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On November 13, 2000, health-care providers at a hospital in Winston-Salem, North Carolina, contacted the local health department about three cases of listeriosis within a 2-week period in recent Mexican immigrants. The North Carolina General Communicable Disease Control Branch, in collaboration with the Forsyth County Health Department, the North Carolina Departments of Agriculture and Consumer Services (NCDA&CS) and Environment and Natural Resources, the Food and Drug Administration (FDA), and CDC investigated this outbreak of *Listeria monocytogenes* infections. This report summarizes the results of the investigation, which implicated noncommercial, homemade, Mexican-style fresh soft cheese produced from contaminated raw milk sold by a local dairy farm as the causative agent. Culturally appropriate education efforts are important to reduce the risk for *L. monocytogenes* transmission through Mexican-style fresh soft cheese.

A case was defined as *L. monocytogenes* (isolated from a normally sterile site or with placental tissue staining positive using immunohistochemical techniques) in a mother of a stillborn or premature infant (<37 weeks' gestation), or a mother with a febrile illness, who was a Winston-Salem resident during October 24, 2000–January 1, 2001. Through active case finding, 12 cases were identified. On initial interview, most patients reported eating unlabelled Mexican-style fresh soft cheese bought at local markets or from door-to-door vendors. A case-control study was conducted to determine risk factors for illness; the questionnaire addressed symptoms, diet, and grocery-shopping histories during the month preceding illness. *L. monocytogenes* isolates from patients, raw milk, and cheese were tested using pulsed-field gel electrophoresis (PFGE). Environmental inspections of homes, local markets, and dairy farms were conducted.

All 12 patients were Hispanic; 11 were women with a median age of 21 years (range: 18-38 years), and one was a 70-year-old immunocompromised man. All but one infection were laboratory confirmed. The 11 women did not speak English, were born in Mexico, and had resided in the United States for a median of 2 years (range: 0-5 years). One had traveled outside Forsyth County during the month preceding illness. Ten women were pregnant, and infection with *L. monocytogenes* resulted in five stillbirths, three premature deliveries, and two infected newborns. The 11th woman was 5 months postpartum when she presented to a local hospital with meningitis caused by *L. monocytogenes*. She had no preexisting medical conditions. The male patient, who presented with a brain abscess, was receiving corticosteroid therapy after brain tumor surgery. On hospital admission, the 11 women reported symptoms that included fever (nine), chills (nine), headache (nine), abdominal cramps (five), stiff neck (five), vomiting (three), and photophobia (two).

The male patient was excluded from the case-control study because of difficulty finding suitable controls. In the case-control study, a mother and her fetus or newborn were counted as one case-patient. Controls were restricted to female Hispanic Winston-Salem residents and matched to patients by age and pregnancy status. Patients were more likely than controls to have eaten any cheese purchased from door-to-door vendors (matched odds ratio [MOR] = 17.5; 95% confidence interval [CI] = 2.0-152.5); quesillo fresco, a Mexican-style fresh soft cheese (MOR = 7.3; 95% CI = 1.4-37.5); and hotdogs (MOR = 4.6; 95% CI = 1.1-19.4). Illness was not associated with purchases at specific markets or supermarkets, eating raw fruits or vegetables, deli products, other cheeses (e.g., American, cheddar, mozzarella, and blue/Gorgonzola), or other dairy products.

Various members of the Hispanic immigrant community made the Mexican-style fresh soft cheese from raw milk in their homes. Inspectors found unlabelled homemade cheese in all three of the small local Latino grocery stores they visited in Winston-Salem. In addition, many persons regularly sold the cheese in parking lots and by going door-to-door. Owners of two local dairies reported selling raw milk. Milk samples were obtained from these two Forsyth County dairies and from three dairies in neighboring counties. *L. monocytogenes* isolates were obtained from nine patients, three cheese samples from two stores, one cheese sample from the home of a patient, and one raw milk sample from a manufacturing grade dairy. All 14 isolates had indistinguishable PFGE patterns, indicating a common link.

NCDA&CS conducted an investigation at a manufacturing grade dairy farm to determine the potential source of *L. monocytogenes* contamination. NCDA&CS collected milk samples from all 49 cows in the herd and samples from the bulk milk storage tanks. Milk from each cow was tested for somatic cell counts. All milk samples were negative for somatic cells, and random samples were collected from all 49 cows for *L. monocytogenes* isolation. Of 140 random milk samples, 139 were negative. One raw milk sample was positive for *L. monocytogenes*; however, all isolates from the bulk milk samples were indistinguishable from the raw milk isolate. Milk from all 49 cows in the herd was tested for somatic cell counts, and random samples were collected from all 49 cows for *L. monocytogenes* isolation. Of 140 random milk samples, 139 were negative. One raw milk sample was positive for *L. monocytogenes*; however, all isolates from the bulk milk samples were indistinguishable from the raw milk isolate. Milk from all 49 cows in the herd was tested for somatic cell counts, and random samples were collected from all 49 cows for *L. monocytogenes* isolation. Of 140 random milk samples, 139 were negative. One raw milk sample was positive for *L. monocytogenes*; however, all isolates from the bulk milk samples were indistinguishable from the raw milk isolate. Milk from all 49 cows in the herd was tested for somatic cell counts, and random samples were collected from all 49 cows for *L. monocytogenes* isolation. Of 140 random milk samples, 139 were negative. One raw milk sample was positive for *L. monocytogenes*; however, all isolates from the bulk milk samples were indistinguishable from the raw milk isolate. Milk from all 49 cows in the herd was tested for somatic cell counts, and random samples were collected from all 49 cows for *L. monocytogenes* isolation. Of 140 random milk samples, 139 were negative. One raw milk sample was positive for *L. monocytogenes*; however, all isolates from the bulk milk samples were indistinguishable from the raw milk isolate.
count to identify mastitic cows. Milk from each cow was also tested for presence of L. monocytogenes. Repeated testing did not identify any cow with milk confirmed positive for L. monocytogenes, suggesting that the cows were not infected and that L. monocytogenes may have originated from environmental contamination. As a result of this outbreak, North Carolina health authorities stopped the sale of raw milk by the dairy farm to non-commercial processors and educated store owners that it is illegal to sell unregulated dairy products. Officials cited the outbreak as sufficient reason to strengthen laws prohibiting the sale of raw milk except to regulated processors. Using already established programs (e.g., Baby Love Program), North Carolina officials recommended reinforcing and expanding the community awareness of the hazards of eating unpasteurized fresh cheese while pregnant. Finally, steps were taken to add listeriosis to the list of reportable diseases in North Carolina.

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CDC Editorial Note: The investigation of this outbreak implicated Mexican-style fresh soft cheese made from unpasteurized milk and hotdogs, two vehicles commonly identified as causes of L. monocytogenes outbreaks. The laboratory investigation resulted in isolation of L. monocytogenes from patients, cheese, and raw milk at a dairy farm. Molecular subtyping identified indistinguishable PFGE patterns, establishing the link between human disease, the cheese, and the source of the raw milk used to make the cheese.

Because of the health risks associated with the consumption of raw milk and raw milk products, FDA requires pasteurization of all dairy products sold across state lines except cheese made from raw milk that has to be aged a minimum of 60 days.1,2 Despite North Carolina laws prohibiting the sale and consumption of raw milk and raw milk products, such practices persist in some communities as a result of consumers’ taste preferences and for cultural reasons. The popularity of queso fresco, a Mexican-style fresh soft cheese made from unpasteurized milk, has resulted in several outbreaks in Hispanic communities since the 1980s. In 1985, an outbreak of septic abortions attributed to L. monocytogenes occurred among Hispanics in Los Angeles and Orange counties, California.3 In 1997, three outbreaks of multidrug resistant Salmonella serotype Typhimurium DT104 complex strains occurred in Hispanic communities in northern California and Washington.4,5 Because queso fresco in these communities is produced in private homes, food safety regulations are difficult to enforce. Education of milk and cheese producers and consumers about the increased risk for acquiring infections, particularly L. monocytogenes, from consuming unpasteurized milk or fresh soft cheese made from unpasteurized milk, complemented by regulatory action, are the keys to making cheese safe. Successful communication of public health messages to the Hispanic community about the risk for eating Mexican-style fresh soft cheese made from raw milk can be challenging because of language and other social barriers.

The findings in this report are subject to at least four limitations. First, interviewers were not blinded to the status of the persons they were interviewing. Second, efforts were made to select controls from the same population as case-patients; however, controls were selected on the basis of use of public health service programs. Most controls were selected from a county registry for a free prenatal care program that does not require documentation to obtain service. Third, during the study, rumors spread in the community that the suspected vehicle of infection was homemade Mexican-style fresh soft cheese. Finally, patients may have had better recall of potential exposures than controls.

Following a listeriosis outbreak in Yakima County, Washington, an education program to train grandmothers, the primary cheese producers in that community, in the safe production of soft cheeses was introduced and was well received. A licensing requirement for commercial cheese makers and appropriate regulatory action also may curtail the sale of fresh soft cheese made from unpasteurized milk. Twenty-eight states permit the sale of raw milk directly from farmers to consumers.6 Until all states prohibit such sales, outbreaks associated with eating queso fresco and other unpasteurized dairy products may continue despite efforts to educate consumers, especially those who do not speak or read English and whose cultural dietary habits favor such products.

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6 available

Hepatitis B Outbreak in a State Correctional Facility, 2000

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On March 31, 2000, acute hepatitis B was confirmed serologically in a 34-year-old man (index patient) who had been incarcerated for 2.5 years at a high-security state correctional facility and who presented to the facility medical unit with jaundice and abnormal liver enzymes. He reported having unprotected sex with his cellmate as his only risk factor for infection during the 6 months preceding his illness. Serologic testing of the 21-year-old cellmate confirmed that he had chronic hepatitis B virus (HBV) infection. He reported no history of symptoms compatible with hepatitis and was previously unaware of his chronic infection, but he did report having unprotected sex with the index...
mates were interviewed. Having sex with other sexual contacts of the inmate with infection to the index patient, one of the two inmates reported nonspecific symptoms (e.g., influenza-like illness) during the preceding 6 months. In addition, acute and chronically infected inmates were notified of their infection status, received a clinical assessment, and postexposure prophylaxis was provided to their contacts. The state’s department of health and department of corrections are collaborating to implement routine hepatitis B vaccination for all inmates in the correctional system.

CDC Editorial Note: The findings in this report document HBV transmission in a correctional facility, including a cluster of cases of acute infection in one dormitory and additional cases distributed throughout the facility. Most persons with acute HBV infection in the correctional facility were asymptomatic, and serologic surveys were needed to determine the extent of HBV transmission. The overall infection rate of 1% reflected infections acquired during the preceding 6 months and was higher than the estimated incidence of 1% per year in previous studies.1,2 This serologic survey also indicated that 1% of inmates had chronic infection and that none were aware of their infection status.

HBV is transmitted primarily by percutaneous or mucosal exposures to an infected person. Risk factors associated with HBV infection include having multiple sex partners, having had an STD, being a man who has sex with men, injection drug use, and being a sexual or nons sexual household contact of a person with chronic HBV infection.3

To control the outbreak, the state’s department of corrections offered hepatitis B vaccination to all susceptible inmates in dorm Y. In addition, acutely and chronically infected inmates were notified of their infection status, received a clinical assessment, and postexposure prophylaxis was provided to their contacts. The state’s department of health and department of corrections are collaborating to implement routine hepatitis B vaccination for all inmates in the correctional system.
ing a tattoo has not been associated with community acquired HBV infections among nonincarcerated populations in the United States; however, transmission could occur if the tattoo is applied using contaminated equipment.

Sex with another man accounted for only 20% of new infections in this investigation. However, this and other behaviors prohibited by the correctional facility (e.g., injecting drugs) probably are underreported by inmates. Inmates with previously unrecognized chronic HBV infection may have served as a source for infection, similar to household contacts of persons with chronic infection. Housing data were not available to determine if persons with acute HBV infection were more likely to have been a cellmate of a chronically infected inmate.

The findings in this report are consistent with previous reports of HBV transmission in prison settings. Since 1982, the Advisory Committee on Immunization Practices has recommended hepatitis B vaccination of long-term inmates with a history of risk factors for infection. Although a large proportion of inmates in this prison reported current or previous risk factors for HBV infection, none of the susceptible inmates had been vaccinated.

In the state correctional system in this report, approximately one third of inmates are released each year (Department of Corrections, unpublished data, 2000). Previously incarcerated persons represent a population at risk for HBV infection. Approximately 30% of persons with acute hepatitis B report a history of incarceration. Hepatitis B vaccination of prisoners would prevent ongoing HBV transmission among inmates in prison facilities and after they have been released into the community. Because of the high proportion of inmates with previous risk factors for HBV infection and the difficulty in ascertaining current risk factors, experts in correctional health recommend vaccination of all inmates.

Some states have implemented successfully routine hepatitis B vaccination of prisoners. However, identifying resources to purchase and administer vaccine remains the major barrier to national implementation of this strategy. Partnerships between state health and corrections departments can help to implement hepatitis B vaccination and promote effective strategies for prevention of other STDs and infections in correctional facilities.

### References

1. Available

## Vitamin A Deficiency Among Children—Federated States of Micronesia, 2000

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**Vitamin A, a fat-soluble, heat-stable nutrient (retinol) derived from animal sources and certain fruits and vegetables, forms the basic component of retinal pigments and plays a vital role in optimal health, growth, and development. Vitamin A deficiency (VAD) (serum retinol ≤20 µg/dL [≤0.7 µmol/L] for subclinical VAD) can substantially increase the risk for childhood mortality from infectious and noninfectious causes. VAD impairs the mobilization and transport of iron and is usually associated with anemia and reduced growth. VAD is a major public health problem in parts of Africa, Asia, Latin America, and the Western Pacific. In Chuuk and Pohnpei, two of the four Federated States of Micronesia (FSM) (2000 population: 107,008), nutrition surveys during the early 1990s documented VAD prevalences among the highest in the world (CDC, unpublished data, 1991; U.S. Public Health Service, unpublished data, 1994). In response to these findings, FSM health authorities, with support of the United Nations Children’s Fund (UNICEF), began distributing vitamin A supplements in 1993 and 1998 in Chuuk and Pohnpei, respectively. In November 1999, FSM requested assistance from CDC in VAD assessment surveys of children in Kosrae and Yap, the other two FSM states. This report summarizes levels of serum retinol and prevalence of VAD and other indicators of nutritional status among children aged 24-59 months in Kosrae and Yap. The findings indicated low serum retinol levels and high VAD prevalences but no substantial stunting or wasting. A comprehensive, long-term national strategy is needed in FSM to promote sustained improvement in vitamin A status.

FSM is an island nation in the western Pacific Ocean. Kosrae state is a single island divided into 21 enumeration districts. Yap comprises four large islands and 134 small islands, primarily atolls, and is divided into 93 villages. For logistic reasons, only the three large islands connected by bridges (Yap proper) were included in the survey. These islands represent approximately 62% of the Yap population.

During January-February 2000, FSM health authorities, UNICEF, and CDC surveyed children aged 24-59 months and their mothers or reproductive-aged female caregivers in Kosrae and Yap. A separate cluster survey was performed in each state. The sample size for each state was calculated to yield a prevalence estimate with 5% error assuming 50% VAD prevalence. Because of uneven village sizes (range: 157-537 residents per village in Kosrae and one-580 in Yap), clusters were selected using the proportionate-to-population size sampling method. Investigators selected 13 villages in Kosrae and 29 villages in Yap. In each village, all children aged 24-59 months identified from a comprehensive list of vaccination records were eligible for the survey. Children were excluded who had moved into the village during the 6 months preceding the survey or had experienced fever or diarrhea during the preceding 24 hours or cough for ≥4 weeks. If more than one eligible child lived in a household, investigators randomly selected one for the survey.
Caregivers were asked about demographics, feeding history, availability of home garden, number of vitamin A-rich plants grown, and vitamin/mineral supplement intake for each child. Caregiver information included demographics, reproductive history, dietary and nutritional knowledge of vitamin A and iron, and vitamin/mineral supplement intake.

Child height and weight were measured to calculate degree of stunting (height-for-age Z-score, ≤−2 standard deviations [SD] below the reference median) and wasting (weight-for-height Z-score, ≤−2 SD below the reference median) based on World Health Organization (WHO)/CDC references. Blood was collected by venipuncture to assess serum retinol and hemoglobin. Hemoglobin levels were measured by the cyanmethemoglobin method using a portable HemoCue™ instrument. Children with hemoglobin <110 g/dL were considered anemic. Serum samples for retinol were analyzed at CDC using high-performance liquid chromatography under a strict quality-control protocol.

For each state’s analysis, the survey sampling design was taken into account and the data were weighted to represent children aged 24–59 months. For Kosrae and Yap combined, the data were analyzed as a stratified cluster survey and weighted to represent the combined population of children aged 24–59 months. Because of the large proportion of children surveyed in each state (47.3% for Kosrae and 39.8% for Yap), the finite population correction was used to reduce the confidence interval.

A total of 270 children in Kosrae and 228 children in Yap was selected for the survey. Blood could not be collected from 13 children, leaving 267 children from Kosrae and 218 children from Yap included in these analyses. Only 485 children with retinol measurements were included in this report. Approximately half of these children were male, and they were distributed equally among ages 2, 3, and 4 years.

The mean serum retinol of all children surveyed was 20.4 µg/dL (18.0 µg/dL in Kosrae and 22.9 µg/dL in Yap). The prevalence of VAD among all children was 48.8% and was higher in Kosrae (63.3%) than Yap (33.8%). The prevalences of stunting (16.6%), wasting (3.8%), and anemia (11.2%) did not differ between the two states.

VAD risk factors among children for both states combined included residence in Kosrae, male sex, household size (>8 persons), maternal income (no income), education (<8 years), maternal VAD, type of first solid food (local food) given to the child, anemia in children, and vitamin A-rich plants (<2) grown in the garden. However, the specific risk factors for VAD varied between the two states. In Kosrae, male sex, family income (no income), and type of first solid food (local food) were associated with VAD. In Yap, the significant risk factors were outer island ethnicity, maternal education (<8 years), and vitamin A-rich plants (<2) grown in the garden. When stratified by each risk factor, all subgroups of children from Kosrae had VAD prevalence >37%, and on Yap all subgroups had VAD prevalence >17%.

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CDC Editorial Note: The findings in this report indicate that VAD prevalence in virtually all subgroups of children examined in this survey was ≥20%. WHO considers VAD prevalence ≥20% among children aged 6–71 months a severe public health problem. Compared with a healthy U.S. population, the serum retinol distributions among children from Kosrae and Yap are substantially lower, underscoring the potential risk for increased morbidity and mortality. Children with VAD often are anemic, stunted, and occasionally wasted.

However, in the population surveyed for this report, these indicators were not evident. The findings indicate relatively good nutritional status among these preschool-aged children. According to a proposed WHO classification for stunting and wasting among children aged <5 years, children from Kosrae and Yap have a low prevalence (<20%) of stunting and an acceptable prevalence (<5%) of wasting. These children also have lower prevalences of anemia than other Asia Pacific regions. This may be, in part, because of the absence of malaria.

The findings in this report are subject to at least one limitation. The survey lacked detailed dietary intake and medical data that would have provided a more complete assessment of the health status of each child.

To address severe VAD in children of Kosrae and Yap, vitamin A capsule distribution is the most practical immediate response. However, because of the magnitude and pervasiveness of VAD among preschool-aged children in all four FSM states and the likelihood that this problem extends to older children and adults, a comprehensive, long-term program is indicated. Although the risk factors for VAD identified in the survey do not fully explain the very low serum retinol distributions, they may be helpful in adjusting intervention programs to suit specific conditions in each state (e.g., promotion of vitamin A-rich plants in household gardens). A national strategy should be aimed at sustained improvement of vitamin A status of the population. Sustained correction of VAD may be achieved only by combining the supplementation effort among children with food fortification, diversification of dietary supply and consumption patterns, or public health education, as appropriate.

REFERENCES
10 references

*Use of trade names and commercial sources is for identification only and does not imply endorsement by CDC or the U.S. Department of Health and Human Services.