

## Oral Hygiene Knowledge and Practice Among Dinka and Nuer from Sudan to the U.S.

Mary S. Willis, PhD; Rachel M. Bothun, BS

### Introduction

Nearly 2.5 million refugees entered the U.S. between 1975 and 2001, however, few originated from Africa (5%) compared to East Asia (52%) and the USSR and Europe (29%).<sup>1</sup> Although refugees from Africa's largest country, Sudan, began to flee as the civil war escalated in the 1980s, the majority arrived to the U.S. during 2000. Individuals and families were resettled among 400 U.S. resettlement sites, including 3 within Nebraska.<sup>1</sup> Despite a low number of primary settlements to the state – just 208 refugees from Sudan had been officially resettled by 2001, the Sudanese refugee population has steadily increased in Nebraska.<sup>1</sup>

A health survey conducted in the city of Lincoln during 2003 revealed that nearly one-third of the Sudanese refugee respondents had not visited a dental professional since their arrival to the U.S.<sup>2</sup> This is not surprising given that refugees are not automatically provided a dental screening as part of resettlement assistance, no matter where they originate and how they survived. Still, when asked about the kinds of dental treatments they might wish to have, refugee survey respondents did not list conditions often of concern to Western populations. Instead, replacement of teeth removed during a childhood ritual in Sudan was considered the most important health priority for 2 of 14 ethnic groups surveyed.<sup>3</sup> Subsequently, a dental project was designed to address this perceived need, but also to assess dental health status, provide prophylaxis and treatment and collect data on oral hygiene knowledge to be used as a basis for oral hygiene training.

### Abstract

**Purpose:** The purpose of this study was to determine knowledge and use of oral hygiene methods for refugees from Sudan now living in the U.S. prior to conducting elective implant surgery.

**Methods:** The sample included 34 adults of the Dinka or Nuer tribes who participated in 1 or more phases of a project to restore 6 lower anterior teeth with implants. An English language survey was administered by an interpreter for whom Dinka or Nuer was a first language. Each interpreter underwent an elective restorative procedure prior to acting as an interpreter. The project survey covered demographics, traditional and current oral hygiene practices, perceived aesthetics and dental visits since arrival to the U.S.

**Results:** Data analyses revealed that male participants outnumbered female participants, and all were under 30 years of age. Traditional dental practices paralleled Western oral hygiene methods and current oral hygiene involved 1 brushing event per day and prevalent toothpick use. Most participants wished to have all teeth in place, bright white coloration and a maxillary diastema. Few had visited a U.S. dental facility more than once, and none were using biannual checkups to maintain dental health. All participants required detailed oral hygiene education to fill the knowledge gap between traditional and U.S. systems and to maintain their newly restored dental health status.

**Conclusion:** Refugees arriving to the U.S. from a non-Western country may be in great need of Western oral hygiene training to create or maintain a high dental health status. Resettlement programs should include dental screening, treatment and oral hygiene training to prevent further decline in dental health status.

**Keywords:** Oral Hygiene Knowledge, African Refugees, Oral Health Beliefs, Traditional Dental Practice, Refugee Dental Care

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Investigate the effectiveness of oral self-care behaviors that prevent or reduce oral diseases among all age, social and cultural groups.

One might anticipate that refugees from war-torn countries, who have no less than 3 years in refugee camps with minimal nutrition and health care, would arrive with compromised oral and general health status. Because the oral health condition is an important indicator of overall health status, immediate dental assessment could provide a window into other chronic or urgent health needs. But as with low income populations nationwide,

refugees have limited access to dental care, and Nebraska is no exception. For example, in Lincoln, a city with a population of approximately 250,000 that also serves as a refugee resettlement location, there are only 2 facilities (a dental college and a federally-funded health clinic) which could provide dental services on a sliding fee scale, and just 1 free mobile dental clinic with limited operating hours. For those individuals and families with Medicaid, dental health choice is equally limited. Few dental clinics accept Medicaid as a form of payment and public clinics are often booked months in advance. Consequently, the authors used a community request for tooth replacement as an opportunity to provide free dental assessment, treatment and oral hygiene training to this vulnerable population.

## Sudanese Refugees

The Sudanese refugees in this study, the Dinka and the Nuer of Sudan, are described as "Nilotic" peoples because they originate from cities and regions on both sides of the Upper Nile River and its main tributaries. Despite a common origin and continuous contact that has included inter-marriage, they maintain distinct ethnic identities, geographic land-bases and mostly oral languages.<sup>4,5</sup> However, both embrace agricultural-pastoral-piscatorial economies, emphasize cattle and traditionally rely upon extensive kinship systems to ensure resource sharing and nutritional support.<sup>6-8</sup> Because both the Dinka and Nuer utilize limited technology and retain the knowledge to produce nearly everything by hand, the learning curve once in the U.S. is great. Moreover, few aspects of a traditional life in Sudan are of value in the U.S., and once significant life essentials (cattle and kin) are no longer accessible. Many required elements of life, such as anterior tooth extraction, no longer have meaning in the U.S., despite their significance for generations of Dinka and Nuer. In fact, removal of the lower anterior teeth was once mandatory for both boys and girls at the time of permanent eruption, and was linked to enhanced sound production, an attractive appearance, preparation for marriage and tribal identity.<sup>4-6</sup> The ritual may have originated when lockjaw or tetanus rates were high – an open space in the lower jaw would allow the tongue to be depressed and liquids to be inserted.<sup>4-6</sup> Now in the U.S., such a gap is no longer an asset but a source of discomfort.

Based upon the 2003 Nebraska health assessment, the Sudanese refugee population now living in the state is relatively young, less than 29 years, and men outnumber women by 2 to 1.<sup>2</sup> Males of the Dinka tribe in Lancaster County often arrived as "The Lost Boys of Sudan," a population sepa-

rated from their families during childhood and entering the U.S. as unaccompanied minors. Other Nebraska assessment descriptors include under educated and low income. Fifty percent of refugees surveyed had not completed a Western K-12 education, and many had not been educated beyond 8th grade.<sup>2</sup>

The authors were unable to locate a single study of dental practices in regions or countries where traditional systems are still in place. By contrast, the available literature on Western dentistry and non-Western populations focuses on the introduction of Western dental systems to a developing country, or on refugee and immigrant populations receiving Western dental care after resettlement to countries such as the U.S. or Australia. This lack of knowledge concerning traditional, non-Western dental systems means that effective oral hygiene training cannot be designed for newly arriving populations – the gap which needs to be filled remains undefined for each unique population. Also, in failing to understand how populations worldwide have maintained high dental health status in the past, valuable tools for enhancing dental health worldwide may have been overlooked.

The overall need for refugee dental care has been assessed in a limited number of studies.<sup>9-13</sup> Although the few assessments that have been conducted demonstrate a need for dental treatment and hygiene among newly arriving populations, there appears to be differences between sites and circumstances of origin. For example, refugee children from Eastern Europe had more caries experiences and more untreated caries compared to African refugee children.<sup>9</sup> This was true despite the fact that African children were less likely to have ever visited a dental professional. Multiple factors for higher dental health status among African refugee children may include traditional diets low in sugar and carbohydrates, effective traditional dental practices and genetic protection.<sup>9</sup> Historically, increased caries prevalence has been tied to availability and amount of refined sugar consumed.<sup>14</sup> African refugee populations have had limited access to sweeteners of any kind while living in camps, and do not regularly consume sugar as part of a traditional diet. However, once in the U.S., African refugee children have constant exposure to sugar-rich food products, and consequently might be expected to experience increased caries rates.<sup>15</sup> Given the limited dental health services offered to refugees, and the limited research conducted on newly arriving populations, studies to confirm dental health needs are critical for those who have endured compromised health conditions prior to arrival in the U.S.

## Methods and Materials

A descriptive questionnaire research design was utilized. The primary investigator drafted the questionnaire in English. Two of the project participants, native speakers of Dinka and Nuer, also worked as interpreters throughout the project. Dinka and Nuer are mostly oral languages and few of the participants could read their first language.<sup>16</sup> Also, software to print Dinka and Nuer is limited in the U.S. Thus, for each interview, the primary investigator read the question in English and the native speaker translated the question into the participant's primary language. Participants then responded in their primary language and the interpreter translated the response into English. The Institutional Review Board of the University of Nebraska–Lincoln reviewed and approved the survey instrument in December 2004 with annual renewals through 2007 (IRB #200411101). For those participants that could not read nor understand English, the interpreter translated the consent form into the first language and read the consent form to each individual. Participants were selected from a list of Dinka and Nuer refugees living in Nebraska who had expressed interest in dental restoration for teeth removed during a childhood ritual. All had previously contacted the first author, an anthropologist who began working with the Sudanese refugee population after Nebraska's Health and Human Services' Office of Minority Health asked for assistance with a new population arriving to the U.S. from Africa. Focus group discussions, health surveys and community events resulted in the selection of dental restoration as a top health priority by the majority of Dinka and Nuer who participated in these events. Long-term relationships were established by offering informal social service assistance, advice and mentoring while funds were raised and resources located to cover costs of refugee dental and general support services. A list of those wishing to undergo restoration was compiled, starting in 2000. From this list, 34 adults of the Dinka and Nuer tribes of Sudan were selected and interviewed as potential participants between March 28 and 30, 2005 and between January 21 and 23, 2006. No identifying markers were included in the questionnaire – it was completely anonymous. Interviews lasted 1 or more hours for each participant and compensation for transportation was provided at the end of the interview session.

The questionnaire was divided into 7 sections:

1. Demographics
2. Traditional dental removal
3. Traditional oral hygiene practice
4. Diet
5. Dental aesthetics
6. Current oral hygiene
7. Western dental visits, procedures and treatment

Sections 2 and 4 were previously reported in journal publications.<sup>15,17</sup> All other questions were designed open-ended with some including multiple prompts or examples. The demographic information section included gender, education, ethnic group, length of residency in the U.S. and dental coverage status. The last section of the questionnaire asked participants to indicate how many visits had been made to a dental facility since arriving in the U.S. and what kind of procedures or treatment they had received in each of these visits.

Prior to survey implementation, 3 men, all native speakers of Nuer and Dinka, were administered the survey and were the first to undergo the dental implant procedure. This allowed interpreters to understand all aspects of the project prior to the time that they interpreted questionnaire materials and procedural guidelines for each individual participant. Although 34 individuals from the Dinka or Nuer tribes participated in the questionnaire portion of the project, only 26 completed the project and received implants to replace the 6 missing anterior teeth.

Inclusion criteria included male or female refugees from Sudan above 19 years in age and missing the mandibular anterior dentition, 22 through 27, removed during childhood. Exclusion criteria included ability to attend all appointments and good bone and overall dental health. This participant population represents a very small portion of all Dinka and Nuer refugees from Sudan in Nebraska, however, the exact number of each ethnic group is unknown due to multiple migrations within the U.S. Still, population estimates are in the thousands, making Nebraska's Sudanese refugee population one of the largest such communities now in the U.S. All participants were interviewed in a University of Nebraska–Lincoln laboratory. Data from the questionnaires were manually entered into a Microsoft Excel spreadsheet. Descriptive statistics were used due to sample size limitations.

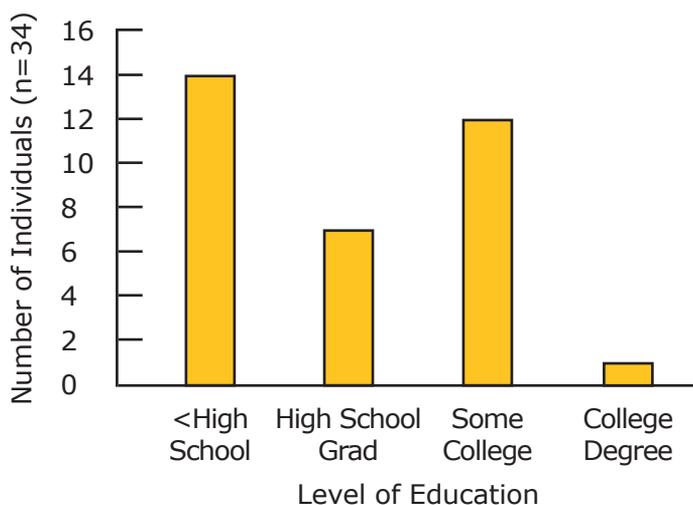
## Results

A total of 34 questionnaires were collected, with 2 participants not completing the entire study, and therefore not answering all portions of the questionnaire. Thus, the responses of 32 participants form the basis for most of the study results.

### Demographics

The Sudanese refugees in this study are from the 2 largest ethnic groups of Southern Sudan – the Dinka and the Nuer. Nine of the participants (26%) were female and all were of the Nuer ethnic group. Twenty-five (74%) of the study par-

Figure 1: Education Levels



Participants were male. Of these, fifteen (44%) were of the Dinka ethnic group, and the remaining ten (29%) were Nuer. Thus, slightly more than half (56%) were Nuer. The mean age of participants was 29.3 years, with a range of 20 to 49. At the time of the study, 14 of the participants (41%) had not completed high school, while 19 had earned a high school diploma and/or a GED certificate or had completed some college (Figure 1). None of the women in this study had been able to complete high school. Twenty-three participants (70%) were employed, 6 had work-related dental insurance, 6 were covered by Medicaid and 20 (59%) had no insurance coverage (Figure 2). Ten participants (30%) arrived in the U.S. between 1993 and 1996 (17 to 14 years ago), 5 (15%) arrived between 1997 and 2000 (10 to 13 years ago) and 18 (55%) came to the U.S. in 2001. One female participant did not indicate her year of arrival to the U.S.

### Traditional Dental Practice

Traditional dental hygiene practices of the Dinka and Nuer, as reported in this study, consisted of 3 primary methods (Tables I, II). The first is similar to brushing with toothpaste in the U.S. and makes use of the ash taken from cow dung fires. The participants reported that ash could be applied to the teeth directly or water could be mixed to make a paste. The index finger is used to brush and apply this baking soda-like cleaner. Several participants reported a salty taste to the ash, and that this cleaning method resulted in very white teeth. Only 3 (20%) of the Lost Boys of Sudan, all of whom are Dinka, reported using ash – most left home quite young and spent the majority of their lives in refugee camps (Table I). This limited time in Sudan would have prevented them from learning or practicing the traditional oral hygiene meth-

Figure 2: Source of Dental Care Coverage for Participants

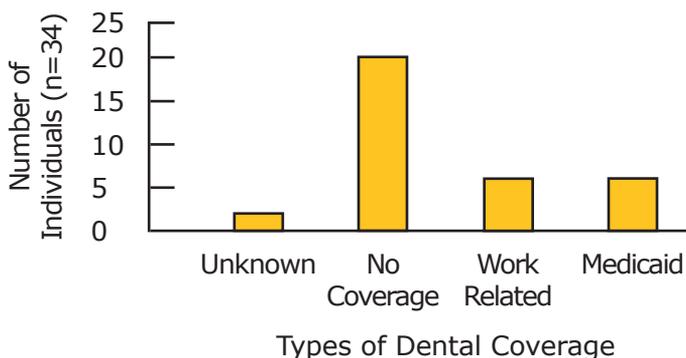


Table I: Traditional Hygiene Methods: Dinka Lost Boys

Method of Cleaning	n=15	Percent
Cow-Dung Ash	3	20
Ash Use Unknown	12	80
Stick use/day: 1x	3	20
2x	6	40
3x+	6	40
Reeds and Grasses	7	47

Table II: Traditional Hygiene Methods: Nuer in Sudan

Method of Cleaning	n=19	Percent
Cow-Dung Ash	15	79
Ash Use Unknown	4	21
Stick use/day: 1x	4	21
2x	10	53
3x+	02	11
Reeds and Grasses	10	53

ods of their ethnic group. By contrast, 79% of the Nuer participants reported using ash at least once per day, often in conjunction with other cleaning methods (Table II).

The second method combines brushing and a kind of inter-dental cleansing through use of the "toothbrush tree," a method that involves the use of a stick or branch of *Salvadora persica* (*miswak* in Arabic, *achuil* in Dinka and *chuil* in Nuer) (Tables I, II, Figures 3, 4). The stick is applied to the teeth and a scrubbing, circular motion is used until the stick itself splays. The ends then allow the teeth to be cleaned and scrubbed between the teeth and gums. All of the participants reported daily use of this method. Among the Dinka Lost Boys, 3 (20%) reported use of the toothbrush tree once per day, and twelve (80%) reported use 2 to

Figure 3: 'Toothbrush Tree' Use by Dinka Lost Boys of Sudan

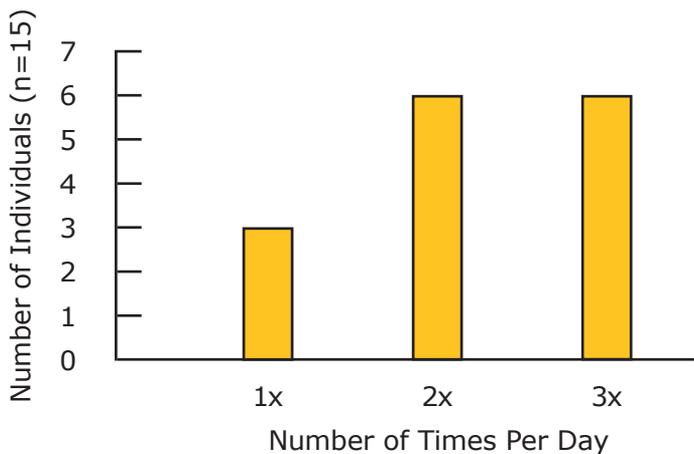
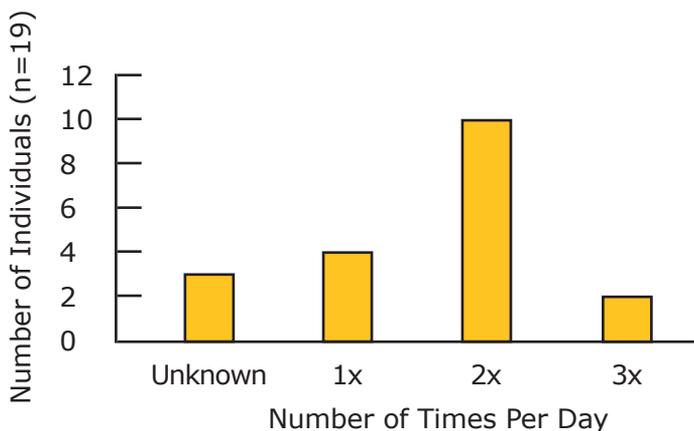


Figure 4: 'Toothbrush Tree' Use by Nuer



3 times a day. By contrast, 4 Nuer reported using the toothbrush tree once per day, 10 (58.8%) reported using the toothbrush tree twice per day, 2 reported application of the sticks 3 times per day and 2 Nuer participants did not specify the number of times per day that the toothbrush tree was used (Figures 3, 4).

The final method involves something similar to using dental floss. Reeds and grasses are used to clean between the teeth in the same manner that dental floss is used. This method is commonly employed after one consumes meat, as is method 2 above. Method 3, the inter-dental cleaning using reeds or grass, was used by half of all participants at least once a day. Among the Dinka Lost Boys, 7 (46.6%) employed the use of reeds and grasses, while 10 of 19 Nuer (53%) made use of this method (Tables I, II).

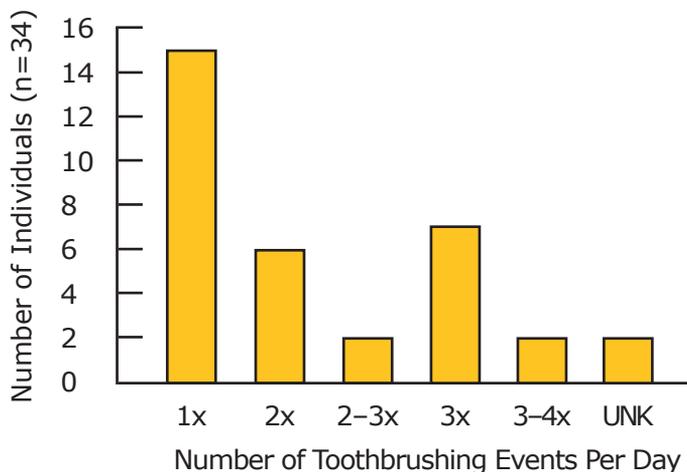
### Current Oral Hygiene Practices

Participants were asked about current oral hygiene practices used since arrival to the U.S. All reported brushing their teeth daily. Fifteen (44%)

Table III: Oral Hygiene Practices in U.S.

Hygiene Method	n=34	Percent
Toothbrushing Per Day		
1x	15	44
2x	06	18
2-3x	02	06
3x	07	21
3-4x	02	06
Unknown	02	06
Toothpicks	24	71
Floss	03	09

Figure 5: Frequency of Toothbrush Use



reported brushing just once per day, 8 reported 2 or more times per day, while 9 reported brushing 3 or more times per day (Table III, Figure 5). Although they affirmed use of a toothbrush as an oral hygiene method, 2 participants did not specify the number of times they brushed each day. The majority of participants (71%) reported use of toothpicks for cleaning between teeth. Toothpicks were commonly used to remove meat and other dense foods. Just 9% of participants reported use of dental floss prior to implant surgery.

All but 5 participants reported the use of toothpaste while brushing. Twenty-nine (85%) could name 1 or more brands of toothpaste. Four different types of toothpaste commonly available in the U.S. were listed by respondents when asked about their brushing habits. A toothpaste containing Triclosan was the most commonly named brand of toothpaste (59%). Most participants suggested they had used this brand or knew of this brand in Africa. In a few cases, participants could name a toothpaste type but did not cite the frequency of toothbrush use.

## Perceived Aesthetics

When asked to list important dental characteristics, more than half (59%) suggested that having all of one's teeth is a very important attribute (Figure 6). While traditional practices for both ethnic groups in Sudan have historically involved the extraction of 6 lower anterior teeth, their attitudes towards dental aesthetics changed with relocation to the U.S. Most of the individuals surveyed stated they wanted all of their teeth for a variety of reasons. For example, one individual stated that he wished to have all of his teeth in place because "they are useful for eating." Another participant stated that teeth "are natural, and you should have what you're born with." Several individuals mentioned they wanted their teeth for the sake of living and adapting to life in the U.S. and that they "don't want to be different" from others in the U.S.

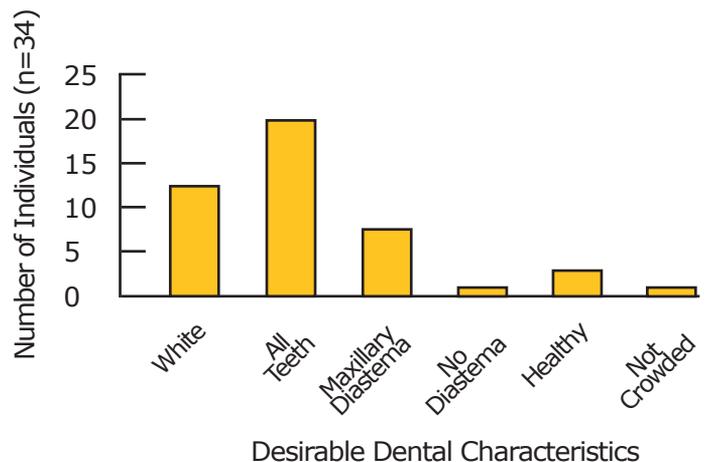
The next important trait was to have white or very white teeth (38%), something suggested by many participants as less common in the U.S., particularly when using U.S. oral hygiene methods (i.e. toothbrushes and toothpaste). Seven participants noted that a maxillary diastema was an important dental attribute, which they did not wish to have changed, despite the contrast to typical U.S. dental aesthetics. One person noted that they did not wish to have a maxillary diastema, while another respondent suggested that the teeth should not be crowded. Three participants simply noted that they wanted their teeth to be healthy.

## Dental visits, Procedures, and Treatment since Arriving in the U.S.

While the year of arrival to the U.S. spanned 8 years (1993 to 2001), 56% of respondents had visited a U.S. dental facility no more than once prior to the onset of the dental restoration project (Figure 7). Twelve percent had made 1 or 2 dental visits, while 6 respondents (18%) had completed 2 or 3 dental visits since arrival. Two participants had never visited a dentist, while 4 (12%) had visited a dental facility 3 or more times. None of the participants had been given a complete dental screening at the time of arrival or reported visiting a dentist for a biannual dental check-up.

Eight participants (24%) had untreated decay at the time of their initial exam in 2005. Furthermore, all study participants were missing 4 to 8 anterior teeth as the study began. These anterior teeth had been removed just after permanent eruption during a childhood ritual in Sudan. In addition, 14 (41%) were missing other teeth, on

Figure 6: Perceived Aesthetics by Refugee Participants



average 2.4 with a range of 1 to 7. Most of these missing teeth were molars. Based on patient histories, the majority of participants with additional missing teeth had to have them pulled once in the U.S. due to decay and/or extensive periodontal disease and bone loss. Five participants had an average of 5 filled teeth, with a range of 1 to 9 fillings.

Regardless of the number of times a participant had visited the dentist since arrival to the U.S., all were in need of a routine prophylaxis to create a baseline of oral health. Six respondents (18%) required debridement or root scaling and planing, 9 (26%) were diagnosed with various levels of periodontal disease and 10 (29%) required 1 or more teeth to be filled or crowned, while 9 individuals required extractions for carious teeth or for third molars which could not be fully functional. Four individuals (13%) required root canals for the maxillary incisors.

## Discussion

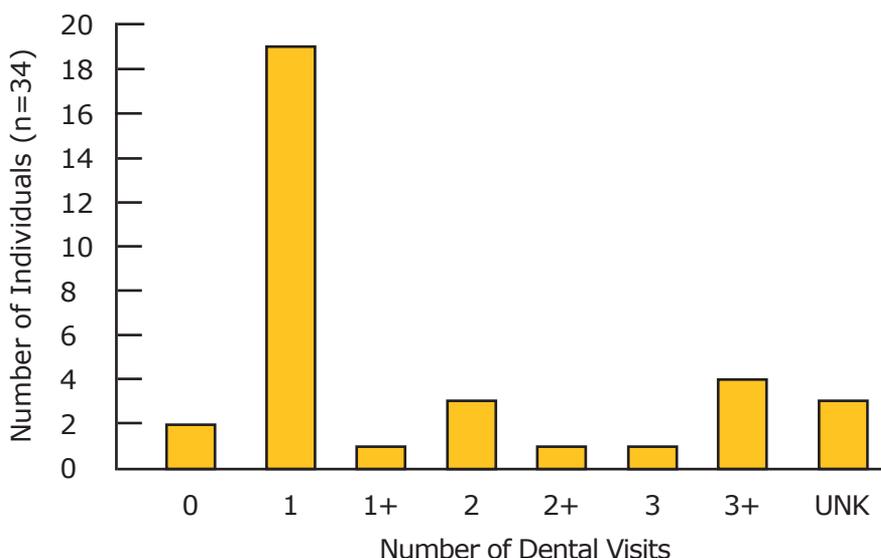
The Sudanese refugees in this study, the Dinka and Nuer, are undoubtedly a small subset of the refugee population from Sudan currently living in Nebraska. However, demographic data parallels results obtained in a recent general health survey of refugees from Sudan now living in the state.<sup>2</sup> For example, as in the general health survey, this study also demonstrates that Dinka and Nuer males outnumber females 2 to 1, the refugee population is relatively young in age (<30) and males, but not females, had earned a GED or a high school diploma. Similarly, although 68% of the population in this study was employed, most reported income levels at or below the U.S. Federal Poverty Guidelines, a finding documented in the general health study.<sup>2</sup> Furthermore, most do not have any

form of dental health coverage, despite employment. Thus, while this relatively young population should be establishing a good oral health baseline, limited resources will prevent them from doing so in a dental health care system which requires substantial investment throughout the year.

The study population spent no less than 3 years in a refugee camp before arrival, and had been living in the U.S. for 5 to 10 years before the project began.<sup>2</sup> Thus, the refugee population in this sample had limited access to any oral hygiene care or dental treatment while in refugee camps, and minimal access to Western oral hygiene education, treatment and dental coverage since coming to the U.S. At present, domestic refugee resettlement programs do not routinely provide dental screenings, treatments or hygiene education for any refugee population, regardless of potential need and experience with Western health systems. This means that refugee populations in the U.S. are likely to have dental care needs that go untreated for an extended period of time, requiring invasive treatment and more extensive costs in emergency care facilities.

While utilizing traditional health systems in Africa, the Dinka and Nuer in this study reported the use of oral hygiene methods which parallel each of the Western oral hygiene practices (i.e. brushing, flossing and toothpaste use). However, the materials associated with Dinka and Nuer oral hygiene practices are vastly different from those available in the U.S. In Africa, they could be easily obtained in the natural environment without cost. Sticks of approximately 8 inches in length are cut from the evergreen shrub or small tree, *Salvadora persica*, and one end is forcefully rubbed against the teeth until it splays, creating a bristled brush.<sup>18</sup> This method was reported to be the most frequently used hygiene tool among participants while living in Africa. Given the fact that *Salvadora persica* has inhibitory effects on multiple strains of caries-inducing aerobic bacteria, such as *Streptococcus mutans*, such common use is not surprising.<sup>19-21</sup> For many African and Middle Eastern populations, this hygiene tool is the most easily acquired, has antibiotic and analgesic properties and is low or free in cost.<sup>19-21</sup> In one study of Sudanese *Salvadora persica* users, periodontal status was higher than that of toothbrush users living in the same community.<sup>22</sup>

Figure 7: Number of Dental Visits Since Arrival to the US



A kind of flossing was accomplished using stiff grasses or reeds selected from a variety of species whose scientific names could not be determined. Flossing was reportedly used as it is in the U.S., when food items such as meat were consumed and not easily removed with brushing, inter-dental cleaning occurred with reeds or fibrous grasses. The ash-paste (*arop* in Dinka and *pok* in Nuer) was described as grainy or textured, providing an abrasive cleanser during brushing. The consistency reported by participants appears to be comparable to U.S. commercialized toothpastes. However, participants stated that ash-paste results in a whiter dental coloration.

Although each of the above methods can be described as comparable to Western oral hygiene practices, there is no direct connection from 1 dental hygiene system to the other. For example, while all participants are brushing their teeth in the U.S., it is less frequent than their reported use in Sudan. None of the participants are now using dental floss and few understood what the word floss meant. Rather, toothpicks may be used in place of the reeds and grasses which removed meat and other dense food from between the teeth in Sudan. The most commonly used toothpaste brand was already known to participants while living in Africa. However, it is unlikely that the toothpaste was actually purchased by participants prior to arrival in the U.S. given traditional livelihood strategies (i.e. cattle-herding) and no access to income generation in refugee camps.

Dental aesthetics once embraced by the Dinka and Nuer are markedly different from those valued in the U.S. For example, in Sudan the removal of the 6 lower teeth, with the resulting inclined lip,

was considered beautiful and a mark of one's ethnic identity.<sup>5,6</sup> Now in the U.S., the desire to have the missing teeth replaced indicates a change in perceived aesthetics, something resulting from intense social pressure and the observation that these visible teeth are so vital to U.S. notions of beauty and health.<sup>23</sup> By contrast, the maxillary diastema was valued in Sudan, and continues to be valued in the U.S., perhaps because this trait is not perceived as repulsive in the States.

None of the participants had received a dental screening at the time of arrival and none had utilized the preventive biannual checkup. Despite the length of time in the U.S., the majority of participants had not been to a U.S. dental facility more than once. As noted above, this limited use of Western dental care is likely related to lack of dental coverage, expendable monetary resources and knowledge of Western preventive systems. Even those with Medicaid coverage would have a difficult time accessing care since few dental facilities accept this form of payment. Finally, limited dental visits may be linked to a lack of understanding related to preventative health care systems and the associated knowledge of Western dental ailments (i.e. caries, tartar buildup and periodontal disease). In fact, conference proceedings and regional strategies prepared by the World Health Organization to improve oral health in Africa have indicated that neither dental caries or periodontal disease are as common or severe as in Western populations living in developed countries.<sup>24,25</sup> Moreover, those dental issues of greatest concern in Africa, including *Cancrum oris*, acute necrotizing ulcerative gingivitis and oral manifestations of HIV/AIDS, have not yet been reported among refugees from the Sudan to the U.S. or Nebraska.<sup>24,25</sup> Nevertheless, this lack of understanding and experience with common Western dental ailments were borne out in the treatments required prior to the implant surgeries. For example, all participants were in need of a routine prophylaxis, and nearly 20% required more extensive cleaning. Nearly one-third were diagnosed with various levels of periodontal disease. Similarly, one-third required fillings or crowns. Two of the participants, who wished to replace the 6 lower anterior teeth, were also missing a large number of teeth which had been extracted in the U.S. due to extensive decay and bone loss. These individuals had to be removed from the study because they could not support the implants. Nine of the participants which remained in this study also required removal of 1 or more teeth, due to caries or an impacted third molar.

This initial study of a refugee population from

Sudan had several limitations related to budget constraints and resulted in a small sample of convenience, incomplete surveys and self-reported data. Should additional funding be available, a more comprehensive dental health study should be conducted with a random sample of refugees from Sudan. Several of the participants were removed from the study due to poor dental health status, while some did not answer all survey questions. Apart from perceived need, which was determined during the screening process, most of the data were self-reported and should be interpreted accordingly. Misinterpretations could have occurred during survey delivery. To minimize this kind of difficulty, interpreters were selected from the Sudanese refugee community and underwent all project procedures prior to the time of acting as interpreters and translators. There is little data from newly arriving populations concerning their dental health status, treatment needs and previous dental practices. All of the refugee participants in this study had spent a minimum of 3 years in a refugee camp, and during this time, oral hygiene systems of any kind were difficult to access. Also, all refugees had been in the U.S. for at least 4 years prior to the time this study began. Consequently, it is impossible to determine the dental health status that each individual might have had if they had remained in Sudan and used their traditional oral hygiene techniques. Despite the fact that results of this study may not be representative of refugees from Africa to the U.S., it is clear that a different kind of oral hygiene training is necessary for populations such as the Dinka and Nuer, who have never been exposed to Western health systems, but must now use them to survive.

## Conclusion

The results of this initial study demonstrated that this refugee population from Sudan had limited knowledge of, and experience with, Western oral hygiene methods. Dinka and Nuer refugees in this sample stressed the replacement of visible missing teeth as the most critical dental health need. By contrast, none of the common U.S. dental needs were listed by the participants as important to their dental health status (e.g. fillings, gum disease, wisdom tooth removal and braces). Limited income, education, dental coverage, English language skills and training in Western oral hygiene methods were barriers to accessing dental care. It is important that dental health professionals understand that many world populations do not use or have a need for Western dental hygiene methods. Knowledge of preventative dental care is not a part of health practice for the Dinka and Nuer because many of

the dental maladies which Westerners seek to prevent are not commonly experienced in Sudan. Extensive oral health screening and treatment upon arrival to the U.S. is essential if we want to return individuals to a high dental health status or prevent future decline in dental health. Furthermore, comprehensive Western oral hygiene training will provide individuals with the tools to maximize oral health in this new cultural context. Likewise, dental and dental hygiene programs should expand clinical rotations to provide training in non-Western oral hygiene methods because these are the most common dental systems worldwide. In addition, dental health professionals should receive exposure to the immigrant and refugee cultures which are now arriving to the U.S. on an annual basis.

*Mary S. Willis, PhD, is an associate professor of Anthropology at the University of Nebraska Lincoln, in Lincoln, Nebraska. Rachel Bothun was awarded a BS in anthropology from the University of Nebraska Lincoln in 2011.*

### **Acknowledgments**

The authors wish to thank the Jacob & Valeria Langeloth Foundation, New York, New York and Nobel Biocare of Yorba Linda, California for the funds to support this research. We thank the faculty and staff of the University of Nebraska Medical Center, College of Dentistry, for the dental services provided over the duration of this study. We thank the UNL Undergraduate Creative Activities and Research Experiences for support. Special thanks to all of the refugee participants for their patience and consideration.

## References

1. U.S. Bureau of Population, Refugees, and Migration. Refugees by Nationality to U.S. U.S. Department of State. 2001.
2. Willis MS, Nkwocha O. Health and related factors for Sudanese refugees in Nebraska. *J Immigr Minor Health*. 2006;8(1):19–33.
3. Willis MS, Nkwocha O. Results of Focus Group Health Discussions among Sudanese Refugees. *Office of Minority Health, Nebraska Health and Human Services*. 2002.
4. Evans–Pritchard EE. The Nuer: A description of the modes of livelihood and political institutions of a Nilotic people. Oxford: Oxford University Press; 1940.
5. Seligman CG, Seligman BZ. Pagan tribes of the Nilotic Sudan. London: George Routledge & Sons, Ltd; 1932.
6. Deng FM. The Dinka of the Sudan. Prospect Heights: Waveland Press; 1972.
7. Harragin S, Chol CC. The Southern Sudan vulnerability study. *The Save the Children Fund South Sudan Programme*. 1998.
8. Hutchinson SE. Nuer dilemmas: Coping with money, war and the state. Berkeley: University of California Press; 1996.
9. Cote S, Geltman P, Nunn M, Lituri K, Henshaw M, Garcia RI. Dental caries of refugee children compared with US children. *Pediatrics*. 2004;114(6):733–740.
10. Hayes EB, Talbot SB, Matheson ES, Pressler HM, Hanna AB, McCarthy CA. Health status of pediatric refugees in Portland, ME. *Arch Pediatr Adolesc Med*. 1998;152(6):564–568.
11. McCaw BR, DeLay P. Demographics and disease prevalence of two new refugee groups in San Francisco. *West J Med*. 1985;143(2):271–275.
12. Meropol SB. Health status of pediatric refugees in Buffalo, NY. *Arch Pediatr Adolesc Med*. 1995;149(8):887–892.
13. Smith DK, Szuster F. Aspects of tooth decay in recently arrived refugees. *Aust N Z J Public Health*. 2000;24(6):623–626.
14. Eggertsson H, Ferreira–Zandona A. Dentition and lesion history. *Monogr Oral Sci*. 2009;21:102–112.
15. Willis MS, Buck JS. From Sudan to Nebraska: Dinka and Nuer refugee diet dilemmas. *J Nutr Educ Behav*. 2007;39(5):273–280.
16. Ethnologue: Languages of the World [Internet]. 2009 [cited 2010 April 11]. Available from: [http://www.ethnologue.com/show\\_family.asp?subid=2763-16](http://www.ethnologue.com/show_family.asp?subid=2763-16)
17. Willis MS, Harris LE, Hergenrader PJ. On traditional dental extraction: case reports from Dinka and Nuer en route to restoration. *Br Dent J*. 2008;204(3):121–124.
18. AgroForestry Tree Database. A tree species reference and selection guide. World Agroforestry Centre [Internet]. [cited 2010 May 7]. Available from: <http://www.worldagroforestrycentre.org/Sea/Products/AFDbases/AF/asp/SpeciesInfo.asp?SpID=1477>
19. Mehanna N, Reid G. Effect of Meswak (Middle Eastern tree bark) on oral pathogens and potential for probiotic applications. *J Med Food*. 2010;13(3):729–732.
20. Alali F, Al–Lafi T. GC–MS analysis and bioactivity testing of the volatile oil from the leaves of the toothbrush tree *Salvadora persica* L. *Nat Prod Res*. 2003;17(3):189–194.
21. Darout IA, Albandar JM, Skaug N, Ali RW. Salivary microbiota levels in relation to periodontal status, experience of caries and miswak use in Sudanese adults. *J Clin Periodontol*. 2002;29(5):411–420.
22. Darout IA, Albandar JM, Skaug N. Periodontal status of adult Sudanese habitual users of miswak chewing sticks or toothbrushes. *Acta Odontol Scand*. 2000;58(1):25–30.
23. Willis MS, Esqueda CW, Schacht RN. Social perceptions of individuals missing upper front teeth. *Percept Mot Skills*. 2008;106(2):423–435.
24. Oral health in the African Region: A regional strategy 1999 – 2008. *World Health Organization Regional Office for Africa*. 2000.
25. Beaglehole RH, Benzian HM. Report on the planning conference for oral health in the African region. Lowestoft: FDI World Dental Press Ltd; 2004.