DOI: 10.1002/vms3.1030

CASE REPORT

WILEY

Survey of wild boar hunter interactions with pig farming in central Europe

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Funding information
Hungarian National Laboratory, Grant/Award Number: RRF-2.3.1-21-2022-00007; Hungarian National Research; One Health, Grant/Award Number: 2020–4.1.1-TKP2020

Abstract

African swine fever (ASF) is a fatal animal disease without zoonotic potential but greatly impacts human well-being, especially in the most vulnerable human communities. In Europe, ASF concerns mostly the wildlife domain of health. The main vector of the disease is confirmed to be the wild boar, though long-distance jumps of the infection are due to anthropogenic effects. This study aimed to evaluate the potential role of hunting assistant personnel (beaters and carcass handlers) in ASF spread in Hungary. Based on a personal interview survey, we attempted to identify the epidemiological risk caused by hunting activities and the hunting personnel. The interviews with 58 hunting workers confirmed that an extent backyard pig sector (13 pig farmers) and pork production system (31 pork producers) existed within the study region out of the authorities' sight. Two pig farmers did not wear special working clothes for pig caring, seven pork producers disposed of slaughter offal in the settlements periphery, and six persons regularly contacted distant pig farms. The revealed knowledge, attitude, and practice of the questioned pig farmers suggested that this sector would be very vulnerable in an epidemic situation; moreover, backyard farms would cause a great risk for wildboar populations. Considering that the study region is the third poorest region of Hungary, these findings called attention to the high epidemiologic risk of socioeconomic inequality between different regions within the European Union.

KEYWORDS
African swine fever, anthropogenic transmission risk, backyard pig, one health, socioeconomic

1 | INTRODUCTION

Within the European Union (EU), African swine fever (ASF) principally affects the wildlife domain of health, as defined by the One Health approach (Buttke et al., 2015). In most Member States (MS), the wild boar populations continuously spread the disease westward (Chenais et al., 2019; Dixon et al., 2020; Podgórski et al., 2020). Long-distance jumps of the disease in Czechia, Belgium, and Hungary also emerged because of pig originated food residuals (Sauter-Louis et al., 2021). Epidemiological analysis of these events concluded that the vectors of these outbreaks should be humans from the eastern part of the continent (Chenais et al., 2019; Schulz et al., 2019). Therefore, ASF affects all three domains of health. Several indirect factors, such as socioeconomic conditions, can play an epidemiologic role. Thus, efficient disease control strategies need the multidisciplinary approach of One Health, which provides a broader view of the infection drivers.

The EU's authorities focus on the wildlife vectors and the role of hunting activities during control planning. Most papers contain a list of recommendations for hunters and hunting parties on avoiding disease transmission to pig farms, such as banning of winter-feeding, increased hunting pressure on wild boar population, and more strict biosecurity measures (Chenais et al., 2019; Dixon et al., 2020). In the case of wild boar, translocation of live animals plays less relevant role in transmission of ASF than raw meat or feed products (Beltran-Alcrudo et al., 2019). The role of backyard pigs is investigated heavily in the eastern part of the continent, where many backyard pig farms are registered (Bellini et al., 2016).

In Hungary, the backyard pig sector is almost extinct. The official registry contains few and continuously decreasing numbers of pig keeping small-holders (EFSA, 2021). On the other side, the forestry and hunting industry provides job opportunities for people of Hungary's low-income regions. Within the poorest regions, a high level of unemployment increases the value of even odd jobs (Németh, 2019).

Though ASF is a suid-specific disease and cannot cause human infection, it can indirectly affect human well-being. African swine fever occurrence in such a region would cause socioeconomic disaster for the most vulnerable communities. Restrictive actions viz hunting ban, closure of forest areas, could obstruct these people's access to the job opportunities (Németh, 2019). In these circumstances, a multifactorial approach is needed to determine the main drivers of an epidemic. One Health approach provides an appropriate way to determine indirect drivers of infectious diseases (Garcia et al., 2020; Torres-Velez et al., 2019). In this study, we focused on the disease vectors' (the humans) behaviour, social and cultural features and needs, influencing their ability to transmit the disease.

We hypothesised that the stakeholders of hunting events, especially those who handle carcasses, could make contacts between the wildlife and livestock populations, and meanwhile, their activity affects their own well-being. Our further aim was to appreciate to what extent these employees might contribute to the spread of ASF. Our study aimed to determine hunting workers' knowledge, attitudes, and practice during hunting events and animal husbandry.

2 | MATERIALS AND METHODS

We conducted a questionnaire-based interview survey during the 2019–2020 hunting season in Somogy County within the South Transdanubian Region of Hungary, the country's third poorest region (Piwowar & Dzikuć, 2020). A draft questionnaire was tested during a pilot study among wildlife management BSc students. We asked the students to add further questions and options to our multi-choice questions based on their experience of field internships.

We involved the County Hunters' Chamber operated in the study site (Somogy County) (Figure 1) and asked the members to allow interviewing during their hunting events. The Chamber has 3806 members who have hunting license. Approximately 400–600 persons contribute as an assistant personnel (beater, carcass handler) within the hunting and wildlife sector. We visited all events, which were permitted by the hunters' parties. For safety reasons, the organisers allowed us to interview the employees during the lunchbreak and at the end of the event. Because of the very limited time-scale, four interviewers worked on each event. They attempted to ask as many persons as they could. The interviewees answered voluntarily. This assured random sampling as the involvement of the interviewees was based on their own decision.

We applied the reviewed and corrected final version of the questionnaire as guidelines to personal interviews. During the interviews, the questioners asked as neutrally as possible to avoid interviewer bias (Thrusfield, 2018). The questioners asked open-ended questions and gave answer options as explaining examples only if the interviewee could not understand clearly the meaning of the question (Table 1). The interviewees could not hear each other's answers to avoid influencing each other. All collected data entered the study.

The true frequency with 95% confidence interval (95% CI) of a certain knowledge indicator, attitude or practice was calculated by Agresti-Coull method using the Epitool Epidemiological calculator (available at: http://epitools.ausvet.com.au).

3 | RESULTS

In the framework of this study, we interviewed 58 persons in the field during hunting events. The distance between the interviewee's residence and the place of the interview was between 0 and 45 km (average 14.4 km). Most of the questioned persons (87.9%; 95% CI: 76.8–94.3) never left the South Transdanubian Region for work. Forty-two of the 58 interviewees (72.4%; 95% CI: 59.5–823) were seasonal workers. Seven workers regularly apply for a forestry job outside the region.

Thirty-eight workers (65.5%; 95% CI: 52.6–76.5) had working clothes dedicated to forest work. Most of them (55.3%; 95% CI: 42.5–67.3) cleaned it regularly. On the other side, 20 of the questioned workers did not have special clothes for forest work; moreover, 60.3% (95% CI: 47.5–71.9) of them did not clean it after each use.

Thirty-one of the 58 interviewees (53.5%; 95% CI: 40.8–65.6) regularly slaughtered pigs and produced dried pork products at home. Among the 31 pork producers, 13 grew pigs while the others butchered

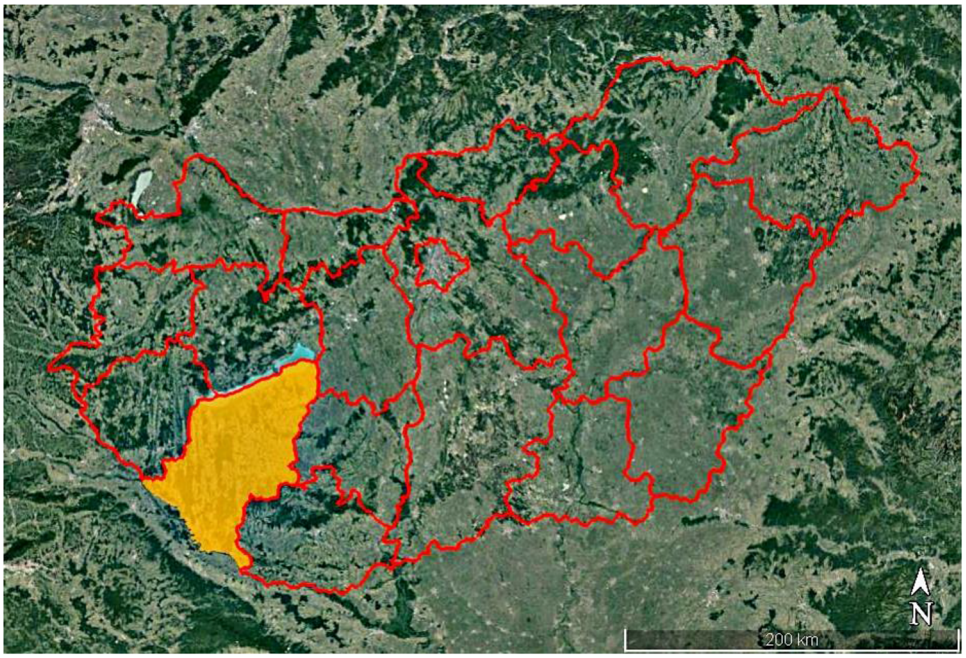

FIGURE 1 The location of the involved area, Somogy County in Hungary

TABLE 1 Points of the personal interviews for evaluation of knowledge, attitude, and practice among stakeholders of hunting events

Points	Optional answers
Frequency of forest work	Regular or occasional
Regions visited for forest work	Residence region, neighbouring regions, further regions
Types of forest work	Hunting, timber industry, other
Alternative use of forest clothing	Never, as business suit, for gardening, for animal care
Cleaning frequency of forest clothes	After each use, as needed
Rubber glove use and disposal	Never used, disposal as hazardous waste, putting into on-site collectors, treating as communal waste, incineration
Duration of forest work per occasion	Hours, whole day, more days
Taking meals outdoor	Yes or no
Preferred in-bag foods	Animal origin or not, home-made or industrial, raw or processed
Outdoor waste management	Taking home, burning at campfire, throwing away
Animal keeping	Yes or no, what species
Working clothes	Dedicated to different activities or not, regularly cleaned or not
Animal slaughter at home	Species, frequency, types of pork products made, by-product management, giving pork products (snack) as gifts for distant family members or not, to which regions of the country
Contribution in pig slaughter as a guest	Yes or no, in which regions of the country, getting pork products (snack) or not

purchased animals. Among pig farmers, six produced pork above family needs. Two of the 18 non-farmer pork producers prepared dried meat products above their family's needs. Between those who had no special working clothes for forest works and did not wash them regularly, two persons reported being pig farmers. No pig farmers were found among those who used regularly washed working clothes dedicated to forest work.

The offal of pig slaughter was reported to be disposed of by placing on settlement periphery (N = 7; 22.6%; 95% CI: 11.1–40.1), mixing with manure in the backyard (N = 9; 29.0%; 95% CI: 15.9–46.8), or dispatching with municipal waste (N = 15; 48.4%; 95% CI: 32.0–65.2). Among all interviewees, six (10.3%; 95% CI: 4.5–21.1) claimed that they regularly took part in family event pig slaughters outside the region and got samplers, mostly sausages from the host family.

About the packed provisions, 54 interviewees (93.1%; 95% CI: 83.1–97.8) reported that they preferred foods of animal origin during forest work. Twenty-five (43.1%; 95% CI: 31.2–55.9) workers took non-prepared foodstuffs (bacon, raw sausages) of home-slaughter origin. Twenty-nine persons had ready-to-consume sandwiches in their bags, of which 20 specimens (34.5%; 95% CI: 23.5–47.4) were originated from backyard pig slaughter.

The leftovers and packages of the in-bag foodstuffs were taken home and dispatched with municipal waste (N = 28; 48.3%; 95% CI: 35.9–60.8), thrown into the campfire at the place of the lunchbreak (N = 13; 22.4%; 95% CI: 13.5–34.8), or thrown away in the forest (N = 6; 10.3%; 95% CI: 4.5–21.1).

4 | DISCUSSION

Our study aimed to evaluate the epidemiological risk of African swine fever caused by hunting activity in Hungary. During the survey, 58 persons were interviewed. This sample size could provide appropriate information about the knowledge, attitude, and practice of the focus group of approximately 400–600 persons. The empirical data, presented in the Supporting Information, confirmed that saturation was reached with interviewing half of all survey subjects (Guest et al., 2020; Hennink & Kaiser, 2022). The findings confirmed that personnel of the hunting events could carry the viral pathogens into the domestic pig population if ASF is present in a certain area. Notwithstanding, the risk of transmission from backyard farms to the wild boar population exceeds the opposite way.

Our survey was conducted within one of Hungary's poorest regions, where backyard farming and casual jobs in forestry and hunting are very important elements of the local economy (Németh, 2019). The finding that more than 70% of the interviewees were seasonal workers on hunting events also confirmed this phenomenon. Nearly 90% of them never left the region for a forest job. The poor knowledge of these people about hygiene and disease control can be observed through their approach to working clothing. More than one-fifth of the questioned persons could not see any problem with multipurpose clothing without washing between different uses.

The most surprising results of this study were that more than half of the interviewees slaughtered pigs regularly and 60% of these pork producers butchered purchased pigs. These findings contradict official data on Hungarian backyard farming. Traditional Hungarian backyard facilities are considered 'outdoor' farms, where the pigs can access open-air in a small pen in front of the covered area. The animal health authority registered about 800 noncommercial outdoor farms in the whole country. From the official viewpoint, the backyard sector is on the verge of dying out (EFSA, 2021). Considering our findings, a recognisable number of unregistered farms and illegal pig and pork trade are presumable in the background.

In our survey, a quarter of the pork producers made pork products above their family's needs. For the sake of the stakeholders' contribution, we could not be curious about the permissions of their pork-producing activity and the sources of supply during the interviews. Therefore, we can only suppose that most of these backyard pig keepers, pig trades, slaughters, and pork distribution cannot be seen by the authorities. The exact epidemiological risk of this 'grey' farming system can only be determined if the extent of this sector is assessed. By the finding that among randomly chosen 58 questioned persons, 31 reported regular pig-slaughters, we hypothesised that the backyard pig sector has a great socioeconomic concern in low-income regions of Hungary.

In Hungary, the Food-chain Control Act (46/2008 Act) regulates the main compensation principles for the losses caused by disease control actions. The Act denies payment for illegally kept animals. For this reason, in an epidemic situation, low-income communities with the 'grey' pig sector will try to defend themselves in their way. In the Eastern European, Russian and Ukrainian backyard sectors, emergency sales and slaughters can be observed close to ASF outbreaks because of the inappropriate compensation system. This phenomenon causes rapid spread and long-distance jumps of the disease (Bellini et al., 2016; Costard et al., 2015).

Additional factors increase the risk of the 'grey' backyard pig farming. Two of the 13 pig farmers did not know the importance of dedicated working clothes for pig caring in our survey. More than 10% of the questioned persons had family members in a distant part of the country from where they regularly got samplers of pig slaughters. Sixteen of 31 pork producers disposed of the slaughter offal so that wild boars' access to the offal cannot be excluded.

Leftovers from the 'grey' pork value chain can reach the natural ecosystems by roadside waste dumps and seasonal workers' litter during forestry, hunting or agricultural work (Figure 2).

These factors can contribute to ASF transmission from the backyard pig sector to the wild boar population, even by long-distance jumps. In our study, nearly 80% of the interviewees took backyard pork products to the forest, and more than 10% of them threw the leftovers away after lunch in the forest.

Previously recorded long-distance jumps within Europe could be observed due to labour migration from the eastern part of the continent (EFSA, 2019). Nowadays, this phenomenon is worsened by the Russian invasion of Ukraine. Thousands of people must leave their homes with their most valuable belongings. The border check stations are under severe pressure, though the efficiency of biosecurity control was not perfect even in peacetime (Devi, 2022). The large number of refugees who enter the European Union (EU) makes maintaining the border biosecurity control nearly impossible.

In the political stalemate between Russia and the West, the Ukrainian crisis is unlikely to end within a short term (Hunter, 2022). More than 5 million refugees are expected to flee from the terror of war to the EU (Devi, 2022). Mass migration and other economic consequences of the war (increasing food and energy prices) will erode the vulnerable economy of the EU Member States, which are significantly exposed to Russian energy imports (Paulson et al., 2022). In these circumstances, economically vulnerable social strata will be affected principally. Their standard of living will decrease, and their dependence on backyard farming will turn into fateful. Populist regimes, such as the re-elected Hungarian government, seek to neutralise the

FIGURE 2 Pig slaughter offal in an illegal refuse dump in the survey area

dissatisfaction of the lowest social strata (Czibere & Kovách, 2021). Therefore, the forthcoming economic crisis will not provide leeway for the authorities to efficiently control grey pig-farming industry and to mitigate the epidemiologic risk. Amid an escalating humanitarian catastrophe, the possible spread of ASF seems the smallest problem but long-term effects on the economy of the lowest income regions of Europe might also be disastrous.

The hazard of illegal pork import multiplied from the beginning of the Ukrainian war. The risk of uncontrollable distribution of these illegally imported pork products also increased as it was experienced previously in wartimes (Moura et al., 2010; Penrith, 2020). The chance of long-distance jumps is higher than ever. In these conditions, delayed detection of an outbreak in a small family holding has increasing odds. The consequence can be a catastrophic impact on a national economy.

5 | CONCLUSION

This study aimed to evaluate the potential role of hunting events in ASF transmission to the domestic pig population. Instead, it revealed an extent backyard pig sector existed within the study region. Our survey confirmed that the low-income pig farmers' average approach to biosecurity could enhance virus spread if the disease occurs in the region. These findings highlight the epidemiologic risks of mass poverty in certain regions of the EU. In the light of the current economic crisis facing Europe, epidemiological investigations, especially in low-income regions, require a new approach. Professionals of social sciences enable the multidisciplinary One Health working groups to reveal the real drivers of ASF in rural circumstances of Central Eastern Europe.

AUTHOR CONTRIBUTIONS

Ferenc Jánoska: *Conceptualization*, *Supervision*, *Writing - review & editing*. Eszter Nagy: *Data curation*, *Investigation*, *Methodology*, *Visualization*, *Writing - original draft*. Tamás Tari: *Data curation*, *Investigation*, *Methodology*, *Writing - original draft*. Rebeka Ráhel Nagy: *Data curation*, *Investigation*, *Writing - original draft*. Tibor Halász: *Conceptualization*, *Investigation*, *Resources*. Gyula Varga: *Conceptualization*, *Resources*, *Writing - review & editing*. Melinda Kovács: *Resources*, *Writing - review & editing*. Peter Kemenszky: *Conceptualization*, *Investigation*, *Methodology*. Gabor Nagy: *Conceptualization*, *Data curation*, *Investigation*, *Methodology*, *Project administration*, *Software*, *Writing - original draft*. Ágnes Csivincsik: *Conceptualization*, *Data curation*, *Investigation*, *Methodology*, *Project administration*, *Writing - original draft*

ACKNOWLEDGEMENTS

The support of the Hungarian National Laboratory project RRF-2.3.1-21-2022-00007 is gratefully acknowledged. The publication was financed by the Hungarian National Research, Development and Innovation Office, "One Health" project, grant number 2020–4.1.1-TKP2020. The authors are grateful to the expert team of the Department of Foreign Languages at the Hungarian University of Agriculture and Life Science.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

Data are available as article's Supporting Information.

ETHICAL STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to. No approval of the Institutional Animal Welfare Committee was needed because the study did not use live animals.

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PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1002/vms3.1030.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Jánoska, F., Nagy, E., Tari, T., Nagy, R. R., Halász, T., Varga, G., Kovács, M., Kemenszky, P., Nagy, G., & Csivincsik, Á. (2023). Survey of wild boar hunter interactions with pig farming in central Europe. *Veterinary Medicine and Science*, *9*, 465–470. https://doi.org/10.1002/vms3.1030