

On-farm pork food safety: Attitudes and beliefs of swine practitioners

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Summary

Objective: To assess US swine veterinarians' knowledge of and attitudes toward on-farm food-safety verification and auditing, veterinary training methods, and the Hazard Analysis Critical Control Point (HACCP) approach.

Method: Attendees at the 1999 American Association of Swine Practitioners (AASP) annual meeting were asked to complete a written survey.

Results: Swine practitioners from 23 states, who had offices or practices in the USA,

provided 243 usable surveys. Respondents found private practitioners or herd veterinarians most acceptable as auditors of on-farm food-safety practices. Most methods of certification for the auditor were acceptable. The AASP was the preferred group to evaluate and certify veterinarians as auditors. Respondents believed that the HACCP approach to food safety was effective for residue avoidance, but were mixed in their opinion about its effectiveness in preventing microbial contamination.

Implications: Veterinarians are interested

in expanding the on-farm services they provide in food safety, and are willing to take further training to provide on-farm auditing and verification. Veterinarians would prefer AASP to take leadership in on-farm food-safety evaluation and certification of veterinarians.

Keywords: swine, veterinarian, food safety, survey, auditing

Received: October 30, 2000

Accepted: February 13, 2001

Currently in the USA, practical guidelines for controlling physical and chemical residues in pork have been published,¹ and methods for reducing zoonotic microbes in swine are under development.²⁻⁴ As on-farm production practices and procedures are developed to reduce swine-associated bacteria that can cause foodborne illnesses, it may be necessary to audit and verify such practices and procedures at the animal production unit. In the United States, on-farm inspections are used in milk production, but have not been common in the production of other animal-based products. In contrast, on-farm inspections of procedures and protocols for pork production have been implemented in certain European countries.⁵

A voluntary quality assurance educational program, the Pork Quality Assurance level III program (PQA III), was developed and implemented by the National Pork Produc-

ers Council (NPPC) in 1992. This program addresses food-safety issues regarding antimicrobial and chemical residues as well as physical defects, and has helped producers improve their on-farm pork quality and safety practices. The PQA III program has been widely accepted by pork producers, with 73,000 enrolled as of January 2000.⁶

Veterinarians may act as important sources of information for pork producers on swine health management and pork food safety. Veterinarians have long been associated with packing plant inspections as part of USDA's Food Safety and Inspection Service, providing or supervising ante mortem and post mortem inspection and plant hygiene inspection. In addition, private veterinary practitioners have taken an active role in the educational process of NPPC's PQA III program. Participation in this program commonly results in an on-farm visit by a third party reviewer, often a veterinar-

ian, although the farm visit is not required. This reviewer evaluates the swine producer's understanding of the Good Production Practices that are core components of the program and usually makes recommendations on how this program may be implemented on each farm. An audit and verification method that includes farm visits has been proposed in the development of the USDA Trichinosis Certification Program.⁷

The development of quality assurance programs and on-farm certification programs has introduced specific verbiage into swine production evaluations. Standardized use of this terminology allows for more concise descriptions of these processes. "Auditing" is a planned independent and documented assessment to determine whether agreed-upon requirements are being met. Audits verify that specific requirements have been fulfilled for a product, process, or system. Auditing compares actual practices to rules or standards. "Verification" confirms by examination or objective evidence (ie, log books, documented procedures) that specific requirements have been fulfilled.⁸ "Certification" of a product or process confers an official status to the product or process audited and verified. Certification provides written or equivalent assurances that control systems conform to requirements.⁹

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Michalak MM, Bahnson PB, Miller GY. On-farm pork food safety: Attitudes and beliefs of swine practitioners. *J Swine Health Prod.* 2001;9(6):275-279.

Certification of an auditor or verifier confers an official status to that person and is often referred to as “accreditation”.

Veterinary practitioners may have an important role in the implementation of on-farm food-safety programs. The responses of dairy practitioners to a survey suggest that they believe a market exists for food safety-related services in dairy practice.¹⁰ However, the attitudes and beliefs of swine practitioners on this topic have not been described. To address this issue, we surveyed US swine veterinarians regarding their knowledge of and attitudes toward on-farm food-safety auditing and verification, training methods, and the Hazard Analysis Critical Control Point (HACCP) approach to food safety.

Materials and methods

A written survey containing fifteen questions was distributed at the business luncheon of the American Association of Swine Practitioners (AASP) annual meeting in St Louis, Missouri, March 1, 1999. The questions pertained to the participants' demographics, their knowledge and attitudes regarding on-farm auditing and verification of production practices, and the HACCP approach to pathogen reduction as applied to pork production. Respondents were not expected to know the technical jargon of quality assurance; therefore, the survey used common English words that could be construed in a technical sense. Six hundred and sixty-eight surveys were placed at the table settings prior to the luncheon. Those in attendance were asked to fill out the surveys at the time of the meal and to leave them at their table. Among the 545 surveys recovered, 339 had completed responses. Data for this analysis is limited to swine practitioners with offices or practices in the USA, resulting in 243 surveys included in this analysis.

Data were analyzed using commercially available software packages (SAS version 6.08, The SAS Institute, Cary, North Carolina, and Statistica for Windows version 5.5, Statsoft, Inc, Tulsa, Oklahoma). Practice type was classified into one of three categories based on the proportion of time devoted to swine. The associations between practice type and attitudes toward HACCP were tested using the Cochran Mantel Haenszel Chi Square test for linear trend.¹¹ Respondents were asked to score the acceptability of four potential methods

Table 1: Swine practitioners' acceptance of potential auditors of food safety-related on-farm practices and their selection of the preferred auditor, in a survey¹ carried out during the 1999 annual meeting of the American Association of Swine Practitioners.

Potential auditors	Acceptable auditor ² %	Preferred auditor ² %
Private practitioners or herd veterinarians	88.7	75.6
State veterinarians	46.9	6.4
State extension personnel	28.4	3.0
Federal government veterinarians	23.3	4.7
Employees of the packer receiving the hogs	15.1	3.8
Producer	9.2	1.7
Other	9.9	4.6

¹ Results of analysis of 243 surveys completed by swine practitioners with offices or practices in the United States.

² Respondents could choose all potential auditors as acceptable, but only one could be selected as preferred.

of certifying the on-farm auditor or verifier. Differences in acceptability of the certification methods were evaluated by the Kruskal-Wallis test. Participants were asked to rank their top three choices of media for delivery of on-farm food-safety training. Patterns of ranking were evaluated by fitting the Mallows' model for partially ranked data.¹²

Results

Demographics

The meeting was attended by 41.8% of the AASP membership from the United States (AASP, personal communication, 1999). Respondents were from 23 states. The largest numbers of responses were from the states of Iowa (23.0%), Illinois (12.3%), Minnesota (10.3%), Indiana (9.0%) and North Carolina (7.4%). Forty-eight percent of the responding veterinarians engaged exclusively in swine practice, 28.8% devoted 51 to 99% of their practice time to swine, and 23% engaged in mixed practice with 50% or less of their practice time devoted to swine.

Auditing and verification of on-farm practices

Assuming that farm visits were a required part of a pork safety program, and given a list of possibilities including federal and state veterinarians, private practitioners, lay employees of the state, employees of the packing plant, or the producers themselves, respondents were asked to select the per-

sons who would be acceptable and the one who would be most preferred to perform audits of on-farm practices (Table 1). From the list of potential auditors, private practitioners or herd veterinarians were selected “most preferred” by 75.6% of respondents. State veterinarians were the next preferred, selected by 6.4% of respondents.

Methods of certification of the auditor

Respondents were asked to rate their preferences (preferred, acceptable, or unacceptable) for methods that could be used to certify or re-certify the on-farm auditor. The methods proposed were written examinations, required continuing education with no evaluation (CE-only), site visits made with a reviewer or verifier, and no evaluation. “No evaluation” was ranked unacceptable by 78.6% of respondents. There was no strong preference among CE-only, written examination, and site visits made with a reviewer ($P=.28$). Among the “evaluation” choices, respondents scored written examinations (93.3%), CE-only (91.2%) and on-farm reviews (89.7%) as either acceptable or preferred.

A majority of respondents (53.6%) indicated that on-farm auditors should be re-evaluated every 2 years, 27% preferred annual re-evaluation, and 16.4% chose 3-year intervals. Fewer than 2% of respondents selected either “no re-evaluation” or “more often than annually” as their choice.

Program administration and certification of the auditor

Assuming that private practitioners or herd veterinarians would audit on-farm practices, 38.6% of respondents selected the AASP to administer the program to certify the auditing practitioners, 24% chose an additional accreditation administered by USDA, and 18.6% selected the National Pork Producers Council to perform this function. Six percent responded that no additional certification or accreditation should be required of veterinarians performing on-farm audits. The response "other" was selected by 12.3% of respondents. Most of these written responses (66%) suggested a combination of two of the previously mentioned groups.

Methods of distributing educational materials

The top three choices among the list of media for providing on-farm food-safety training of the auditors were meetings and (or) classroom, videotape, and interactive CD ROM. Other choices offered were audio tape, satellite down links, internet or web pages, written materials (books and magazines), and other. Two hundred and nineteen surveys had only one response ranked number one (Table 2). No rank order of preference was detected among the 185 valid responses that ranked responses one to three as instructed.

Evaluation of HACCP principles

Respondents were asked to agree or disagree with statements related to the HACCP approach to food safety. For each statement, one of five responses was allowed: strongly agree, mildly agree, undecided or unsure, mildly disagree, and strongly disagree (Table 3).

Evaluations were performed to compare these responses to the percentage of time the respondent devoted to swine practice. The three categories for time devoted to swine practice were 100% swine practice (exclusive), 51 to 99% swine practice (predominate), and 50% swine practice or less (mixed). The responses to four of the HACCP statements (Table 3) tended to differ ($P < .1$) by the proportion of practice time devoted to swine.

Discussion

The three states with the most responses (Iowa, 23%; Illinois, 12.3%; Minnesota, 10.3%) were also the states with the high-

Table 2: Media preferred by swine veterinarians for delivery of food-safety training programs for auditors, in a survey¹ carried out during the 1999 Annual Meeting of the American Association of Swine Practitioners.

Medium	No. of times selected as one of top three media	No. of times ranked first
Meetings and (or) classroom	130	65
Video tape	119	47
Interactive CD ROM	113	35
Written materials (books and magazines)	107	33
Internet or Web pages	97	23
Audio tape	50	12
Satellite down links	45	7

¹ Results of analysis of 243 surveys completed by swine practitioners with offices or practices in the United States.

est representation in AASP membership for 1999 (Iowa, 27.3%; Minnesota, 11.2%; Illinois, 11.0%). This suggests that the states of origin of the respondents reflected the geographic distribution of the AASP membership. This, in combination with the high proportion of AASP members that attended this meeting, suggests that the respondents may broadly represent the membership of the AASP, even though the sampling method was not randomized.

A high proportion of respondents selected private veterinary practitioners as the preferred auditors. This, coupled with the fact that respondents were engaged in swine practice, suggests that practitioners are willing to take on new responsibilities for on-farm pork food safety. This is in spite of the fact that auditing on-farm practices has not been a component of other animal health programs, such as the pseudorabies eradication program and USDA-funded buy-out programs. These programs required simple procedures such as blood testing or permanent identification of animals destined for slaughter and were designed to run for a limited period of time, with a defined, temporary objective. In contrast, on-farm auditing and verification of production practices would create a continuous, dynamic evaluation system. Since a large number of those attending the AASP meeting were engaged in private practice, this choice for auditor might have been biased by the population surveyed.

Most respondents believed that the auditor should be re-evaluated every 2 years, implying a commitment of the respondent's time and resources to maintain current

knowledge of the program. Presently, few veterinary licensures or accrediting bodies require on-going evaluation for maintenance of licensure or accreditation. These responses suggest a commitment to quality and uniformity.

Respondents preferred that the AASP be the agency to administer a certification program for auditing veterinarians, rather than other agencies, including the USDA. This suggests that veterinarians desire an active role for their professional organization in food safety. Administration of such a program would be a new direction for the AASP, which in the past has focused primarily on practitioner education and program development. However, it is important to consider that the limited choices provided in the survey do not represent the full range of approaches to this issue. In particular, the question did not offer the possibility of a combination of groups or agencies to provide auditor certification and training, which was the most commonly suggested "other" choice of respondents. In addition, consumers of pork have expressed more confidence in USDA certification than in pork industry certification.¹³ A program overseen by a government agency that utilizes private practitioners as auditors and (or) verifiers would allow for accreditation of the auditor and government certification of the verifying audit.

Meetings were the most preferred means for distribution of educational materials and information to potential auditors, despite substantial travel costs and time commitment. This suggests that educational programming should contain a component

of “in-person” training. However, other choices were ranked nearly as high in preference, including alternatives for those unable to travel. Further, these responses may be biased, since this survey was conducted at a meeting of potential auditors, where respondents had already committed to the meeting format of continuing education. Satellite down links and audio tapes were less preferred choices. Interestingly, both of these methods have been commonly used in recent years for the distribution of information to veterinarians.

Respondents appear confident about their understanding of HACCP, with 89% agreeing with the statement, “I understand the principles of HACCP.” While confidence does not necessarily imply actual understanding of HACCP principles, it may imply a high level of awareness. In contrast, most (64.3%) were either unsure of or disagreed with a similar statement about the pork producers they serve (Table 3). In combination, these findings suggest that veterinarians are a potential source of HACCP information for producers.

Respondents expressed confidence in the use of HACCP systems to control chemical residues, but were less confident that the use of HACCP systems would control microbial contamination. This response is in keeping with practical experience of swine veterinarians and with the knowledge that there are limited scientific practices for on-farm microbial control systems. In spite of this lack of experience and knowledge, 55.4% of respondents either mildly or strongly agreed that HACCP systems could be used on the farm to control microbial contamination on pork carcasses. This suggests that veterinarians may be willing to embrace HACCP-based pathogen reduction systems as the scientific principles become better defined.

Most (44.1%) responded positively to the proposal that on-farm HACCP programs should be required by USDA, 28.7% believed that on-farm HACCP should not be required by the USDA, and many (27.2%) were undecided. Coupled with the support indicated in this survey for the veterinary practitioner as an on-farm auditor, verification and certification systems that

partner the USDA with practitioners seem likely to receive support among veterinarians. This is the method being implemented in the USDA Trichinosis Certification Program.

Respondents felt that the currently implemented in-plant HACCP plans should improve the safety of pork, and a sizeable minority (25.2%) agreed that in-plant HACCP had greatly affected on-farm practices of their clients. This survey was administered shortly after many packing plants required PQA level III completion from their pork suppliers, a change which may have contributed to the response to this statement.

Proportion of time spent in swine practice accounted for only relatively small differences in attitude toward HACCP issues. Swine-exclusive practitioners tended to agree more strongly that HACCP systems could be used effectively to control chemical and antibiotic residues in pork and felt more strongly that they understood the principles of HACCP. In contrast, they had a stronger tendency to feel that the recent packing industry HACCP changes had not

Table 3: Attitudes of swine practitioners toward Hazard Analysis Critical Control Point (HACCP), in a survey¹ carried out during the 1999 Annual Meeting of the American Association of Swine Practitioners.

HACCP Statement	Strongly Agree ² %	Mildly Agree ² %	Undecided or Unsure ² %	Mildly Disagree ² %	Strongly Disagree ² %
HACCP systems can be used on the farm to control chemical and antibiotic residues in pork carcasses ³	58.6	31.5	6.7	1.6	1.6
HACCP systems can be used on the farm to control microbiological contamination of pork carcasses	16.9	38.5	22.9	13.7	8.0
Pork producers I serve understand the principles of HACCP	6.8	28.9	23.7	29.2	11.4
Current packing plant HACCP plans should improve the safety of pork delivered to the retailer or exporter	38.7	45.4	13.1	1.9	1.0
I understand the principles of HACCP ³	57.0	32.0	7.4	3.5	0
On-farm HACCP programs should be required by USDA	11.8	32.3	27.2	15	13.7
The HACCP system recently established by the packing industry has greatly affected my clients' on-farm practices ³	2.7	22.5	36.6	27.2	11.1
HACCP systems should be uniform for all swine operations ³	40.3	35.9	9.5	7.0	7.3

¹ Results of analysis of 243 surveys completed by swine practitioners with offices or practices in the United States.

² Results are rounded to the nearest tenth.

³ Responses tended to differ ($P < .1$) by practice type.

greatly affected their producers' on-farm practices. Since all their working time is devoted to swine practice, swine-exclusive practitioners may be better informed on the developing pre-harvest food-safety issues of the swine industry. They may also serve clients who are devoting a high percentage of effort to swine production. These clients are likely to have had more experience with on-farm quality and safety assurance; thus, recent changes are less likely to have had an impact on their swine production practices.

More swine-exclusive practitioners agreed that on-farm HACCP should be uniform, but a sizeable minority of swine-exclusive practitioners (14%) believed strongly that it should not be uniform. In principle, HACCP systems should be customized to each production system, since critical control points will vary in different systems. However, the necessary brevity of the survey instrument forced presentation of concise statements. Thus, it is possible that either respondents may not have understood the principle that HACCP plans should be customized, or alternatively, they may have taken the phrase "HACCP systems" to mean the approach to HACCP plan development, rather than the content of the plan itself.

Veterinarians have the foundational education and experience necessary to work with and develop policy for on-farm food-safety interventions and evaluations. The findings of this survey suggest that swine practitioners are willing to undergo additional education and training needed to take an active role with on-farm auditing and verification of pork food safety. They express a willingness to commit time and personal resources to ensure that their contributions will be valuable. The number of

private practitioners and their widespread geographic locations make them logical partners for auditing and verifying on-farm food-safety practices. Additionally, swine veterinarians have the capacity to acquire the essential education to quickly develop the knowledge and skills needed to perform this role with consistency.

Implications

- According to a survey carried out at the 1999 Annual Meeting of the AASP, swine veterinarians in the United States are interested in expanding the on-farm services they provide in food safety.
- These swine veterinarians are willing to take additional training regarding on-farm food-safety practices and methods to audit and verify these practices, and are willing to be evaluated periodically for their competency in food safety and auditing.
- Among swine veterinarians surveyed, most selected meetings as the preferred method of obtaining educational information.
- Veterinarians surveyed prefer AASP to take a leadership role in the administration and certification of on-farm food-safety auditors.

It should be noted that the American Association of Swine Practitioners is now called the American Association of Swine Veterinarians.

Acknowledgements

Financial support for this project was provided by the Food Safety Strategic Research Initiative, the Illinois Council on Food and Agricultural Research. The authors thank

Maria Muyot, PhD, for statistical consultation.

References – refereed

5. Unnevehr LJ, Miller GY, Gomez MI. Ensuring food safety and quality in farm level production: Emerging lessons from the pork industry. *Amer J Agric Econ.* 1999;1:1096–1101.
8. Russell, JP. *The Quality Audit Handbook.* American Society for Quality, Quality Audit Division. 2nd ed. Milwaukee: Quality Press; 2000:XII.
10. Moore DA, Sischo WM, Wilson DJ. Continuing education needs assessment for on-farm food safety services. *JAVMA.* 2000;217:479–484.
11. Agesti A. *Categorical Data Analysis.* New York: John Wiley and Sons Inc; 1996:284.
12. Critchon DF. *Metric Methods for Analyzing Partially Ranked Data.* New York: Springer-Verlag; 1985:97–116.

References – non refereed

1. *National Pork Producers Council: Pork Quality Assurance: A program of America's pork producers.* Des Moines, Iowa: National Pork Producers Council in cooperation with the National Pork Board; 1997.
2. Bush, EJ, Wagner B, Fedorka-Cray PJ. Risk factors associated with shedding of Salmonella by U.S. finishing hogs. *Proc Third International Symposium on Epidemiology and Control of Salmonella in Pork.* Washington, DC. 1999;106–108.
3. Lo Fo Wong DMA, Altrock AV, Granfanakis S, Thorberg BM, van der Wolf PJ. Herd-level risk factors for the introduction and spread of Salmonella in pig herds. *Proc Third International Symposium on Epidemiology and Control of Salmonella in Pork.* Washington, DC. 1999;151–154.
4. Bahnson PB, Fedorka-Cray PJ. Defining the risk of Salmonella infection in slaughter weight pigs. *Proc Pork Quality and Safety Summit.* Des Moines, Iowa. 1998;60–64.
6. PQA enrollment reaches all-time high. *Food Safety Digest.* Bowling Green, Kentucky: National Institute for Animal Agriculture. 2000;(1):8.
7. Pyburn DG. Preharvest pork safety. *Proc George Young Conf.* Lincoln, Nebraska. 1998:13–20.
9. Joint FAO/WHO Food Standards Programme. Rome, 1999. ftp://ftp.fao.org/codex/standard/Fc_compl_e.pdf. Accessed August 27, 2001.
13. Miller GY, Unnevehr LJ. Characteristics of consumers demanding certified safer pork. *J Agribusiness.* In press.

