Evaluation of a Harmonized Undergraduate Catalogue for Veterinary Public Health and Food Hygiene Pedagogy in Europe

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“Evaluation of a Harmonized Undergraduate Catalogue for Veterinary Public Health and Food Hygiene Pedagogy in Europe”

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Abstract
Current and emerging veterinary public health (VPH) challenges raised by globalization, climate change and industrialization of food production, require the veterinarian’s role to evolve in parallel, and veterinary education to adapt to reflect these changes. The European Food Hygiene catalogue was developed to provide a list of topics relevant to Day One Competencies in VPH. A study was undertaken to ensure that the catalogue and teaching practices were relevant to the work of public health veterinarians. A consultation process was undertaken with relevant stakeholders using questionnaires and semi-structured interviews. A long questionnaire was distributed to 49 academics teaching VPH in European veterinary schools to review topics listed in the catalogue. Eighteen responses were received (36.7%), representing 12 European countries. There was general agreement that most topics were appropriate for the undergraduate VPH curriculum. A short questionnaire was distributed to 348 European veterinarians working in the industry. Twenty-four questionnaires (6.7%) were...
received, representing eight European countries. Despite the low participation rate, topics needing greater emphasis in the undergraduate curriculum included Hazard Analysis Critical Control Points (HACCP), food microbiology and, audits and animal welfare at slaughter. Seven semi-structured interviews with public health veterinarians working in the UK identified the need for curricular changes including greater practical experience and a shift from a focus on meat inspection to risk management. This may be partly achieved by replacing traditional lectures with authentic case-based scenarios. The study findings can be used to inform the future direction to VPH education for veterinary students across Europe.

Key Words: Veterinary Public Health, Food Hygiene, One Health, Veterinary Curriculum, Day One Competencies.

Introduction

Veterinary Public Health (VPH) is an academic discipline that encompasses the principles of prevention and control of zoonotic and animal diseases, and of food hygiene and foodborne diseases.1 In the veterinary curriculum of most European veterinary schools, VPH is synonymous with food hygiene (FH) and regulatory veterinary work (i.e. working as Official Veterinarian in abattoirs), whereas the related subject of veterinary epidemiology is taught separately. In this article, the term VPH is used as per the typical European interpretation.

The VPH curriculum in Europe should equip veterinary students with the skills necessary to satisfy the Day One Competencies (or exit outcomes) required by accreditation bodies like the European Association of Establishments for Veterinary Education (EAEVE) in Europe, and the Royal College of Veterinary Surgeons (RCVS) in the UK. These are underpinned by the European Directive 2005/36/EC (and subsequent amendments) on the recognition of professional qualifications.2 For both EAEVE and RCVS, the Day One Competencies (D1C) in FH revolve around the ability to conduct ante-mortem and post-mortem inspection of animals presented for slaughter. This will contribute to the prevention of foodborne hazards entering the food chain, and the associated risk to public health. EAEVE also identifies auditing skills as a competency,5,6 which are part of the veterinary tasks undertaken during Official Controls at the abattoir and other food producing establishments. The latest European Union Regulation 2017/625 on Official Controls has highlighted that the protection of human and animal health, animal welfare, and the environment can only be achieved by adopting a holistic approach throughout the agri-food chain.7 The same principles are supported by the World Organisation for Animal Health (OIE) in their recommendations on competencies of graduating veterinarians.8 Therefore, veterinary schools should train students to develop a risk-based mind-set while applying their FH skills to the entire agri-food supply chain in a One Health context, not just at slaughter. Postgraduate specialization and on-the-job training are necessary to achieve proficiency in performing these duties.

Globalization has resulted in changes to the socio-economic and socio-demographic climate, with barriers to the movement of people and goods being relaxed and an increasing range of food available. As such, food can be sourced from many disparate locations and subject to different food quality and hygiene standards, meaning that food hazards know no boundaries. Therefore, FH expertise and the role of the veterinarian in PH are changing and need to evolve to continue to be relevant to a global context.9
The changing situation globally may appear to necessitate an increase in the breadth of VPH teaching. However, an indiscriminate increase in the VPH curriculum content would compound the pre-existing concerns of an already overloaded veterinary curriculum. An increase in VPH content at the expense of other disciplines is not realistic when comparing the proportion of veterinarians in Europe working in PH after graduation with other areas of the profession. Instead, what is envisaged is a modernization of the VPH curriculum and a re-focusing of VPH learning and teaching practices on the essential D1Cs needed to tackle current and future FH concerns.

One of the main challenges facing VPH education in Europe is that the subject is unpopular among veterinary students, who struggle to see the relevance of working as a veterinarian in PH. There is no easy solution and VPH educators need to address this problem from different angles. In 2011, a meeting was organized at the University of Leipzig (Germany), to which VPH teachers from nine European countries attended. It was unanimously recognized that a forum was needed specifically to discuss learning and teaching practices in VPH. The following year, at the University of Ghent (Belgium), the European Veterinary Food Safety Teachers (EVFST) group (EVFSTG) was established and tasked with improving teaching quality in VPH. The EVFSTG group currently has 27 members representing veterinary schools of 24 European countries. The group meets once a year to discuss innovations in VPH pedagogy and each member is responsible for cascading information to the rest of their teaching team and ensuring senior management at their institutions are made aware of developments.

One of the objectives of the EVFSTG group was to discuss the proposal from EAEVE for a harmonized European VPH Curriculum for all undergraduate students. As a starting point, the group reviewed the English version of the ‘Catalogue of Teaching in Food, Meat and Dairy Hygiene in Germany, Austria and Switzerland’, developed for German-speaking countries.

The group refined the content by removing topics that were not considered relevant at a pan-European level. The first edition of a harmonized ‘European Catalogue for Teaching Food, Meat and Dairy Hygiene’ (the European Food Hygiene catalogue) was published in August 2018.

At following EVFSTG meetings it was debated whether the European Food Hygiene (EFH) catalogue provided the D1Cs required of veterinary graduates, met employers’ expectations, and aligned with OIE’s recommendations on veterinary education to facilitate international mobility of veterinarians. If so, the catalogue could then be used when planning future VPH teaching at European veterinary schools and to define learning outcomes of VPH courses. These aims became particularly relevant in view of the uncertainties associated with the departure of the UK from the European Union and the unforeseen changes to education resulting from the COVID-19 pandemic. Importantly, the EFH Catalogue would also contribute to consistency in VPH activities conducted by veterinary graduates across Europe and facilitate mobility of veterinarians working in VPH.

In 2017, a research project was launched to evaluate the fitness for purpose of the EFH catalogue, by evaluating its alignment with current educational needs identified by academics teaching VPH and those actively working in VPH across Europe. A secondary aim was to collate field veterinarian suggestions to improve teaching of undergraduate students in VPH.

Materials and Methods

The project consisted of three stages. Stage 1: a long questionnaire to evaluate the content of the EFH catalogue, distributed to the European academics teaching VPH. Stage 2: a short
questionnaire to collect opinions on the future of VPH education, distributed to European veterinarians currently or with previous experience working in PH. Stage 3: semi-structured interviews to further explore the themes emerging from the short questionnaire with veterinarians working in PH and to elicit more in-depth views on improving VPH education.

The target population was from all European countries except Germany, Austria and Switzerland as they had already agreed on the content of their catalogue. All participants were made aware of the aims of the project, the nature of involvement in the research and agreed to take part by signing a consent statement. This research project received approval from the Royal (Dick) School of Veterinary Studies Human (research) Ethical Review Committee (HERC) approval (HERC_182_18).

Stage 1: Long questionnaire for academics

The list of topics in the first edition of the EFH catalogue was used as a template to create the long questionnaire. There were 305 topics divided into three sections: the Food Hygiene syllabus (131 topics), the Meat Hygiene syllabus (103 topics), and the Dairy Hygiene syllabus (71 topics). The questionnaire was distributed to academics teaching VPH in European veterinary schools who were members of the EVFST Group and/or members of the European College of VPH (https://ecvph.org/). Participants were asked to provide a response for each topic using the following scale:

0. I don't teach this topic because it is not relevant
1. I don't teach this topic because I don't have the time
2. I don't teach this topic because it is taught by another department
3. I teach this topic but briefly or recommend for self-study
4. I teach this topic as it is important

Stage 2: Short questionnaire for veterinarians

A short questionnaire was developed and was distributed to veterinarians working in PH recruited through the EVFST Group and two private companies that employ European veterinarians working in abattoirs in the UK on behalf of the government authority. The questionnaire collected demographical information (age, gender, nationality, veterinary school and year of graduation, previous and past occupation, and years of VPH experience) and used open questions to elicit personal views on undergraduate VPH education as follows:

1. Taking into consideration your career in food hygiene/ VPH, what are the topics that were not taught at your vet school, but you think are necessary to fulfil your role?
2. What are the food hygiene/ VPH topics that were taught at your vet school, but not in enough depth to fulfil your role?
3. What are the food hygiene/ VPH topics that were taught at your vet school, but you find less relevant to your role?
4. Is there anything else you would like to comment on that would have improved your veterinary education in food hygiene/ VPH?

Questionnaire validation, data acquisition and analysis

The questionnaires were piloted between August and December 2017 by members of the EVFST Group. The final version of each questionnaire was distributed using Online Surveys (https://www.onlinesurveys.ac.uk/) with a link in an email sent to both cohorts of participants. The questionnaire was open from February until 31 May 2018 and reminders were sent in March and April to encourage further responses. Completed questionnaires were downloaded into Excel and information that could identify a respondent (nationality and veterinary school)
was removed before analysis to maintain anonymity. The long questionnaire data were analyzed using descriptive statistics. For the short questionnaire, free text entries from questions 1, 2 and 3 were clustered under main headings by two authors (AS, JDP) and assigned to broad categories matching the EFH catalogue and collated for descriptive statistical analysis. For question 4 qualitative analysis was used to identify relevant and recurrent topics.

Stage 3: Semi-structured interviews

Participants for the semi-structured interviews were based in the UK and were recruited at the national UK conference of the VPH Association held in September 2018, as well as via the authors' professional networks. The veterinarians participating in the interviews did not take part in the questionnaires. All interviews were conducted by the one researcher (author CS), in person or by phone. At the start of the interview, the researcher explained the scope of the project and the preliminary results of the short questionnaire, and then asked the interviewee to consent to participate before proceeding with the interview. The structure of the interview was as follows:

- Comment on the main themes that emerged from the short questionnaire.
- Offer suggestions on the best way to teach these topics whilst considering the constraints of an overloaded curriculum in European veterinary schools.
- Give any final comment to improve VPH education in veterinary schools overall.

Interviews were recorded on an audio digital recorder. Audio files were downloaded and stored on a secure, password protected university computer. Audio files were transcribed and a thematic qualitative analysis was performed independently by two of the authors (AS, JDP) following the methodology described by Braun and Clarke (2006).17

Results

Stage 1: Long questionnaire for academics

The long questionnaire was distributed to 49 academics responsible for organizing and teaching the VPH course at their institutions. They represented 24 European countries. Eighteen responses were received (36.7%), representing 12 European countries. The participant frequency by country is shown in Figure 1, and the responses to all the topics in the questionnaire are shown in Figure 2 (a, b, c and d).

Figure 1. Map and frequency table of academic participants in the long questionnaire (n=18).

Figure 2a, b. Long questionnaire to academics (n=18). The Food Hygiene syllabus. Table of response frequencies for each topic.

Figure 2c. Long questionnaire to academics (n=18). The Meat Hygiene syllabus. Table of response frequencies for each topic.
Figure 2d. Long questionnaire to academics (n=18). The Dairy Hygiene syllabus. Table of response frequencies for each topic.

The Meat Hygiene syllabus (Figure 2c; n=103 topics): there was strong agreement about the importance of the meat hygiene topics (theory and practical) related to ante and post-mortem inspection (Fig. 2c, topics 11.1 to 11.40 and topics 14.1 to 14.13). Some differences were observed between academics regarding teaching of topics related to game meat hygiene (Fig. 2c, topics 12.1 to 12.9 and topic 14.14), and import and export of meat (Fig. 2c, topics 13.1 to 13.4).

The Dairy Hygiene syllabus (Figure 2d; n=71 topics): although the majority of academics agreed on the importance of teaching most of these topics, the responses were divided as to whether the VPH academics or another department were delivering the teaching (Fig. 2d, topics 16.1 to 17.16), showing less ownership of some components of the syllabus. Some examples of topics that were identified as less relevant in the VPH curriculum were ‘Product-specific legislation’ (Fig. 2d, topics 15.9 and 19.1), ‘Specific dairy products’ (Fig. 2d, topics 19.13 to 19.21), and ‘nutritional significance of dairy products’ (Fig. 2d, topics 16.12 and 19.2).

Stage 2: Short questionnaire for veterinarians

This questionnaire was distributed to 348 European veterinarians working in VPH. Twenty-four completed questionnaires (6.7%) were received, representing veterinarians who had graduated from veterinary schools in eight European countries. Due to the low number of responses, and to facilitate descriptive statistics, the eight European countries have been clustered together as North, South and Eastern European zones based on their geographical distribution. Demographic data are reported in Figure 3. Despite the low participation rate, it was possible to appreciate a consensus on the relevance of the topics that had been taught during their undergraduate training. A summary of the main themes extracted from responses is presented in Table 1.

Figure 3. Map, frequency table and demographic information of veterinarians participating in the short questionnaire (n=24).

Thirteen topics were identified from 34 free text answers. In addition, 29% of respondents specifically stated that there were no topics to add to the VPH curriculum. This was particularly relevant for veterinarians doing clinical work (n=4; 75%) (n=the total number of veterinarians in the demographic group as reported in Figure 3, and the percentage is the proportion of veterinarians in that group who mentioned the topic), especially from Northern European countries (n=3; 67%) but less so for veterinarians working as OV (n=16; 19%), graduating in Southern Europe (n=13; 15%) and with less than five years of VPH work experience (n=8; 13%). Twenty-five percent of the respondents indicated that more teaching on ‘Legislation and...
enforcement’ was needed during undergraduate studies. This was more relevant for veterinary
managers working for the government (n=4; 50%) from Northern European countries (n=3;
67%). Seventeen percent of the respondents indicated that more teaching on ‘Welfare at
slaughter’ was required, this was particularly noted by veterinarians with less than five years
of VPH work experience (n=8; 25%) and those from Southern European countries (n=13;
23%). More teaching on recognizing ‘Post mortem pathology’ was important for 13% of the
respondents. This was more relevant to veterinarians who were more than 10 years since
graduation (n=13; 23%) and graduated in Spain (n=10; 30%). Among the other topics ‘Audits’
and ‘Food microbiology’ where both mentioned (n=2; 8%) in particular from veterinarians
graduating in Eastern European countries.

Question 2: topics that were taught at your vet school but not in enough depth to fulfil your
role.

Nine topics were identified from 37 free text answers. Thirteen percent of the respondents
when asked to identify any topics that had not been taught in enough depth at their veterinary
schools, stated ‘none’ (or equivalent wording). More ‘Practical training in VPH’ (n=10; 42%)
was the main theme. This was particularly a concern for veterinarians graduating in
Southern Europe (n=13; 46%). It was mentioned by veterinarians who were less than 5 years
graduated (n=4; 75%), working as an OV (n=16; 44%) but also by more experienced
veterinarians with 6 to 10 years of VPH work experience (n=7; 71%). Hazard Analysis and
Critical Control Points (HACCP) was identified as the next topic that was not taught in enough
depth at veterinary schools (n=7 29%). As above, this was brought up by veterinarians who
were less than 5 years graduated (n=2; 50%), working as an OV (n=16; 31%) and by more
experienced veterinarians with more than 10 years’ experience (n=10; 44%) especially
graduating in from Southern Europe (n=13; 38%). ‘Legislation and enforcement’ was also
present in 25% of responses by veterinarians with both less than 5 years from graduation
(n=2; 50%) and less than 10 years of VPH work experience (n=8; 38%) mainly graduating in
from Southern European (n=13; 38%). Other topics of interest also mentioned when
answering question 1 were ‘Post mortem pathology’ (n=5; 21%), ‘Welfare at slaughter’ (n=2;
8%) and ‘Audits’ (n=1; 4%).

Question 3: topics that were taught at your vet school, but you find less relevant to your role.
Six topics were identified from 25 free text answers. Fifty-four percent of respondents stated
there had been no irrelevant topics in their VPH curriculum, and this was reported across all
categories of veterinarians. ‘Food quality’ and ‘Food technology’ were both listed as
unnecessarily topics for 13% of respondents. This was more evident for veterinarians with 6
to 10 years of VPH work experience (n=7; 29%), and from Northern (n=3; 33%) and Eastern
European (n=8; 25%) countries. ‘Food microbiology’ (n=1; 4%) and ‘Post mortem pathology’
(4%) were also mentioned.

Question 4: Is there anything else you would like to comment on that would have improved
your veterinary education in food hygiene / VPH?

Eleven out of 24 free text answers (45.8%) re-emphasized that more practical training in VPH
would improve VPH education, one response (4.2%) asked for more teaching on EU new
Regulations and the rest of the respondent stated there was nothing more to add.

Stage 3: Semi-Structured Interviews

Seven semi-structured interviews were conducted with veterinarians working in the UK, four
were OVs, two were former OVs now working for other government authorities, and one was
a former OV now working as a veterinary advisor for the UK government. A unanimous theme
from all the veterinarians was the need to increase the practical training in VPH by, for example, introducing mock audits of food producing establishments into veterinary training where knowledge and integration of legislation, HACCP and food microbiology can be applied at the same time. An example of an interviewee comment:

“Of course they teach us legislation but not really in a practical way. I think is better if someone will go in a slaughterhouse and I don’t know if here in England will be allowed. To say, look about the legislation that we have just learned this week, let say hygiene regulation 853, you see in that paragraph it says about the walls, inspect this room, for example to learn in a more practical way. So they can read the paragraph of legislation and you go with them in the slaughterhouse and ask the students to identify what is wrong, just their impression. Is this wall clean, is this floor clean, is this operator doing what he should do.” [Interviewee 1]

Interviewees were also keen to give examples of activities that could be achieved ‘in-house’ at veterinary school by, for example, using pictures related to authentic case-based scenarios on animal welfare, to diagnose pathology at post mortem inspection or provide microbiology testing reports to allow students to interpret the results. An example of an interviewee comment:

“I think it will be useful to maybe have some scenario based teaching on what you do if you came across certain welfare issues in the lairage. Because for me that is definitely, yes, probably one of the biggest things to deal with working as an OV… because I found it difficult to gauge with what was enough to report to the local authorities”. [Interviewee 6]

An important aspect was also a need for practical training on communication and negotiation skills to be able to liaise with farmers, operators on the production line, and senior management. As well as having a working knowledge of the practical and financial implications of problem resolution, other professional skills were considered necessary, particularly how to improve self-confidence and resilience when dealing with difficult situations especially as a new graduate. An example of an interviewee comment:

“Because you will finish the university and you are not confident on your knowledge and after that you are not confident in your powers and what you do. If you say something they need to respect so, you are there like oh my god, what else I have to do now because he was shouting at me and he knows better than me because for sure a lot of managers in the plant will know more things than you at the beginning because they have the experience for twenty years or more. That’s the thing they (the students) need more support”. [Interviewee 4]

To appreciate the complexity of working in the food industry, some interviewees advocated for veterinary schools owning a commercial abattoir to use for teaching and research purposes and to show the students the implications of running this kind of business. Where there is limited access to an abattoir for teaching, the use of a virtual simulator to train in practical aspects of FH was also mentioned as an educational option. An example of an interviewee comment:

“For example, if they are doing let’s say a chamber in a slaughterhouse and on the virtual reality you can have some non-compliances with comments: here the ceiling, I don’t know, is rusty, things like that and when you see with your own eyes, condensation, bad practice on slaughter hygiene and you will see exactly what is happening. And you have like decision on what to do and how to speak to the FBO (Food Business Operator). This will be a tremendous work to do but it will change the learning process”. [Interviewee 3]
Discussion

The primary aim of this research project was to evaluate the content of the EFH catalogue and to determine if it is suitable to prepare veterinary students for the current and future challenges in VPH. A secondary aim was to collate veterinarians’ suggestions to improve VPH teaching for undergraduate students. A consultation process was undertaken with academics and veterinarians working in the sector using questionnaires and semi-structured interviews. European academics indicated via the long questionnaire that the EFH catalogue included most of the topics that were appropriate for a modern undergraduate VPH curriculum. The low number of responses to the questionnaires did not allow for quantitative statistical analysis of the results. However, qualitative analysis of free text answers in the short questionnaire identified recurring themes that can be used to inform the future direction of VPH education. Semi-structured interviews with PH veterinarians identified the need for curricular changes including greater practical experience and a shift from a focus on meat inspection to risk management. Risk management in food safety is defined by the World Health Organisation as: “the process of weighing policy alternatives to accept, minimize or reduce assessed risks and to select and implement appropriate options”.18

Topics that are taught and are relevant to the VPH role

The results of the long questionnaire showed an overall agreement among VPH academics that the majority of the topics in the EFH catalogue were important, and therefore relevant to the undergraduate VPH curriculum. Some differences were observed that related to country specific requirements (e.g. wild game meat hygiene in countries where hunting is common or fish hygiene where veterinarians perform official duties in fish markets). It is therefore important that the European VPH curriculum allow for some degree of flexibility so that more time is devoted to teaching topics that are relevant to each country. In the case of inspection of fishery products however, although this can be country specific, it is important to consider the rising contribution of fish in terms of provision of animal protein worldwide.19

While meat inspection was taught by VPH academics across European veterinary schools, teaching of milk hygiene or food analysis was mostly delivered with or by colleagues working in other departments (e.g. farm animal clinics, epidemiology or pathology). This approach is often an organizational solution to the fact that in some veterinary schools there is a lack of veterinary expertise in FH and food microbiology.20 The implication of other departments delivering VPH content is that they might not be familiar with practical PH aspects or provide a One Health approach to the topics as they may be inclined to expand on their field of expertise rather than focusing on FH and PH. It can be speculated that this per se may not constitute a problem in terms of delivery of the content, but it may have an impact on students’ experience and perception of VPH, if the teacher does not show the same level of confidence and enthusiasm in teaching VPH, as they do when teaching their own subject. Therefore, this could be a contributing factor to the unpopularity of VPH among students.

Some topics of particular relevance to specific hazards such as antimicrobial resistant pathogens, mycotoxins, and infective proteins like prions were not taught by all the VPH academics but by their colleagues. This warrants further investigation as it is important to link these important PH and One Health topics across the curriculum. The EFH catalogue could be used as a tool to support such discussions and it may also help to spot duplication of teaching in the curriculum and reduce curriculum overload. This result is also interesting due to the importance of adopting a holistic approach in reducing antimicrobial resistance in animals and food, which is also relevant to other disciplines in a One Health context.21 Mycotoxins are considered to be a primary food borne hazard in the future due to global
warming, and prions are linked to the Bovine Spongiform Encephalopathy (BSE) crisis whose global repercussions still endure.

In the short questionnaire for veterinarians, 29% stated that there were no topics that needed to be added to the VPH curriculum. A possible reason for this view could be because most students go into clinical practice and for them the VPH content taught at the veterinary schools is sufficient. In the authors’ experience, some students report that there is too much VPH content in the curriculum at the expense of other clinical disciplines and this may contribute to the unpopularity of VPH. On the other hand, the veterinarians currently working in PH felt that more VPH teaching was needed at veterinary schools to perform their duties. Contrasting stakeholder views on this point indicate a need to find the right balance of VPH content in the curriculum by focusing on D1Cs and avoiding curriculum overload.

**Topics that are taught and are not relevant to the VPH role**

There was agreement between academics and veterinarians on topics that are not relevant for the VPH curriculum. The nutritional significance of food and food of plant origin are more applicable at post-graduate specialization level rather than as D1Cs for veterinary students. Similarly, the rules and guidelines for import and export of food to different countries and the associated legal and administrative procedures are more appropriate to on-the-job training for OVs. Differentiation of topics at each level of training will help reduce the burden on the undergraduate curriculum.

**Topics that are not taught in enough depth in the VPH curriculum**

Twenty-five percent of the respondents indicated that more teaching on ‘Legislation and enforcement’ was needed during undergraduate studies. Interestingly, good knowledge and application of legislation and enforcement is key to the work of OVs and even more so, for managers who need to provide pertinent advice to OVs. However, in many European countries, veterinarians working in PH need to attend postgraduate courses to be licensed as OVs (e.g. the OV course in the United Kingdom) and familiarize themselves with the legislation and enforcement practices specific to their country. Therefore, it is more appropriate to expand this topic as part of a postgraduate specialization rather than in the undergraduate curriculum and as part of on-the-job training to perform OV duties.

Practical teaching of pathology for post mortem inspection was the second topic that required greater emphasis in the VPH curriculum as it is essential to perform official controls at the abattoir and is a D1C.

Hazard Analysis and Critical Control Points (HACCP) was identified as the third topic that needs more teaching at veterinary schools. This result validates the relevance of HACCP as one of the cornerstones of modern FH and safety. This is an example where a practical training on audits of food producing establishments or by using authentic case-based scenarios may help students to integrate and apply the underpinning knowledge to real-world situations.

**Practical training in VPH**

The analysis of the responses to the short questionnaire and the semi-structured interviews clearly identified two main topics: ‘Legislation and enforcement’ and ‘Practical training in VPH’.

These results are consistent with the findings of Maijala and Korkeala (2008), in Finland. Other topics relevant to modern VPH curriculum were also ‘Post mortem pathology’, ‘HACCP’, ‘food microbiology’ and ‘audits’. It is worthwhile noticing that these topics have a strong
Day One Competencies, professional practice and employability

Two important themes identified during the interviews were the need for training to include communication and negotiation skills to deal with different stakeholders, and how to improve self-confidence and resilience when dealing with difficult situations especially as a recent graduate. These findings are relevant when considering the competencies desired by those employing VPH professionals, which have been identified by Alonso et al. (2013) in descending order of importance: (i) Problem solving in an analytical and scientific way; (ii) Efficient and effective organization of work; (iii) Clear expression of thoughts; (iv) Broad horizon and inter/ multidisciplinary thinking; (iv) Social competence, empathy and ability to work in team.²¹ In 2015, Stark et al. (2017) revisited the competencies for government veterinary services for the future and concluded that along with technical knowledge, it was necessary to improve communication skills.²² It is interesting to note that the competencies identified by Alonso and Stark have been included as part of many curricular reviews in recent years, which have increased emphasis on the development of clinical reasoning, problem-solving and professional skills, with less on content knowledge.²³ Many veterinary schools are
including specific professional skills courses within the curriculum, with a recent increased emphasis on improving student resilience and mental health at work.\textsuperscript{324}

In addition, the range of job opportunities for VPH professionals is extending beyond the more traditional government and academic work. For example, the food industry is becoming more aware of the role that veterinarians can play with a shift from a technical role to one that emphasizes leadership (Figures 4 and 5). With an increased range of job opportunities for veterinarians in PH, veterinary schools should therefore consider a balance of day one competencies and specific skills related to the careers students may chose after graduation. Therefore, some specific VPH competencies may be offered in undergraduate elective courses, further postgraduate qualifications or on-the-job training.

**Figure 4.** Main job categories available to VPH professionals (QMRA= Quantitative Microbiological Risk Assessment; FBO= Food Business Operators). The European Veterinary Food Safety Teachers Meeting, Uppsala (June 2016).

**Figure 5.** Main job competencies expected from VPH professionals. The UK VPH Teachers Meeting with government authorities, Cambridge (September 2016).

### Limitations and areas for future research

Information that could identify a respondent in long questionnaires (nationality and veterinary school) was removed before analysis to maintain anonymity. It was accepted that removing nationality and veterinary school reduced the ability to draw conclusions. As mentioned above, the low number of responses to the questionnaires did not allow for quantitative statistical analysis of the results and this can be seen as a limitation of this study. For the long questionnaire, the need to evaluate 305 items would have affected the response rate. However, the 18 (of a possible 49) academics did represent 12 countries and there was general agreement about most topics in the EFH catalogue. The response to the short questionnaire was low (24/348) and may indicate that these individuals did not prioritize completing a survey as part of their daily work. In retrospect, we should perhaps have sought additional ways to raise awareness among this group. In addition, it would have been helpful to be able to perform a more granular country-based analysis, but the low response rate to the short questionnaires prevented it. This can be considered as further area of research in retrospect we should perhaps have sought additional ways to raise awareness among this group. Another limitation is that the VPH curriculum may have changed since the veterinarians who participated in our study graduated, especially if that was some years ago. The participants were likely to have reflected on the curriculum they experienced and therefore their suggestions need to be checked against the current curriculum at veterinary schools. Lastly, interviews were only conducted with veterinarians working in PH in the UK so the findings may not be relevant or generalizable across Europe.

Future areas of research will be to explore the student perspective in the future of VPH education (a stakeholder not included in this study) and in particular, how to spark their interest in VPH in the undergraduate curriculum. The study findings will be presented and discussed at the next European Veterinary Food Safety Teachers group (EVFSTG(EVFST)) group meeting and will promote the relevance and value of using the EFH catalogue as well as discussing opportunities to engage in new ways of teaching. The study team are also

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\textsuperscript{324}
encouraged by the recent award of the UNA Europa Seed Funding grant in February 2021 to facilitate the creation of a network of European VPH educators and to complement the EVFST group initiative.

Conclusions

The results of this study have shown that the EFH catalogue is a valid and useful tool on which to base VPH teaching and potentially provide a more harmonized European VPH curriculum. Useful enhancements to approaches to teaching and learning practices were identified to better align with employers requirements and the modern role of veterinarians in VPH. There is an opportunity for veterinary schools across Europe to adopt a more collaborative and consistent approach to improve and modernize the ever-evolving pedagogy of VPH.

Acknowledgements

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Conflict of interest statement: The authors declare, to the best of their knowledge, that they have no conflict of interest.

Source of funding: None

References


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Table 1. Frequency of specific topics suggested by European veterinarians working in VPH in the short questionnaire.

<table>
<thead>
<tr>
<th>Topics</th>
<th>Topically not taught but are relevant to my role</th>
<th>Topics that were NOT TAUGHT IN ENOUGH DEPTH but are relevant to my role</th>
<th>Topics that were taught but are LESS RELEVANT to my role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislation and enforcement</td>
<td>29%</td>
<td>13%</td>
<td>54%</td>
</tr>
<tr>
<td>Welfare at slaughter</td>
<td>25%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Post mortem pathology</td>
<td>17%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Audits</td>
<td>13%</td>
<td>21%</td>
<td>4%</td>
</tr>
<tr>
<td>Population health</td>
<td>8%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>General meat hygiene</td>
<td>8%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Food microbiology</td>
<td>8%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Practical emergency slaughter</td>
<td>8%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Ethics</td>
<td>4%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>4%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Outbreak investigation</td>
<td>4%</td>
<td>4%</td>
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</tr>
<tr>
<td>Emerging diseases</td>
<td>4%</td>
<td>4%</td>
<td></td>
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<tr>
<td>Food production</td>
<td>4%</td>
<td>4%</td>
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<tr>
<td>HACCP</td>
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<tr>
<td>Practical training in VPH</td>
<td>29%</td>
<td>42%</td>
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<tr>
<td>Milk hygiene</td>
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</tr>
<tr>
<td>Zoonoses</td>
<td>4%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Food quality</td>
<td>4%</td>
<td>13%</td>
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</tr>
<tr>
<td>Food technology</td>
<td>13%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Foods other than meat</td>
<td>8%</td>
<td>8%</td>
<td></td>
</tr>
</tbody>
</table>

Figure Captions

Figure 1. Map and frequency table of academic participants in the long questionnaire (n=18).

Figure 2a, b. Long questionnaire to academics (n=18). The Food Hygiene syllabus. Table of response frequencies for each topic.

Figure 2c. Long questionnaire to academics (n=18). The Meat Hygiene syllabus. Table of response frequencies for each topic.
Figure 2d. Long questionnaire to academics (n=18). The Dairy Hygiene syllabus. Table of response frequencies for each topic.

Figure 3. Map, frequency table and demographic information of veterinarians participating in the short questionnaire (n=24).

Figure 4. Main job categories available to VPH professionals (QMRA= Quantitative Microbiological Risk Assessment; FBO= Food Business Operators). The European Veterinary Food Safety Teachers Meeting, Uppsala (June 2016).

Figure 5. Main job competencies expected from VPH professionals. The UK VPH Teachers Meeting with government authorities, Cambridge (September 2016).