Outbreak of Listeriosis Associated With Homemade Mexican-Style Cheese—North Carolina, October 2000–January 2001

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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 unleaved 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 identified at a Women, Infants, and Children program office and through the county’s record of women enrolled in the state’s Baby Love Program, which provides outreach and prenatal-care home visits. A median of four controls (range: three to six controls) per case was selected. 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); queso 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 unlabeled 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 contamination.
count to identify mastitic cows. Milk from each cow also was 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.

Hepatitis B Outbreak in a State Correctional Facility, 2000

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 patient.
another man was the only risk factor as-
mates were interviewed. Having sex with
one (1%) had chronic infection, con-
sidering additional cases of HBV in-
fection in this correctional facility and
underscores the need to implement hepa-
titis B vaccination in correctional fa-
cilities.

Current inmates who had resided in
dorm Y at any time since October 1,
1999, were offered serologic testing for
HBV infection and were interviewed
about exposures during the preceding
6 months, including sexual activity, be-
ing tattooed, sustaining a cut or injury,
sharing exposed blood, sharing a razor, and injection drug use. Acute HBV infection was defined as the presence of IgM antibody to hepatitis B core antigen (IgM anti-HBc) with or without the presence of hepatitis B sur-
face antigen (HBsAg). Chronic HBV in-
fec tion was defined as the presence of
HBsAg and total (IgG and IgM) anti-
HBc, and absence of IgM anti-HBc. Re-
solved infection was defined as the pres-
ence of total anti-HBc, but absence of
IgM anti-HBc and HBsAg. Persons test-
ing negative for anti-HBc and HBsAg
were considered susceptible to HBV infection.

Of 103 eligible inmates, 97 (94%), in-
cluding the sexual contacts of the in-
mate with chronic infection, con-
sented to serologic testing. Of these 97
inmates, six (6%) had acute HBV in-
fec tion, one (1%) had chronic infection, and 16 (16%) had resolved infection. The acute HBV infection rate among sus-
ceptible dorm Y inmates was 8%. Two
inmates reported nonspecific symp-
toms (e.g., influenza-like illness) dur-
ing the preceding 6 months. In addi-
tion to the index patient, one of the two
other sexual contacts of the inmate with
chronic infection had acute infection.

The six inmates with acute infection
and 70 (95%) of 74 susceptible in-
mates were interviewed. Having sex with
another man was the only risk factor as-
sociated with acute HBV infection (risk
ratio = 12.2; 95% confidence inter-
val=3.5-42.2) and accounted for two of
six acute infections.

The correctional facility is com-
prised of 14 dormitories housing 96 in-
mates each; it operates at 99% capac-
ity. Inmates move within the facility to
participate in daily scheduled activities
and frequently move among dormi-
tories during their incarceration. Con-
doms are not available to inmates. Be-
cause of the HBV transmission in dorm
Y, on June 6, 2000, serologic testing was
offered to inmates who resided in the
remainder of the facility to determine if
further HBV transmission had oc-
curred.

Of 1247 inmates in the remainder of
the facility, 1026 (82%) consented to se-
rologic testing and completed a self-
administered questionnaire, which col-
clected information on demographic
characteristics and history of behaviors
or characteristics that may have placed
them at risk for HBV infection both dur-
ing incarceration and during their life-
time. Of the 1026 inmates, 10 (1%) had
chronic HBV infection and 178 (17%)
had resolved infection. Of 838 suscep-
tible inmates, five (<1%) were identi-
fied with previously undiagnosed acute
HBV infection, resulting in an acute in-
fec tion rate of 0.6% among inmates who
did not reside in dorm Y, and an over-
all infection rate of 1.2% (11 of 918). Of
the inmates with acute infection who did
not reside in dorm Y, two were housed
in one dormitory and the remainder re-
sided in three other dormitories. None
reported risk factors for HBV infection
during the preceding 6 months.

Risk behaviors were evaluated to
determine the potential for susceptible
inmates to acquire HBV infection. Among
the 907 susceptible inmates who com-
pleted the questionnaire, 473 (52%) repor-
ted at least one exposure while incarcerated that could have resulted in
HBV transmission. These included
injecting drugs (21 [2%] of 902), hav-
ing sex with another man (36 [4%] of
899), using a razor that had been used
by another inmate (73 [8%] of 900), and
receiving a tattoo (429 [48%] of 898).

HBV is transmitted primarily by per-
cutaneous or permucosal exposures to
an infected person. Risk factors associ-
ated with HBV infection include hav-
ing multiple sex partners, having had an
STD, being a man who has sex with men,
injection drug use, and being a sexual
or nonssexual household contact of a per-
son with chronic HBV infection. Recov-
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

8 available

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

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**Table 1:**

| Table 1 | Figure omitted |

**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 <11.0 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 were 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.