The 2016-17 Mumps Epidemic in Arkansas:
Tailoring a public health response to the population affected

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State Epidemiologist

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Assistant Patient Care Manager

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Communicable Disease Nurse Specialist

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Conflict of Interest

- Received no monetary incentives
- Received no in kind gifts/services

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Objectives

- Recognize how mumps virus is transmitted
- Identify signs and symptoms of mumps
- Distinguish how Northwest Arkansas mumps outbreak was different than the norm
- Summarize clinical outbreak efforts

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Mumps

- Major cause of outbreaks in pre-vaccine era
- Vaccination has reduced mumps by 99% in the US
- Recently, a few outbreaks have centered around colleges and schools

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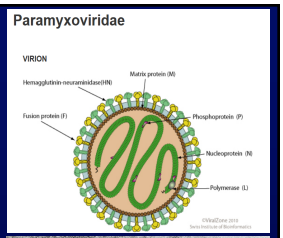
Mumps Virus

- Paramyxovirus
- Transmitted via respiratory droplets
- Reservoir is man



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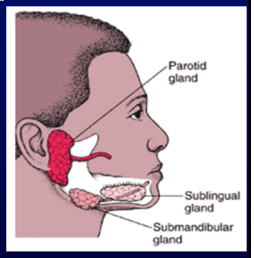
Mumps Clinical Features

- Incubation period usually 14-18d (but can be 12-26d)
- Often starts with 2-3d of nonspecific symptoms
- Classic parotitis in 30%-40%
- Up to 20% of infections asymptomatic
  - Higher proportion seen among vaccinated persons
  - Can still transmit



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Classic Swelling of Cheek and Neck (Parotitis) Seen with Mumps

CDC Public Health Image Library

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Other Causes of Parotitis

- Viruses
  - Epstein Barr virus
  - Parainfluenza viruses types 1 and 3
  - Influenza A viruses
  - Coxsackievirus
  - Adenovirus
  - Parvovirus B19
  - Human Herpes virus 6
  - Lymphocytic choriomeningitis virus
  - HIV
- Bacteria
  - Staphylococcal infections
  - Atypical mycobacteria
- Salivary stones
- Cysts
- Drugs
  - Thiouracil
  - Iodides
  - Phenothiazines
- Starch ingestion
- Malnutrition
- Tumors
- Diabetes
- Cirrhosis
- Uremia
- Rare genetic disorders:
  - Mikulicz's, Parinaud's and Sjögren's syndromes

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Potentially Serious Complications

- Inflammation of the:
  - Testicles
  - Pancreas
  - Ovaries
  - Breast
  - Encephalitis or Meningitis
- Deafness
- Male infertility

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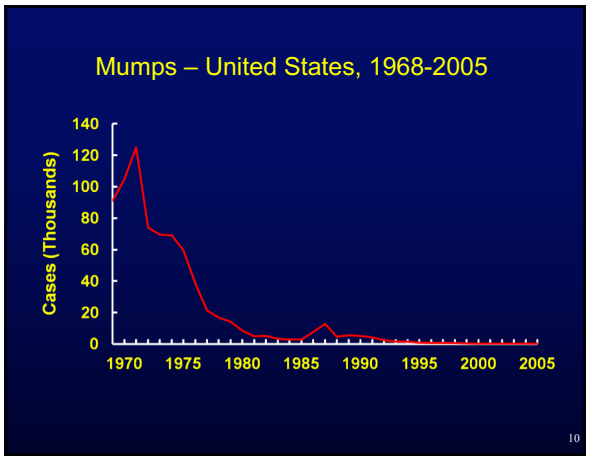
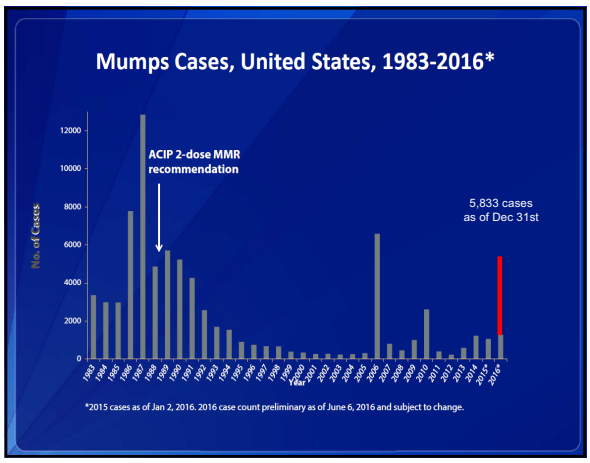
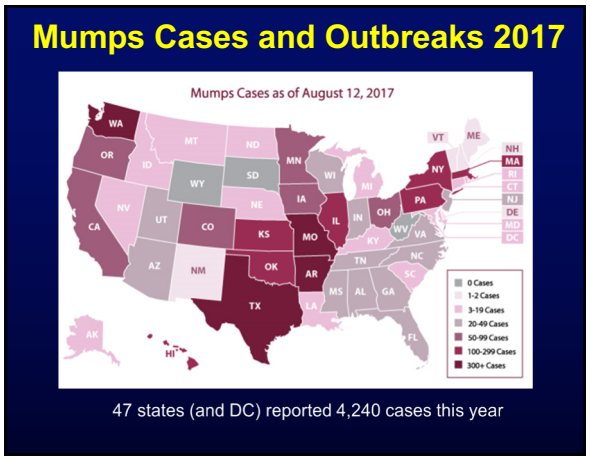

Mumps – United States, 1968-2005
Cases (Thousands)
140
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
10


Mumps Cases, United States, 1983-2016*
No. of Cases
12000
10000
8000
6000
4000
2000
0
ACIP 2-dose MMR recommendation
5,833 cases as of Dec 31st
Year
*2015 cases as of Jan 2, 2016. 2016 case count preliminary as of June 6, 2016 and subject to change.


Mumps Cases and Outbreaks 2017
Mumps Cases as of August 12, 2017
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
VT
ME
NH
MA
RI
CT
NJ
DE
MD
DC
AK
HI
0 Cases
1-2 Cases
3-19 Cases
20-49 Cases
50-99 Cases
100-299 Cases
300+ Cases
47 states (and DC) reported 4,240 cases this year

Epidemiological Characteristics

- Persistence in Environment: Low
  - Readily inactivated by UV light, formalin, heat, acid
- Epidemic Potential: High
  - High – epidemic parotitis
  - R_o=7.1
- Challenges
  - Imported cases
  - Immunity may not be lifelong

Mumps Laboratory Diagnosis

- Isolation of mumps virus
- Detection of RNA via PCR
- Serologic testing
  - Positive IgM antibody
    - At least 6 months since vaccination
  - 4 fold increase in IgG antibody between acute and convalescent specimens

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Mumps Vaccine

- Effectiveness — 88% after two doses
- Duration of Immunity — Generally lifelong
- Schedule — 1st dose at 12-15 months, 2nd after age 4 and for adults at higher risk
- Administered with measles and rubella (MMR)
- Developed from the Jeryl Lynn strain (genotype A)
- Every dollar spent on mumps vaccination saves $13.2 in direct and $24.9 in indirect costs. (Zhou et al. 2004)

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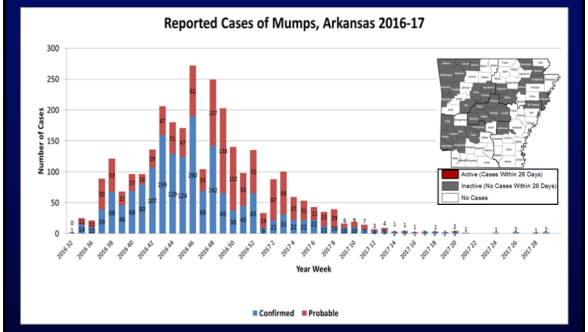
Current Status of the Outbreak
(as of Aug 31, 2017)



Outreach and Unique Populations

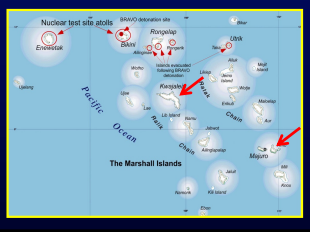
Many slides and advice kindly provided by Mrs. Sandy Hainline, RN

Marshall Islanders in NW Arkansas

- ~12,000 Marshallese in NW AR
  - Largest number in continental US

Challenges of Island Living

- Physical lack of land
- Economy is Poor
- Only two hospitals
- Out migration is accelerating



Compact of Free Association

- 1983 Legal agreement between the USA and the Republic of the Marshall Islands
  - May enter USA with passport only
  - Obtain a US social security number
  - Allows the Marshallese to work, attend school, and serve in the US military
  - Does not provide a pathway to citizenship
  - Prohibits most state or federal funding

Disproportionate Burden of Disease

- They bring the health issues of the islands with them
  - VPDs, TB, STDs, HIV, IPD, Hansen's, nutritional deficiencies
  - Rapidly incorporate American diet
    - Huge increase in diabetes, obesity, HTN
- Pristine immune system?
- Genetic damage from radiation
  - Increased burden of cancers

Clan / Household Structure

- Matrilineal
- Decisions that effect the house and children are made by oldest women in the house
- Large families
  - 8-12 in the islands
  - 6-8 in the US
  - Single house may have 3 families
  - Sister mothers
- ½ of the population is under 25

Effective Interaction

- Negativity will cause them to 'shut down'
  - Emphasize health promotion, not illness prevention
- Eye contact is considered aggressive
- Gain trust
- Deal holistically
- Take time to explain
- They live in an immediate world
- You must show interest

Primary Places Where Transmission Was Occurring

- Churches
- Homes
- Birthday Parties
- Employer Settings
- Schools

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Numerous Challenges Forced us to Adapt our Response

- Initially, we were not welcomed into churches
- Many community members considered this a low priority
- Some 'pushed back' due to perceptions of stigma
- Engaged the community
  - Identified community champions
  - Had medical mission from RMI
  - Set up a Marshallese Task Force
  - Partnered with UAMS, ARCOM, RMI Consulate, RMI MOH, CDC, Walmart
  - Pastors and pastors wives
- Medical anthropologist
- Interpreters
- Marshallese messaging
- Presented on Marshallese radio stations
- Brought vaccine to worksites, homes, apartments, and grocery stores

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Communication Challenges

- Massive outreach effort
- Different messages worked for different audiences
- Stakeholders have varied perspectives, goals, and needs
- Multipronged and repetitive approach needed

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Outreach Clinics

Location	Number of Sites	Number Vaccinated
School	28	3124
Worksites	18	2601
Churches	10	268
Residence	4	85
*WCHD Mass Clinic	3	1122
ADH Clinics	2	459
Grocery Store	1	18
Total	**66**	**7,677**

* Flu vaccine was also provided at these clinics.

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Surveillance

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August 2016

- August 6th : Initial case in local E.D. /onset parotitis August 5th
- August 8th: Positive serology report to ADH
- August 15th: Confirmed with ADH lab
- August 21st: Household contact developed symptoms
- August 29th: Positive IgM and PCR
- August 30th: 5 new suspects report
- August 31st: 16 new suspects report

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September

- September 1st:
  - 4 confirmed cases
  - 14 pending PCRs
  - 30 suspects
  - 11 schools impacted
- September 21st
  - 220 investigations
- September 30th
  - 280 investigations

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Surveillance Activities

- Surveillance
  - Field Coordination
  - Assignments and investigation
  - Interpreters, staffing, equipment, communication letters
  - Surveillance and outreach efforts

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Outbreak Continued

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Vaccination Status Among Those Who Have Been Investigated

	Age Groups				
Vaccination Status of Cases	<1	1 - 4	5 - 17	18+	Total
0 MMR	10	36	88	726	860
1 MMR	0	39	48	134	221
2+ MMR	0	24	1,535	293	1,852
Total	10	99	1,671	1,153	2,933
Total Up-to-date	0	63	1,535	427	2,025
% Up-to-date	N/A	63.6%	91.9%	37.0%	69.0%

There are 8 more cases under investigation whose vaccine status is not known

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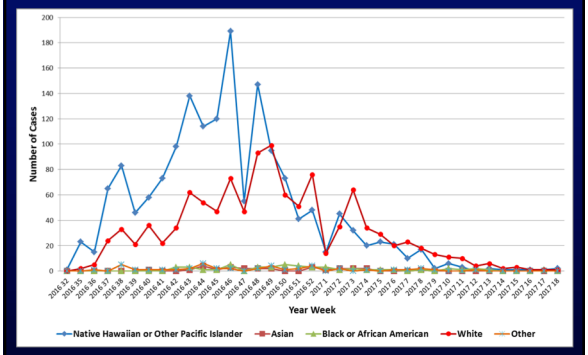
Weekly Mumps Cases by Race



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Observed vs. Expected Complications of Mumps

	Age Groups			
Complication	**% Pre vaccination**	**% Post-vaccination**	**Approximate Number Expected with 3,000 cases**	**Number Observed as of 5/10/17**
Meningitis	1-10%	<1%	30-300	0
Encephalitis	0.5%	<1%	15-30	0
Orchitis	12-66% of men	~10%	180-990	18
Oophoritis	5% of women	<1%	75	0
Pancreatitis	2-5%	<1%	60-150	1
Deafness	0.005%	rare	0-1	0
Infertility	4% of men	rare	60	0
Hospitalization	10%	2%	60-300	6

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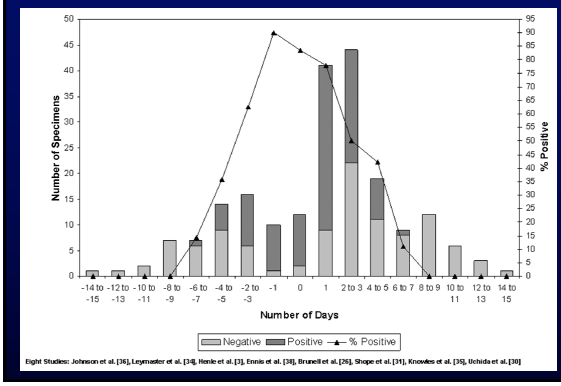
Duration of Mumps Positivity Relative to Parotitis Onset (Kutty et. al 2010)



Eight Studies: Johnson et al. [36], Leymaster et al. [34], Henle et al. [3], Ennis et al. [38], Brunell et al. [26], Shope et al. [31], Knowles et al. [35], Uchida et al. [30]

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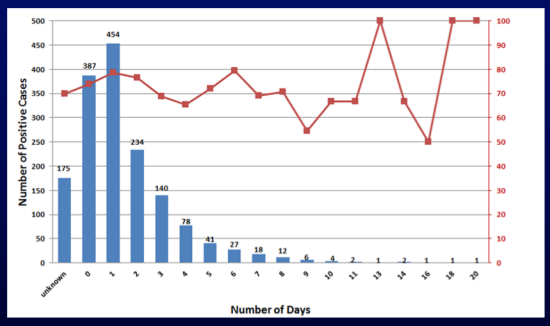
Number of PCR-Positive Cases and Proportion Positive by Days After Parotitis Onset



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Prolonged PCR Positivity

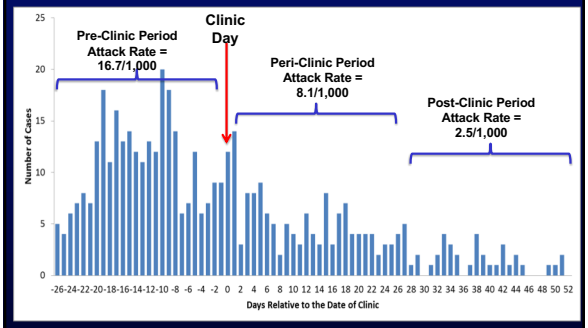
- 75 cases confirmed by PCR greater than 5 days after parotitis onset
- Age range 2-46 years
- 65% Marshallese
- 57% Female

- PCR positivity ≠ infectious
  - 10 samples sent to CDC and all had live virus

Recurrent Disease

- 28 cases with recurrent onset of clinical parotitis
  - 7 days to 161 days after first episode, average 71 days, median 69 days
  - Age range 5 months - 52 years
  - 79% Marshallese
  - 57% female
- Vaccination history
  - 68% had at least 2 doses of MMR, 14% had 1 dose, and 18% had none

Rates of Mumps in 21 Schools Before and After Clinics



Does the Booster help?

Note: This analysis is restricted only to students in the 21 schools who already had two MMR doses

Mumps Before and After MMR Clinics			
Pre-Clinic Rate of Mumps	Results of Clinic	Rate (Count) of Mumps From 1-26d After Clinic	Rate (Count) of Mumps From 27-52d After Clinic
16.7 (278)	1,916 Students Received 3rd Dose Booster	13.0 (25)	1.0 (2)
	14,397 Did Not Receive 3rd Dose Booster	7.4 (107)	2.7 (38)

Crude 3rd dose Vaccine Effectiveness = (2.6-1.0)/2.6= 61%

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What is ADH Doing about Mumps?

- Using the best evidence available
- Interviewing suspect cases and contacts
- Excluding undervaccinated kids from school
- Performing vaccination clinics in many settings
- Providing advice to providers, schools, employers, and parents
- Evaluating our control efforts and contributing to the understanding of mumps
- Communicating to many audiences

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Lessons Learned

- Know your community resources
- Flexibility
- Communication
- Identify early any difference than the norm
- Supplies

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Resources

- https://www.healthy.arkansas.gov/programs-services/topics/mumps
- https://www.cdc.gov/mumps/about

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Acknowledgements

- Thanks to all that have been involved in the outbreak response!
  - ADH staff, CDC staff, RMI Ministry of Health, Marshallese Task Force, ARCOM, UAMS, community leaders, and more
- Thanks specifically to Dr. Haytham Safi and Ms. Virgie Fields who helped create the slides

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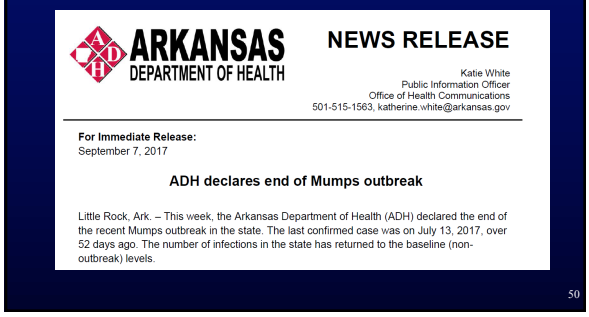
Questions / Comments



ARKANSAS DEPARTMENT OF HEALTH

NEWS RELEASE

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For Immediate Release:
September 7, 2017

ADH declares end of Mumps outbreak

Little Rock, Ark. – This week, the Arkansas Department of Health (ADH) declared the end of the recent Mumps outbreak in the state. The last confirmed case was on July 13, 2017, over 52 days ago. The number of infections in the state has returned to the baseline (non-outbreak) levels.

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