A chick quality monitoring or diagnostic program must be developed with the following in perspective:

a. All incubation systems provide overall good chick quality.
b. In an egg mass, variations in embryo temperature occur not only in certain areas but within individual egg flats and hatcher baskets.
c. For this reason, an effective chick quality monitoring program defines the small population of problem chicks that are going to the field.
d. The evaluation should lead to correct diagnosis of incubator or hatcher involvement.
e. The result of the monitoring should be graphed into an SPC type system so that problems can be noted and resolved.
f. Results can vary by breeder flock age group. Therefore evaluations should be graphed by breeder flock age group.

A chick quality investigation can be done in both the hatchery and the field. The hatchery evaluation should determine if the source of quality defects is in the setter or the hatcher. The field mortality profile is used to evaluate chick mortality and determine if mortality is caused by field or hatchery issues. There are two ways to evaluate chick quality in the hatchery and field:

1. The most common is a defects based approach.
2. The second approach is based on chick length as an indicator of chick development. In this evaluation the only defect noted is the navel quality since it is determined late in incubation and chick size will not be appreciably impacted by problems in the hatcher.

Both defects and chick size are used in a hatchery and field chick quality/mortality evaluation.

**Chick Length: Literature Review**

1. Chick length reflects embryo temperature
2. Embryo temperature is correlated with field performance
3. Chick length is positively correlated with yolk free body mass
4. Chick length evaluations are practical and can be correlated by different people
   a. Better than weight as a predictor of performance

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1 Hill, Field Surveys
2 Gladys, 2000 and Hulet, 2006
3 Wolanski et al, 2004
4 Mauldin, 2008
b. Good predictor of performance, especially to 21 days  
c. Good predictor of field mortality

In the past, chick length was used to measure the flock average. Now it is better used to determine the percentage of chicks that have poor development and will die in the field. The size of the normal chicks and chicks that are considered too small to survive is shown below.

Normal chick size for use in the chick length evaluation is:

a. Young flock: 19-21 cm  
b. Prime flock: 19.5-21.5 cm  
c. Old flock: 20-22 cm

In the chick length evaluation, the sizes of small chicks that will be first week field mortality are:

a. Young flock<17.5 cm  
b. Prime flock<18 cm  
c. Old flock<18.5 cm

_In the Defect Based Chick Quality Evaluation_ it is difficult to categorize specific lesions to specific incubation problems since all environmental variations occur within an egg mass. It is also difficult to determine the normal percentage and the percentage that indicates a field problem. That said, generalities can be drawn for certain lesions and causes. A pictorial review of lesions and their causes will be given in the presentation.

**Lesions and causative agents:**

**Low weight loss:**

Signs: Large retained yolk, strings, diffuse red hocks, and yellow discoloration around the navel and leg deformities. Normal chick size. Fluid buildup under the skin at hatch.

Causes: High relative humidity in the incubation environment, low embryo temperature, high embryo temperature.

**High embryo temperature during incubation**

Signs: Abrasion of the cere, membranes adhere to chick, poor feathering, short pale feathers, ectopic viscera chicks, red hocks, bad navel closure, small chick size, and urates in the eggs and on the chicks, large unabsorbed yolks. Egg debris is dirty with meconium and blood. Dehydrated chicks are small. Ascites at hatch. Fluid buildup under the skin at hatch.

Causes: Variations in airflow, variations in air temperature and high dry bulb set point

**High chick body temperature after hatch:**
Signs: Crust at the corners of the beak, panting, urates and pasty vent. Dehydrated chicks are normal sized

Causes: Variations in airflow, variations in air temperature, and high dry bulb set point

Low embryo temperature during incubation:

Signs: Slow hatching chicks with clean egg debris, chicks sit and do not stand properly, large retained yolks, red hocks, and bad navel closure. They are low weight loss chicks.

Causes: Variations in airflow, variations in air temperature, low dry bulb set point, excessive humidification spray

To evaluate the chick quality results using a problem oriented approach, the following problem categories are used:

*In the hatchery chick quality evaluation:*

1. Bacterial contamination
2. Mold contamination
3. Incubation issues
   a. Signs of low weight loss
   b. Signs of high embryo temperature
   c. Signs of low embryo temperature
   d. Abnormal chicks
4. Trauma

*In the field mortality evaluation, the following problem groups are used:*

1. Incubation issues.
   Chicks with incubation issues include all chicks with any signs of poor incubation. In general small chicks with large unabsorbed yolks are incubation related.
   a. Small chicks (see list above)
   b. Chicks with retained yolks, especially large yolks
   c. Signs of high embryo temperatures
   d. Signs of low embryo temperatures
   e. Abnormal chicks
   f. Dehydration in a small chick
   g. Ascites in the first week in the house
2. Bacterial contamination
3. Mold contamination
4. Conditions after hatch in the hatcher, chick processing area, truck delivery, and early brooding. In general chick size is normal and yolk is utilized with problems after hatch.
   a. Normal sized chicks with utilized yolks.
b. Urates and pasty vents  
c. Debris or crusts at the corner of the beak  
d. Actual high or low body temperature of the chicks.  
e. Dehydration in a normal sized chick with no retained yolk  

5. Trauma  

To summarize:  

1. Small chicks with large yolks are incubation problems.  
   a. The smaller the chick, the earlier that the problem occurred in incubation.  
   b. Any retained yolk is a sign of incubation problems.  
2. Large chicks with no yolk are handling after hatch problems.  
3. Bad navels are often caused by the hatcher conditions, either too cold or too hot.  
4. Small chicks with dehydration are incubation problems  
5. Normal sized chicks with dehydration and no signs of incubation problems are caused by problems after hatch.  
6. Chicks with the following signs are signs of incubation problems  
   a. Retained yolk  
   b. Pale short feathers  
   c. Red hocks  
   d. Strings  
   e. Yellow down around the navel  
   f. Dehydration with an unabsorbed yolk.  
   g. Strings  
   h. Leg problems at hatch  
   i. Ascites at hatch or in the first week.  
   j. Fluid buildup under the skin

Evaluation of chick quality in the hatchery and mortality in the field can be used to identify general problem areas; the incubator, the hatcher, or the environment after hatch. Both size and defect based evaluations are used for effective diagnostics. After the field and hatchery evaluations are done, the function of the machine and environment after hatch must be evaluated. This is often done using embryo temperatures, rectal temperatures, patterns of hatch, hatch loss, and chick quality loss.