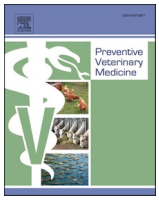
Preventive Veterinary Medicine 252 (2026) 106854

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed



National definitions and legal requirements for biosecurity on small-scale livestock farms in Europe

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https://doi.org/10.1016/j.prevetmed.2026.106854
Received 12 December 2025; Received in revised form 15 February 2026; Accepted 16 March 2026
Available online 19 March 2026

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ARTICLE INFO

Keywords:
Biosecurity
Legislation
Mapping
Risk-based policy

ABSTRACT

Small-scale livestock farms play an important role in food security and are often associated with lower levels of biosecurity, thereby increasing the risk of disease introduction and spread, which compromises both animal and public health. Establishing a clear legal framework for biosecurity could help ensure the consistent adoption of preventive measures on these farms. However, little is known about how biosecurity is regulated for small-scale farms across Europe, and on how these farms are defined at national level. This study aimed to map the biosecurity measures that are mandated for small-scale pig, poultry and cattle farms by national legislation and to identify the criteria used to define small-scale farms. Species-specific questionnaires covering pre-listed biosecurity measures were distributed to national experts, and validated information was obtained from 19 European countries. The results showed considerable heterogeneity: most countries lack a clear definition of small-scale farms, with categorization most frequently based on the purpose of animal keeping rather than the number of animals. Biosecurity measures were mandated by national legislation for small-scale farms, but were rarely tailored to the production systems, instead being applied uniformly to all holdings of a given species. Furthermore, regular assessment of biosecurity implementation was mandatory in around half of the small-scale farm types. These findings highlight legislative gaps and inconsistencies that limit the ability to design proportionate, risk-based approaches for small-scale farms. More targeted policies are needed including clear definitions and adapted biosecurity requirements. Otherwise, small-scale farm types continue to be overlooked in Europe's biosecurity framework.

1. Introduction

In recent years, there has been a growing demand for sustainable, animal welfare-oriented, and environmentally friendly livestock farming (Escribano, 2016). Consumers increasingly prefer products from livestock raised under extensive conditions, leading to renewed interest in organic, low-input, and small-scale production as alternatives to large-scale intensive farming (Busch and Spiller, 2018; Stampa et al., 2020). At the same time, urbanization, and human population growth are placing unprecedented pressure on food systems. By 2050, global food demand is expected to rise by 35–56% compared to 2010 levels (van Dijk et al., 2021). Small-scale farming plays a vital role in food security, particularly in marginal areas, by converting low-quality feed into high-protein food (Rivera-Ferre and López-i-Gelats, 2012) while contributing to maintaining biodiversity and landscape heterogeneity (Karlsson et al., 2022; Lomba et al., 2022). Unlike intensive systems that rely on breeds highly selected on production (Rivera-Ferre and López-i-Gelats, 2012), small-scale farms typically use more robust genotypes or indigenous breeds better adapted to natural local environments and more resilient to climate and other ecological stressors (Dal Bosco et al., 2021; Sila et al., 2021).

Although the European Union's Common Agricultural Policy (CAP) aims to support small-scale farms, the absence of a clear definition of "small farmer" in national strategic plans limits effective targeting (Alessandrini et al., 2024). Existing criteria, such as agricultural area (in hectares), economic output, and labor input, are inconsistently applied, often excluding subsistence or backyard farms (Gioia, 2017; Alessandrini et al., 2024). Yet these farms dominate the European landscape; around 93% of the holdings are family-run, and nearly half operate on less than two hectares, particularly in Southern and Eastern Europe (EPRS, 2014; Eurostat, 2020), underlining the importance of more inclusive definitions.

Despite their importance, small-scale farms may present higher risks for disease introduction and further transmission to large-scale, intensive farms due to potential increased wildlife contact, shared pasture, and lower biosecurity standards (Correia-Gomes et al., 2017, Batista et al., 2020; Jori et al., 2021; Souvestre et al., 2021). However, smaller herd sizes are often related to a smaller risk for disease presence (Lindström et al., 2012; Waldeck et al., 2021). While legal biosecurity requirements exist in many European countries for intensive pig, cattle, and poultry farms (Biebaut et al., 2025; Mahmood et al., 2025), these often do not specifically address small-scale systems. The European Animal Health Law (AHL) (Regulation (EU) 2016/429) mandates biosecurity implementation but does not differentiate between farm sizes. Consequently, it is left to the Member States (MS) to decide whether and how to apply size-specific biosecurity rules.

Currently, no clear definition of "small-scale farms" exists at the European level, and little is known about how countries regulate biosecurity in such systems. Therefore, this study aimed to map which pre-listed biosecurity measures are addressed in national legislation for these farms and how "small-scale pig, cattle, and poultry farms" are defined at the national level.

2. Materials and methods

2.1. Design of the questionnaires

Two questionnaires were created by members of the EU-funded COST Action (CA20103) – Biosecurity Enhanced through Training Evaluation and Raising Awareness (BETTER) (https://better-biosecurity.eu/). Revisions were made until a general agreement was reached and the questionnaires were finalized after internal pilot testing. Questionnaire 1, a general Microsoft® Word document applicable to pig, poultry, and cattle farms, consisted of three sections. The first section asked whether small-scale pig, poultry, or cattle farms were defined in the country by legislation or other sources (e.g., official documents or common usage) and, if so, the corresponding definitions had to be provided. The second section asked whether national legislation specified which biosecurity measures should be implemented on small-scale farms, and whether it was mandatory by law to regularly assess biosecurity on these farms. The third section requested national data on the number of small-scale farms. The full questionnaire 1 is available in Supplementary file 1. A guiding document clearly stated that "small-scale farms also include backyard farms. The presence and definition of *backyard farms* differ across countries; therefore, we decided to use the term *small-scale*".

Questionnaire 2, a species-specific questionnaire (a Microsoft® Excel document), had to be completed when biosecurity measures for small-

scale farms were present in national legislation. These questionnaires covered both external and internal biosecurity measures, and were adapted from those used in previous research (Biebaut et al., 2025; Mahmood et al., 2025). The final Excel questionnaires listed 41, 32, and 58 biosecurity measures for small-scale pig, cattle, and poultry production, respectively. These measures were grouped into categories (Table 1). For each measure, respondents were asked whether its implementation was mandatory by law on small-scale farms, with three answering options: 'yes', 'yes, but only in a specific situation', and 'no'. Respondents could also include notes and references. If a country classified multiple types of small-scale farms, for example holdings keeping poultry for self-consumption and holdings with less than 200 birds, and different biosecurity measures applied to each type, a separate worksheet using the same pre-listed measures had to be completed. The final Excel questionnaires 2 are provided in Supplementary file 2.

2.2. Data collection and validation

Within the COST Action BETTER project consortium, a call was made to identify for each species one volunteer from each country, most often biosecurity experts. This network of volunteers acted as Country Focal Points (CFPs) to coordinate data collection in their country for their respective species. In some countries, one CFP covered multiple species, while in others, each species was represented by a different CFP. The CFPs could collaborate with other national experts or stakeholders to obtain the required information. Fifty-three CFPs from 32 European countries were contacted and invited to a preparatory meeting where they received detailed information, explanation on completing the questionnaires, and clarifications on specific questions and biosecurity measures. Two similar meetings were held to maximize participation. During these meetings, it was clearly stated that the aim was to identify biosecurity measures that are mandatory by law for small-scale farms in the absence of disease outbreaks when emergency measures are not mandated or implemented. Data were collected between February and October 2024.

To validate the submitted answers, three researchers (one per species) conducted validation meetings with the respective CFPs. Before initiating the validation process, the researchers met to align meeting protocols and agree on the additional information to be requested. Prior to each validation meeting, the submitted questionnaires were reviewed for inconsistencies, unclear answers, or missing information. These points were then discussed in detail with the CFP during the meeting. Changes to the submitted data could be made during the validation meeting or data could be resubmitted afterwards in case more time was needed to consult the national legislation. Once all clarifications were addressed and agreement was achieved between the researcher and the CFP, the questionnaires were considered validated for that species and country. This two-step process, combining national data collection by local experts with centralized validation by the research team, was specifically designed to maximize both national accuracy and cross-study consistency.

Table 1
Number of biosecurity measures per biosecurity category listed in questionnaire 2. The list, prepared by the COST Action BETTER members, was used to assess which measures were mandated by national legislation for small-scale pig, cattle, and poultry farms.

Category of biosecurity measures	Pigs	Cattle	Poultry
Farm location	3	3	3
Personnel and visitors	10	6	15
Vehicle movements	4	2	3
Introduction of new animals	4	5	NA
Breeding management	2	3	NA
Equipment and materials	1	NA	4
Feed and water	3	1	5
Manure management	1	1	3
Dead-animals disposal	1	2	3
Pest control	2	3	3
Cleaning and disinfection	4	NA	4
Disease management	6	6	NA
Litter management	NA	NA	4
Poultry house	NA	NA	9
Outdoor protection	NA	NA	2
Total	**41**	**32**	**58**

NA: not applicable, no biosecurity measures were included in this category for the specific species.

2.3. Data analysis

Due to large variability in data received, direct comparisons between countries and regions were not possible and data were only analyzed descriptively. To make a European map with countries included in the study, an online tool was used (MapChart™). For each species the top five most and bottom five least frequently mandated biosecurity measures by national legislation for the different types of small-scale farms were summarized in a table. When multiple measures had the same frequency as the fifth most or least mandated measure, these were also included in the table.

3. Results

3.1. Participating countries and small-scale farm definitions

In total, data were submitted by 30 CFPs from 19 countries, including 13 EU-member states, four EU-candidate countries (Bosnia and Herzegovina, North Macedonia, Serbia and Türkiye), a potential EU-candidate country (Kosovo) and a non-EU state that has a strong relation with the EU through the European Economic Area agreement (Norway). Among EU-member states, countries were represented from all four geographical areas: North (n = 3), East (n = 4), South (n = 3) and West (n = 3) (United Nations Statistics, 1999). Not all countries submitted information for each of the three species. Data were received from 18, 16 and 17 countries for pigs, cattle and poultry, respectively. Completed questionnaires (1 and 2) were validated and included in the analysis for 17 countries for pigs, 16 for cattle, and 16 for poultry (Fig. 1). Thirteen countries provided data for all three species, four countries for two species, and two countries for one species only.

Information obtained via questionnaire 1 revealed that in most countries, legislation or other official national documents did not explicitly state *'small-scale farms are defined as…'* or similar wording. As a result, the criteria indicated by CFPs to identify such farms differed significantly. Differentiating farm types was often based on criteria such as the number of animals kept, the purpose of keeping the animals (e.g., self-consumption), or economic turnover, without explicitly using the label "small-scale". For instance, national legislation or other official national documents may state: *'The following measures apply to farms keeping animals solely for self-consumption'*, or may define exceptions, such as in Belgium, where authorization is not required for poultry establishments with fewer than 200 birds (Royal Decree (BE) 2022/41385). The number of animals used as a cut-off to differentiate between farm types varied largely between countries; for instance, in Hungary small-scale cattle farms were defined as those with fewer than 50 heads, whereas in the Netherlands the cut-off was set at four cows. Table 2 provides an overview of the criteria used in each country to define or differentiate between the various types of (small-scale) farms. For these types of farms, CFPs reported whether biosecurity measures listed in the Excel questionnaire were mandatory according to national legislation. It is important to note that the biosecurity measures indicated as mandatory for the small-scale farm types may not apply solely to those farms, but rather to all holdings keeping pigs, cattle or poultry.

3.2. Biosecurity implementation on pig farms

Sweden did not define specific criteria for small-scale pig farms

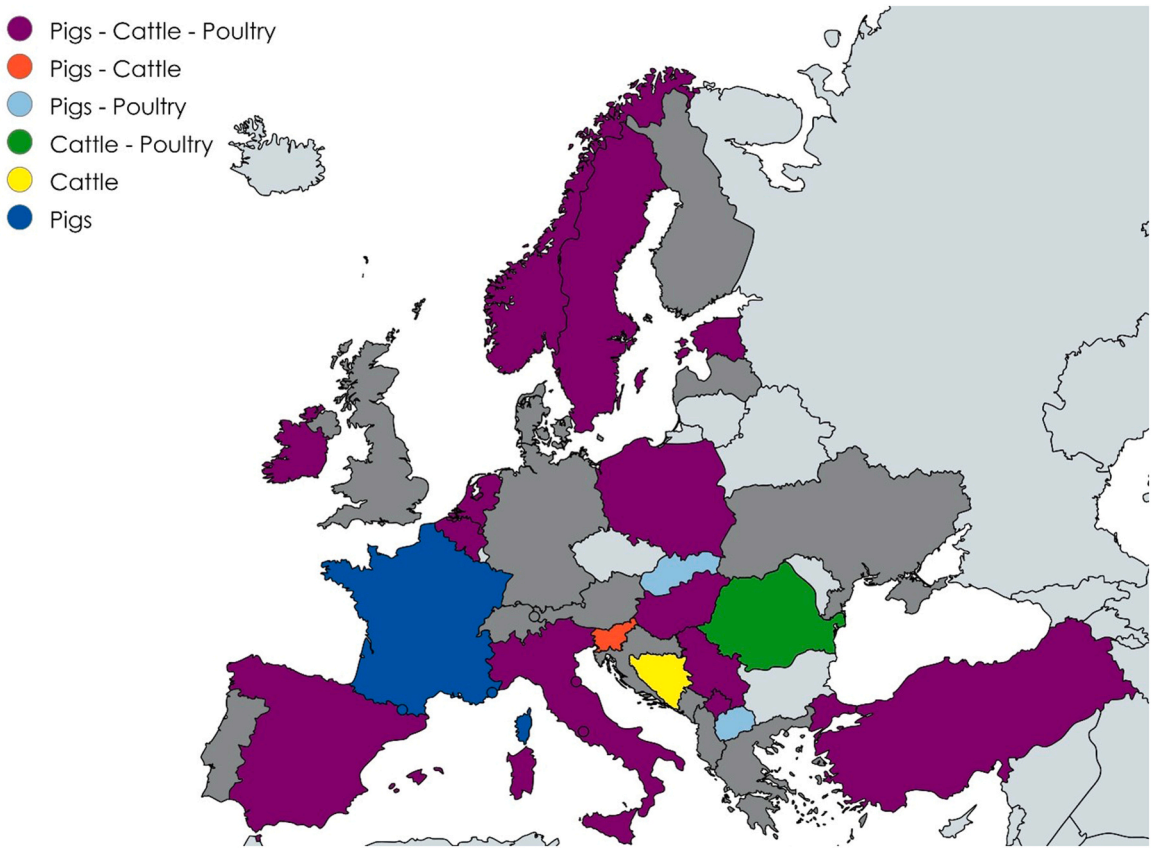

Fig. 1. Countries for which data on small-scale pig, cattle and/or poultry farms were included in the study. CFPs from countries shown in dark grey were contacted but did not submit data. Countries in light grey were not surveyed.

(Table 2), and any mandatory biosecurity measures applied to all pig holdings. Also in Estonia, Ireland, Kosovo, Poland, and Serbia the biosecurity measures mandated by national legislation applied to all holdings keeping pigs, regardless of the farm type. Countries indicating the fewest mandatory biosecurity measures for pig farms were Ireland (n = 2), Estonia (n = 3), Slovenia (n = 3), the Netherlands (n = 4), and Norway for farms not subject to VAT payment (Norway 2) (n = 4). Conversely, the countries with the highest number of mandated measures were Italy for commercial farms with fewer than 300 pigs (Italy 2) (n = 29), France (n = 23), and Norway for farms subjected to VAT payment (Norway 1) (n = 23). In Türkiye, due to cultural and religious norms, raising and keeping pigs is rare. No specific criteria exist for defining small-scale pig farms, and no mandatory biosecurity measures were reported in national legislation. Fig. 2 illustrates the distribution of mandatory measures for each type of pig farm listed in Table 2.

Across all farm types and countries, national legislation prohibited feeding pigs with food waste, canteen, or household leftovers (Pi_27). With respect to cleaning and disinfection, none of the countries mandated a sanitary break in the farrowing unit following these procedures (Pi_33). The biosecurity measures most and least frequently mandated for pig farms are summarized in Table 3.

3.3. Biosecurity implementation on cattle farms

Although Türkiye and Estonia defined criteria for small-scale cattle farms, no mandatory biosecurity measures were reported in national legislation for these types of farms. In Bosnia and Herzegovina, farms with fewer than five calves are unregistered and exempt from requirements applicable to larger farms; consequently, no biosecurity measures were mandated. In contrast, Belgium, Ireland, Poland, and Sweden did not define specific criteria for small-scale cattle farms (Table 2), and any mandatory biosecurity measures applied to all cattle holdings. The countries reporting the highest number of mandated measures for cattle farms were Kosovo (n = 29), Romania for both farm types (1; n = 18 and 2; n = 20), and Hungary (n = 17). Fig. 3 shows the distribution of biosecurity measures mandated for each type of cattle farm listed in Table 2.

None of the countries prohibited the presence of other livestock species on cattle farms (Ca_2). However, in 12 countries, across 14 different farm types, it was mandatory to implement a system for animal identification and traceability (Ca_28), and to collect dead animals and/or animal materials by a rendering vehicle (Ca_22) was mandated for 13 farm types. The biosecurity measures most and least frequently mandated on cattle farms are summarized in Table 4.

3.4. Biosecurity implementation on poultry farms

In Türkiye, Serbia, and Kosovo, no specific criteria were reported to identify small-scale poultry farms, and no biosecurity measures were stated in the national legislation. Similarly, no measures were mandated by national legislation in Spain for non-commercial farms raising a maximum of 0.15 Large Livestock Units for personal consumption only (Spain 1) and for both poultry farm types in Estonia. Countries reporting the fewest mandatory measures were: the Netherlands (n = 1), Italy for farms housing a maximum of 50 birds for personal consumption or own use, and without commercial purpose (Italy 1) (n = 2), and Romania for backyard or household poultry holdings for self-consumption (Romania 1) (n = 3). On the other hand, Romania reported over 50 mandatory measures for small commercial (Romania 2), organic (Romania 3) and free-range poultry farms (Romania 4). Sweden required 30 measures across two farm types, and Italy required 28 measures for farms housing a maximum of 250 birds for commercial purposes (Italy 2). In Ireland

Table 2
Criteria used to identify (small-scale) pig, cattle, and poultry farms in the participating countries, as reported by CFPs based on legislation or other official national documents. In some countries, multiple (small-scale) farm types with specific criteria were provided.

Country	Criteria used to identify (small-scale) farms		
	Pigs	Cattle	Poultry
Belgium (1)	Holding housing a maximum of 3 pigs intended for slaughter	NA	Holding housing between 200 and 5000 birds
Belgium (2)	-	-	Holding with a capacity less than 200 birds
Bosnia and Herzegovina	-	Holding with less than 5 calves	-
Estonia (1)	Holding where pigs are kept for personal consumption	Holding where cattle are kept for personal consumption	Holding where poultry are kept for personal consumption
Estonia (2)	Public health low risk farm – up to 5 pigs	Public health low risk farm – up to 5 cattle	Public health low risk farm – up to 50 broiler chickens/turkeys or up to 100 layer chickens
France	Holding where pigs are kept either for personal consumption or own use, or as a pet animal	-	-
Hungary	Holding with a capacity less than 100 heads of pigs	Holding with a capacity less than 50 heads of cattle	Holding with a capacity less than 2000 heads of broilers, 500 heads of adult poultry, and 50 heads of ostriches
Ireland	Holding sending less than 200 pigs to slaughter yearly	NA	Commercial holdings (located not > 100 km from the flock) with: 1) maximum 50 layers; 2) maximum 1000 broilers slaughtered/week (10000/year); 3) maximum 100 turkeys slaughtered/week (1000/year); 4) maximum 50 broiler breeders
Italy (1)	Holding where pigs are raised exclusively for self-consumption, without any commercial purpose	Holding where cattle is raised exclusively for self-consumption, with a maximum of 3 beef cows not intended for breeding	Holding housing a maximum of 50 birds kept for personal consumption or own use, without any commercial purpose
Italy (2)	Commercial holding with less than 300 animals	-	Holding housing a maximum of 250 birds for commercial activity
Kosovo	Holding rearing less than 5 livestock units of farm animals on a daily basis	Small livestock holding, breeding less than 5 livestock units on a daily basis. Usually animals are kept for self-consumption and occasional sale of dairy products	NA
North Macedonia (1)	Holding that houses from 11 up to 1000 fattening pigs or has no more than 50 breeding animals	-	Holding where poultry are kept either for personal consumption or own use, or as a pet animal
North Macedonia (2)	Holding with 1–10 fattening pigs kept for self-consumption and without breeding animals	-	Non-commercial poultry where poultry is kept in backyards holding and village holdings
Netherlands	Holding housing a maximum of 4 pigs and their potential piglets at any time	Holding with maximum 4 cows kept for the production of milk or beef	Holding housing a maximum of 249 birds
Norway (1)	Holding subjected to the payment of VAT and a turnover > 50 000 NOK	Holding subjected to the payment of VAT and a turnover > 50 000 NOK	Holding subjected to the payment of VAT and a turnover > 50 000 NOK
Norway (2)	Holding not subjected to the payment of VAT and a turnover < 50 000 NOK	Holding not subjected to the payment of VAT and a turnover < 50 000 NOK	Holding not subjected to the payment of VAT and a turnover < 50 000 NOK
Poland (1)	Holding raising animals exclusively for family consumption, with a maximum yearly production of 10 fattening pigs and with maximum 1 sow	NA	Holding housing a maximum of 250 birds kept either for personal consumption or own use, without any commercial purpose or as fancy birds
Poland (2)	-	-	Commercial (direct selling) holding producing a maximum of: 1) 50 carcasses (and offal)/week of turkeys (2500/year), 500 carcasses (and offal)/week of geese, and 200 carcasses (and offal)/week of other poultry (e.g., chickens, ducks, quails, guinea fowls) (10000/year); 2) 2450 poultry eggs/week (127400/year), and no limit for ratite eggs, but not more than 500 eggs/year

(*continued on next page*)

Table 2 (*continued*)

Country	Criteria used to identify (small-scale) farms		
	Pigs	Cattle	Poultry
Romania (1)	-	Holding registered in the National system for the Identification and Registration of Animals, owned by individuals not registered with the Trade Register Office (Non-professional holding)	Backyard or household poultry holdings typically maintained for self-consumption rather than commercial purposes.
Romania (2)	-	Holding owned by authorized natural persons, individual enterprises, family enterprises, or legal entities organized according to the law, registered and authorized by the Trade Register Office, recorded in the National System for the Identification and Registration of Animals, and registered with the veterinary sanitary authorities (Type A commercial holding)	Small commercial poultry holding with a larger scale than backyard farms and are intended for commercial purposes
Romania (3)	-	-	Organic poultry holdings
Romania (4)	-	-	Free-range poultry holdings allow birds to roam freely outside for at least part of the day
Serbia	Holding raising pigs in a closed system, pigs are bred in a closed production cycle	Holding with less than 20 conditional heads of cattle	NA
Slovakia (1)	Holding raising a maximum of 1 pig for self-consumption	-	Holding housing a maximum of 50 birds kept either for personal consumption or own use, without any commercial purpose or as a pet animal
Slovakia (2)	-	-	Holding where birds are reared under continuous daytime access to open-air runs, water and feed
Slovakia (3)	-	-	Family-owned poultry (usually 10–30 bird) kept for personal consumption or own use
Slovenia	Holding with maximum 5 fattening pigs for own consumption, only movements to the slaughterhouse are allowed	Holding in which terrestrial animals are kept solely for the operator's own purpose, not for sale or transfer to other holdings	-
Spain (1)	Holding with a maximum of 5 breeding animals and not more than 25 fattening animals	Holding where a maximum of 20 Large Livestock Units (LLU) are kept (1 dairy cattle = 1 LLU)	Holding raising poultry for personal consumption with a maximum of 0.15 Large Livestock Units (LLU), without any commercial purpose (1 laying hen = 0.005 LLU; 1 broiler = 0.003 LLU)
Spain (2)	Holding raising animals exclusively for family consumption with a maximum yearly production of 3 fattening pigs, and without breeding stock (i.e., self-consumption).	-	Holding raising poultry (including ratites) with a maximum of 0.75 Large Livestock Units (LLU), with commercial purpose (1 laying hen = 0.005 LLU; 1 broiler = 0.003 LLU)
Sweden (1)	NA	NA	Holding where poultry are kept either for personal consumption or own use, or as a pet animal without any commercial purpose (Birds in captivity)
Sweden (2)	-	-	Poultry holdings not categorized as "Birds in captivity"
Türkiye	NA	Holding with up to 20 breeding and/or fattening cattle	NA

NA: Countries where the CFP reported that no specific criteria exist to identify small-scale farms for the given species. (-): No data were submitted or validated for the specific country-species combination. Numbers in parentheses after country names indicate multiple farm types for that country and are provided for reference in the main text.

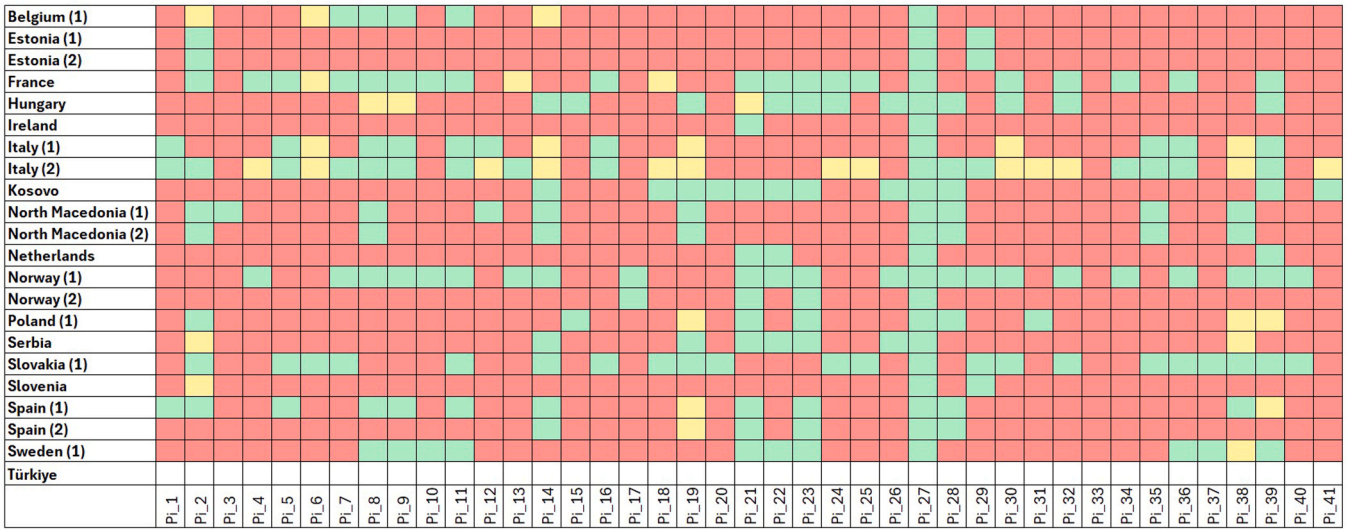

Fig. 2. Heat map showing which biosecurity measures were mandated by national legislation for different types of pig farms in each country (Table 2). The numbers (Pi_X) correspond to specific biosecurity measure listed in the pig specific questionnaire 2 (Supplementary file 2). For each measure, countries indicated whether implementation was mandatory by national legislation on that type of pig farm: green = yes; yellow = yes, but only in specific situations (e.g., when animals are purchased, in relation to a specific disease, or when animals have outdoor access); red = no; white = the CFP indicated no biosecurity measures were mandated by national legislation for that type of pig farms.

and North-Macedonia, the biosecurity measures mandated by national legislation apply to all holdings keeping poultry, regardless of the farm type. Fig. 4 illustrates the distribution of mandatory biosecurity measures across poultry farm types listed in Table 2.

Among the most commonly mandated measures (on 17 farm types) were the requirement to place drinking water in protected areas during high-risk periods for the introduction and dissemination of epidemic diseases (Po_58) and the use of tools to prevent birds or vermin entry into the poultry house (Po_39). Notably, in none of the countries was it mandatory by national legislation for poultry farms to provide a parking area outside the farm (Po_18). The biosecurity measures most and least frequently mandated for poultry farms are summarized in Table 5.

3.5. Assessing biosecurity on small-scale farms

Data collected via questionnaire 1 demonstrated that biosecurity assessments were mandatory depending on the farm type identified. For example, in Norway such assessments were required for livestock holdings subject to VAT payment (Norway 1), but not for those exempts from VAT (Norway 2). In Belgium, assessments were mandatory annually for all poultry farms with 200–500 birds, whereas in Italy 10% of small-scale poultry farms were assessed annually. Overall, biosecurity assessments were mandatory by national legislation in 45%, 53%, and 62% of the types of poultry, cattle and pig farms identified, respectively (Fig. 5). Supplementary file 3 includes for all different farm types identified in each country if it is mandatory by law to regularly assess the biosecurity.

3.6. Number of small-scale farms

Data on the number of small-scale farms present in the country was collected via questionnaire 1. However, in the majority of countries these data could not be retrieved or where highly inconsistent for example because registration of small-scale farms was not mandatory or because the registration did not distinguish between the different farming types. Therefore, the data obtained were not included in the results.

4. Discussion

Information on the definition of small-scale pig, cattle and poultry farms, along with the biosecurity measures mandated by national legislation for these farms, was obtained from 19 European countries through two questionnaires. The results demonstrated that, among countries different criteria were used to identify small-scale farms and that no single, uniform definition of a ‘small-scale farm’ exist. The criterion most often applied was the purpose of production, i.e. animals kept for self or family-consumption, for personal use, or without any commercial purpose. In some cases, also the number of animals was used, though thresholds varied widely between countries. This lack of a clear definition has direct implications for the specificity and comparability of biosecurity legislation. Furthermore, in multiple countries measures mandated by national legislation were not specific to small-scale farms but applied to all farms housing a specific species. Due to this variability, direct comparisons between countries and regions were not possible.

Our findings reveal that only a few biosecurity measures were generally mandated and that legislation for small-scale farms follows distinct, species-specific patterns, likely driven by the epidemiology of high-profile diseases. For pig farms, national legislation often focused on the prohibition of swill feeding as stated in European legislation; likely to prevent African swine fever and foot-and-mouth disease incursion and transmission (Regulation (EC) 1069/2009; Guinat et al., 2016). On the other hand, more systemic biosecurity management such as visitor controls or fencing was far less consistently regulated. The findings for cattle differed, with legislation placing greater emphasis on traceability and disease surveillance, likely a legacy of the bovine spongiform encephalopathy crisis which made individual animal identification a cornerstone of EU policy (EFSA, 2018), rather than preventive on-farm biosecurity like farm access controls or quarantine, which are frequently identified as weak points in the cattle sector (Sarrazin et al., 2014). Finally, for poultry most measures focused on managing the wildlife-livestock interface; likely to prevent avian influenza transmission (Ssematimba et al., 2013). In contrast, measures to control human-mediated transmission pathways were largely neglected, with requirements for visitor protocols, dedicated equipment, or external parking areas being among the least frequently mandated, in accordance with recent findings from field observations from commercial poultry

Table 3
Biosecurity measures most and least frequently mandated by national legislation for the different types of pig farms (n = 22).

Category	Measure questioned (Pi_X)	Frequency
Feed and water	It is forbidden to feed animals with any kind of food waste, canteen or household leftovers (Pi_27)	21
Vehicle movements	All transport vehicles must have official documentation certifying that they have been cleaned and disinfected (Pi_14)	12
Introduction of new animals	There are specific biosecurity measures for introduction of animals from foreign country (Pi_21)	12
Farm location	Fencing around the pig farm is complete (Pi_2)	12
Introduction of new animals	Documentation that certifies the health status of newly introduced animals is required and controlled (Pi_19)	11
Disease management	Vaccination and treatment schemes are documented and controlled (Pi_39)	11
Vehicle movements	The transport vehicles for live animals must be empty before loading (Pi_15)	2
Vehicle movements	There exists a loading/unloading dock (Pi_17)	2
Introduction of new animals	The newly arrived animals in quarantine must be subjected to diagnostic screening (Pi_20)	2
Pest control	Birds cannot have contact with the pigs (Pi_31)	2
Disease management	Separate equipment, needles, gloves etc. are used when handling animals in the sickbay (Pi_37)	2
Disease management	The farm has a system for recording the animal health, breeding, reproduction and production data (Pi_40)	2
Disease management	Animals of different ages are housed in different rooms (Pi_41)	2
Farm location	Keeping other livestock species on the farm is forbidden (Pi_3)	1
Cleaning and disinfection	After cleaning and disinfection, there is a suitable period of sanitary break in the farrowing unit, before new animals enter the stables (Pi_33)	0

Frequency indicates the number of types of pig farms for which the biosecurity measure was reported as mandatory by national legislation. The numbers (Pi_X) correspond to the specific biosecurity measures listed in the pig specific Excel questionnaire (Supplementary file 2).

farms (Elbers and Gonzales, 2025).

In general, it is clear that there is considerable variation in the number of biosecurity measures mandated by national legislation specifically targeting the nationally defined small-scale farms. However, this variation may not be unique to small-scale operations, since similar differences have also been observed for large-scale intensive farms (Biebaut et al., 2025; Mahmood et al., 2025). This study did not assess the level of biosecurity implementation on small-scale farms. However, previous research has demonstrated that biosecurity compliance on these types of farms is generally low (Correia-Gomes et al., 2017;

Table 4
Biosecurity measures most and least frequently mandated by national legislation for the different types of cattle farms (n = 19).

Category	Measure questioned (Ca_X)	Frequency
Disease management	A system for animal identification and traceability is in place (Ca_28)	14
Dead-animals disposal	Dead animals and/or animal materials are collected by a rendering vehicle (Ca_22)	13
Disease management	The herd health is controlled by a veterinarian at least once per year (Ca_27)	10
Feed and water	Quality of drinking water should be checked by bacteriological analysis at least once a year (Ca_20)	9
Introduction of new animals	Cattle that are introduced into the herd are isolated in quarantine facilities (Ca_12)	8
Dead-animals disposal	The rendering vehicle can remove dead cattle without entering the farm perimeter (Ca_23)	2
Disease management	There are written protocols for cleaning and disinfection (Ca_31)	2
Disease management	Hospital pens should be disinfected after each use (Ca_30)	2
Breeding management	Cows are only artificially inseminated (Ca_17)	1
Vehicles movements	Transport vehicles for animals, feed, supplies, maintenance etc. are only permitted to enter the perimeter of the farm once properly disinfected (Ca_10)	1
Farm location	Contact with cattle from other herds during grazing is not allowed (Ca_3)	1
Farm location	Keeping other livestock species on the farm is forbidden (Ca_2)	0

Frequency indicates the number of types of cattle farms for which the biosecurity measure was reported as mandatory by national legislation. The numbers (Ca_X) correspond to the specific biosecurity measure listed in the cattle specific Excel questionnaire (Supplementary File 2).

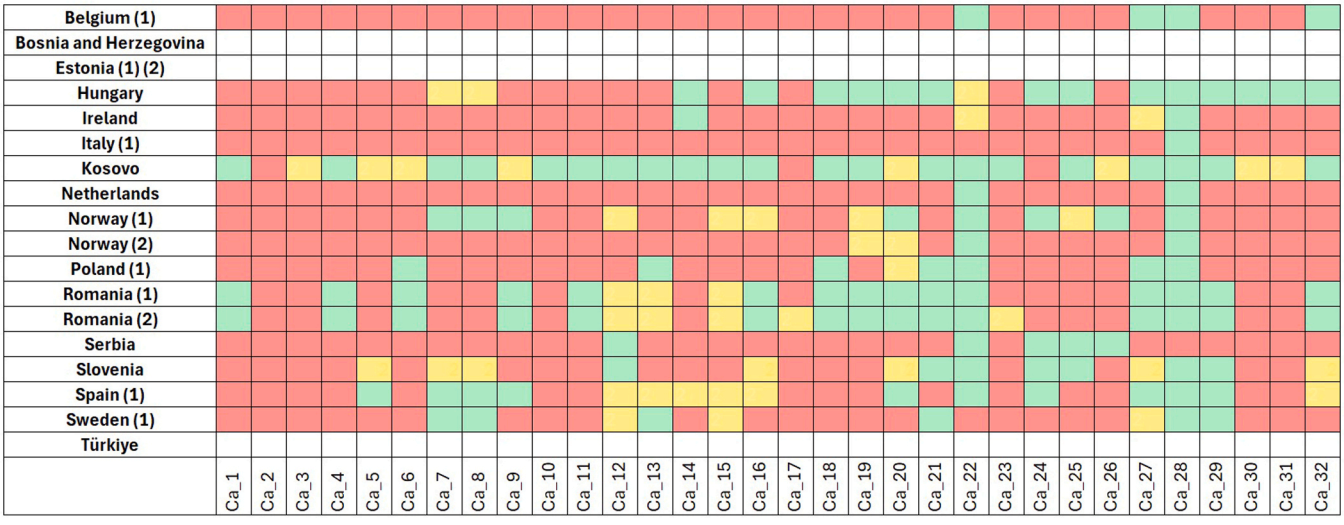

Fig. 3. Heat map showing which specific biosecurity measures were mandated by national legislation for different types of cattle farms in each country (Table 2). The numbers (Ca_X) correspond to specific biosecurity measures listed in the cattle specific questionnaire 2 (Supplementary file 2). For each measure, countries indicated whether implementation was mandatory by national legislation on that type of cattle farm: green = yes; yellow = yes, but only in specific situations (e.g., only when animals are purchased or in the context of controlling a specific disease); red = no; white = the CFP indicated no biosecurity measures were mandated by national legislation for that type of cattle farm.

Fig. 4. Heat map showing which specific biosecurity measures were mandated by national legislation for different types of poultry farms in each country (Table 2). The numbers (Po_X) correspond to specific biosecurity measure listed in the poultry specific questionnaire 2 (Supplementary file 2). For each measure, countries indicated whether implementation was mandatory by national legislation on that type of poultry farm: green = yes; yellow = yes, but only in specific situations (e.g., when animals are purchased, in the context of disease control, or if animals have outdoor access); red = no; white = the CFP indicated no biosecurity measures were mandated by national legislation for that type of poultry farm. *Belgium: mandatory for all poultry categories except breeders. *Sweden: implementation depends on the specific poultry category kept.

Correia-Gomes and Sparks, 2020; Souvestre et al., 2021; Zanon et al., 2024; Duarte et al., 2026). However, on small-scale farms the implementation of biosecurity measures is influenced not only by legislation but also by other factors, such as the availability of financial resources, of accurate and reliable information and the effectiveness of communication with farmers and households. Therefore, further research should focus on the influence of biosecurity legislation on the actual level of implementation and perform an economic analysis of compliance costs.

The lack of a clear definition at national level is not merely an administrative issue; it represents a significant barrier to effective policy implementation. The AHL is based on the principle of risk-based disease prevention, yet risks cannot be adequately assessed or managed for a sector that is poorly defined and quantified. This directly hinders the ability of MS to fulfill their obligations under the AHL, which requires comprehensive surveillance and control of diseases across all kept animal populations. In the absence of a clear definition, small-scale farms risk either being subjected to overly burdensome regulations designed for industrial systems or being entirely overlooked, creating a dangerous blind spot in national biosecurity frameworks (Alessandrini et al., 2024). The epidemiological link between disease outbreaks in small-scale farms and commercial holdings has been demonstrated underlining the need to define the small-scale farms and recognizing them as an equally important part of the livestock sector (Batista et al., 2020; Boklund et al., 2020).

This legislative ambiguity also results in high variability in on-the-ground requirements. The "one-size-fits-all" approach observed in several countries, where small farms are subject to the same rules as intensive operations, contradicts the AHL's principle of proportionality. This principle emphasizes that biosecurity measures should be "sufficiently flexible, suit the type of production, the species or categories of animals involved, and take account of the local circumstances" (Regulation (EU) 2016/429). This highlights the responsibility of each MS to clearly define small-scale farms at the national level as their characteristics depend on the local farm structure. According to veterinarians the definition should focus on the purpose of keeping animals rather than on the number of animals present (Duarte et al., 2026). Furthermore, the frequent practice on small-scale farms of keeping multiple species, unlike the monospecific nature of most intensive operations, requires producers to comply with multiple, often fragmented, pieces of legislation, which can pose a significant barrier to compliance. This multi-species environment can also create unique epidemiological bridges for pathogen transmission (Abdelwhab and Mettenleiter, 2023). However, small-scale farms play a vital role in food security and contribute to maintaining the biodiversity in the agricultural landscape (Rivera-Ferre and López-i-Gelats, 2012; Karlsson et al., 2022; Lomba et al., 2022). Therefore, supporting them in enhancing the level of biosecurity is crucial.

Furthermore, EU legislations such as the AHL provide a framework, and translating general statements into specific national requirements is the responsibility of the MS. For example, the AHL outlines the need for appropriate biosecurity measures when introducing pigs from foreign countries, which is not mandated by national legislation in all MSs (Regulation (EU) 2016/429). Therefore, the absence of such national legislation specifying biosecurity measures for small-scale farms should not be interpreted as a justification for inaction. Instead, it highlights the need for clearer guidance and consistent enforcement at the national level to ensure that minimum standards are upheld.

Moreover, the AHL recommends that competent authorities assess biosecurity implementation, yet our survey found this to be mandatory in only about half of the identified farm types. The sheer number of small-scale holdings makes comprehensive inspection highly resource-intensive and potentially beyond the capacity of many national veterinary services (FVE, 2023). This dilemma is compounded by the fact that

Table 5
Biosecurity measures most and least frequently mandated by national legislation for the different types of poultry farms (n = 29).

Category	Measure questioned (Po_X)	Frequency
Pest control	Is the house protected by the entry of birds or other vermin by using proper tools (e.g., bird-proof nets, mosquito screens) (Po_39)	17
Outdoor	Access to feed and drinking water in protected area (e.g., indoor or under a shed)-in high risk of introduction and dissemination of an epidemic disease (Po_58)	17
Pest control	Is a rodent control program implemented on the farm? (Po_37)	16
Outdoor	Feed is properly stored and protected from pests before its use (Po_57)	16
Pest control	Is an insect control program implemented on the farm? (Po_38)	15
Cleaning and disinfection	Is the house cleaned and disinfected after each production cycle? (Po_45)	15
Personnel and visitors	Are the farmer and the personnel prohibited to be engaged in bird-related activities (e.g., hunting)? (Po_8)	3
Personnel and visitors	Do the farmer and the personnel use a shower in the farm hygiene lock? (Po_15)	3
Equipment and materials	Is each house provided with dedicated equipment (e.g., wheelbarrows, buckets, spades, milling machines, etc.)? (Po_24)	3
Manure management	Can the manure be collected by the rendering company without entering the farm area? (Po_32)	3
Feed and water	Does the loading of silos occur from the outside of the farm area (without trucks entering the farm area)? (Po_26)	1
Littre management	Is the litter milled and/or replaced during a single production cycle? (Po_43)	1
Personnel and visitors	Is the farm provided with a parking area located outside the farm area? (Po_18)	0

Frequency indicates the number of types of poultry farms for which the biosecurity measure was reported as mandatory by national legislation. The numbers (Po_X) correspond to the specific biosecurity measure listed in the poultry specific Excel questionnaire (Supplementary File 2).

small-scale farming carries deep cultural and social importance, making the imposition of stringent, costly regulations a politically sensitive issue that could potentially drive non-compliant farms "underground" and away from official surveillance (McCullough et al., 2008; Matacena, 2016; Iles et al.,2020). This suggests that policy should not rely solely on punitive measures. While legislation provides a mandatory baseline, its limitations highlight the need for complementary sector-led initiatives. Financial support for biosecurity enhancement, tailored communication programs at the farm and community levels and realistic biosecurity practices are essential to overcome barriers faced by small-scale farmers (Buckel et al., 2024). Furthermore, tools specifically developed to assess the level of biosecurity in small-scale farms such as Classyfarm in Italy or Biocheck.Ugent can help raising awareness and strengthening the implementation of preventive measures (Amalraj et al., 2024; Zanon et al., 2024; Ibrahim et al., 2025).

Reflecting on policy implementation, regulatory requirements must be complemented by supportive and enabling measures (Vecchio et al., 2021). Many essential practices require upfront investments often beyond the reach of small-scale producers (Samanta et al., 2018; Morris et al., 2023). Here, the EU's CAP becomes critically important. The CAP (2023–2027) offers opportunities to use instruments, such as eco-schemes or Rural Development funds to support biosecurity adoption. However, as noted by Alessandrini et al. (2024), the absence of a clear definition of a "small farmer" in national strategic plans limits the effective targeting of this support. Yet, defining farm types alone is not sufficient. National and European strategies must also account for the diversity in farm purposes, farmers' perspectives and species-specific risks. Therefore, tailored financial and technical assistance for biosecurity improvements on small-scale farms is needed. By linking agricultural support to improved animal health outcomes, the CAP could create a strong incentive, moving beyond a purely regulatory approach (Toma et al., 2021).

(Strengths and) Limitations of the study

The primary strength of this study lies in its broad geographic coverage and systematic, multi-species approach to data collection, which together provided a unique pan-European overview. Moreover, the decision to adopt the term 'small-scale' as a descriptor enabled a common analytical language for a study including 19 countries, where local terminologies like 'backyard' or 'hobby' farm carry different legal and cultural meanings. However, several limitations should be acknowledged. First, COST Action BETTER CFPs were most often biosecurity experts and not necessarily experts in national legislation. It was recommended they completed the questionnaire with the support of other national experts, but this was not mandatory, possibly affecting consistency. Second, biosecurity measures applicable to the different farm types were often spread across multiple national legislations, increasing the risk of missing mandatory measures. Lastly, the pre-listed biosecurity measures always focused on a singular specific animal species potentially missing measures mandated in mixed farm settings and some of the measures had a double content. For example, one item stated that access to poultry farms, without distinguishing between

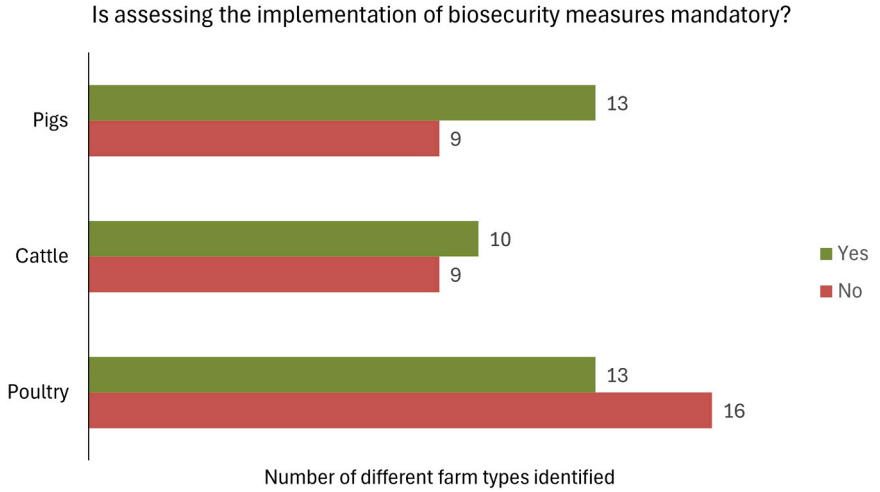

Fig. 5. Number of (small-scale) farm types identified across all 19 countries for which regular assessment of biosecurity implementation was mandated by national legislation.

personnel and visitors, must be through a farm hygiene lock and that this must be located at the farm entrance. As a result, simpler measures or measures not explicitly listed may have been overlooked. Despite these limitations, the study provides a robust, first-kind evidence-based understanding of how small-scale farm biosecurity is legislated across Europe, offering valuable guidance for future policy making and research.

5. Conclusion

This study reveals substantial heterogeneity in national definitions of small-scale livestock farms and shows that biosecurity measures are seldom tailored to this sector. The amount of biosecurity measures being mandated specifically to the small-scale sector was therefore low in the three investigated species. The absence of clear national definitions limits cross-country comparison and undermines the risk-based principles of the AHL. Addressing legislative gaps and generating further evidence on the epidemiological role and current biosecurity implementation of these farms are essential to guiding proportionate, coordinated, and effective biosecurity policies in Europe.

CRediT authorship contribution statement

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Ethics approval and consent to participate

Due to the nature of the study formal approval from an Ethics Committee was not required.

Consent for publication

Not applicable

Funding

This manuscript is based upon work from COST Action BETTER, CA20103, supported by COST (European Cooperation in Science and Technology).

This work was funded by the European Union under the Horizon Europe grant 101083923 (BIOSECURE). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Declaration of Competing Interest

All the authors declare no conflicts of interest

Acknowledgement

The authors would like to thank Costanza Romanelli, Sabina Seric Haracic and all experts and stakeholders in the countries that supported the country focal points and experts that submitted data included in this manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.prevetmed.2026.106854.

Data availability

All data supporting the findings of this study are included in the article and its supplementary materials.

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