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D6.2 – Knowledge clips, webinars, tutorials and digital assignments targeted at relevant stakeholders

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Executive Summary

As part of the CATALYSE project, new educational materials were developed under WP6 to support knowledge exchange, innovation uptake, and capacity building in food safety. The development of these materials was informed by stakeholder engagement activities conducted in Work Package 2 (WP2), together with the review and evaluation of existing educational resources performed in Task 6.1 of Work Package 6 (WP6). This process enabled the identification of priority thematic areas, existing knowledge gaps, and underrepresented topics requiring additional educational support.

Based on these findings, educational materials were developed addressing a wide range of thematic areas relevant to current and emerging food safety challenges, including detection methods, emerging risks, digitalisation and Artificial Inteligence (AI), control methods, food microbiological analysis and techniques, food safety culture, food safety regulation and compliance, hygiene by design, tools for monitoring and detecting hazards, and packaging innovations.

The educational outputs were produced in multiple formats to support accessibility and knowledge dissemination across different stakeholder groups. These included recorded webinars, videos, PowerPoint presentations, podcasts and online courses. The predefined KPIs of developing at least six webinars and a minimum of ten additional educational materials were successfully exceeded, resulting in the production of seven webinars and twenty-three additional educational outputs.

The development process drew on the scientific and technical expertise of consortium members and their broader professional network. Contemporary digital tools, including AI-based applications, supported the development of audiovisual and digital learning content. All materials underwent internal review and validation procedures to ensure scientific correctness, clarity, reliability, and overall quality before finalization. As a next step, the materials will be evaluated by stakeholders from academia, industry, and regulatory organisations, and a roadmap will be developed to support their integration, dissemination, and long-term use. In addition, all developed materials will be made freely accessible through the CATALYSE Community of Practice (CoP) platform.

The developed resources contribute to the objectives of the CATALYSE project by providing accessible and scientifically robust educational material that supports food safety awareness, training, and stakeholder engagement across the food sector.

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1. Introduction

The development of scientifically and practically relevant educational resources plays an important role in supporting food safety awareness, knowledge transfer, and the dissemination of innovation across the food sector. As food systems continue to evolve in response to new technologies, emerging hazards, sustainability challenges, and changing consumer expectations, there is an increasing need for educational materials that can translate scientific knowledge into accessible and applicable content for different stakeholder groups. In this context, CATALYSE project focuses on the creation of new educational materials addressing current and emerging topics in food safety.

The development process was closely linked to the activities conducted under Work Package 2 (WP2), which focused on engaging stakeholders to identify needs and priorities related to food safety innovation, education, training and knowledge exchange. These interactions provided the basis for defining the thematic focus and educational direction of the materials developed in this task. The development process further built upon the review and evaluation of existing educational resources carried out within Work Package 6 (WP6), particularly Task 6.1 (Collect existing education materials for a link library and create governance system). This assessment highlighted important differences in the availability and coverage of educational content across the identified thematic areas. While some domains were supported by substantial existing material, other areas remained underrepresented, and several relevant subtopics were insufficiently addressed. Consequently, the consortium focused on developing new educational materials targeting identified knowledge gaps and emerging food safety topics considered highly relevant by stakeholders. The aim is to develop at least six new recorded webinars, together with a minimum of ten additional materials such as tutorials, PowerPoint presentations and educational videos according to the KPI.

2. Methodology

2.1 Thematic framework and planning

The methodological framework applied for the development of the educational materials was structured around predefined thematic areas covered by the Community of Practice (CoP; WP4 & 5). The selection of these thematic areas was based on needs and priorities identified through stakeholder engagement activities (WP2) and the evaluation of existing educational materials (WP6-Task 6.1). Accordingly, the developed materials focused on detection methods, emerging risks, digitalization and AI, control methods, food microbiological analysis and techniques, food safety culture, food safety regulation and compliance, hygiene by design, tools for monitoring and detecting hazards, and packaging innovations.

The overall development process was based on the scientific and technical expertise of the consortium members, ensuring that the developed content addressed the identified needs and

existing gaps in available educational resources. The selection of topics, definition of scope, and structuring of content were guided by domain knowledge and the outcomes of the prioritisation process, while contributions from external experts and collaborators were incorporated where relevant, particularly in the development of webinars.

2.2 Content creation approaches

Building on this framework, the webinars were designed and coordinated by WP6 partners, often in collaboration with other European initiatives and organisations, to ensure broad scientific exchange and complementarity of expertise. Each webinar was built around contributions from invited speakers, selected to represent diverse disciplinary and sectoral perspectives, thereby enabling a comprehensive and balanced discussion of each topic. It is worth noting that, prior to recording each webinar, consent was obtained from all invited speakers.

For the development of the additional educational outputs, three complementary approaches were applied. In several cases, relevant scientific literature was reviewed and the main findings were synthesised into concise summaries, which then served as the foundation for the developed educational material. In other cases, a single scientific paper, official guideline, or standard was used as the primary source, from which the most relevant information and key messages were extracted and transformed into concise educational material adapted to the background and needs of the intended audience. Finally, some materials were derived from presentations delivered during organised events, which were recorded and further used as educational video resources, with appropriate consent obtained from the speakers prior to recording.

2.3 Production, review and standarization

The production of audiovisual and digital learning content was supported by the use of contemporary digital tools including AI-based applications (NotebookLM, ClipChamp, OpenAI, ChatGPT, Copilot, etc.), which facilitated content structuring, visual design, and narration development. It is worth noting that AI tools only played a supporting role, while the scientific content and final expert approval remained the responsibility of the experts. Thus, all the materials were subsequently reviewed, validated, and finalised by the responsible developers of the educational material to ensure accuracy, reliability, and consistency with the source of information. The materials were primarily produced in English; however, selected outputs were also produced in an additional language to improve accessibility for relevant target audiences.

To ensure consistency across all materials and to clearly indicate that they were developed within the CATALYSE project, a standardised communication framework was applied throughout the development process. All audiovisual materials were designed to incorporate a brief introductory segment at the beginning referencing the project, together with relevant contact details and consortium information at the end, where applicable. In addition, all materials produced as PowerPoint presentations were developed using the official CATALYSE

PowerPoint template, ensuring visual and structural coherence across all outputs. Finally, the materials underwent an independent internal review by at least one additional consortium member to further verify scientific correctness, clarity, and overall quality, after which the materials were revised accordingly where necessary. This combined workflow enabled the efficient transformation of scientific information into engaging and accessible educational resources.

3. Results

A total of thirty educational outputs were developed under WP6-Task 6.2 as part of the CATALYSE project, comprising seven recorded webinars and twenty-three additional educational materials, including videos, PowerPoint presentations, online courses and podcasts. This exceeds the established KPIs of at least six webinars and ten additional materials. The developed outputs cover a broad range of thematic areas relevant to current and emerging food safety challenges. Several materials address more than one thematic area, reflecting the interconnected nature of food safety challenges and the multidisciplinary approach adopted in their development. Overall, the educational outputs were designed to support knowledge transfer and capacity building by translating scientific and technical information into accessible learning resources for different stakeholder groups.

3.1 Overview of webinars

The webinars developed under WP6 address key thematic areas in food safety, including emerging risks, detection methods, control methods, food microbiological analysis and techniques, packaging innovations, and digitalisation and AI. An overview of the individual webinars is provided in Table 1. All webinars were delivered in an online format and varied in duration from 35 to 92 minutes, depending on topic complexity and the scope of contributions included. The majority were organised in a multi-speaker format, bringing together invited contributors with diverse scientific and sectoral backgrounds. One webinar was delivered by a single speaker, providing a full topic overview.

Table 1: Overview of the webinars developed under WP6

Recording Date	Title	Thematic area	Number of speakers	Duration (min)
15 May 2025	Predicting the Troublemakers: Guidance and a Computer Tool for Microbial Growth	• Emerging risks	3	75
24 June 2025	Update on Mineral Oil Hydrocarbons: Safety, Analytics and Remediation	• Emerging risks	3	90
3 September 2025	From Emerging Risks to Real-Time Solutions in Food Safety	• Emerging risks	4	92

26 March 2026	CATALYSE webinar: scientific innovations for food safety action	• Detection methods • Control methods	4	60
20 April 2026	Biosolutions for improved safety and quality of food	• Control methods • Food microbiological analysis & techniques • Packaging innovations	5	35
21 May 2026	Smart Labels	• Packaging innovations	6	65
30 June 2026	Digitalization and AI in food safety	• Digitalization & AI	1	42

To provide further detail on their scope and content, each webinar is briefly described below, including its main topic, intended audience and a short summary of the content covered.

- **Predicting the Troublemakers: Guidance and a Computer Tool for Microbial Growth**

  The webinar, organised under the framework of the International Association for Food Protection (IAFP) with the support of the CATALYSE consortium, addresses key aspects of predictive microbiology and quantitative microbiological risk assessment (QMRA) through three interconnected presentations: "*How to predict growth of microorganisms?*", "*Development of an international standard of the determination and use of cardinal values for growth*", and "*User-friendly, freely available computer tool to predict microbial growth*". The content is particularly relevant for students, researchers, food safety professionals, risk assessors, regulatory authorities, and industry stakeholders working in predictive microbiology and QMRA. The webinar contributes to bridging the gap between predictive microbiology modelling approaches, parameter standardisation, and their practical implementation in food safety applications. Overall, the webinar addresses the fundamentals of microbial growth modelling, including how microbial behaviour in food systems can be mathematically described and predicted under different environmental conditions. It also covers international efforts to harmonise key modelling parameters, particularly cardinal values, with the aim of improving consistency and comparability across applications. In addition, it presents the translation of these concepts into practical computational tools that allow simulation of microbial growth and behaviour along the food supply chain, supporting more applied and decision-oriented food safety assessments.

- **Update on Mineral Oil Hydrocarbons: Safety, Analytics and Remediation**

  The webinar, held under the CATALYSE consortium framework, aims to advance the understanding and management of mineral oil hydrocarbons in food by addressing the uncertainties that still limit their assessment. The webinar comprises three interconnected presentations: "*ILSI mineral oil workshop follow-up: Toxicological assessment*", "*SI mineral oil workshop follow-up: Analytical update*", and "*Update on Mineral Oil Hydrocarbons: Remediation*". The content is particularly relevant for students, researchers, toxicologists, analytical chemists, risk assessors, regulatory authorities, and industry stakeholders

involved in the assessment, monitoring, and control of chemical contaminants in the food supply chain. The webinar highlights a persistent knowledge gap between toxicological interpretation, analytical capability, and practical mitigation strategies. It discusses the existing uncertainties in toxicological assessment, particularly with respect to different hydrocarbon fractions and the limitations of available data for robust risk characterisation. In addition, it highlights the challenges in the analytical determination of these compounds in complex food matrices, as well as it presents approaches for contamination prevention and reduction.

- **From Emerging Risks to Real-Time Solutions in Food Safety**

  The webinar, held under the CATALYSE framework, brings together four presentations focused on advances in food safety and quality: "*Listeria monocytogenes*: *Are all strains (equally) pathogenic?*", "*Meal2Muscle: Beyond Quantity-Why Protein Quality Truly Matters*", "*Hepatitis E virus transmission through meat products*", and "*Impact of pH and temperature on the infectivity of avian influenza viruses in fermented raw milk products*". The content is particularly relevant for students, microbiologists, virologists, food safety scientists, nutrition researchers, risk assessors, analytical laboratories, and regulatory authorities working on microbial hazards, viral transmission, and protein quality in food systems. The webinar contributes to a more integrated understanding of food safety and quality by linking advances in molecular characterisation, experimental modelling, and virological and nutritional assessment approaches. The webinar addresses how strain variability in bacterial hazards can influence pathogenic potential, how viruses may be transmitted and inactivated in different food matrices and processing conditions, and how protein quality can be more accurately evaluated using digestive simulation models beyond traditional compositional approaches. Collectively, the content illustrates how biological, chemical, and nutritional factors interact within food systems and how different methodological approaches can be used to better understand and assess these processes.

- **CATALYSE webinar: scientific innovations for food safety action**

  The webinar, held under the CATALYSE project framework, brings together industrial and academic stakeholders working across food safety, microbial detection, contamination control, and sustainable packaging innovation. The webinar comprises four presentations: "*Rapid diagnostic pathogen detection and product quality testing*", "*From healthcare to high care*", "*FreshCheck-Colour change test to validate and improve cleaning*", and "*How a novel plant compound can improve food safety and food life extension*". The content is particularly relevant for students, food safety professionals, industrial hygiene and sanitation experts, packaging and processing technologists, quality assurance managers, and applied researchers working on contamination control, food preservation, and food system innovation. The webinar contributes to the understanding of how different technological approaches can be translated into practical food safety applications. The

content covers rapid sequencing-based methods for broad pathogen detection in food and environmental samples, the adaptation of contamination control strategies from healthcare to high-care food production environments, the use of colour-change tools for rapid validation and monitoring of cleaning effectiveness, and the application of plant-based antimicrobial compounds in washing, packaging, and sanitation contexts to improve food safety and extend shelf life.

- **Biosolutions for improved safety and quality of food**

  The webinar was held in collaboration with the MICROORC and FOODGUARD projects and the CATALYSE consortium. It comprises five interconnected presentations: "*Microbiome-based protection for optimized quality and safety of cold-smoked salmon*", "*Biosolutions in the food industry*", "*Microbiome-based strategies for meat analogues*", "*SorfML platform*", and "*Antimicrobial effect of oregano essential oil under active packaging for shelf-life extension and safety of various products*". The content is particularly relevant for students, researchers, food microbiologists, food technologists, process engineers, industry innovators, and applied scientists involved in fermentation systems, microbial ecology applications, food preservation technologies, smart monitoring tools, and active packaging development. The webinar supports the convergence of biological, technological, and data-driven approaches in food systems. Overall, the webinar covers the application of microbiome-based strategies to improve the safety and quality of cold-smoked salmon, the industrial use of biosolutions such as cultures, enzymes, and fermentates to support food processing and product functionality, and the extension of microbiome-informed approaches to plant-based meat analogue systems for better microbial control and shelf-life management. It further introduces a sensor- and machine learning-based platform for predicting quality-related parameters, and explores the incorporation of plant-derived antimicrobial compounds into active packaging systems aimed at enhancing product stability and safety in perishable foods such as fish and dairy products.

- **Smart labels**

  The webinar was organised in collaboration with the MICROORC project and the CATALYSE consortium. It features six interconnected presentations, including "*Current technologies in smart labels*", "*From smart labels signals to real world outcomes*", "*Consumers' acceptance of shelf-life indicators: Evidence from a digital survey in Europe*", as well as three contributions from industry representatives presenting recent technological advances and innovations in smart labelling. The content is relevant for researchers, students, food technologists, industry professionals, and stakeholders working in food packaging, food safety, shelf-life assessment, sensor technologies, and digital solutions for food systems. The webinar addressed smart labelling and dynamic shelf-life concepts within food systems, focusing on different technological approaches used to monitor and communicate product freshness. It covered current developments in time-temperature and freshness indicators,

sensor-based systems for detecting spoilage-related changes, and digital solutions such as QR-linked information systems and advanced packaging technologies. In addition, industrial presentations illustrated practical applications of smart labelling technologies currently under development and implementation.

- **Digitalisation and AI in food safety**

  The webinar, held under the CATALYSE project framework, features a presentation by a member of the CATALYSE consortium, and brings together themes at the intersection of food safety, artificial intelligence, and data science. The content is particularly relevant for food safety professionals, regulators, data scientists, applied researchers, and industry stakeholders working on digitalisation, predictive risk assessment, and evidence-based decision-making in food systems. The webinar aims to strengthen AI and data literacy in the food safety sector and to bridge the gap between rapidly evolving AI capabilities and their practical uptake in research, regulatory, and industrial contexts. It covers the increasing complexity of modern food systems, the growing availability of large and heterogeneous datasets, and the shift towards predictive and near-real-time risk management enabled by advances in artificial intelligence, alongside a range of applications such as machine learning for sensor data analysis, satellite-based mycotoxin forecasting, adulteration detection, genomic approaches for antimicrobial resistance prediction, and AI-assisted evidence synthesis, including a KNIME-based workflow for automated literature screening benchmarked against human reviewers.

3.2 Overview of other materials

Other materials developed under WP6 cover a wide range of food safety topics, including emerging risks, detection and control methods, food microbiological analysis and techniques, hygiene by design, tools for monitoring and detecting hazards, food safety regulation and compliance, food safety culture, and the integration of digitalisation and AI in food safety systems. A detailed overview of the individual outputs is provided in Table 2. The materials consist of 18 videos (3-25 minutes), 3 podcasts (6-18 minutes), an online course comprising video content with a total duration of 64 minutes, and a PowerPoint presentation. The format and length of each material vary depending on the complexity of the topic and the depth of content required.

Table 2: Overview of other materials developed under WP6

Title	Thematic area	Duration (min)
Video		
Designing for Food Safety: Inside the EHEDG Hygienic Design Principles	• Hygiene by design	3
Antimicrobial Resistance in the Food Chain: an EFSA Perspective	• Emerging risks	5
Alternative protein risks	• Emerging risks	8

	• Food safety regulation & compliance	
Emerging food system risks	• Emerging risks • Control measures • Digitalization & AI	9
Future food systems safety	• Emerging risks	9
Listeria monocytogenes in cheese production and supply chains	• Detection methods • Control methods	11
Escherichia coli in cheese production and supply chains	• Detection methods • Control methods	12
Salmonella in cheese production and supply chains	• Detection methods • Control methods	11
Staphylococcus in cheese production and supply chains	• Detection methods • Control methods	11
Clostridium in cheese production and supply chains	• Detection methods • Control methods	12
How to rank Food Safety Risks	• Tools for monitoring & detecting hazards	8
Qualitative Risk Ranking in Food Safety	• Tools for monitoring & detecting hazards	11
Semi-Quantitative Risk Ranking in Food Safety	• Tools for monitoring & detecting hazards	10
Quantitative Risk Ranking in Food Safety	• Tools for monitoring & detecting hazards	12
Inhibition of *Bacillus cereus* growth by fermentation of sunflower seed oil press cake for cheese alternatives	• Food microbiological analysis & techniques • Control methods	5
Key revisions in the EN ISO 7218:2024	• Food microbiological analysis & techniques	8
Targeted Protective Cultures for Cheese	• Food microbiological analysis & techniques	25
Fermentation against *Bacillus cereus* in Plant-Based Foods	• Food microbiological analysis & techniques • Control methods	18
Podcast		
Artificial Intelligence for Food Safety: Applications, Regulation, and Emerging Practices	• Digitalization & AI	14
Consumer food trends and food safety: Challenges in modern food systems	• Emerging risks	18
Nitrite reduction in cooked ham: an organoleptic and food safety concern?	• Control methods • Food safety regulation & compliance	6
Online course		
Cheesemonger Profession: How to master the profession of a professional cheese seller	• Hygiene by design • Food safety culture • Control methods	64
PowerPoint presentation		
Listeria shelf-life Studies: European guidance	• Food microbiological analysis & techniques • Food safety regulation & compliance • Tools for monitoring & detecting hazards	

To provide further detail on their scope and content, each material is briefly described below, including its main topic, intended audience, and a short summary of the content covered.

- **Designing for Food Safety: Inside the EHEDG Hygienic Design Principles**

  The material is an interview-based educational video developed based on the EHEDG Hygienic Design Principles (EHEDG 2025)[1], structured as a guided dialogue between a host and an invited expert. It serves as an introductory learning resource and a basis for discussion on food safety and hygienic engineering, providing an overview of hygienic design principles and their role in preventive food safety. The video is intended for students, early-career researchers, food engineers, quality assurance professionals, industry practitioners, equipment manufacturers, and regulatory or inspection personnel involved in food processing, facility design, and food safety management. It supports awareness and reflection on how hygienic design contributes to preventing contamination by considering equipment and facility design, material selection, and structural features that reduce contamination risks. Overall, the video presents the core principles of hygienic design in food processing environments, highlighting how design choices can help prevent microbial, chemical, and physical contamination, improve cleanability, and support broader objectives such as food safety, operational efficiency, sustainability, and cost reduction.

- **Antimicrobial Resistance in the Food Chain: an EFSA Perspective**

  The video is an educational and informative material based on European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC) report on antimicrobial resistance (AMR)[2]. From an educational perspective, it is intended for students and professionals in food safety, nutrition, veterinary sciences, microbiology, public health, and related disciplines, providing a structured and accessible introduction to AMR surveillance and its implications in the food system. It addresses AMR in the food chain and its relevance for food safety and public health, with emphasis on monitoring within the One Health framework and the need for coordinated surveillance and preventive actions. The video provides an overview of AMR in zoonotic and indicator bacteria, including how resistance develops and spreads, and highlights key surveillance findings, resistance patterns, and trends in multidrug resistance. It also outlines the role of One Health and EU monitoring systems, stressing the importance of coordinated policies, responsible antimicrobial use, and continuous surveillance to protect public health.

- **Alternative protein risks**

[1]EHEDG (2025). Hygienic design principles (EHEDG Guideline No. 8, 4th ed.). https://www.ehedg.org/news-events/news/ehedg-news/detail/article/ehedg-guideline-8-hygienic-design-principles-new-available-guideline

[2]European Food Safety Authority (EFSA), & European Centre for Disease Prevention and Control (ECDC). (2026). The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2023-2024. *EFSA Journal, 24*(2), e9887. https://doi.org/10.2903/j.efsa.2026.9887

The video is an educational material on alternative protein sources, developed based on current scientific knowledge in food safety and emerging food systems. This material is relevant for students, researchers, and professionals working in food-related and life science fields who are interested in emerging protein sources. It addresses the limited current understanding of potential safety issues associated with alternative proteins, despite their rapid development driven by sustainability and health considerations. The video provides an overview of key risk categories associated with alternative protein sources, including plant-based, microbial, insect, algal, and cultured products. It covers nutritional aspects such as protein quality, allergenicity, and anti-nutritional factors, as well as microbiological and chemical hazards including pathogens, heavy metals, mycotoxins, and processing-related contaminants. It also highlights challenges linked to novel production technologies and regulatory uncertainties, emphasizing the need for further research to support safe and sustainable development.

- **Emerging food system risks**

  The video serves as a knowledge resource addressing emerging food safety risks in rapidly evolving global food systems. It is relevant for students, researchers, and professionals in food science, food safety, risk assessment, and related life science disciplines who are interested in understanding how future-oriented approaches can support risk management in complex food systems. The material reflects the limitations of traditional food safety approaches in anticipating and managing emerging and less predictable risks arising from rapid changes in production systems, environmental conditions, and technological developments. The video presents the main drivers shaping future food systems and complementary approaches for anticipating potential risks. It also discusses the role of data-driven methods, including text mining and network analysis, in identifying patterns and early signals in large datasets, while underlining the importance of expert interpretation in handling uncertainty. Overall, the video advocates for a holistic, systems-based approach to building resilient and proactive food safety frameworks.

- **Future food systems safety**

  The video focuses on the evolution of food safety approaches in the context of increasingly complex global food systems. It is relevant for audiences working or studying in food safety and related disciplines who are interested in systems-based thinking and future-oriented approaches to food safety. The material contributes to a better understanding of the limitations of conventional food safety frameworks in managing emerging and uncertain risks. The video explores emerging and interconnected food safety risks associated with environmental pressures, global supply constraints, and novel contaminants. It presents systems-based perspectives for addressing complexity and uncertainty in food systems, discusses the influence of global drivers such as population growth, resource limitations, and environmental change, and introduces concepts such as post-normal science,

interdisciplinary approaches, and advanced scientific tools for food safety assessment and management.

- ***Listeria monocytogenes* in cheese production and supply chains**

  This educational video explores *Listeria monocytogenes*, a significant foodborne pathogen that can contaminate cheese at multiple stages of the dairy supply chain, from primary production to the consumer table. The material is provided in both English and Ukrainian to support accessibility for a broader range of learners and stakeholders. The material is intended for professionals, students, and stakeholders involved in cheese production, distribution, and food safety who seek a deeper understanding of pathogen management within dairy systems and the importance of integrated food safety practices across the entire cheese supply chain. The material supports a better understanding of how *Listeria monocytogenes* behaves as a foodborne hazard in dairy systems, particularly in relation to how it can enter, persist, and spread across different stages of cheese production and distribution. The video explains its biological characteristics and public health relevance, describes contamination routes from processing through to retail and food service environments, and outlines methods used for its detection and control. It also presents how preventive, risk-based approaches and hygienic practices can be applied across the dairy chain, while considering the limitations of relying solely on corrective actions after contamination events.

- ***Escherichia coli* in cheese production and supply chains**

  This educational video examines *Escherichia coli* as a major foodborne pathogen associated with cheese and dairy products. The material is provided in both English and Ukrainian to support accessibility for a broader range of learners and stakeholders. It is designed for individuals involved in the cheese sector who wish to strengthen their understanding of microbial hazards and food safety management in dairy systems, including milk producers, dairy processors, cheesemongers, retail and HoReCa professionals, students in food science and technology, and others interested in pathogen control in the food industry. The video presents the microbiological characteristics of *Escherichia coli* and its relevance for food safety and public health. It describes health implications of infection, conditions supporting its survival in dairy environments, and main contamination routes across cheese production and distribution, including raw materials, equipment, processing, storage, transport, and handling. It also outlines detection methods and preventive control measures, with emphasis on hygiene practices and risk management throughout the supply chain.

- ***Salmonella* in cheese production and supply chains**

  This learning video offers an overview of *Salmonella* as a foodborne pathogen of relevance in cheese and dairy products. The material is provided in both English and Ukrainian to support accessibility for a broader range of learners and stakeholders. The material is relevant for professionals, students, and stakeholders involved in dairy safety,

contamination control, and microbiological risks related to cheese production and distribution. The video uses the cheese supply chain as a framework to explain how microbiological hazards can emerge and spread across production, processing, distribution, and consumption stages. It introduces the biological characteristics of *Salmonella* and its relevance as a major food safety concern, including its impact on human health and the conditions that support its survival in dairy environments. It further examines key contamination pathways across the dairy chain, including raw materials, farm practices, equipment, processing, storage, transport, and handling. In addition, the video outlines detection methods and discusses preventive control measures such as sanitation, monitoring, process control, and good hygiene and manufacturing practices.

- ***Staphylococcus aureus* in cheese production and supply chains**

  This instructional video provides an overview of *Staphylococcus aureus* as a foodborne pathogen of relevance within cheese and broader dairy production systems. The material is provided in both English and Ukrainian to support accessibility for a broader range of learners and stakeholders. The material is aimed at students, early-career researchers, food safety professionals, and stakeholders involved in dairy production, quality assurance, and microbial risk management. It helps address the limited understanding of how this pathogen can establish, persist, and contribute to contamination events across multiple stages of the dairy supply chain. The video describes the biological properties of *Staphylococcus aureus* and its relevance for foodborne disease and dairy safety, with particular focus on its toxin-producing capacity and survival in food processing environments. It examines how contamination can occur through raw milk, equipment, processing facilities, storage conditions, temperature abuse, and handling practices. It further explains how these factors interact across the supply chain to influence overall product safety. In addition, the material presents commonly used detection and monitoring approaches and discusses preventive strategies.

- ***Clostridium* in cheese production and supply chains**

  This educational video focuses on *Clostridium* species as microbiological hazards associated with cheese and dairy production systems. The material is provided in both English and Ukrainian to support accessibility for a broader range of learners and stakeholders. It is designed for learners and professionals involved in dairy science, food safety, microbiology, and quality management within production and regulatory contexts. The material reflects the need for better understanding of how spore-forming bacteria behave across complex dairy processes and how they contribute to safety and quality challenges. The video explains the main biological features of *Clostridium*. It describes how these organisms may enter the dairy chain through raw milk, farm environments, equipment surfaces, processing steps, storage conditions, and temperature variations. The material also considers their role in spoilage and defect formation in cheese. Furthermore, it presents detection techniques

used in dairy settings and discusses control measures based on hygiene, process control, environmental management, and preventive monitoring strategies applied throughout the supply chain.

- **How to rank Food Safety Risks**

  This educational video provides an introduction to how food safety risks can systematically be ranked to support public health protection, based on established international frameworks. It is designed for professionals, students, researchers, and practitioners in food safety and public health who are interested in how scientific evidence is structured into practical tools for decision-making. The video explores how risk ranking fits within broader risk analysis frameworks used in food safety governance, particularly in contexts where multiple and evolving hazards need to be considered simultaneously. It outlines the distinction between risk assessment, risk management, and risk communication, and situates risk ranking as a structured approach for comparing food safety hazards. The content describes the general steps involved in developing a risk ranking process, including defining objectives, selecting relevant hazards, and setting the scope of the analysis. It also introduces different methodological approaches used in practice, such as qualitative and quantitative techniques, and the use of available data and evidence to support systematic comparison of risks.

- **Qualitative Risk Ranking in Food Safety**

  This video introduces the concept of qualitative risk ranking in food safety, explaining how experts structure early-stage decisions when comparing a wide range of potential food safety hazards. It is intended for professionals, students, researchers, and stakeholders in food safety and public health who are interested in how structured judgment is used to support prioritisation when detailed quantitative data is limited. The video illustrates how qualitative approaches can be applied to organise and compare food safety risks in situations where information is incomplete and uncertainty is substantial. It covers the main elements of qualitative risk ranking, including risk matrices, decision trees, and expert judgement as complementary approaches for organising and comparing hazards. The content also explains how these tools are applied in practice.

- **Semi-Quantitative Risk Ranking in Food Safety**

  This video introduces semi-quantitative risk ranking as an approach used in food safety assessment to bridge the gap between qualitative judgement and fully quantitative modelling. It targets professionals, students, researchers, and practitioners in food safety and risk assessment who are interested in how numerical elements can be incorporated into structured decision-making when data availability is partial or incomplete. It is illustrated in this video how semi-quantitative approaches are applied to structure the comparison of food safety risks by combining simplified classifications with basic numerical

elements. The content introduces the main semi-quantitative methods applied in risk ranking, including scoring systems, risk ratio approaches, and multi-criteria decision analysis. It describes how these methods bring together different types of information within a single framework for evaluating risks, and outlines their main characteristics.

- **Quantitative Risk Ranking in Food Safety**

  This video concludes the series on food safety risk ranking by introducing quantitative approaches used to estimate and compare the public health impact of foodborne hazards. It is intended for professionals, researchers, students, and practitioners in food safety, epidemiology, and risk assessment who are interested in how mathematical models and statistical methods are used to support evidence-based decision-making. The video addresses the need for approaches capable of translating food safety hazards into measurable, comparable outcomes when sufficient data and evidence are available for quantitative assessment. The video revisits earlier qualitative and semi-quantitative risk ranking approaches and contrasts them with fully quantitative methods used when adequate data are available. It explains how quantitative models convert exposure and hazard information into numerical estimates of health impact, enabling comparison of different food safety risks on a common scale. The content introduces key quantitative approaches, including classical risk assessment, comparative risk assessment, disability-adjusted life years (DALYs), and cost of illness analysis, each capturing different aspects of risk such as health burden and economic impact.

- **Inhibition of *Bacillus cereus* growth by fermentation of sunflower seed oil press cake for cheese alternatives**

  This video explores food safety challenges associated with plant-based cheese alternatives, focusing on the behaviour and control of *Bacillus cereus* during processing. It is based on the study "*Inhibition of Bacillus cereus growth by fermentation of sunflower seed oil press cake for cheese alternatives*" (Looser et al., 2026)[3]. It is designed for learners, food safety professionals, researchers, product developers, and quality assurance specialists engaged in plant-based dairy innovation, especially in the context of managing microbiological risks in novel food systems. The material targets the limited understanding of microbiological risks specific to plant-based cheese alternatives, especially in relation to plant-derived raw materials and their association with spore-forming bacteria from soil environments. The video explains that these products may be affected by hazards such as *Bacillus cereus*, which can survive processing steps, withstand heat treatment, and subsequently grow and produce toxins under favourable conditions. It also describes the use of fermentation with lactic acid bacteria as a control strategy based on acidification, and briefly outlines key

[3]Looser, V., Purtschert-Montenegro, G., von Ah, U., Weik, D., Wagner, E., Hummerjohann, J., Egger, L., Stoffers, H., Arias, E.M., Ingenhoff, J-E., Schmidt, R.S.,Bachmann, H-P., Nemati, G. (2026). Inhibition of *Bacillus cereus* growth by fermentation of sunflower seed oil press cake for cheese alternatives. *Future Foods*, 101017. https://doi.org/10.1016/j.fufo.2026.101017

stages in the process such as heat treatment and fermentation, where targeted control measures are essential.

- **Key revisions in the EN ISO 7218:2024**

  This video explores the key revisions introduced in the updated EN ISO 7218:2024 standard for microbiological examination in the food chain, with a focus on its implications for laboratory practice, quality assurance, and methodological consistency. The content is particularly relevant for microbiology laboratory professionals, food safety practitioners, quality assurance managers, auditors, and researchers involved in microbiological testing and standard implementation within the food and feed sectors. The video aims to strengthen understanding of the revised standard and its practical application in ensuring reliability, reproducibility, and comparability of microbiological results, while supporting harmonised laboratory practice across the food chain. It covers key conceptual and operational updates in the standard, including the use of normative terminology and modal verbs in standardisation, the scope and structure of EN ISO 7218, and its alignment with ISO and CEN frameworks. It further explains updated requirements related to laboratory quality assurance, including control organisms, replicate testing, external quality assessment, sample handling and transport, storage conditions, and prevention of cross-contamination. In addition, the video addresses methodological aspects of microbiological examination such as enumeration techniques (e.g. pour plate and surface plating methods), counting rules, interpretation of results, and good laboratory practices across qualitative and quantitative testing approaches, highlighting their role in ensuring robust and standardised microbiological analysis across the food chain.

- **Targeted Protective Cultures for Cheese**

  This video is a recording of a presentation delivered during the event "*Innovation CATALYSEs Food Safety-Bridging Science and Practice*", organised by CATALYSE consortium in the context of World Food Safety Day 2026 (June 8-9, 2026) in Liebefeld and Posieux, Switzerland. This video presents research on the development of miniaturised cheese models as experimental tools to study microbial behaviour, microbial interactions, and food safety risks in cheese systems. It is based on applied work investigating protective cultures and their performance in real cheese matrices, with a particular focus on smear-ripened and Protected Designation of Origin (PDO)-type cheeses. The content is relevant for food microbiologists, researchers, dairy scientists, product developers, learners and food safety specialists working on cheese fermentation, microbial ecology, and protective culture design. The video addresses the limitations of conventional laboratory approaches for studying complex cheese ecosystems and introduces a miniaturised cheese model that enables high-throughput testing under controlled yet realistic conditions. The presentation further describes experimental approaches used to assess pathogen behaviour, including studies on *Listeria monocytogenes* and *Escherichia coli* in different cheese matrices, as well as the influence of smear microbiota composition, salt concentration, and ripening

conditions. It also introduces the concept of combining microbiological and abiotic factors to better understand microbial dynamics in complex food systems and support the development of targeted protective cultures.

- **Fermentation against *Bacillus cereus* in Plant-Based Foods**

  This video is a recording of a presentation delivered during the event "Innovation CATALYSEs Food Safety-Bridging Science and Practice", organised by CATALYSE consortium in the context of World Food Safety Day 2026 (June 8-9, 2026) in Liebefeld and Posieux, Switzerland. This presentation addresses food safety challenges associated with plant-based food development. The content is relevant for food microbiologists, food safety experts, researchers, product developers, fermentation technologists, learners and industry stakeholders working on plant-based foods, novel food matrices, and microbial risk management in alternative protein systems. The video discusses the emergence of *Bacillus cereus* as a safety concern in plant-derived raw materials, particularly those of soil origin, and explains how processing steps such as heat treatment can eliminate vegetative cells while potentially triggering spore germination. It further describes the conditions under which growth can rapidly reach toxin-relevant levels during subsequent incubation and storage. To control these risks, the presentation explores fermentation-based strategies to inhibit *Bacillus cereus* growth through acidification and metabolic activity. The video also discusses how fermentation conditions affect product stability and safety during storage, and reflects on the implications of microbial detection timing for food safety assessment in plant-based systems.

- **Artificial Intelligence for Food Safety: Applications, Regulation, and Emerging Practices**

  This podcast explores the growing role of artificial intelligence in food safety, drawing on insights from "*Artificial intelligence for food safety: A literature synthesis, real-world applications and regulatory frameworks*" (van Meer et al., 2025)[4]. It targets professionals, researchers, regulators, and students in food safety, data science, and related disciplines with an interest in the intersection of digital technologies and risk management within food systems. The podcast provides insight into how artificial intelligence is being applied to support more predictive and data-driven approaches in food safety risk management. It explores the use of AI in food safety systems, focusing on data analysis, pattern recognition, and predictive modelling to improve hazard detection and monitoring across food supply chains. It discusses real-world applications in both industry and regulatory settings, showing how AI tools can support decision-making and complement existing food safety practices. It also considers key governance aspects, including implementation challenges and the need for transparency and accountability in AI-driven systems.

[4]van Meer, F., van der Velden, B.H.M., Takeuchi, M. (2025). *Artificial intelligence for food safety: A literature synthesis, real-world applications and regulatory frameworks*. FAO: Rome, Italy. https://doi.org/10.4060/cd7242en

- **Consumer food trends and food safety: Challenges in modern food systems**

  This podcast examines the relationship between evolving consumer preferences for healthier and more sustainable diets and the resulting implications for food safety, drawing on the commentary "*Consumer food trends and food safety: Challenges in modern food systems*" (Kirby & Teixeira, 2025)[5]. It is intended for professionals, researchers, students, and stakeholders working in food safety, nutrition, and food systems who are interested in how societal dietary shifts influence risk management, regulatory decision-making, and food system design. The podcast helps clarify how consumer-driven changes in food choices can reshape the way food safety risks emerge and need to be managed in modern food systems. The material addresses current consumption trends such as the preference for natural, minimally processed, plant-based, raw, and reformulated foods with reduced sugar and salt. It explores how these developments influence processing and preservation strategies and how they may impact microbial stability, shelf life, and potential exposure to hazards. The discussion also reflects the balance between health, sustainability, and safety considerations, and the implications of these interacting priorities for food system design and management.

- **Nitrite reduction in cooked ham: an organoleptic and food safety concern?**

  This podcast explores the topic of nitrite reduction in cooked meat products, with a specific focus on whole cooked ham, drawing on the scientific study "*Nitrite reduction in cooked ham: an organoleptic and food safety concern?*" (Nunes et al., 2026)[6]. It is intended for professionals, researchers, students, and stakeholders working in meat science, food safety, and product development who are interested in the balance between public health considerations, regulatory constraints, and food quality in processed meat systems. The material examines why reducing nitrite levels in cured meats has become a key priority, driven by health concerns and evolving regulatory expectations. The material examines the role of nitrites in cooked ham and the reasons behind efforts to reduce their use. It explores the impact of reduced nitrite levels on product safety and stability, focusing on shelf-life performance and microbial behaviour under both normal and temperature-abuse conditions. The discussion includes results from challenge testing assessing pathogen growth, such as *Listeria monocytogenes* and *Clostridium* species, under controlled storage scenarios.

- **Cheesemonger Profession: How to master the profession of a professional cheese seller**

[5]Kirby, R., Teixeira, P. (2025). Consumer food trends and food safety: Challenges in modern food systems. *Trends in Food Science & Technology*, 105398. https://doi.org/10.1016/j.tifs.2025.105398

[6]Nunes, M.J., Pereira, R.C., Noronha, L., Cruz, I., Komora, N., Barbosa, J.B., Monteiro, M.J., Ribas, T.C.F., Mesquita, R.B.R., Rangel, A.O.S., Carvalho, F., Brandão, T.R.S., Teixeira, P. (2026). Nitrite reduction in cooked ham: an organoleptic and food safety concern?. *Meat Science*, 110072. https://doi.org/10.1016/j.meatsci.2026.110072

This online learning series introduces the cheesemonger profession through a structured set of seven short video episodes, covering among other topics safe handling practices, hygiene in cheese retail environments and food safety culture. The material is provided in both English and Ukrainian to support accessibility for a broader range of learners and stakeholders. It is intended for learners, early-career professionals, and individuals working with or interested in cheese, who need a practical understanding of how product knowledge and food safety principles are applied in day-to-day cheesemongering. The series provides a progressive introduction to the cheesemonger profession, outlining key responsibilities and the core skills needed to work with cheese in a retail environment, together with basic principles for recognising and describing different cheese types. A central focus is placed on day-to-day practices that support product safety and integrity, including proper handling, hygiene measures, appropriate use of tools, and correct storage conditions to minimise contamination risks. It further emphasises how routine operational choices in retail environments directly contribute to preserving cheese quality and safety. In this context, the series also underlines the importance of consistent practices that collectively support a stronger food safety culture within retail operations.

- ***Listeria* shelf-life Studies: European guidance**

  This presentation, developed by the European Union Reference Laboratory for *Listeria monocytogenes* (EURL Lm)[7], provides an overview of European guidance for conducting shelf-life studies in support of food safety management. It is aimed at food safety professionals, laboratory specialists, regulators, and food business operators involved in the evaluation of microbiological stability and the regulatory compliance of ready-to-eat food products. The material helps to translate regulatory requirements for shelf-life assessment into a more accessible and practical understanding for implementation in food safety practice. It outlines the regulatory context within the European Union, particularly Regulation (EC) No 2073/2005, and clarifies the responsibilities of food business operators in ensuring compliance with food safety criteria throughout product shelf-life. The presentation also describes scientific approaches used to assess the behaviour of *Listeria monocytogenes* in foods, including product characterisation, predictive modelling, challenge testing, and durability studies. In addition, it addresses the application of harmonised methods across Europe, supported by relevant ISO standards and guidance documents, and briefly considers laboratory competence and reliability in the execution of shelf-life studies used for regulatory decision-making.

[7]Bergis, H., Bonanno, L., Asséré, A., Lombard, B., Polet, M., & Andersen, J. K. (2021). EURL Lm technical guidance document on challenge tests and durability studies for assessing shelf-life of ready-to-eat foods related to *Listeria monocytogenes*. *EURL Lm*, *4*(60), 196. https://doi.org/10.5281/zenodo.18783767

4. Conclusion

The deliverable D6.2 *Knowledge clips, webinars, tutorials and digital assignments targeted at relevant stakeholders* was effectively achieved as planned.

Education and knowledge transfer are essential for supporting the continuous advancement of food safety systems and ensuring that scientific developments, emerging risks, and innovative solutions can be effectively communicated to relevant stakeholders. In response to this need, the project successfully achieved and exceeded its predefined targets for educational resource development. A total of seven recorded webinars and twenty-three additional educational materials were produced, surpassing the KPIs of at least six webinars and ten additional educational outputs.

The developed resources comprise a diverse range of formats, including webinars, educational videos, podcasts, online courses, and PowerPoint-based learning materials. Together, these outputs address a broad spectrum of food safety topics, ranging from emerging risks, microbiological analysis, and hazard detection to food safety culture, regulatory compliance, hygiene by design, packaging innovations, and digitalisation and AI. The use of multiple formats supports accessibility, ensures diverse learning preferences, and enables knowledge dissemination to different stakeholder groups with varying educational and professional backgrounds. By translating scientific and technical information into accessible learning resources, the materials support knowledge exchange, capacity building, and the dissemination of food safety innovation among students, researchers, food safety professionals, industry stakeholders, and regulatory communities.

As a next step, the developed materials will be evaluated by stakeholders from academia, industry, and regulatory organisations to identify strengths, limitations, and opportunities for further refinement. A roadmap will also be developed to support the integration of the materials into appropriate educational and training environments, facilitating their wider dissemination, uptake, and long-term use by safety professionals, industry stakeholders, and regulatory communities. In addition, all developed materials will be made freely accessible through the CATALYSE Community of Practice (CoP) platform.