
Hepatitis A Outbreaks From Green Onions

Foodborne Threats to Health
Institute of Medicine
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Hepatitis A Virus (HAV) Infection

Clinical Features

Incubation period:	Average 30 days Range 15-50 days
Symptoms:	Range: None or nonspecific (young children) to fever and jaundice (adults) Diarrhea, nausea, abdominal pain, fatigue
Chronic infection:	None
Diagnosis:	Serologic test (IgM anti-HAV)
Immunity after infection:	Lifelong

Transmission of HAV

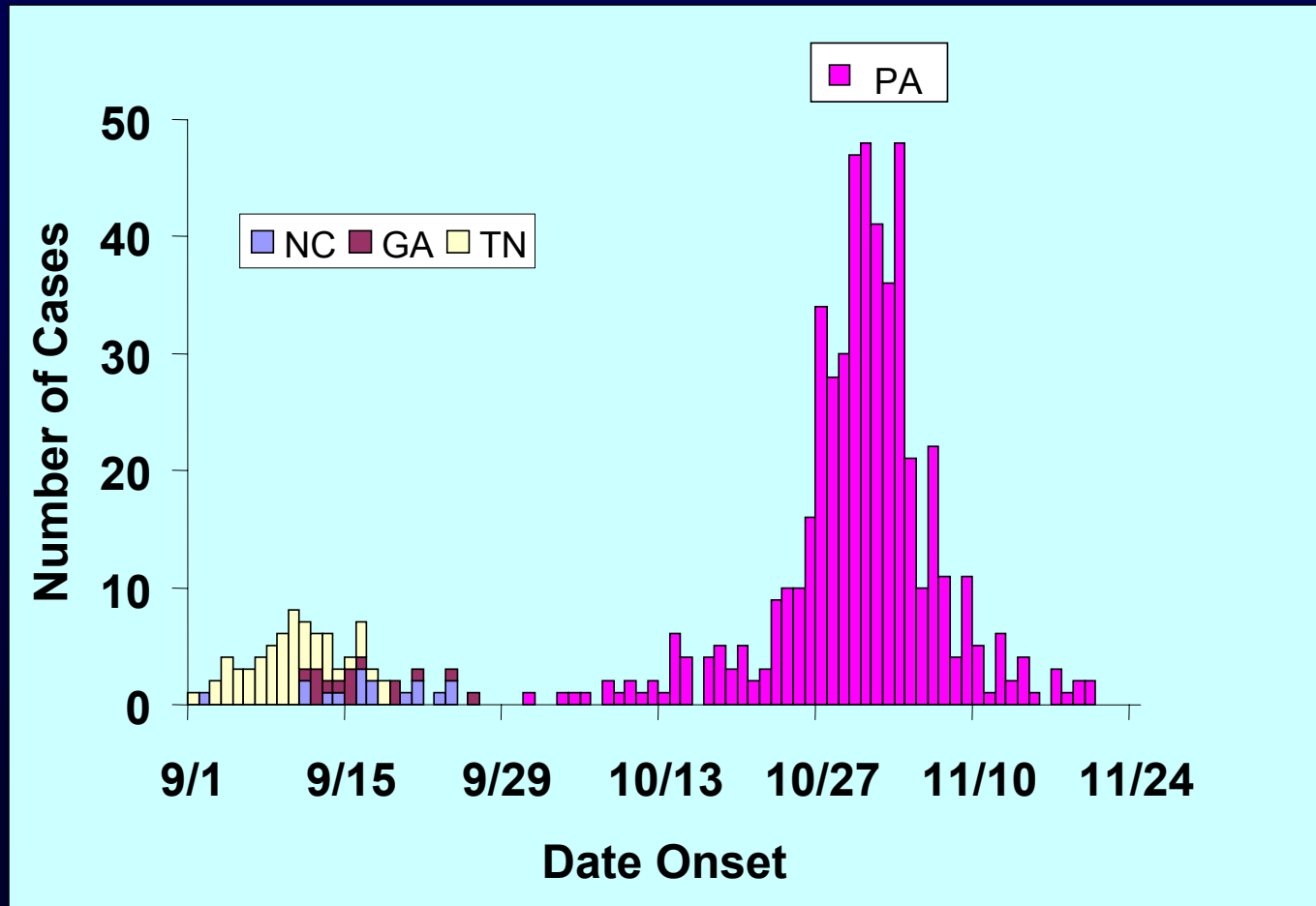
- Period of communicability: 2 weeks before onset of jaundice to 1 week after
- Infectious dose is unknown but likely low
- Stool can contain ~1 billion virus particles per gram
- HAV in organic material is stable in the environment for weeks

Hepatitis A Outbreaks from Green Onions, Fall, 2003

Summary

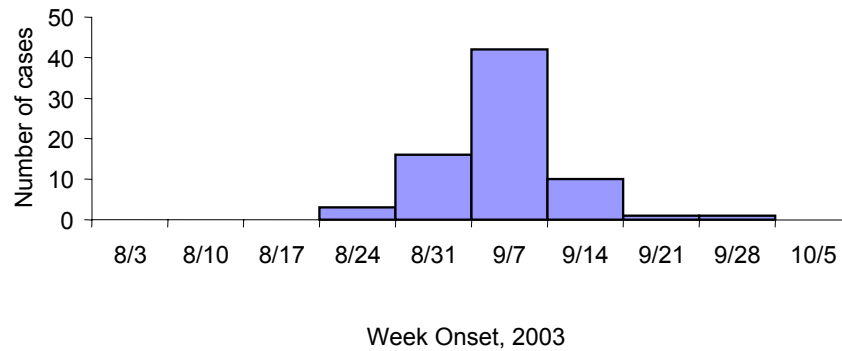
- Several distinct outbreaks during September-November, involving at least 4 states
- Over 1,000 cases; at least 3 deaths
- Most cases from exposures in a small number of restaurants
 - Over 600 cases among patrons of a single restaurant in Pennsylvania
- Implicated food in each outbreak was green onions from Mexico
- Resulted in FDA import ban on green onions from potentially implicated farms

Green Onion Associated Hepatitis A Outbreaks September – November, 2003; n=1023

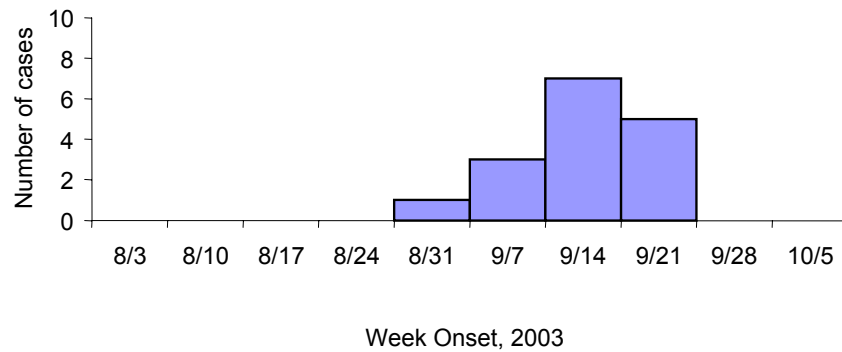


**Onset of Symptoms of
Hepatitis A Cases,
Tennessee, North
Carolina, Georgia;
August-September,
2003; n=422**

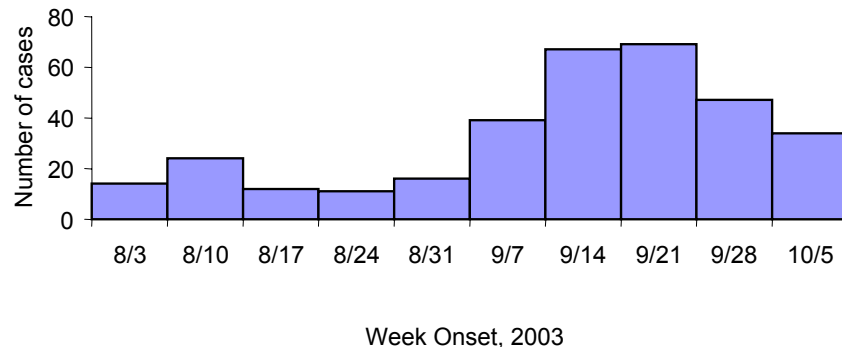
Knoxville, Tennessee (n=73)



Buncombe County, North Carolina (n=16)



Georgia (n=333)



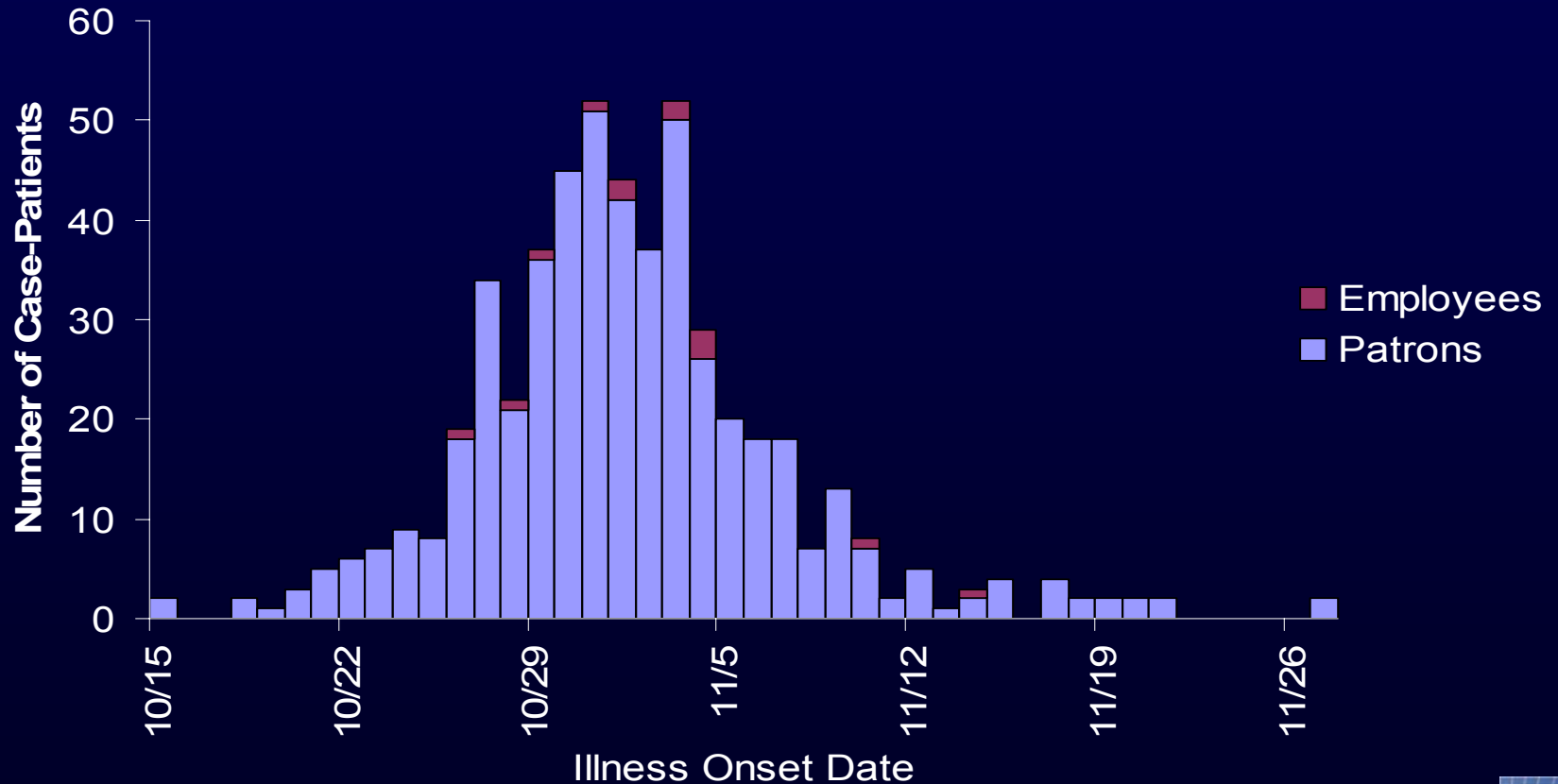
Green Onion-Associated Hepatitis A Outbreaks, Tennessee, Georgia, North Carolina Epidemiologic Features

- Associations with restaurants
 - TN and NC: all cases associated with one restaurant in each state
 - Ill food service workers with onsets concurrent with other cases
 - In GA, at least 3 restaurant-associated clusters identified
 - Incomplete information for many cases that shared outbreak strain
- Exposures primarily during 10 day period in August
- Green onions implicated by case control studies among restaurant patrons in each state
- Ongoing identification of viral strains as outbreaks unfolded
 - Clarified epidemiology
 - Informed traceback
 - Affected investigation of subsequent Pennsylvania outbreak

Green Onion-Associated Hepatitis A Outbreak Pennsylvania

- **November 1**
 - 10 cases reported from Beaver County, PA
 - Only 1 case in previous year
 - 6 cases reported eating in two separate groups at same restaurant
- **November 2**
 - 10 restaurant workers with symptoms of hepatitis A
 - Restaurant voluntarily closed
- **November 7**
 - 111 cases reported, all associated with eating at same restaurant

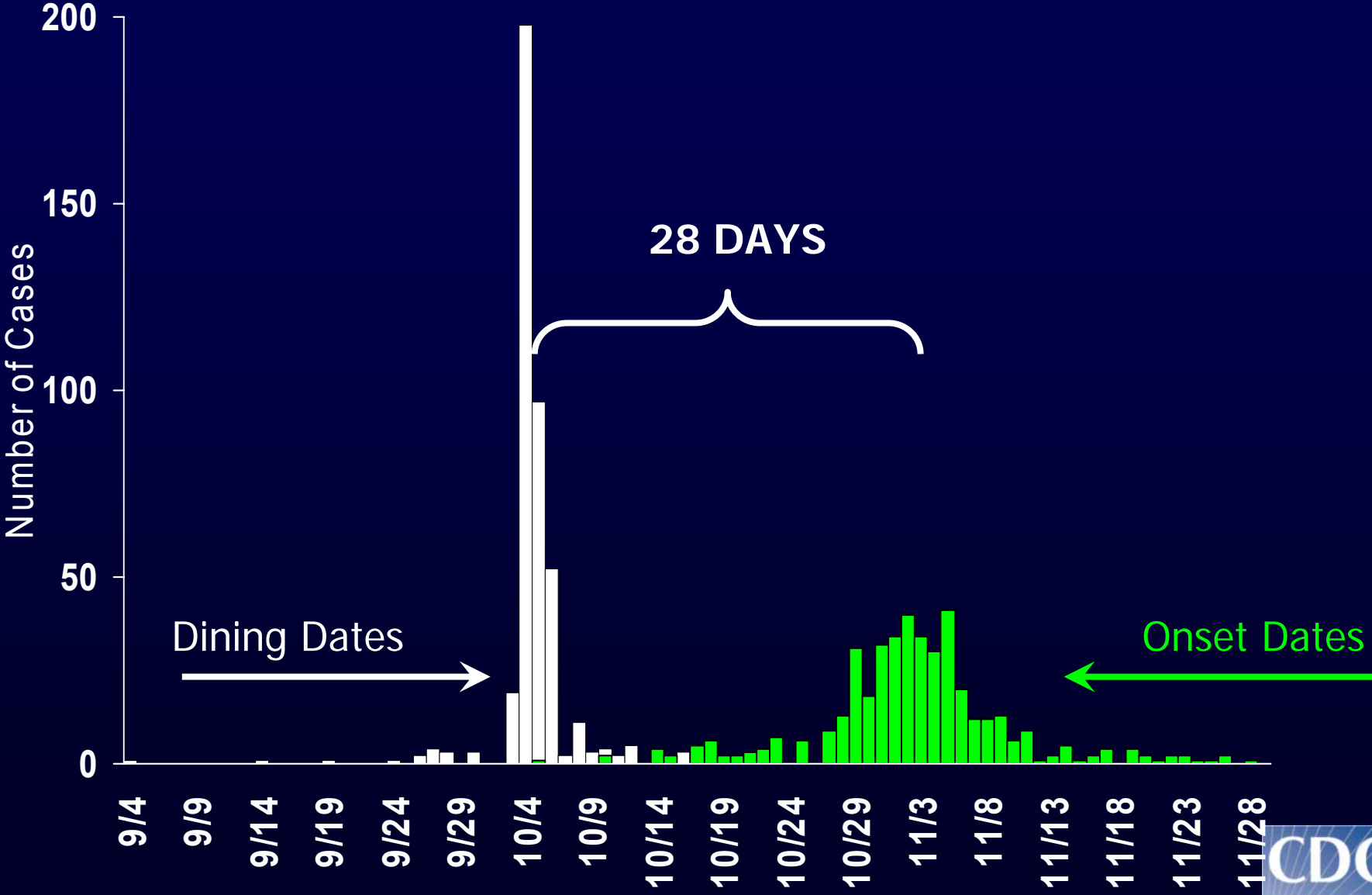
Cases of Hepatitis A by Reported Date of Onset Patrons and Employees of Restaurant D, Monaca, PA (n=527)*



*Additional 74 cases among residents of seven other states



Reported Dining and Illness Onset Dates of Hepatitis A Cases Patrons Who Ate Only Once at Restaurant D (n=425)



One-Time Restaurant D Patrons Dates of Exposure and Attack Rates, n=425

- 84% reported eating between October 3 and October 6
 - 67% dined on October 4 or October 5
- Estimated attack rate for 4 day period = 17.9%
 - 25% of diners on October 4
 - 29% of diners on October 5

Restaurant D Outbreak Investigation Case-Control Study

- 181 cases and 89 controls enrolled
- Menu items
 - Mild salsa eaten by 91% of cases and 35% of controls (odds ratio 19.6; 95% CI 11-34.9)
- Ingredients
 - Green onions eaten by 98% of cases and 58% of controls (odds ratio 33.3; 95% CI 12.8-86.2)
 - Only ingredient associated with illness in multivariate model

Restaurant D Practices

Green onions

- Arrived in boxes packed at farm, refrigerated up to 5 days
- Intact banded bundles of 5-8 green onions washed by running under tap
- Chopped and refrigerated for up to 2 days
- Used in preparing 49 menu items

Mild salsa

- Prepared in 40 quart batches
- Each quart contained 6 ounces of raw chopped green onions
- Batches could be refrigerated for up to 6 days
- Served to every table free of charge when patrons arrived

Hepatitis A Virus Sequences “Molecular Surveillance”

- Nested RT-PCR amplification of 315 nucleotide segment at VP1-2a junction





Serologic specimens from cases:

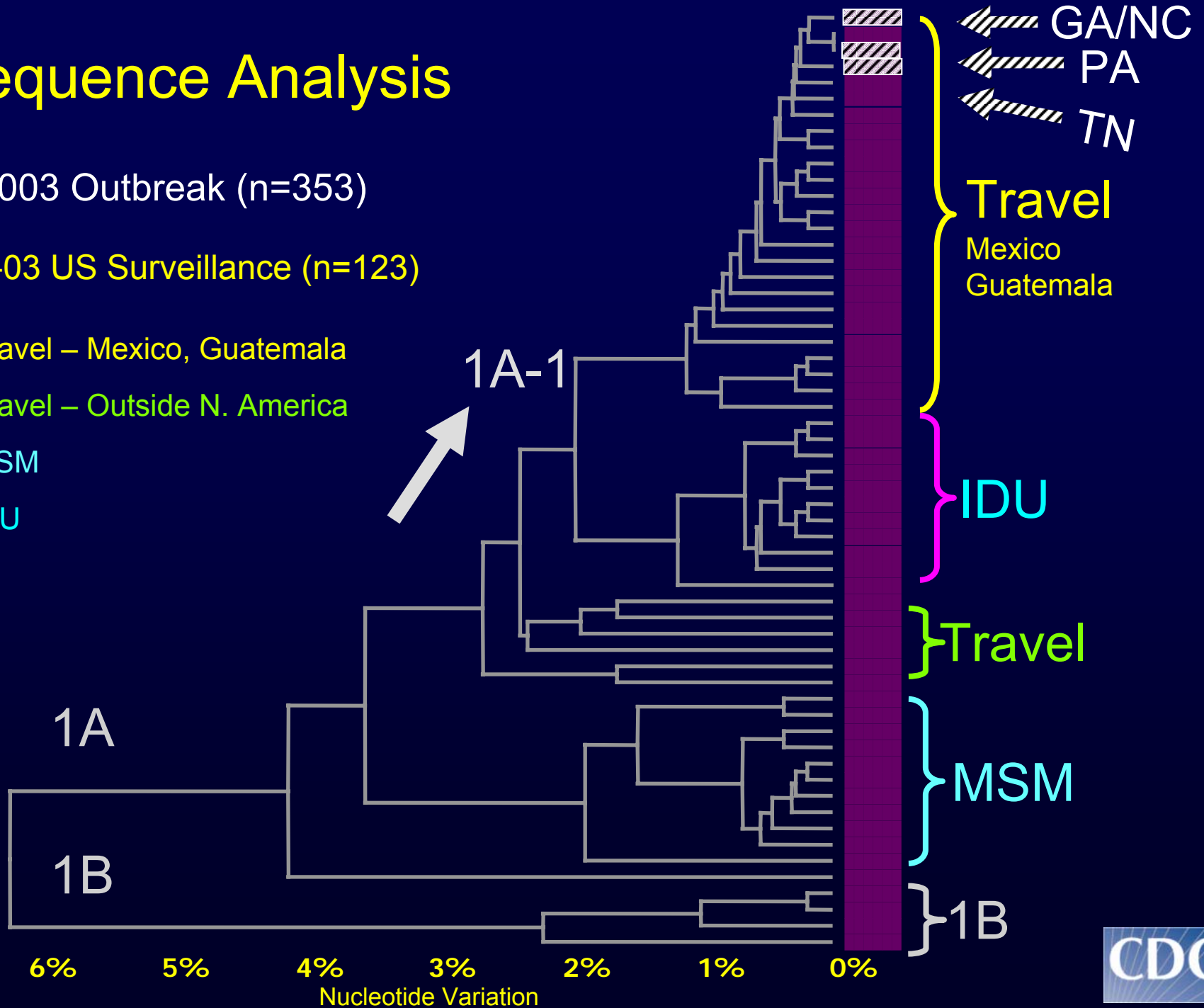
- Outbreak period (Sept-Dec 2003)
 - Outbreak-related settings (GA, TN, NC, PA)
 - Other states in response to national announcements and heightened surveillance
- Ongoing strain surveillance projects (2002-Aug 2003)
 - Sentinel Counties Study of Acute Viral Hepatitis (6 US counties)
 - Border Infectious Disease Surveillance Project (US-Mexico border region)

Sequence Analysis

 2003 Outbreak (n=353)

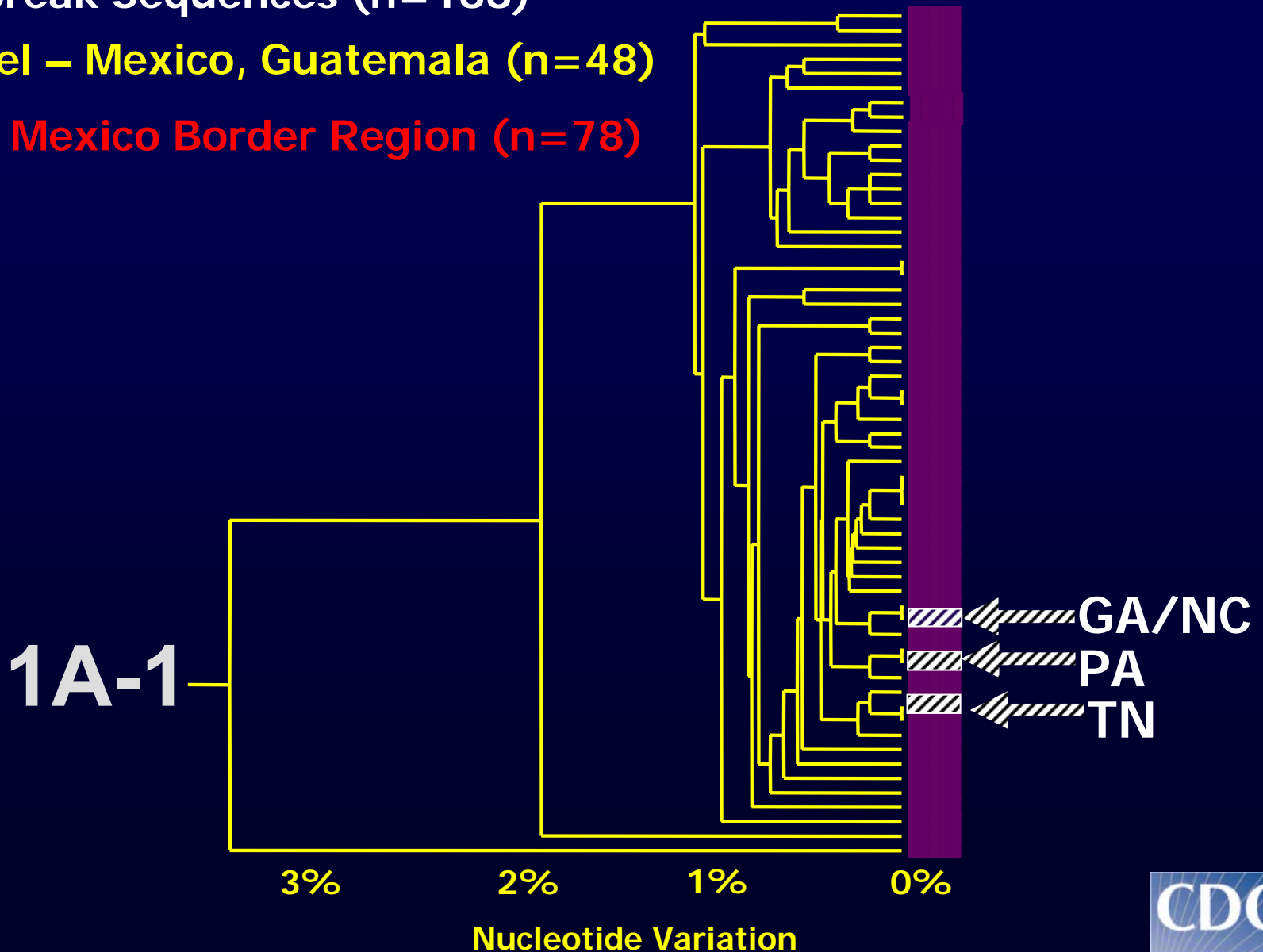
2002-03 US Surveillance (n=123)

-  Travel – Mexico, Guatemala
-  Travel – Outside N. America
-  MSM
-  IDU



Sequence Analysis

- Outbreak Sequences (n=188)
- Travel – Mexico, Guatemala (n=48)
- US – Mexico Border Region (n=78)



Sources and Distribution of Cluster 1A-1 HAV Sequences

Source	Cluster 1A-1 non-A, B, D (n=73)	Sequence "A" (TN) (n=54)	Sequence 'B' (GA/NC) (n=154)	Sequence 'D' (PA) (n=197)
Outbreak Surveillance				
TN	0	32	0	0
PA/OH/WV	0	0	0	170
NC	0	0	10	0
GA	0	1	122	0
Other	8	1	21	4
US Sentinel Counties	23	0	0	8
Mexico (BIDS)	42	20	1	15

FDA Investigation: Product Traceback

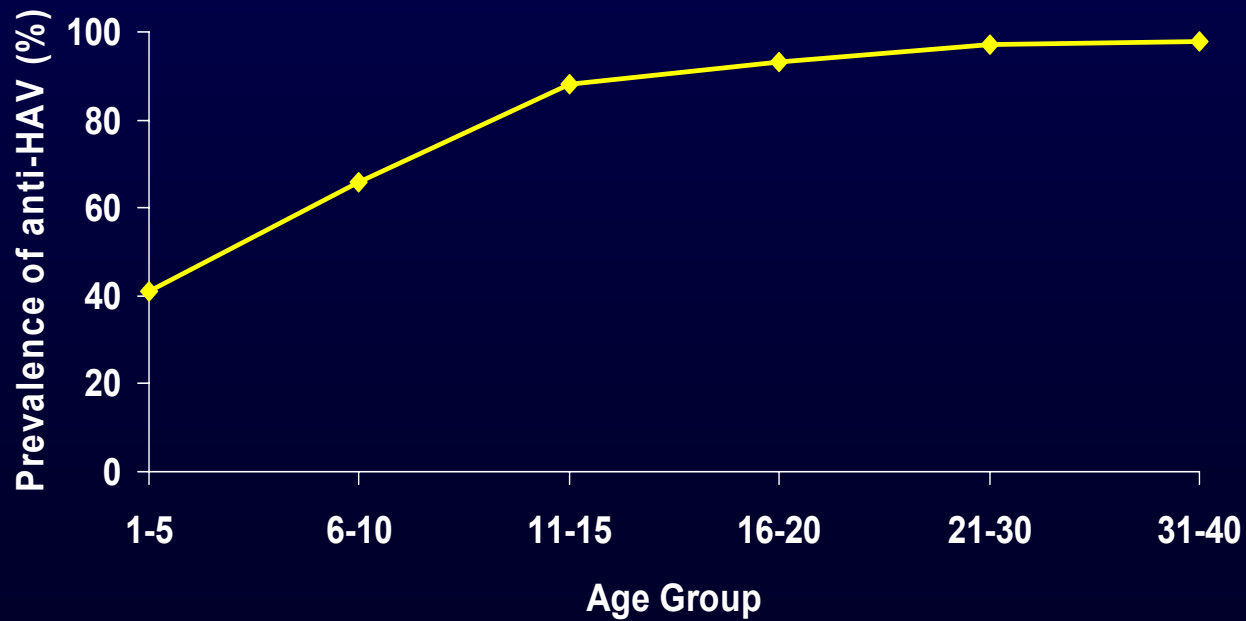
- 4 farms potentially supplied restaurants
 - No single farm could explain all 4 outbreaks
- All located in northern Mexico
- Thousands of pounds of green onions included in potentially implicated shipments
- Distributed widely throughout the country
- No more than 2 boxes implicated in each restaurant-associated outbreak

Hepatitis A Incidence Baja California, 2003

- Routine hepatitis surveillance does not include serologic testing
 - Etiology cannot be determined
- Local public health authorities and clinicians reported few hepatitis cases and no unusual increases
 - All identified cases among children
- News report of hepatitis outbreak in an area school
- Border surveillance sites
 - Tijuana: peak in late 2002
 - Mexicali: peak in early 2003

Why are there no reports of field workers with hepatitis A in agricultural areas of Mexico?

Anti-HAV Prevalence, by Age Group, Mexico; 1996-97



Source: Tapia et. al., 1999



Green Onion Handling Practices on the Farm

- Harvest
 - Pull from ground
 - Peel outer layer
 - Remove roots
 - Cut to size
 - Band 9-10 per bunch
- Packing
 - Spray bunches with chlorinated water while passing on conveyor belt
 - Pack in cardboard box; top with chipped ice
- Distribution
 - Boxes not handled between farm and restaurant

If adult field workers do not have hepatitis A, where could contamination come from?

- Adults with contaminated hands touched green onions during harvest or processing
- HAV-infected children contaminated the green onions directly
- Sewage contaminated growing areas



Prevention Outbreak Detection

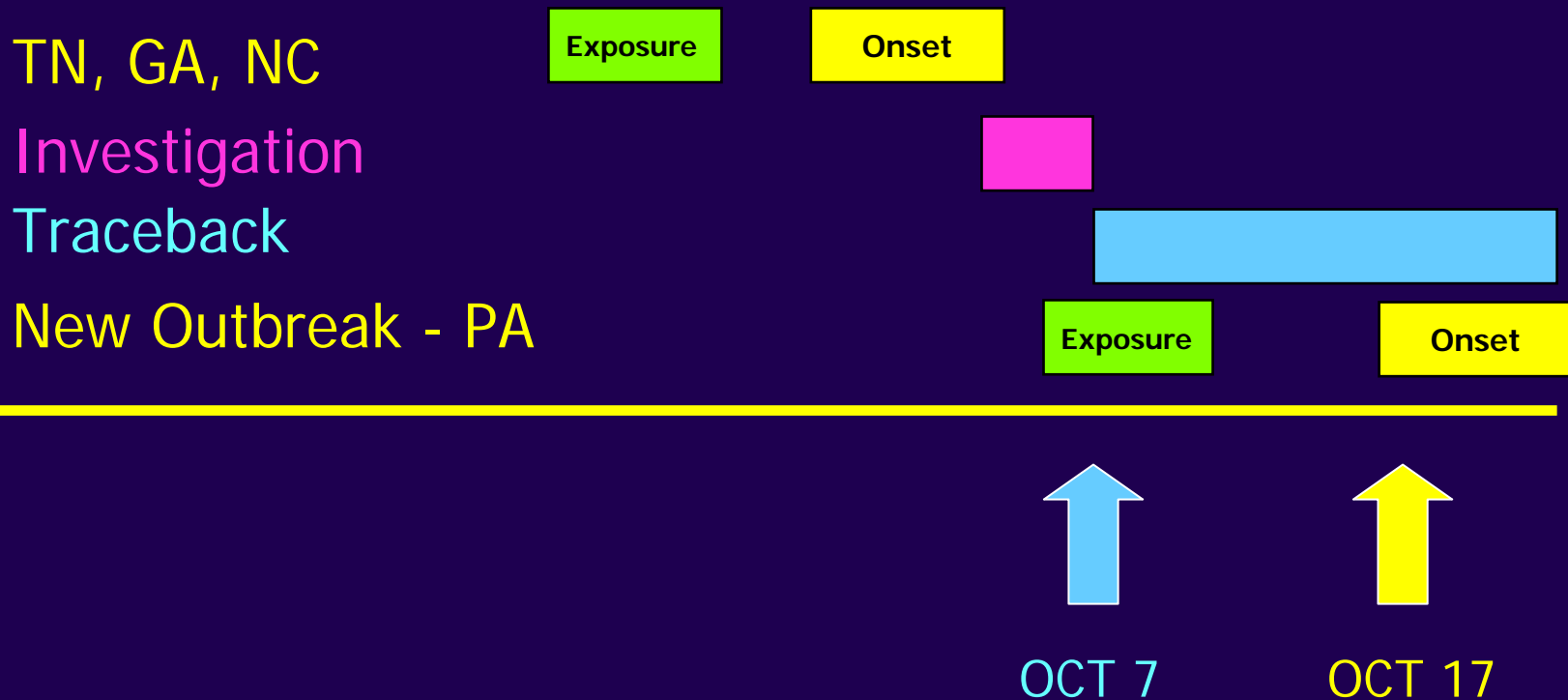
- **Progress**

- Supplemental surveillance systems
- Wider and faster use of molecular typing
 - Inform ongoing investigations
 - Improved sensitivity to detect “sporadic” cases
 - Integration of information from other countries

- **Challenges**

- Routine surveillance capacity
- Long incubation period
- Focal contamination may result in low attack rates
- “Routine” molecular typing of specimens from only a few sites
 - All lab work done at CDC

Investigation/Traceback Timeline



Prevention

Other Observations

- Green onions as emerging potential “problem” food
 - Implicated in at least two previous restaurant-associated hepatitis A outbreaks and outbreaks of other enteric pathogens
 - Vast majority now imported from Mexico
 - Require extensive handling
 - May be particularly difficult to clean
 - Pattern of contamination may complicate transmission detection
- Restaurant-associated outbreaks are not necessarily from infected food handlers
 - Food handlers with concurrent illness may suggest distributed product
- Conditions at point of sale can amplify outbreak
 - Types of foods
 - Food handling practices

Prevention

Detection of HAV in Food

- **Progress**

- Detection in “spiked” food samples and produce washes using reproducible RT-PCR methods

- **Challenges**

- Virus does not multiply in foods
- Infectious dose is small and contamination may be minimal
- Need to distinguish infectious HAV from non-infectious HAV RNA
- Not yet able to scale up to volumes needed to be reasonably sure that contamination is not present
- Current methods take days to complete
- RT-PCR may not perform consistently in presence of complex food mixtures

Prevention On the Farm

- Healthy field workers with access to adequate sanitary facilities
- Clean irrigation and rinse water
- Children not present in areas where food is harvested
- ? Reduce HAV transmission among population in growing regions

New rules target green onions, are tougher than in U.S.

By Diane Lindquist

UNION-TRIBUNE STAFF WRITER

May 15, 2005

MEXICALI – After the deadly hepatitis A outbreak linked to Baja California green onions a year and a half ago, Mexico has imposed an unprecedented food safety program that far exceeds practices in the United States.

"If you're going to grow onions in Baja California, you're going to do it right," said Baja California Agriculture Secretary Juan Pablo Hernández.

It's Mexico's first mandatory food safety certification program.

The practices are based largely on Food and Drug Administration guidelines for minimizing microbial contamination, but with more specific requirements.



Peggy Peattie/ Union Tribune

