National Antimicrobial Resistance Monitoring System (NARMS)
Quarterly Conference Call

Date:	**Thursday, September 17, 2009**
Time:	2:00 – 3:00 p.m. ET
Toll-free number:	877-546-1566
Passcode:	48018
Leader:	Andrew Stuart (dgz6@cdc.gov)

A. Administrative
1. Roll call/Introductions
2. Main NARMS epidemiology and laboratory contacts
   -Regan Rickert (NARMS Coordinator): RRickert@cdc.gov or gqv9@cdc.gov
   -Kevin Joyce (Main NARMS Lab Contact): KJoyce@cdc.gov or kdj7@cdc.gov

B. NARMS Routine Surveillance
1. Status of 2008-2009 isolate submissions
2. NARMS annual report update (2006, 2007)

C. NARMS Activities and Special Projects
1. Electronic Data Communication Working Group
2. Resistance Patterns in Non-Typhi *Salmonella* Resistant to Three or More Classes of Antimicrobial Agents, NARMS, 1996-2007
3. Spatio-Temporal Distribution of Antimicrobial Resistance in Non-Typhi *Salmonella*, NARMS, 2003-2007

D. Other
1. NARMS version 3

E. Status of Manuscripts

F. Status of FWA and IRB

Next NARMS Quarterly Conference Call:
December 10th, 2009 (Thursday), 2:00 – 3:00 pm ET (Tentative)

Non-Typhi *Salmonella* Isolates by Site and Month, 2008
Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	1	0	0	1	0	0	1	0	0	0	1	0	**4**
AL	4	2	3	2	6	8	12	12	8	5	4	2	**68**
AR	1	2	1	1	3	3	6	5	4	5	3	2	**36**
AZ	3	3	3	3	5	5	6	11	6	5	5	2	**57**
CA	13	14	12	20	17	13	24	21	22	19	17	23	**215**
CO	3	3	7	3	3	3	4	6	3	2	3	3	**43**
CT	2	3	2	2	2	4	6	3	4	0	0	1	**29**
DC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DE	0	1	0	1	1	1	1	1	1	2	0	0	**9**
FL	2	1	3	3	5	4	10	3	0	0	0	2	**33**
GA	6	4	4	9	8	13	20	19	19	15	9	7	**133**
HI	2	1	1	2	1	1	3	2	2	2	0	1	**18**
HT	4	1	1	5	6	6	10	10	7	6	1	2	**59**
IA	1	1	1	1	3	2	2	2	1	2	1	2	**19**
ID	1	0	1	0	1	1	1	1	0	2	1	1	**10**
IL	8	3	5	5	5	12	8	8	7	7	4	5	**77**
IN	2	2	1	2	2	6	5	3	4	2	3	3	**35**
KS	2	1	0	1	1	4	2	2	3	1	1	1	**19**
KY	2	1	1	1	2	3	3	3	2	3	2	0	**23**
LA	0	0	0	0	3	2	5	4	6	3	1	0	**24**
LX	4	2	2	3	4	6	8	5	5	22	8	6	**75**
MA	3	3	3	5	4	14	7	11	13	4	4	5	**76**
MD	3	2	2	3	4	5	7	6	5	5	3	2	**47**
ME	1	0	1	0	1	0	2	0	0	0	0	0	**5**
MI	3	2	4	3	4	6	5	8	5	4	3	3	**50**
MN	3	2	4	2	3	5	5	3	3	3	2	3	**38**
MO	3	3	2	0	2	10	8	8	8	5	3	5	**57**
MS	2	0	1	0	1	6	6	8	8	6	4	2	**44**
MT	0	1	0	0	1	0	1	1	0	0	2	0	**6**
NC	4	2	4	4	5	11	13	14	11	8	7	4	**87**
ND	0	0	0	1	0	0	1	1	0	0	1	1	**5**
NE	3	0	1	2	0	0	0	0	0	4	1	2	**13**
NH	1	2	0	1	1	1	1	2	0	0	2	1	**12**
NJ	5	2	6	4	5	8	9	13	10	5	6	3	**76**
NM	1	1	1	1	5	4	5	3	2	1	1	1	**26**
NV	1	1	1	1	1	1	1	1	1	1	1	1	**12**
NYC	10	3	6	6	6	9	10	11	21	8	4	4	**98**
NYS	6	3	7	5	6	11	10	8	10	6	3	2	**77**
OH	4	3	1	9	11	7	9	6	7	6	8	8	**79**
OK	0	0	0	0	0	0	0	0	0	0	0	0	**0**
OR	2	1	1	2	1	4	2	4	2	2	2	1	**24**
PA	5	5	5	6	8	10	15	12	16	10	7	6	**105**
RI	1	0	0	1	0	1	1	1	0	1	0	2	**8**
SC	3	2	3	2	4	4	7	6	9	4	4	2	**50**
SD	1	0	1	0	1	1	1	1	0	1	1	0	**8**
TN	2	1	2	7	5	5	6	5	8	6	1	1	**49**
TX	4	2	1	0	0	19	34	27	29	21	13	7	**157**
UT	1	1	1	1	0	1	4	1	3	1	2	1	**17**
VA	5	3	3	4	5	9	10	9	8	6	5	5	**72**
VT	0	1	0	0	0	1	1	0	1	0	0	1	**5**
WA	2	2	3	4	4	3	4	5	3	4	0	0	**34**
WI	3	4	1	4	2	5	4	6	5	2	3	1	**40**
WV	3	3	4	2	2	3	2	4	3	3	3	3	**35**
WY	1	0	0	1	1	0	0	1	2	0	0	1	**7**
Total	**147**	**100**	**117**	**146**	**171**	**261**	**328**	**307**	**297**	**230**	**160**	**141**	**2405**

Non-Typhi *Salmonella* Isolates by Site and Month, 2009
Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	1	0	0	0	0	0	0	-	-	-	-	-	**1**
AL	5	2	3	4	0	0	0	-	-	-	-	-	**14**
AR	2	1	0	0	0	0	0	-	-	-	-	-	**3**
AZ	6	2	5	4	4	1	0	-	-	-	-	-	**22**
CA	14	14	20	20	21	18	14	-	-	-	-	-	**121**
CO	0	0	0	0	0	0	0	-	-	-	-	-	**0**
CT	2	2	3	2	1	1	0	-	-	-	-	-	**11**
DC	5	3	7	7	16	4	3	-	-	-	-	-	**45**
DE	0	0	0	1	0	1	0	-	-	-	-	-	**2**
FL	7	3	4	3	0	0	0	-	-	-	-	-	**17**
GA	8	4	7	5	12	14	0	-	-	-	-	-	**50**
HI	2	1	0	0	0	0	0	-	-	-	-	-	**3**
HT	2	2	3	1	2	5	1	-	-	-	-	-	**16**
IA	0	1	1	1	2	3	1	-	-	-	-	-	**9**
ID	1	0	1	0	1	0	0	-	-	-	-	-	**3**
IL	6	5	5	5	6	5	0	-	-	-	-	-	**32**
IN	3	0	3	1	3	0	0	-	-	-	-	-	**10**
KS	1	1	1	1	1	1	0	-	-	-	-	-	**6**
KY	2	1	1	2	2	1	0	-	-	-	-	-	**9**
LA	1	1	0	1	3	0	0	-	-	-	-	-	**6**
LX	4	3	4	0	0	0	0	-	-	-	-	-	**11**
MA	3	3	5	6	6	4	1	-	-	-	-	-	**28**
MD	3	3	2	8	5	9	0	-	-	-	-	-	**30**
ME	0	0	1	0	0	0	0	-	-	-	-	-	**1**
MI	3	3	1	2	0	0	0	-	-	-	-	-	**9**
MN	3	2	2	3	2	2	0	-	-	-	-	-	**14**
MO	2	3	2	0	0	0	0	-	-	-	-	-	**7**
MS	1	2	1	1	1	4	1	-	-	-	-	-	**11**
MT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
ND	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NE	1	0	2	1	0	0	0	-	-	-	-	-	**4**
NH	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NJ	5	2	3	4	5	0	0	-	-	-	-	-	**19**
NM	0	1	1	1	1	3	1	-	-	-	-	-	**8**
NV	1	1	1	1	2	0	1	-	-	-	-	-	**7**
NYC	7	3	4	4	6	4	0	-	-	-	-	-	**28**
NYS	11	2	3	0	0	0	0	-	-	-	-	-	**16**
OH	7	6	4	6	9	5	0	-	-	-	-	-	**37**
OK	0	0	0	0	0	0	0	-	-	-	-	-	**0**
OR	3	2	2	1	3	3	0	-	-	-	-	-	**14**
PA	7	6	6	7	8	8	0	-	-	-	-	-	**42**
RI	0	0	0	0	0	0	0	-	-	-	-	-	**0**
SC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
SD	0	0	0	0	0	0	0	-	-	-	-	-	**0**
TN	2	3	0	2	4	3	0	-	-	-	-	-	**14**
TX	7	5	10	7	4	0	0	-	-	-	-	-	**33**
UT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
VA	4	5	4	0	0	0	0	-	-	-	-	-	**13**
VT	0	0	0	0	1	0	0	-	-	-	-	-	**1**
WA	0	0	0	0	0	0	0	-	-	-	-	-	**0**
WI	2	3	1	3	3	3	0	-	-	-	-	-	**15**
WV	2	4	3	3	3	2	0	-	-	-	-	-	**17**
WY	1	0	1	0	1	0	0	-	-	-	-	-	**3**
Total	**147**	**105**	**127**	**118**	**138**	**104**	**23**	**0**	**0**	**0**	**0**	**0**	**762**

S. Typhi Isolates by Site and Month, 2008

Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	1	0	0	0	0	0	0	0	**1**
AL	0	0	0	0	0	1	3	0	0	0	0	0	**4**
AR	0	0	0	3	0	0	0	0	0	0	0	0	**3**
AZ	1	0	0	0	0	1	1	0	0	0	0	0	**3**
CA	8	3	4	5	5	2	5	10	7	2	3	14	**68**
CO	2	1	0	0	0	0	0	0	0	0	0	0	**3**
CT	0	0	0	0	2	0	0	0	4	0	0	0	**6**
DC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DE	1	0	1	0	0	0	0	2	0	0	0	0	**4**
FL	3	1	0	1	0	1	2	3	1	2	1	1	**16**
GA	0	0	2	0	2	0	0	0	0	1	0	0	**5**
HI	1	0	2	1	1	0	1	1	0	0	0	1	**8**
HT	4	2	2	1	0	0	2	1	0	0	1	1	**14**
IA	0	0	1	0	0	0	2	2	0	1	0	0	**6**
ID	0	0	0	0	0	0	0	0	0	0	0	0	**0**
IL	5	0	3	3	1	1	2	0	4	2	1	0	**22**
IN	0	0	0	0	0	0	0	0	0	0	0	0	**0**
KS	0	0	0	0	0	0	1	0	0	0	0	0	**1**
KY	0	0	0	0	0	0	0	0	0	0	0	0	**0**
LA	0	0	0	0	0	0	0	0	0	0	0	0	**0**
LX	2	1	2	3	1	1	2	0	2	2	0	3	**19**
MA	2	1	1	4	2	4	3	3	2	6	1	0	**29**
MD	0	2	0	4	5	6	1	2	4	5	0	6	**35**
ME	0	0	0	0	0	0	0	0	0	0	0	0	**0**
MI	1	1	0	0	1	0	0	1	1	2	0	1	**8**
MN	0	1	1	1	0	0	0	2	2	0	0	0	**7**
MO	0	0	0	0	1	0	1	0	1	2	0	0	**5**
MS	0	0	0	0	0	0	0	0	0	0	0	0	**0**
MT	0	0	0	0	0	1	0	0	0	0	0	0	**1**
NC	2	0	0	0	1	1	0	0	0	1	0	0	**5**
ND	0	0	0	1	0	1	0	0	1	0	0	0	**3**
NE	1	0	1	0	0	0	0	0	0	0	0	0	**2**
NH	0	0	0	2	2	0	0	0	0	0	0	0	**4**
NJ	2	3	2	3	8	5	1	6	4	4	1	0	**39**
NM	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NV	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NYC	5	11	13	12	5	2	4	2	11	10	1	1	**77**
NYS	2	0	1	3	2	1	0	1	5	2	0	1	**18**
OH	1	1	0	1	0	0	2	3	1	2	0	0	**11**
OK	0	0	0	0	0	0	0	0	0	0	0	0	**0**
OR	1	0	0	0	0	0	0	0	1	0	0	0	**2**
PA	2	2	1	2	3	2	1	1	2	2	1	1	**20**
RI	0	1	0	0	0	0	0	0	0	0	0	0	**1**
SC	1	2	0	0	0	0	1	1	0	0	0	0	**5**
SD	0	0	0	1	0	0	0	0	0	0	0	0	**1**
TN	0	0	0	0	0	1	0	0	0	0	0	2	**3**
TX	1	2	0	0	0	1	0	2	1	1	1	0	**9**
UT	0	0	0	0	0	0	0	0	1	0	0	0	**1**
VA	1	0	0	1	3	1	5	4	8	2	1	2	**28**
VT	0	0	0	0	0	0	0	0	1	0	0	0	**1**
WA	2	2	0	0	1	1	0	2	1	0	2	1	**12**
WI	0	0	0	2	1	0	1	0	1	0	1	2	**8**
WV	0	0	0	0	1	0	0	0	0	0	0	0	**1**
WY	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**51**	**37**	**37**	**54**	**49**	**34**	**41**	**49**	**66**	**49**	**15**	**37**	**519**

S. Typhi Isolates by Site and Month, 2009 Preliminary data subject to change. Last revised 9-16-2009													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	0	0	0	-	-	-	-	-	**0**
AL	0	0	0	0	0	0	0	-	-	-	-	-	**0**
AR	0	0	0	0	0	0	0	-	-	-	-	-	**0**
AZ	2	0	0	0	1	0	0	-	-	-	-	-	**3**
CA	14	8	3	4	12	9	4	-	-	-	-	-	**54**
CO	0	0	0	0	0	0	0	-	-	-	-	-	**0**
CT	1	0	1	1	1	0	0	-	-	-	-	-	**4**
DC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
DE	0	0	0	0	0	0	0	-	-	-	-	-	**0**
FL	1	1	1	3	1	0	1	-	-	-	-	-	**8**
GA	2	2	1	1	1	1	0	-	-	-	-	-	**8**
HI	0	0	0	0	0	0	0	-	-	-	-	-	**0**
HT	0	2	0	0	0	0	2	-	-	-	-	-	**4**
IA	0	0	0	0	0	0	0	-	-	-	-	-	**0**
ID	0	0	0	0	0	0	0	-	-	-	-	-	**0**
IL	3	2	1	1	1	1	0	-	-	-	-	-	**9**
IN	0	0	0	0	0	0	0	-	-	-	-	-	**0**
KS	0	0	0	0	0	0	0	-	-	-	-	-	**0**
KY	0	0	0	0	0	0	0	-	-	-	-	-	**0**
LA	0	0	0	0	0	0	0	-	-	-	-	-	**0**
LX	1	1	0	0	0	0	0	-	-	-	-	-	**2**
MA	1	0	1	1	0	0	0	-	-	-	-	-	**3**
MD	1	2	0	2	6	2	0	-	-	-	-	-	**13**
ME	0	0	0	0	0	0	0	-	-	-	-	-	**0**
MI	2	1	1	0	0	0	0	-	-	-	-	-	**4**
MN	0	2	1	1	0	0	0	-	-	-	-	-	**4**
MO	0	0	0	0	0	0	0	-	-	-	-	-	**0**
MS	0	1	0	0	0	0	0	-	-	-	-	-	**1**
MT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
ND	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NE	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NH	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NJ	5	1	2	4	3	0	0	-	-	-	-	-	**15**
NM	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NV	2	0	0	0	0	0	0	-	-	-	-	-	**2**
NYC	6	7	4	4	8	1	0	-	-	-	-	-	**30**
NYS	3	2	0	0	0	0	0	-	-	-	-	-	**5**
OH	3	1	1	1	0	1	0	-	-	-	-	-	**7**
OK	0	0	0	0	0	0	0	-	-	-	-	-	**0**
OR	0	0	0	0	0	1	0	-	-	-	-	-	**1**
PA	3	2	2	0	2	3	0	-	-	-	-	-	**12**
RI	0	0	0	0	0	0	0	-	-	-	-	-	**0**
SC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
SD	0	0	0	0	0	0	0	-	-	-	-	-	**0**
TN	0	0	0	1	2	1	0	-	-	-	-	-	**4**
TX	4	0	0	1	0	0	0	-	-	-	-	-	**5**
UT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
VA	2	2	0	0	0	0	0	-	-	-	-	-	**4**
VT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
WA	3	1	0	0	1	0	0	-	-	-	-	-	**5**
WI	1	0	0	2	0	0	0	-	-	-	-	-	**3**
WV	0	0	0	0	0	0	0	-	-	-	-	-	**0**
WY	0	0	0	0	0	0	0	-	-	-	-	-	**0**
Total	**60**	**38**	**19**	**27**	**39**	**20**	**7**	**0**	**0**	**0**	**0**	**0**	**210**

***Shigella* Isolates by Site and Month, 2008**

Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	0	0	0	0	1	0	0	0	**1**
AL	2	2	3	4	6	2	1	1	1	2	2	2	**28**
AR	0	0	1	1	2	2	3	3	2	2	2	2	**20**
AZ	2	0	1	1	2	2	3	4	4	4	3	2	**28**
CA	0	0	0	0	0	0	0	0	0	2	0	1	**3**
CO	1	0	1	0	0	1	1	1	1	0	1	1	**8**
CT	1	0	0	0	0	1	0	0	0	0	0	1	**3**
DC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DE	0	0	0	0	0	0	0	0	0	0	0	0	**0**
FL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
GA	5	4	3	3	7	3	5	2	4	6	5	2	**49**
HI	1	0	0	0	0	0	1	0	0	0	1	0	**3**
HT	4	2	0	3	3	4	3	3	2	1	1	1	**27**
IA	0	0	0	0	1	1	0	1	0	1	1	1	**6**
ID	0	0	0	0	0	0	0	0	0	0	0	0	**0**
IL	5	2	5	3	6	5	5	5	4	2	4	3	**49**
IN	2	1	1	0	2	2	0	0	0	0	1	0	**9**
KS	0	0	0	0	0	0	0	1	0	1	0	0	**2**
KY	1	1	0	1	1	2	0	1	0	1	0	0	**8**
LA	0	0	0	0	2	0	1	0	0	1	1	0	**5**
LX	0	0	1	0	2	0	2	0	1	1	2	1	**10**
MA	0	0	1	0	1	1	1	1	2	1	1	1	**10**
MD	0	1	0	1	1	1	1	0	0	0	0	1	**6**
ME	0	0	1	0	0	0	0	0	0	0	0	0	**1**
MI	0	0	0	1	0	1	1	1	0	2	2	3	**11**
MN	1	1	1	1	1	2	2	3	1	1	1	1	**16**
MO	1	0	1	0	1	0	3	0	0	1	0	1	**8**
MS	1	1	2	1	4	0	2	0	0	1	0	0	**12**
MT	0	0	0	0	0	0	0	0	0	1	0	0	**1**
NC	0	0	1	0	1	3	0	0	1	0	0	0	**6**
ND	0	0	0	0	0	1	0	0	0	0	0	0	**1**
NE	0	0	0	0	0	0	0	0	0	2	0	0	**2**
NH	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NJ	1	1	1	1	2	3	5	4	4	3	3	3	**31**
NM	0	0	0	0	0	1	0	1	1	2	1	1	**7**
NV	0	1	1	0	1	1	1	1	1	0	0	1	**8**
NYC	0	3	4	5	4	7	2	3	4	3	3	3	**41**
NYS	1	1	2	3	2	1	1	1	2	2	0	1	**17**
OH	1	1	2	3	2	3	3	3	1	3	5	5	**32**
OK	0	0	0	0	0	0	0	0	0	0	0	0	**0**
OR	1	0	0	0	0	0	1	0	1	1	0	0	**4**
PA	1	0	0	0	1	1	2	1	0	1	2	3	**12**
RI	1	0	0	0	0	0	0	0	0	0	0	0	**1**
SC	1	2	3	2	3	2	1	1	2	1	1	2	**21**
SD	1	0	0	0	0	0	0	0	0	0	0	0	**1**
TN	4	0	2	5	6	4	3	3	4	7	2	0	**40**
TX	0	0	2	0	1	0	3	1	4	2	2	0	**15**
UT	0	0	0	0	0	0	1	0	0	1	0	0	**2**
VA	0	0	2	1	1	2	0	1	2	0	1	4	**14**
VT	0	0	0	0	0	0	0	0	0	0	0	0	**0**
WA	0	0	0	1	0	1	0	1	1	0	0	0	**4**
WI	3	1	0	1	1	2	2	2	6	5	3	1	**27**
WV	0	0	1	2	0	0	0	3	3	3	1	0	**13**
WY	0	0	0	0	0	0	0	0	0	0	0	1	**1**
Total	**42**	**25**	**43**	**44**	**67**	**62**	**60**	**53**	**60**	**67**	**52**	**49**	**624**

***Shigella* Isolates by Site and Month, 2009**
Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	0	0	0	-	-	-	-	-	**0**
AL	1	1	1	0	1	0	0	-	-	-	-	-	**4**
AR	0	1	0	0	0	0	0	-	-	-	-	-	**1**
AZ	3	3	2	3	4	2	0	-	-	-	-	-	**17**
CA	0	0	0	0	0	1	0	-	-	-	-	-	**1**
CO	0	0	0	0	0	0	0	-	-	-	-	-	**0**
CT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
DC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
DE	0	0	0	0	1	1	0	-	-	-	-	-	**2**
FL	0	0	0	0	0	0	0	-	-	-	-	-	**0**
GA	1	2	2	3	4	2	0	-	-	-	-	-	**14**
HI	1	0	0	0	0	0	0	-	-	-	-	-	**1**
HT	1	0	1	1	1	1	1	-	-	-	-	-	**6**
IA	2	0	0	1	0	0	0	-	-	-	-	-	**3**
ID	0	0	0	0	1	0	0	-	-	-	-	-	**1**
IL	3	2	3	4	3	3	0	-	-	-	-	-	**18**
IN	1	0	0	0	0	0	0	-	-	-	-	-	**1**
KS	1	0	1	0	2	1	0	-	-	-	-	-	**5**
KY	0	0	1	1	1	0	0	-	-	-	-	-	**3**
LA	0	0	0	0	0	0	0	-	-	-	-	-	**0**
LX	0	0	1	0	0	0	0	-	-	-	-	-	**1**
MA	0	0	1	0	1	0	2	-	-	-	-	-	**4**
MD	0	0	2	1	5	3	0	-	-	-	-	-	**11**
ME	0	0	0	0	0	0	0	-	-	-	-	-	**0**
MI	1	0	2	0	0	0	0	-	-	-	-	-	**3**
MN	1	0	0	0	1	0	0	-	-	-	-	-	**2**
MO	0	0	1	0	0	0	0	-	-	-	-	-	**1**
MS	1	0	0	0	0	0	0	-	-	-	-	-	**1**
MT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
ND	0	0	1	0	0	0	0	-	-	-	-	-	**1**
NE	1	1	1	1	0	0	0	-	-	-	-	-	**4**
NH	0	0	0	0	0	0	0	-	-	-	-	-	**0**
NJ	3	1	2	1	1	0	0	-	-	-	-	-	**8**
NM	0	1	0	0	1	0	0	-	-	-	-	-	**2**
NV	0	0	1	0	0	0	0	-	-	-	-	-	**1**
NYC	2	3	1	2	2	1	0	-	-	-	-	-	**11**
NYS	0	0	0	0	0	0	0	-	-	-	-	-	**0**
OH	5	1	3	1	3	1	0	-	-	-	-	-	**14**
OK	0	0	0	0	0	0	0	-	-	-	-	-	**0**
OR	1	0	0	0	0	1	0	-	-	-	-	-	**2**
PA	5	4	4	6	11	6	0	-	-	-	-	-	**36**
RI	0	0	0	0	0	0	0	-	-	-	-	-	**0**
SC	0	0	0	0	0	0	0	-	-	-	-	-	**0**
SD	0	0	0	0	0	0	0	-	-	-	-	-	**0**
TN	2	2	1	2	3	1	0	-	-	-	-	-	**11**
TX	1	0	1	2	0	0	0	-	-	-	-	-	**4**
UT	0	0	0	0	0	0	0	-	-	-	-	-	**0**
VA	1	0	1	0	0	0	0	-	-	-	-	-	**2**
VT	0	0	1	0	0	0	0	-	-	-	-	-	**1**
WA	0	0	0	0	0	0	0	-	-	-	-	-	**0**
WI	2	1	2	1	4	3	0	-	-	-	-	-	**13**
WV	4	0	0	0	0	1	0	-	-	-	-	-	**5**
WY	0	0	0	0	0	0	0	-	-	-	-	-	**0**
Total	**44**	**23**	**37**	**30**	**50**	**28**	**3**	**0**	**0**	**0**	**0**	**0**	**215**

E. coli Isolates by Site and Month, 2008

Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	1	0	0	0	0	0	0	0	0	**1**
AL	0	1	0	0	0	0	0	1	0	0	0	0	**2**
AR	0	0	0	0	0	1	0	0	0	0	0	0	**1**
AZ	0	0	0	0	0	1	0	0	0	0	0	0	**1**
CA	0	0	1	2	0	0	1	1	1	3	0	1	**10**
CO	1	0	0	0	2	0	1	0	3	2	1	0	**10**
CT	0	1	0	0	0	0	1	0	0	0	0	1	**3**
DC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DE	0	0	0	0	0	0	0	0	0	0	0	0	**0**
FL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
GA	0	0	1	3	0	6	8	8	3	1	1	0	**31**
HI	1	0	0	0	0	0	0	0	0	0	0	0	**1**
HT	0	1	0	0	0	0	0	0	0	0	0	1	**2**
IA	1	0	0	0	0	1	0	1	1	1	0	0	**5**
ID	0	0	0	0	0	0	0	1	0	1	0	0	**2**
IL	0	0	1	1	0	2	1	1	1	1	1	0	**9**
IN	1	0	0	0	0	0	1	1	0	0	1	0	**4**
KS	1	0	0	0	0	0	0	0	0	1	0	0	**2**
KY	1	0	0	0	0	0	0	0	1	0	0	0	**2**
LA	0	0	0	0	0	0	0	0	0	0	0	0	**0**
LX	0	0	0	0	0	0	0	0	0	0	0	0	**0**
MA	0	0	0	0	0	1	1	0	1	1	0	0	**4**
MD	0	0	0	0	0	0	1	0	0	0	0	1	**2**
ME	1	0	0	0	0	0	0	0	0	0	0	0	**1**
MI	0	0	0	0	0	2	0	0	3	0	1	0	**6**
MN	1	0	0	0	0	2	1	0	2	0	1	0	**7**
MO	1	0	0	0	1	1	0	1	0	1	0	0	**5**
MS	0	0	0	0	0	0	0	0	0	0	0	0	**0**
MT	0	0	0	0	0	0	1	0	0	0	0	1	**2**
NC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
ND	0	0	0	0	0	0	0	0	0	0	1	0	**1**
NE	0	0	0	1	0	0	0	0	0	1	0	1	**3**
NH	0	0	0	0	0	0	1	0	0	0	0	0	**1**
NJ	1	0	1	1	1	1	1	1	1	1	1	1	**11**
NM	1	0	0	0	0	0	0	0	0	0	0	0	**1**
NV	0	0	0	0	0	0	1	0	0	0	0	0	**1**
NYC	0	0	0	1	0	0	0	1	0	1	0	1	**4**
NYS	0	0	0	0	0	2	1	2	0	1	0	0	**6**
OH	1	0	0	0	0	2	1	3	0	1	0	1	**9**
OK	0	0	0	0	0	0	0	0	0	0	0	0	**0**
OR	0	1	0	0	0	0	1	0	1	0	0	1	**4**
PA	0	1	0	0	0	0	2	0	1	0	1	0	**5**
RI	0	0	0	1	0	0	0	0	0	0	0	0	**1**
SC	1	0	0	0	0	0	0	0	0	0	0	0	**1**
SD	0	1	0	0	0	0	0	0	1	0	0	0	**2**
TN	0	0	0	0	1	0	1	2	1	1	0	1	**7**
TX	0	0	0	0	1	0	0	1	0	0	0	1	**3**
UT	0	0	0	0	0	0	0	1	0	1	0	0	**2**
VA	0	0	1	0	0	0	1	1	1	0	0	0	**4**
VT	0	0	0	0	0	0	0	0	0	1	0	0	**1**
WA	0	0	0	0	0	1	1	1	2	1	0	0	**6**
WI	0	0	0	0	0	2	1	2	1	0	1	0	**7**
WV	0	0	1	0	0	1	1	2	0	0	0	0	**5**
WY	0	0	0	0	1	0	1	0	0	0	0	0	**2**
Total	**13**	**6**	**6**	**11**	**7**	**26**	**31**	**32**	**25**	**21**	**10**	**12**	**200**

E. coli Isolates by Site and Month, 2009

Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	0	0	0	0	-	-	-	-	**0**
AL	0	1	0	0	0	0	0	0	-	-	-	-	**1**
AR	0	0	0	0	0	0	0	0	-	-	-	-	**0**
AZ	0	0	1	0	0	1	0	0	-	-	-	-	**2**
CA	0	0	0	1	1	2	1	0	-	-	-	-	**5**
CO	0	0	0	0	0	0	0	0	-	-	-	-	**0**
CT	0	0	0	1	0	0	0	0	-	-	-	-	**1**
DC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
DE	0	0	0	0	0	0	0	0	-	-	-	-	**0**
FL	0	0	0	0	0	0	0	0	-	-	-	-	**0**
GA	0	0	1	1	1	2	0	0	-	-	-	-	**5**
HI	1	0	0	0	0	0	0	0	-	-	-	-	**1**
HT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
IA	1	0	0	0	0	1	1	0	-	-	-	-	**3**
ID	0	0	0	0	0	1	0	0	-	-	-	-	**1**
IL	2	4	4	0	1	0	0	0	-	-	-	-	**11**
IN	0	0	0	0	0	0	0	0	-	-	-	-	**0**
KS	1	0	0	0	0	0	0	0	-	-	-	-	**1**
KY	0	0	0	0	0	0	0	0	-	-	-	-	**0**
LA	0	0	0	0	0	0	0	0	-	-	-	-	**0**
LX	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MA	1	0	0	0	0	0	0	0	-	-	-	-	**1**
MD	6	4	0	2	2	2	0	0	-	-	-	-	**16**
ME	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MI	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MN	1	0	0	0	1	1	0	0	-	-	-	-	**3**
MO	1	0	1	0	0	0	0	0	-	-	-	-	**2**
MS	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
ND	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NE	0	0	0	1	0	0	0	0	-	-	-	-	**1**
NH	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NJ	1	0	0	1	1	0	0	0	-	-	-	-	**3**
NM	0	0	0	0	1	1	0	0	-	-	-	-	**2**
NV	0	0	0	0	0	1	0	0	-	-	-	-	**1**
NYC	0	0	0	1	0	0	0	0	-	-	-	-	**1**
NYS	1	0	0	0	0	0	0	0	-	-	-	-	**1**
OH	0	0	0	0	1	0	0	0	-	-	-	-	**1**
OK	0	0	0	0	0	0	0	0	-	-	-	-	**0**
OR	1	0	0	0	0	0	0	0	-	-	-	-	**1**
PA	0	0	0	0	0	1	0	0	-	-	-	-	**1**
RI	0	0	0	0	0	0	0	0	-	-	-	-	**0**
SC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
SD	0	0	0	0	0	0	0	0	-	-	-	-	**0**
TN	0	0	1	0	0	0	0	0	-	-	-	-	**1**
TX	0	0	0	0	0	0	0	1	-	-	-	-	**1**
UT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
VA	1	0	0	0	0	0	0	0	-	-	-	-	**1**
VT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
WA	0	0	0	0	0	0	0	0	-	-	-	-	**0**
WI	0	0	0	1	0	1	0	0	-	-	-	-	**2**
WV	0	0	1	0	0	0	0	0	-	-	-	-	**1**
WY	1	0	0	0	1	0	0	0	-	-	-	-	**2**
Total	**19**	**9**	**9**	**9**	**10**	**14**	**2**	**1**	**0**	**0**	**0**	**0**	**73**

Vibrio Isolates by Site and Month, 2008

Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	0	0	0	0	0	0	0	0	**0**
AL	0	0	0	0	0	2	2	1	1	1	1	0	**8**
AR	0	0	0	0	0	0	0	0	0	0	0	0	**0**
AZ	0	0	0	0	0	0	0	0	2	2	1	0	**5**
CA	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CO	0	0	0	0	1	1	1	2	0	0	0	0	**5**
CT	0	0	2	1	0	1	1	4	1	0	0	0	**10**
DC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DE	0	0	0	0	0	0	1	0	0	1	0	0	**2**
FL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
GA	0	0	0	1	1	2	2	1	3	0	1	0	**11**
HI	2	0	2	3	2	1	1	2	1	1	2	0	**17**
HT	0	0	0	0	0	0	0	0	0	0	0	0	**0**
IA	0	0	0	1	0	0	0	0	0	0	0	0	**1**
ID	0	0	0	0	0	0	0	0	0	0	0	0	**0**
IL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
IN	0	0	0	0	1	0	0	0	0	0	0	0	**1**
KS	0	0	0	0	0	0	0	0	0	0	0	0	**0**
KY	0	0	0	0	0	0	0	0	0	0	0	0	**0**
LA	0	0	0	0	0	9	6	0	3	2	2	0	**22**
LX	0	0	0	0	0	0	0	0	0	0	0	0	**0**
MA	0	1	0	0	0	0	2	0	3	1	2	3	**12**
MD	1	0	0	1	5	5	9	5	2	2	1	0	**31**
ME	0	0	0	0	0	0	1	0	2	0	0	0	**3**
MI	0	0	0	0	0	0	0	0	1	0	0	0	**1**
MN	0	0	0	0	0	0	0	2	0	1	2	0	**5**
MO	0	0	0	0	0	0	0	0	1	0	0	0	**1**
MS	0	0	0	0	0	3	1	0	0	1	0	0	**5**
MT	0	0	0	0	0	0	0	1	0	0	0	0	**1**
NC	0	0	0	0	0	0	0	0	1	0	1	0	**2**
ND	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NE	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NH	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NJ	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NM	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NV	0	0	0	0	0	0	0	0	0	2	0	0	**2**
NYC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NYS	0	0	0	0	0	0	2	6	4	2	0	0	**14**
OH	0	0	0	0	0	1	4	1	1	0	0	0	**7**
OK	0	0	0	0	0	0	0	0	0	0	0	0	**0**
OR	0	0	0	0	0	0	1	7	5	1	0	0	**14**
PA	0	0	0	0	0	0	0	0	2	0	0	0	**2**
RI	0	0	0	0	0	0	0	0	0	0	0	0	**0**
SC	0	0	0	0	0	0	0	0	0	0	0	0	**0**
SD	0	0	0	0	0	0	0	0	0	0	0	0	**0**
TN	0	0	0	0	0	0	2	0	5	0	0	0	**7**
TX	0	0	0	1	5	2	5	4	4	3	1	1	**26**
UT	0	0	0	0	0	0	0	0	0	0	0	0	**0**
VA	0	0	0	0	1	5	7	3	1	0	0	0	**17**
VT	0	0	0	0	0	0	0	0	0	0	0	0	**0**
WA	0	0	0	0	0	0	8	2	1	0	0	0	**11**
WI	0	0	0	0	0	0	2	0	1	0	0	0	**3**
WV	0	0	0	0	0	0	0	0	0	0	0	0	**0**
WY	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**3**	**1**	**4**	**8**	**16**	**32**	**58**	**41**	**45**	**20**	**14**	**4**	**246**

Vibrio Isolates by Site and Month, 2009

Preliminary data subject to change. Last revised 9-16-2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
AK	0	0	0	0	0	0	0	0	-	-	-	-	**0**
AL	0	0	0	0	0	0	0	0	-	-	-	-	**0**
AR	0	0	0	0	0	0	0	0	-	-	-	-	**0**
AZ	0	0	0	0	0	2	0	0	-	-	-	-	**2**
CA	0	0	0	0	0	0	0	0	-	-	-	-	**0**
CO	0	0	0	0	0	0	0	0	-	-	-	-	**0**
CT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
DC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
DE	0	0	0	0	0	0	0	0	-	-	-	-	**0**
FL	0	0	0	0	0	0	0	0	-	-	-	-	**0**
GA	0	0	1	0	2	3	4	2	-	-	-	-	**12**
HI	1	0	0	0	0	0	0	0	-	-	-	-	**1**
HT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
IA	0	0	0	0	0	0	0	0	-	-	-	-	**0**
ID	0	0	0	0	0	0	0	0	-	-	-	-	**0**
IL	0	0	0	0	0	0	0	0	-	-	-	-	**0**
IN	0	0	0	0	0	0	0	0	-	-	-	-	**0**
KS	0	0	0	0	0	0	0	0	-	-	-	-	**0**
KY	0	0	0	0	0	0	0	0	-	-	-	-	**0**
LA	0	0	2	4	4	3	0	0	-	-	-	-	**13**
LX	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MA	0	0	0	0	1	0	0	0	-	-	-	-	**1**
MD	0	0	0	2	1	0	0	0	-	-	-	-	**3**
ME	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MI	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MN	0	0	1	0	1	0	0	0	-	-	-	-	**2**
MO	0	0	0	0	0	0	0	0	-	-	-	-	**0**
MS	0	0	0	0	1	2	0	0	-	-	-	-	**3**
MT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
ND	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NE	0	0	0	0	0	1	0	0	-	-	-	-	**1**
NH	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NJ	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NM	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NV	0	0	0	0	1	0	0	0	-	-	-	-	**1**
NYC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
NYS	0	0	0	0	0	0	0	0	-	-	-	-	**0**
OH	0	1	0	0	0	0	0	0	-	-	-	-	**1**
OK	0	0	0	0	0	0	0	0	-	-	-	-	**0**
OR	0	0	0	0	0	1	0	0	-	-	-	-	**1**
PA	0	0	0	0	0	0	1	0	-	-	-	-	**1**
RI	0	0	0	0	0	0	0	0	-	-	-	-	**0**
SC	0	0	0	0	0	0	0	0	-	-	-	-	**0**
SD	0	0	0	0	0	0	0	0	-	-	-	-	**0**
TN	0	0	0	1	0	0	0	0	-	-	-	-	**1**
TX	0	1	1	0	1	0	0	0	-	-	-	-	**3**
UT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
VA	0	0	0	0	0	0	0	0	-	-	-	-	**0**
VT	0	0	0	0	0	0	0	0	-	-	-	-	**0**
WA	0	0	0	0	0	0	0	0	-	-	-	-	**0**
WI	0	0	0	0	0	0	0	0	-	-	-	-	**0**
WV	0	0	0	0	0	0	0	0	-	-	-	-	**0**
WY	0	0	0	0	0	0	0	0	-	-	-	-	**0**
Total	**1**	**2**	**5**	**7**	**12**	**12**	**5**	**2**	**0**	**0**	**0**	**0**	**46**

***Campylobacter* Isolates by Site and Month, 2008** Preliminary data subject to change. Last revised 9-16-2009													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
CA	8	0	0	6	7	0	10	3	4	0	4	3	**45**
CO	5	5	6	3	4	8	7	8	5	2	5	9	**67**
CT	6	8	14	6	17	15	23	16	6	16	4	8	**139**
GA	14	25	13	25	43	22	53	60	29	35	15	21	**355**
MD	14	1	4	9	13	15	16	13	8	1	9	9	**112**
MN	8	7	10	12	12	18	22	22	12	15	13	10	**161**
NM	4	2	1	3	7	4	11	9	11	3	7	1	**63**
NYS	8	6	7	14	4	17	17	14	15	6	10	6	**124**
OR	7	11	1	9	9	14	22	9	9	7	7	6	**111**
TN	4	3	5	3	4	3	4	2	0	1	8	2	**39**
Total	**78**	**68**	**61**	**90**	**120**	**116**	**185**	**156**	**99**	**86**	**82**	**75**	**1216**

***Campylobacter* Isolates by Site and Month, 2009** Preliminary data subject to change. Last revised 9-16-2009													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
CA	20	5	3	11	8	4	6	-	-	-	-	-	**57**
CO	0	0	0	0	0	0	0	-	-	-	-	-	**0**
CT	8	2	8	9	12	8	0	-	-	-	-	-	**47**
GA	23	29	31	41	33	0	0	-	-	-	-	-	**157**
MD	14	8	5	13	21	17	0	-	-	-	-	-	**78**
MN	10	10	10	13	10	20	0	-	-	-	-	-	**73**
NM	2	2	5	3	8	16	2	-	-	-	-	-	**38**
NYS	10	6	2	0	0	0	0	-	-	-	-	-	**18**
OR	7	11	9	7	12	10	0	-	-	-	-	-	**56**
TN	2	1	4	0	0	0	0	-	-	-	-	-	**7**
Total	**96**	**74**	**77**	**97**	**104**	**75**	**8**	**0**	**0**	**0**	**0**	**0**	**531**

Resistance Patterns in Non-Typhi *Salmonella* Resistant to Three or More Classes of Antimicrobial Agents, NARMS, 1996-2007

F. Medalla, J.M. Whichard, A. Stuart, K. Joyce, R.M. Hoekstra, and E.J. Barzilay

Background:
Non-Typhi *Salmonella* (NTS) is a major cause of bacterial foodborne illness in the United States. Quinolones (e.g., ciprofloxacin) and cephems (e.g., ceftriaxone) are important classes of agents for the treatment of serious infections. Resistance to nalidixic acid and ceftiofur correlates with decreased susceptibility to ciprofloxacin and ceftriaxone, respectively. *Salmonella* Typhimurium resistant to ACSSuT, a multidrug resistance (MDR) pattern that includes resistance to at least ampicillin (A), chloramphenicol (C), streptomycin (S), sulfonamide (Su), and tetracycline (T), is associated with increased risk for invasive illness.

Methods:
In 1996, 14 sites submitted NTS isolates to the National Antimicrobial Resistance Monitoring System (NARMS) at CDC for susceptibility testing. Participation increased and became nationwide in 2003. MICs for 15 agents representing 8 CLSI antimicrobial classes were determined by broth microdilution and interpreted using CLSI criteria when available.

Results:
From 1996-2007, 2813 (13.8%) of 20,443 NTS isolates were resistant to ≥3 antimicrobial classes. Of the 2813 isolates resistant to ≥3 classes, 2251 (80.0%) were serotype Typhimurium, Newport, Heidelberg, or Enteritidis. MDR patterns in the 2813 isolates include resistance to at least ACT in 1702 (60.5%), ACSuT in 1685 (59.9%), ACSSuT in 1615 (57.4%), nalidixic acid and ceftiofur in 24 (0.9%), ciprofloxacin and ceftriaxone in 1 (0.04%). The 24 isolates resistant to at least nalidixic acid and ceftiofur accounted for all NTS isolates resistant to these two drugs.

Conclusions:
Isolates resistant to nalidixic acid and ceftiofur, drugs representative of two clinically important agents, can be detected in NTS based on resistance to ≥3 classes. ACSSuT is a major MDR pattern in NTS resistant to ≥3 classes. These findings support the utility of using resistance to ≥3 classes as an indicator for infections with limited treatment options

Non-Typhi *Salmonella* Infections

- A leading cause of foodborne illness in the United States
  - Estimated to cause 1.4 million infections, 15,000 hospitalizations, and 400 deaths annually[1]
- Most infections are self-limited but antimicrobial agents are essential to treat serious illness[2]
  - Fluoroquinolones and third-generation cephalosporins are commonly used for antimicrobial treatment

Multidrug Resistance

- Multidrug resistance (MDR) has been associated with increased morbidity in non-Typhi *Salmonella*[12-14]
  - Infections due to *Salmonella* Typhimurium definitive type 104 (DT 104) with resistance to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline (ACSSuT) have been found to be more invasive than infections due to other *Salmonella* Typhimurium strains[12]
- MDR complicates management of severe infections by limiting options for antimicrobial therapy
  - Resistance to quinolones and third-generation cephalosporins is of particular concern
- Currently there is no standard definition for MDR in bacterial pathogens
- MDR may be reported by quantifying resistance to classes of antimicrobial agents (e.g., resistance to ≥3 classes)

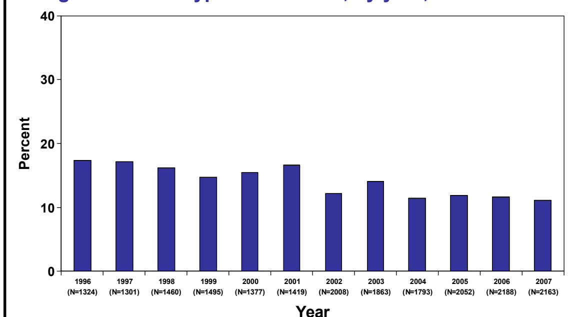
Antimicrobial Susceptibility Testing

- Isolates were tested using broth microdilution (Sensititre) to determine minimum inhibitory concentrations (MICs) for the following eight classes of antimicrobial agents:

Aminoglycoside:	**Folate pathway inhibitor:**
Amikacin*	Sulfonamide*
Gentamicin	Trimethoprim-sulfamethoxazole
Kanamycin	**Penicillin:**
Streptomycin	Ampicillin
β-lactam/β-lactamase inhibitor combination:	**Phenicol:**
Amoxicillin-clavulanic acid	Chloramphenicol
Cephem:	**Quinolone:**
1st gen. cephalosporin	Ciprofloxacin
-Cephalothin*	Nalidixic acid
3rd gen. cephalosporin	**Tetracycline:**
-Ceftiofur	Tetracycline
-Ceftriaxone	
Cephamycin	
-Cefoxitin*	

***Not tested all years: amikacin (not tested in 1996), cefoxitin (not tested from 1996-1999), cephalothin (not tested since 2004), sulfamethoxazole, and sulfisoxazole (sulfisoxazole replaced sulfamethoxazole in 2004 to represent sulfonamides).**

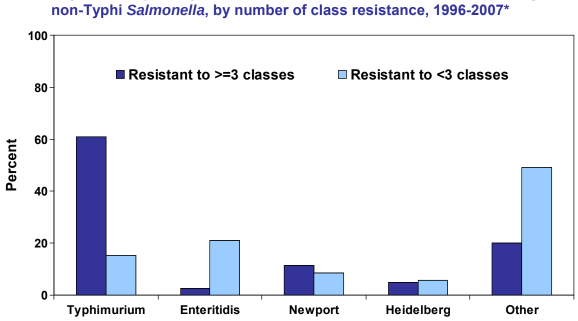
Percentage of resistance to ≥3 classes of antimicrobial agents in non-Typhi *Salmonella*, by year, 1996-2007*



Resistance to ≥3 classes of agents in non-Typhi *Salmonella* declined from 17.4% in 1996 to 11.1% in 2007.

*Preliminary 2007 data

Percentage of serotypes Typhimurium, Enteritidis, Newport, and Heidelberg in non-Typhi *Salmonella*, by number of class resistance, 1996-2007*



Serotypes Typhimurium, Newport, Heidelberg, and Enteritidis were the four most common serotypes and accounted for 54.8% of all non-Typhi *Salmonella* isolates tested from 1996-2007. These four serotypes accounted for 80.0% of isolates resistant to ≥3 classes, a higher proportion compared with 50.8% of isolates resistant to <3 classes (p<0.01). Typhimurium was the most common serotype (21.7%) in all non-Typhi *Salmonella*. It accounted for 61.0% of isolates resistant to ≥3 classes, a higher proportion compared with 15.4% of isolates resistant to <3 classes (p<0.01).

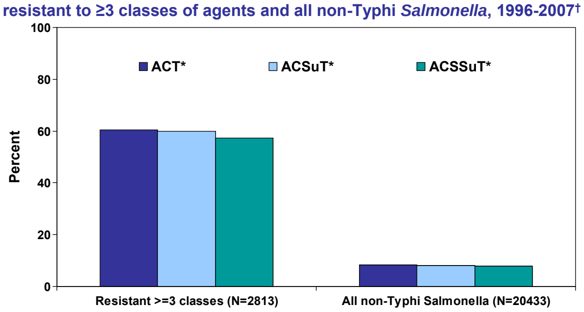
*Preliminary 2007 data

Percentage of resistance to antimicrobial agents in non-Typhi *Salmonella*, by number of class resistance, 1996-2007*

Antimicrobial Class/Agent	Resistant to ≥3 classes N=2,813	Resistant to <3 classes N=17,630
Aminoglycoside		
Amikacin†	0.1	0.0
Gentamicin	9.9	1.0
Kanamycin	23.6	0.8
Streptomycin	86.0	3.2
β-lactam/β-lactamase inhibitor		
Amoxicillin-clavulanic acid	23.5	0.1
Cephem		
Cefoxitin (cephamycin)†	27.1	<0.1
Ceftiofur (third-gen. ceph.)	20.7	0.1
Ceftriaxone (third-gen. ceph.)	1.5	<0.1
Cephalothin (first-gen. ceph.)†	21.6	0.6
Folate pathway inhibitor		
Sulfonamide†	90.8	3.4
Trimethoprim-sulfamethoxazole	10.9	0.5
Penicillin		
Ampicillin	87.2	2.4
Phenicol		
Chloramphenicol	64.0	<0.1
Quinolone		
Ciprofloxacin	0.7	<0.1
Nalidixic acid	4.6	1.7
Tetracycline		
Tetracycline	89.4	5.3

*Preliminary 2007 data
†Amikacin, cefoxitin, and cephalothin were not tested all years; sulfamethoxazole or sulfisoxazole were tested for sulfonamides.

Percentage of ACT, ACSuT, and ACSSuT* in non-Typhi *Salmonella* resistant to ≥3 classes of agents and all non-Typhi *Salmonella*, 1996-2007†



Of 2,813 non-Typhi *Salmonella* isolates resistant to ≥3 classes, 1,702 (60.5%) isolates were resistant to at least ACT, 1,685 (59.9%) to at least ACSuT, and 1,615 (57.4%) to at least ACSSuT. These resistance patterns ranged from 7.9% to 8.3% in all non-Typhi *Salmonella* isolates tested from 1996-2007

*ACSSuT (resistance to at least ampicillin [A], chloramphenicol [C], streptomycin [S], sulfonamide [Su] and tetracycline [T]) represents resistance to ≥5 classes; ACSuT represents resistance to ≥4 classes; ACT represents resistance to ≥3 classes

†Preliminary 2007 data

Resistance to Quinolones and Third-Generation Cephalosporins

- **Of 2,813 non-Typhi *Salmonella* isolates resistant to ≥3 classes, resistance to at least nalidixic acid and ceftiofur was detected in 24 (0.9%) isolates**
  - **The 24 isolates resistant to at least nalidixic acid and ceftiofur accounted for all non-Typhi *Salmonella* isolates resistant to these two drugs**
    - **Additional MDR patterns**
      - **One (4.2%) of 24 isolates was also resistant to ciprofloxacin and ceftriaxone (0.04% of 2,813 isolates)**
      - **14 (58.3%) of 24 isolates were also resistant to at least ampicillin, amoxicillin-clavulanic acid, chloramphenicol, streptomycin, sulfonamide, and tetracycline**
    - **Additional single drug resistance**
      - **Resistance to ampicillin (95.8%), amoxicillin-clavulanic acid (83.3%), sulfonamide (83.3%) cefoxitin (75.0%), chloramphenicol (75.0%), streptomycin (75%), tetracycline (70.8%), kanamycin (58.3%), trimethoprim-sulfamethoxazole (25.0%), gentamicin (20.8%), ciprofloxacin (16.7%), ceftriaxone (12.5%)**

Key Findings/Conclusions

- From 1996-2007, resistance to ≥3 classes of antimicrobial agents has declined in non-Typhi *Salmonella.*
- *Salmonella* Typhimurium, which is the most common serotype in non-Typhi *Salmonella,* accounts for a higher proportion of isolates resistant to ≥3 classes than isolates resistant to <3 classes.
- ACSSuT, which represents resistance to at least five classes, is a major MDR pattern in non-Typhi *Salmonella* resistant to ≥3 classes.
- Isolates resistant to nalidixic acid and ceftiofur, drugs representative of two clinically important agents (i.e., ciprofloxacin and ceftriaxone), can be detected in non-Typhi *Salmonella* using resistance to ≥3 classes as a cut-off to measure important class resistance.
- These findings support the utility of using resistance to ≥3 classes as an indicator for infections with limited treatment options.

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- 50 state and 3 local health departments (Houston, Los Angeles County, New York City) and their public health laboratories
- U.S. Food and Drug Administration (FDA) Center for Veterinary Medicine

Spatio-Temporal Distribution of Antimicrobial Resistance in Non-Typhi *Salmonella*, NARMS, 2003-2007

AL Krueger,[1,2] F Medalla,[1,] G Pecic,[1,2] A Stuart,[1,2] RM Hoekstra,[1]
and EJ Barzilay[1]

[1]**CDC, Atlanta, GA**
2Atlanta Res. and Ed. Fndn., Decatur, GA

Abstract (amended)

Background

Non-Typhi *Salmonella* (NTS) is estimated to cause 1.4 million illnesses a year resulting in over 100,000 office visits, 16,000 hospitalizations, and 400 deaths. Antimicrobial resistant strains of NTS are more likely to cause invasive infections and result in hospitalization, which increase the burden of illness and health care costs.

Methods

From 2003-2007, the National Antimicrobial Resistance Monitoring System received every 20th NTS isolate submitted to 50 states and 3 local public health laboratories. At CDC, isolates were susceptibility tested by broth microdilution. MICs were determined for 15 antimicrobial agents and interpreted using CLSI criteria when available. ArcGIS 9.3 was used to map the spatio-temporal distribution of resistance in NTS. We calculated *Shannon* conditional entropy values for the distribution of resistance patterns by geography.

Results

From 2003-2007, 3.5% of NTS were resistant to ceftiofur, 2.6% to nalidixic acid, 7.0% to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline (ACSSuT), 2.3% to at least ACSSuT, amoxicillin-clavulanic acid, and ceftiofur (MDRAmpC). The prevalence of ACSSuT and MDRAmpC has declined since 2003: highest resistances were observed in the northern Midwest. Highest level of resistance to ceftiofur was noted in some northern Midwest states. Nalidixic acid resistance ranged from 2.3% to 3.0% from 2003-2007. In *Salmonella* serotype Typhimurium, 22.8% were ACSSuT from 2003-2007; a decline was noted since 2003 and highest resistance prevalence rates remained in the Midwest and South. In serotype Newport, 13.3% were MDRAmpC from 2003-2007; a decline was observed since 2003 and highest resistance rates remained in the Midwest.

Conclusion

Highest rates of several resistance patterns in NTS were found in Midwestern states. A spatio-temporal view allows monitoring of trends across space and time to better understand the emergence and spread of resistance.

Methods

- Isolate submission scheme
  - NARMS received every 20th NTS isolate submitted to 50 states by clinical laboratories.
  - Typhimurium var. O:5- is categorized with Typhimurium.
- Antimicrobial susceptibility testing
  - All isolates were tested using broth microdilution (Sensititre) to determine minimum inhibitory concentrations (MICs) for 15 agents.
  - MICs were interpreted using criteria from the Clinical and Laboratory Standards Institute (CLSI) when available.
  - Clinically important resistances in NTS and specific serotypes are discussed in this study
- Spatio-temporal analysis
  - ArcGIS 9.3 was used to map the spatio-temporal distribution of resistance in NTS.
    - States were categorized by Census division.[3]
  - We calculated *Shannon* conditional entropy values for the distribution of resistance patterns by geography using the census divisions.

    Entropy =-(PopulationProportion)*((ProportionResistant* LOG(ProportionResistant)+(1- ProportionResistant) *LOG(1- ProportionResistant)))

  - Entropy provides an ordering; low entropy distributions showing concentration of higher values in a smaller area.

Results

Results 2003-2007

- Non-Typhi *Salmonella*
  - 3.5% resistant to ceftiofur.
  - 2.6% resistant to nalidixic acid.
  - 7.0% resistant to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline (ACSSuT).
  - 2.3% resistant to at least ACSSuT, amoxicillin-clavulanic acid, and ceftiofur (MDRAmpC).
  - ACSSuT and MDRAmpC declined since 2003
    - ACSSuT declined from 9.3% in 2003 to 6.3% in 2007
    - MDRAmpC declined from 3.2% in 2003 to 2.1% in 2007
    - Highest ACSSuT resistances were observed in the northern Midwest: MT, 6 (25%); ID, 8 (17.4%); IA, 13 (14.9%); ND, 2 (11.8%); NE, 9 (14.3%); SD, 5 (10.6%).
  - Highest level of resistance to ceftiofur was noted in some northern Midwest states: MT, 4 (16%); MI, 13 (6.2%); ND, 1 (5.9%); WI, 12 (5.4%).
  - Nalidixic acid resistance ranged from 2.3% to 3.0% from 2003-2007.
- *Salmonella* serotype Typhimurium
  - 22.8% were ACSSuT from 2003-2007; a decline was noted since 2003.
    - ACSSuT declined from 26.1% in 2003 to 22.8% in 2007
  - Highest ACSSuT resistance prevalence rates remained in Midwest and Southern states: ID, 7 (46.7%); IA, 9 (39.1%); GA, 33, (34.7%); FL, 9 (34.6%); VA, 28 (34.6%); SC, 10 (34.5%); KS, 2 (33.3%); ND, 1 (33.3%); LA, 7 (31.8%).
- *Salmonella* serotype Newport
  - 13.3% were MDRAmpC from 2003-2007; a decline was observed since 2003.
    - MDRAmpC declined from 22.8% in 2003 to 7.7% in 2007
  - Highest MDRAmpC resistance rates remained in the Midwest: NE, 1 (100%); MI, 10 (58.8%); WI, 11 (52.4%); NV, 2 (40%).

Entropy Score Results

- MDRAmpC resistance in NTS - most resistance lies in the west and northern divisions (Figure 1).
- Nalidixic acid resistance in NTS - lower resistance proportions are found in the West South Central and East South Central divisions (Figure 2).
- Ceftiofur resistance in NTS - most resistance lies in the west and northern divisions (Figure 3).
- Nalidixic acid resistance in *Salmonella* Enteritidis - lower resistance proportions are found in the southern divisions (Figure 4).
- ACSSuT resistance in NTS - The highest resistance proportion was found in the West North Central division (Figure 5).
- Ceftiofur resistance in *Salmonella* Heidelberg - highest proportion of resistance was found in the Middle Atlantic and East South Central divisions (Figure 6).
- MDRAmpC resistance in *Salmonella* Newport - lower resistance proportions are found in the southern divisions (Figure 7).
- Ceftiofur resistance in *Salmonella* Newport - lower resistance proportions are found in the southern divisions (Figure 8).
- ACSSuT resistance in *Salmonella* Typhimurium - High resistance proportions were found across all divisions (Figure 9).

Figure 1: Spatial Distribution by Census Division of MDRAmpC* Resistance in Non-Typhi *Salmonella*, 2003-2007
Entropy Score† = 0.0461

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy‡
East North Central	46	1384	46338216	0.033	0.15363052	0.009676
East South Central	8	838	17944829	0.01	0.0594946	0.001447
Middle Atlantic	33	1406	40416441	0.023	0.13399737	0.006372
Mountain	25	668	21360990	0.037	0.0708206	0.004869
New England	19	597	14264185	0.032	0.04729173	0.002909
Pacific	54	1497	48735960	0.036	0.16158004	0.010878
South Atlantic	13	2072	57860260	0.006	0.19183091	0.003056
West North Central	24	700	18276008	0.034	0.06059259	0.003905
West South Central	10	895	34649697	0.011	0.1148782	0.003021

*MDRAmpC: Resistant to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, tetracycline, amoxicillin-clavulanic acid, ceftiofur and decreased susceptibility to ceftriaxone (MIC≥2 μg/L)
†Sum of entropy scores by region
‡Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 2: Spatial Distribution by Census Division of Nalidixic acid Resistance in Non-Typhi *Salmonella*, 2003-2007
Entropy Score* = 0.0511

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy†
East North Central	30	1384	46338216	0.022	0.15363052	0.0071
East South Central	6	838	17944829	0.007	0.0594946	0.0011
Middle Atlantic	55	1406	40416441	0.039	0.13399737	0.0096
Mountain	20	668	21360990	0.03	0.0708206	0.0041
New England	24	597	14264185	0.04	0.04729173	0.0034
Pacific	41	1497	48735960	0.027	0.16158004	0.0087
South Atlantic	55	2072	57860260	0.027	0.19183091	0.0103
West North Central	24	700	18276008	0.034	0.06059259	0.0039
West South Central	9	895	34649697	0.01	0.1148782	0.0028

*Sum of entropy scores by region
†Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 3: Spatial Distribution by Census Division of Ceftiofur Resistance in Non-Typhi *Salmonella*, 2003-2007
Entropy Score* = 0.0646

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy†
East North Central	60	1384	46338216	0.043	0.15363052	0.0118
East South Central	18	838	17944829	0.021	0.0594946	0.0026
Middle Atlantic	67	1406	40416441	0.048	0.13399737	0.0112
Mountain	30	668	21360990	0.045	0.0708206	0.0056
New England	28	597	14264185	0.047	0.04729173	0.0039
Pacific	70	1497	48735960	0.047	0.16158004	0.0133
South Atlantic	33	2072	57860260	0.016	0.19183091	0.0068
West North Central	31	700	18276008	0.044	0.06059259	0.0047
West South Central	16	895	34649697	0.018	0.1148782	0.0045

*Sum of entropy scores by region
†Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 4: Spatial Distribution by Census Division of Nalidixic acid Resistance in *Salmonella* Enteritidis, 2003-2007
Entropy Score* = 0.0923

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy†
East North Central	14	270	46338216	0.052	0.15363052	0.013635
East South Central	3	72	17944829	0.042	0.0594946	0.004502
Middle Atlantic	18	358	40416441	0.05	0.13399737	0.011552
Mountain	6	67	21360990	0.09	0.0708206	0.009305
New England	11	142	14264185	0.077	0.04729173	0.005574
Pacific	20	278	48735960	0.072	0.16158004	0.01816
South Atlantic	15	342	57860260	0.044	0.19183091	0.015034
West North Central	10	107	18276008	0.093	0.06059259	0.008143
West South Central	2	72	34649697	0.028	0.1148782	0.006372

*Sum of entropy scores by region
†Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 5: Spatial Distribution by Census Division of ACSSuT* Resistance in Non-Typhi *Salmonella*, 2003-2007
Entropy Score† = 0.1078

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy‡
East North Central	105	1384	46338216	0.076	0.15363052	0.017941
East South Central	42	838	17944829	0.05	0.0594946	0.005129
Middle Atlantic	90	1406	40416441	0.064	0.13399737	0.013841
Mountain	57	668	21360990	0.085	0.0708206	0.008945
New England	36	597	14264185	0.06	0.04729173	0.004662
Pacific	122	1497	48735960	0.081	0.16158004	0.019733
South Atlantic	143	2072	57860260	0.069	0.19183091	0.020915
West North Central	70	700	18276008	0.1	0.06059259	0.008555
West South Central	34	895	34649697	0.038	0.1148782	0.008059

*ACSSuT: Resistant to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline
†Sum of entropy scores by region
‡Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 6: Spatial Distribution by Census Division of Ceftiofur Resistance in *Salmonella* Heidelberg, 2003-2007
Entropy Score* = 0.1161

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy†
East North Central	6	76	46338216	0.079	0.15363052	0.018436
East South Central	5	36	17944829	0.139	0.0594946	0.010417
Middle Atlantic	13	99	40416441	0.131	0.13399737	0.022596
Mountain	2	39	21360990	0.051	0.0708206	0.006196
New England	2	32	14264185	0.062	0.04729173	0.004774
Pacific	7	107	48735960	0.065	0.16158004	0.016877
South Atlantic	4	62	57860260	0.065	0.19183091	0.020037
West North Central	1	37	18276008	0.027	0.06059259	0.003267
West South Central	2	26	34649697	0.077	0.1148782	0.013539

*Sum of entropy scores by region
†Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 7: Spatial Distribution by Census Division of MDRAmpC* Resistance in *Salmonella* Newport, 2003-2007
Entropy Score† = 0.1739

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy‡
East North Central	32	99	46338216	0.323	0.15363052	0.041975
East South Central	3	101	17944829	0.03	0.0594946	0.003481
Middle Atlantic	26	103	40416441	0.252	0.13399737	0.032852
Mountain	11	55	21360990	0.2	0.0708206	0.015391
New England	15	46	14264185	0.326	0.04729173	0.012966
Pacific	33	120	48735960	0.275	0.16158004	0.041274
South Atlantic	9	297	57860260	0.03	0.19183091	0.011226
West North Central	10	61	18276008	0.164	0.06059259	0.011743
West South Central	2	176	34649697	0.011	0.1148782	0.003021

*MDRAmpC: Resistant to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, tetracycline, amoxicillin-clavulanic acid, ceftiofur and decreased susceptibility to ceftriaxone (MIC≥2 μg/L)
†Sum of entropy scores by region
‡Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 8: Spatial Distribution by Census Division of Ceftiofur Resistance in *Salmonella* Newport, 2003-2007
Entropy Score* = 0.1785

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy†
East North Central	32	99	46338216	0.323	0.15363052	0.041975
East South Central	3	101	17944829	0.03	0.0594946	0.003481
Middle Atlantic	26	103	40416441	0.252	0.13399737	0.032852
Mountain	12	55	21360990	0.218	0.0708206	0.016128
New England	16	46	14264185	0.348	0.04729173	0.013272
Pacific	36	120	48735960	0.3	0.16158004	0.042866
South Atlantic	11	297	57860260	0.037	0.19183091	0.013187
West North Central	10	61	18276008	0.164	0.06059259	0.011743
West South Central	2	176	34649697	0.011	0.1148782	0.003021

*Sum of entropy scores by region
†Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Figure 9: Spatial Distribution by Census Division of ACSSuT* Resistance in *Salmonella* Typhimurium, 2003-2007
Entropy Score† = 0.2281

Division	Number resistant	Total Submitted	Population Estimates	Proportion Resistant	Population Proportion	Entropy‡
East North Central	59	281	46338216	0.21	0.15363052	0.034292
East South Central	33	171	17944829	0.193	0.0594946	0.012675
Middle Atlantic	55	277	40416441	0.199	0.13399737	0.02904
Mountain	33	114	21360990	0.289	0.0708206	0.018493
New England	17	107	14264185	0.159	0.04729173	0.008996
Pacific	64	295	48735960	0.217	0.16158004	0.036707
South Atlantic	125	443	57860260	0.282	0.19183091	0.049556
West North Central	49	194	18276008	0.253	0.06059259	0.014884
West South Central	28	156	34649697	0.179	0.1148782	0.023442

*ACSSuT: Resistant to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline
†Sum of entropy scores by region
‡Entropy = -(PopulationProportion)*((ProportionResistant* LOG(ProportionResisant) +(1-ProportionResistant)*LOG(1-ProportionResistant)))

Key Findings/Conclusions

- **Resistance in *Salmonella* Typhimurium is more widely distributed, entropy score = 0.2281.**
- **Ceftiofur resistance in *Salmonella* Newport follows a similar pattern to MDRAmpC.**
- **Ceftiofur resistance in *Salmonella* Heidelberg seems to be more widely distributed.**
- **Resistance rates in *Salmonella* Enteritidis are low, more data is needed to see if the distribution is regional.**
- **High rates of several resistance patterns in NTS were found in Western and Central states.**
- **A spatio-temporal view allows monitoring of trends across space and time to better understand the emergence and spread of resistance.**

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- U.S. Food and Drug Administration (FDA) Center for Veterinary Medicine

The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention

NARMS Active Manuscripts

Status	#	Lead	Coauthors	Title	DoC	Comment
9						
	885	Hendricksen RS	Seyfarth AM, Jensen AB, Whichard, Jean M., Karlsmose S, Joyce, K, Mikoleit M, DeLong, Stephanie M., Weill F, Aidara-Kane, A, Lo Fo Wong, DM, Angulo, Fredrick J.	Results of use of WHO Global Salm-Surv external quality assurance system for antimicrobial susceptibility testing of Salmonella isolates from 200 to 2007	7/21/2009	
	811	Lynch, Michael	Blanton, Elizabeth M., Bulens, Sandra N., Polyak, Christine, Stevenson, Jennifer E., Medalla, Felicita, Barrett, Timothy J., Mintz, Eric D.	Multidrug resistance among Salmonella Typhi isolates in the United States, 1999-2004	7/1/2009	August 26, 2009
	865	Petrov, Petar	Hendricksen RS, Kantardjev, T., Asseva, G., Sorensen, G, Fields, Patricia, Mikoleit M, Whichard, Jean M., McQuiston, John R., Torpdahl, M, Aarestrup FM, Angulo, Fredrick J.	Occurrence and Characterization of Salmonella enterica subspecies enterica serovar 9,12:l,v:- strains from Bulgaria, Denmark, and the United States	6/10/2009	
	816	Sjolund, Maria	Yam J, Schwenk J, Joyce, Kevin W., Medalla, Felicita, Barzilay, Ezra J., Whichard, Jean M.	A domestically acquired human Salmonella infection yielding a CTX-M B-lactamase, United States.	2/20/2009	EID 2008 14(12):1957-9
	803	Sjolund-Karlsson, Maria	Folster, JF, Whichard, Jean M., Joyce, Kevin W., Medalla, Felicita, Rickert, Regan	Emergence of Plasmid-mediated Quinolone Resistance among non-Typhi Salmonella enterica Isolated from Humans in the United States	7/22/2009	2009 May;53(5):2142-4. Epub 2009 Feb 17
8						
	855	Folster, JP	Rickert, Regan, Barzilay, Ezra J., Whichard, Jean M.	Identification of the Aminoglycoside Resistance Determinants, armA and rmtC, among human non-Typhi Salmonella Isolated in the United States	7/7/2009	Accepted by AAC as "Letter to the Editor"
	907	Fricke, WF	Mammel, M, Zhao, S, Johnson, T, Rasko, D, White, D, Cebula, T, McDermott, Patrick F., Cray, P, Whichard, Jean M., Leclerc, JE, Ravel, J	Antimicrobial Resistance-encoding APEC Plasmids in Salmonella enterica serovar Kentucky from Poultry	7/24/2009	
	812	Hendricksen RS	Mikoleit M, Kornschober C, Angulo, Fredrick J., Rickert, Regan, Van Duyne, Susan, Kjelso C, Hasman H, Cormican M, Mevius D, Threlfall EJ, Valinsky L, Aarestrup FM	Multidrug resistant Salmonella Concord in adoptees from Ethiopia: A collaborative international investigation	2/24/2009	Accepted by PIDJ
7						
	802	Folster, JF	Pecic, G, Bolcen, Shanna, Theobald, Lisa, Hise, Kelley B., Carattoli A, Zhao, S, McDermott, Patrick F., Whichard, Jean M.	Characterization of extended-spectrum cephalosporin resistant Salmonella enterica serovar Heidelberg isolated from humans in the United States	7/21/2009	Accepted by Foodborne Pathogens and Disease

0=proposal, 1=analysis, 2=writing, 3=draft being reviewed by coauthors, 4=incorp coauthor comments, 5=NCID/CDC clearance, 6= incorp NCID/CDC comments, 7=at journal, 8=in press, 9=published, 10=posted to website

Status	#	Lead	Coauthors	Title	DoC	Comment
	804	Howie, R	Folster, JF, Whichard, Jean M., Barzilay, Ezra J., Bowen, Anna	Azithromycin MIC distributions of Shigella sonnei, NARMS 2005 vs 2006/07 outbreak isolates	7/21/2009	Rejected by CMI; reformatting for JAC and adding data
	807	Medalla, Felicita	Gay, Kathryn, Shin, Sanghyuk, Harvey, Emily, Joyce, Kevin, Nygren, Benjamin, Theobald, Lisa, Sjolund-Karlsson, Maria, Stuart, Andrew, Austin, Jana, Blanton, Elizabeth, Mintz, Eric D., Whichard, Jean M., Barzilay, Ezra J.	Report of ciprofloxacin-resistant Salmonella enterica serotype Typhi isolates in the National Antimicrobial Resistance Monitoring System, 199-2007	2/26/2009	Revising draft for submission to journal
	856	M'ikanatha, Nkuchia M	Sandt, Carol, Localio, Russell A., Tewari, Deepanker, Rankin, Shelley C., Whichard, Jean M., Altekruse, Sean F, Lautenbach, Ebbing, Folster, Jason P., Russo, Anthony, Chiller, Tom, Reynolds, Stanley M, McDermott, Patrick F.	Antimicrobial-Resistant Salmonella Isolates from Retail Chicken Meat Compared with Human Clinical Isolates	7/21/2009	Resubmitted to JAC
	834	Sjolund-Karlsson, Maria	Rickert, Regan, Mator, Caline, Pecic, Gary, Howie, Rebecca, Joyce, Kevin, Medalla, Felicita, Barzilay, Ezra, Whichard, Jean	Molecular Characterization of Salmonella Isolates with Decreased Susceptibility to Third Generation Cephalosporins in the United States	7/14/2009	Betalactamase gene screening
	813	Whichard, Jean M.	Medalla, Felicita, Hoekstra, Robert M., Joyce, Kevin W., Chiller, Tom, Barrett, Timothy J.	Antimicrobial resistance predictors for multidrug-resistant Salmonella in the United States: human isolates, 1996-2004	7/21/2009	Submitted 9/10/2009
	878	Wong, Melissa R.	Reddy, Vasudha, Hanson, Heather, Johnson, Kristen M., Tsoi, Benjamin, Cokes, Carolyn, Gallagher, Lauren, Lee, Lillian, Plentsova, Anna, Dang, Thoa, Krueger, Amy, Joyce, Kevin W., Balter, Sharon	Antimicrobial Resistance Trends of Shigella serotypes in New York City, 2006-2009	7/23/2009	
4						
	808	Krueger, Amy	Folster, JF, Medalla, Felicita, Joyce, Kevin W., Perri, M.B., Johnson, Laura, Zervos, MJ, Whichard, Jean M., Barzilay, Ezra J.	E. coli Isolate Resistant to 10 CLSI Subclasses, United States, NARMS, 2004-2007	7/14/2009	
2						
	883	Folster, JF		Characterization of ESBL-producing Shigella isolates in the United States	7/21/2009	
	801	Folster, JF	Howie, R, Whichard, Jean M.	mphA-mediated macrolide resistance in Shigella sonnei	2/23/2009	Being incorporated into R. Howie's Shigella manuscript
	905	Karlsson, Maria	Howie, R, Rickert, R, Krueger, Amy, Tran, Thu-Thuy, Zhao, S., Ball, T, Frye, J, Pecic, G, Joyce, K, Fedorka-Cray, P, Whichard, Jean M., McDermott, Patrick F.	Plasmid-Mediated Quinolone Resistance among Non-Typhi Salmonella enterica Isolated from Humans, Animals and Retail Meat in the United States, NARMS 2007	9/16/2009	Drafting Manuscript
	882	Sjolund-Karlsson, Maria	Howie, R, Rickert, R, Krueger, A, Pecic, G, Joyce, K, Whichard, Jean M.	Molecular characterization of CTX-M-producing isolates of non-Typhi Salmonella, NARMS 2007	7/14/2009	

0=proposal, 1=analysis, 2=writing, 3=draft being reviewed by coauthors, 4=incorp coauthor comments, 5=NCID/CDC clearance, 6= incorp NCID/CDC comments, 7=at journal, 8=in press, 9=published, 10=posted to website

Status	#	Lead	Coauthors	Title	DoC	Comment
	378	ThurdeKoos, A. M.	Gay, Katie, Perri, M.B., Joyce, Kevin W., Donabedian, S.M., Zervos, MJ, Chiller, Tom	Vancomycin-Resistant Enterococci (VRE) Carriage in the Community: Is This a New Reservoir for Infection?	1/23/2009	Drafts written
	806	Whichard, Jean M.	caratooli A, Gottleib S, Morabito S, Hyytia-Trees, Eija, Connor R, Bird, Michele M., Wheeler D, Ribot, Efrain, Baker, NL, Griffin, Patricia M., Barrett, Timothy J.	Emergence of plasmid-mediated blaCMY genes and multidrug resistance among Escherichia coli O157:H7: results of NARMS monitoring 2000-2001		
1						
	839	Sjolund-Karlsson, Maria	Whichard, Jean M.	Salmonella Genomic Island I (SGI1)	2/23/2009	SGI1 screening of NARMS MDR isolates with ACSSuT
	880	Sjolund-Karlsson, Maria	Boerlin, P, Blickenstaff, K, Zhao, S, Ball, T, Howie, R, Pecic, G, Joyce, KJ, Rickert, R, Cray, P, Whichard, Jean M., McDermott, Patrick F.	Presence of B-lactamases among non-Typhi Salmonella isolated from humans, animals and retail meat - a NARMS/CIPARS collaboration	7/14/2009	B-lactamase gene screening among NARMS/CIPARS NTS - '08
	835	Sjolund-Karlsson, Maria	Medalla, Felicita, Hoekstra, Robert M.	Mutators among non-Typhi Salmonella	2/20/2009	Prevalence of mutator straings among NTS isolates
	838	Whichard, Jean M.	Yam J	Salmonella and E. coli plasmid inc typing	2/24/2009	Plasmid incompatibility typing

Status of FWA and IRB Approval for Protocol 3138 (as of 6/15/09)
Interviews of persons from which enteric bacterial isolates have been cultured with uncommon antimicrobial resistance patterns

State	State IRB Approval	Deferral to CDC IRB*	IRB Approval -Expiring Date
AK			
AL			
AR			
AZ			
CA	Yes		10/2/2009
CO		Yes	
CT	Yes		11/12/2009
DC			
DE		Yes	
FL		Yes	
GA	Yes		8/1/2009
HI	Yes		4/13/2010
HT			
IA		Yes	
ID			
IL			
IN		Yes	
KS		Yes	
KY		Yes	
LA		Yes	
LX			
MA	Yes		11/21/2009
MD			
ME		Yes	
MI	Yes		12/16/2009
MN		Yes	
MO		Yes	
MS			
MT		Yes	
NC			
ND		Yes	
NE		Yes	
NH			
NJ			
NM	Yes		2/24/2010
NV			
NY	Yes**		
NYC	Yes		5/8/2010
OH			
OK			
OR	Yes		2/14/2010
PA		Yes	
RI			
SC			
SD		Yes	
TN		Yes	
TX			
UT			
VA	Yes		2/13/2010
VT		Yes	
WA		Yes	
WI			
WV			
WY			
Total (Yes)	11	19	

***Sites have deferred to CDC IRB for local approval of the protocol.**

****State IRB has granted exempt status**

*****CDC will follow up with site to request copy of current IRB approval**