

## Update on FSS's foodborne illness reduction strategy

### 1 Purpose of the paper

- 1.1 This paper provides an update to the Board on the current status of foodborne illness in Scotland and describes Food Standards Scotland's current and future priorities for reducing the public health risks associated with the transmission of pathogens through the food chain.
- 1.2 The Board is asked to:
- **Note** the current profile of foodborne illness in Scotland and work undertaken to date to reduce the risks to public health;
  - **Provide views** on the proposed future priorities and direction of our strategy for reducing foodborne illness in Scotland.

### 2 Strategic priorities

- 2.1 The work presented in this paper contributes to FSS's strategic priority on "Public health and consumer protection". Under this priority we have committed to working with partners to reduce pathogen transmission across the food chain through research to improve our understanding of risks, helping businesses to produce food safely, and providing evidence-based advice to those most vulnerable to infection. This aligns with Pillar 1 (Prevention) of Scottish Government's Public Service Reform Strategy (PSR) by supporting interventions for addressing risks that can result in poor health outcomes for people in Scotland.

### 3 Background

- 3.1 In April 2017, FSS published its strategy for reducing foodborne illness in Scotland, focusing on the five pathogens responsible for the greatest disease burden: campylobacter, salmonella, STEC, *Listeria monocytogenes* and norovirus. The strategy aims to reduce the transmission of these pathogens by improving understanding of how they cause foodborne illness, raising awareness of risks, and promoting effective food safety controls. It also highlights the importance of a One Health approach to foodborne illness reduction; recognising the interconnected roles of human, animal, environmental and food systems and the need for collaboration across government and partner organisations.
- 3.2 Since the publication of our strategy, the Board has received two updates on our progress in tackling foodborne illness, including a report on our work to control campylobacter in May 2019 and a wider programme update in June 2023. This paper describes the work we have undertaken over the past 3 years to address foodborne illness risks in Scotland and outlines our future priorities in this area. The

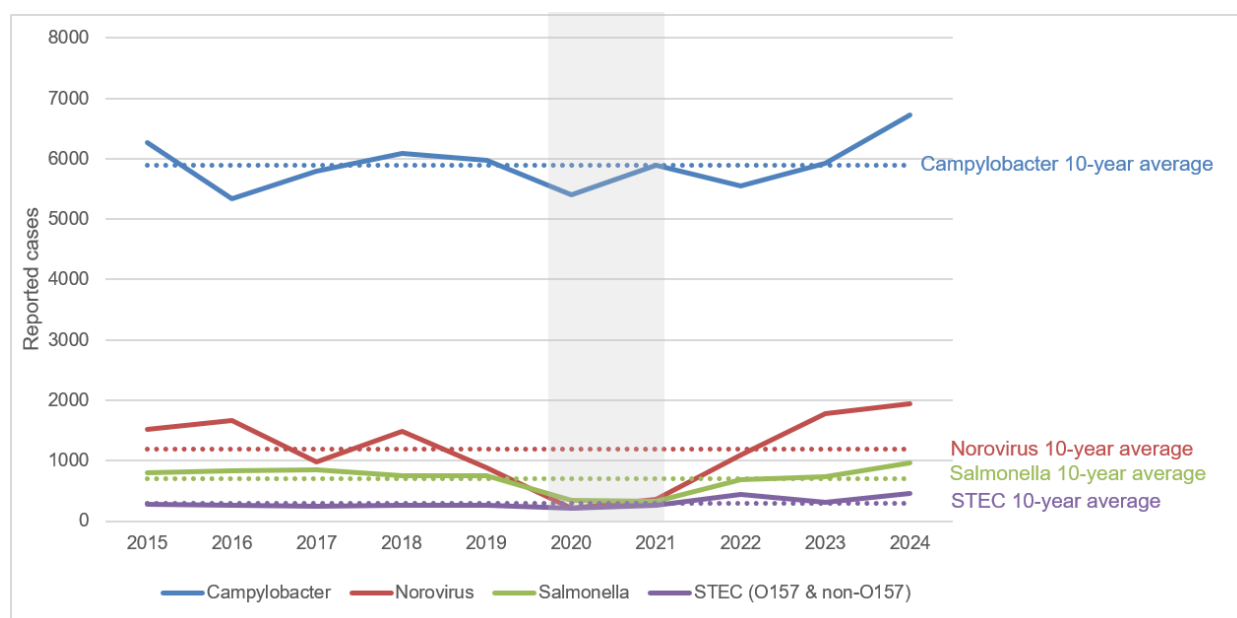
evidence used to inform this work is covered by Areas of Research Interest (ARI) that fall under two of the themes in [FSS's Food and Health Research Programme \(FHRP\)](#): Understanding and Mitigating Risks to the Food Chain; and Foodborne Illness and Food Hypersensitivity.

- 3.3 The highly integrated nature of UK food supply chains means that our efforts to reduce foodborne illness are largely dependent on national initiatives delivered in partnership with the Food Standards Agency (FSA). FSS complements this work by commissioning targeted research and interventions where evidence from public health surveillance, consumer insight, incidents, and outbreaks indicates that specific additional measures will deliver benefits in Scotland.

## 4 Discussion

### *Overview of foodborne illness in Scotland*

- 4.1 It has been estimated that the burden for the UK economy from foodborne illness is around £9.1 billion, which equates to approximately £750 million in Scotland<sup>1</sup>. The number of laboratory reported cases of infectious intestinal disease (IID) from the most common foodborne pathogens in Scotland are reported by Public Health Scotland (PHS) and have remained relatively stable since 2015 (Figure 1), excluding during the COVID-19 pandemic period<sup>2</sup>. Campylobacter accounts for the highest number of reported cases (approximately 6000 annually), followed by norovirus, salmonella, STEC, and *L. monocytogenes*. Figure 1 does not show *L. monocytogenes* due to the relatively low incidence of this pathogen (approximately 20 cases per year).



<sup>1</sup> Based on research undertaken by the FSA on "[The Burden of Foodborne Disease in the UK](#)".

<sup>2</sup> During 2020-2021, reductions in reported numbers of salmonella and norovirus were observed, hypothesised to be due to the impact of reduced travel and limited person-to-person contact.

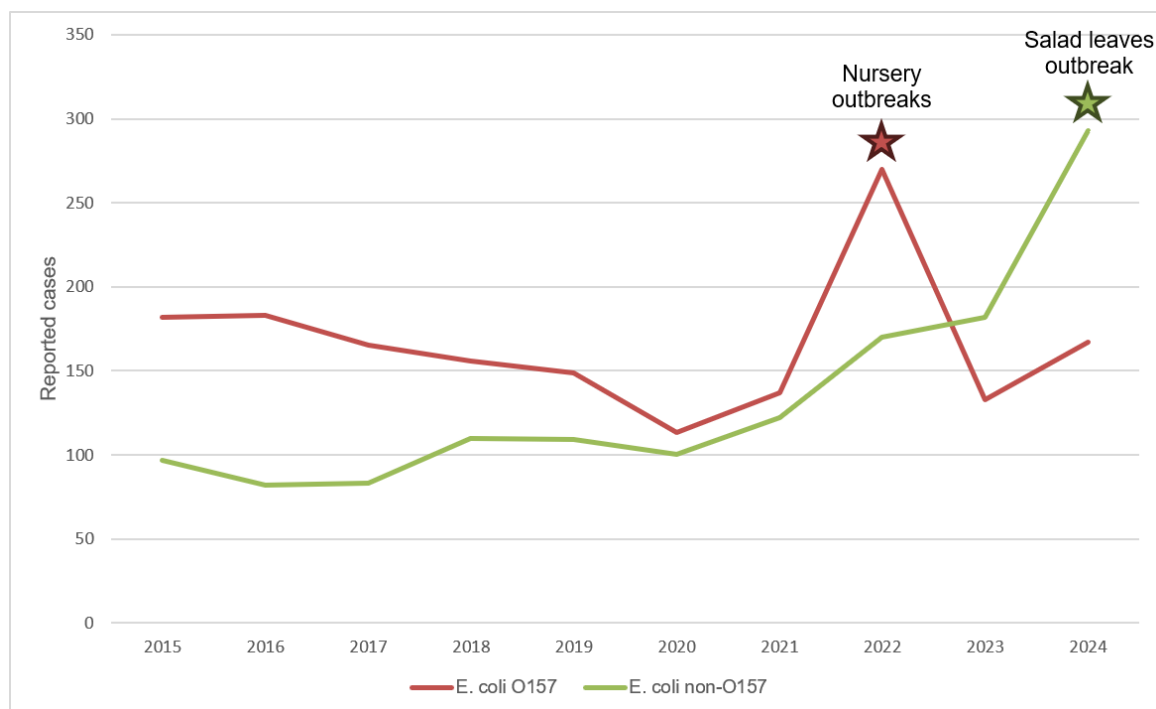
**Figure 1. Overview of laboratory reported cases in Scotland from 2015 - 2024. The 10-year average (excluding the 2020-2021 years, as shown by the shaded area on the graph, due to the impact of COVID-19) for each pathogen is shown by the dotted line.**

- 4.2 It is important to note that whilst the numbers of laboratory reported cases of IID provide our only means of monitoring trends in the infections caused by these pathogens, they provide only a partial picture of foodborne illness risk in Scotland. Not all cases of IID seek medical attention or provide a sample for testing, and even when samples are submitted, testing may be inconclusive or results not reported to national surveillance. In addition, not all reported cases are foodborne, as infections may be acquired through environmental, waterborne, animal, person-to-person, or travel-related exposure. The impact of travel-associated infections was particularly evident during the COVID-19 pandemic, when reductions in salmonella cases were partly attributed to international travel restrictions.

#### *Pathogen-specific priorities and interventions*

- 4.3 To date, our targeted efforts to reduce foodborne illness have focused on campylobacter, *L. monocytogenes* and STEC. While all three remain important public health priorities, the drivers for action differ. Our work on campylobacter and *L. monocytogenes* has largely been delivered through coordinated UK-wide strategies. **Campylobacter** control requires a four-nation approach due to the integrated UK poultry supply chain, and for more than 20 years we have worked with the FSA to support research and drive interventions to reduce contamination and prevalence. Whilst the UK industry has made good progress in reducing campylobacter contamination on fresh chicken, the lack of a corresponding decline in human infections and the changing nature of transmission reinforce the need for continued focus on this pathogen.
- 4.4 Although *L. monocytogenes* causes relatively few infections, it is a UK priority because of the severe outcomes associated with listeriosis, particularly among high-risk groups. A coordinated UK-wide approach has helped to deliver consistent advice for national care settings and the chilled ready-to-eat food sector, where managing this pathogen presents considerable challenges that are relevant to a number of foods produced in Scotland, such as cold-smoked fish, dairy products, and cooked and cured meats.
- 4.5 **STEC** presents a distinct challenge for FSS because of its disproportionate impact in Scotland and the severity of illness it can cause, including haemolytic uraemic syndrome (HUS), a potentially life-threatening complication that particularly affects young children. Scotland continues to report the highest rate of STEC O157 infection in the UK, with ruminant-derived foods and environmentally contaminated fresh produce posing important transmission risks. Our [previous research](#) has shown that although STEC O157 prevalence in cattle is similar across Great Britain, Scottish herds more commonly carry strains associated with severe human illness, which may contribute to Scotland's higher infection rates. While O157 has traditionally been the serotype most closely associated with serious illness, non-O157 infections have increased in recent years and have exceeded O157 cases in Scotland since 2023. Notable peaks in reported cases of STEC in Scotland occurred in 2022 and 2024,

due to two outbreaks of *E. coli* O157 that occurred in nurseries (not foodborne-related), and a national outbreak of *E. coli* O145, which was associated with salad leaves (Figure 2).



**Figure 2. STEC reported cases in Scotland from 2015 - 2024, split by *E. coli* O157 cases and non-O157 cases. Outbreaks responsible for the peaks in cases in 2022 (O157) and 2024 (non-O157) are noted.**

- 4.6 While salmonella and norovirus are not currently priority pathogens for targeted intervention, they remain important causes of foodborne illness and are kept under close review. **Salmonella** risks are largely managed through national control programmes for livestock and poultry, alongside industry assurance schemes such as the Lion Code for eggs. In recent years, foodborne Salmonella infections in Scotland have been associated with overseas travel, handling of raw pet food, and imported foods, including eggs sourced outside the UK which have not met the UK's Salmonella control requirements. For **norovirus**, transmission is predominantly via person-to-person contact; however, food vehicles have been implicated in illness. Control measures focus on monitoring high-risk products, particularly shellfish and fresh produce, and promoting good hygiene practices to prevent the contamination of food. Where surveillance identifies emerging risks or changing trends in these pathogens, appropriate action is taken to protect public health.

#### *Interpreting trends in foodborne illness*

- 4.7 FSS and the FSA monitor trends in reported cases of IID and work with PHS and the UK Health Security Agency (UKHSA) to determine whether there are any increases that may be outside of the expected range. To support this monitoring, FSA has set UK thresholds for the key pathogens to identify the need for investigation and action

to strengthen food safety controls. In 2023, the FSS Board agreed that the possibility of setting a threshold for Scotland should be explored as a means of identifying where specific action may be needed on a Scottish basis. However, following consultation with PHS and the FSA it was concluded that Scotland-specific thresholds would not be appropriate due to the integrated nature of the UK's food supply chain and the difficulties in identifying significant changes in reported rates where incidence is low (e.g. for *L. monocytogenes*). Consequently, FSS continues to support a UK-wide threshold approach, with any breach triggering a collaborative assessment of potential causes and implications for Scotland.

- 4.8 In 2024, UK-wide thresholds for both campylobacter and salmonella were exceeded. In response, the cross-government Epidemiology of Foodborne Infections Group (EFIG)<sup>3</sup> convened an extraordinary meeting to review the available evidence and concluded that the increase was likely to reflect the combined effect of multiple factors rather than a single underlying cause. Their findings were consistent with those of an FSA-commissioned expert elicitation exercise on rising campylobacter incidence, which identified several potential contributors, including changes to NHS diagnostic/sampling methods, an increase in the consumption of imported poultry meat, a rise in pet ownership and the use of raw pet food, changes in consumer food hygiene practices, travel-related exposures (particularly for salmonella), and the impacts of climate change.
- 4.9 Assessment of provisional data for 2025 (currently under validation prior to publication by PHS later this year) indicates trends for the major foodborne pathogens appear to be approximately similar or marginally lower than reports in 2024. FSS is therefore continuing to work with FSA and relevant public health partners to understand UK trends and which of the hypotheses identified through these investigations could be applicable to Scotland.

#### *Understanding the epidemiology of foodborne illness in Scotland*

- 4.10 Our most valuable data for understanding trends in IID relate to the populations affected, their potential exposures, and illness severity, including hospitalisation and mortality. When linked to laboratory data on the characteristics of pathogens isolated from patients, these datasets provide powerful insights into the drivers of disease. All such data are collected through NHS systems and can only be accessed by PHS under strict governance arrangements.
- 4.11 Since 2018, FSS has been funding a series of projects with PHS to enable the anonymisation, linkage and statistical analysis of these datasets; providing important insights into disease trends and risk factors in Scotland. In 2020, we published our first report of this data linkage and analysis work, which identified the [key demographics at increased risk of campylobacter infection](#) and provided the evidence base used to target our consumer messaging in this area (as detailed in

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<sup>3</sup> EFIG includes representatives from FSS, FSA, UKHSA, PHS, Public Health Wales (PHW) and APHA (Animal and Plant Health Agency).

section 4.25). Over the past 3 years, we have been extending this work to cover salmonella and STEC, with plans to publish, in early 2027, similar reports on the epidemiology of these infections in the Scottish population.

- 4.12 Our STEC project is particularly complex and novel, linking, for the first time, patient epidemiology, exposure, clinical, hospitalisation and prescribing data with genomic information on the bacteria isolated from infections. Covering the period 2015 to 2023, the analysis will provide a unique understanding of the factors associated with infection and disease severity in Scotland, helping to strengthen incident management and guide future public health interventions. Given Scotland's higher rate of STEC infection and evidence of a distinct strain profile, this work is critical to improving understanding of transmission routes and the burden of disease in a Scottish context.
- 4.13 In parallel with this work, we have been working with the FSA to update the evidence base at UK level through our input into the third study of infectious intestinal disease in the UK (IID3). This flagship research project involves the recruitment of GP practices and patients across the UK to collect data on the incidence of IID in the community, enabling the recalibration of under-reporting within national surveillance systems. The findings, due to be published in 2026, will support updated estimates of the burden and economic impact of foodborne illness and help target future surveillance and interventions for priority pathogens.
- 4.14 Recognising that the challenges of reducing foodborne illness extend beyond Scotland and the UK, FSS invests in building relationships with international food safety and public health partners. Collaboration with organisations including Health Canada, the Food Safety Authority of Ireland (FSAI), New Zealand's Ministry for Primary Industries, and the US Centers for Disease Control and Prevention (CDC) has facilitated the exchange of evidence and best practice, including reciprocal visits to share knowledge and experience on surveillance, outbreak management and foodborne illness prevention.

#### *Understanding sources and transmission routes*

- 4.15 Effective targeting of foodborne illness interventions relies on our ability to identify the key sources and transmission routes of priority pathogens. Advances in whole genome sequencing (WGS) have greatly improved this capability through a research approach known as source attribution, which uses statistical models to compare pathogen genomes from human cases with those from livestock, food and environmental sources. This enables the most likely sources of infection to be identified and supports more targeted risk management and control measures.
- 4.16 Previous FSS-funded [source attribution studies](#) have verified that the majority of clinical campylobacter cases in Scotland are linked to a chicken source. The past two decades have seen a significant collaborative programme of work between FSA/FSS, the poultry industry and retailers, with a key output being a reduction in the percentage of most heavily campylobacter-contaminated chickens placed on the market by UK Food business operators (FBOs). Understanding why reductions in

campylobacter levels in poultry have not led to a corresponding decline in campylobacteriosis, and the extent to which industry practices, consumption patterns, pathogen evolution and environmental factors influence current infection rates, remain important research questions.

- 4.17 In 2026, FSA published a [review of interventions](#) across the poultry supply chain, from primary production through to retail and consumer handling. FSA is also currently running a microbiological survey of imported and domestically produced frozen chicken on retail sale across the UK to generate new data on contamination levels in these products. We are currently working with FSA to map out the evidence and support them in developing new research that will improve our understanding of campylobacter transmission and interventions across the poultry supply chain.
- 4.18 To complement these UK-wide activities, FSS undertakes its own programme of work to identify potential pathogen risks in the Scottish food chain. In 2025, we commissioned [a review of on-farm interventions in Scotland](#) to better understand transmission risks and the practical factors affecting their implementation. We also engage regularly with our Operational Delivery team on controls at Scotland's only poultry processing plant and work closely with the Scottish Environment Food and Agriculture Research Institutes (SEFARI) to support and influence research activities funded through [SG's Strategic Research Programme \(SRP\)](#), which are aimed at understanding pathogen risks in the agri-food environment and the development of interventions for controlling transmission.
- 4.19 FSS's annual food sampling programme also helps us to determine areas of emerging risk by targeting commodities and testing parameters based on horizon scanning to identify where there is potential for contamination. Surveillance has proven to be particularly effective in our work on *L. monocytogenes*, for which enhanced sampling has enabled us to generate data on food products which have been implicated in previous listeria incidents worldwide. The evidence has been used to support risk assessment and inform consumer advice, for example on [foods to avoid during pregnancy](#).
- 4.20 Social science contributes another important dimension to our evidence base on foodborne illness risks. We utilise the outputs from our contribution to the UK's flagship consumer survey on food [Food and You 2 \(FY2\)](#), along with insights from our own [Food in Scotland consumer tracker](#) and bespoke social research projects, to inform the design of food safety messaging to consumers.

#### *FSS-led interventions for targeting foodborne illness risks in Scotland*

- 4.21 As the key drivers of foodborne illness are common across the UK, FSS invests significant resource in collaborating with the FSA on UK-wide control programmes, particularly for campylobacter in poultry. However, alongside this work, we use evidence from outbreaks, surveillance, epidemiological studies, research and food monitoring to identify Scotland-specific risks and target interventions where they are likely to deliver the greatest benefit to the Scottish population. FSS activity is focused on two key areas: supporting key food sectors in Scotland to manage pathogen risks

and providing targeted advice to help vulnerable consumers reduce their risk of foodborne illness.

- 4.22 A key area of work has been the development of practical guidance on the control of pathogens in sectors that have previously been involved in incidents. This includes the publication of online decision-support tools to help the [smoked fish](#) and [fresh produce](#) sectors assess potential contamination risks throughout their production processes and identify measures that can be taken to control them. These tools have recently been updated using the latest evidence and stakeholder feedback to improve accessibility and usability; with further work underway to produce an additional tool on charcuterie production later this year. To support these resources, we have also published [guidance on how to set a safe shelf-life](#), addressing a technically complex area of food safety management which is often identified as an issue during incident investigations. FSS has also participated in work led by the [Food Safety Research Network \(FSRN\)](#) to [explore opportunities for improving STEC testing regimes](#) that will support the control of this pathogen in fresh produce and help to prevent further outbreaks resulting from the contamination of salad leaves and other ready-to-eat fruit and vegetables.
- 4.23 FSS's social research programme regularly highlights that many consumers in Scotland report behaviours that can increase their risk of foodborne illness, and we use this evidence to support social media and press campaigns on different food safety topics, targeting particular touch points, such as advice for University students who may be cooking for the first time during Freshers Week or how to ensure turkey is cooked properly at Christmas. A recent example is the finding from [Wave 11 of FY2](#) that a third of respondents admitted to eating pink beef burgers, which prompted us to [issue messaging](#) via social media and the press to promote food safety advice for these products.
- 4.24 Our research has also shown that consumers typically don't check fridge temperatures, even though correct refrigeration is essential for controlling bacterial growth and minimising food waste. A [citizen science project](#) conducted by FSS in 2023/24 found that the majority of fridges tested were operating above the recommended maximum temperature of 5°C. This work has been disseminated through publication in the [scientific press](#), a public webinar and shared with the industry and FSRN to inform new research aimed at identifying improvements for the design of domestic refrigerators.
- 4.25 Over the past four years, we have prioritised more targeted consumer advice, informed by our research with PHS which has clearly demonstrated that the burden of foodborne illness is not evenly distributed across the population, highlighting the need for advice tailored to those at greatest risk. Our previous data linkage project identified older adults as a key risk group for campylobacter infection, with an increased likelihood of hospitalisation and severe outcomes. [With over 20% of Scotland's population now aged 65 or over](#), and this proportion continuing to increase, FSS has developed targeted campaign materials to reduce infection risk in this demographic. We established partnerships with retailers across Scotland to promote food safety messages through in-store information stands, leaflets and

recipe cards that incorporated key food safety advice, particularly on the safe handling and preparation of chicken. To extend reach, [a communications toolkit](#) was shared with third sector organisations, local authorities and community groups alongside in-person presentations at assisted living premises across Scotland and the distribution of leaflets to service users with limited digital access. This work was also presented to the Cross-Party Group on Older People, Age and Ageing, enabling further dissemination to a wider range of networks.

- 4.26 During a prolonged *L. monocytogenes* outbreak linked to smoked fish, FSS faced further challenges in targeting food safety advice. In response, in 2023 we commissioned [a series of projects](#) examining clinical case data and the lifestyle factors that may increase food safety risks among older adults. This work has informed [a revised definition of those at higher risk of foodborne illness](#), which was published in June 2026. While continuing to recognise established higher-risk groups, including young children, older adults and pregnant women, our revised definition expands the previous "weakened immune system" category to include specific medical conditions, treatments and medications associated with increased susceptibility to infection. The terminology was consumer-tested before publication and supporting communications materials were shared with health professionals, consumers and partner organisations across Scotland. Our [research](#) also identified physical, economic and social factors that may influence food safety behaviours among older adults, including difficulties reading food labels and prolonged food storage due to living alone or limited transport access. These findings will help shape future consumer advice and communications.
- 4.27 The Communications and Marketing team has been updating FSS education resources to align them with the refreshed FSS website and current accessibility standards. This includes [Crazy Kitchen](#) which challenges children to identify food safety hazards in the kitchen. The redevelopment will provide an improved user experience across a range of devices, with classroom teaching as the primary intended use. A promotional campaign for Scottish teachers will launch in the coming weeks, supported by social media, education influencers, and key stakeholders such as Education Scotland. The campaign will be evaluated to inform future resource development and promotion.

*Working with partners to promote a One Health approach to pathogen surveillance and intervention*

- 4.28 FSS's foodborne illness reduction strategy recognises that a One Health approach is needed to understand factors that influence the transmission routes to consumers, taking into consideration impacts from agricultural practices, climate change, and wider environmental factors. The expansion of WGS for comparing the genetic sequences of pathogens found in humans, animals, food and the environment has been a key driver for collaboration on One Health across government. In Scotland, [PHS's Public Health Microbiology Strategy](#) and [Pathogen Genomics Strategic Plan](#) lay out the commitments for developing One Health WGS capability in Scotland, and FSS is supporting this work by helping to define the services required for foodborne disease surveillance and outbreak investigation.

- 4.29 Along with other One Health government partners, FSS is committed to supporting the [UK national action plan \(NAP\)](#) for 2024-2029 to combat antimicrobial resistance (AMR); a 4-nation agreement to reduce the use of antimicrobials and the risks of AMR to humans and animals. Our work in this area is focussed on including AMR in our surveillance of pathogen risks in food, and the provision of data relating to AMR in *E. coli* isolated from healthy livestock at selected abattoirs across Scotland. We report on this work through SG Chief Nursing Officer Directorate and Antimicrobial Resistance and Healthcare Associated Infection (ARHAI) Scotland; with the findings published annually in the [Scottish One Health Antimicrobial Use and Antimicrobial Resistance \(SONAAR\) report](#).
- 4.30 We have further strengthened our impact in the area of One Health through the synthesis of evidence generated through FSS's contribution to the [UK Pathogen Surveillance in Agriculture, Food and the Environment \(PATH-SAFE\) Programme \(2022–2025\)](#). Our cross-disciplinary project to identify transmission pathways and AMR profiles of *E. coli* isolated from animal, environmental, food and clinical sources in Scotland has generated WGS of ~6000 *E. coli* isolates (including a sub-set of STEC strains); supporting the development of machine-learning models that will help us to predict likely sources and identify preventative risk management interventions.

#### *Future priorities*

- 4.31 Over the next three years, we intend to build on the work described in this paper; advancing our evidence base by synthesising the findings from our data linkage studies, IID3, and wider research activities. This will improve our understanding of foodborne disease epidemiology and generate the data and insights needed to strengthen risk analysis and intervention strategies. Our work with FSA to tackle campylobacter infection will continue to be a key focus; drawing on research and stakeholder engagement to elucidate how chicken and non-poultry related sources contribute to infection and identify effective interventions. Alongside this, we will continue to work across government to support the wider One Health approach by generating data through our food sampling and AMR monitoring programmes. We will also continue to tailor our research efforts and resources to Scotland through the specific areas of work outlined below:
- A review of interventions in place on Scottish poultry farms and at slaughter to reduce the incidence and transmission of campylobacter;
  - The delivery of research to enable the risk ranking of foods associated with *L. monocytogenes*, with the provision of new guidance on “safer alternatives” for high-risk consumers;
  - Publication and dissemination of our data linkage studies on STEC and salmonella, that will inform future approaches to outbreak investigations, industry guidance and consumer advice;

- On-going promotion of our food safety messaging for at-risk population groups, and evaluation of uptake through engagement with key stakeholders and consumer research;
- New research activities on consumer practices regarding the handling and preparation of raw pet food (which has been identified as a high-risk product for foodborne pathogens and AMR);
- Collaboration with SEFARI to ensure projects for the new SRP will support our evidence base on pathogen transmission and control;
- Further development of technical guidance and tools for priority food sectors in Scotland; aligning with FSS's SAFER programme to support improvements in food law delivery and compliance.

## 5 Identification of risks and issues

- 5.1 The Delivery of the proposed future activity will need to be prioritised within the resources available to FSS. The reduction in the research budget will require careful consideration of where FSS investment can add greatest value, alongside maximising opportunities to draw on evidence, research and expertise available through partners including FSA, Public Health Scotland and the Scottish Government Strategic Research Programme. The Executive will therefore keep the programme under review and prioritise activity according to public health risk, the contribution FSS can uniquely make, and the availability of wider evidence and collaborative opportunities.

## 6 Equality Impact Assessment and Fairer Scotland Duty

- 6.1 Equality Impact Assessment (EQIA) and Fairer Scotland Duty requirements do not apply to the summary presented in this paper, although both are fully considered during the development of research requirements, the commissioning of individual projects and the dissemination of public health messaging.

## 7 Consumer Duty

- 7.1 The work presented in this paper fully aligns with the aims of the consumer duty by always considering the impact of interventions and public health messaging on consumers in Scotland. The focus of this work is to achieve better outcomes for public health, by reducing the burden of foodborne illness for Scotland.

## 8 Conclusion/Recommendations

- 8.1 The Board is asked to:
- **Note** the current profile of foodborne illness in Scotland and work undertaken to date to reduce the risks to public health;

- **Provide views** on the proposed future priorities and direction of our strategy for reducing foodborne illness in Scotland.

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