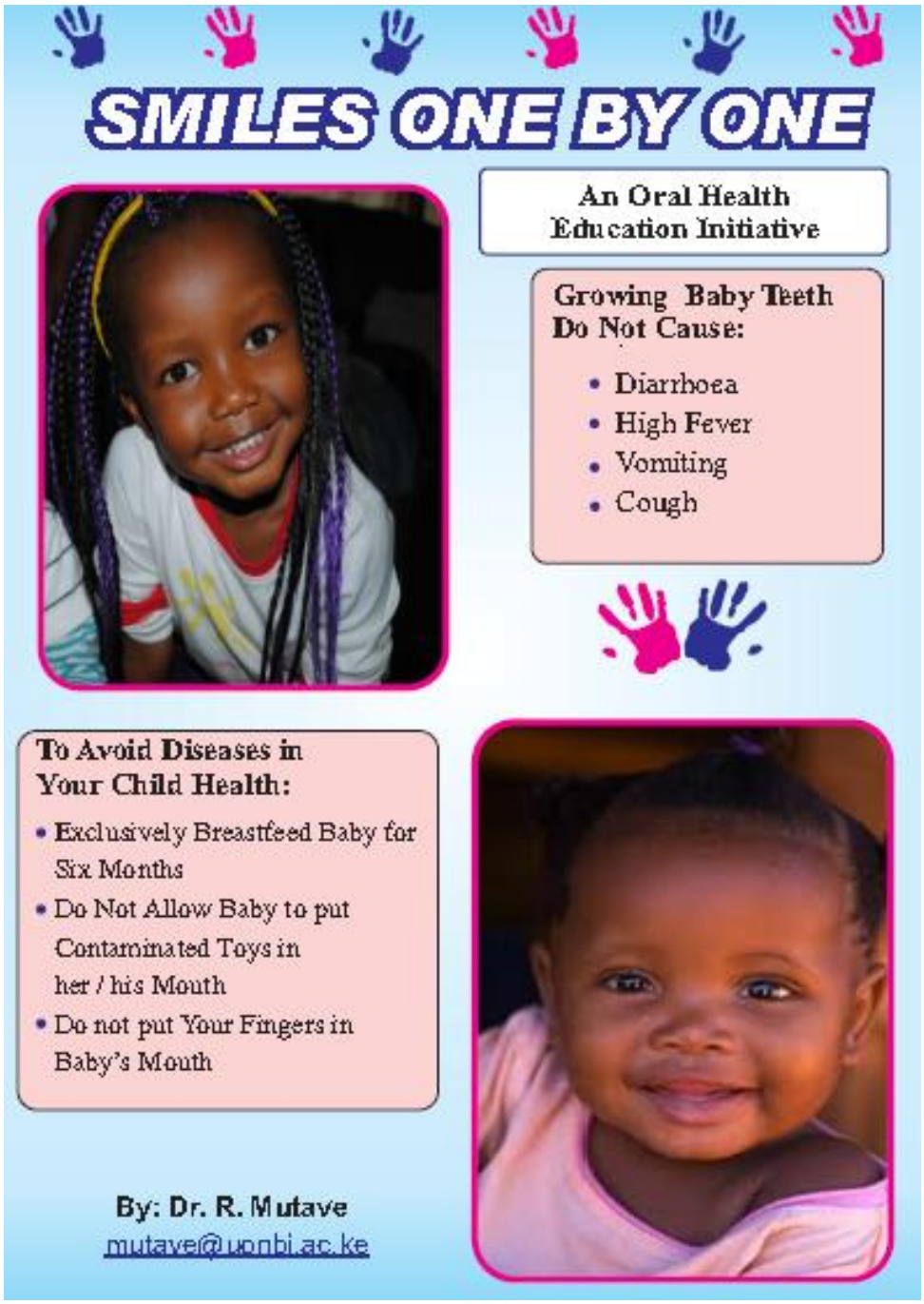
	Age tooth comes in	Age tooth falls out
Central incisor	8-12 mos.	6-7 yrs.
Lateral incisor	9-13 mos.	7-8 yrs.
Canine (cuspid)	16-22 mos.	10-12 yrs.
First molar	13-19 mos.	9-11 yrs.
Second molar	25-33 mos.	10-12 yrs.

Second molar	23-31 mos.	10-12 yrs.
First molar	14-18 mos.	9-11 yrs.
Canine (cuspid)	17-23 mos.	9-12 yrs.
Lateral incisor	10-16 mos.	7-8 yrs.
Central incisor	6-10 mos.	6-7 yrs.

Meno huanza kukua kwa mtoto wako akiwa wiki sita kwa mimba ya mama na na huwa zimekomaa kabla ya mtoto kuzaliwa

Baada ya kuzaliwa, gums za mtoto huwa haziko laini ni kama ziko na ridges

- Kwa ridges dipo meno huanzia kumea
- Haya si meno ya bandia au plastic
- Usiwache mtu yeyote ayatoe. Kumea meno ya watoto huwa chini ya gums na huweza kuaribiwa


SMILES ONE BY ONE
An Oral Health Education Initiative
Growing Baby Teeth Do Not Cause:
• Diarrhoea
• High Fever
• Vomiting
• Cough
To Avoid Diseases in Your Child Health:
• Exclusively Breastfeed Baby for Six Months
• Do Not Allow Baby to put Contaminated Toys in her / his Mouth
• Do not put Your Fingers in Baby's Mouth
By: Dr. R. Mutave
mutave@uonbi.ac.ke

SMILES ONE BY ONE

Caring for baby's teeth

Does your child have teeth?

You can care for them to avoid diseases like tooth decay and gum infections by:

- Cleaning the gums twice daily using a clean, soft cloth until your baby gets teeth.
- Use a soft toothbrush made for children with a smear of toothpaste once teeth erupt.
- Progress to pea-size toothpaste as soon as baby learns to spit after brushing (Usually 2 -3 years of age)

Clean gums with soft wet cloth, when teeth emerge use soft baby-tooth brush

Use a smear of tooth paste with baby-tooth brush to clean baby's teeth(1-2 Years)

Use toothpaste the size of rice-grain for baby's teeth when all teeth are erupted (2-3 Years)

Use pea-size toothpaste when baby can take instructions to spit (Over 3 years)

Dr. R. Mutave
Mutave@uonbi.ac.ke

SMILES ONE BY ONE

Dental caries in children

Your baby's teeth can develop tooth decay. Tooth decay causes serious pain, and the baby may avoid eating some foods.

Treatment of tooth decay for children is expensive, and may require the child to be admitted in hospital to manage.

You can prevent tooth decay by:

- Feeding your child on healthy foods and keeping to a clear feeding timetable. Avoid snacks in between meals, when necessary give whole fruits and/ or cereals
- Do not let baby go to bed with bottle filled with sweetened juices
- Bacteria responsible for tooth decay can be passed to the baby through sharing spoons, tasting baby's food, allowing baby to play with other people's toothbrushes, avoid all these.
- Clean your baby's teeth daily

By: Dr. R. Mutave
mutave@uonbi.ac.ke

SMILES ONE BY ONE

Prevention of dental fluorosis

Smiles on

Have you seen people with different types of brown teeth?

This is a condition known as dental fluorosis.

Dental fluorosis results from consumption of water with high level of fluoride (>1mg/l) during tooth formation (between 1-7 years)

You can prevent dental fluorosis for your child by ensuring you know the fluoride content of your water supply (Laboratories do this)

If your water supply has high levels of fluoride, use alternative water source, or consider defluoridation of your domestic water.

Instruct your child to spit after brushing and store tooth pastes away from children's reach, as they contain fluoride.

Dr. R. Mutave
Mutave@uonbi.ac.ke

Short Text Message samples

1. Mama mtoto: Meno ya mtoto mchanga yakiota hayawezi kusababisha kuhara, kutapika, joto jingi mwilini au kukohoa. Mpeleke mtoto kwa Kliniki ukiona dalili hizi
2. Mama, ili kuepusha mtoto wako na magonjwa kama kuhara na kutapika, hakikisha kumnyonyesha bila vyakula vingine hadi miezi sita. Pia, usiwache mtoto ashike au kucheza na vitu vichafu. Usikubali mtu kuingiza vidole vyake kwa mdomo wa mtoto bila kunawa mikono, hata wewe mwenyewe.
3. meno ya mtoto wako ilianza kuumbika wiki ya sita akiwa tumboni mwa mama. Wakati wa kuzaliwa, ufizi (gums) zake huonekana kuwa na matuta, haziko laini kwa sababu meno za maziwa ziko chini yake. Hizi meno zitaanza kuchipuka kuanzia miezi 4-6, na 6-8 kwa meno za mbele za chini na juu mtawalia.
4. Meno ya mtoto yakianza kuota , ufizi (gum) wake waweza kuonekana kama wenye matuta, na weupe ndani yake. Mtoto anaweza kutokwa na mate kwa wingi, na kuhisi kiwasho. Atakuwa na tabia ya kitia vitu mdomoni ili kujikuna.Hakikisha mahali pa kuchezea ni pasafi, mpe motto vipuzi (toys) safi kuchezea
5. Wakati meno za mtoto wako zinapoota, unaweza kumweka kwa afya jema kwa kumpatia vipuzi (toys) visafi kuchezea, hasa vile vya plastiki . Epukana na dawa za kupaka au kutia kinywani maana zinaweza kumletea madhara mtoto wako. Ulizia usaidizi kwa muhudumu wa afya katika kliniki.
6. Tunza meno ya mtoto wako yasipate matundu. Safisha ufizi wake ukitumia kitambaa laini mara mbili kwa siku hadi meno yaote. Tumia mswaki laini wa watoto na mpako (smear) wa dawa ya meno kuyasafisha yakiota. Ongezea dawa hadi kiwango cha mfano wa ndengu mara tu mtoto anapojua kutema mkipiga mswaki.
7. Viini vinavyosababisha matundu kwa meno ya mtoto vyaweza kuambukuzwa kupitia kwa mate akitumia vyombo au vijiko vilivyotumiwa na wengine. Mpe mtoto wako lishe kamili, epukana na vinyaji vilivyoongezewa sukari. Panga masaa ya chakula kwa mtoto, mpe matunda badala ya snaki zenye sukari.
8. Je, umeona watoto wenye meno ya rangi ya hudhurungi (brown)?Hii husababishwa na kunywa maji yenye madini mengi ya fluoride, au utumizi mbaya wa dawa ya meno mtoto akiwa na umri wa mwaka moja hadi sita. Hakikisha wajua kiwango cha fluoride cha maji unayotumia.kuna mahabara za kupima maji nchini