

# Vaccination to Reduce Salmonella Works, if they Get the Vaccine!

---

Chuck Hofacre

The University of Georgia  
College of Veterinary Medicine,  
Department of Population Health  
Poultry Diagnostic and Research Center  
953 College Station Road  
Athens, Georgia 30602-4875



# CDC – MMWR 1<sup>st</sup> Editorial Comment (April 10, 2009)

---

“The lack of recent progress toward the national health objective targets...point to gaps in the current food safety system...from the farm to the table.”

# WHO / FAO Meeting Rome, Italy    May, 2009

---

Vaccination is a **key** Salmonella control strategy.

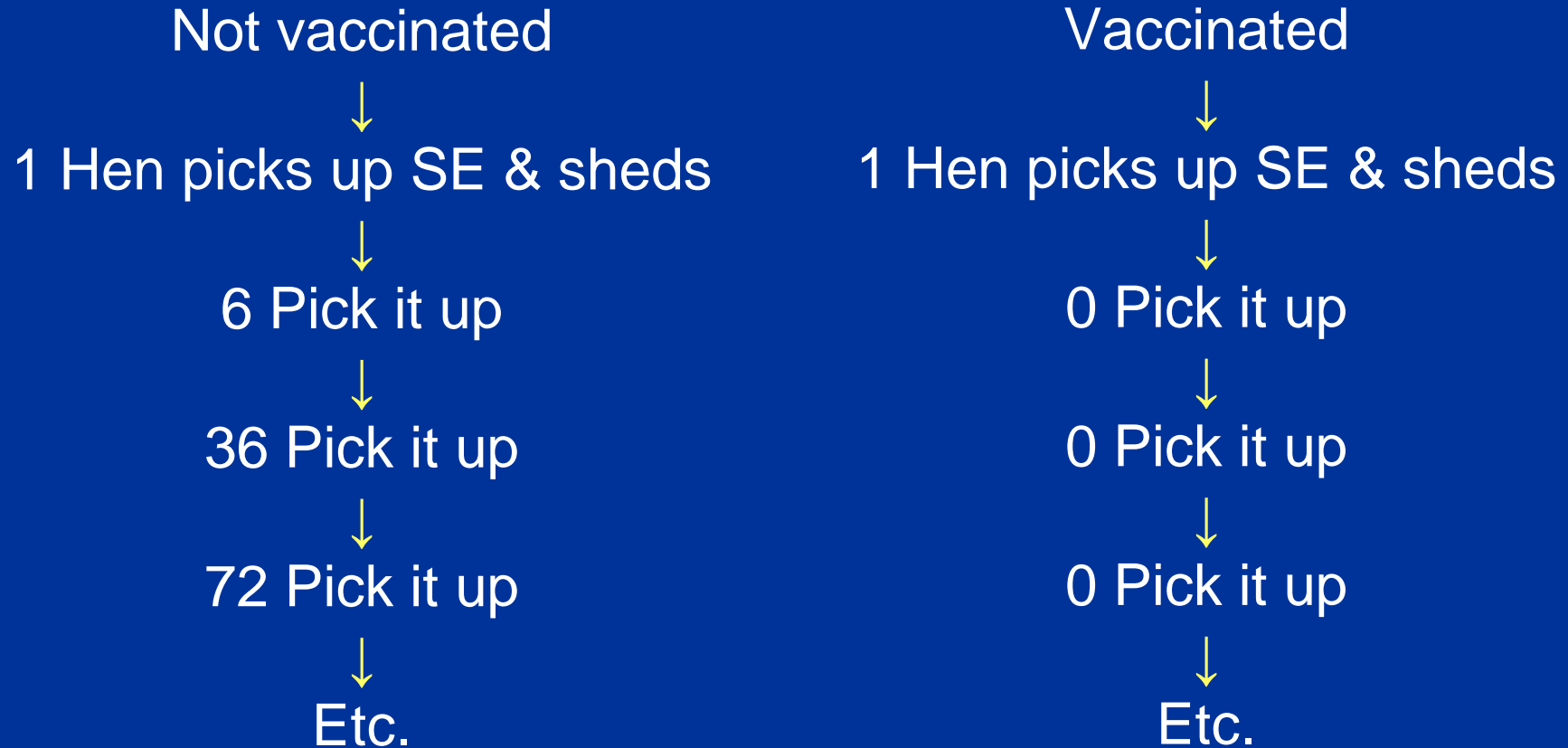
# Choices of Vaccines

---

- Live vaccine only
- Killed vaccine / Killed vaccine  
(Bacterin) (Bacterin)
- Live vaccine / Killed vaccine
- Killed vaccine once  
(Bacterin)

# My Simple Understanding of How Vaccination Works

---



**Vaccination is not 100% Effective !!**  
**Immunity can be overwhelmed.**

# Live Vaccines

---

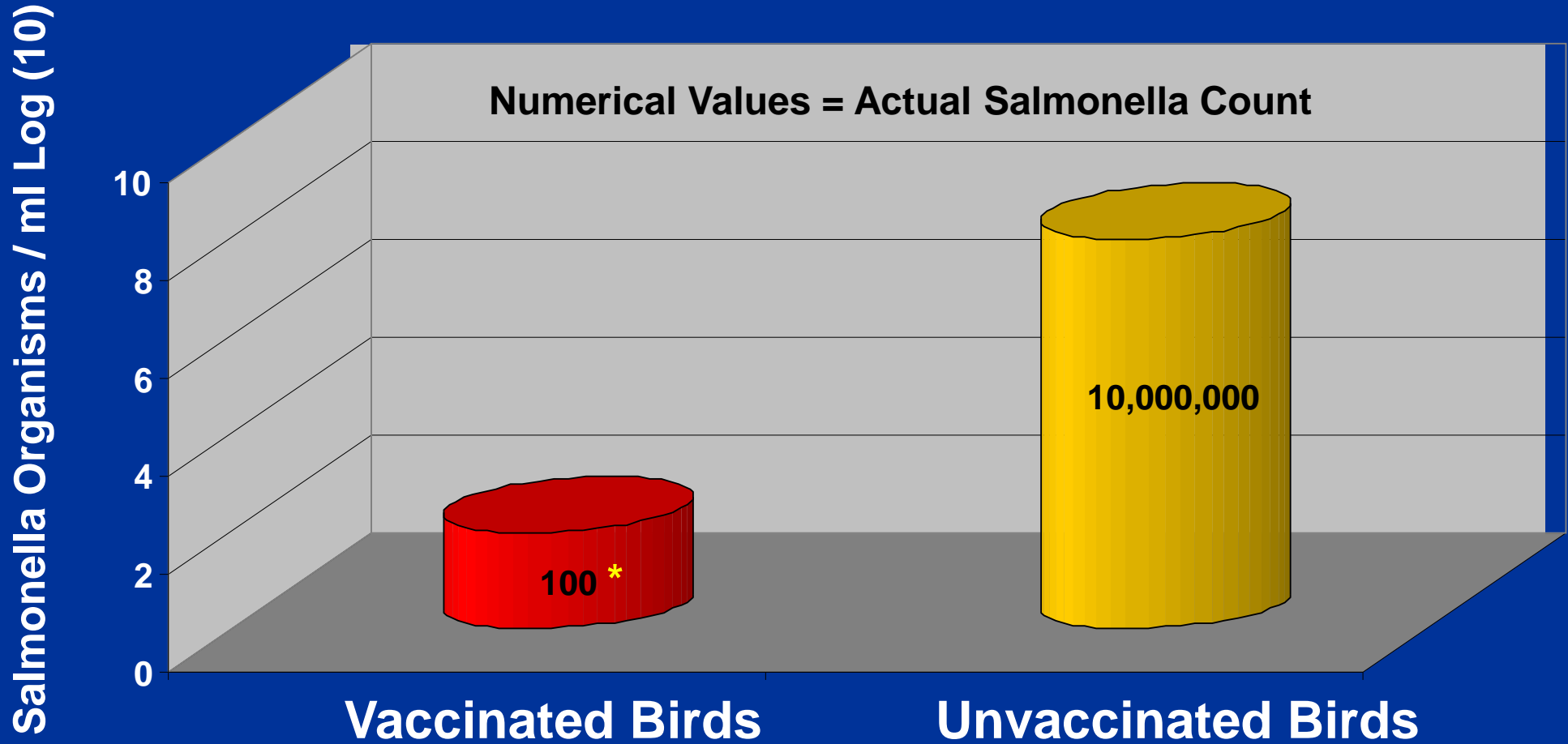
- Will not make Salmonella positive chicks negative
- S.T. vaccines do give protection to S.E.
- Do not provide immunity to all serotypes
- Will reduce fecal shed
- Early protection almost like C.E.
- Don't prime for the killed

# Killed Vaccines?

---

- Birds respond poorly to bacterial vaccines
- Need 2 injections before lay
- Provide protection only to serotype(s) in the vaccine
  - Killed S.E. Vaccine won't protect against S.heidelberg

# SE bacterin slows the growth of SE in contaminated eggs (Holt et al)



\* Indicates a statistically significant difference ( $P < 0.05$ )



# Experimental Design

---

## Poultry Company

**NO VAX**

(HACCP: passing)

**VAX**

(HACCP: failing)

4 Broiler Breeder Farms

No Vaccination



Progeny

Broiler Farms

Vaccination:



- Live, *S. Typhimurium* MeganVac1™
- Killed, *S. Kentucky*, *S. Berta*
- Vaccinate ALL pullet flocks

# *Salmonella* Surveillance

---

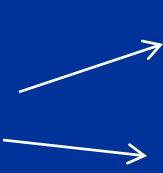
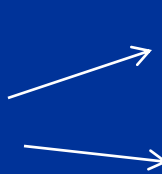
- 49 Poultry Farms
- 239 Farm Visits
- 7,408 Samples Collected: ~22% *Salmonella* positive (1,642 *Salmonella* isolates)

# Correlation Between Vaccination of Pullet Flocks and *Salmonella* Prevalence in Broiler Chicken Meat Birds for Two Poultry Integrators

Bird Type	Sample	NO-VAX	VAX	P Value
Pullets	Liners	0.0%	0.8%	<b>0.033</b>
	Environment	40.7%	40.6%	0.987
	Feed	2.6%	8.0%	0.006
	Total	17.2%	16.5%	0.617
Breeder	Environment	34.0%	35.4%	0.741
	<b>Ceca</b>	<b>64.2%</b>	<b>38.3%</b>	<b>&lt;0.001</b>
	<b>Ovaries</b>	<b>51.7%</b>	<b>14.2%</b>	<b>&lt;0.001</b>
Broiler	<b>Liners</b>	<b>33.8%</b>	<b>18.5%</b>	<b>&lt;0.001</b>
	<b>Environment</b>	<b>30.5%</b>	<b>15.1%</b>	<b>&lt;0.001</b>
	Feed	5.6%	0.0%	0.246
	<b>Ceca</b>	<b>29.1%</b>	<b>17.0%</b>	<b>&lt;0.001</b>

# Second Vaccination Study

---

- 12 breeder flocks  6 vaccinated  
6 not vaccinated
- 4 Drag swabs and 4 Boot socks at 35 and 45 weeks of age
- 58 broiler flocks  29 from vaccinated  
29 from not vaccinated
- 4 Drag swabs and 4 Boot socks 1 week before kill
- Ceca at rehang

# Results 2<sup>nd</sup> Vaccination Study

---

## Breeders:

- No difference in Salmonella environmental samples or MPN per sample

## Broilers:

- Vaccinated 14.1% positive
- Not vaccinated 25.5%
- Vaccinated 50% lower in ceca (MPN = 0.3 log<sub>10</sub> lower)

\* Note – Boot socks again better than Drag Swabs

# How can you get a Vaccine Failure?

---

- Immune suppression
- Live vaccine – poor handling, poor administration
- Inactivated vaccines – poor administration (S.Q. or I.M. in breast or thigh), less reactive emulsion – oil vs. water
  - Every bird must be injected

# Poor Administration

---

Didn't get the vaccine!!

and

How can you tell?

# Can tell by the Immune Response

---

- Measure indirectly i.e. NDV
  - pre-vaccination vs. post
- Measure Salmonella response directly
  - S. pullorum plate test
  - Salmonella ELISA



## Salmonella Quality for Commercial Layers

Farm	Age	SE* ELISA % Positive	GMT	%CV	Plate % Positive
1	14	100	4012	16	100
2	14	100	2062	43	100
3	16	70	1180	80	100
4	15	100	2729	31	97
5	20	100	3130	30	100
6	15	90	1470	60	95
7	15	100	2551	33	97
8	18	100	3468	19	100
9	35	90	1353	59	100
10	33	80	1510	68	100
11	36	70	963	84	100
12	6	0	30	54	4
13	11	0	3	173	10
14	13	50	370	135	93
15	23	90	2330	45	95

\*SE/ST ELISA vs. SE ELISA

# Summary

---

- Vaccination is **one** tool to reduce or control Salmonella
- Effective control of vectors - insects, rodents and people
- Vaccination only works if all the pullets get the vaccine
- My goal: at least 95% positive if less than 85% revaccinate with inactivated if giving only one

# Prevention of Salmonella

---

- No silver bullet
- No magic potion
- No single remedy