Multistate Listeria Outbreak: The New Mexico Perspective

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Arizona Infectious Disease Training and Exercise
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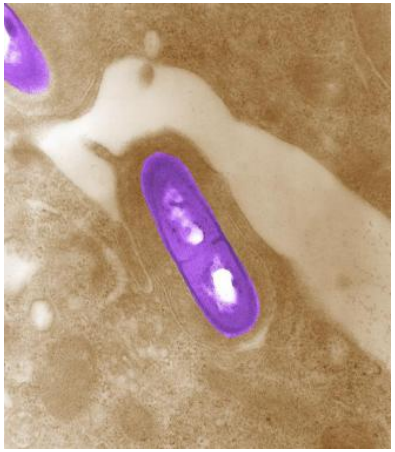
Listeriosis



- Caused by bacterium *Listeria monocytogenes*
- Annually causes 1,600 illnesses and 260 deaths in the U.S.
- Incubation period of 3-70 days
- Symptoms usually include fever, aches, and GI illness; septicemia, meningitis, and birth complications in severe cases
- Pregnant women, adults $\geq$ 65, and immunocompromised are at greatest risk for invasive disease

Epidemiologic Investigation

- NMDOH notified of *Listeria* in a child on Oct. 23, an adult on Nov. 10, and a neonate on Nov. 13
- Nov. 14: Reached out to AZ and CO; CDC notified
  - Early link: 2 young Native American boys in AZ and NM
- Nov. 21: CDC begins coordination of multistate investigation
  - 5 PFGE-matched cases in 4 states (AZ, CO, NM, WI)
- Investigation combined with cluster originating in MN

Next Steps

A lot of head scratching

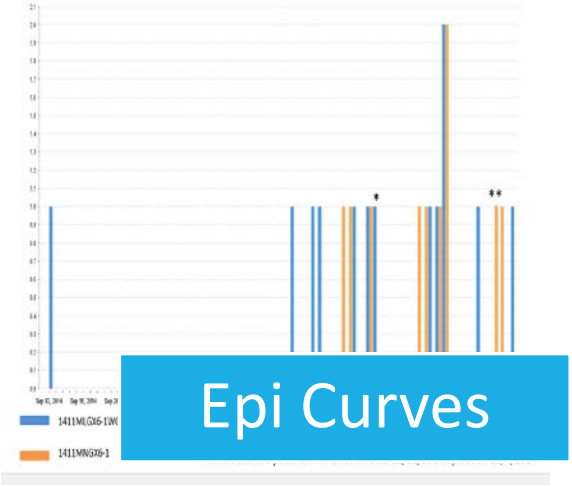
Variable	No. Cases Exp.	% Cases Exp.	% Controls Exp.	Difference
CEREAL	9	100.0%	55.9%	34.1%
ANYPB	8	100.0%	63.4%	36.6%
EGGS	8	100.0%	68.6%	31.4%
BACON	7	77.8%	43.1%	34.7%
CHIPS	7	87.5%	78.0%	9.5%
CREAMYPB	7	77.8%	39.2%	38.6%
MILK	7	100.0%	82.0%	18.0%
SHREDCHZ	7	87.5%	55.1%	32.4%
GBDISHHOME	6	85.7%	65.2%	20.5%
GRAPE	6	75.0%	36.4%	38.6%
GREENS	6	66.7%	41.9%	24.8%
OJ	6	66.7%	14.6%	52.0%
SMBOTTLEWATER	6	100.0%	36.7%	63.3%
STRAWBERRY	6	75.0%	44.7%	30.3%
WHOLEGRN	6	85.7%	46.8%	38.9%
APPLE	5	62.5%	65.9%	-3.4%
BLOOKCHZ	5	71.4%	44.9%	26.5%
BREADEDCKN	5	55.6%	50.0%	5.6%
BROCCOLI	5	62.5%	18.6%	43.9%
FZNPIZZA	5	62.5%	48.8%	13.7%
HOTDOGS*	5	55.6%	59.6%	-4.0%
ICEBERG	5	71.4%	38.6%	32.8%
LETTUCESAND	5	55.6%	27.5%	28.1%
ONION*	5	71.4%	25.0%	46.4%
ORANGE	5	55.6%	33.3%	22.2%
PPCHAX	5	71.4%	76.3%	-4.9%
SLICEDCHZ	5	83.3%	53.1%	30.3%
WATERMELON	5	55.6%	37.0%	18.6%
BELLPEPPER*	4	57.1%	9.8%	47.4%
CANTALOUPE*	4	44.4%	14.3%	30.2%
CHOCOLATE	4	66.7%	41.5%	25.2%
CUCUMBER	4	57.1%	31.1%	26.0%
FSHTOMATO	4	50.0%	25.6%	24.4%
FZNPFAST	4	50.0%	32.4%	17.6%
GBDISHAWAY	4	44.4%	33.3%	11.1%
HOTPEPPER	4	44.4%	4.8%	39.7%
ICECREAM				
MINICARROT				
OTHERPORK				
PEPPERONI				
FRESLTWELON				
ROMATOM				
TOMATOSAND				
APPLUCE				
CASHEW				
FSHFISH				
FSHGRAPFTY				
GUACAMOLE	3	37.5%	2.3%	35.2%
HOTCEREAL	3	42.9%	25.0%	17.9%

Variable	No. Cases Exp.	% Cases Exp.	% Controls Exp.	Difference
LEMONLIME	5	37.5%	100.0%	-62.5%
NORBAWAY	3	33.3%	0.0%	33.3%
OTHDELIMEAT	3	37.5%	9.1%	28.4%
OTHEXJUICE	3	42.9%	21.1%	21.8%
OTHTROPICAL	3	33.3%	4.5%	28.8%
FARMESEAN	3	37.5%	20.4%	17.1%
FBFOODS	3	37.5%	7.7%	29.8%
KEAKUT	3	50.0%	18.4%	31.6%
PINEAPPLE	3	33.3%	15.9%	17.4%
PPACKDELIMEAT	3	37.5%	37.0%	0.5%
PIGREENS	3	33.3%	23.5%	9.8%
SAUSAGE	3	37.5%	52.2%	-14.7%
STEAK	3	37.5%	2.3%	35.2%
SUPPLEMENT	3	50.0%	24.4%	25.6%
ALMOND	2	33.3%	12.5%	20.8%
ANOTHDAIRY	2	28.6%	28.6%	0.0%
BLUEBERRY	2	25.0%	28.9%	-3.9%
CAULIFLOWER	2	28.6%	4.9%	23.7%
CELERY	2	22.2%	21.4%	0.8%
CILANTRO	2	22.2%	0.0%	22.2%
DRYFISH	2	28.6%	2.2%	26.4%
FRUITROLL	2	28.6%	13.2%	15.4%
FZNBERRY	2	22.2%	2.7%	19.5%
FZNNACHS	2	28.6%	5.3%	23.3%
FZNYOGURT	2	25.0%	4.4%	20.6%
GRANOLA	2	28.6%	27.5%	1.1%
HEADICEBERG	2	22.2%	5.9%	16.3%
HONEYDEW	2	22.2%	13.6%	8.6%
JERKY	2	22.2%	6.5%	15.7%
LGBOTTLEWATER	2	33.3%	14.6%	18.8%
NOCKNAWAY	2	22.2%	0.0%	22.2%
NOGREENSAWAY	2	22.2%	0.0%	22.2%
OTHCARROT	2	22.2%	12.2%	10.0%
OTHDREDFRUIT	2	25.0%	5.3%	19.7%
PANCAKENS	2	25.0%	4.7%	20.3%
VINETOM	2	22.2%	2.0%	20.3%

Food Histories

Safeway	WA	WA__20278	
Sam's Club	AZ	AZ__AZ00023398	
Sam's Club	TX	TX__TXACB1403743	
			MN__C2014019204 MN__C2014019515
Sam's Club	MN		
Schnucks	MO	CDC__M14-127	
Schwann's Delivery	TX	TX__TXACB1403743	
Sekapp Orchard	MN	MN__C2014020760	
Silver Lake Foods	MN	MN__C2014020760	
Smith's	NM	NM__2014035025 NM__2014035347	
Smith's	UT	UT__0901244	
Sprouts	AZ	AZ__AZ00023800	
Sprouts	UT	UT__0901244	
Sun Fresh	MO		CDC__M14-124
T&R	NM	CDC__2014033414	
Target	MN		MN__C2014019628
United	TX		TX__TXACB1403719
Walgreens	WA	WA__20278	
Walmart	AZ	AZ__AZ00023172 AZ__AZ00023800 AZ__AZ00024032	
Walmart			
Walmart			
Walmart			
Walmart			
Walmart	MO		CDC__M14-124

Grocery Stores



Epi Curves

	1411MLGX6-1	1411MNGX6-1	Combined
Number of Cases	13*	10*	22
States Involved	AZ (3)*, NM (3), MO (2), CO, TX, UT, WA, WI	MN (3), MO (2), AZ*, NC, NM, TX, WI	AZ (3)*, MO (4), NM (4), MN (3), WI (2), TX (2), NC, UT, CO, WA
Listeria Initiative forms	12	8	20
Isolation Dates	9/12-11/18/2014	10/26-11/17/2014	9/12-11/18/2014
Median Age (range)*	36 (0-81)	45 (0-92)	36(0-92)
Female (%)	4/13 (18)	4/10 (40)	8/22 (36)
Race	White (6), Native American (4)*, Unknown (3)	White (6), Unknown (2), Native American, (1)*, African American (1), African American/Native American (1),	White (12, 55%), Native American (4, 18%)*, Unknown (5, 23%), African American (1, 5%), African American/Native American (1, 5%)
Hispanic			
Pregnancy-associated			
Hospitalizations			
Deaths			

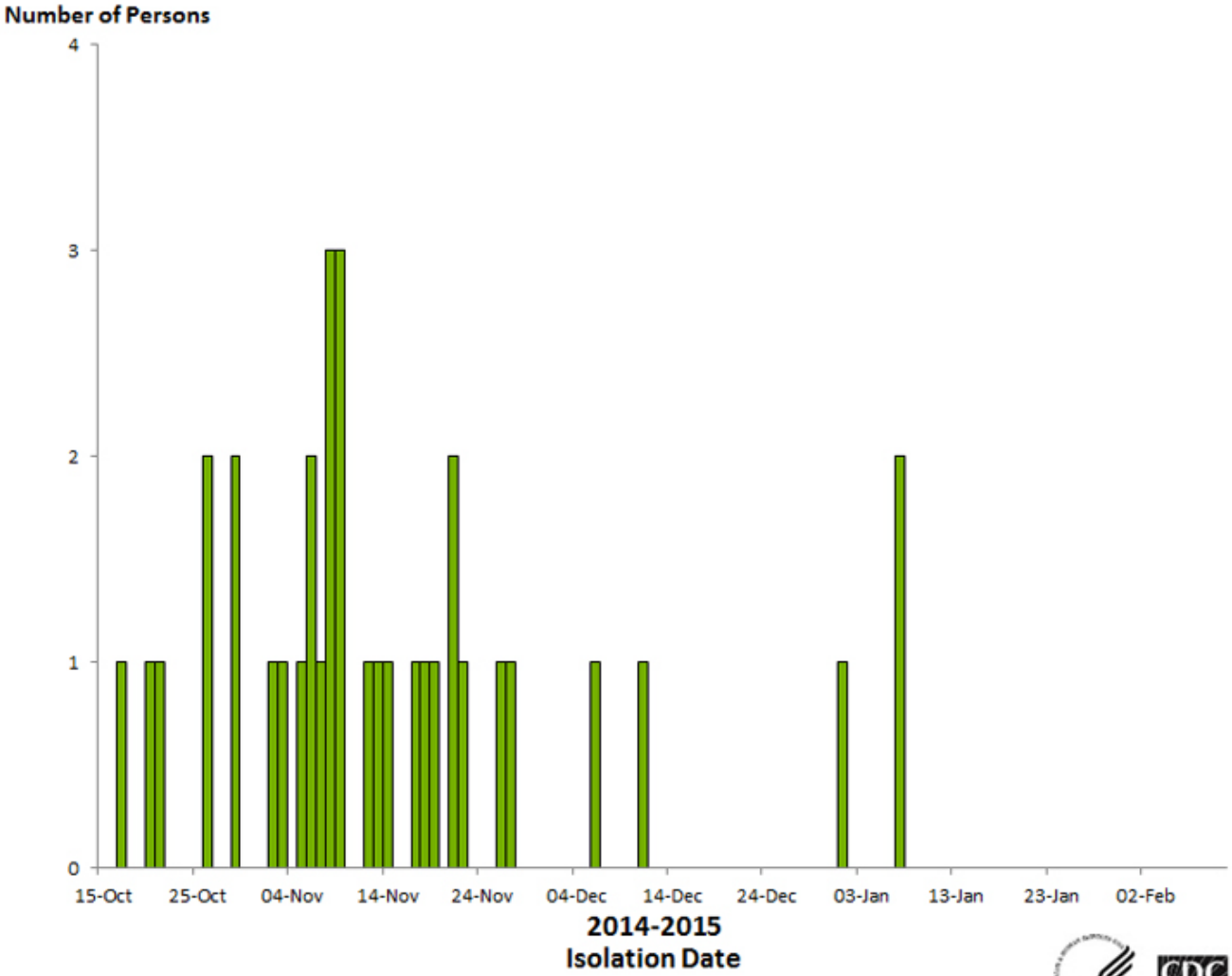
Epi Data

Caramel Apples

- Dec. 15: CDC requests inquiry regarding caramel apple exposure
  - Later that evening: 7/8 say “yes”
- Dec. 19: CDC posts outbreak
  - 28 ill; 15/18 say “yes”
- Additional product information sought
- Traceback pinpoints Bidart Brothers

Epi Curve of Outbreak Cases

Oct. 15, 2014 – Feb. 02, 2015 (n=35)



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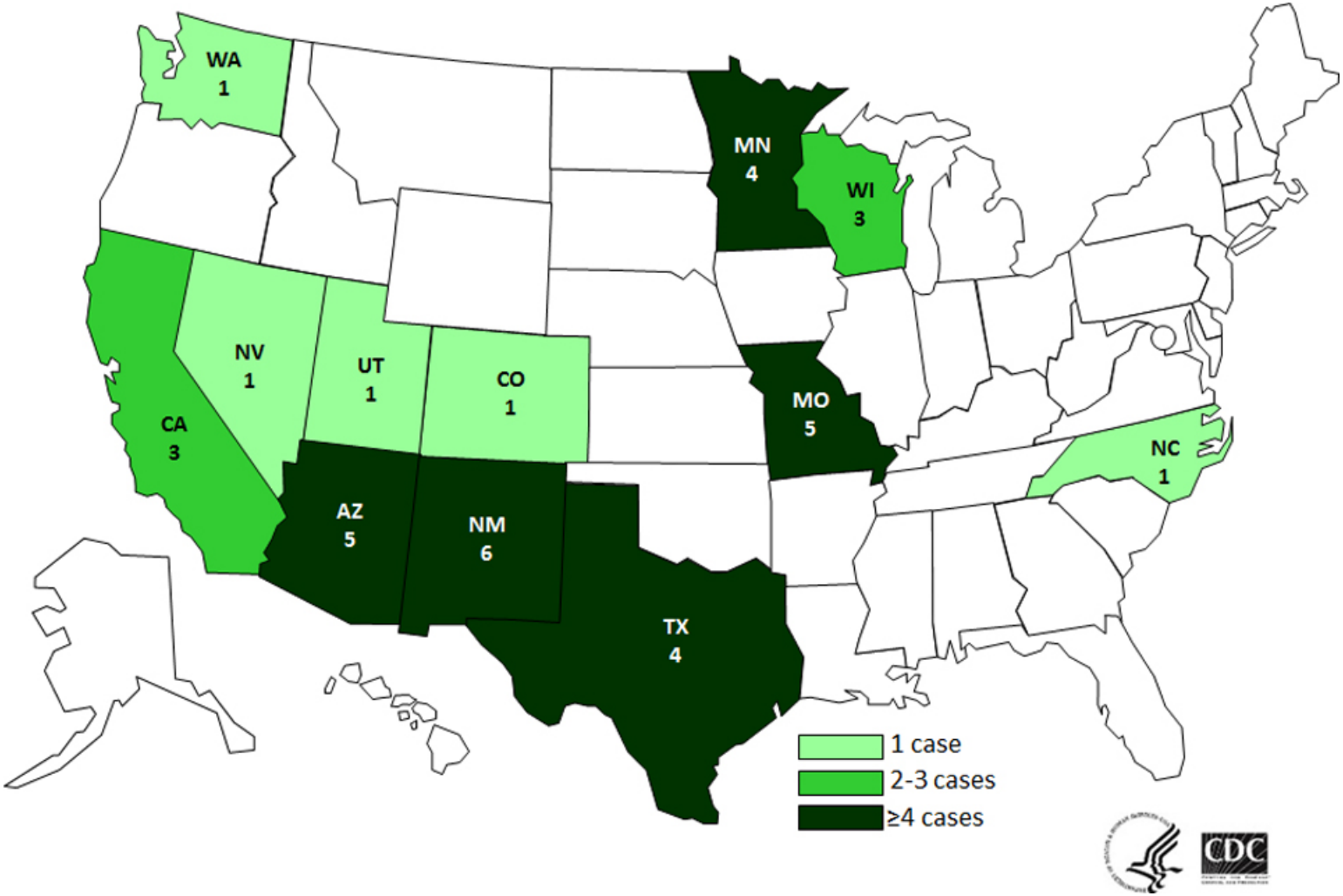
Cases by state of residence

As of Feb. 15, 2015 (n=35)



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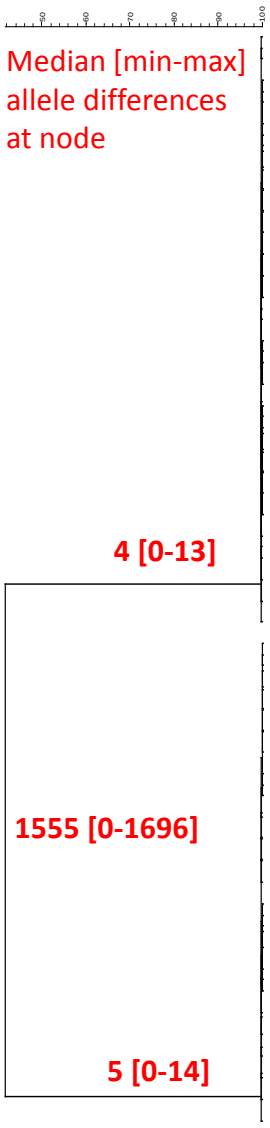
Whole Genome Sequencing Results

wgMLST (<All Characters>)



cdc_id	Id	State ID	PFGE-AscI-pattern	PFGE-ApaI-pattern	Outbreak	IsolatDate	SourceState	SourceType	SourceSite
	FDA00008711	FCF__824917-3A	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	MO	Food	Granny Smith Apples
	FDA00008715	FCF__824917-7A	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	MO	Food	Granny Smith Apples
2014L-6707	PNUSAL001180	AZ___AZ00023560	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS		AZ	Human	CSF
2014L-6790	PNUSAL001215	NV___CL2014-00024194	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-11	NV	Human	Blood
	FDA00008671	FCF__870215-39	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
	FDA00008672	FCF__870215-41	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
	FDA00008673	FCF__870215-44	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
	FDA00008712	FCF__824917-4A	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	MO	Food	Granny Smith Apples
2015L-6028	PNUSAL001289	AZ___AZ00025892	GX6A16.0012	GX6A12.0126	1411MLGX6-1WGS	2015-01-07	AZ	Human	Blood
	PNUSAL001167	MN___C2014019515	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-06	MN	Human	Hip fluid
2014L-6716	PNUSAL001188	TX___TXACB1403719	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-05	TX	Human	Left Arm
	FDA00008676	FCF__870215-106	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
	CFSAN028866	MN___C2015000414	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2015-01-06	MN	Food	
2014L-6756	PNUSAL001225	CDC__M14-133	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS		MO	Human	CSF
2014L-6704	PNUSAL001177	WI___14MP008990	GX6A16.0012	GX6A12.0126	1411MLGX6-1WGS	2014-11-09	WI	Human	CSF
2015L-6017	PNUSAL001313	CA___M14X06722	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-09	CA	Human	Blood
	FDA00008714	FCF__824917-6A	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	MO	Food	Granny Smith Apples
2014L-6730	PNUSAL001202	NM___2014035887	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-17	NM	Human	Blood
2014L-6787	PNUSAL001257	CA___M14X06515	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-27	CA	Human	Blood
2014L-6684	PNUSAL001157	CDC__M14-119	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-10-26	MO	Human	Blood
2014L-6710	PNUSAL001182	CDC__M14-124	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-09	MO	Human	Blood
2014L-6680	PNUSAL001146	MN___C2014019204	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-10-29	MN	Human	Blood
	PNUSAL001168	MN___C2014019628	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-08	MN	Human	Blood
2014L-6751	PNUSAL001220	NC___MB120114-0028	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-14	NC	Human	Blood
2014L-6737	PNUSAL001209	TX___TXACB1403739	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-12	TX	Human	Blood
2014L-6784	PNUSAL001254	WI___14MP009827	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-11-26	WI	Human	Blood
2015L-6026	PNUSAL001312	CO___HUM-2015001070	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2015-01-07	CO	Human	Blood
	FDA00008670	FCF__870215-3	GX6A16.0012	GX6A12.0696	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
2014L-6677	PNUSAL001151	WI___14MP008696	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-10-29	WI	Human	Blood
2014L-6766	PNUSAL001237	MN___C2014020760	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-22		Human	Blood
2014L-6714	PNUSAL001186	NM___2014035025	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-08	NM	Human	Blood
2014L-6723	PNUSAL001195	CDC__M14-127	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-06	MO	Human	Blood
	FDA00008675	FCF__870215-100	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
	CFSAN028867	MN___C2015000416	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2015-01-06	MN	Food	
2014L-6788	PNUSAL001258	NM___2014038352	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-12-06	NM	Human	Blood
	FDA00008674	FCF__870215-63	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-12-23	CA	Environmental	Enviromental Swab
2014L-6736	PNUSAL001208	TX___TXACB1403743	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-03	TX	Human	Blood
2014L-6660	PNUSAL001135	CDC__2014033414	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-10-21	NM	Human	CSF
2014L-6732	PNUSAL001204	UT___0901244	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-18	UT	Human	Sputum
	14-8656	PNC__14-8656	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS		MB	Human	
2014L-6656	PNUSAL001131	TX___TXACB1403543	GX6A16	GX6A12.0349	1411MLGX6-1WGS	2014-10-17	TX	Human	Blood
2014L-6724	PNUSAL001196	AZ___AZ00023800	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-08	AZ	Human	Blood
2014L-6695	PNUSAL001166	CDC__M14-123	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-02	MO	Human	placenta
2014L-6681	PNUSAL001154	AZ___AZ00023172	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-10-20	AZ	Human	Blood
2015L-6033	PNUSAL001264	CA___M15X00142	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2015-01-01	CA	Human	Blood
2014L-6752	PNUSAL001221	AZ___AZ00024032	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-19	AZ	Human	Blood
	PNUSAL001169	WA___20278	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-13	WA	Human	Cerebrospinal fluid, NOS
	FDA00008716	FCF__824917-10A	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-12-23	MO	Food	Granny Smith Apples
2014L-6748	PNUSAL001218	TX___TXACB1403761	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-21	NM	Human	Blood
	FDA00008713	FCF__824917-5A	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-12-23	MO	Food	Granny Smith Apples
2014L-6713	PNUSAL001185	NM___2014035347	GX6A16.0135	GX6A12.0349	1411MLGX6-1WGS	2014-11-07	NM	Human	Ascites fluid

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Summary

- Total: 35 cases in 12 states, 34 hospitalizations, 7 deaths; 28/31 reported eating caramel apples
  - NM: 6 cases, 6 hospitalizations, 0 deaths*
- Bidart Brothers issued voluntary recall of Granny Smith and Gala apples on Jan. 6
- Many difficulties: Long incubation period, recall, seasonal food
- Utility of WGS, combined with traditional epidemiologic investigation

Acknowledgements

- NMDOH Scientific Laboratory Division and Public Health Division
- Indian Health Services Public Health Nursing
- Arizona Department of Health Services
- Centers for Disease Control and Prevention

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Any questions?

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