

Practices of Vitamin D Recommendation in Las Vegas, Nevada

Ulfat Shaikh, MD, MPH, and Patricia T. Alpert, MSN, MPH

Abstract

Reports of vitamin D deficiency rickets, although rare in the United States, have increased over the past few years, including in children living in climates with abundant sunshine. The purpose of this study was to describe vitamin D recommendation practices among pediatric health care providers in Las Vegas, Nevada. Of the 155 providers surveyed, 52.3% did not recommend vitamin D for exclusively breastfed babies. Providers who were more likely to recommend supplementation were doctors of medicine, were female, specialized in pediatrics, were of Hispanic ethnicity, had previously practiced and trained in states less sunny than Nevada, had graduated from training 21 or more years previously, had taken histories of infants' sun exposure, and had clinical experience with cases of rickets. Providers demonstrated a knowledge deficit for questions that dealt with preventive measures. *J Hum Lact.* 20(1):56-61.

Keywords: rickets, vitamin D, Las Vegas, Nevada, supplementation

Las Vegas has about 310 sunny days per year. In this year-round sunny climate, we recently encountered a 7-month-old African American patient who was admitted to the hospital with seizures and hypocalcemia. He had nutritional rickets associated with exclusive breastfeeding in the absence of vitamin D supplementation. We found 4 additional cases of nutritional rickets seen in our outpatient clinic over the past 5 years. Rickets, although still rare in the United States, has been increasingly reported over the past few years.^{1,2} Recently, a case series from North Carolina described 30 patients with nutritional rickets seen between 1990 and 1999. Its actual incidence is unknown because it is not a report-

able condition.³ Nutritional rickets can cause severe physical disability in children, which is easily preventable.^{4,5} The American Academy of Pediatrics (AAP) recently published recommendations for vitamin D supplementation in exclusively breastfed babies.⁶

In a survey of 383 pediatricians done in 1999 in North Carolina, 44.6% recommended vitamin D supplementation for all breastfed infants. Most pediatricians recommended supplementation within the first month of life, although one fourth recommended supplementation after 6 months of age. There are limited data on health care providers' practice with respect to vitamin D recommendation in climates with abundant sunshine. Approximately 15 years ago, a survey on the practice of vitamin D recommendation conducted among pediatricians in San Diego, California, showed that 29% of pediatricians did not recommend supplementing breastfed babies with vitamin D. More recently trained pediatricians were less likely to recommend supplementation than those who had been in practice longer.⁷ However, the study did not report the geographic locations of providers' training and experience, whether or not they took histories of the amount of sunlight exposure, their personal or spousal breastfeeding experiences, or their professional experiences with nutritional rickets.

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Ulfat Shaikh, MD, MPH, is an assistant professor in the Department of Pediatrics at the University of Nevada School of Medicine, Las Vegas. **Patricia T. Alpert, MSN, MPH**, is an instructor in the Department of Nursing at the University of Nevada, Las Vegas.

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Given the period of time since the San Diego survey was performed, the study limitations, and increased reports of rickets, we undertook a survey of a broader cross section of health care providers in our community. The goal of our study was to describe vitamin D recommendation practices and knowledge regarding the prevention of rickets among pediatric health care providers in Las Vegas.

Methods

Study Design

This study was a cross-sectional survey of pediatricians, family physicians, and nurse practitioners practicing general pediatrics more than 10% of their time in outpatient clinics in Las Vegas during the years 2001 and 2002. We excluded retired practitioners and practitioners in solely inpatient, urgent care, or emergency room settings. On the basis of a previous survey, we estimated needing a sample of 150 responses to show a stable estimate of 30% nonsupplementation with 95% confidence.⁷

Survey Instrument

Our instrument was a 2-page, self-administered questionnaire, which took approximately 5 minutes to complete. Five faculty members, experienced in survey research and involved in pediatric health care, pilot tested the questionnaire for face validity, after which we made revisions. The initial part of the questionnaire collected information about the providers' specialties, degrees, gender, race, locations of training, years in which training was completed, numbers of years in practice in Las Vegas, and, if applicable, previous locations of practice. The items regarding geographic locations of training and prior practice were phrased as open-ended questions. We then queried providers on their knowledge of and experience with rickets in children. To assess knowledge, we included 7 statements about rickets with which participants could either agree or disagree. Experience was assessed by collecting data on the numbers and locations of cases of nutritional rickets providers encountered. Additionally, we gathered information about the insurance status of patients, vitamin D supplementation, reasons for supplementing or not supplementing, personal or spousal experience with breastfeeding, and whether the providers had elicited histories of the amount of sun exposure in their patients. For the purpose of our study, babies whose

diets consisted of only maternal breast milk (ie, no infant formula or solid food) were considered exclusively breastfed.

Procedures

The Institutional Review Board at the University of Nevada, Reno, approved this research protocol. Physician and nurse practitioner listings by specialty were obtained from the Nevada state boards of medical examiners, osteopathic physicians, and nursing. We included all providers in the databases in our sample to minimize volunteerism and selection bias. A scripted phone call was placed to each provider in the study sample. The purposes of the call were multifold: to ensure that the contact information was current, that the provider practiced at least 10% of his or her professional time in an outpatient setting in Las Vegas, to explain the study, and to obtain consent to fax the questionnaire to the participant's location. If consent was obtained, the questionnaire was faxed to the provider. If a provider refused to participate in the survey, no further contact was made. Information collected on providers who refused to participate included specialty and gender. All participants who were initially contacted were refaxed the questionnaire after 2 weeks.

Data Analysis

We analyzed data using SPSS version 10.1 (SPSS Inc, Chicago, IL). Frequency statistics on demographic information were computed. Bivariate analyses were performed for characteristics associated with the recommendation of vitamin D for breastfed babies. We used chi-square analysis for statistical testing on the categorical variables. Possible predictors of supplementation by health care providers that we studied were the type of training, specialty, the geographic location of training, the number of years in practice in Las Vegas, the elicitation of patient history of sun exposure, and personal or spousal breastfeeding experience. The percentage of possible sunshine per year in major cities in the United States was obtained from data published by the National Climatic Data Center.⁸ A mean of the percentage of possible sunshine from major cities in each state was calculated to obtain state-specific data. We excluded areas outside the United States in this analysis because data were not available for those regions. For the purpose of our study, the percentage of possible sunshine by state was used to collapse the locations of training and prior employment into categories. Reasons

Table 1. Characteristics of Health Care Providers in Las Vegas Who Completed the Survey Regarding the Recommendation of Vitamin D for Exclusively Breastfed Infants < 12 Months of Age (N = 155)

	No. (%)	Recommended Vitamin D, No. (%)	Did Not Recommend Vitamin D, No. (%)	P Value	
Type of training					
Doctor of osteopathy	28 (18.1)	7 (25.0)	21 (75.0)	.025*	
Doctor of medicine	116 (74.8)	62 (53.4)	54 (46.6)		
Nurse practitioner	11 (7.1)	5 (45.4)	6 (54.6)		
Specialty					
Family practice	76 (49.0)	34 (44.7)	42 (55.3)	.049*	
Medicine-pediatrics	5 (3.2)	0	5 (100.0)		
Pediatrics	74 (47.7)	40 (54.0)	34 (46.0)		
Other	0	0	0		
Gender					
Male	99 (63.9)	45 (45.4)	54 (54.6)	.089	
Female	56 (36.1)	29 (51.8)	27 (48.2)		
Ethnicity					
African American	10 (6.5)	5 (50.0)	5 (50.0)	.410	
Asian and Pacific Islander	35 (22.6)	13 (37.1)	22 (62.9)		
Hispanic	7 (4.5)	4 (57.1)	3 (42.9)		
Caucasian	96 (61.9)	48 (50.0)	48 (50.0)		
Native American	1 (0.6)	1 (100.0)	0		
Other	4 (2.6)	1 (25.0)	3 (75.0)		
Patient insurance					
>50% private	100 (64.5)	51 (51.0)	49 (49.0)		.500
>50% Medicaid	15 (9.7)	6 (40.0)	9 (60.0)		
Private and Medicaid patients equal	17 (11.0)	7 (41.2)	10 (58.8)		
Don't know	8 (5.2)	5 (62.5)	3 (37.5)		
Other	15 (9.7)	5 (33.3)	10 (66.7)		
Geographic location of training (average % possible sunshine/year in state)**					
>80%	8 (5.2)	3 (37.5)	5 (62.5)	.770	
70%-79%	50 (32.3)	22 (44.0)	28 (56.0)		
60%-69%	23 (14.8)	10 (43.5)	13 (56.5)		
50%-59%	51 (32.9)	24 (47.0)	27 (53.0)		
40%-49%	14 (9.0)	9 (64.3)	5 (35.7)		
30%-39%	0	0	0		
Previous location of practice (average % possible sunshine/year in state)**					
>80%	5 (3.4)	2 (40.0)	3 (60.0)	.087	
70%-79%	95 (64.6)	37 (39.0)	58 (61.0)		
60%-69%	21 (14.3)	14 (66.7)	7 (33.3)		
50%-59%	20 (13.6)	12 (60.0)	8 (40.0)		
40%-49%	6 (4.1)	4 (66.7)	2 (33.3)		
30%-39%	0	0	0		
Years since graduation from training					
0-10	83 (54.5)	33 (39.8)	50 (60.2)	.828	
11-20	26 (15.6)	12 (46.2)	14 (53.8)		
21-30	29 (18.8)	18 (62.0)	11 (38.0)		
31-40	13 (8.4)	9 (69.2)	4 (30.8)		
>40	3 (1.9)	2 (66.7)	1 (33.3)		

(continued)

Table 1 (continued)

	No. (%)	Recommended Vitamin D, No. (%)	Did Not Recommend Vitamin D, No. (%)	P Value
Take history of infants' sun exposure	29 (18.7)	20 (69.0)	9 (31.0)	.011*
Personal/spousal breastfeeding experience	81 (52.3)	43 (53.0)	38 (47.0)	.619
Clinical experience with cases of rickets	15 (9.7)	11 (73.3)	4 (26.7)	.037*

*Statistically significant. Comparisons were made using chi-square tests.
 **Classification by state derived from the US National Climatic Data Center⁸: >80%: Arizona; 70% to 79%: California, Colorado, Nevada, New Mexico; 60% to 69%: Arkansas, Florida, Georgia, Iowa, Idaho, Kansas, Louisiana, Mississippi, Nebraska, North Carolina, Oklahoma, South Carolina, South Dakota, Texas, Utah, Virginia; 50% to 59%: Alabama, Connecticut, District of Columbia, Hawaii, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, New Jersey, New York, North Dakota, Ohio, Pitcairn Islands, Pennsylvania, Rhode Island, Tennessee, Wisconsin; 40% to 49%: Michigan, New Hampshire, Oregon, Vermont, Washington, West Virginia; 30% to 39%: Alaska.

given by providers for recommending or not recommending vitamins were summarized.

Results

A total of 233 telephone calls were made, and 230 surveys were faxed to health care providers. Three health care providers refused to participate, namely, 1 female pediatrician, 1 female family physician, and 1 male family physician. One hundred fifty-five surveys were completed and faxed back to the researchers. The response rate was 67%.

Most providers who responded to the survey (49%) had begun practicing in Las Vegas within the past 5 years. Approximately 32% had practiced in Las Vegas for between 6 and 15 years, and 11.6% and 7.7% had practiced here for between 16 and 25 years and 26 and 40 years, respectively.

Seventy-four (47.7%) providers recommended the supplementation of exclusively breastfed infants with vitamin D, whereas 81 (52.3%) did not. Forty-two (27.1%) providers additionally supplemented babies fed both breast milk and infant formula with vitamin D. Vitamin D recommendations for exclusively breastfed infants according to demographic characteristics are shown in Table 1. Predictive variables that reached statistical significance were being a doctor of medicine, specializing in pediatrics, having clinical experience with cases of rickets, and taking histories of infants' sun

Table 2. Knowledge of Nutritional Rickets Among Las Vegas Health Care Providers (N = 155)

<i>Rickets Secondary to Nutritional Deficiency Is a Disease That</i>	<i>Correct Response</i>	<i>Health Care Providers Who Gave Correct Response, No. (%)*</i>	<i>Recommenders Who Gave Correct Response (n = 74), No. (%)**</i>	<i>Nonrecommenders Who Gave Correct Response (n = 81), No. (%)†</i>	<i>P Value</i>
Is nonexistent or rare these days	False	79 (51)	43 (58.1)	36 (44.4)	.089
Does not require preventative measures, due to fortification of food	False	143 (92.2)	69 (93.2)	74 (91.4)	.661
Is only seen in African American infants	False	152 (98.1)	73 (98.6)	79 (97.5)	.614
Is more common in geographic regions with very little sun exposure	True	87 (56.1)	46 (62.2)	41 (50.6)	.148
Is seen only in poor infants	False	146 (94.2)	71 (95.9)	75 (92.6)	.373
Can be prevented if nursing mothers are supplemented with vitamin D	False	115 (74.2)	54 (73.0)	61 (75.3)	.740
Can be prevented if breastfed babies are supplemented with vitamin D	True	93 (60)	56 (75.7)	37 (45.7)	.000‡

*Percentages in column 3 = health care providers who gave correct response/total number of health care providers surveyed (N = 155).

**Percentages in column 4 = recommenders who gave correct response/total number of recommenders (n = 74).

†Percentages in column 5 = nonrecommenders who gave correct response/total number of nonrecommenders (n = 81).

‡Statistically significant. Comparisons were made using chi-square tests.

exposure. Providers who recommended vitamin D supplementation were more likely to be female and Hispanic, to have graduated from training 21 or more years previously, to have trained in states with less than or equal to 49% sunshine, to have previously practiced in states with less than or equal to 69% sunshine, to have had a majority of patients with private insurance, and to have reported personal or spousal breastfeeding experience for at least 2 weeks. Almost 10% of providers had encountered a total of 41 clinical cases of rickets in the total time they had practiced pediatrics. The duration of practice of these providers varied widely between 1 year and 40 years. The greatest numbers of cases (n = 7 each, 17%) were found in Las Vegas, Michigan, and Pennsylvania. Other cases were seen in New York, California, Virginia, and North Carolina. Cases in other countries, such as the Philippines and Romania, were also reported. Of providers who recommended supplementation, 35% hoped to prevent rickets. Fifteen percent hoped to prevent malnutrition, and 8.3% wanted to prevent anemia. To the open-ended query as to why providers did not recommend vitamin supplements, common responses were that "Las Vegas had abundant sunshine" (11.7%), "rickets was very rare" (6.7%), "breast milk had adequate amounts of vitamins" (3.3%), and "supplementing with vitamins was not cost effective" (1.7%).

Chi-square analysis was used to examine providers' knowledge about nutritional rickets and vitamin D (Table 2). Recommenders of vitamin D supplementation correctly believed that rickets could be avoided if breastfed infants were supplemented with vitamin D ($P < .000$).

Discussion

We found that a large number of providers in Las Vegas (52.3%) do not recommend supplementation with vitamin D for exclusively breastfed babies. Fifteen years ago, in a similar study conducted by Hayward et al,⁷ 29% of pediatricians in San Diego did not recommend supplementation. If Las Vegas and San Diego are representative of most sunny areas, our data suggest that vitamin D supplementation is recommended even less frequently than in the past. Our data also demonstrate the trend that more recently trained providers recommend vitamin D supplementation less frequently than providers who completed training 21 or more years ago. Unfortunately, rickets is not a reportable condition, and therefore national public health surveillance systems cannot track its incidence. Thus, the full impact of neglecting to supplement all breastfeeding infants with vitamin D remains unknown.

Inadequate exposure to sunlight is an important contributory factor in nutritional rickets.⁹ The AAP defines adequate sun exposure for white infants as "30 minutes per week, clothed only in a diaper or 2 hours per week fully clothed with no hat."^{10(pp275-277)} African Americans possibly need about 6 times as much exposure to sunlight compared with Caucasians to maintain comparable vitamin D levels in their serum.¹¹ In Las Vegas, temperatures in the summer can reach as high as 117°F. In these temperatures, adequate sun exposure as defined by the AAP, especially in infants, could be dangerous and unrealistic, placing infants at risk for heat-related illnesses such as heat stroke and increasing their risk for skin cancer later in life.^{12,13} Our data show that providers

in Las Vegas, who routinely elicit histories of the amount of sun exposure from their patients, tend to recommend supplementation more frequently.

Even though rickets is rare in the United States and is usually associated with children living at northern latitudes,¹⁴ it is increasingly being reported over the past few years in geographic areas with abundant sunshine, such as northern Texas,¹⁵ Mississippi,¹⁶ Georgia,⁹ San Diego,⁷ and North Carolina.¹⁷ Our study was limited because our study population was restricted to providers in Las Vegas. However, we were particularly interested in vitamin D recommendation practices in sunny climates. Although our data would be of most interest to local providers, it is also applicable to providers practicing in other perennially sunny locations. We found that doctors of medicine recommended supplementation more frequently than other types of providers. However, these data should be interpreted with caution because the sample sizes of doctors of osteopathy and nurse practitioners in our study were limited. According to the Nevada State Board of Medical Examiners (personal communication), the number of new pediatricians and family physicians in the county has seen a sharp rise in the past 5 years. Therefore, local standards of care may not play a strong role in the approach to vitamin D recommendation in Las Vegas. We did not design our survey instrument to collect detailed information on why providers did not recommend vitamin D or on social and cultural influences that could play a role in recommending supplementation. A focus group interview could possibly aid in learning more about reasons for nonsupplementation.

Pediatric health care providers should attempt to promote the Healthy People 2010 goal for breastfeeding promotion.¹⁸ Exclusive breastfeeding has always been the healthiest feeding practice for infants younger than 6 months of age, in the presence of adequate sun exposure. Rickets may have shown a resurgence because of changes in lifestyle (an increase in daycare attendance among infants), environmental issues (an increase in air pollution, dangerously high outdoor temperatures in certain geographic regions), and increased awareness of the risks of sun exposure (resulting in the increased use of sunscreen and protective clothing).

Two hundred to 400 IU of vitamin D per day for exclusively breastfed infants has been shown to be effective, safe, and cost-effective in preventing nutritional rickets in the absence of adequate sun exposure.^{16,19-21} The AAP has recently released a policy state-

ment regarding vitamin D supplementation for breastfed babies.⁶ Data for our study were collected prior to the release of this policy statement. The data provide information on the knowledge of providers with respect to rickets and vitamin D recommendation and indicate a need to plan educational activities for health care providers in sunny areas of the country. Although certain demographic groups of providers are more likely than others to recommend vitamin D, there appear to be large numbers of health care providers in all groups who do not recommend supplementation. We hope that our findings contribute to current evidence to recommend a national surveillance system for nutritional deficiencies. Additionally, we foresee the potential to resurvey providers after educational programs about the policy statement are implemented, to measure changes in knowledge and practice.

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Resumen

Los reportes de deficiencia de vitamina D o raquitismo, a pesar de que son raros en Estados Unidos, han aumentado en los últimos años, inclusive en los niños que viven en climas con gran exposición a los

rayos solares. El propósito de nuestro estudio fue de describir la práctica de la recomendación de vitamina D entre proveedores de cuidado pediátrico en Las Vegas, Nevada, USA. De 155 proveedores que se encuestaron, 52.3% no recomendaban vitamina D a bebés exclusivamente amamantados. Los proveedores que con mayor probabilidad recomendaron la suplementación fueron médicos tales como internistas, pediatras, especialistas en salud de la mujer, de origen Hispano, que practicaron o se entrenaron en estados con poco sol comparado con Nevada, que se graduaron hace más de 21 años, tomaron historia de exposición al sol o tuvieron experiencias clínicas con casos de raquitismo. Los proveedores demostraron poco conocimiento al responder las preguntas que se relacionaban a las medidas preventivas.