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Addressing the Health of Refugees: Vitamin D

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Vitamin D deficiency is an important health problem for refugees. Vitamin D deficiency can have serious implications on morbidity and mortality, as the literature shows that it is a risk factor for rickets, osteomalacia, cardiovascular disease, some cancers, and diabetes. To assess the problem of vitamin D deficiency among refugees, literature reviews of relevant research were conducted. Databases searched include PubMed, Cochrane Library, Trip database and relevant grey literature. The United States (US) welcomes many refugees and provides them with healthcare for their first eight months. Refugees, however, face barriers in accessing healthcare, especially after their initial months in the US. Currently refugees in the US are tested for vitamin D deficiency during the Domestic Medical Examination only if the physician identifies clinical signs and symptoms. Further research should be conducted about vitamin D deficiency in refugees entering the US since most studies have previously been conducted in Australia, New Zealand, and the Netherlands. Systematic deficiency screening and vitamin D supplementation could alleviate the burden of vitamin D deficiency among refugees. Further research is needed to determine whether these strategies would be acceptable to refugees and cost-effective.

INTRODUCTION

Through the United States Refugee Admission Program, the US has granted asylum to almost 3 million refugees since 1975 and currently welcomes more refugees than any other country.[1,2] Furthermore, the US accepts more than half of all refugees who settle in a country other than the country to which they initially fled (also known as a "third country"). These refugees are at the highest risk of persecution.[1] In 2012, refugees arriving in the US came from: Africa (18.2%), East Asia (24.7%), the Near East/South Asia (51.6%), Latin America (3.6%), and Eastern Europe (1.9%).[3]

The following article demonstrates that vitamin D deficiency is a commonly reported issue among refugee populations.[4,5] Vitamin D deficiency is an important health issue as it is associated with many pathologies such as rickets and osteomalacia.[6] Additionally, there is growing evidence linking vitamin D deficiency or insufficiency to bone fractures,[7] periodontitis,[8] cardiovascular disease,[9] poor immune function, certain cancers, diabetes mellitus, osteoporosis, and impaired muscle function.[10] Thus, significant health gains could result from addressing vitamin D deficiency and insufficiency among refugees.

The US Centers for Disease Control (CDC) considers vitamin D deficiency as a serum level of less than 30 nmol/L, while vitamin D insufficiency occurs at serum levels of 30-50 nmol/L.[11] However, there is some debate in the literature about the appropriate serum values associated with deficiency and insufficiency. As a result, researchers often use different values to define vitamin D deficiency and insufficiency.

Vitamin D is normally produced in the skin as a result of sunlight exposure, although it can also be derived from the diet.[11] For individuals with limited sunlight exposure, The National Institutes of Health Office of Dietary Supplements recommends taking dietary supplements.[12] Table 1 lists the suggested Vitamin D intake by age group.

Table 1. Vitamin D Intake Recommendations by Age Group[11]

Age Group (years)	Recommendation (IU or mg)
0-1 years	400 IU or 10 mg
1-70 years	600 IU or 15 mg
70+ years	800 IU or 20 mg

Note: This table was constructed using recommendations from the "Second National Report on Biochemical Indicators of Diet and Nutrition in the US Population."

The healthcare needs of newly arriving refugees, including vitamin deficiencies, are provided for by US government services. The US Department of State; US Centers for Disease Control and Prevention; the US Immigrant, Refugee and Migrant Health Branch; and the US Office of Refugee Resettlement coordinate the processing of refugees and healthcare provisions for these individuals. The literature shows, however, that refugees underutilize healthcare services after the initial US government medical support provided during the eight months after they enter the US. Furthermore, refugees struggle at all points of healthcare access because of the language barrier, stress, and isolation resulting from acculturation.[13]

METHODS

A review of the relevant scientific literature and grey literature policy documents was conducted. PubMed, Trip, and The Cochrane Library were searched to identify relevant studies and review articles. Specific search terms and their results are listed in Table 2. The search results regarding vitamin D deficiency in refugees were limited to scientific papers that reported on human studies and were published in English before June 2012. Studies were individually assessed to determine whether they were relevant to the vitamin D burden among refugees. This narrowed search identified eleven papers meeting the inclusion criteria.

RESULTS

VITAMIN D DEFICIENCY IN REFUGEES

Eight results returned by PubMed, Cochrane Library, and Trip databases were descriptive epidemiological studies that

Table 2. Search Terms on Medical Databases and Results

Database	Search Terms	Number of Results
PubMed	(vitamin D insufficiency OR vitamin D deficiency OR vitamin D deficient OR vit D insufficiency OR vit D deficiency OR vit D deficient OR hypovitaminosis D3) AND (refugee OR asylum seeker)	20
Trip	(vitamin D insufficiency OR vitamin D deficiency OR vitamin D deficient OR vit D insufficiency OR vit D deficiency OR vit D deficient OR hypovitaminosis D3) AND (refugee OR asylum seeker)	5
The Cochrane Library	(vitamin D insufficiency OR vitamin D deficiency OR vitamin D deficient OR vit D insufficiency OR vit D deficiency OR vit D deficient OR hypovitaminosis D3) AND (refugee OR asylum seeker)	1

sought to measure the burden of vitamin D deficiency among refugees. All found that a large proportion of the refugee population were vitamin D deficient or insufficient, with a range of 29-88% of refugee sample populations being classified as either deficient or insufficient. The findings from these studies are summarized in Table 3.

Three other studies provided further information about the burden of vitamin D deficiency and insufficiency among refugees. A study by Paul Benitez-Aguirre et al. tested 93 dark skinned refugees in Australia for vitamin D deficiency at the end of winter and the end of the summer. Although vitamin D levels increased on average during the summer (from 19 nmol/L to 36 nmol/L, $p<0.0001$), 87% of the subjects (n=79) were still vitamin D deficient at the end of the summer.[14]

Another study examined eleven cases of female refugees in Switzerland suffering from vitamin D deficiency. The authors focused on the manner in which women presented their symptoms in primary care settings and the steps doctors used to make their diagnoses. The women presented with histories of "bone pain, proximal muscular weakness, and change in gait or fatigue."[15] Nine of the eleven women wore a veil, which greatly restricted their exposure to sunlight. Four of the women were from Bosnia, four were from Somalia, one was from Afghanistan, one was from Albania, and another was from Ethiopia. The authors identified two points that were extremely relevant to this review:[15]

- Vitamin D deficiency can be difficult to identify in a clinical setting despite its characteristic pattern of pain. The doctors in the study first attributed the women's pain to somatization disorder, chronic back pain, or unexplained somatic symptoms. In only one case did the doctor initially consider vitamin D deficiency.

- Pain associated with vitamin D deficiency has been shown to resolve in three to six months with treatment. For ten of the women, the symptoms resolved in one to three months with treatment for vitamin D deficiency. For the last woman, her symptoms resolved in seven months.

Furthermore, a review by Benson and Skull provided insight into the characteristics that are associated with a higher risk of vitamin D deficiency or insufficiency in refugees.[8] For example, vitamin D deficiency is likely to occur in individuals who are dark-skinned, have limited sunlight exposure, have difficulty absorbing vitamin D, or have a diet that is deficient of vitamin D—such as a strict vegetarian diet.[8,15] These characteristics are common in refugee populations.

Within the refugee population, the studies identified several groups that were at an even greater risk of vitamin D deficiency than the general refugee population: women of child-bearing age, men age 46 and older,[16] East African refugees,[4,17] Middle Eastern refugees, children with precocious puberty, and populations with increased time in hiding.[17]

CURRENT US POLICY ADDRESSING VITAMIN D DEFICIENCY IN REFUGEES

The Refugee Act of 1980 established The Federal Refugee Resettlement Program as a division of the Department of Health and Human Services. The legislation delineated that healthcare provisions for newly arriving refugees would be part of the resettlement process.[18] After arriving in the US, refugees are provided with Medicaid or Refugee Medical Assistance (summarized in Table 4) as a form of medical insurance during their first eight months in the country. Refugees are strongly encouraged to undergo a free health screening within 90 days of arrival.[19] The primary purpose of evaluating the refugee's health is to prevent transmission of communicable diseases within the US. During the course of the medical screening, patients with communicable diseases or other health issues are referred to the appropriate physicians for proper treatment. Afterward, refugees are encouraged to seek follow-up treatment while their healthcare costs are still covered by Medicaid or Refugee Medical Assistance.[19]

The US Centers for Disease Control's (CDC) Immigrant, Refugee, and Migrant Health Branch provides clinical guidelines for the Domestic Medical Examination for Newly Arriving Refugees.[20] These guidelines, however, are only recommendations and are not prescriptive or mandatory.[21] To date, the *Summary Checklist for Domestic Medical Examination for Newly Arriving Refugees* does not contain an explicit general recommendation for testing refugees for vitamin D deficiency, and a comprehensive approach for addressing vitamin D deficiency in the refugee population is lacking. That being said, the CDC's *Guidelines for Evaluation of the Nutritional Status and Growth in Refugee Children During the Domestic Medical Screening Examination* does include an advisory statement stating that most immigrants are affected by vitamin D deficiency. The CDC advises that many risk factors for vitamin D deficiency are often seen in refugees and that vitamin D deficiency is most common among veiled, dark-skinned immigrant women.[22]

Table 3. Descriptive Studies of Vitamin D Deficiency and Insufficiency Among Refugees

Author(s)	Number of Subjects	Study Population Details	Proportion Vitamin D Deficient or Insufficient	Level of Severity of Vitamin D Deficiency
Chaves et al, 2009.[34]	156	• Burmese refugees • Age range 16-86 years • Median age 30 years • Attending a clinic at a hospital in Melbourne, Australia	37% deficient (<50 nmol/L)	N/A
Huntington et al, 2010.[33]	153	• Sub-Saharan and South Asia refugees • Age range 6 months – 57 years • 97% Pediatric patients • Attending new refugee examinations by Sioux Falls Health Dept in South Dakota, USA	64% deficient (<32 ng/mL)[a]	6% severely deficient (<15 ng/mL)[b] 58% mildly deficient (15-32 ng/mL)
Renzaho et al, 2011.[5]	49	• Sub-Saharan migrants and refugees • Age 20+ • Mean age 41.5 years • Living in Melbourne, Australia	88% deficient (<50 nmol/L)	N/A
Sheikh et al, 2009.[35]	239	• Newly arrived refugees, mostly from Africa • Age range 1-17 years • 36% age 0-7 years; 45% age 8-12 years; 19% age 13-17 years • Attending clinic in Sydney, Australia	61% deficient (<50 nmol/L)	N/A
Sheikh et al, 2011.[17]	251	• Refugees, mostly from Africa • Age range 0-17 years • Mean age 8 years • Attending outpatient general health clinic in Sydney, Australia	61% deficient (<50 nmol/L)	2% severely deficient (<13 nmol/L) 19% moderately deficient (13-25 nmol/L) 40% mildly deficient (26-50 nmol/L)
Stellinga- Boelen et al, 2007.[36]	112	• Refugees from Africa, Central Asia or Eastern Europe living in The Netherlands • Age range 2-12 years • Median age 7.1 years	55% deficient or hypovitaminosis D	13% deficient (<30 nmol/L) 42% hypovitaminosis D (30-50 nmol/L)
Tiong et al, 2006.[4]	258	• African refugees attending general practice clinics in Melbourne, Australia • 57% Sudanese • 17% Liberian • 50% <15 years old	29% deficient (<37 nmol/L)	N/A
Wishart et al, 2007.[16]	869	• Refugees arriving at the national refugee resettlement center in New Zealand	54% deficient or insufficient (<50 nmol/L)	17% deficient (<25 nmol/L) 37% insufficient (25-50 nmol/L)[c]

Note: Table constructed using data from the scientific papers specified in the table. a. 32 ng/mL is equivalent to 80 nmol/L. The conversion factor is 1ng/mL = 2.5 nmol/L.[11] b. 15 ng/mL is equivalent to 37.5 nmol/L. c. Wishart et al. use these values because they argue that <25nmol/L is a "frank deficiency" and 25-50 nmol/L is when bone health becomes negatively affected.

The US domestic medical examination focuses on communicable disease control, explicitly testing for communicable diseases and administering immunizations.[21] The *Summary Checklist for Domestic Medical Examination for Newly Arriving Refugees* provides a number of conditions that physicians should test for even if clinical signs are not present. These include tuberculosis, lead levels, malaria, syphilis, chlamydia, gonococcus, HIV, and viral hepatitis. Physicians are also asked to obtain a complete blood count, glucose and serum chemistries, pregnancy test, dietary history and anthropometric indices. Testing for most other conditions, including vitamin D deficiency, is at the discretion of the physician conducting the examination on a case-by-case basis.[23]

From an international perspective, the World Health Organization (WHO) makes recommendations about emergency nutrition for refugees, specifically about how to avoid deficiencies in vitamins B1, B3 and C during humanitarian emergencies including periods of conflict, natural disasters, and food insecurity.[24] Though the WHO has made no recommendations to date about vitamin D specific to refugees in the resettlement process, the international body does indicate that vitamin D supplementation may decrease the incidence and severity of respiratory infections in children, prevent rickets in infants, and reduce the risk of pre-eclampsia in pregnant women.[25,26,27]

DISCUSSION

The findings show that vitamin D deficiency is widespread among refugee populations. Six of the eight studies found that the majority of their study population of refugees was vitamin D deficient or insufficient. The remaining two studies found that a substantial proportion of the refugee population was deficient, with average vitamin D deficiency rates among the refugee population being higher than the reference rates for deficiency in the US population (31% of non-Hispanic

Table 4. Types of Healthcare Assistance Offered to Refugees

Type of Healthcare Assistance	Description
Refugee Medical Assistance[20]	A federal insurance program for refugees provided for the first eight months after the date of arrival as a refugee or the date on which asylum was granted.
Medicaid[20,30,31]	An insurance program that is provided to all individuals meeting eligibility criteria as part of a state-federal partnership. The Medicaid program is provided nationally, but is administered by the individual states. Healthcare services are either provided at reduced cost or for free. Eligible individuals must meet income requirements. Medicaid is NOT a refugee specific program.

Blacks, 12% of Mexican Americans, and 3% non-Hispanic whites).[28] A significant limitation to this project is that the studies were primarily conducted in Australia and New Zealand. Additional research should be conducted to determine the rates in the US context.

The evidence provides convincing support that preventative measures should be taken to address vitamin D deficiency among refugees—both to eliminate health disparities and to provide protection for a vulnerable population.

The de Torrente de la Jara et al. study highlights several key factors related to addressing vitamin D deficiency among refugees. Under the current policy, refugees are to be treated for vitamin D deficiency if they are identified as being deficient. Currently, the responsibility falls on their physicians to identify relevant symptoms as possible indicators of the deficiency and then testing for vitamin D levels. However, as the paper argues, physicians often incorrectly attribute the pain symptoms to other conditions.[15] As a result, refugee patients often remain untested for vitamin D deficiency during their domestic medical examination, missing a crucial opportunity to address the deficiency, which can be easily corrected using supplements or by providing educational information about vitamin D. Furthermore, since refugees are unfamiliar with the healthcare system in the US, they are less likely to seek medical care during the first eight months after their arrival. After that time, they may be uninsured if they do not apply for Medicaid or health insurance under the Affordable Care Act, which often occurs due to language or cultural barriers or an unfamiliarity with the US healthcare system.[29,30]

Since the US domestic medical examination is highly encouraged for all refugees, it is an ideal time to intervene in an effort to improve the vitamin D status of the patients. A systematic deficiency screening and vitamin D supplementation policy could alleviate the burden of vitamin D deficiency among refugees.

CONCLUSION

Vitamin D deficiency is a major health issue among refugees worldwide.[4,5] A policy is needed to systematically improve vitamin D status in the refugee population during the initial period of medical provision by the US government, in order to prevent and mitigate the effects of vitamin D deficiency from the beginning of the refugees' time in the US. This is likely to be best accomplished by testing for vitamin D deficiency and providing interventions during refugees' domestic medical examination. In addition, further research should be conducted about the specific population of refugees entering the US since much of the research to date has been conducted in Australia, New Zealand, and The Netherlands.

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