



# New Zealand **FOOD SAFETY SCIENCE & RESEARCH CENTRE**

Catherine McLeod

Overview of potential food safety issues in  
fresh produce

12 March 2020



# Food Safety: Global and Domestic Concern

- Globally important cause of illness and mortality
- International trade
  - Incidents, real or perceived
  - Cost of compliance high
  - Many instances of food fraud, disruption to food supplies and food crime
  - Heightened demand from consumers
- In New Zealand
  - >6000 reported cases of norovirus per year
  - >400 Shiga-toxin producing *E. coli* cases per year





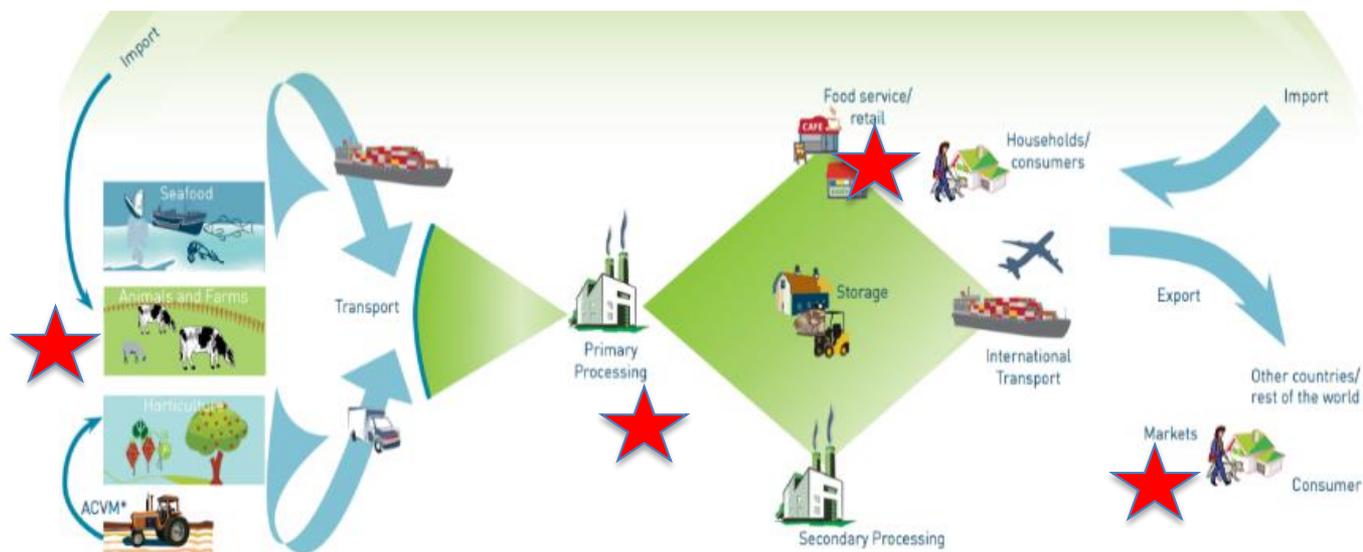
# Purpose of the NZ Food Safety Science and Research Centre: Risk Reduction

Focus for food safety research in New Zealand

Undertake research through the supply chain

Protect and enhance reputation of food produced in New Zealand

Protect public health of New Zealanders and international consumers





# New Zealand FOOD SAFETY SCIENCE & RESEARCH CENTRE



## INDUSTRY PARTNERS:



## GOVERNMENT FUNDERS:



**MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT**  
HĪKINA WHAKATUTUKI

**Ministry for Primary Industries**  
Manatū Ahu Matua



## RESEARCH PARTNERS:





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## Centre Research

- Since 2016 40+ projects have been initiated with industry
- Projects span industry, many projects assessing pathogen occurrence through the supply chain and interventions
- Check out website for examples/ resources you can use:  
<http://www.nzfssrc.org.nz/>



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*“Talking about food safety does not make  
your food less safe – it makes it safer”*

Bill Marler, 2012



## Overview of today's discussion

- What are the hazards of concern?
- What are the main fruit and vegetables of concern?
- How do foods become contaminated?
- What do we know about occurrence in NZ?
- How can we reduce risk?

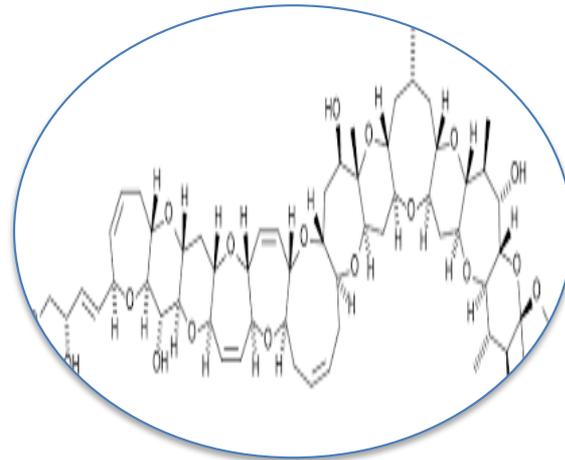
# What are the key hazards of concern to the fruit and vegetable sector?



Microbiological



Physical



Chemical

# Hazards potentially associated with fresh produce

## Chemical contaminants

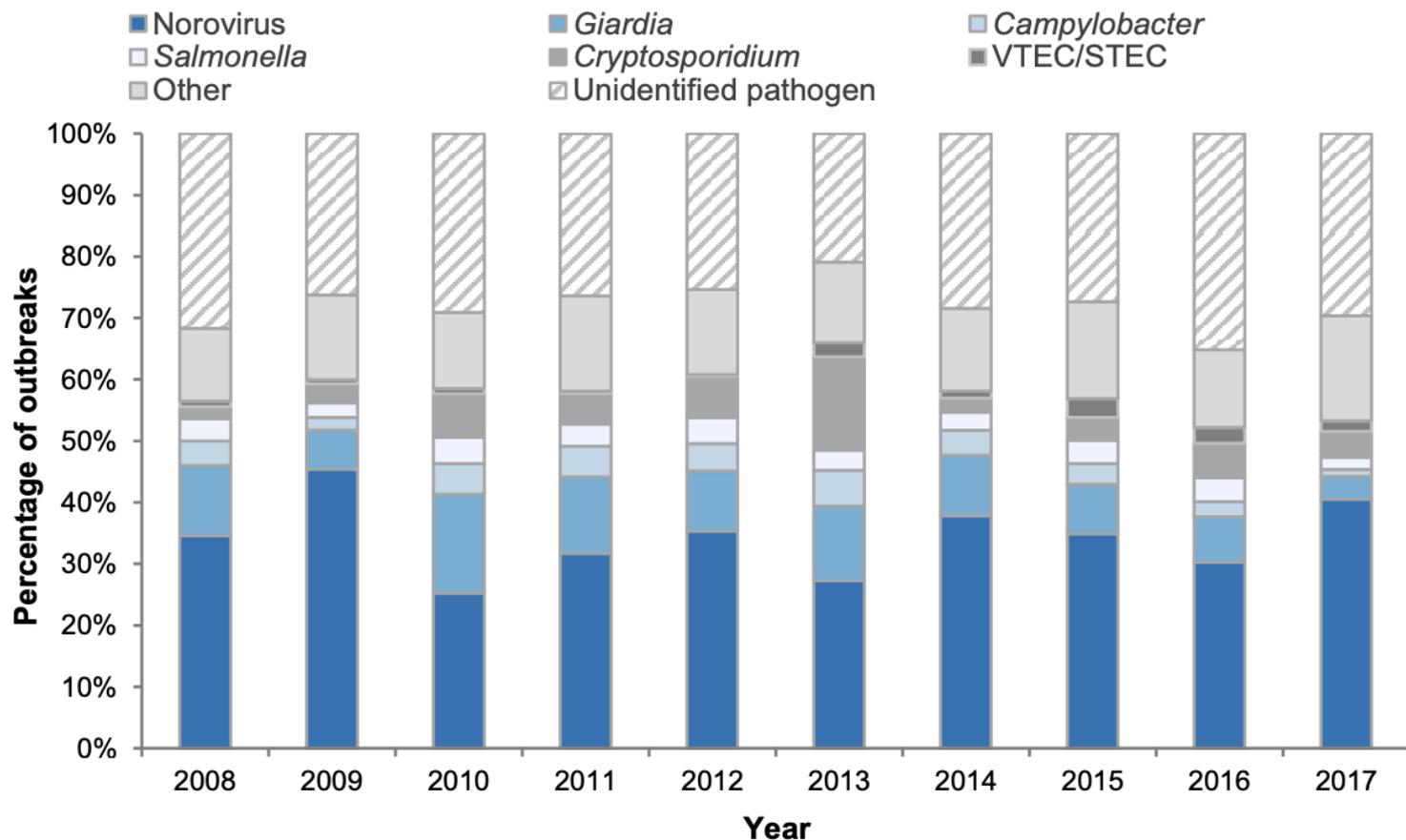
- Pesticides/herbicides
- Heavy metal residues (lead, zinc)
- Natural toxins (aflatoxins)
- Food allergens (sesame seeds, sulphur dioxide)
- Sustainable packaging??

## Physical contaminants

- Foreign objects from the environment (stones, bones, insects, feathers)
- Glass
- Objects from packing environment (wood splinters, metal shavings, staples, hard plastic)
- Food tampering

# Microbiological contaminants

Figure 5. Percentage of outbreaks by pathogen or condition and year, 2008–2017



Source: Annual Summary of Outbreaks in NZ 2017. ESR Report. Sept 2019. Prepared for MoH



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*Epidemiol. Infect.* (2003), **131**, 745–751. © 2003 Cambridge University Press  
DOI: 10.1017/S0950268803008586 Printed in the United Kingdom

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## **An outbreak of hepatitis A associated with consumption of raw blueberries**

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L. CALDER<sup>1\*</sup>, G. SIMMONS<sup>1</sup>, C. THORNLEY<sup>2</sup>, P. TAYLOR<sup>1</sup>, K. PRITCHARD<sup>1</sup>,  
G. GREENING<sup>2</sup> AND J. BISHOP<sup>3</sup>

# New hepatitis scare connected to frozen berries

9 Dec, 2015 4:51pm

🕒 5 minutes to read



The Ministry of Primary Industries has asked anyone who has bought Fruzio brand mixed berries to throw them out.

## Making berries safe

You can make frozen imported berries safe by:

- bringing them to the boil for a short amount of time
- cooking them at 85 degrees Celsius for at least 1 minute.

Preparing berries safely is particularly important when preparing foods that contain frozen berries like smoothies, and when serving them to vulnerable people – such as nursing home residents, young children or pregnant women.

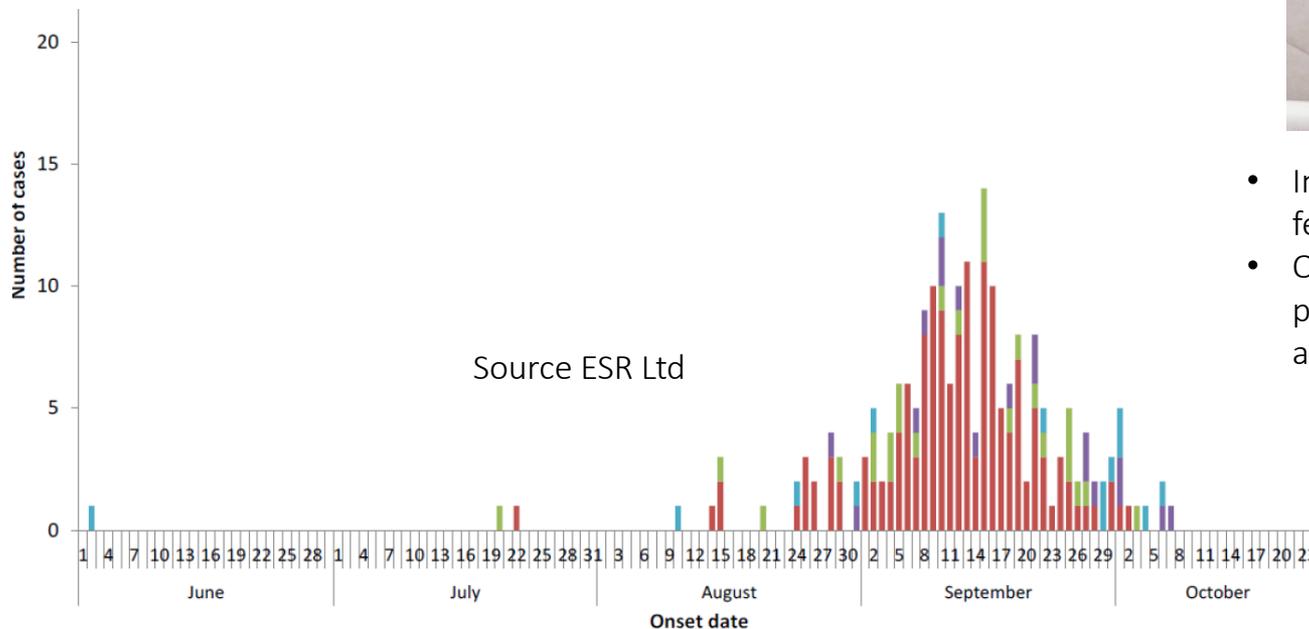
Washing frozen berries will not remove the risk.

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Haumaru Kai Aotearoa

# *Yersinia* outbreak in NZ in 2014

- 217 cases, 65 hospitalised – one of largest outbreaks ever, anywhere
- “highly unlikely that the source of contamination will be identified”
- Fresh-produce most likely source, lettuce and carrots
- Complex supply chains
- Highlighted need for better diagnostics

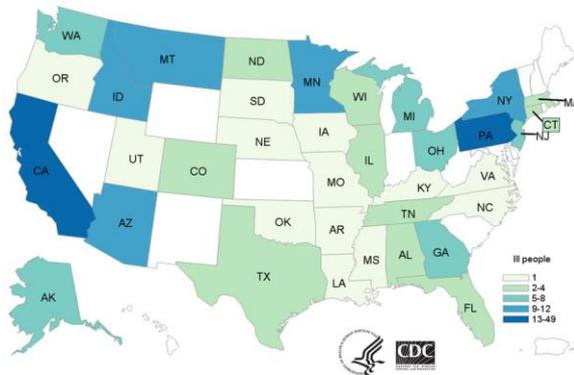
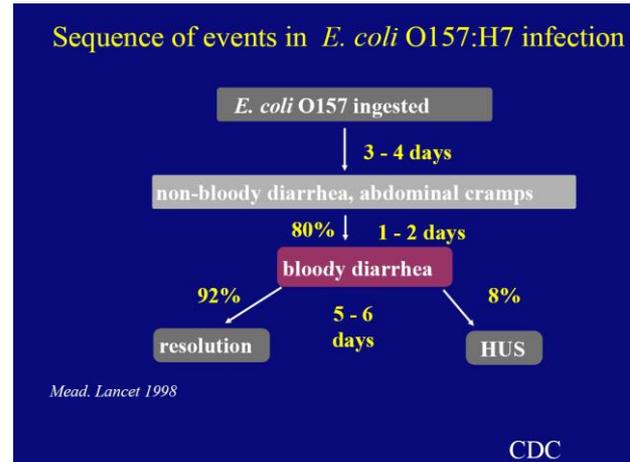


- In children <5 y.o. Diarrhoea, vomiting, fever and occasionally abdominal pain
- Older children and adults – abdominal pain (can be confused with appendicitis)

# Shiga toxin-producing *E. coli* (STEC) in fresh produce

Five dead, nearly 200 sick in US *E. coli* outbreak from lettuce

Kristine Phillips · 11:40, Jun 03 2018



- 210 cases
- 36 states
- 5 deaths
- 96 hospitalisations

Irrigation canal implicated  
 3.5 miles long  
 Same sequence as as the outbreak strain  
 Direct application of irrigation water  
 Use of irrigation water to dilute chemicals

# Link between plant pathogens and human health: Use of contaminated water for

Simko et al. *BMC Microbiology* (2015) 15:19  
DOI 10.1186/s12866-015-0360-5

BMC  
Microbiology

RESEARCH ARTICLE

Open Access

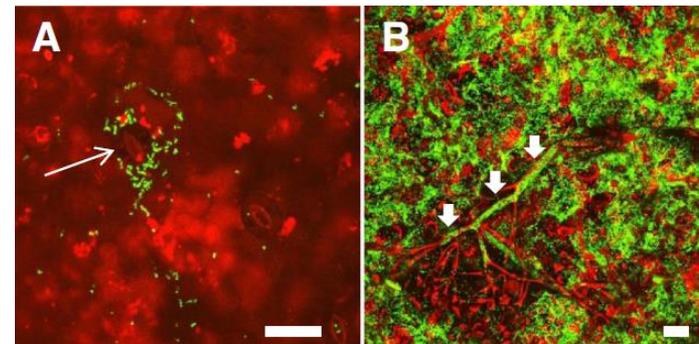
g?

Downy mildew disease promotes the colonization of romaine lettuce by *Escherichia coli* O157:H7 and *Salmonella enterica*

Ivan Simko<sup>1</sup>, Yaguang Zhou<sup>2</sup> and Maria T Brandl<sup>2\*</sup>

Climate change:

- Increase in plant pathogens?
- Increase in demand for chemical sprays?
- Increased contamination of water sources?
  - Spray irrigation and aerial application



Green= bacteria

Healthy

Diseased



# Cost to industry and government: Wallis Lake HA Outbreak (1997)

- Oysters contaminated with effluent
- 500 illnesses, 70 hospitalized, 1 death
- National health cost \$12.1 million
- Oyster sales fell 20%
- 60 less workers employed in the oyster industry
- Fishing industry lost up to 30% market value
- Tourism impact: 40,000 less guest nights in the year after the outbreak (\$1.1 million less 'take' in the second half of 1997)

Reference: Handmer and Hillman. The Australian Journal of Emergency Management, Vol. 19 No. 4, November 2004

# Produce types of highest risk

- Risk is a function of two things:
  - Presence (occurrence) of the hazard
  - Likelihood of consuming the contaminated food

# Hazard

vs.

# Risk

A Hazard is something that has the potential to harm you

Risk is the likelihood of a hazard causing harm

## SHARK



A shark in the sea is a hazard



Swimming with a shark is a risk

## LIGHTNING



Lightning is a hazard



Standing under a tree during a thunderstorm is a risk

Fruit type	Tonnes produced	Linked to viral illness outbreak (O) or contamination event (E)	Source
Soft fruit	13457		
Apples	53239		
Blueberries	9615	Yes (O, E)	RASFF, literature
Strawberries	7166	Yes (O, E)	RASFF, literature
Raspberries	311	Yes (O, E)	RASFF, literature
Rhubarb	297		
Blackcurrants	224	Yes (O)	Literature
Blackberries	30	Yes (O, E)	RASFF, literature
	<b>Tonnes imported (minus exports)</b>		
Bananas	79426		
Citrus fruits <sup>b</sup>	59117	Yes (O)	Literature
Apples	56159		
Pears, quinces	45294		
Grapes	17606	Yes (O)	Literature
Melons	14985	Yes (O)	Literature
Soft fruit <sup>c</sup>	9632		
Avocados and Mangos	6492	Yes (O)	Literature
Frozen berries <sup>d</sup>	4349	Yes (O, E)	RASFF, literature
Fresh berries <sup>e</sup>	3087	Yes (O, E)	RASFF, literature
Pineapples	2162	Yes (O)	Literature
Coconuts	1098		
Dates	323	Yes (E)	RASFF, literature
Figs	225		

# What are the fruits and vegetables of highest concern?

## Foods associated with:

- Strong evidence outbreaks
- Detection of microorganisms in surveys in NZ
- Foods that have been recalled due to contamination

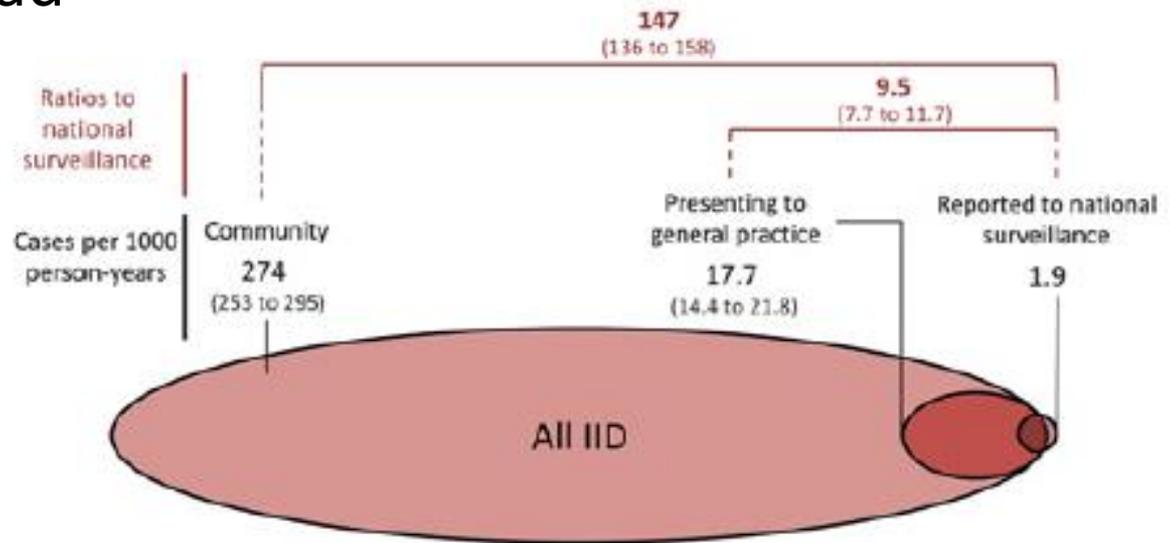


July 2015

PREPARED FOR: The Ministry for Primary Industries  
CLIENT REPORT No: FW15021  
PREPARED BY: Nicola King, Dr Joanne Hewitt and Peter Cressey  
REVIEWED BY: Dr Rob Lake

# Higher risk produce (2015)

- Leafy green vegetables (lettuce, spinach)
- Sprouts
- Fresh-cut fruit salad
- Coleslaw
- Watermelon
- Blueberries
- Carrots
- Apples
- Pears
- Parsley



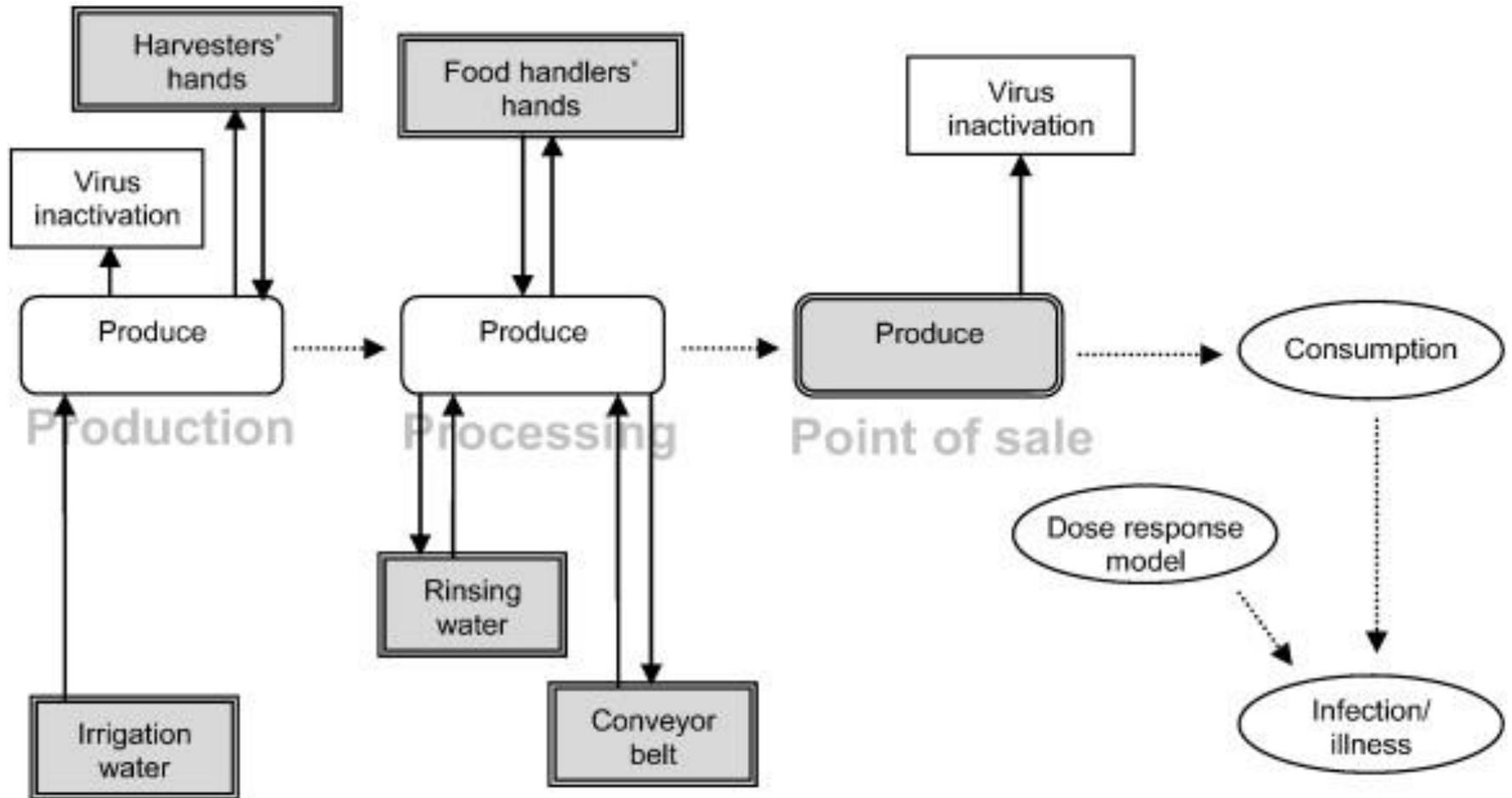
*Do we need an up to date risk ranking on food safety priorities for the fruit and vegetable sector? What should you be most concerned with?*



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# How do foods become contaminated?

# Produce contamination pathways



# Contamination pathways

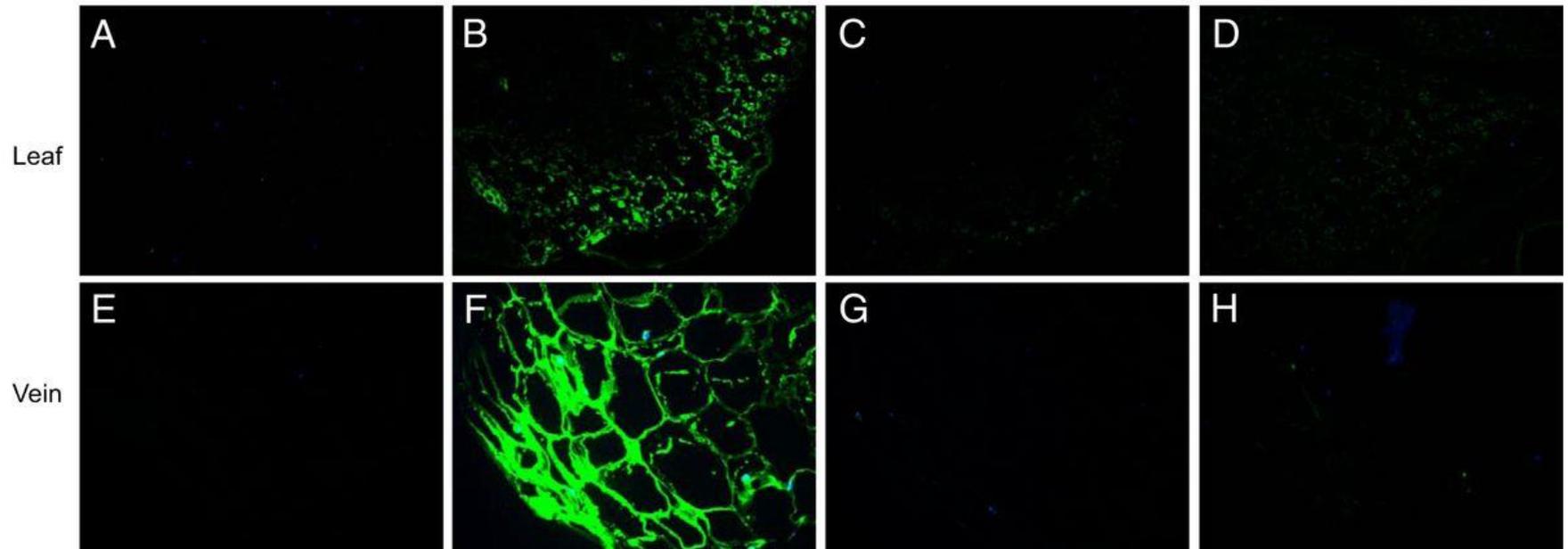
- People
- Water – irrigation, spraying, top-icing, washing, post-harvest treatments
- Soil and dust
- Organic products (manure fertilisers)
- Wild and domestic animals (including birds)
- Storage facilities, transport and vehicles





## Internalisation: Norovirus binds to HBGA in lettuce

Cellulase R-10	-	+	+	+
HuNoV VLPs	+	+	-	+
NaIO <sub>4</sub>	-	-	-	+





# Prevalence – what proportion of vegetables and fruits are contaminated?

Korea, Belgium, France, Canada, Greece, Turkey, Malaysia, Mexico, Australia

## Vegetables

- Detections in leafy greens (various lettuce species and spinach), red and green onions, cherry tomatoes and tomato slices, cucumber slices, parsley, cilantro, watercress, radish, leeks and purslane
- NoV detection rates vary: **0 to 62.5%** of samples positive

## Fruits

- Detections in raspberries, strawberries, blackberries and fruit salads
- NoV detection rates vary: **0-50%** of samples positive

# Prevalence in New Zealand: MPI Data

Year	Samples	<i>Campylobacter</i> spp.	<i>E. Coli</i> O157 or STEC	<i>L. monocytogenes</i>	<i>Salmonella</i> spp.	Norovirus	Coagulase-producing <i>Staphylococcus</i> spp.
1999	291 hydroponic veges	ND	ND	ND	ND	-	-
2003	474 lettuces	-	1 (not STEC)	-	-	-	-
2003	469 apples	-	-	-	1 (batch)	-	-
2008/9	891 fresh produce	ND	ND	-	2 (lettuces)	-	-
2012	307 packaged leafy veges	ND	ND	ND	ND	3 (PCR)	-
2013/14	75 fresh-cut fruit salads	-	-	4	-	-	ND
2014	50 sprout and shoot lots	-	ND	1	1	-	-



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# What are the control options?

# Reducing Risk for the Produce Sector

- Key sources:
  - Workers hands
  - Contaminated irrigation and washing water
- Control Steps:
  - Careful selection of water sources for irrigation and pesticide application;
  - Avoiding the use or ingress of sewage contaminated water;
  - Evaluation of production areas to identify sources of faecal pollution and consideration of interventions if necessary; and
  - Hygiene training for persons involved in produce handling
  - Providing appropriate toilet and handwashing facilities
  - Compliance with Good Agricultural Practices (GAP), Good Hygiene Practices (GHP) and Good Manufacturing Practices (GMP);

# Guidance for Food Business Operators

## Essential

- Guidelines for Fresh Produce Food Safety
  - Fresh Produce Safety Centre 2019
- Codex Virus Guideline (2012)
- EFSA Opinions (2014)

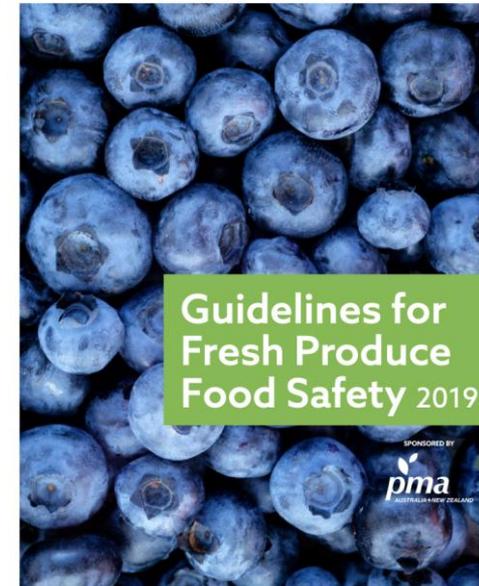
### Hygiene Inspections in Ireland (2014)

- 131 inspections of primary producers of fruit and vegetables conducted
- 93% minor non-compliance, 7% serious non-compliance, 3% (4FBOs) closed as offences were deemed critical to public health
- 20% of water samples (irrigation and washing) were non-compliant with *E. coli* standards

*Training programmes covering GAP, the role of foods in pathogen transmission, transmission pathways etc, should be targeted at food businesses*

FRESH PRODUCE  
SAFETY CENTRE  
AUSTRALIA & NEW ZEALAND

UNIVERSITY OF  
SYDNEY  
pma  
AUSTRALIA & NEW ZEALAND





# Other control options for produce

- Pathogen testing to verify compliance with GAP and GHP (continual improvement)
  - EFSA recommendation for surveys of NoV at specific steps in the food chain for leafy greens, tomatoes and berries
- Vaccination of food handlers (e.g. HAV)
- Increase sanitiser concentration and wash times??
- Consumer advisories??

*Preferable that product is 'bullet proof' at retail*



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# Future Directions

- Preventing a foodborne outbreak is far cheaper than recovering from one
- Be vigilant, exercise due diligence
- Understand and follow best practice (education/training)
- Improve infrastructure
- Many countries establishing prevalence on a national scale
- Identify pathogen occurrence and problem areas in supply chain – incentivise finding pathogens
- Implement improvements

# Think globally, act locally



**40**



**MILLION PEOPLE CONSUME  
NEW ZEALAND FOOD**

New Zealand has a vast capacity for food production and already feeds 40 million people around the world.

Source: Agribusiness Agenda, KPMG, 2017



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