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New Zealand
FOOD SAFETY SCIENCE
& RESEARCH CENTRE

Applying genomics for the management of food safety risks associated with *Listeria* spp.

WS1: 'Stakeholder Perceptions'

This report details the interest of different sectors in the food industry in the proposed *Listeria* spp. based research project and highlights perceived potential pitfalls or drawbacks that food companies and regulatory authorities see in the project and how these may be mitigated.

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Stakeholder Perceptions

Objectives

This 'Stakeholder Perceptions' work stream is designed to support the wider research programme by providing early consultation with key project stakeholders to ensure engagement with the research and to confirm that the proposed research direction is relevant and of use. This report summarises the information collected in the interviews.

Method

Semi-structured interviews with Industry and Regulatory bodies were conducted by two experienced 'food' and 'consumer' scientist members of the New Zealand Food Safety Science Research Centre (NZFSSRC) Strategic Leadership Team. Interviews were mostly conducted in person in Auckland, Nelson and Wellington. When face-to-face contact was not possible, the software Zoom was used to conduct the interviews online. The University of Otago's Human ethics approval processes assured that all information collected, including commercially sensitive data, remains confidential. Interviewees were given the option of agreeing to being named in the research or remaining anonymous. They were also asked if they agreed to be audio recorded or if they would rather no audio recording was made. Each interview was transcribed *per verbatim* by the Researchers and then the resulting transcript was sent to the Interviewee to approve.

Overview of Interviewees

The industry interviews included a range of New Zealand food and beverage companies, both export-orientated (e.g. from the dairy, seafood, meat, vegetable sectors) and with a domestic focus (e.g. processing companies for cut vegetables, small goods, deli). A total of 19 people were interviewed. This included people at: 2 different regulatory bodies (n=7); 10 different companies (seafood n=3, meat n=2, poultry n=1, dairy n=2, horticulture/fresh cut n=1, cross-sector n=2); and 1 industry association body (n=1).

Interview Questions for Industry Stakeholders

- What are the current challenges that *Listeria* spp. poses to their company?
- What *Listeria* spp. controls do they have in place beyond the regulatory mandated testing?
- Do they have any historical data that they can provide on Listeria spp.?
- What sort of barriers do they see to being involved in this research project?
- What, if any, assurances/strategies would they require to be in place to be involved with this research?
- What would they like to know/how could this research best help them?
- Are there any perceived or real barriers to commercialisation and uptake of novel technologies for *Listeria* spp. control?

Background of research project given to Interviewees

In the most recent estimate of foodborne burden of disease in New Zealand, for 2013, listeriosis was third in the ranking of zoonotic foodborne diseases, after campylobacteriosis and norovirus infection (Cressey et al., 2014). Although the number of listeriosis cases is small (approximately 20-40 notified cases per year) outcomes are severe, including mortality in the very young (including foetuses) and the elderly. The effect on food businesses can also be severe. For example, the linking of ready-to-eat meats with four cases including two deaths in 2012 resulted in the meat company being prosecuted and fined approximately $200,000.

This research will help the New Zealand food industry to maintain current markets by assuring food safety. Contamination of product from food processing environments by the food-borne pathogen *L. monocytogenes* is a serious issue for dairy, meat, horticultural and seafood products.

As products become more highly processed (giving longer shelf lives and achieving higher value returns), the food safety and compliance risks from *L. monocytogenes* increase. *L. monocytogenes* also incurs major compliance costs. The results from previous work developing elimination procedures using heat, cleaners and sanitisers, and establishing likely sources of contamination are currently being used by industry and incidence has greatly reduced. However, certain strains continue to persist in food businesses and the challenge is to understand how these strains colonise, grow and persist within processing plants and food businesses. This proposal will augment existing work in the dairy, seafood and horticulture (fresh produce / pre-packaged salads) industries, bringing to bear the expertise of researchers with much greater depth of understanding of *Listeria* spp. persistence and the genomics of food-borne pathogens. This work is expected to lead to new targets for *Listeria* spp. control, to prevent persistence in food businesses and to ensure that the value of New Zealand's food exports continues to grow unabated.

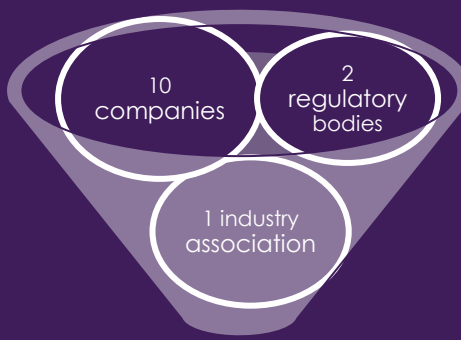
Programme Goal

To develop the application of whole genome sequencing (WGS) to understand the origin, entry points and dissemination of *Listeria* spp. in food production environments, and develop multi-hurdle risk reduction.

Interview Questions for Regulatory Stakeholders

- What concerns, from a regulatory perspective, do they have about us carrying out this research (e.g. the consequences of us finding a positive result)?
- What approach/evidence would they require to validate the effectiveness of a novel technology/new approach for Listeria control?

Overview of Interviewees



Benefits
Barriers
Assurances

Results

Companies interviewed fell into one of two categotories:

1) Companies producing products where *L. monocytogenes* is recognised as being of potential concern. These companies were characterised by:

   a. Being concerned about the cost and effort involved in monitoring for and controlling *Listeria* and the impact of food safety, economic and reputational risk that uncontolled *Listeria* poses for their company.

   b. Producing Ready to Eat (RTE) or Ready To Heat (RTH) products.

   c. Having control steps designed to control the occurrence of *Listeria* spp.

   d. Having sampling programs in place to test for the presence of *Listeria* spp. and *L. monocytogenes* within defined production batches.

   e. Only releasing product after representative samples were confirmed as being free of Listeria.

   f. Finding *Listeria* spp. and *L. monocytogenes* ocassionally on non-product contact surfaces and rarely on product or product contact surfaces.

   g. Most companies treated a *Listeria* spp. result in a similar way to finding *L. monocytogenes*.

   h. A few companies treated a *Listeria* spp. positive result as a warning and while they may resample the lot at greater frequency they would not reject product unless *L. monocytogenes* was detected.

   i. Being enthusatic about the proposed research and the potential benefits that a greater understanding of *Listeria* spp. would bring in terms of controlling *L. monocytogenes.*

   j. Operating under a Ministry for Primary Industry (MPI) Risk Management Programme, Food Control Plan, or other risk based measure such as a MPI National Programme.

   k. Being realistic about the possbility of finding *Listeria* spp. during the proposed research and relatively confident that their Risk Management Programmes would guide them on what steps to take, assuming that affected product had not been released.

   l. Two companies had historical *Listeria* spp. isolates they would be happy for the research group to gain access to.

m. Most companies were, up to a point, willing to share their historical *Listeria* spp. detection data.

2) Companies producing products for which testing for *Listeria* spp. was not currently required. These companies were characterised by:

a. *Listeria* spp. not being of specific concern to them.

b. Producing raw or unprocessed products.

c. Concern that the proposed research may influence regulatory practice.

d. No clear understanding of how the proposed research could be of the benefit to them.

e. Taking a supportive but cautious approach regarding involvement in the proposed research.

Perceived benefits: What companies would like to know and how this research could best help them

Interviewees were mostly supportive of the proposed research and saw multiple benefits of the project for their own company and/or for New Zealand INC.

The following quotes illustrate the overall enthusaim expressed:

> *"It sounds quite exciting what you guys are looking at. Any other tools that we can use will benefit the whole industry. I think the benefits of the project outweigh any risks. We want to protect the whole industry. If one of us has an issue, it affects everyone else. So we are generally quite helpful in sharing tools and resources that are out there*" (Seafood) [1].

> *"Sold on the benefits of the research on a personal level. We see the value we just need to be able to sell it" (Poultry).*

> *"Fantastic Research. Great to have it being done. Great to understand where Listeria comes from, how it tracks through. It will enable companies to understand their danger points better than they do now. It will give them the opportunities to validate new interventions*" (Regulator).

[1] Note that all quotes have been kept in the Interviewee's own speech and have not been modified for grammatical correctness. Square brackets indicate Researchers' insertions.

"I have a real strong interest in this area in terms of what practical implications this project can have. I'm really interested in the better detection of foodborne illness from a human health perspective but also from a regulatory perspective. The stuff you propose to do in WS4 could really lead to some breakthroughs in terms of cost control for industry. I absolutely 'get' the benefits" (Regulator).

The key benefits were identified as being:

Definitive source attribution

Better targeted control regimes

Understanding contribution of different industries to illness

Preservation of the provenance image

Phenotypic information

Respond to customer trends for *L. monocytogenes* control in raw products

Making safer food

Facilitate knowledge and best practice sharing across industries

Future legislation

Cost effectiveness

Understanding the diversity, commonalities and persistence of strains in the environment

Understanding acceptance and uptake of novel technologies for *Listeria* spp. control

Definitive source attribution

- *Interest in this research*

  "[We] *have been looking at source attribution for years using PFGE – as a company* [we] *have been keen on doing this for years. Anyone who has been involved in Listeria or had problems will understand the importance of the proposed research"* (Poultry).
- Understanding raw materials better

  "I can see benefits. Understanding Listeria better, particularly in our raw material supply, and if we can do anything further to minimise those risks" (Horticulture/fresh cut).

- Determine definitive cause and effects

> *"My interest in the whole project is the use of WGS. I can see that that has a lot of value, to really know what strains you've got and is it the same one turning up each time and can you track that to a specific source, where it's coming from and eliminate that long-term so it removes it as a hazard from your environment. I do not know how easy that would be to do"* (Dairy).
>
> *"In my experience in trying to do this it is very difficult to determine a definitive cause and effect, only once in 20 years as I have been able to do this. So this would help"* (Seafood).

- Understanding vectors

> *"I'm really interested to know if there are multiple strains that are coming for the same source, is it brother and sister Listeria or have I got a couple of different potential sources and it's out of control? We don't get that sort of info at the moment"* (Cross sector).

- Understanding how effective current sampling regimes are

> *"Better to know than not to know, especially if something goes pear shaped"* (Seafood).

Better targeted control regimes

> *"Hope to see, it gives it a better understanding of Listeria, where it is coming from and how we manage it. Particularly if we identify unique resistances, to dehydration, biofilms, sanitisers etc. they all impact on the effectiveness of your management or control systems"* (Meat).
>
> [Re novel technologies for control] *"If you identify genome and specific characteristics, it may tell you how to deal with it, how you can target and deal with them"* (Meat).

Understanding contribution of different industries to illness

> *"In terms of a sector contribution to listeriosis it could again be a +ve or a -ve. If it shows that our sector is not a contributor, the Listeria we have simply form biofilms and are not very virulent and that actually we have good control. Then once again, that could be a +ve or -ve. Is the train going to hit us or the train is coming to hit someone else?"* (Poultry).

Preservation of the provenance image:

> *"In terms of the risk profile in New Zealand, if we cannot get it right how can we expect anyone else to get it right? As an exporting nation, if* [we] *cannot actually be the best in the world, then we are screwed for the next 20 years, as food safety is what our reputation is based on we need to put our best foot forward"* (Poultry).

> *"Perseveration of the provenance image – clean green NZ. We want to position ourselves at the value end of the value vs volume spectrum. If we are genuine about positioning our primary products at this value end of the market, then the safety that is taken for granted needs to be reinforced with the contemporary science. In a nutshell, through these technologies, we are getting better at detecting – 'detection of food safety issues is catching up with prevention'-quoting Frank Yannis"* (Regulator).

Phenotypic information

> *"We have three plants. Each plant may or may not have its own challenges If we have a problem at plant X I have a problem I am trying to solve – do I have a problem because of my heat treatment or is it my sanitation? Or is it because of some other vector I do not understand, that I keep getting this problem? At a very high level this program will help to deliver this answer. On another level I may not only one pathway, I may have three pathways of contamination when I think I only have one. I may have a heat tolerant organism, I may also have a biofilm in a different part of the plant which has a very similar genome sequence, but a different fingerprint – in a different part of the factory, did it arrive 10 years ago and it has actually morphed and got some slightly different phenotypic characteristics and now it has a resistance to QAC. What I need to do is target how I control that?"* (Poultry).

Respond to customer trends for L. M control in raw products

> *"Very difficult to do due to the inherent nature of making the product. Maybe not a big thing but it worried me a little bit and I believe it is only a matter of time before customers, start demanding no LM in everything"* (Seafood).

Making safer food

> *"Their* [our customers] *key drivers are cost and compliance. They are very risk adverse. So anything around food safety is key for them so I would say promoting novel technologies for control would be more important to them than for the end consumer"* (Cross sector).

Facilitate knowledge and best practice sharing across industries

> *"I do feel like the industry could be more collaborative in how we talk about eliminating it but because we have this overarching policeman that scares you so much that you don't want to speak up too much because if something happens and it's a bit of a plane crash and everyone gets all the information.... The last thing the person said to me at MPI was "I hope I don't have to ever hear from you again". But shouldn't everybody be talking about it!"* (Cross sector).

Future legislation

> *"Understanding the market space for this and future regulatory intentions is going to be important. So we can budget capital. So if there's going to be a change, we're ahead of the game"* (Seafood).

Cost effectiveness

> *"The other one is – why can we not just go and do it ourselves? Why don't we go and do this ourselves, go get our own WGS – What is the argument against this? Cost is the only real factor. However – it is part of industry good and knowledge as a technical person, we contribute to that and should learn off each other. It could reduce the cost the fact that everyone is doing it"* (Poultry).

Understanding the diversity, commonalities and persistence of strains in the environment

> [The program will be cross sector – obtain a wide range of strains from other companies around NZ]: *"For example, how prevalent is the strain? Is this common in the food industry? It is everywhere – don't worry about it …. Access to industry wide data base is very, very useful to me"* (Poultry).

Understanding acceptance and uptake of novel technologies for Listeria control

> *"It is fantastic that you are going to talk to consumers about this. A real key interest for me is P1024 - the review of nutritive substances in novel foods. We are keenly interested in how and what we need to be learning about for the future. A whole lot of this stuff requires pre-market assessment. We are re-developing the framework for that at the moment. At the moment, we have a vague set of statements which requires companies to have a guess about whether or not the product requires pre-market assessment and if it does, an application results. So we are very interested in not only understanding what sorts of products and new technologies we need to start thinking about but also what the consumer reaction is to them as that obviously drives the political reaction to them which drives the industry reaction to them etc."* (Regulator).

Perceived barriers: What sort of barriers companies see to being involved in this research project

A few companies expressed no concern about the project. For example:

> *"In our case if there was work being done* [for the project]*, we would hold particular batches. I don't have any concerns really. If it's found in areas, we would want to get rid of it anyway. There is more advantage in what that info could give us. If we could lead it back to particular sources or understand what we might be able to use to combat that – a particular chemical or whatever"* (Seafood).

Most interviewees, however, expressed a number of potential barriers to the proposed research including:

The requirement to act on a positive result

Concern around how MPI will respond if Listeria is found

More sensitive testing changing a "cleared" result

Concern around the accessibility of the WGS data

Official Information Act requests

Practical application of research is not clear

Commercial risk (e.g. reputational damage of being implicated in previous illness)

Concern about the reputational damage of product recall

Concern about negative media attention

Technical staff's ability to convince Board Members of the value of the research

Liability

Requirement to act on a positive result

> *"MPI – cannot exempt… if a pathogen is detected* [in a food for which Listeria testing is compulsory or on a food contact surface] *then MPI is required to act as if was identified under a regulatory program – NZFSSRC and the company expected to do the same"* (Regulator).

> *"If it* [Listeria] *is found, then* [the company] *needs to follow what is written in its Food Control Plan or Risk Management Programme. About detecting in zone 1,2,3 or 4 – the company needs to react. Whatever they have written down is what they need to do. The presence of Listeria is not as bad as failing to react to a detection"* (Regulator).

Concern around how MPI will respond if Listeria is found

> *"It depends on how the regulatory side will see this project. My experience with them during the recall process was that it was a one size fits all approach to Listeria risk and how they actually investigate Listeria. The road they put us down was completely incorrect and I was only new to the business. What they forced us to do was completely wrong and I would now have robust debate about it if there were ever a next time. They do not understand the risk of and how you can get Listeria into our business is a lot different to other ones. They tend to treat everyone as if they have a kill step. They were*

making us spend money on testing every raw material out in the field… it is going to be random if you do find it so will prove nothing. It was quite patronising in many ways. We would have done thousands of swabs in our factory and we did not find it. MPI did not believe us, so they also came down and did their own swabs and did not find it either. Meanwhile, it was costing us a fortune on stuff we knew was not the problem. We wanted to focus on what we had narrowed the cause down to of the recall but they would not let us as they had to follow their own investigation strategy. It was very frustrating and slowed things down. We got to the cause of the recalls ourselves but we had to wear all the costs on things we knew were not going to give us anything" (Horticulture/fresh cut).

"Making sure that rules do not get changed by regulatory authorities in midstream. We have a procedure in place and they have signed off on it so they have to respect that" (Meat).

"We have problems, Listeria is pretty hard to get rid of, we have it popping up now and again, we have a management programme in place and MPI is pretty happy with it, so as long as we don't have someone else in MPI interested and they want us to change what we are going we are ok with it" (Meat).

More sensitive testing finding more and potentially changing a cleared result

"We are also concerned that the more sophisticated our tools get for detecting Listeria (e.g. using PCR testing), the harder it will be to produce compliant product. It makes me nervous that we will not be permitted to eat anything eventually!" (Horticulture/fresh cut).

"That you can manage any investigation testing results in a timely manner so that they can ensure that there is not any product released before being cleared and we can't change a cleared result. If we do our PCR test, which is a pretty accurate test, if you sample using a more sensitive test and you detect Listeria and then we need to recall the product. We cannot be doing that" (Meat).

Concern around the accessibility of the WGS data

"So I guess the worry for us is that if we develop this WGS info and have that stored somewhere that people can access then it makes it much easier to lay blame at someone's feet. It also becomes a problem if people are already doing this already, people are already sequencing things and tracking them back to outbreak to see where they have come from, so for us to be involved in the project, to understand how this technology is used, and applied, and regulated, is important for us" (Dairy).

Official Information Act request

> *"Is there any way that the results could be discovered under an OIA* [yes] *that leads to a level of nervousness you will understand. Being sued is a big issue"* (Poultry).

> *"So if we find LM on a product we have submitted for WGS. Is it discoverable by a Researcher or an MP, or someone like that asking a question, or would it only be the police or would it be any other body? So that would only be by the police, it would be no other body?? Please confirm this, it would give some comfort"* (Poultry).

Practical application of research is not clear

> *"At the moment the project seems to be more from an academic curiosity rather than from a practical application. My questions on the project from a food safety perspective and company buy-in perspective are: 'what's the end game that will benefit my factory tomorrow?' 'What is it about this project that will make our project safer or make us money?' and 'What problem will it solve?'"* (Cross sector).

Commercial risk (e.g. reputational damage of being implicated in previous illness)

> *"If WGS data is compared to clinical data that could then be linked back to us… that's not good"* (Dairy).

> *"There is a food safety risk – they don't want to producing food that is unsafe for people to eat. But there is also the commercial risk"* (Poultry).

Concern about the reputational damage of product recall

> *"As long as we do not release product I do not see any problems. We can deal with it internally. It is only when it is out in the market that you have problems"* (Seafood).

> *"MPI might have something to say they may not like the market to know that we have that a degree of contamination in our products. That will reflect poorly on them – you will need to have those discussions with them"* (Seafood).

Concern about negative media attention

> *"If results of testing get into the public domain and people don't understand the science and there's all this emotion around it. You just need one journalist going wahwahwah…"* (Seafood).

Technical staff's ability to convince Board Members of the value of the research

> *"While I get the benefits, I also understand the fears, especially from the non-technical folk. I am not here how to tell you to run your work stream but I almost think you need to get the attention of Board Members of these agencies. Board members are now acutely aware, following on from the Hawkes Bay Campylobacter outbreak and from WPC80 Incident, that there have been changes to Director's liabilities MPI has commissioned has work explaining the implications of such incidents for directors of food companies. There is a growing consciousness amongst company directors, so for example, the MIA, Beef and Lamb, they are all answerable to Boards and are accountable on these sorts of issues. I would imagine if they are not aware of people within their organisations choosing to not proceed with these types of investments, then they ought to be"* (Regulator).

Liability

> *"For senior executive in the company, it is the issue of being associated with some sort of outbreak or death. Talking about Listeria here, death is very possible of course. It is the risk of being associated with that. They know it is possible. It is the risk of it becoming known… The words I would use is 'personal or criminal liability against the company', there is the reputational risk and personal risk against the Directors and they need to be very wary of that… If* [we] *were doing everything due diligence wise to have a good program, but worst happened and it was linked to a human case, where would this leave a prosecution case?????"* (Poultry).

Assurances/strategies required to be in place to be involved with this research

Concern around how MPI will respond if *Listeria* is found

That a positive released product cannot be recalled

Confidentiality of information

That the implication of making the WGS data publically available online will be considered

That the project won't unduly impact on factory operation

Ongoing communication from NZFSSRC to effectively outline the risks 16

MPI's approval of an action plan if positive samples are found

That all parties understand the implication of finding a positive result

MPI's approval of an action plan if positive samples are found

"What we need is truly defined and agreed upon protocols. Having defined criteria about what the trigger points MPI would require to put a hold on production is important" (Dairy).

"And this is exactly what some folk will say "what's MPI's view on this?" so until that's clear, it's the chicken and egg thing" (Seafood).

"It's important that MPI manage the results with a degree of caution. We don't want to be penalised for what we find. If they are mature and see what is to be gained by this project then everybody will be more willing to participate. Industry and regulatory agencies need to work together without punishing the companies involved" (Dairy).

"Case by case. MPI cannot provide the solution as they do not know it. Onus is on the company to do the right thing. MPI cannot give a generic approval to a process for a company. Maybe right in some cases but not all circumstances. We need to understand a company's Food Control Plan or Risk Management Programme" (Regulator).

That all parties understand the implication of finding a positive result

"There are real ethical considerations around surveying food that is in the market place and you have to have red light protocols to follow when you find something. You do not put something into a lab until you know what you are going to do with that result" (Regulator).

"You cannot ethically take a sample, get a result and publish a result two years on that says the public were at risk. It is something that I have had intense discussions about with scientists over the years. There are people that have different views… I think it unconscionable in a nutshell. You have to be prepared to take action if you find something" (Regulator).

That a positive released product cannot be recalled

"All testing of product for Listeria will need to be done prior to release from our warehouse. We need to manage the timing within that so that we can do it prior to release. We are not going to test our product and release it and then you come and do some extra testing and all of this product is subject to a public recall that is not going to happen. Anything prior to release we can work around that. So it depends on timing if your tests are more likely to pick things up" (Meat).

Confidentiality of information

"We would require the standard confidentially clauses between us, you and MPI as required under contract. I would set it up exactly like you are a 3rd party laboratory. So the procedure would be exactly like ours, tell us first, then we notify MPI" (Cross sector).

"What is the information that NZFSSRC will be looking for within the sequences? What will other people be looking for in the future? What information could be found in future? What will we try to mine out? There is a lot of information in a WGS – what other information could they be used for? Hunted for by other people. Let companies know that somebody else may use the WGS in the future" (Regulator).

That the implication of making the WGS data publically available online will be considered

> *"I'd imagine that for things where there are individual specific items, that there would be no problems there. You could also anonymise where the data came from, as there is enough companies in New Zealand presumably in each industry so it does not necessarily point the finger at one or the other. I hope that that would be all right"* (Dairy).

> *"NZFSSRC needs to be clear where the* [WGS] *data will end up. Is publication / recognition the goal? Are all NZFSSRC members on the same page re publication? How will the data be kept secure etc.?"* (Regulator).

That the project won't unduly impact on factory operation

> *"The only thing would be for you guys to fit in with us commercially in terms of when you come in for testing"* (Cross sector).

Ongoing communication from NZFSSRC to effectively outline the risks

> *"I would expect if the same thing happened with the data from the trial, it would help if the NZFSRRC would go to bat and say that it is sensationalist journalism run amok and you would put out an article refuting it"* (Meat).

> *"You would want to talk to the science media group prior to the release of any information. Prior warning of a media release is important –however, you cannot stop a story"* (Poultry).

Perceived or real barriers to commercialisation and uptake of novel technologies (e.g. pulsed electric field, high-pressure processing, LED, ultra violet, sanitisers) for Listeria spp. control?

Regulatory validation

Regulatory approval

Scientific validation

Consumer perception

Commercial viability

Regulatory validation

> *"It's more about the validation and getting MPI to approve them. Validation against the high-risk organisms for the particular market"* (Cross sector).

> *"As long as there is scientific justification behind any change* [implementation of any new technology] *the customer will be ok with this. The issue will be the regulatory acceptance"* (Meat).

Regulatory approval

> *"Unfortunately some of the technology that's available (e.g. Ozone and stuff like that) have issues for us. We're an exporter and you come up with market access issues. Residues etc… it's never easy. There's Listeria phages that available and we could use that but there's countries where that product hasn't been approved yet. There's no one magic bullet. It's a series of tools so the more tools we have in our toolbox for the industry, the better"* (Seafood).

Scientific validation

> *"It's hard to find good solid peer review evidence on this sort of stuff as an amateur" (Seafood).*

Consumer perception

> *"Consumers might be concerned if the technologies change the quality of the product (e.g. colour) in some way… Consumers might be concerned about some of the chemicals used on things… like lettuces that go through chemical washes, it starts getting difficult if they knew that was happening versus not happening – what would they prefer? There's obviously lots of processing aids that aren't declarable"* (Seafood).

Commercial viability

> *"In fact, we already have looked at some technologies but while they might be ok on a lab scale on a commercial scale they don't stack up"* (Dairy).

Discussion

All interviewees were relatively positive about the research. The companies that were familiar with the challenges posed by *Listeria* spp. were more able to annunciate the benefits and were generally enthusiastic to be involved in the proposed research. For the companies where *Listeria* spp. testing is currently not mandated, the benefits were less obvious.

The advantages of the proposed research focused on the fact for many companies *Listeria* spp. was an on-going challenge and expense and the more knowledge companies had about *Listeria* spp. and how to control it the better.

The barriers of the proposed research focused on how the research could impact on their current approved processes and the potential that more or better testing could in the worst case scenario either implicate them in illness or result in product recalls. The regulatory or legal ramifications, and economic and reputational damage this could cause was of great concern.

Key assurances required by companies were that:

- MPI was on-board with the research and that there was a clear understanding, for each company, of the response a positive result would trigger.
- That additional or more sensitive testing would be carried out in such a manner that a positive result would not trigger a product recall.
- That confidentially would be maintained and due consideration be given to the reputational damage of publishing.
- That WGS information be safe guarded and not be made widely available.

Key assurances required by MPI were that:

- That there was a clear understanding, for each company, of the implications of a positive result.
- That any testing should be not undertaken unless there is a clear understanding and a plan or agreed protocol, including product recall in the event of a positive result.
- That confidentially would be maintained and due consideration be given to the reputational damage of New Zealand INC of publishing.
- That WGS information be safe guarded and not be made widely available.

The take-home message is that prior to working with a company, the Research Team will need to understand the company's Food Control Plan or Risk Management Programme and the steps it takes to ensure that the products it releases are *Listeria*-free (positive release, or environmental

testing, validated control regimes). A sampling plan including the implications and responses associated with a finding *Listeria* will need to be agreed upon. MPI must be involved in the development of the response plan should this be required by a processer/producer [Note it may be sufficient for the response plan to follow actions detailed in their Food Control Plan or Risk Management Programme. Researchers need to work with company to ensure this is sufficient].

The NZFSSRC, MPI and companies will need agree on media communication to explain the proposed testing.

NZFSSRC and MPI will actively work together to dispel any inaccurate reports that appear in the media. MPI will objectively review the outcomes of the research once this is completed and will consider how this information can be used to support the future regulatory framework.

Further Information

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For questions about the wider research programme 'Applying genomics for the management of food safety risks associated with Listeria spp.' please contact the Science Leader:

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