

Book of abstracts



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## Preface

The COST action CA20103 titled “Biosecurity Enhanced Through Training Evaluation and Raising Awareness” (<https://better-biosecurity.eu/>) aims to reduce the risk of infectious disease introduction and spread by improving the implementation of biosecurity measures in animal production systems. The 2023 Annual General Meeting of the COST action BETTER was held in Ghent, Belgium, on the 7th and 8th of February. In addition, a call for the latest research on the topic “Challenges on implementation of biosecurity and training needs” was set. Hereby, we present you the book of abstracts of the research that was presented in this event.

*On behalf of the COST BETTER action,  
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*(Views expressed in these proceedings are not necessarily those of the organizing committee or of the COST BETTER action)*

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# The Importance of Biosecurity for the World Organization for Animal Health and Veterinary Services of Member Countries

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The World Organisation for Animal Health (WOAH, founded as OIE) is an international, intergovernmental organization responsible for standard-setting processes on animal health and welfare since its establishment in 1924. Terrestrial and Aquatic Animal Health Codes of WOAH provide internationally recognized science-based standards for improving animal health and welfare and veterinary public health worldwide, including through means for safe international trade in terrestrial and aquatic animals and their products. The Manuals of Diagnostic Tests and Vaccines for Terrestrial and Aquatic Animals provide a standardized approach to diagnosing the diseases listed in the Terrestrial and Aquatic Codes.

For the WOAH and its 182 Members, biosecurity is defined as “a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population”. Although there is no specific chapter on biosecurity in WOAH international standard yet, the term biosecurity is mentioned 264 times across 12 sections and 45 chapters of Terrestrial Code, which recognizes the importance of biosecurity in the whole veterinary domain: for prevention and control of animal diseases, improving animal health and protecting public health, for animal welfare purposes, safe trade of live animals and veterinary commodities, etc.

However, WOAH recognizes biosecurity as essential for disease prevention and control, thereby improving animal health and welfare. Therefore, an *ad hoc* group of recognized international experts has been designated by the Director General of WOAH to start drafting a specific chapter on biosecurity. This work will follow WOAH’s standards-setting process which includes consultation with WOAH Members before being proposed for adoption by the World Assembly of Delegates at the WOAH General Assembly. The role of the scientific community and national research entities is key for developing further these standards and their implementation by Members.

Keywords: Biosecurity, prevention, international standards, Members, science

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## Evaluation of biosecurity on pig production sector in Serbia: lessons learned from the period between 2010-2018

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The Veterinary Services of Serbia, namely the Veterinary Authority, local Veterinary Organizations and regional Veterinary Institutes, carried out a series of complementary activities aimed at improving the biosecurity in the pig production sector on the national level, with the overall goal of preventing the spreading of animal diseases and ensure the sustainability of swine production.

This paper aims to present the design of a complex and comprehensive national programme for the assessment and improvement of the biosecurity of pig holdings in Serbia between 2010 and 2018, with the most significant results. The programme's primary goals include i) pig holdings categorization based on biosecurity level, their ii) classification based on the assessment of the implementation of a national disease control programme, iii) biosecurity risk analysis and iv) evaluation of good farming practices (GFP) of pig farms.

The biosecurity programme, underpinned by the legislation, and funded by the Government, was carried out in three phases with detailed prescription of all activities. Its outstanding quality was ensured by using unique on-spot evaluation questionnaires with well-defined data sets, supported by software applications with integrated algorithms to automate the assessment and calculate the biosecurity risk level. Professional competences of evaluators provided an additional advantage – assessments were carried out exclusively by authorized Veterinary Stations on contract-based engagement with Ministry, concretely by their veterinarians licensed by the Veterinary Chamber of Serbia. They used modern information technologies to collect the data, which were incorporated into the national Central Database, where all software applications were integrated, and data from questionnaires stored, eligible for expert analysis. The programme's purpose was to improve biosecurity in the pig sector, to ensure high animal health and welfare status, and to promote certification of pig holdings eligible for premium biosecurity status. Among other results of these evaluations, all pig holdings were categorized into five different types and four classes, while each pig firm was assessed against biosecurity risk (high, medium, low) and level of implementation of GFP.

Keywords: Biosecurity, animal diseases, prevention, evaluation, risk analysis

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# Impact Of Globalization On Rural Development In Bosnia And Herzegovina

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This article explores how globalization affects rural poverty in Bosnia and Herzegovina. The forces of change can affect the well-being of the rural poor through their impact on productivity, growth, income distribution, technology, livelihood security and policies. There are both credit and debt entries: great potential benefits, such as from accelerated growth, but also the real danger that the rural poor will be left behind, for example, they will not have access to knowledge and other resources needed to succeed in the global market. Social and economic restructuring has turned the villages of Bosnia and Herzegovina into a far more complex area than it once was. Many rural areas in Bosnia and Herzegovina are affected by depopulation, declining birth rates and an aging population.

In the European Union, contemporary ideas of the development of the creative industries started to develop at the end of 2001 with the use of the technology of the developed countries of the world. Creative industries, contrary to their low market dimension, have an economic potential which shows significant results in comparison with other segments of the economy. The concentration of intellectual capital is particularly high in the video industry, IT, multimedia, advertising, etc.

The article also discusses some of the influences on the ways in which the forces of change act on their own, emphasizing the importance of market access, positive government attitudes and the assets of the poor in rural areas of Bosnia and Herzegovina. In relation to urban areas, the dynamics of globalization in rural areas is relatively weak in Bosnia and Herzegovina. The prevailing fact is that primarily rural areas are victims of such movements, as local farms and businesses are forced to compete with importers, and factories close because production has moved to a lower level of the economy, and rural localities can only survive as dumps for the poor and low quality industry. However, there are also positive examples of economic growth from foreign direct investment in rural areas of Bosnia and Herzegovina. The pessimistic view of globalization believes that it destroys local cultures, spreads world inequalities and greatly worsens the lives of the poor.

Keywords: Globalization, technology, creative industries, rural development, Bosnia and Herzegovina

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## Methods used to assess biosecurity

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There is little information regarding the methods used to assess on-farm biosecurity. An online survey was created to characterise these methods. The survey considered variations between animal categories (AC), type of information used, objectives, indicators, validation and how it is collected, aggregated, and stored. As a result of comments and bibliography noted in COST BETTER CA20103 meetings, drafts were made and transformed into a user-friendly format using the “EUSurvey” app. Country focal points were selected and trained to conduct the survey. Thirty-six surveys were received, mainly from Spain (27/36) and mostly belonging to the private sector (28/36). From a preliminary analysis, 14 initial AC were grouped into 5: Pigs, Poultry, Cattle, Small ruminants and Others. 29/36 methods were applied in only one AC, and the remaining in two or more AC. Methods could have more than one objective, the most common being “voluntary assessment for improving biosecurity” in the case of pigs (20/27), poultry (4/9) and other AC (3/4). “Compulsory method focusing on a specific disease” and “Compulsory audits for improving biosecurity” were the main objectives for cattle (4/8) and small ruminants (2/3), respectively. Half of the methods were developed by private companies and 70% of the methods were free of charge. 8/36 methods did not perform a visit to the production units for the biosecurity evaluation. The respondent was usually the farm manager (33/36) and the farm veterinarian (21/36). Data was collected on paper (56%) or with an app (28%). The storage was in databases in 44% of methods. Extra-data was collected in 14/36 methods, the most common being “inspection of farm records” (11/14). Scoring method was the most used to measure biosecurity (58%), and feedback was given in 34/36 methods. The survey is still ongoing, and more surveys are expected from Europe and worldwide.

Keywords: On-farm biosecurity; Assessment; Survey

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## Biosecurity compliance in poultry production in Belgium: neglected measures and reasons

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Biosecurity practices in poultry production are often known quite well, but compliance is not optimum. Project Netpoulsafe is a EU Horizon 2020 project with participants from seven European countries, designed to stimulate knowledge exchange between all relevant stakeholders and to find support measures to motivate farmers and farm workers to improve and maintain high biosecurity levels in poultry farms. In order to better understand the reasons and identify ways for improvement in biosecurity in the framework of project Netpoulsafe, 192 poultry farmers were interviewed in the 7 countries about the common biosecurity measures implemented on their farms. Another focus point was to identify main difficulties encountered by the farmers to implement the indicated biosecurity. The analysis is here realized on the farmers questionnaires collected in Belgium poultry farms (n=20). The results showed that most of the biosecurity measures questioned to the farmers (75%) were always implemented in the farms more frequently because they were controlled by regulatory entities. Various reasons were reported to explain why certain biosecurity measures were not always implemented by the farmers: mainly “takes too much time” (16.8%), “too expensive” (14.8%), “not adapted to the farm” (14.7%), “not knowing advantages” (11.5%) and “not useful” (10.2%). Improving biosecurity in animal production systems is a major lever to reduce the risk of disease introduction or pathogens spreading, especially foodborne pathogens, or pathogens with a zoonotic potential like the recent High Pathogenic Avian Influenza HPAI in many EU countries. Through this study relevant supporting tools will be used and tested in farms and information will be disseminated in educational materials. Research funded by the H2020, under the grant agreement number: 101000728 (NetPoulsafe Project).

Keywords: biosecurity; knowledge sharing; netpoulsafe; poultry; supporting tools

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## Optimizing internal biosecurity on pig farms by assessing movements of farm staff

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In terms of internal biosecurity, it is important to separate different age groups in a pig farm and to stick to specific procedures and working lines when visiting the stables. Currently, there is no research available on the movements of farm staff between the different stables of pig farms. The objectives of this observational study were to assess the movements of farm staff on pig farms, to assess risky movements and to investigate whether movements differ according to week of the batch farrowing system (BFS). Five commercial sow farms were enrolled in the study. On each farm, an internal movement monitoring system was installed. Detection points were installed in all rooms of the farm, and farm workers had to wear a personal beacon that sent a Bluetooth signal to the detection points. Movements were registered in an online platform. Movement data were collected from 1 December 2019 until 30 November 2020. The following sequence of movements were considered as safe: 1) dressing room, 2) farrowing unit, 3) gestation/insemination unit, 4) nursery unit, 5) fattening unit, 6) quarantine unit, and 7) cadaver storage. Movements in the opposite direction were considered as risky, unless a dressing room was visited in between. The total number of movements differed according to week of the BFS for farms B, C, D, and E ( $p < 0.05$ ), and was highest in the insemination + farrowing week. The percentage of risky movements was influenced by week of the BFS for two farms, and was highest in weaning week (Table 1). The percentage of risky movements varied from 9 % up to 38 %. This study investigated movements of farm staff in Belgian pig farms. Some movements were influenced by week of the BFS, and in general there were too many risky movements on the farms. This study created awareness on farm staff movements, which could be a first step in optimizing the working lines. Future research could focus on why certain risky movements occur, in order to adapt the working lines afterwards to achieve better biosecurity and a higher health status on the farms.

**Table 1.** Median (min.-max.) number of daily movements and percentage of risky movements in the different weeks of the batch farrowing system

	Total (n)	Risky (%)
Farm A		
a	32 (2-76)	11 (0-30)
b	32 (9-75)	9 (0-32)
c	33 (13-90)	11 (0-35)
Farm B		
d	32 (2-633)	33 (0-52)
e	53 (2-348)	33 (0-46)
f	33 (1-349)	33 (0-45)
g	38 (2-320)	32 (0-50)
Farm C		
d	58 (21-244)	38 (10-46)
e	64 (14-236)	35 (17-47)
f	49 (14-166)	36 (20-44)
g	41 (13-103)	36 (8-50)
Farm D		
d	71 (10-247)	16 (6-27)
e	85 (8-210)	14 (4-27)
f	66 (2-173)	15 (0-32)
g	52 (7-273)	13 (0-28)
Farm E		
d	43 (5-487)	14 (0-44)
e	57 (2-351)	10 (0-60)
f	31 (1-629)	12 (0-40)
g	35 (1-544)	14 (0-40)

Keywords: Pig production, internal biosecurity, farm staff movements, working lines

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## Biosecurity in Italian poultry production: strengths and weaknesses

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Biosecurity represents an effective tool to break the transmission cycle of infectious agents to and within farms, avoiding economic losses and assuring high production standards in the poultry sector. This becomes crucial in countries in which the production reaches high productive standards, such as Italy, but not always the implementation of biosecurity measures is optimal. Within the NetPoulSafe project (G.A. 101000728), a survey with the aim to collect information on the implementation of biosecurity measures, from different stakeholders belonging to different productive categories and sectors was conducted in spring-summer 2021. Data were collected through questionnaires administered to 76 stakeholders, belonging to three different groups: advisors (n=37), farmers (n=30) and operator (n=9). In detail, questionnaires were administered to farmers and advisors of conventional broiler (n=13) and layer (n=13), free range broiler (n=8) and layer (n=10), turkey (n=13), duck (n=3), and breeder (n=7) farms, and to operators working in slaughterhouses (n=2), hatcheries (n=3), egg collection facilities (n=2) and feed suppliers (n=2). Data were analyzed with descriptive statistics aimed at determining the level of biosecurity measures' implementation according to the stakeholders' answers. While several strengths were identified both in external (e.g., clear definition of the farm area and presence of the farm hygiene lock, management of dead birds, and pests' control) and internal biosecurity (e.g., presence of the house hygiene lock, and cleaning and disinfection procedures), implementation of specific measures presented weaknesses, such as washing hands and showering before entering in the farm or other facilities (e.g., hatcheries), as well as storage of manure. Despite an overall good level of biosecurity, this survey suggests that intervention points are to be addressed in order to further improve biosecurity compliance in the Italian poultry production.

Keywords: Biosecurity, biosecurity measures, poultry farms, stakeholders

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# Assessing biosecurity compliance in poultry farms: a survey in a densely populated poultry area in North East Italy

G. Tilli\*, A. Laconi, F. Galuppo, L. Mughini-Gras and A. Piccirillo

Biosecurity in poultry farms represents the first line of defence against the entry and spread of pathogens that may have animal health, food safety, and economic consequences. Therefore, it is necessary to comply with and implement the proper biosecurity measures. The aim of this study was to assess biosecurity compliance in poultry farms located in a densely populated poultry area in North East Italy. A total of 259 poultry farms (i.e., broilers, turkeys and layers) were surveyed between 2018 and 2019 using standardized checklists, and the differences in biosecurity compliance between the poultry sectors and years (only for turkey farms) were tested for significance. Farm hygiene, infrastructure condition, cleaning and disinfection tools and procedures were the most compliant biosecurity measures. Some deficiencies were observed in the cleanliness of the farm hygiene lock in broiler farms, as well as in the presence of the house hygiene lock in broiler and layer farms (Fig. 1), and in adequate coverage of built-up litter in turkey and broiler farms. Differences among the three sectors were identified, with turkey and broiler farms being the most and least compliant, respectively. Overall, our findings show a generally high level of biosecurity implementation in poultry farms in North East Italy. This can be explained by several factors, including strict national biosecurity regulation, vertical integration of poultry production, and increased awareness of farmers on the correct implementation of biosecurity measures over the years. On the other hand, our study showed that some biosecurity measures (both internal and external) still need to be improved, indicating that to achieve high biosecurity compliance continuous implementation, control and training of personnel are required.

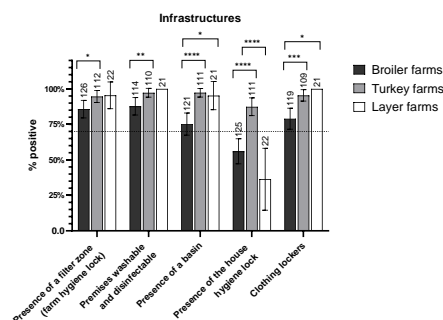


Figure 1. Level of significance among biosecurity measures related to infrastructures in broiler, turkey and layer farms. The number of responding farms is reported above each column.  $p < 0.05$  shown as \*,  $p < 0.01$  as \*\*,  $p < 0.005$  as \*\*\* and  $p < 0.001$  as \*\*\*\*. Bars represent 95% confidence interval (CI).

These data have been previously published in *Animals* (MDPI); doi.org/10.3390/ani12111409

Keywords: Biosecurity compliance, biosecurity checklist, broilers, turkeys, layers

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## Coaching as supporting measure to improve biosecurity in Italian poultry farms

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Tools to support and improve the implementation of biosecurity measures in poultry farms are needed. Therefore, a study was conducted with the aim to collect, select, test and share the best supporting measure to help farmers to improve biosecurity in their farms within the framework of the NetPoulSafe project (G.A. 101000728). A set of specific supporting measures, such as virtual farm tour, group discussion and coaching, was chosen to be validated in Italian poultry farms. To this purpose, 26 pilot farms located in different Italian regions (i.e., Veneto, Lombardy, Piedmont, Emilia-Romagna, and Apulia) were involved in the validation phase. These farms belonged to the following commercial categories: broilers (n=5), free range broilers (n=4), layers (n=4), free range layers (n=3), turkeys (n=6), ducks (n=2), breeders (n=2). Starting from the virtual farm tour organized for different farmer groups (i.e., eggs and meat production), several critical points on biosecurity were identified and then discussed during group meetings. As a final step, coaching sessions were carried out, targeting mainly the farmer but involving all the relevant stakeholders linked to the farm. In order to evaluate the efficacy of the supporting measure under validation, a specific scoring system was used. From each coaching session, the following critical points were identified: external crews management (i.e., catching, vaccination); wild animals management; poultry house hygiene lock management; appropriate farm signage; improvements in poultry house; farm fencing; litter management; microbiological control after C&D procedures. These findings suggest that interventions addressed to the farmer, with the support of other stakeholders, could be useful in improving biosecurity on farm.

Keywords: Biosecurity, biosecurity measures, supporting measure, coaching, farmers

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## Perception of biosecurity and risks in Ecuadorian Wildlife Management Units

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Little information is available on biosecurity and risk in wildlife management units in the Pastaza Province of Ecuador. This study provides a baseline assessment of biosecurity practices in wildlife refuges and will contribute to efforts to adapt biosecurity programs to wildlife management units. We applied a total of 151 questionnaires, maintaining a total of 70 questions divided into 3 categories of general knowledge; Education, Infrastructure, Practices, divided into 3 groups owners (n = 9), volunteers (n = 21) and visitors (n = 121). Results: The survey index (scale between 0 and 100) reflects a failure in biosecurity in terms of the infrastructure (index 50.0) of wildlife management units. Although the other two areas showed higher values (Education 63.04 and Practices 65.33), a lack of training in biosecurity education and best practices is evident. These results show the lack of wildlife management protocols within the wildlife management units that promote the application of biosecurity guidelines in an integrated manner where owners, visitors and volunteers are considered. The present study suggests the need to promote continuous and systematic training on biosecurity measures in wildlife management units. These will directly contribute to better management animal and human health. We also seek to promote genuine biosecurity plans that identify and prioritise effective strategies in procedures, policies, and practices to minimise incidents.

Keywords: Perception; Biosecurity; Ecuador; Wildlife; Management; Risks

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## Compliance with Barrier Gestures during COVID-19 Pandemic as a Function of the Context: A Longitudinal Observational Survey at the University of Liège

Gianni Parisi\*, Véronique Renault, Marie-France Humblet, Nicolas Ochelen, Anh Nguyen Diep, Michèle Guillaume, Anne-Françoise Donneau, Fabrice Bureau, Laurent Gillet, Anne-Catherine Lang, Fabienne Michèle, Sébastien Fontaine, Claude Saegerman

During the COVID-19 pandemic, barrier gestures such as mask wearing, physical distancing, greetings without contact, one-way circulation flow and hand sanitization were major strategies to prevent the spread of SARS-CoV-2, but they were only useful if consistently applied. This survey was a follow-up of the first survey performed in 2020 at the University of Liège. We aim to evaluate the compliance with these gestures on campuses and examine differences in the extent of the compliance observed in different educational activities and contexts. During 3.5 months, the counting of compliant and non-compliant behaviours was performed each week in randomly selected rooms. Using data collected during both surveys (2020 and 2021), binomial negative regression models of compliance depending on periods (teaching periods and exam sessions), type of rooms, and campuses were conducted to evaluate prevalence ratios of compliance. The percentage of compliance in this second survey was the highest for mask wearing and physical distancing during educational activities (90% and 88%, respectively) and lowest for physical distancing outside educational activities and hand sanitization (45% and 52%, respectively). Multivariate analyses revealed that the compliance with most gestures was significantly higher in teaching rooms than in hallways and restaurants, and during exam sessions. The compliance with physical distancing was significantly higher (from 66%) in auditoriums, where students had to remain seated, than during practical works that allowed or required free movement. Therefore, the compliance with barrier gestures was associated with contextual settings, which should be considered when communicating and managing barrier gestures.

Keywords: COVID-19; Pandemic; Observational survey; University; Barrier Gestures

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## BeeTools: towards biosecurity measures in beekeeping

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The emergence of honeybee new pathogens, along with the increased drug resistance and contamination of hive products, represents an important threat to the development of the beekeeping sector in Europe. The implementation of Good Beekeeping Practices (GBPs) and Biosecurity Measures in Beekeeping (BMBs) plays an essential role in supporting honeybee health. GBPs are a pre-requisite to the use of BMBs in day-to-day apiary management. BMBs are all those operational activities implemented by the beekeeper in controlling the risk of the introduction and spread of specific honey bee disease agents. Importantly, in cattle biosecurity preventive measures to avoid contact between wild/feral and bred animals in managed areas is crucial. In beekeeping, as bees forage around the hive in a range of 3 to 5 km, honeybees are inevitably in contact with other domesticated and wild bees and with environmental contaminants. In a perspective of improving BMBs, two tools have been designed and made available for the beekeepers i- Bee Best Check tool: to estimate the current GBPs of the participant beekeeper and improve it and ii- Bee Tox Check: to estimate the potential toxicity of the foundation wax to honeybees. The often-observed absence or limited implementation of biosecurity measures in GBPs is generally due to insufficient knowledge of risk factors, motivation and training. The tools have been designed with an educational and informative purpose, in addition to being a risk assessment tool.

Keywords: honey bee; good beekeeping practices (gbp); biosecurity measures in beekeeping (bmb); bee best check tool; bee tox check tool.

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## Good Management Practices including Biosecurity in Meliponiculture: An overview in Latin America, especially in Ecuador

Joseline Sofía Ocaña-Cabrera\*, Sarah Martín-Solano, Claude Saegerman

The global economic value of pollination services amounts to 153 billion euros, representing 9.5% of the total value of agricultural production for human consumption. 70% of this crops depends on pollination, mainly by bees. Stingless bees beekeeping (meliponiculture) is an activity used in sustainable agricultural systems and enables wildlife conservation, also. Bee populations decline, including stingless bee species, will have a great impact on economy, food security, human health and ecosystem stability. Therefore, the aim of this work was to collect information on the management of stingless bee nests in order to establish guidelines on Good Meliponiculture Practices. An online questionnaire was developed in KoboToolbox free software, it included 36 questions organized in four sections (socio-demographics, nest and product management, nest origin, division and infrastructure of the farm, sanitary and environmental aspects). The complete survey was available from 23/03/2022, in two languages: Spanish and Portuguese. The target audience was meliponiculturists with experience in managing at least one nest of any stingless bee species, from Latin America, especially Ecuador. Responses were obtained from 14 countries, mostly Ecuador (24%). The main interest in this activity was the conservation (92%) of biodiversity in general. More than 50% of questions on biosecurity were answered positively, farmers practice biosecurity. Hand washing, prior to any activity with bees, was the main rule. Followed by sterilization of the material coming into contact with the nest and the use of personal protective equipment. Despite this, risks as: nest invasions (72%), nearby pollution sources (60%), unusual symptoms (43%), need to be addressed to ensure best management practices including biosecurity in meliponiculture. We are committed to environmental education as the main tool to raise awareness among producers.

Keywords: stingless bee; meliponiculture; good beekeeping practices (gbp); biosecurity measures in beekeeping (bmb); Ecuador

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## What is your perception of biosecurity and disease spread in animals? Preliminary results from a survey to the general public

Lidiia Moskalenko\*, Maria Costa, and Giovanna Ciaravino, on behalf of WG2

WG2 launched a survey for consumers (general public) to assess their perception of biosecurity and the role they could play in disease spread. The survey was initially launched in English in late August 2022, subsequently launched in 20 additional languages, and closed in mid-January 2023. Only survey translations with more than 30 responses were analysed (n= 15). In total, 969 consumers living in 37 countries worldwide answered the survey, all of them “did not work or had worked in or with the livestock sector” (inclusion criteria). Respondents were mostly female (64.5%), on average  $42 \pm 13.8$  years old, and 86.3% “never had or were having any training or education in livestock animal health or animal production”. About 60.7% of consumers lived in urban areas, 16.3% in suburban areas, and 22.0% in rural areas. Of all respondents, 60.3% did not live close by or regularly visited areas which have livestock. Around half of respondents (47.2%) heard about “biosecurity” before, but were not sure what it means, while 28.3% had never heard it before. When asked how much they agreed (in a scale of 0-10 – completely disagree to completely agree) with the statements: “Infectious disease has negative consequences for livestock”, “disease can spread from animals to humans” and “disease can spread from humans to animals”, respondents scored on average  $8.2 \pm 2.76$ ,  $8.1 \pm 2.36$ , and  $6.5 \pm 3.03$ . Finally, 71.7% of respondents “do not wash their hands or do so after contacting with animals (pets or livestock) on a farm or other locations” (Figure1). Based on these data, the general public is unsure about the meaning of biosecurity and unaware of the possibility of them spreading disease to animals. However, consumers were mindful of the potential to spread disease from animals to humans. This work will be used to prepare semi-structured interviews and forthcoming participatory actions with consumers.

Keywords: survey; general public; biosecurity awareness; disease spread; perception

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## Assessment of implementation of biosecurity measures in livestock farms in three regions of Kosovo

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Biosecurity is a multicomponent procedure that encompasses risk analysis and management strategies relevant to human, animal and plant life, as well as risk assessment related to the environment.

The aim of this research was to assess verified data related to biosecurity measures that are implemented by farmers in cattle, sheep and goat farms in Kosovo. Knowledge of a farm's biosecurity level is required to evaluate if and where improvement is needed, and it is useful for future animal disease risk assessments. The level of implementation of biosecurity measures in livestock farms directly affects food safety and quality.

A total of 36 farms from three regions of Kosovo, Pristina, Ferizaj and Peja were included in this research. A questionnaire consisting of one open-ended question and 29 closed questions was administered directly to farmers, and the current on-farm situation was observed by the investigators. Based on the collected results, 86% of farms were multi-species livestock farms, 8% were sheep farms, and 6% were goat farms. Among all the farms visited, 67% of them operated with a combined system, 28% with a closed system and only 5% operated with an open system. The vast majority of participants (81%) declared that they did not have sufficient knowledge about the term biosecurity, whereas 11% of them were moderately familiar with the term biosecurity and only 8% of them were quite familiar with the term. Out of all respondents, 83% reported that their animals go through a veterinary health check only when necessary. Other biosecurity measures which were applied less frequently included: showering before entering the farm, specific clothing and shoes for visitors, animal quarantine, and systematic plan for insect and rodent control. Farmers admitted that there is room for improving the level of biosecurity on their farms, but indicated the need for practical information and financial support from local institutions. We conclude that routine integration of biosecurity measures is not demonstrated by most local farmers in their management practices and that the level of biosecurity in Kosovo has a tremendous opportunity to be improved.

Keywords: on-farm biosecurity, cattle, sheep, goats, food safety and public health

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## Enzootic abortion as a leading cause of abortion in sheep and goat in Kosovo

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Enzootic abortion of ewes is an important zoonotic disease that is responsible for a broad spectrum of diseases in animals and humans, causing significant harm and economic losses in the sheep and goat industries. *Chlamydophila abortus* causes a series of reproductive disorders in ruminants, including abortions, premature births, and stillbirths. A zoonotic potential is well described, ranging from subclinical cases to influenza-like symptoms, as well as placentitis and abortions in pregnant women.

This study highlights the enzootic abortion of ewes as a leading infectious cause of abortions in small ruminants in Kosovo

Between December 2015 and January 2021, a total of 377 serum samples and 10 vaginal swabs-placenta (312 sheep and 75 goats) from 28 farms in 10 municipalities were submitted for the determination of the cause of abortions. Samples were submitted to the Kosovo Food and Veterinary Laboratory. Serum samples were tested for antibodies against *Chlamydophila abortus* with ELISA (IDEXX Chlamydiosis Total Ab Test). Vaginal swabs or placenta when available were tested by real-time PCR with a set of primer/probes described in Pantchev et al 2009; Gutierrez et al., 2012.

19 out of 22 farms had at least one positive animal for antibodies against *Chlamydophila abortus*. In total, out 377 serum samples tested, 167 were positive for antibodies. 5 out of 10 vaginal swabs, placenta or aborted foetus that were available, were positive by means of real-time PCR for *Chlamydophila abortus*. The presence of antibodies, as well as confirmation of *Chlamydophila abortus* by real-time PCR, suggest that enzootic abortion of ewes is the leading infectious cause of abortion in small ruminants in Kosovo.

There is a need for an information campaign for farmers with regard to the measures to be taken in order to mitigate the risk of abortion, in particular the enzootic abortion of ewes. Vaccination could reduce the number of enzootic abortions and is also known to reduce the number of abortions in latently infected ewes. We recommend raising farmers' awareness of biosecurity. It is important that the cause of abortion be identified by sending samples to the lab for analysis. Once the cause of abortion is known, a preventative approach must be taken in advance of the next breeding season.

Keywords: *Chlamydo filia abortus*, sheep, goat, blood samples, Kosovo

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## Biosecurity quantification tools for conventional indoor and free-range poultry

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In today's intensive poultry farming, disease prevention programs will be effective only with the correct implementation of biosecurity measures. Biosecurity quantification tools allow better understanding of the relationship between farm biosecurity levels and farm characteristics like, animal health, antimicrobial usage and production performance. In this study a weighted risk-based scoring tool was developed to measure biosecurity in breeder, turkey, duck, free-range layer and free-range broiler production. Questionnaires were drafted regarding the implemented biosecurity measures and questions were grouped into sub-categories. Answers to questions get converted to scores ranging from 0 (total lack of biosecurity) to 100 (full application of biosecurity) (Table 1). All questions and the different sub-categories were weighed and scored by an expert panel depending on the importance of the biosecurity measure. The score per question and subcategory scores were multiplied by the respective weighting factors. The scores for external and internal biosecurity were obtained by taking the weighted averages of all subcategories included and the total farm biosecurity score is the sum of external and internal biosecurity. Biosecurity levels were measured in poultry farms part of the Netpoulsafe consortium. Breeder farms of Belgium (n=3) (69% vs 74%) scored lower for external than internal biosecurity whereas in Netherlands (n=3) (85% vs 83%) and Hungary (n=2) (85% vs 83%) and in tested duck farms (n=5) (75% vs 61%) it was vice versa. Free-range layer farms of Netherlands (n=4) had better internal biosecurity scores (71% vs 74%). The free online accessibility of the Biocheck.Ugent (<https://biocheckgent.com/ent>) tool has allowed worldwide usage and from its launch in August 2022 the tool is used in many countries, e.g. turkey farms of Finland (n=6) (66% vs 84%) and Sweden (n=9) (64% vs 84%), and breeder farms of Finland (n=33) (74% vs 80%) had better internal biosecurity scores. The scoring system allows a standardized way of evaluating biosecurity, allows benchmarking the farms and in providing farm-specific advice for improvements.

Keywords: Biocheck ugent; biosecurity; netpoulsafe; poultry; scores

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## Modelling indirect transmission between wildlife and cattle to improve biosecurity

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The implementation of biosecurity measures against environmentally resistant multi-host pathogens is a challenge in extensive farming. Tuberculosis, for example, can circulate in wildlife and be transmitted to livestock, mainly by indirect contact. In extensive farming systems, water and feeding points are locations where indirect wildlife-livestock tuberculosis transmission can occur and, therefore, are usually the target of biosecurity measures. This work aims to develop a quantitative risk analysis model for the indirect transmission of pathogens between wildlife and cattle to assess the impact of biosecurity measures on risk points.

This stochastic model has been programmed in R and uses probability distributions to describe parameter uncertainty. It uses questionnaires to collect farm-level data on biosecurity and other farm characteristics (e.g. water points). It also interpolates geographical information to estimate wild host density and disease prevalence in the farm region. This input is used to calculate the probability distribution of the time between the visit of an infected wild host to the water point and the visit of susceptible livestock. The probability that the pathogen is infectious at the time of the indirect contact and the probability that cattle are infected as a result of such contact are estimated using survival and transmissibility information from the literature.

Modelling the risk of disease introduction through wildlife interactions addresses the specific need for feasible and effective biosecurity plans adapted to the extensive farm context. Limitations include estimating pathogen prevalence in wildlife and visit frequency from fragmented data. However, the aim is to balance complexity and applicability for useful biosecurity assessments. This model will be extended to other risk points, pathogens and animal species, being part of a general biosecurity assessment model to improve risk management. It will be tested on real farms and used to support biosecurity decision-making.

Keywords: Biosecurity assessment, wildlife-livestock interaction, quantitative risk assessment, modelling

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## Biosecurity measures and practices during cattle transport in Spain

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Live animal transport can be a pathway for the transmission of pathogens, but despite this, there are not many studies on the subject. Given the above, the objective of this study was to characterise which are the most common practices and biosecurity measures implemented by cattle transport drivers. The main topics covered within the survey were characteristics of travels (e.g., frequency, types of animals transported, and destination), practices during the loading and unloading of animals, and cleaning and disinfection procedures during (and after) transport. A total of 82 participants were enrolled via various means, including personal contacts and snowball sampling. The drivers were recruited at slaughterhouses, public vehicle washing centres or livestock markets. Interviews were conducted face-to-face (N=26) or by telephone (N=56). The interviewed drivers were from nine Spanish Autonomous Communities, 52% of them reported working with beef and dairy farms indistinctly, while 48% only with one type of farm. The majority of drivers (78%) could load animals from different farms during the same trip, and 55% usually make more than one trip per day. Only 23% of the drivers reported making international travels. Most of them (66%) reported that the mean duration of a single trip varied between one and four hours, and 26% reported lasting more than four hours. During the loading and unloading of animals, 61% entered the farmyard where the animals were kept and 56% had contact with animals from the farm. When cleaning the vehicle, 57% of the drivers used detergent and disinfectant, while 32% only disinfectant. As the next step, the study will be complemented by in-depth interviewing with cattle transport drivers to obtain information on some barriers to the implementation of biosecurity measures.

Keywords: Biosecurity; Cattle; Transport; Truck drivers.

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# Evaluating Biosecurity of Finnish Broiler Production with Biocheck.UGent®

Ina Toppari \*

Highly Pathogenic Avian Influenza (HPAI) was detected in Finland for the first time in 2016 in wild birds. In 202, the first and only case of HPAI in poultry occurred on a pheasant farm. Although biosecurity was believed to be well managed in commercial poultry farms, it was important to find out its actual level using a measurable method. In addition, it was necessary to be able to give personal advice to farmers, because not everybody can be reached by training in form of written instructions or lectures.

The Finnish Ministry of Agriculture and Forestry financed in 2022 a project to evaluate the biosecurity on broiler farms with the Biocheck.UGent method. The Tarikko-project was managed by Animal Health ETT. All 181 Finnish conventional broiler farms and 90 % of the parent stock farms were visited. Some additional, more specific questions relating rodent control, protection of feed etc. were asked.

The results showed that the biosecurity is at a good level in the broiler production. However, almost every farm had some details to develop. The most common development proposals concerned structure of the hygiene barrier, pest control as well as cleaning and disinfection during the break between batches. Mostly, the variation in the results between the farms was not very large. This can partially be explained by the strict contract production, where the same rules apply to every farm. In international comparison, Finnish farms scored in most areas better than the world average. Even the worse result in purchase of day-old chicks (DOC) due to the lack of disinfection of the transport vehicles between the batches of the same hatch day cannot be considered a significant risk in the current poultry health situation in Finland.

Two other projects are running to evaluate the biosecurity of turkey and laying hen farms.

Figure 1. External and Internal Biosecurity in Finnish Broiler Farms.



Keywords: biosecurity, broiler

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# Evaluating Biosecurity of Finnish Swine Farms with Biocheck.UGent®

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Sikava<sup>1</sup> is a health classification register founded 20 years ago for swine farms in Finland. Sikava covers over 95 % of commercial pig production in Finland. In the Sikava system herd veterinarians visit pig farms regularly and several times per year depending on herd size and production type. On farm visits several observations of swine health, welfare, housing conditions and biosecurity are made by vets and recorded in the database. Every year a herd-specific health plan is updated. In 2019 Biocheck -evaluations were added to the Sikava health management scheme, in order to improve biosecurity in commercial swine herds. Since 2021 the evaluation has been required to be done every 12 months.

## Materials and methods

Biocheck.UGent® system<sup>2</sup> is a risk-based questionnaire on most important biosecurity measures. Each question and subcategory have weighed scoring. Results are expressed in two categories, external and internal biosecurity. The questionnaire is integrated into the Sikava online register by a licence. The biosecurity measures which need improvement are recorded in the health management plan. Herd vets are trained to do Biocheck audits in order to increase the uniformity of the readings. The slaughterhouses can access the audit results of their client farms and the national reference values.

The number of surveys done and results from Finland were gathered from Sikava, and the results of other countries was gathered from the Biocheck.UGent® webpage.<sup>3</sup>

## Results

Biosecurity results in pig farms in Finland during the years 2019-2022 were evaluated (graph 1). The results have slightly improved each year. Results of 13 037 audits from other countries are presented on the UGent webpages<sup>3</sup>.

## Discussion

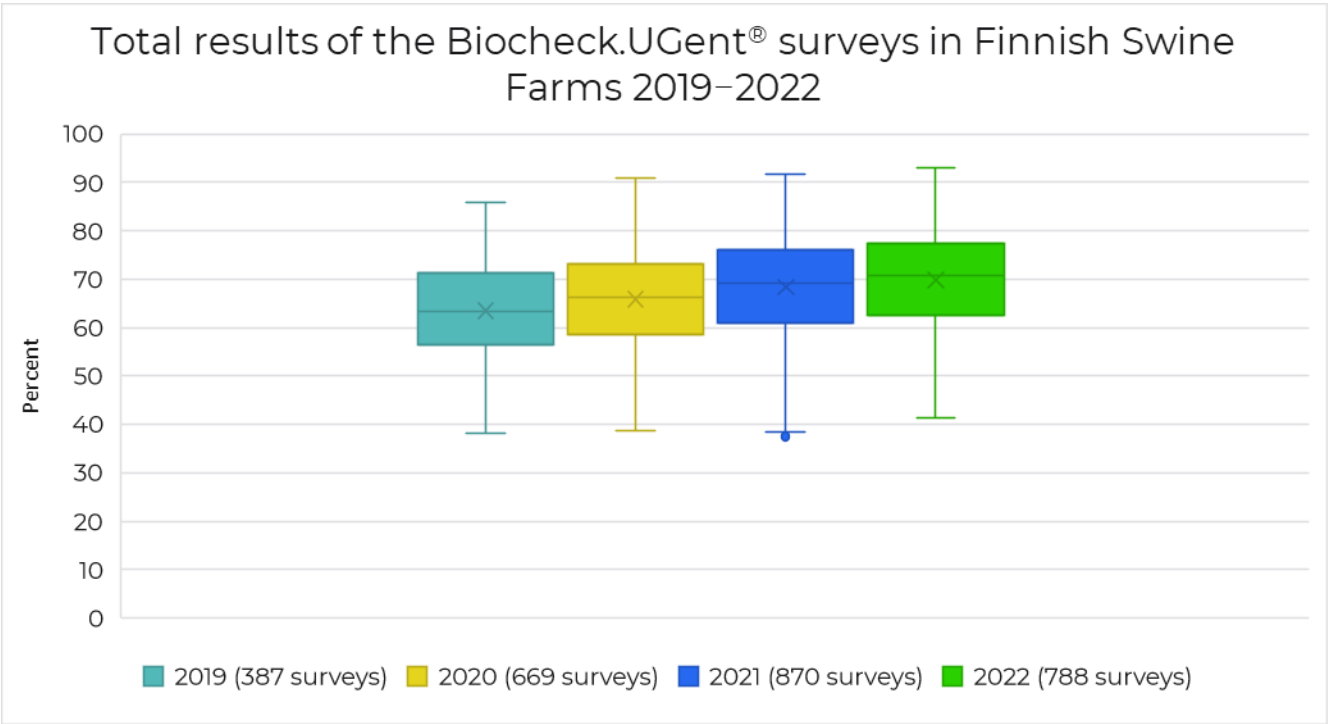
Biocheck.UGent survey is an efficient tool to improve biosecurity on swine farms. Trends and deviation can be shown with graphs. To ensure similar interpretations on audit visits and provide comparable data, training to do these visits and discussions on interpretations is very important.

Fig. 1. Total results of Biocheck surveys in Finnish Swine farms in 2019–2022

<sup>1</sup> Sikava. <https://www.sikava.fi/PublicContent/IntroductionInEnglish>. 18.1.2023

<sup>2</sup> Biocheck.UGent®. <https://biocheckgent.com/en>. 18.1.2023.

<sup>3</sup> Biocheck Worldwide. <https://biocheckgent.com/en/worldwide>. 20.1.2023



Keywords: Biocheck.UGent, Swine, biosecurity

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## Comparison Of Different Methods Of Biosecurity Of A Mink Farm On The Example Of Two Ukrainian Farms

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In the conditions of the spread of dangerous mink diseases in Ukraine, in particular the Aleutian mink disease (AMD), the farm's preservation is the producer's responsibility. The main means of achieving the goal are a proper biosecurity system.

The most problematic aspects in this regard are: admission to the territory of the farm and to the production building, organization of sanitary treatment of personnel; organization of sanitary treatment of transports and mink houses.

The comparison of biosecurity measures was carried out on the basis of two almost identical farms in the territory of Ukraine (the names are not announced for ethical reasons). There were about 100,000 animals.

On the first farm (hereinafter farm A) there was a classic option for visitors and workers to pass. A regular disinfection mat at the entrance to each buildings, the fixation of vehicles arriving at the farm and visitors, as well as a disinfection room and quarantine of newly arrived animals. The second farm (hereafter Farm B) was the same, except for the sanitary pass, which was divided into a clean and a dirty area. To determine which system works better, an indicator was taken, which was based on the mortality of animals from diseases transmitted by airborne, contact, or fecal-oral diseases. On-farm "A" it ranged from 45% to 57%, and on-farm "B" - from 23% to 36%. By comparing these data, advice can be given to farm A that it would be better for the farm to implement a variation of the sanitary pass with a clean and a dirty zone; more carefully process all cars entering the territory; disinfect the premises of the farm more often. This will help avoid a high percentage of mortality and preserve the herd.

Keywords: Biosecurity, mink production, mink disease, zoonoses, farm biosecurity, animal husbandry.

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## Biosecurity Education in the Department of Veterinary Sciences (Turin University): development and rationale

Annalisa SCOLLO; Alessandro MANNELLI; Mariateresa CAPUCCHIO; Daniele DE MENEGHI\*

Biosecurity is a set of structural, logistical-managerial, behavioural measures aimed to minimize the risk of introduction, establishment, and spread of disease-causing agents in animal/human populations. Major challenges for today's international livestock community are to find effective ways to raise awareness among veterinarians and farm personnel about their responsibility on the topic. This abstract describes the development of a higher-education approach adopted by the Dept. Veterinary Sciences, Turin University (DVS\_UNITO). The education system adopted relies on a tailored methodology synergizing train-the-trainers methods, students training, information sharing and gap-analysis. A sustainable training system was achieved by creating a Biosecurity Committee and implementing train-the-trainers courses to allow a cascade training output. DVS\_UNITO personnel (researchers and technicians) were trained by qualified trainers - selected by the Biosecurity Committee- through a series of step-wise theoretical-practical courses, followed by a final exam, aimed to state-of-the art learning objectives. All aspects of biosecurity management were covered under different perspectives (technical, policy, legal, including professional risks at work). Afterwards students are taught both by professors and trained personnel; an interactive approach was adopted with frontal lessons (ppt., videos) and practical exercises (brainstorming, case-study analysis, group-work) to ensure a fruitful ideas exchange, expertise sharing and best practices. E-learning modules were also delivered through Moodle, housing educational material, e-libraries, Manual of Best practices/Biosecurity Guidelines([https://veteren.campusnet.unito.it/do/home.pl/View?doc=/department/END108\\_Operating\\_manuals.html](https://veteren.campusnet.unito.it/do/home.pl/View?doc=/department/END108_Operating_manuals.html)).

Further activities carried out were: review of internal and external signage with specific risks on-farm sessions led by selected biosecurity trainers, gap analysis of the teaching-farm, microbiological risk monitoring of necropsy room, surgery and isolation units, and knowledge disseminating initiatives with stakeholders.

Basing on their experience, the authors suggest to apply a participatory approach in similar training initiatives. As such methodology requires time, patience and understanding of mutual needs, it's necessary to devote efforts and energy -especially at the project beginning- to guarantee effectiveness and sustainability.

Keywords: Biosecurity; integrated training methodology; sustainability

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## First quantification of farm biosecurity in Greece: data from three sheep farms

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Despite the emergence of farm biosecurity as an important topic in research and farm management of livestock worldwide, there is still very few research conducted focusing on biosecurity in small ruminants. In Greece, where small ruminants represent the most important species in livestock production, the development and description of biosecurity standards specific for small ruminant farms can be a starting point to ensure the health and welfare of animals and to increase the commercialisation of their products. Aiming for a first quantification of the level of biosecurity in small ruminant farms in Greece, the Biocheck.Ugent® tool for cattle was employed, given the similarities that exist between ruminant species. The tool was used during face-to-face interviews, which were performed at the time of visits in, so far, three medium-sized intensive dairy sheep farms (average number of lactating ewes (N)= 200) in December 2022. This set of farms was selected at this point as being representative of an average sheep farm in the country, based on previous visits. Although some positive points were identified (e.g. no contact with animals from other farms, no other species reared at the farm), the level of biosecurity quantified at the three farms was overall medium to low (see Table1). For both internal and external biosecurity, there is considerable room for improvement, with various points being poorly implemented (e.g. working lines per age, carcass management, cleaning and disinfection). These results highlight the need for a tool that is specifically tailored for small ruminants, to address the particularities of their production. The use of the tool should be extended to a larger number of farms, to provide a fuller view of the biosecurity level of Greek small ruminant farms. The latter will be conducted within the framework of the Biosecurity in Small Ruminant Farms in Greece (BIOSMARF) pilot project.

Keywords: Biosecurity, sheep, small ruminants, quantification

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## Biosecurity measures on the broilers and breeders' farms in Serbia

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Poultry production can be a source of different food-borne pathogens, zoonotic diseases, and antimicrobial resistance transmission. The prerequisite in maintaining disease-free flocks is the implementation of biosecurity measures, external and internal, and regular evaluation of existing biosecurity measures.

In this study, an assessment of biosecurity measures was done on 7 broiler farms and 4 breeders' farms. Scoring was performed using the biosecurity scoring system Biocheck.UGent™. According to the results, subtotal external biosecurity scores on broilers' farms ranged from 53 % to 93 %, with an average score of  $75.86 \pm 16.43$  %, and on breeders' farms ranged from 60 % to 87 %, with an average score of  $77.25 \pm 12.82$  %. Within external parameters for biosecurity of broiler farms, the lowest score (35 %) was obtained for depopulation of the stables which happens in a few steps on some farms, and on breeders' farms, the lowest score (31 %) was obtained for the organization of the farm and supply of material on one farm. Also, a lower score (37 %) had some farms for the supply and storage of feed, as well as for manipulation with drinking water. Among other external parameters, noteworthy results were obtained for the manure removal solution on both types of production (three farms have scores of 100 %). Some farms have great locations, but some of them are at high risk of infection. Subtotal internal biosecurity scores on the broiler's farms ranged from 39 % to 98 %, with an average score of  $75.14 \pm 25.26$  %, and the breeders' farms ranged from 72 % to 91 %, with an average score of  $83 \pm 9.13$  %. The average level differences between both external and internal biosecurity were not significant ( $p = 0.951$  for broiler;  $p = 0.4924$  for breeder). On the broiler farms, the level of compliance with external biosecurity within farms was 78.34 % and for internal biosecurity within farms was 66.38 %. On the breeders' farms, the level of compliance with external biosecurity within farms was 83.41 % and for internal biosecurity within farms was 89.01 %. There are no significant differences between subtotal external broilers and breeders' farms ( $p = 0.5704$ ), and subtotal internal biosecurity scores between broilers and breeders' farms ( $p = 0.5704$ ). Compared to the world scores obtained from Biochek.UGent online surveys database the results of the external scores for some broiler farms were higher, but the results of internal scores were lower for most of the farms, but for breeders' farm situation is better.

This study showed that there is a lot of space for improvement in the biosecurity protocols on both, broilers' and breeders' farms.

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## A systematic approach for quantifying biosecurity measures in aquaculture

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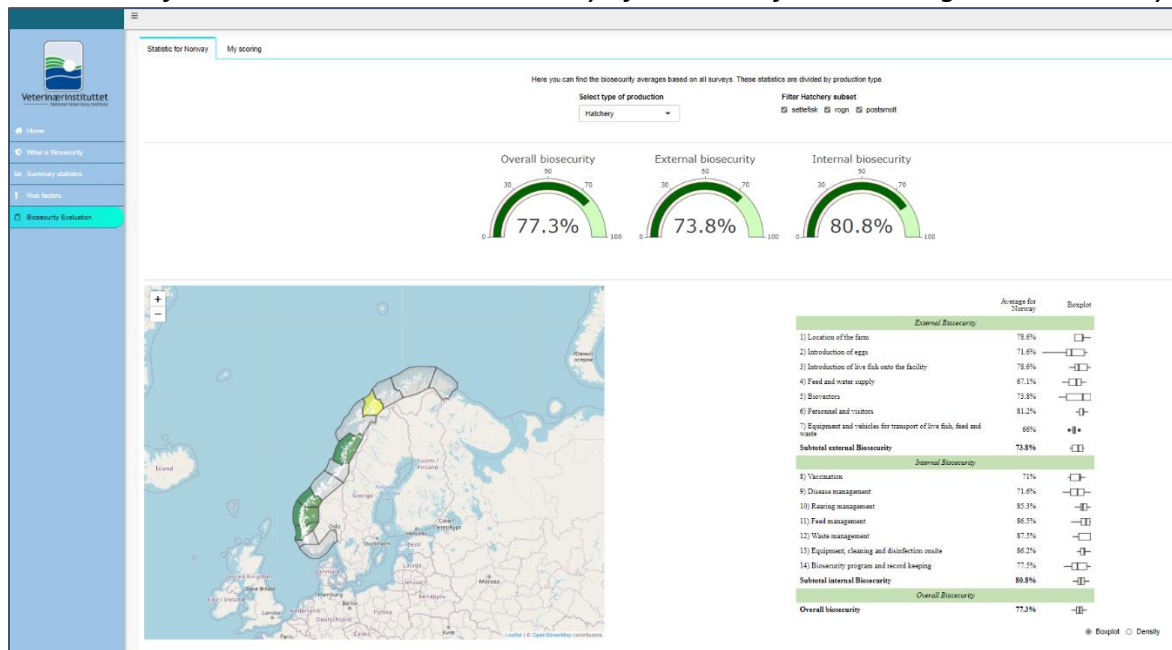
The study aims to create a system to quantify the risk of pathogen introduction and spread on basis of farm management and biosecurity practices for Mediterranean Seabass and Seabream farms (Tavoranpanich, S. et al. 2020). The same systematic approach has been applied for Atlantic salmon farms in Norway. This system is then developed to be a farmer self-assessment tool with a user friendly automate dashboard containing the functionalities so that the farmers interested in an objective evaluation of their farm or regional biosecurity can have a secure access of their own information.

We first map existing biosecurity routines, identify critical control points and control measures using HACCP and Risk Assessment approaches. This step involves discussion with subject experts on current production system, lay out sequential production flow throughout the chain of production and identify transmission routes and actions that have potential for disease introduction and spread. *Second step* is data collection and acquisition through digital/in-person survey on farm management, rearing management, health monitoring, disease detection and reporting, diagnostic capacity, and biosecurity and record keeping. *Third*, a risk-based, weighted scoring system to measure farm biosecurity based on Biocheck.Ugent™ (<https://www.biocheck.ugent.be>) was used. Algorithms for quantifying biosecurity measures and risk estimates were integrated with the survey data into an interactive web-based platform for users to have a secure access of their biosecurity level, and a presentation of the overall risk of a region through a map.

The system helps farmers to identify gaps and weaknesses in biosecurity plan, allocate resources and tailor biosecurity programme to fit the risk profile of their farms, compare with an average of the biosecurity scores obtained by neighbouring farms, so that the owners can benchmark their biosecurity and evaluate the risk profile of the region. The system is now being developed for fresh-water rearing species including productions of tilapia and rainbow trout.



Figure. Dashboard- the interactive digital platform including analytical functionalities for evaluation of internal and external biosecurity of individual farms and regional biosecurity



Keywords: Aquaculture, Seabass, Seabream, Atlantic salmon, Biosecurity measures

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## Biosecurity in poultry farms: from assessment to improvement, using a diversity of approaches and targeting a diversity of actors

Mattias Delpont\*, Sophie, Planchand, Oksana Saccavini, Chloé Chavoix, Lisa Fourtune, Jean-Luc Guérin, Mathilde C. Paul

The IHAP research unit from Ecole Nationale Vétérinaire de Toulouse (ENVT) and INRAE has developed an expertise in the domain of biosecurity in poultry farms, in the framework of various projects.

The main components of biosecurity compliance are addressed by our past, current and upcoming projects, with regards to biosecurity assessment, the exploration of the determinants of biosecurity compliance and the evaluation of interventions aiming at improving compliance.

Our projects address local and global issues related to poultry farming, such as the challenges faced by the increasing popularity for free-range and small-scale farming, sometimes in territories with a high density in poultry farms, or including species with a high risk of Highly Pathogenic Avian Influenza dissemination (waterfowl).

Also, we expand our approach of biosecurity further than solely the farm and the farmer, by considering biosecurity practices from other operators such as poultry catchers or at a regional scale (multi-actor approach, in a given territory).

Currently, apart from our activities at the regional and national scale (AI-TRACK, Chair for avian biosecurity, Chair for avian biosecurity and health) our research unit is involved in various projects conducted at the European level: NetPoulSafe (2020-2023), BETTER COST-Action CA20103 (2021-2025) and BioSecure (2023-2026). These European projects involve research as well as experience-sharing on biosecurity compliance, biosecurity assessment methods, the evaluation of the benefits of biosecurity and the description and the test of supportive measures to improve compliance.

Keywords: Compliance, perception, catcher, free-range, duck, psycho-social, intervention, small-scale, veterinarians, farmer

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# Is There an Association Between Biosecurity and Antimicrobial Usage in Food Animals?

Pankaj Dhaka\*, Jeroen Dewulf, Deepthi Vijay, J.S. Bedi, Iryna Makovska, Evelien Biebaut and Ilias Chantziaras

Limited and judicious antimicrobial usage (AMU) remains key to retain the efficacy of human and veterinary medicine. Presented with limited alternatives for antimicrobials, farm biosecurity is considered a promising tool to mitigate the non-judicious AMU. This scoping review aims to analyse the associations between farm biosecurity and AMU in livestock systems and to formulate recommendations. Peer-reviewed manuscripts published between 2001-2022 were analyzed by means of the PRISMA framework using PubMed, Scopus and Science Direct databases. Twenty-five studies assessed the effect of farm biosecurity (or management practices) on AMU at the herd/farm level in (semi-)quantitative terms. These studies were carried out in 16 countries, of which 72% (18/25) were from 11 European countries. The highest number of studies were carried out in pig farms (n=13), followed by poultry (broiler/layer) farms (n=7), cattle farms (n=3), turkey farms (n=1), and one combined study on pig and poultry farms. The majority were cross-sectional [72% (18/25)], six were longitudinal and one was an intervention-based study. A complex interaction was observed among various factors influencing AMU, i.e., biosecurity measures, farm characteristics, farmers' attitudes, availability of animal health services, stewardship etc. Quantitative estimations of farm biosecurity parameters and AMU were mostly from the European region highlighting the awareness among stakeholders and the establishment of robust surveillance systems. A positive association between farm biosecurity and reduction in AMU was observed in 48% (12/25) of the studies and 20% (5/25) showed that improvement in farm management practices was associated with a reduction in AMU. Two studies highlighted that coaching and awareness among farmers may lead to reduction in AMU, and a single study on economic assessment established biosecurity practices as a cost-effective way to reduce AMU. Five studies (20%) showed an uncertain or spurious association between farm biosecurity and AMU. We propose that the estimation of AMU should be an integral part of farm biosecurity or Herd Health Management programs.

Keywords: Antimicrobial usage; Cattle; Farm Biosecurity; Herd Health; Pigs; Poultry

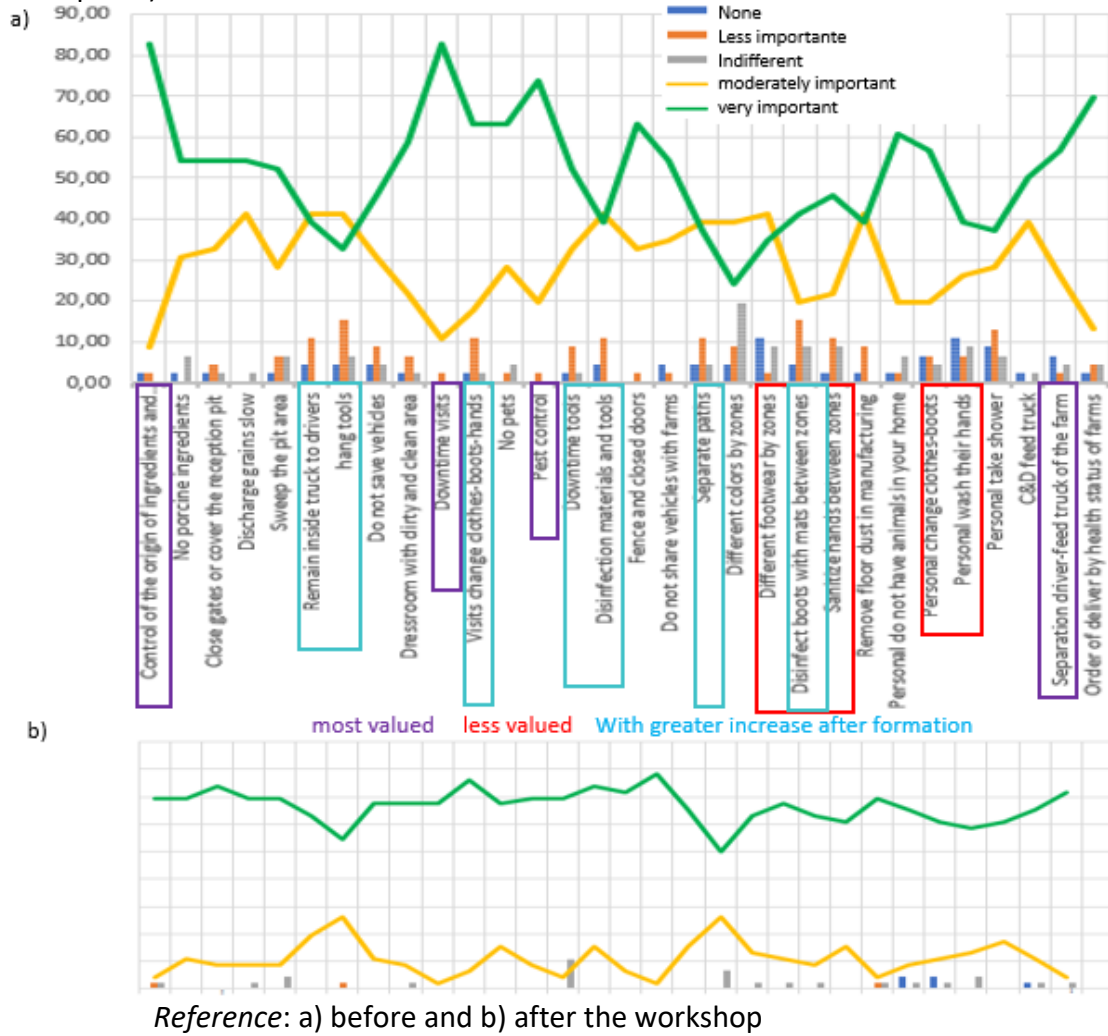
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## Perception Of Workers And Veterinarians On Biosecurity In Argentinean Feed Mill And Training Effect

Alarcón Laura Valeria\*, Lambert Damián, Ortega Emanuel, Benito Lucila.

Current scientific evidence is growing in relation to ingredients and feed as vectors of disease transmission between farms and countries. This has set in motion the implementation of biosecurity measures in feed mill (FM). For this, it has been suggested to increase awareness about biosecurity and disease prevention in workers and veterinarians, through awareness and training adapted to the educational level. In October 2022, 46 workers from 15 FM completed a questionnaire with questions about age, level of training, years of work experience and the perception of 30 biosecurity measures, using an importance scale (0 to 5). This individual questionnaire and working in five discussion groups with illustrated material (posters and stickers) on the risks of introduction and spread of pathogens and biosecurity in FM, were made before and after receiving 30 minutes of training. Then, the construction of generalized linear models with Poisson distribution was carried out to analyze the data with the R software (glm package). Where the sum of the scores awarded to each measure was related to the personal and educational characteristics. In the figure the most and least valued measures can be observed, as well as those that presented a greater interest post-training. The average perception of biosecurity is 21.4% lower before training, and at this stage, for each year of increase in age, the perception increases by 0.42%. Before the training, people with primary level have 24.36% less perception of the importance of the measures, but after training only people with secondary studies value the biosecurity less by 11.44% and with each year older, 0.57% less. Years of experience did not show differences. Awareness and training on disease transmission with discussion workshops with illustrated materials is an effective tool to improve the perception of biosecurity in people with different educational levels and age groups.

**Figure:** Perception of biosecurity measures, through an ordinal scale of importance. (x-axis: biosecurity measures of feed mill, y-axis: sum of the scores awarded (0 to 5) by the 46 participants)



Keywords: Training of biosecurity, feed mill, perception of risk, education tools, awareness.

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# Quantification of the application of cleaning and disinfection measures on pig farms in eight EU countries

Iryna Makovska\*, Ilias Chantziaras, Nele Caekebeke, Pankaj Dhaka, Jeroen Dewulf

Biosecurity measures are the key component to minimize the risk of introduction and spread of infectious agents. Cleaning and disinfection (C&D) procedures are a crucial component of internal biosecurity. The objectives of the present study were to quantify the application of C&D procedures on pig farms in Europe and to identify potential gaps.

Biocheck.UGent (<https://biocheckgent.com>) data from 7182 pig farms in 8 EU countries (Belgium, Finland, Ireland, Italy, Spain, Netherlands, Germany and Poland) were considered and parameters from the questionnaire that are of interest to C&D measures were selected.

Out of the targeted 7182 farms, 82% (n=5918) of the respondents reported the presence of a hygiene lock and use of it by visitors. In 82% (n= 5878) the disinfection baths/boot washers were present at the entrance of the farm. In 45% (n=3236) of the farms, there were no hand washing stations and/or hand disinfection equipment, and in 62% (n=4456), there were poor practice for boot cleaning and disinfection measures between compartments/units. In 71% (n=5063) of the farm's stables / compartments are said to be cleaned and disinfected following a proper procedure. The application of specific measures for the proper introduction of material was noted in 21% (n=1473). The protocol for C&D of equipment after their use was present in almost half the farms. Unfortunately, the efficacy of the cleaning and disinfection was validated (e.g. a hygienogram) in only 2% of the farms (n=154).

The present study pointed out that some aspects of C&D are already applied commonly on pig farms in European countries whereas others are still implemented poorly. In this regard further quantification of these parameters using the Biocheck.UGent survey can help farmers to identify these gaps and timely improvement so that they can minimize risks of introduction and spread of pathogenic agents.

Country	1	2	3	4	5	6	7	8	9	10	11	12
Belgium	83	87	89	37	24	20	55	73	96	78	87	3
Finland	83	78	57	29	11	17	32	44	89	41	55	0
Germany	91	61	71	48	17	17	52	91	74	65	57	0
Ireland	60	53	93	37	22	15	49	49	88	51	67	1
Italy	72	31	97	39	38	9	54	96	96	82	96	2
Netherlands	95	66	73	61	14	21	48	82	69	60	58	1
Poland	87	74	81	69	50	65	49	96	95	63	90	2
Spain	91	59	78	55	13	23	53	97	93	45	68	1

1. Presence of hygiene lock	7. Presence of protocol for the C&D of equipment
2. Presence of disinfection baths/boot washers at the entrance of the farm	8. Conducting C&D after each production cycle
3. Appropriate change of fluid of the disinfection baths	9. Long enough sanitary break
4. Presence of disinfection baths &/or boot washers between compartments/units	10. C&D of corridors and the loading area
5. Presence of hands washed and/or disinfected between compartments/units	11. Provided different stages in the C&D process
6. C&D measures taken for the introduction of material	12. Checking the efficacy of C&D

Keywords: Biocheck.UGent, Biosecurity, Cleaning, Disinfection, Pig farming

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## Impact of war in Ukraine at hunting grounds biosecurity

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The war in Ukraine, which started on February 24th, put in danger domestic livestock production by not only ruination of farms and disruptions of logistics chains, but also by weakening veterinary control along the food chain.

In Ukraine since 2012 over 300 thsd pigs have been culled to prevent the ASF spread. The total losses of the swine industry in Ukraine due to ASF are about 130 mln USD.

Most ASF outbreaks in Ukraine were reported in households and wild fauna (287 and 122 cases) Private companies were also affected due to lapses in biosecurity protocols (115 cases).

Currently, the risk of ASF outbreaks is higher in the regions that have been heavily affected by the ongoing war. Due to broken supply chains, animal products, including meat, are sold at illegal markets, being a potential source of the infection.

Main epidemiological risks are the wild fauna. The ban on hunting in the war time contributed to the growth of populations of wild animals while implementation of the control programs is challenging.

In ASF-infected areas, it is not possible to determine of virus present in boar. All hunted wild boar must therefore be treated as if they are infected, which means applying a complete set biosecurity measures during all hunting phases.

Developing a biosecurity protocols are the most efficient tool to identify gaps and improve biosecurity for hunting grounds. We suggest that biosecurity protocols are an essential part of awareness raising and will let to approach the biggest numbers of hunting grounds on ASF virus control.

Biosecurity protocols for hunting ground has include: wild boar transportation from the hunting spot to the dressing facility, dressing area requirements and equipment, the proper disposal of offal, safe on-site storage of hunted wild boar until an ASF-negative test result; procedures for the disposal of ASF-positive wild boar; procedures for cleansing and disinfecting facilities.

Keywords: Biosecurity, war in Ukraine, ASF, wild fauna, hunting ground, wild boar

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## Biosecurity In Cattle Breeding Of Ukraine

Oleksandr Verzhychovskiy\*, Vitalii Nedosekov.

Biosecurity is key element of any strategy for health management of animals. During the last decades in Ukraine, a lot of efficient actions and measures have been implemented to decrease the impact of infectious diseases due to the progress in particular epidemiology.

The main task of biosecurity in cattle of Ukraine is to decrease the risk of introduction and spread of infectious diseases with the main focus at prevention of pathogens introduction into animal environment with the result of animal health preservation, higher stability of animal production systems, lower level of veterinary medicines utilization and, as the result, higher productivity and economic efficiency of production system.

Despite of all the described advantages of efficient biosecurity measures, its current level on Ukrainian cattle farms is quite low, due to the next factors: insufficient level of awareness of the biosecurity, especially in households with low level of resource supply; lack of qualified biosecurity specialists in cattle breeding; fact that 64% of cattle is kept in private, non-industrialized households; and economic crisis and cattle farms destruction caused by Russian aggression in Ukraine.

In Ukraine biosecurity on cattle farms should include measures that can be implemented on the farm level to reduce risk of infectious diseases introduction and spread. All these measures should be separated on 5 groups: prevention of infectious agent entry to the farm/household; prevention of infectious agent spread within the farm; prevention of infectious agent spread to other farms/households; prevention of zoonosis spread to humans; prevention of infectious agent spread into the environment.

Despite the fact that during the last decades the biosecurity measures implementation has strengthened a lot, especially in highly intensive branches of animal husbandry, such as poultry, but we have to state that in cattle breeding the biosecurity level is still very low.

Keywords : Biosecurity, cattle, epidemiology, zoonosis

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# Assessment Of Biosecurity Measures In The Commercial (Industrial) Pig Farms In Serbia

Branislav Kureljušić\*, Božidar Savić, Bojan Milovanović, Jelena Maletić, Milan Ninković, Nemanja Jezdimirović, Jasna Prodanov Radulović

Biosecurity measures together with the efficient on-farm management embraces all aspects of the prevention of pathogens entering pig farms, regardless of structure and animal number. In the present study assessment of biosecurity measures in the commercial (industrial) pig farms in Serbia was carried out through application of the questionnaire to farm veterinarians.

To assess biosecurity in commercial (industrial) farms, a Biocheck online survey (<https://biocheckgent.com>) was conducted in the ten commercial pigs farms located in the Northern part of Serbia where industrial pig production is localized and the highest density of pig production can be found.

The results of the external biosecurity assessment showed a mean score of 75.55%, compared to the average in Serbia, which was 68.55%, and the global average of 73%. External biosecurity assessment showed the lowest scores for feed, water and equipment supply (47%). The assessment of internal biosecurity revealed a score of 54.89% compared to the national average of 44.22% and the world average of 64.11%. Regarding internal biosecurity, the lowest percentage score (37.22%) was confirmed for farrowing and suckling period and for finishing unit (37.67%). The overall biosecurity score for commercial pig farms included in this study was 65.55%. The national average was 56.33%, while the global average was 68.67%.

This study showed a bit less lower level of biosecurity measures in commercial pig farms in Serbia comparing with global average. Certainly, having in mind the different pig production systems in Serbia, there is urgent need to improve biosecurity in industrial farms. Serbia as a Western Balkan country, has variable pig farming system characterized by a domination of traditional family farms, smallholdings, backyard production and semi-free and free-range. Currently, traditional farming methods in Serbia represent a cultural identity. The biosecurity measures that could be implemented in existed animal production systems need to be urgently identified.

Keywords: biosecurity assessment, commercial (industrial) pig farms, Serbia

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What are the required supporting measures to improve the biosecurity of Spanish farms?

## What are the required supporting measures to improve the biosecurity of Spanish farms?

Aitor Devesa\*, Pablo Catalá-Gregori, Ramón Jové , Rubén Roca-Torrente , Artur Żbikowski , Karol Pawłowski 3 and Sandra Sevilla-Navarro

The H2020 Netpoulsafe project aims to improve biosecurity compliance on poultry farms through the compilation, validation and sharing of supporting measures (SM) in France, Belgium, Netherlands, Poland, Italy, Spain, and Hungary. One of the aims of this project is to collect successful and required SMs from the point of view of farmers, advisors and operators. In this context, a total of 24 questionnaires for farmers, 19 for advisors from different types and 8 for operators, were performed in Spain. Each questionnaire included 9 items with 23 SM options. For each SM option, two questions were asked to assess whether the SM have been successful or are required. Each SM was analysed and ranked by the percentage of "successful" and "required" responses. Only the results >40% of the required SM are reflected in this work. "Live workshops" (42%), "educational modules" (60%), "posters/banners/newsletters/leaflets" (48%), "biosecurity checks (audits) by stakeholders" (48%), "advisors coaching methods" (50%) and "financial support for biosecurity implementation" (92%) were found as a required SM for farmers. "Live workshops" (65%), "educational modules" (45%), contact support (farm visiting) by a biosecurity advisor (coach /vets)" (40%), "advisors coaching methods" (97%) and "financial support for biosecurity implementation" (95%) were found as a required SM for advisors. Only "financial support for biosecurity implementation" (75%) was found as a required SM for operators. Considering both farmers' and advisors' answers (also the comments collected from them), Spanish farmers require more individualized and preferably on-site theoretical and practical courses/workshops + audits/coaching. These SM will help Spanish farmers to identify their specific risk factors to find practical solutions to improve the biosecurity in their farms. Further, these SM will make them aware of the importance of the correct application of biosecurity measures and the impact on the farm economy. It is important to highlight that this should not be only applied to farmers but also to all farm workers.

Keywords: Biosecurity, supporting measures, audits, biosecurity trainings, coaching.

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