

# Food safety concerns associated with frozen foods cooked in a microwave oven



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# A quick reheating of microwave oven history

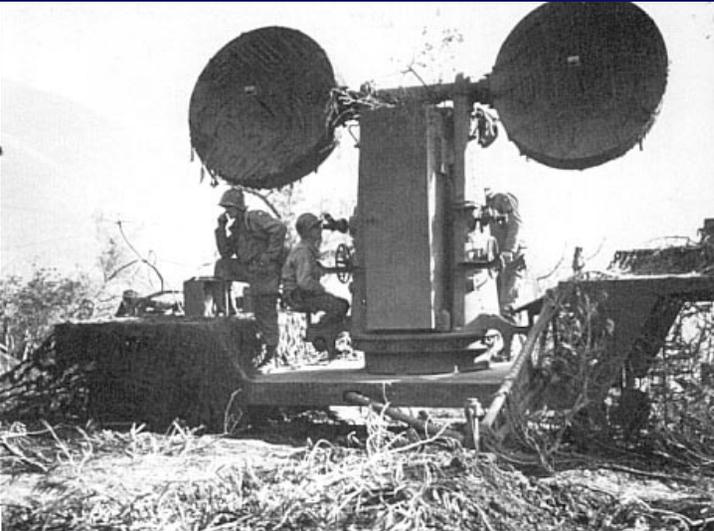
- 1945: Radar units found useful to heat coffee, explode eggs
- 1967: Amana Radarange: \$495 (\$3,500 in 2013)

Demos:  
Heated coffee,  
reheated meals,  
made popcorn

24 hour hotline  
On call engineers



- 1986: 25% of homes had a microwave
- 2001: 90% of homes, 30% used for most cooking
- 2010: 95% of households, 9% have 2 or more



# Foods of animal origin (meat, poultry, milk, eggs) are of two kinds:

## ➤ RAW:

- Higher levels of microbes
- Occasional pathogens
- Likely to be unsafe
- May cause infection if eaten

## ➤ COOKED:

- Low levels of microbes
- No pathogens
- Very low risk of infection
- (Unless recontaminated or abused)

# The consumer has to figure out two things about a food of animal origin in their kitchen

#1 Is it raw and needs to be cooked, or is it already cooked and I just need to warm it up?

#2 If it needs to be cooked, how do I cook it thoroughly?

➤ The answers matter, but can be hard to figure out, especially for microwaveable foods

# #1 Does it need to be cooked, or can I just warm it up?

“Ready-to-cook” vs  
“Not pre-cooked”  
“Not ready to eat”  
“Contains raw poultry”  
“Cook thoroughly”

“Ready-to-heat”  
“Brown and serve”  
“Pre-cooked”  
“Fully cooked”  
“Heat and serve”

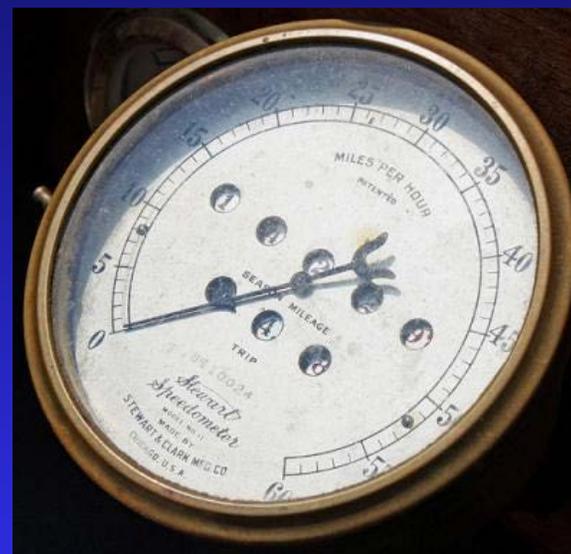
## #2 If it needs to be cooked, how to cook it thoroughly?

- Hi Power for 8 minutes
  - Rotate or stir
  - Med power for 5 minutes
  - Let stand for 3 minutes
  - Take temperature in multiple locations to be sure that it reaches 165 degrees
- 
- These instructions are for ovens of at least 1100 watts, use longer cooking times if oven has less, OR
  - Do not cook in microwave below 1100 watts as product may not be thoroughly cooked, BUT
  - Ovens may vary

# Is cooking raw meat or poultry with a microwave oven is like driving without a speedometer?



One way to learn how fast you are going



1914 Model T

First car with a speedometer as standard equipment

# Six outbreaks of *Salmonella* infections related to microwaveable breaded poultry products

- Detected in Minnesota using PulseNet, but could occur anywhere
- All were microwaveable, frozen, breaded, pre-browned chicken
- Most victims thought they just needed to heat them
- New labeling guidance in 2006

Year	Serotype	Cases	Hosp	Ave age	Product
1998	Typhimurium	33	3	17	Chicken Kiev
2005	Heidelberg	4	1	30	Chicken broccoli and cheese
2005	Enteritidis	27	6	31	Chicken Kiev
2006	Typhimurium	3	2	18	Chicken broccoli and cheese
2008	Enteritidis	7	3	19	Chicken cordon bleu
2008	I: 4,5,12:i:-	16	7	17	Chicken cordon bleu

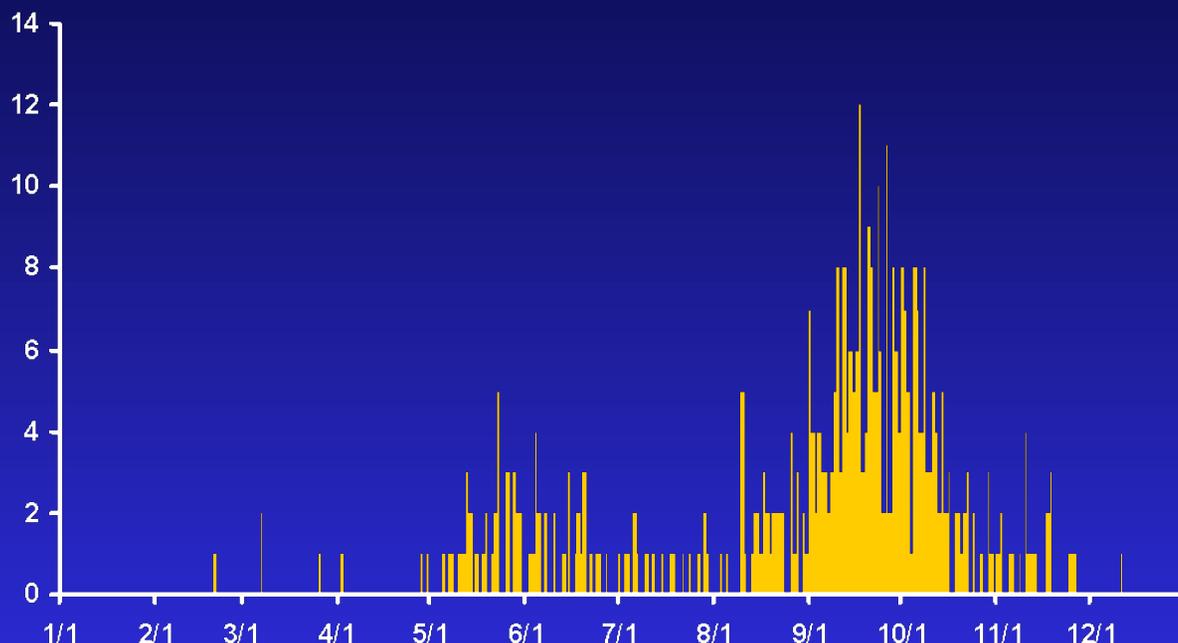
Smith et al. 2008, J Food Protect 71:2153-2160, plus personal comm.

# Six outbreaks of *Salmonella* infections related to microwaveable breaded poultry products

- Observations and lesson learned
  - About 25% of chicken parts have *Salmonella* on them
  - Most consumers thought heating was sufficient
  - Most cooked them in microwave ovens
  - No one used a thermometer
  - New labeling guidance in 2006 made little difference
- Saying “not pre-cooked” made no difference if the product looks cooked
- Relying on the consumer to measure the food temperature after cooking is not realistic
- **“These foods should not be marketed as microwaveable”**

Smith et al. 2008, J Food Protect 71:2153-2160, plus personal comm.

# Salmonella I:4,[5],12:i:- infections and frozen pot pies - 2007



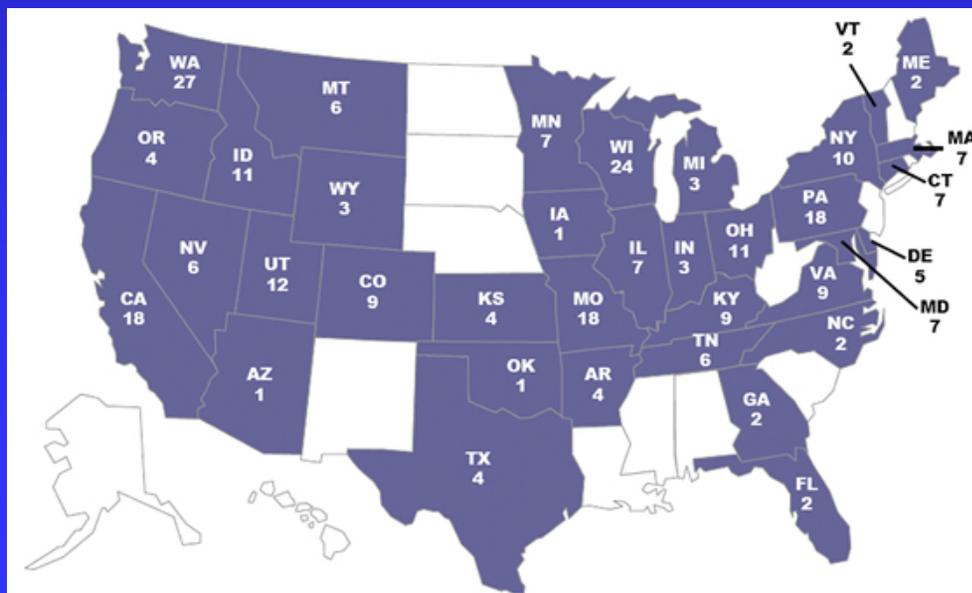
Between Feb 1 and  
and Dec 31, 2007  
401 confirmed cases  
32 % hospitalized  
3 deaths

Median age = 20 years

Cases in 35 states

One brand of frozen pot pies

[www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)



# Brand X Pot Pie Package



# Brand X Pot Pie Package



COOK THOROUGHLY

# Brand X Pot Pie Package



Nutrition Facts	
Serving Size 1 Pie	
Amount Per Serving	
Calories 380 Calories from Fat 190	
% Daily Value*	
Total Fat 21g	32%
Saturated Fat 9g	45%
Trans Fat 0g	
Cholesterol 35mg	12%
Sodium 840mg	35%
Total Carbohydrate 36g	12%
Dietary Fiber 2g	8%
Sugars 3g	
Protein 10g	
Vitamin A 25%	Vitamin C 0%
Calcium 2%	Iron 4%

\*Percent Daily Values are based on a diet of 2,000 calories per day. Your daily values may be higher or lower depending on your calorie needs.

	2,000	2,500
Total Fat	Less than 65g	80g
Sat Fat	Less than 20g	25g
Cholesterol	Less than 300mg	300mg
Sodium	Less than 2,400mg	2,400mg
Total Carbohydrate	300g	375g
Dietary Fiber	25g	30g

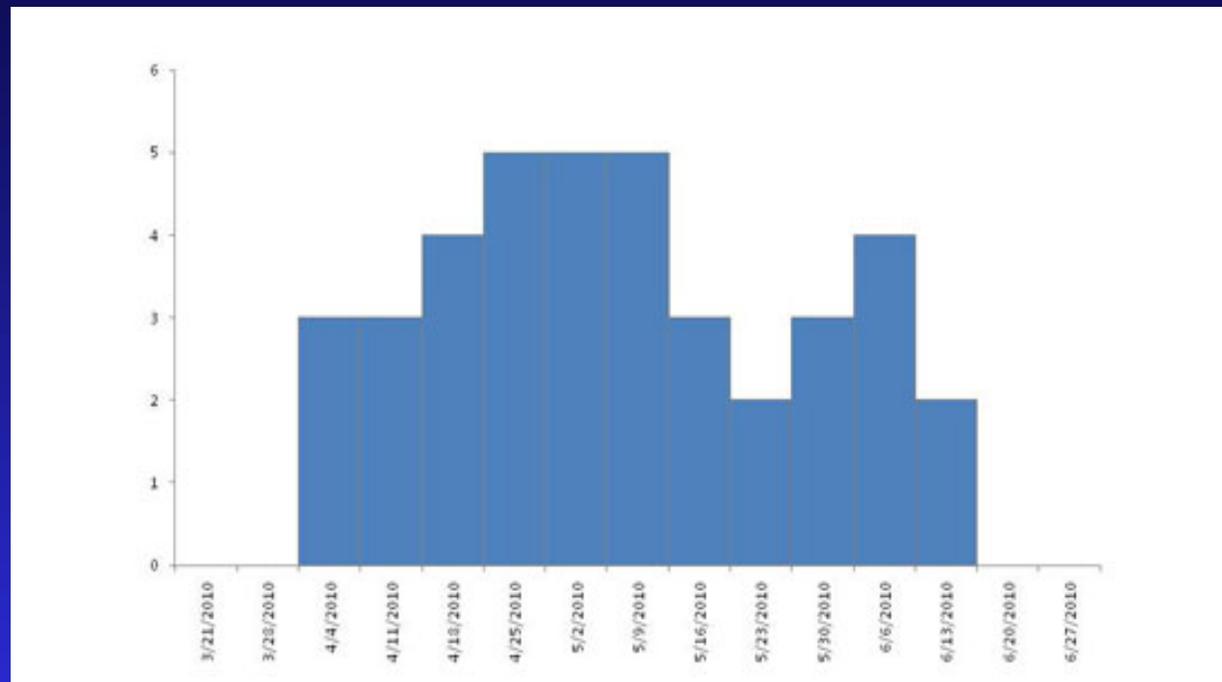
Calories per gram:  
Fat 9 • Carbohydrate 4 • Protein 4

Microwaving related to infection risk?

# Microwave Knowledge & Practices

- 96 (76%) of 127 cooked the pies in microwaves
- Microwave knowledge
  - 29% reported knowing exact wattage
  - 42% reported knowing wattage category
  - No one reported using a low wattage microwave
- Microwave practices
  - At least 68% did not let pies stand for the recommended time after cooking

# Salmonella Chester infections and frozen chicken dinners - 2010

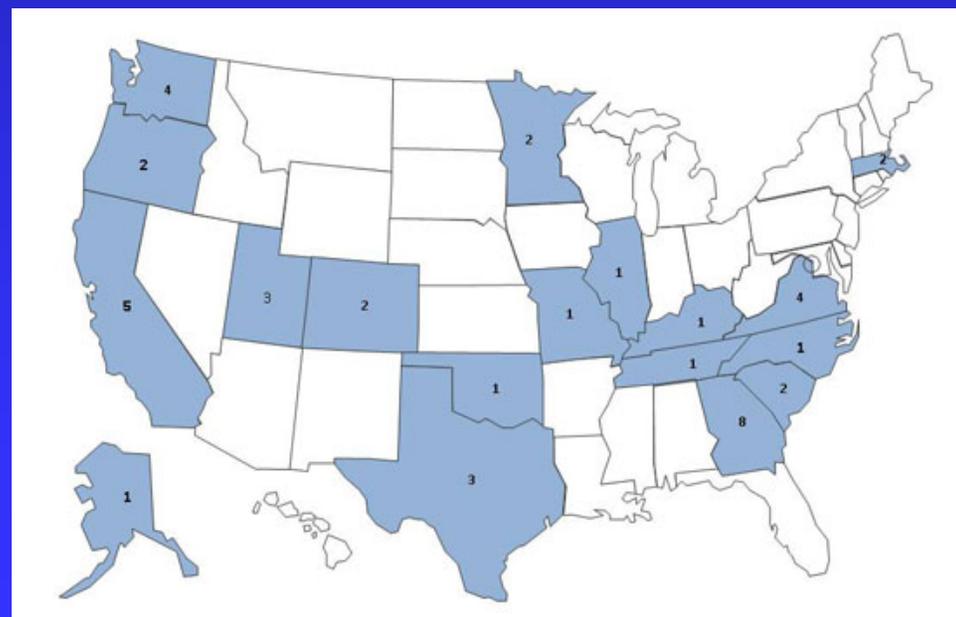


Between April 1  
and August 27, 2010  
44 cases  
37% hospitalized  
0 deaths  
median age 36 years

Cases in 18 states

One brand of  
frozen chicken dinner

[www.cdc.gov/salmonella](http://www.cdc.gov/salmonella)



# Salmonella Chester infections and frozen chicken dinners - 2010

Brand Y



# Salmonella Chester infections and frozen chicken dinners - 2010



Product labeled:  
“MUST COOK THOROUGHLY”  
In small print

# *Salmonella* Chester infections and frozen chicken entrées – Reported behavior

- 87 % heated the meals in a microwave
- 87 % said they let it stand for the recommended time
- BUT the fact that they still got sick suggests they did not cook the dinners thoroughly
- Even with improved labeling and instructions, consumers did not reliably cook the food

# Can we rely on the consumer to cook meat and poultry safely with a microwave oven?

- Consumers get confused about what is raw and what is cooked
  - Very few know when to cook vs when to heat
  - Have to read the fine print
- Probably not, if oven wattage is 1100 or less
- Instructions depend on wattage, but few know the wattage
- Almost no one uses a thermometer to judge doneness
  - What people really do is guess
  - then stick their finger in to see if it is “hot enough”
  - and then lick their finger
- Even a well-educated consumer may not cook correctly

# Options for preventing foodborne illnesses

- Make food safer - Make it all ready-to-eat
  - Abandon microwave cooking as unachievable
  - Cook it before it leaves the factory
  - Irradiate it
  
- Make the consumer smarter
  - Obvious labeling for RAW product
  - Standard oven wattage labeling
  - Even more cooking instructions
  - OR Say cook only in a conventional oven only
  
- Make the oven smarter

# Labelling the oven

- Frozen food industry approached oven sellers
- Convinced major marketers to require their manufacturers to label their ovens with maximum



# Making ovens smarter than a Model T Ford



- Display actual wattage output
- Enter standard cooking code for each food. Enter via keypad - the oven takes it from there
- Code readable by the oven, which then cooks it appropriately
- Infrared camera inside oven to monitor temperature of food

Samsung UK:

“built in scanner that reads bar code information from instant and packaged meals, adjusting cooking time and temperatures accordingly”

# We can learn more

- The tip of a much bigger iceberg – a likely factor in many sporadic illnesses
- Consider the role of microwave cooking in outbreaks – we can look harder in future
- Microwaves are standard in many restaurants and institutional kitchens
- Evaluate consumer knowledge, attitudes and practices around their microwave ovens

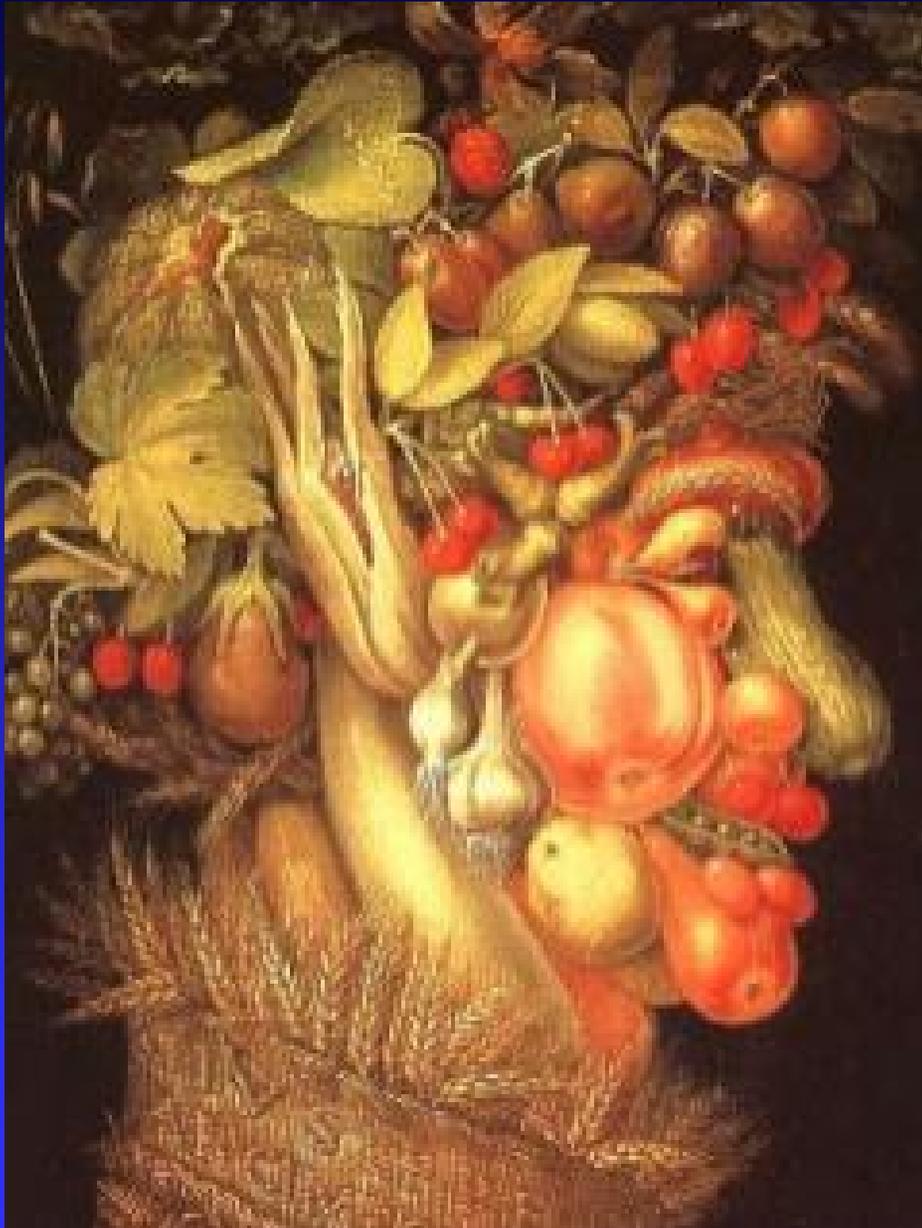
# Foodborne diseases in the 21<sup>st</sup> century: Keeping up with the changing kitchen

- New pathogens, new foods, cooked in new ways
- Collision between contaminated foods and convenient fast appliances
- Difficult to cook safely in many circumstances
- Did microwaves ovens play a role?
- We can improve prevention
  - Consider consumer knowledge and behavior
  - Provide better labeling and smarter designs
  - Some combinations are just not going to be safe



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# Thank you

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



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