Estimated prevalence and impact of periweaning failure to thrive syndrome in Canada and the United States

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Summary

Objectives: To estimate the prevalence of periweaning failure to thrive syndrome (PFTS) in Canadian and American nursery-pig flows, to estimate the percentage of PFTS-affected pigs within an affected nursery flow, and to rank the common clinical signs observed by practitioners associated with PFTS on commercial farms.

Materials and methods: A questionnaire was designed, beta tested, and then made available through the American Association of Swine Veterinarians (AASV) and University of Guelph Web sites. Swine practitioners in major swine-producing regions of Canada and the United States completed the questionnaire to estimate the prevalence and impact of PFTS in nursery flows. To raise awareness and to aid in consistent recognition and reporting of the syndrome, a video was produced and accompanied the questionnaire. Oral, scientific-poster, and video presentations were also made at major swine-practitioner meetings across Canada and the United States to promote awareness of the syndrome and questionnaire.

Results: Fifty-five questionnaires were completed, with respondents servicing 1974 nursery flows. The reported mean flow prevalence of PFTS was 4.3% (95% CI, 0.9%-8.0%). The within-flow prevalence was reported to be variable (1% to 20%), with cases reported in five provinces and 11 states.

Implications: This report provides the first estimate of the mean flow prevalence and impact of PFTS in Canada and the United States. It is reasonable to expect this estimated prevalence to change as we continue to understand the syndrome. Video documentation, including demonstration of the clinical signs associated with PFTS, was an effective method to raise awareness of the syndrome.

Keywords: swine, periweaning failure to thrive syndrome, prevalence, survey, mortality

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Resumen - Impacto y prevalencia estimados del síndrome porcino de retraso en el desarrollo en destete en Canadá y Estados Unidos

Objetivos: Estimar la prevalencia del síndrome porcino de retraso en el desarrollo en el destete (PFTS por sus siglas en inglés) en el flujo de cerdos en los destetes de los Estados Unidos y Canadá, estimar el porcentaje de cerdos afectados con el PFTS dentro de un flujo de destete afectado, y clasificar los signos clínicos comunes observados por médicos veterinarios relacionados con el PFTS en granjas comerciales.

Materiales y métodos: Se diseñó un cuestionario, se hizo una prueba beta, y se puso a disposición a través de las páginas Web de la Asociación Americana de Veterinarios Especialistas en Cerdos (AASV por sus siglas en inglés) y de la Universidad de Guelph. Los médicos veterinarios especialistas en cerdos en las regiones más importantes de producción porcina de Canadá y Estados Unidos respondieron el cuestionario para estimar la prevalencia e impacto de PFTS en los flujos de destete. Se elaboró un video que acompañó al cuestionario para despertar conciencia y ayudar a la identificación consistente y al reporte del síndrome. Para promover la conciencia del síndrome y del cuestionario, se hicieron presentaciones orales, del video, y se presentó un póster científico en las reuniones porcinas más impotentes de Canadá y Estados Unidos.

Resultados: Se llenaron cincuenta y cinco cuestionarios, con encuestados que dan servicio a 1974 flujos de destete. La prevalencia media de flujo reportada de PFTS fue de 4.3% (95% CI, 0.9%-8.0%). La prevalencia dentro del flujo fue variable (1% a 20%), con casos reportados en cinco provincias y 11 estados.

Implicaciones: Este reporte provee la primera estimación de la media de la prevalencia e impacto de PFTS en Canadá y Estados Unidos. Es razonable esperar que esta prevalencia estimada cambie mientras continuamos entendiendo este síndrome. La documentación de video, incluyendo la demostración de los signos clínicos asociados con el PFTS, fue un método efectivo para despertar la conciencia de este síndrome.

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Résumé - Prévalence estimée et impact du syndrome d'échec de croissance en période péri-sevrage au Canada et aux États-Unis

Objectifs: Estimer la prévalence du syndrome d'échec de croissance en période péri-sevrage (PFTS) chez les porcelets en pouponnière canadiens et américains, estimer le pourcentage de porcelets affectés par le PFTS à l'intérieur d'une pouponnière affectée, et classifier les signes cliniques communs associés au PFTS observés par les vétérinaires sur des fermes commerciales.

Matériels et méthodes: Un questionnaire a été élaboré, bêta testé, et par la suite rendu disponible via les sites Web de l'American Association of Swine Veterinarians (AASV) et de l'Université de Guelph. Les praticiens porcins dans les principales régions de production porcine du Canada et des États-Unis ont complété ce questionnaire afin d'estimer la prévalence et l'impact du PFTS dans le flot des pouponnières. Afin d'attirer l'attention et d'aider à être constant dans la reconnaissance et à rapporter ce syndrome, un vidéo a été produit et accompagnait le questionnaire. Des présentations orales, par affiches scientifiques et par vidéo ont également faites lors des principales rencontres de praticiens porcins à travers le Canada et les États-Unis dans le but de faire connaître ce syndrome et le questionnaire.

Résultats: Cinquante-cinq questionnaires ont été complétés, les répondants offrant leurs services auprès de 1974 flots de pouponnières. La prévalence moyenne rapportée de PFTS était de 4,3% (IC 95%, 0,9%-8,0%). La prévalence intra-flot a été rapportée comme étant variable (1% à 20%), avec des cas rapportés dans cinq provinces et 11 états.

Implications: Cet article fourni le premier estimé de la prévalence moyenne et de l'impact de PFTS au Canada et aux États-Unis. Il est raisonnable de s'attendre à ce que cette prévalence estimée change à mesure que nous apprenions à mieux connaître ce syndrome. La documentation vidéo, incluant une démonstration des signes cliniques associés au PFTS, était une méthode efficace de faire connaître ce syndrome.

Periweaning failure to thrive syndrome (PFTS) is a clinical condition in which weaned pigs develop anorexia and lose body condition, progressing to debilitation. Additionally, a subset of affected piglets often demonstrate oral behavioral changes resembling a continuous sham chewing motion, with most clinical signs apparent as early as 7 days post weaning.[1] The syndrome has generated interest among swine veterinarians and researchers over the past few years due to an increasing number of cases being unofficially and officially reported in Canada, Spain, and the United States from 2008 to 2012.[2-5]

Research conducted to date has been unable to elucidate definitive risk factors, etiologic agent(s), or the pathogenesis associated with the syndrome.[6] It has been suggested that inconsistent clinical recognition and inaccurate recording of cause of mortality by swine veterinarians and producers may have contributed to the lack of understanding of the syndrome.[7] In 2011, a clinical case definition was published to aid in case recognition and was based on information gained from research conducted on confirmed cases of PFTS through exhaustive exclusion of common porcine infectious agents and obtainment of a thorough herd history.[1] The case definition of PFTS used for this project was the currently published definition and is as follows:

> "PFTS is characterized clinically by the progressive debilitation of weanling (nursery) pigs in the absence of discernible and detrimental infectious, nutritional, managemental, or environmental factors that can explain the clinical syndrome. At weaning, affected pigs are of average to above average body weight, and neither affected pigs nor their cohorts show evidence of residual illnesses from the suckling phase. Within 7 days of weaning, affected pigs are anorexic and lethargic. They deteriorate and within 2 to 3 weeks of weaning demonstrate marked muscle weakness and loss of body condition. Some affected pigs in all affected farms show repetitive oral behaviour such as licking, chewing, or chomping. In affected farms, morbidity and mortality by batch varies over time, but case fatality is high."[1]

Some believe this case definition simply describes "starve out" or "fall back" pigs that have been observed in low frequency in most hog operations for decades. The authors do not necessarily disagree with this. However, when mortality reaches 10% to 20% in some batches without underlying management changes or presence of infectious pathogens, the authors hypothesize that unknown risk factors are associated with the elevated mortality, beyond what is related to a sporadic "starve-out" problem in these affected herds.

The prevalence and the proportionate mortality related to PFTS remain unknown and represent crucial epidemiological information required in order to assess the economic impact of the clinical syndrome and guide future research objectives. The objectives of this study were to estimate the prevalence of PFTS in Canadian and American nursery-pig flows, to estimate the percentage of PFTS-affected pigs within an affected nursery flow, and to determine the common clinical signs associated with PFTS cases observed by practitioners on commercial farms.

Materials and methods

This project was reviewed and approved by the Animal Research Ethics Board of the University of Saskatchewan.

Instructional video and awareness campaign

The initial phase of this project involved development of an instructional video for wide dissemination to swine veterinarians and producers in Canada and the United States. The video was a short narrated production that demonstrated pigs naturally affected with PFTS in all stages of the syndrome (as described in the above case definition) and also identified humane endpoints. The video was made available online via two different Uniform Resource Locators (URLs). One URL was accessible by members of the American Association of Swine Veterinarians (AASV) via the association home page. A second URL, made available at the University of Guelph, was password protected and available to any person requesting access.

A PFTS awareness campaign launched in September 2011 consisted of oral, scientific-poster, and video presentations. The presentations were made at major swine-practitioner and producer meetings in Canada and the United States, including the Allen D. Leman Swine Conference, Swine Disease Conference for Swine Practitioners (Iowa State University), Canadian Swine Health Board Forum, Western Canadian Association of Swine Veterinarians Conference, and the Ontario Association of Swine Veterinarians Fall Conference. The goal of showing the video as part of the PFTS awareness campaign was to assist with standardization of PFTS case identification and to familiarize practitioners with the presentation of PFTS that is currently being reported.

Questionnaire design and distribution

A questionnaire was developed and distributed in a three-stage process, including design of questions, beta testing of questionnaire, and distribution to swine veterinarians in major swine-producing regions of Canada and the United States. The participants were asked to view the instructional video to become familiar with the syndrome and standardize the case definition prior to completing the questionnaire. The questionnaire asked for the number of nursery flows the respondent attended as the primary person providing veterinary services on a regular basis, as well as the number of PFTS-affected flows (based on video description) within the nursery flows serviced. "Regular basis" was defined as two to three visits per year, in order to minimize the number of repeat reports on the same flow. For the purpose of this study, a nursery flow was defined as consecutive groups of pigs sourced from a single sow operation that supplied one or more nurseries, or consecutive groups of pigs sourced from multiple sow operations that supplied one or more nurseries. Flow prevalence was calculated by dividing the total number of PFTS-affected flows reported by the respondents by the total number of flows serviced by the respondents. Veterinarians were also asked to report on the percentage of PFTS characteristic clinical signs (similar to those demonstrated in the video) observed within affected flows and to estimate the percentage of PFTS-affected pigs within flows. Information was obtained regarding the type of veterinary practice (mixed-animal practice, swine specialty, swine corporate, industry, government, or academia), PFTS case location (state or province), practice location (state or province), year of graduation, and number of nursery pigs attended in the past 6 months. Respondents were also asked to report on their confidence in recalling herd information and PFTS case information.

Prior to wide dissemination of the questionnaire, a beta test was conducted, and the questionnaire was edited according to responses and the suggestions received. The URL for the questionnaire was sent to members of the AASV via the association's electronic membership list. Biweekly, September 1 to December 31, 2011, electronically generated reminders were sent to AASV members. The questionnaire was translated into French for distribution to swine veterinarians in the province of Quebec. In addition to online notification of the survey, veterinarians had the opportunity to complete a printed copy of the questionnaire at any of the conferences in which oral presentations were made during the awareness campaign or upon request from the project coordinator.

Statistical analysis

Survey results were tabulated and analysed in Stata (Stata Statistical Software, Release 11; StataCorp LP, College Station, Texas) using frequencies and the binomial exact test.

Results

A total of 55 questionnaire responses were submitted and tabulated. The 55 survey respondents provided veterinary services for 1974 nursery-pig flows in six Canadian provinces and 11 American states (Table 1). The mean flow prevalence of PFTS observed within the reported nursery flows was 4.3% (95% CI, 0.9%-8.0%). Two online respondents were from countries outside of North America, and this information was excluded from the study, as we were primarily interested in Canadian and American herds. Over 89.0% (95% CI, 77.8%-95.9%) of the respondents indicated that they were in some form of clinical swine practice and attended nursery pigs as the principal herd veterinarian. Year of graduation from veterinary school ranged from 1967 to 2009, and 92.7% (95% CI, 82.4%-98.0%) of the respondents indicated that > 50% of their practice time was devoted to swine. Thirty-two percent (95% CI, 20.6%-46.7%) of respondents indicated that they provided exact numbers for nursery-pig flows attended, and 45.5% (95% CI, 32.0%-59.4%) reported that they provided an estimate of the flow numbers, but they were > 50% confident in the accuracy of their estimate. Twenty-five veterinarians (45.5%) reported observing PFTS-affected pigs within the previous 6 months. Sixty percent (95% CI, 45.9%-73.0%) of respondents indicated that they were able to provide exact numbers of PFTS cases reported, and 25.5% (95% CI, 14.7%-39.0%) reported they provided estimates but were > 50% confident in the accuracy of their numbers. Approximately half of the respondents that reported on PFTS-affected flows stated that the proportion of PFTS-affected pigs within an affected flow was between 1% and 3%. Forty-four percent of respondents that reported on PFTS-affected flows reported higher mortality of 4% to 10% within affected flows (Table 2). The four most commonly reported clinical signs, on an affected-flow basis, were anorexia, loss of body condition, prolonged standing, and the oral behaviour of repetitive chomping and licking (Table 3).

In response to questions regarding respondents' awareness of PFTS prior to viewing the video or attending an awareness campaign presentation (taking into consideration all the swine veterinary-practice-type categories, not just respondents who reported seeing PFTS-affected flows), 3.6% (95% CI, 0.4%-12.5%) indicated they were completely unfamiliar with the syndrome, 18.0% (95% CI, 9.0%-30.9%) were aware of the syndrome but could not previously describe clinical signs, 20.0% (95% CI, 10.4%-33.0%) were aware of the syndrome but had not seen the syndrome or clinical signs, 32.7 % (95% CI, 20.7%-46.7%) were aware of the syndrome and may have seen an unconfirmed case, and 25.5% (95% CI, 14.7%-39.0%) were aware of the syndrome and had worked on a case of PFTS.

Discussion

Results of this survey and awareness campaign have provided the first and presently only crude estimate of the mean flow-prevalence of PFTS reported in Canadian and American nurseries. These estimates are not meant to be representative of all nursery flows in North America, as the response rate for this survey was low and based on a convenience sampling of veterinarians. A formal response rate could not be calculated because the questionnaire and video were distributed widely online, which resulted in an unknown number of distributed questionnaires (denominator). The secondary objective of the project was to raise awareness of the syndrome, and so wide distribution was felt to be important instead of limiting the survey to a smaller random sample. Having only 55 respondents complete the survey could be extrapolated to suggest an overall lack of concern or interest in the syndrome, and should be considered a source of response bias. In 2011, the AASV membership was 1266, with 48% of the membership recorded as being active in private practice (Dr Sue Schulteis, e-mail communication, July 2013). If these numbers were to be taken into consideration for calculating a response rate from practitioners,

Table 1: Geographic locations where 55 questionnaire respondents* attended nursery pigs and reported observing PFTS-affected nursery flows†

Location	PFTS reported‡
Canada	
Alberta	Yes
Manitoba	Yes
Ontario	Yes
Prince Edward Island	No
Quebec	Yes
Saskatchewan	Yes
United States	
Illinois	Yes
Iowa	Yes
Kansas	Yes
Minnesota	Yes
Missouri	Yes
Nebraska	Yes
North Carolina	Yes
Oklahoma	Yes
South Dakota	Yes
Texas	Yes
Virginia	Yes

* Based on responses from a questionnaire distributed to members of the American Association of Swine Veterinarians via the member electronic mailing list, September to December 2011. Printed copies of the questionnaire also were available during the same time period at swine-practitioner meetings or from the project coordinator.

† Clinical signs demonstrated in an information video accompanying the questionnaire for standardization of case definition. Nursery flow = consecutive groups of pigs sourced from a single sow operation supplying one or more nurseries, or consecutive groups of pigs sourced from multiple sow operations supplying one or more nurseries.

‡ PFTS-affected pigs in nursery flow(s) in state or province. Information aggregated to maintain confidentiality.

PFTS = periweaning failure to thrive syndrome.

the estimated questionnaire response rate is indeed low at approximately 9.0%. However, the respondents did provide routine and regular veterinary service for a large number of nursery-pig flows (n = 1974) and the results represent the only industry-wide estimates available to date. While it is unknown exactly how many individual pigs this represents, there is potential for this number to be large, as many of the respondents were from major pig-producing areas of Canada and the United States. It is reasonable to expect that the reported prevalence of the syndrome may change in time as we continue to learn and understand its epidemiology and pathogenesis.

The results of the reports on the most common clinical signs associated with the syndrome should serve as a guide for case selection of animals in future investigations. However, it should be kept in mind that additional on-farm epidemiological studies are necessary to further understand the risk factors at the pig level, flow level, and management level that may or may not contribute to the expression of PFTS. Moreover, discovering causative agents, either infective or non-infective, will greatly enhance our understanding of the clinical expression and impact of PFTS on commercial farms.

While awareness of the syndrome could be measured formally only in the survey respondents, the awareness campaign, including viewing the video, generated discussion and awareness of PFTS among veterinarians at practitioner meetings. The exact number of video viewings could not be determined, as the survey and video URLs were kept anonymous. However, during the campaign, the authors received numerous requests from Australia, Europe, North America, South America, and the United Kingdom to view the video. Subsequent correspondence made it apparent to the authors that PFTS is not unique to Canada and the United States. In addition, many comments received on the questionnaires and verbally during the awareness campaign also expressed appreciation for development of a video demonstrating the clinical signs and the humane endpoints associated with the syndrome. Continued awareness, accurate reporting, due diligence, and collaboration among swine veterinarians are crucial to the successful progression of our understanding and ultimate ability to manage or control PFTS. Consistency in recognizing and reporting PFTS will ultimately enable global comparisons.

Implications

- This report provides the first estimate of the mean nursery-flow prevalence of PFTS (4.3%; 95% CI, 0.9%-8.0%) in Canada and the United States.
- The results of this survey and awareness campaign indicate that PFTS cases have been reported broadly across pig-producing regions of Canada and the United States.
- In the context of this survey, the four most commonly reported clinical signs of PFTS are anorexia, loss of body condition, prolonged standing, and repetitive chomping and licking.
- Video is an effective method to raise awareness and develop consistency in the use of the case definition of PFTS.
- It is reasonable to expect the reported prevalence of PFTS to change as we continue to understand the epidemiology, case definition, and pathogenesis of the syndrome.

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Table 2: Mean percentage of 25 questionnaire respondents reporting* on the estimated proportion of PFTS-affected piglets in PFTS-affected flows

	Respondents reporting in each category	
Questionnaire categories to estimate % PFTS-affected pigs	**%**	**95% CI†**
1-3 (low)	52.0	31.3-72.2
4-10 (low to moderate)	44.0	24.4-65.1
11-25 (moderate)	4.0	0.10-20.0
26-50 (high)	0.0	NA
> 50 (very high)	0.0	NA

* Questionnaire and distribution described in Table 1. Clinical signs of PFTS were demonstrated in an information video that accompanied the questionnaire for standardization of case definition. Nursery flow defined in Table 1.

† Binomial exact.

PFTS = periweaning failure to thrive syndrome; CI = confidence interval; NA = not applicable.

Table 3: Percentage of 25 questionnaire respondents* reporting clinical signs demonstrated by PFTS-affected nursery pigs in PFTS-affected flows

	Respondents reporting observation of specific clinical signs	
Observed clinical sign	**%**	**95% CI†**
Anorexia	100	86.3-100
Loss of body condition	88.0	68.8-97.5
Prolonged standing	84.0	63.9-95.5
Chomping or licking	76.0	54.9-90.6
Dazed demeanour	72.0	50.6-87.9
Diarrhea	68.0	46.5-85.1
Excessive investigative behavior	56.0	34.9-75.6
Sneezing	52.0	31.3-72.2
Dyspnea	45.8	25.5-67.2
Cough	40.0	22.1-61.3

* Questionnaire and distribution described in Table 1. Clinical signs were demonstrated in an information video that accompanied the questionnaire for standardization of case definition. Nursery flow defined in Table 1.

† Binomial exact.

PFTS = periweaning failure to thrive syndrome; CI = confidence interval.

survey and video. A special note of thanks is extended to the survey beta testers and participants for taking the time to complete the questionnaire.

Conflict of interest

None reported.

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