

Porcine Epidemic Diarrhea Virus

Impact on a Benchmark Farm

Prepared for:

Cross-Provincial Pork Initiative¹

Prepared by:

Lynn Marchand²

University of Guelph, Ridgetown Campus



RIDGETOWN
CAMPUS

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¹ Cross-Provincial Pork Initiative includes Alberta Pork, Sask Pork, Manitoba Pork, and Ontario Pork

² Research Associate

Executive Summary

The first case of Porcine Epidemic Diarrhea (PED) in the United States occurred in 2013 while the first case in Canada was in 2014. The most notable symptom is high nursing piglet mortality but other symptoms include diarrhea, vomiting and dehydration. The highly transmissible disease is especially challenging for nursing piglets where mortality can be up to 100%. Pigs in other stages may feel unwell and reduce their feed intake for a short period of time but generally recover. This disease is of global concern due to the effect on nursing pig mortality and the impact on farm finances.

The financial impact of a PED outbreak at the farm level can be significant due to lower annual revenue and changes to expenses such as feed, veterinary, labour, facilities costs, and marketing. The purpose of this work is to estimate the financial impact of an outbreak on benchmark Manitoba and Ontario 1,200 sow farrow-to-finish farms. This farm size was selected to provide perspective at the farm level. Farm models were constructed from provincial swine enterprise data for the 5-year period 2019 to 2023. This time included variable revenues and costs whereas had only one year been analysed it would not have captured this variability.

The analysis included two scenarios termed low impact and high impact. Under the low impact scenario there is 100% nursing pig death loss for 4 weeks and nursery and grow-finish pigs go off feed for 3 days. Under the high impact scenario there is 100% nursing pig death loss for 7 weeks and nursery and grow-finish pigs go off feed for 7 days. It's acknowledged that individual farm impacts could vary considerably from these impacts due to factors such as herd health prior to PED exposure, disease control strategies used, strain of the disease, etc. However, using the low and high impact scenarios as described is intended to provide a range of potential outcomes.

The analysis accounts for lower revenue potential arising from high nursing pig mortality and therefore reduced market hog production. It also accounts for impacts in costs such as feed, labour, cleaning, veterinary and marketing.

Manitoba Model

Lost revenue potential due to 100% nursing pig mortality is a key financial impact. For the Manitoba model annual farm revenue declines by \$501,438 and \$877,715 for the two scenarios. Offsetting some of the decline is a decrease in feed expenses because feed expenses are incurred for fewer pigs (i.e. \$370,428 to \$648,396 lower feed costs). However, nursery and grow-finish pigs that become sick and take longer to grow result in additional feed and facilities costs (i.e. additional costs of \$3,464 to \$8,083).

Labour costs were assumed to increase during a PED outbreak due to employing the feeding of infected material (i.e. feedback) to the herd in an effort to control PED. On the Manitoba

farm this amounted to \$2,160 for one-time feedback. The impact on cleaning costs was estimated to range from \$12,258 to \$21,378 although it's recognized that individual farm costs could vary greatly.

Further, routine veterinary costs (i.e. \$6,887 to \$12,056 lower) and marketing/transportation costs (i.e. \$12,818 to \$22,437 lower) were dependent on production numbers and as a result, declined due to a PED outbreak. Farm costs such as utilities, taxes, insurance, etc. were assumed to remain the same as baseline and did not change based on production levels.

For the Manitoba model using the two scenarios it is estimated that a PED outbreak could result in net returns \$129,189 to \$226,447 lower than baseline. This equates to \$108 to \$189 on a per sow basis.

Ontario Model

The Ontario model experienced a decline in annual revenue of \$482,043 to \$845,224 due to fewer pigs being sold as market hogs because of the loss of nursing pigs. The offsetting feed costs were \$283,326 to \$496,789 lower but increased feed and facilities costs for nursery and grow-finish pigs that took longer to grow cost an additional \$2,534 to \$5,914.

Additional labour costs incurred while doing feedback of infected material amounted to \$2,040 for one day. Cleaning/disinfection costs associated with controlling PED were estimated to range from \$11,778 to \$20,538 under the low and high impact scenarios respectively.

In addition, routine veterinary costs (i.e. \$11,109 to \$19,479 lower) and marketing/transportation costs (\$20,820 to \$36,507 lower) declined, a reflection of producing fewer pigs because of PED. Other costs (e.g. utilities, taxes, insurance, etc.) remained the same regardless of production.

Overall, it is estimated that for the Ontario model a PED outbreak would cause net returns to decline between \$183,140 and \$320,940 on an annual basis. This amounts to \$153 to \$267 on a per sow basis.

In conclusion, PED is a disease of global concern due to the impact on nursing piglet mortality and the financial implications at the farm level. Lower animal throughput reduces revenue potential which is only partially offset by feed, veterinary and marketing costs not incurred. However, additional costs such as sick pigs taking longer to grow and labour to clean and control/eliminate the disease do contribute to the net impact of a PED outbreak. It is acknowledged that these modelled scenarios for Manitoba and Ontario may not reflect all individual swine farm level impacts.

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1.0 Background

Canadian pig producers strive to maintain high-health herds. Strategies used to accomplish this include strict attention to animal care, proper nutrition, ventilation, diligent biosecurity, etc. However, despite these efforts and protocols, disease may appear in the barn. The arrival of Porcine Epidemic Diarrhea (PED) virus in the US in 2013 was concerning as it was the first time the disease had been found there [1,10]. Canada first reported the disease in January 2014 [6]. PED research is ongoing to better understand the disease and determine the best methods for control and elimination. In the interim, Canadian swine farms would benefit from understanding the financial costs associated with a PED outbreak on a benchmark farm. This could assist in developing policy initiatives regarding the control and elimination of PED from Canada.

1.1 Project Objectives

The key objective for this project was to estimate the financial impact of a PED outbreak on a benchmark Canadian farm. More specifically, the impacts on benchmark Manitoba and Ontario farrow-to-finish farms were modelled.

1.2 Methodology and Limitations

The methodology that was used consisted of the following steps:

- 1) A literature review of publicly available economic and production information related to PED was undertaken.
- 2) Findings from the literature review were used to conduct an analysis of the impacts of a PED outbreak on a western Canadian benchmark farm (i.e. Manitoba model) and an eastern Canadian benchmark farm (i.e. Ontario model). A 1,200-sow farrow-to-finish farm size was used for both models. Provincial swine enterprise budgets from Manitoba and Ontario were used to develop the baseline farm models.
- 3) The analysis is summarized in report format.

Some limitations of the analysis are discussed below.

One limitation is that the findings reported in the literature review are based on various sample sizes, study duration, farm size, etc. Therefore, the information used in the analysis is intended for discussion purposes and may not reflect individual farm impacts.

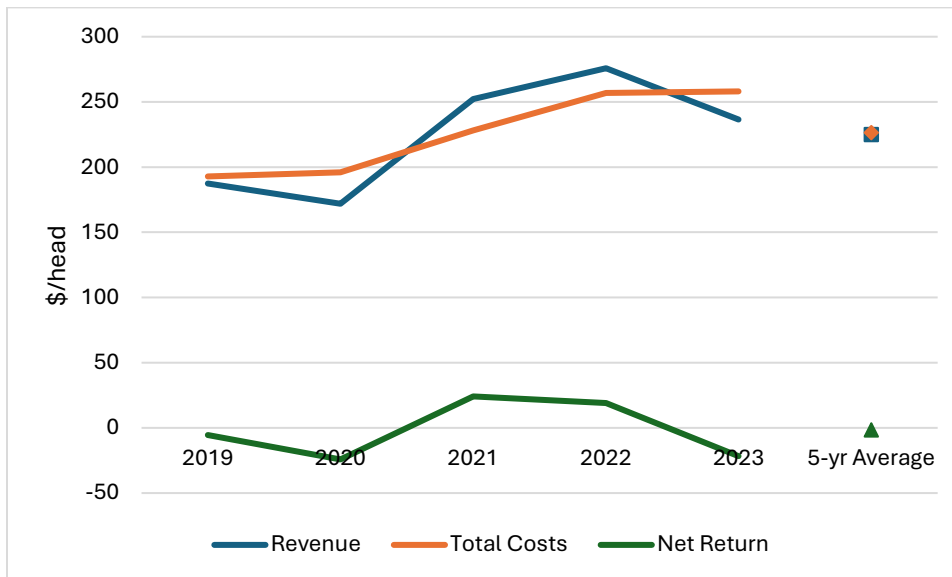
A second limitation is that swine enterprise data from the provinces of Manitoba and Ontario were used for the farm models.³ While these models may not necessarily represent an average farm in each province, they are still useful for this analysis. The baseline Manitoba

³ It's important to note that there are significant differences between the two provincial swine enterprise budgets with respect to hog weights and market prices, costs, and productivity that are key factors in farm income and expenses.

and Ontario models were constructed using the five-year averages of the enterprise data for the years 2019 to 2023.

It's important to discuss why a 5-year average was used. Figure 1 shows annual revenue, total costs, and net returns based on the Ontario farrow-to-finish swine enterprise data. It highlights the variability in revenue and costs, and therefore net returns, that exist within the swine industry. For example, revenue per pig ranged from \$171.90 to \$275.83 during the 5 years while net returns ranged from -\$24.22 to \$24.12. It's believed that using a shorter time frame may not have captured this variability.

Figure 1: Ontario Revenue, Costs, Net Return (\$/pig)



Source: OMAFRA Annual Swine Budgets

Finally, the analysis takes into account increased mortality in piglets and pigs going off feed due to PED. It also includes estimated additional disease-related costs such as labour and cleaning that could be incurred during an outbreak.⁴ Two scenarios, termed low impact and high impact, were developed to provide a range of estimated outcomes related to a PED outbreak. The low impact scenario is the loss of all piglets for 4 weeks (i.e. 100% mortality for 4 weeks) and nursery and grow-finish pigs going off feed for 3 days. Four weeks is the length of time typically experienced on a farm that hasn't had PED in the past [11]. The high impact scenario is the loss of all piglets for 7 weeks and nursery and grow-finish pigs going off feed for 7 days. Seven weeks of mortalities is consistent with the length of time used in a 2019 analysis [5]. It's acknowledged that the impacts of PED will vary by farm depending on factors such as herd health prior to PED infection, disease control strategies used, strain of

⁴ The analysis does not consider potential changes in farrowing rate, litter sizes, or mortality in other stages of production that may occur during a PED outbreak.

the disease, etc. Anecdotal evidence provided by industry stakeholders suggest that individual farm impacts could, in some cases, be more severe than findings presented here.⁵

2.0 Literature Review

PED is highly transmissible by fecal-oral transmission [1,2] but also in other ways, such as through contaminated feed or surfaces (e.g. employee clothing, equipment, trucks, etc.) [2,10]. Pigs of any age are susceptible to this disease and may at times feel unwell and reduce their feed consumption [11,12] but the highest mortality rates are in nursing piglets where mortality may reach 100% [1,3,10,11]. Notable symptoms also include diarrhea, vomiting, and dehydration. Control and prevention strategies that have been used include immunization through the feeding back of infected material (i.e. feedback) [10,13] and enhanced biosecurity. Eliminating the virus may be possible by closing the herd, ensuring all pigs are exposed to the disease, and thoroughly cleaning and disinfecting throughout the barn [10]. The length of time to return to pre-PED production levels varies but could be up to several weeks [4,12,5]. There are different strains of PED and this has made it difficult to develop effective vaccines [2,3,4]. In fact, vaccination without the use of other control strategies was shown to be the least cost-effective among 16 interventions modelled [13].

When PED was first detected in the US in 2013 the impact was significant with an estimated loss of 3.7 million pigs [1]. Paarlberg estimated that the impact at the farm level during that time varied with farms that had PED suffering revenue losses while farms that didn't get PED benefited from higher pig prices [14].

The economic impacts of PED vary depending on production type, mortality, herd health prior to exposure, control methods used, and so on. MNP estimated that a Manitoba farrow-to-finish farm would incur potential losses of \$468/sow if there was 100% mortality in nursing piglets for 7 weeks [5]. In the US, it was estimated that a 5,000 head sow farm would lose \$500,000 if one month of nursing pigs die from PED [11]. Even in the grow-finish stage if PED occurs causing finishing pigs to go off feed for 3 days, it could cost \$3/pig [11]. It was estimated that the most profitable intervention methods used on a 700-sow farrow-to-finish farm would cost \$27,000 while reducing total losses by \$276,000 [13]. Labour costs may increase during a PED outbreak if certain mitigation measures such as feedback are implemented throughout the herd [13].

The literature often reported the need for enhanced biosecurity including thorough sanitation and disinfection [13,11,2,15]. It's possible however, that even farms that are not infected with PED will increase biosecurity vigilance and incur additional expenses for cleaning and disinfection [4].

It's important to note that Porcine Deltacoronavirus (PDCoV) presents with the same symptoms as PED but typically has lower mortality [9]. When a farm is diagnosed with

⁵ The author wishes to acknowledge and thank the industry stakeholders who reviewed this document.

PDCoV the same procedures for eliminating the disease apply as for PED. It's possible that pigs could be infected with PED and PDCoV at the same time resulting in more severe disease outcomes [9].

During the first seven months of 2024, there were 22 PED and 14 PDCoV cases in Ontario [6]. This compares to a combined 29 PED and PDCoV cases in Ontario during all of 2023 [6]. In comparison, Manitoba hasn't had any cases year-to-date in 2024 [7] and Alberta hasn't had a case of PED since 2022 [8].

3.0 Analysis

The analysis focuses primarily on the impacts resulting from nursing pig mortality and is comprised of four parts. The first part investigates the lost revenue potential on each benchmark farm arising from the deaths of nursing piglets. High piglet mortality rates due to PED result in a large impact on farm revenue due to fewer market hogs sold. The second part assesses the impact on feed expenses associated with the disease. This includes the corresponding reductions in feed costs relative to the baseline farms due to fewer hogs being produced but also increased costs related to surviving pigs feeling unwell, not eating as well for a few days, and therefore taking longer to grow. The third part includes the costs specific to the PED outbreak and getting the herd back to pre-PED production. This includes labour and cleaning costs. The fourth part assesses the impacts on the remaining farm expenses. Some reflect changes in production (e.g. veterinary and marketing costs) while other costs (e.g. fixed costs) do not change. Financial and production data for the Manitoba and Ontario baseline models are provided in Appendix A. As stated previously, the estimated impacts are presented using low and high impact scenarios.

3.1 Impact on Farm Revenue

To analyse the potential impact on farm revenue due to PED, two lengths of time (i.e. 4 weeks and 7 weeks) of 100% nursing pig mortalities are used. A complete loss of all piglets (i.e. 100% mortality) for any length of time is significant. If there had been no PED these piglets would have grown and been sold as market hogs. The estimated revenue impacts on the Manitoba and Ontario benchmark farms if all piglets are lost for 4 weeks (i.e. low impact scenario) are displayed in Tables 1 and 2 respectively. In Table 1 the baseline data is shown in column A, the impact due to PED in column B, and the difference between the baseline and the PED impact in column C. Therefore, the change in revenue is the difference between selling 31,089 hogs annually without PED versus selling 28,698 hogs with 4 weeks of PED mortalities. Based on this information, the Manitoba farm would have an estimated \$501,438 reduction in revenue and the Ontario model farm would have \$482,043 less revenue due to 4 weeks of mortalities.

Table 1: Manitoba Benchmark Farm Revenue, 4 Weeks of Losses

	Baseline	With PED	Difference
	A	B	C = B - A
# of sows	1,200	1,200	
# hogs marketed/sow/year	25.9	23.9	-2.0
Annual marketings	31,089	28,698	-2,391
Baseline revenue \$/head	\$209.68	\$209.68	
Revenue/sow	\$5,432	\$5,014	-\$418
Total revenue/year	\$6,518,694	\$6,017,256	-\$501,438

Based on marketing 598 hogs/week. Numbers may not add due to rounding.

Table 2: Ontario Benchmark Farm Revenue, 4 Weeks of Losses

	Baseline	With PED	Difference
	A	B	C = B - A
# of sows	1,200	1,200	
# hogs marketed/sow/year	23.2 ⁶	21.4	-1.8
Annual marketings	27,880	25,736	-2,145
Baseline revenue \$/head	\$224.76	\$224.76	
Revenue/sow/year	\$5,222	\$4,820	-\$402
Total revenue/year	\$6,266,554	\$5,784,511	-\$482,043

Based on marketing 536 hogs/week. Numbers may not add due to rounding.

The high range scenario considers the loss of all piglets for 7 weeks. The same methodology is used as was used for 4 weeks of mortalities. An estimated reduction in annual revenue of \$877,715 for the Manitoba farm is shown in Table 3. The Ontario farm would have an estimated \$845,224 reduction in revenue (see Table 4) due to 7 weeks of mortalities.

Table 3: Manitoba Benchmark Farm Revenue, 7 Weeks of Losses

Manitoba	Baseline	With PED	Difference
# of sows	1,200	1,200	
# hogs marketed/sow/year	25.9	22.4	-3.5
Annual marketings	31,089	26,903	-4,186
Baseline revenue \$/head	\$209.68	\$ 209.68	
Revenue/sow	\$5,432	\$4,701	-\$731
Total revenue/year	\$6,518,694	\$5,640,980	-\$877,715

Based on marketing 598 hogs/week. Numbers may not add due to rounding.

⁶ Anecdotal evidence suggests that many commercial scale farms in Ontario are marketing more than 23.2 hogs/sow.

Table 4: Ontario Benchmark Farm Revenue, 7 Weeks of Losses

Ontario	Baseline	With PED	Difference
# of sows	1,200	1,200	
# hogs marketed/sow/year	23.2	20.1	-3.1
Annual marketings	27,880	24,120	-3,760
Baseline revenue \$/head	\$224.76	\$224.76	
Revenue/sow/year	\$5,222	\$4,518	-\$704
Total revenue/year	\$6,266,544	\$5,421,330	-\$845,224

Based on marketing 536 hogs/week. Numbers may not add due to rounding.

3.2 Impact on Feed Expenses

Changes to feed costs resulting from PED are two-fold. First, annual feed costs are reduced from baseline when fewer pigs are raised. Nursery and grow-finish feed costs are not incurred when mortality occurs prior to weaning. The reduction in feed costs offsets some of the reduction in revenue. Second, nursery and grow-finish pigs are less likely to die when infected with PED but they may feel unwell and not eat for some length of time so pigs take longer to grow. Both components (i.e. reduced feed costs due to fewer pigs marketed and costs due to extra days on feed) are analysed below.

Table 5 shows feed related cost impacts for the Manitoba model. The baseline farm is shown in column A. Column B displays the feed cost impacts arising from feeding fewer pigs due to 4 weeks of mortalities. The difference is shown in column C. It's assumed that the same amount of sow feed is used but on a per pig basis the cost is allocated across fewer hogs marketed (i.e. 28,697 hogs marketed due to 4 weeks of mortalities versus 31,089 hogs marketed in the baseline model). In the nursery and grow-finish stages the resulting total feed costs are \$370,428 lower than the baseline because there are fewer pigs. Similar information is shown for 7 weeks of mortalities in columns D and E and the feed cost is \$648,396 lower than the baseline in this scenario.

It's important to include the costs that are incurred when pigs are not feeling well and take longer to grow. It is assumed that newly weaned (i.e. nursery) or newly moved (i.e. grow-finish) pigs are most susceptible to disease. Table 5 assumes one week of pig production or movement is affected although it's acknowledged that PED-related changes in feed intake could affect additional pigs in these production stages. The low range scenario assumes 3 days off feed [11,13,15] while the high range scenario assumes 7 days off feed [13,15]. The increased cost of this feed ranges from \$3,135 to \$7,316 for the Manitoba model. Similarly, there is a cost to house these pigs for the additional 3 or 7 days. In this model the facilities cost ranges from \$329 to \$767. Therefore, the combined feed and facilities costs associated with an extra 3 or 7 days results in additional costs of \$3,464 to \$8,083.

Table 5: Manitoba Feed Cost Impacts

	Baseline	PED - 4 weeks, Low Impact		PED - 7 weeks, High Impact	
	A	B	C = B - A	D	E = D - A
# hogs marketed/year	31,089	28,697	-2,392	26,903	-4,186
Feed expenses					
Sow feed/hog	\$22.53	\$24.41		\$26.04	
Nursery feed/hog	\$25.37	\$25.37		\$25.37	
Finish feed/hog	\$129.52	\$129.52		\$129.52	
Sow feed	\$700,547	\$700,547	\$0	\$700,547	\$0
Nursery feed	\$ 788,805	\$728,127	-\$60,678	\$682,595	-\$106,210
Finish feed	\$4,026,765	\$3,717,014	-\$309,751	\$3,484,578	-\$542,187
Feed costs	\$5,516,117	\$5,145,688	-\$370,428	\$4,867,720	-\$648,396
Cost of extra growing days					
# nursery pigs		625		625	
# grow-finish pigs		598		598	
# additional days in stage		3		7	
Cost of nursery feed/pig		\$1.81		4.23	
Cost of finish feed/pig		\$3.35		7.82	
Increased feed costs		\$3,135	\$3,135	\$7,316	\$7,316
Fixed costs/day – nursery*		\$0.09		\$0.09	
Fixed costs/day – grow-finish*		\$0.09		\$0.09	
Increased facilities costs		\$329	\$329	\$767	\$767
Extra feed & facilities costs		\$3,464	\$3,464	\$8,083	\$8,083

*Fixed costs are based on average capital costs for 2018/19 and 2023. Numbers may not add due to rounding.

Table 6 shows the results for an Ontario farm using the same methodology. Feed costs are estimated to be reduced by \$283,326 (low impact) to \$496,789 (high impact) due to fewer pigs raised. Additional feed costs due to an extra 3 or 7 days on feed add \$2,534 (i.e. \$2,231 extra feed + \$304 facilities costs) to \$5,914 (i.e. \$5,205 extra feed + \$709 facilities costs) respectively.

Table 6: Ontario Feed Cost Impacts

	Baseline	PED - 4 weeks, Low Impact		PED - 7 weeks, High Impact	
	A	B	C = B - A	D	E = D - A
# hogs marketed/year	27,880	25,736	-2,145	24,120	-3,760
Feed expenses					
Sow feed/hog	\$18.56	\$20.11		\$21.46	
Nursery feed/hog	\$20.59	\$20.59		\$20.59	
Finish feed/hog	\$111.52	\$111.52		\$111.52	
Sow feed	\$517,517	\$517,517	\$0	\$517,517	\$0
Nursery feed	\$574,003	\$529,849	-\$44,154	\$496,583	-\$77,420
Finish feed	\$ 3,109,231	\$2,870,059	-\$239,172	\$2,689,862	-\$419,369
Feed costs	\$4,200,752	\$3,917,426	-\$283,326	\$3,703,962	-\$496,789
Cost of extra growing days					
# nursery pigs		570		570	
# grow-finish pigs		536		536	
# additional days in stage		3		7	
Cost of nursery feed/pig		\$1.10		\$2.57	
Cost of finish feed/pig		\$2.99		\$6.97	
Increased feed costs		\$2,231	\$2,231	\$5,205	\$5,205
Fixed costs/day – nursery*		\$0.07		\$0.07	
Fixed costs/day – grow-finish*		\$0.11		\$0.11	
Increased facilities costs		\$304	\$304	\$709	\$709
Extra feed & facilities costs		\$2,534	\$2,534	\$5,914	\$5,914

*Fixed costs are based on average capital costs for 2018/19 and 2023. Numbers may not add due to rounding.

Table 7 summarizes the impacts of feed costs in terms of feed expenses not incurred as well as the additional feed and facilities costs that are incurred. The range of feed cost impacts for Ontario is quite different compared to Manitoba. This is due to higher feed costs per pig in Manitoba (i.e. \$154.89 for nursery and grow-finish pigs in Manitoba versus \$132.11 in Ontario) and the number of pigs impacted (e.g. 2,392 fewer hogs marketed per year in Manitoba versus 2,145 fewer hogs marketed in Ontario for 4 weeks of losses).

Table 7: Impact of PED on Feed and Facilities Costs – Manitoba and Ontario

	PED - 4 weeks, Low Impact		PED - 7 weeks, High Impact	
	MB	ON	MB	ON
Feed costs not incurred				
Lost production - # pigs	2,392	2,145	4,186	3,760
Feed cost not incurred	\$370,428	\$283,326	\$648,396	\$496,789
Additional feed & facilities costs				
# nursery pigs	625	570	625	570
# grow-finish pigs	598	536	598	536
# days off feed	3	3	7	7
Cost of additional feed	\$3,135	\$2,231	\$7,316	\$5,205
Facilities costs	\$329	\$304	\$767	\$709
Extra feed & facilities costs	\$3,464	\$2,534	\$8,083	\$5,914

Numbers may not add due to rounding.

3.3 Other PED-Related Expenses

One strategy to control/eliminate PED is to employ feedback of infected material to the entire herd [10,13]. This cost was included in the analysis (see Table 8). It is based on Weng et al and assumes this is done one time only and completed in one day [13]. It is also assumed that this one-day activity applies to both the low and high range scenarios. The number of workers has been adjusted to account for 1,200 sows and the average wage reflects Manitoba and Ontario swine enterprise data. Table 8 shows that estimated labour costs associated with feedback are \$2,160 on the Manitoba farm and \$2,040 on the Ontario farm.

Table 8: Additional Cost of Labour

Labour – feedback (one time)	Manitoba	Ontario
# workers	10	10
Wage \$/hour	\$27.00	\$25.50
# of hours/worker	8	8
Labour costs of feedback	\$2,160	\$2,040

Source: Based on Weng et al 2016 [13], adjusted for farm size and 2023 labour costs from the provincial swine enterprise data.

With respect to costs associated with cleaning/disinfection it's possible that farms with PED as well as PED-free farms may have increased cleaning costs to control or prevent the

disease. However, it's likely that when a farm breaks with PED it will undergo additional cleaning and disinfection. MNP estimated cleaning costs to be \$50,000 for a 400-sow farrow-to-finish operation [5] while Weng et al estimated \$26,466 for a 700-sow farrow-to-finish farm [13].

Table 9 estimates cleaning costs for the Manitoba and Ontario farm models under two scenarios. The scenarios assume 1 day of extensive cleaning per week of mortalities (i.e. 4 or 7 weeks). The labour costs per day are the same as the costs used in Table 8. The value allocated for supplies was used by Weng et al [13] and it's acknowledged that the cost may have changed. The estimated costs for cleaning range from \$12,258 to \$21,378 in Manitoba and \$11,778 to \$20,538 in Ontario for 4 weeks and 7 weeks of mortalities respectively. These cost estimates are lower than what was reported in the literature review. This is due to differences in the number of weeks of cleaning used in the calculation. For example, this analysis assumes one day of cleaning activities per week of mortalities whereas Weng et al assumed 16 weeks of cleaning [13]. Duration and stage of a PED outbreak and the cleaning protocol adopted could significantly impact this cost on individual farms.⁷ Also, it's possible that labour could be re-allocated from routine tasks to undertake other tasks such as cleaning rather than hiring additional labour.⁷ Decisions regarding labour needs during a disease outbreak will be unique to each farm situation.

Table 9: Cleaning/Disinfection Costs

	Manitoba		Ontario	
	PED 4-weeks, Low impact	PED 7-weeks, High impact	PED 4-weeks, Low impact	PED 7-weeks, High impact
1 day labour costs	\$2,160	\$2,160	\$2,040	\$2,040
Supplies	\$880	\$880	\$880	\$880
# of weeks of mortalities	4	7	4	7
Other supplies (one-time cost)	\$98	\$98	\$98	\$98
Cleaning/disinfection costs	\$12,258	\$21,378	\$11,778	\$20,538

Source: Based on Weng et al 2016, adjusted for labour costs and number of weeks [13].

3.4 Other Farm Costs

To complete the analysis the potential impact on other costs, particularly costs related to production levels, must also be considered. These include routine veterinary costs as well as marketing and transportation costs. The category "Other costs" includes utilities, labour⁸, fixed costs, etc. that remain the same as the baseline. Tables 10 and 11 display the costs for each of these under the baseline and two PED scenarios. For the Manitoba farm model (see Table 10), routine veterinary and health costs decline by \$6,887 to \$12,056 and marketing

⁷ The author thanks a reviewer for this comment.

⁸ Labour refers to the baseline farms labour costs with no disease.

costs decline by \$12,818 to \$22,437 relative to the baseline due to 4 weeks and 7 weeks of lost production respectively.

Table 10: Other Farm Costs - Manitoba

\$	Baseline	PED - 4 weeks, Low Range		PED - 7 weeks, High Range	
	A	B	C = B - A	D	E = D - A
Veterinary/health	89,536	82,649	-6,887	77,481	-12,056
Marketing/transportation	166,637	153,819	-12,818	144,200	-22,437
Other costs	2,152,010	2,152,010	0	2,152,010	0

For the Ontario farm model (see Table 11), veterinary costs are \$11,109 to \$19,479 lower than baseline and marketing costs are \$20,820 to \$36,507 lower. It's possible that additional veterinary costs could be incurred during diagnosis and control/elimination of PED. This has not been included.

Table 11: Other Farm Costs – Ontario

\$	Baseline	PED - 4 weeks, Low Range		PED - 7 weeks, High Range	
	A	B	C = B - A	D	E = D - A
Veterinary/health	144,421	133,312	-11,109	124,942	-19,479
Marketing/transportation	270,664	249,843	-20,820	234,157	-36,507
Other costs	1,696,639	1,696,639	0	1,696,639	0

3.5 Estimated Farm Impact

The estimated impacts on the Manitoba and Ontario model farms are shown in Tables 12 and 13 respectively. Additional detail is provided in Appendix B. Nursing pig mortality of 100% lasting either 4 or 7 weeks translates into \$501,438 to \$877,715 lower revenue potential for the Manitoba model and \$482,043 to \$845,224 for the Ontario model. While reductions in feed costs offset some of this because there are fewer pigs to feed, surviving pigs impacted by PED may take longer to grow resulting in additional feed and facilities costs. To control PED, feedback of infected material adds labour costs of \$2,160 in Manitoba and \$2,040 in Ontario. Veterinary and marketing costs, influenced by production levels, decline due to fewer pigs raised. Impacts related to PED are estimated to range from \$129,186 to \$226,447 for the Manitoba farm and from \$183,140 to \$320,940 for the Ontario farm. On a per sow basis the impacts range from \$108 to \$189/sow for Manitoba and \$153 to \$267/sow for Ontario.

It is important to note that the year-to-year impact could vary from the results presented here depending on market hog prices and cost of inputs. Data depicting the years 2019 to 2023, low and high impact scenarios, for the Manitoba and Ontario models are provided in Appendix C.

Table 12: Estimated Impacts of PED on a Manitoba Farm

\$	Baseline	Manitoba		Difference vs Baseline	
		PED 4-weeks, Low impact	PED 7-weeks, High impact	PED 4-weeks, Low impact	PED 7-weeks, High impact
Total revenue	6,518,694	6,017,256	5,640,980	-501,438	-877,715
Feed costs impacted by production	5,516,117	5,145,688	4,867,720	-370,428	-648,396
Feed & facilities (lower ADG)		3,464	8,083	3,464	8,083
Labour (feedback)		2,160	2,160	2,160	2,160
Cleaning/disinfection		12,258	21,378	12,258	21,378
Veterinary costs impacted by production	89,536	82,649	77,481	-6,887	-12,056
Marketing costs impacted by production	166,637	153,819	144,200	-12,818	-22,437
Other costs	2,152,010	2,152,010	2,152,010	0	0
Total costs	7,924,300	7,552,048	7,273,032	-372,252	-651,268
Net return	-1,405,605	-1,534,791	-1,632,052	-129,186	-226,447
\$/sow	-1,171	-1,279	-1,360	-108	-189

Numbers may not add due to rounding.

Table 13: Estimated Impacts of PED on an Ontario Farm

\$	Baseline	Ontario		Difference vs Baseline	
		PED 4-weeks, Low impact	PED 7-weeks, High impact	PED 4-weeks, Low impact	PED 7-weeks, High impact
Total revenue	6,266,554	5,784,511	5,421,330	-482,043	-845,224
Feed costs impacted by production	4,200,752	3,917,426	3,703,962	-283,326	-496,789
Feed & facilities (lower ADG)		2,534	5,914	2,534	5,914
Labour (feedback)		2,040	2,040	2,040	2,040
Cleaning/disinfection		11,778	20,538	11,778	20,538
Veterinary costs impacted by production	144,421	133,312	124,942	-11,109	-19,479
Marketing costs impacted by production	270,664	249,843	234,157	-20,821	-36,507
Other costs	1,696,639	1,696,639	1,696,639	0	0
Total costs	6,312,475	6,013,572	5,788,191	-298,903	-524,284
Net return	-45,921	-229,061	-366,861	-183,140	-320,940
\$/sow	-38	-191	-306	-153	-267

Numbers may not add due to rounding.

4.0 Conclusion

PED is a disease of concern globally due to the serious effect on nursing piglet mortality and impact on farm finances. This analysis compared two scenarios, low-impact and high-impact, for benchmark Manitoba and Ontario farrow-to-finish farms. These scenarios were intended to represent a range of potential outcomes. Included in the analysis was 100% mortality in nursing pigs for 4 weeks (i.e. low impact) and 7 weeks (i.e. high impact), impacts on feed costs relative to the baseline farm data, additional costs incurred to control/eliminate the disease, and the impact on routine veterinary and marketing costs due to fewer pigs produced. It was assumed that all other costs remained the same.

The findings highlight lower farm revenue and changes in costs related to feed, labour, cleaning, veterinary, and marketing. In Manitoba, the impact of PED is estimated to range from \$129,186 to \$226,447 for a 1,200-sow farrow-to-finish farm. This equates to \$108 to \$189 per sow. On a similar size Ontario farm, the net impact is estimated to range from \$183,140 to \$320,940 or \$153 to \$267 per sow. Differences between the Manitoba and Ontario modelled scenarios are due to differences in baseline productivity and financial assumptions (e.g. hogs marketed/sow/year, feed costs/pig, etc.). Individual farm impacts will vary but the analysis indicates that estimated financial impacts of PED are significant on the benchmark farms.

Appendix A - Manitoba and Ontario Benchmark Farm Models

Table A1: Financial Baseline (5-year average 2019 to 2023)

		Manitoba	Ontario
		\$/pig	\$/pig
Revenue	Market hog price (\$/ckg)	199.91	189.34
	Avg weight (kg)	118.05	132.17
	Market hog value (incl \$2/hd premium)	209.68	224.76
Expenses			
Feed	Sow	22.53	18.56
	Nursery	25.37	20.59
	Grow/finish	129.52	111.52
	Veterinary & health	2.88	5.18
	Labour	17.13	13.74
	Marketing, transportation	5.36	9.71
	Other variable costs (e.g. utilities, operating loan interest, etc)	28.02	20.39
	Total variable costs	230.82	199.69
Fixed	Total fixed costs (excl. land)	24.07	26.72
Total Expenses		254.89	226.41
Net Return		-45.21	-1.65

Source: Manitoba Agriculture, OMAFRA Swine Budgets

Table A2: Production Baseline

	MB	ON
# litters/sow/year	2.38	2.35
# pigs born alive/litter	13.5	12.5
% pre-wean mortality/morbidity (incl post-wean)	14.9	12.0
# pigs weaned/sow/year placed in nursery*	27.3	25.7
% nursery mortality/morbidity	1.0	4.0
% finisher mortality/morbidity	4.3	6.0
# hogs marketed/sow/year*	25.9	23.2

Source: Manitoba 2023/2024 Cost of Production, OMAFRA Swine Budget Average 2023; *Calculated

Appendix B - Detailed Findings

Table B1: Manitoba

	Baseline	PED 4-weeks, Low impact		PED 7-weeks, High impact	
Revenue	A	B	C = B - A	D	E = D - A
# hogs marketed/year	31,089	28,698	-2,391	26,903	-4,186
\$/head (2023 average)	\$209.68	\$209.68		\$209.68	
Total Revenue	\$6,518,694	\$6,017,256	-\$501,438	\$5,640,980	-\$877,715
Feed expenses					
Sow feed	\$700,547	\$700,547		\$700,547	
Nursery feed	\$788,805	\$728,127		\$682,595	
Finish feed	\$4,026,765	\$3,717,014		\$3,484,578	
Feed costs	\$5,516,117	\$5,145,688	-\$370,428	\$4,867,720	-\$648,396
Extra feed required					
# nursery pigs		625		625	
# grow-finish pigs		598		598	
# days of extra feed		3		7	
Extra cost of nursery feed/pig		\$1.81		\$4.23	
Extra cost of finish feed/pig		\$3.35		\$7.82	
Cost of extra feed		\$3,135	\$3,135	\$7,316	\$7,316
Facilities costs for extra days					
Fixed costs/day – nursery		\$0.09		\$0.09	
Fixed costs/day – grow/finish		\$0.09		\$0.09	
Facilities costs		\$329	\$329	\$767	\$767
Labour – feedback (one time)					
# workers		10		10	
Wage \$/hour		\$27.00		\$27.00	
# of hours/worker		8		8	
Labour costs of feedback		\$2,160	\$2,160	\$2,160	\$2,160
Cleaning/disinfection					
1 day labour costs + \$880 supplies		\$3,040		\$3,040	
# of weeks		4		7	
Other supplies		\$98		\$98	
Cleaning/disinfection costs		\$12,258	\$12,258	\$21,378	\$21,378
Other Farm Costs					
Veterinary/health	\$89,536	\$82,649	-\$6,887	\$77,481	-\$12,056
Marketing/transportation	\$166,637	\$153,819	-\$12,818	\$144,200	-\$22,437
Other costs	\$2,152,010	\$2,152,010	\$0	\$2,152,010	\$0
Total Costs	\$7,924,300	\$7,552,048	-\$372,252	\$7,273,032	-\$651,268
Net Return	-\$1,405,605	-\$1,534,791	-\$129,186	-\$1,632,052	-\$226,447
\$/sow	-\$1,171	-\$1,279	-\$108	-\$1,360	-\$189

Table B2: Ontario

	Baseline	PED 4-weeks, Low range		PED 7-weeks, High range	
Revenue	A	B	C = B - A	D	E = D - A
# hogs marketed/year	27,880	25,736	-2,144	24,120	-3,760
\$/head	\$ 224.76	\$224.76		\$224.76	
Total Revenue	\$6,266,554	\$5,784,511	-\$482,043	\$5,421,330	-\$845,224
Feed expenses					
Sow feed/year	\$517,517	\$517,517		\$517,517	
Nursery feed/year	\$574,003	\$529,849		\$496,583	
Finish feed/year	\$3,109,231	\$2,870,059		\$2,689,862	
Feed costs	\$4,200,752	\$3,917,426	-\$283,326	\$3,703,962	-\$496,789
Feed for extra days					
# nursery pigs		570		570	
# grow-finish pigs		536		536	
# days of extra feed		3		7	
Cost of nursery feed/pig		\$1.10		\$2.57	
Cost of finish feed/pig		\$2.99		\$6.97	
Cost of extra feed		\$2,231	\$2,231	\$5,205	\$5,205
Facilities costs for extra days					
Fixed costs/day – nursery		\$0.07		\$0.07	
Fixed costs/day – grow/finish		\$0.11		\$0.11	
Facilities costs		304	\$304	\$709	\$709
Labour – feedback (one time)					
# workers		10		10	
Wage \$/hour		\$25.50		\$25.50	
# of hours/worker		8		8	
Labour costs of feedback		\$2,040	\$2,040	\$2,040	\$2,040
Cleaning/disinfection					
1 day labour costs + \$880 supplies		\$2,920		\$2,920	
# of weeks		4		7	
Other supplies		\$98		\$98	
Cleaning/disinfection costs		\$11,778	\$11,778	\$20,538	\$20,538
Other Farm Costs					
Veterinary/health	\$144,421	\$133,312	-\$11,109	\$124,942	-\$19,479
Marketing/transportation	\$270,664	\$249,843	-\$20,820	\$234,157	-\$36,507
Other costs	\$1,696,639	\$1,696,639	\$0	\$1,696,639	\$0
Total Costs	\$6,312,475	\$6,013,572	-\$298,903	\$5,788,191	-\$524,284
Net Return	-\$45,921	-\$229,061	-\$183,140	-\$366,861	-\$320,940
\$/sow	-\$38	-\$191	-\$153	-\$306	-\$267

Appendix C – Annual Impact of PED, Manitoba and Ontario

Table C1: Manitoba, Low Impact Scenario by Year

	Baseline	2019	2020	2021	2022	2023
# hogs marketed/year	31,089	28,698	28,698	28,698	28,698	28,698
\$/head	209.68	179.54	174.00	221.77	246.70	226.39
Total revenue	6,518,694	5,152,287	4,993,389	6,364,150	7,079,641	6,496,814
Feed costs impacted by production	5,516,117	3,446,506	4,252,160	5,471,662	6,562,398	5,995,714
Feed & facilities		2,429	2,920	3,663	4,327	3,982
Labour (feedback)		2,160	2,160	2,160	2,160	2,160
Cleaning/disinfection		12,258	12,258	12,258	12,258	12,258
Veterinary impacted by production	89,536	82,649	82,649	82,649	82,649	82,649
Marketing impacted by production	166,637	146,644	153,819	153,819	153,819	160,993
Other costs	2,152,010	1,874,665	2,103,635	2,201,566	2,216,178	2,364,006
Total Costs	7,924,300	5,567,311	6,609,601	7,927,776	9,033,789	8,621,762
Net Return	-1,405,605	-415,024	-1,616,212	-1,563,626	-1,954,147	-2,124,948
\$/sow	-1,171	-346	-1,347	-1,303	-1,628	-1,771

Table C2: Manitoba, High Impact Scenario by Year

	Baseline	2019	2020	2021	2022	2023
# hogs marketed/year	31,089	26,903	26,903	26,903	26,903	26,903
\$/head	209.68	179.54	174.00	221.77	246.70	226.39
Total revenue	6,518,694	4,830,100	4,681,137	5,966,181	6,636,930	6,090,549
Feed costs impacted by production	5,516,117	3,260,327	4,022,460	5,176,085	6,207,900	5,671,828
Feed & facilities		5,667	6,813	8,546	10,097	9,292
Labour (feedback)		2,160	2,160	2,160	2,160	2,160
Cleaning/disinfection		21,378	21,378	21,378	21,378	21,378
Veterinary impacted by production	89,536	77,481	77,481	77,481	77,481	77,481
Marketing impacted by production	166,637	137,474	144,200	144,200	144,200	150,926
Other costs	2,152,010	1,874,665	2,103,635	2,201,566	2,216,178	2,364,006
Total Costs	7,924,300	5,379,152	6,378,127	7,631,416	8,679,394	8,297,070
Net Return	-1,405,605	-549,053	-1,696,990	-1,665,235	-2,042,463	-2,206,521
\$/sow	-1,171	-458	-1,414	-1,388	-1,702	-1,839

Table C3: Ontario, Low Impact Scenario by Year

	Baseline	2019	2020	2021	2022	2023
# hogs marketed/year	27,880	25,736	25,736	25,736	25,736	25,736
\$/head	224.76	187.36	171.90	252.33	275.83	236.40
Total revenue	6,266,554	4,821,968	4,424,001	6,493,891	7,098,711	6,083,986
Feed costs impacted by production	4,200,752	3,198,127	3,224,742	4,034,670	4,658,549	4,471,042
Feed & facilities		2,137	2,143	2,613	2,951	2,829
Labour (feedback)		2,040	2,040	2,040	2,040	2,040
Cleaning/disinfection		11,778	11,778	11,778	11,778	11,778
Veterinary impacted by production	144,421	129,451	129,451	129,451	137,944	140,260
Marketing impacted by production	270,664	224,931	224,931	244,748	261,733	292,874
Other costs	1,696,639	1,563,537	1,627,384	1,627,384	1,729,426	1,935,463
Total Costs	6,312,475	5,132,001	5,222,468	6,052,683	6,804,421	6,856,286
Net Return	-45,921	-310,033	-798,467	441,207	294,290	-772,299
\$/sow	-38	-258	-665	368	245	-644

Table C4: Ontario High Impact Scenario by Year

	Baseline	2019	2020	2021	2022	2023
# hogs marketed/year	27,880	24,120	24,120	24,120	24,120	24,120
\$/head	224.76	187.36	171.90	252.33	275.83	236.40
Total revenue	6,266,554	4,519,220	4,146,240	6,086,171	6,653,018	5,702,003
Feed costs impacted by production	4,200,752	3,024,167	3,050,039	3,812,284	4,402,909	4,230,413
Feed & facilities		4,986	4,999	6,097	6,886	6,600
Labour (feedback)		2,040	2,040	2,040	2,040	2,040
Cleaning/disinfection		20,538	20,538	20,538	20,538	20,538
Veterinary impacted by production	144,421	121,324	121,324	121,324	129,283	131,454
Marketing impacted by production	270,664	210,809	210,809	229,381	245,300	274,486
Other costs	1,696,639	1,563,537	1,627,384	1,627,384	1,729,426	1,935,463
Total Costs	6,312,475	4,947,401	5,037,132	5,819,047	6,536,382	6,600,994
Net Return	-45,921	-428,180	-890,892	267,124	116,636	-898,991
\$/sow	-38	-357	-742	223	97	-749

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