

**SIXTH FRAMEWORK PROGRAMME  
PRIORITY SSP/5.4.6**



**SPECIFIC TARGETED RESEARCH OR INNOVATION  
PROJECT**

***PMWS case definition (Herd level)  
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Project acronym: PCVD

Project full title: **Control of Porcine Circovirus Diseases (PCVDs):  
Towards Improved Food Quality and Safety**

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# PMWS herd case definition<sup>1</sup>

The PMWS case definition on herd level is based on two elements: 1) the clinical appearance in the herd and 2) laboratory examination of necropsied pigs suffering from wasting.

## 1. Clinical appearance on herd level

The occurrence of PMWS is characterised by an excessive **increase** in mortality and wasting post weaning compared with the historical level in the herd. There are two options for recognising this increase, of which **1a** should be used whenever possible.

### **1a:**

If the mortality has been recorded in the herd, then the increase in mortality may be recognised in either of two ways:

1. Current mortality  $\geq$  mean of historical levels in previous periods + 1.66 x SD<sup>2</sup>
2. Statistical testing of whether or not the mortality in the current period is higher than in the previous periods by the chi-square test<sup>3</sup>

In this context, mortality is defined as the prevalence of dead pigs within a specific period of time. The current time period is typically one or two months. The historical reference period should be at least three months<sup>4</sup>.

### **1b:**

If there are no records of the mortality in the herd, the following approach may be used:

- An increase in mortality exceeding the national or regional level by 50% is considered indicative of PMWS.

## 2. Pathological & histopathological diagnosis of PMWS

Autopsy should be performed on at least five pigs per herd. A herd is considered positive for PMWS when the pathological and histopathological findings, indicative for PMWS, are all present at the same time in at least one of the autopsied pigs. The pathological and histopathological findings are:

- 2.1 Clinical signs including growth retardation and wasting. Enlargement of inguinal lymph nodes, dyspnoea, diarrhoea and jaundice may be seen sporadically.
- 2.2 Presence of characteristic histopathological lesions in lymphoid tissues: Lymphocyte depletion together with histiocytic infiltration and/or inclusion bodies and/or giant cells.
- 2.3 Detection of PCV2 in moderate to massive quantity within the lesions in lymphoid tissues of affected pigs (basically using antigen detection in tissue by immunostaining or *in situ* hybridisation).

Other relevant diagnostic procedures must be carried out to exclude other obvious reasons for high mortality (e.g. *E.coli* post-weaning diarrhoea or acute pleuropneumonia).

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Comments:

<sup>1</sup> The PMWS case definition on herd level is due to change whenever new knowledge on the aetiology, epidemiology and pathogenesis of PMWS is available.

<sup>2</sup> Certain assumptions are made when the mortality in the current period (measured as a proportion) is compared with the previous level by calculating the mean and standard deviation in the historical reference period. It is assumed that the mortality is a continuous variable, which it is not and moreover, that it is normally distributed around a true mean, which is unlikely. However, even if these assumptions are not met, it is still possible to apply the method, and it will give reasonable results in many cases, provided data are available (Table 1). As can be seen from the example data in the spreadsheet, the method is, in this case, somewhat too sensitive and will indicate a problem even when there is only a slight increase in the mortality. This can be prevented by choosing a less rigid significance level than the 95% level (1.66). It is not clear what the significance level should be to take appropriate account of all possible outcomes.

Compared with the chi-square test approach, the standard deviation approach is not sensitive to the number of observed pigs. It should be noted, though, that it is sensitive to the number of proportions observed. The model in the spreadsheet uses a moving average and standard deviation and included only the previous three months of observations at any point in time. From the spreadsheet, it is seen that under special circumstances the standard deviation may be zero or close to zero when observations are collapsed over weeks.

Table 1. Output from the excel simulation of the standard deviation approach using a spreadsheet (PMWS\_Case\_definition\_Denmark.xls).

<b>Batch No.</b>	<b>Total pigs</b>	<b>Dead pigs</b>	<b>% Mortality</b>	<b>Indicator</b>	<b>Mean of available batches</b>	<b>Stand. Dev. (SD)</b>	<b>Mean + 1.66SD</b>
weeks							
1	100	1	1	Not applicable	1	0	1
2	100	0	0	ok	0,5	0,71	1,67
3	100	3	3	Warning	1,33	1,53	3,87
4	100	5	5	Warning	2,25	2,22	5,93
5	100	0	0	ok	1,8	2,17	5,40
6	100	3	3	ok	2	2,00	5,32
7	100	1	1	ok	1,86	1,86	4,95
8	100	5	5	Warning	2,25	2,05	5,66
9	100	0	0	ok	2	2,06	5,42
10	100	5	5	ok	2,3	2,16	5,89
11	100	2	2	ok	2,27	2,05	5,68
12	100	2	2	ok	2,25	1,96	5,50
13	100	7	7	Warning	2,75	2,29	6,56
14	100	11	11	Warning	3,67	3,20	8,98
15	100	9	9	Warning	4,17	3,38	9,77
16	100	13	13	Warning	4,83	4,16	11,74
<b>Batch No.</b>	<b>Total pigs</b>	<b>Death pigs</b>	<b>% Mortality</b>		<b>Mean of available batches</b>	<b>Stand. Dev. (SD)</b>	<b>Mean + 1.66SD</b>
months							
1	400	9	2,25	Not applicable	2,25	0	2,25
2	400	9	2,25	ok	2,25	0	2,25
3	400	9	2,25	ok	2,25	0	2,25
4	400	40	10	Warning	4,83	4,47	12,26

- 3 The more appropriate way to compare two proportions (frequency data) is to use a chi-square test. This can be done using for example the software StatCalc, which is a part of the shareware program EpiInfo. However, it should be noted that the method is sensitive to the number of observations (Table 2). From the table, it may be seen that when the number of pigs in a herd increase, it becomes increasingly easy to show a significant difference in the two proportions. In other words, the same increase in mortality (e.g. from 4% to 8%) is non-significant in a small herd (pigs per batch/month =50) but significant in herds larger than 200 pigs per batch/month.

Table 2. Chi-square test results for comparison of two proportions of mortality in herds with various herd sizes

Increase in mortality	Number of pigs per month/batch <sup>A</sup>					
	50	100	200	400	800	1600
1% - 2%	- <sup>B</sup>	-	-	-	+	+
1% - 4%	-	+	+	+	+	+
1% - 8%	+	+	+	+	+	+
2% - 3%	-	-	-	-	+	+
2% - 4%	-	-	-	+	+	+
2% - 8%	+	+	+	+	+	+
2% - 12%	+	+	+	+	+	+
4% - 6%	-	-	-	(+)	+	+
4% - 8%	-	-	+	+	+	+
4% - 12%	+	+	+	+	+	+
4% - 16%	+	+	+	+	+	+
8% - 10%	-	-	-	-	(+)	+
8% - 12%	-	-	+	+	+	+
8% - 16%	-	+	+	+	+	+
8% - 20%	+	+	+	+	+	+

<sup>A</sup> Assume three months in the historical reference period and one month in the current time period

<sup>B</sup> A non-significant increase is shown as -, a borderline significant ( $P < 0.1$ ) as (+) and a significant increase ( $P < 0.05$ ) as +

<sup>4</sup> Ideally, the mortality should be measured as the incidence of dead pigs. However, this is impractical in most situations. Instead, the prevalence may be used. This is straightforward in herds running a batch operation (closed population) but may be less obvious in herds with a continuous operation (dynamic population). The methods mentioned in 1a above are easily implemented in the former type of herd but may also be adopted in the latter type.

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