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The paradox of increasing mortality and health expenditures (Hanson Lecture)

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Introduction

Have you ever heard a producer say 'it used to be easier to raise pigs'? Do you sometimes drift back and fondly recall routine nursery mortalities of 1% and finishing mortalities of 2%? We aren't spending any less on Vet Meds per pig and in many cases we spend more to less effect. What happened?

In this paper and subsequent talk, I will attempt to describe the problem, investigate possible causes, look at cases where the trend seems to have been reversed, and finally reflect on what role veterinarians play in the paradox of increasing mortality and health expenditures.

Before proceeding I would like to make some qualifications. First, I am not a practicing veterinarian and never have been. Second, while I do work for PIC and will use genetic examples, the views and opinions in this piece are mine alone. Finally, the very nature of this talk is that it is meant to challenge. To do that I have drawn conclusions and have based ideas on generalities. Exceptions abound.

The problem

Is wean to finish mortality going up? In this time of PCVAD (and let's not forget about PRRS) we have all dealt with individual units or flows having issues with mortality. To try and put pig mortality into an industry-wide perspective we will look at three national databases: Agrimetrics, NAHMS, and Denmark.

Agrimetrics Associates Inc., is a benchmarking service that includes information from 15-20 large companies.[1] It represents approximately 20% of the sows in the US, and, by definition, is comprised of large modern pork production companies. As you can see, wean to finish mortality has been increasing for the last 10 years at a rate of approximately 0.10% per year (**Figure 1**).

The USDA, through NAHMS, has reported on various aspects of pig health based on surveys carried out in 1990, 1995, and 2000.[2] They are also currently doing another survey, but results were not available at the time of this writing. NAHMS includes data from farms of all sizes – certainly including on average, far smaller farms than Agrimetrics. Wean to finish mortality was reported as 4.2, 4.4, and 5.5% respectively for the three surveys, or an increase of approximately 0.13% per year - in line with the Agrimetrics numbers.

Is the trend of increasing wean to finish mortality a US phenomenon alone? The Danish pork industry is well organized and transparent, routinely publishing industry mortality figures that are far more comprehensive than US figures because of the industry organization.[3] As you can see, mortality has increased by approximately 2.5% over the last 10 years (**Figure 2**). The average mortalities are in line with the Agrimetrics numbers given above. However, the rate of increase is greater, perhaps reflecting the effects of PCVAD over the last 3-4 years. The US numbers were all collected before the onset of significant PCVAD that has occurred over the last year.

The other part of the paradox – increasing health expenditure – is harder to evaluate from a national perspective. Two pieces of Agrimetrics data are presented in **Figure 3**. While there is

Figure 1:

10-Year Trend for Wean to Finish Mortality % (Agrimetrics, 2005)

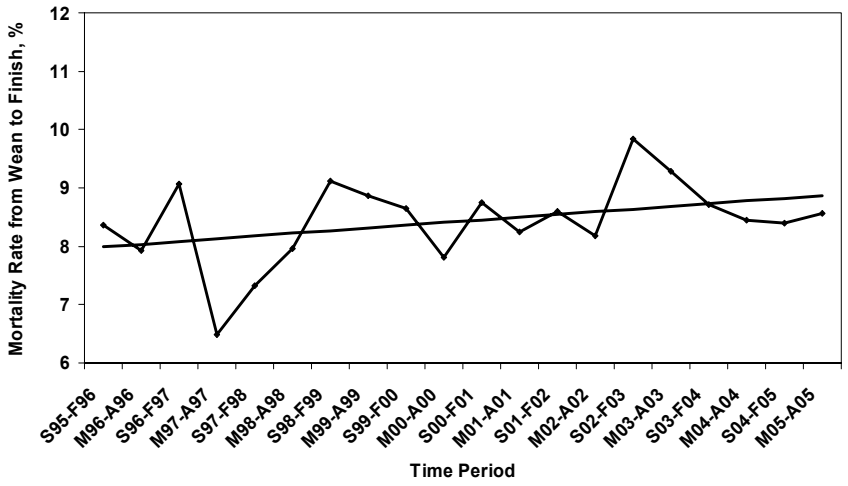


Figure 2

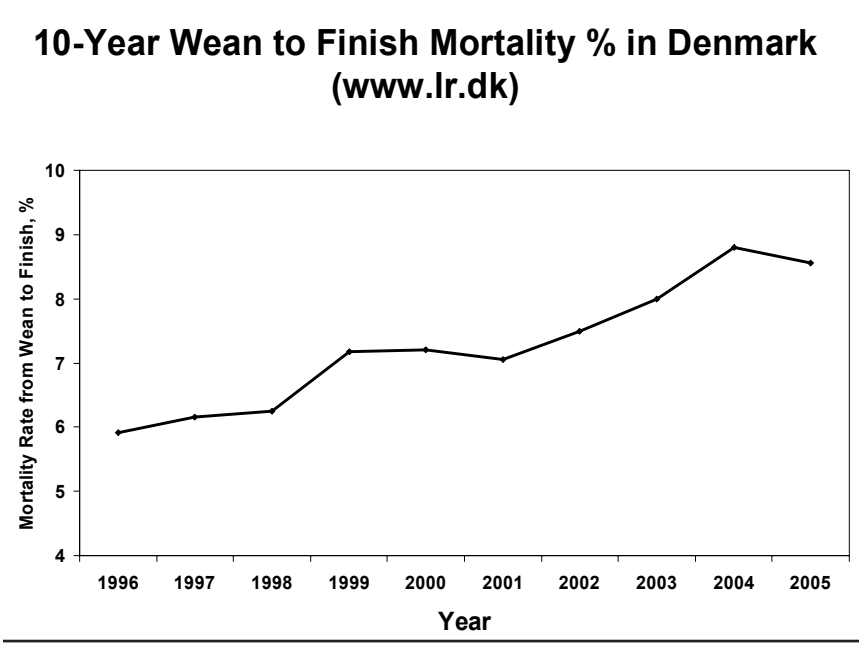
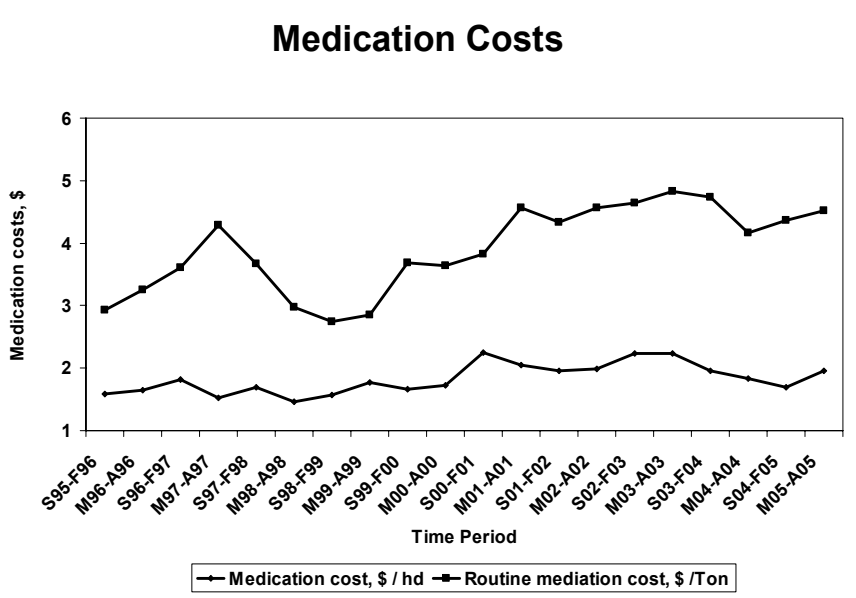


Figure 3



a definite trend in routine medication cost per ton over the past 10 years, the total medication cost per pig has held relatively flat over the same time period. It has increased slightly, indicating that routine medication through feed is an increasing part of total medication cost per pig.

An interesting set of closeouts from a large producer in the Midwest (**Figure 4**) shows a negative correlation between livability and Vet Med expenditures / pig. Clearly sick pigs that need treatment to survive will end up with higher Vet Med expenditures / pig. As these were routine commercial closeouts, controls were not included side by side to ultimately test the effectiveness of the Vet Med expenditures.

I found it difficult to obtain estimates for average health costs that could be compared across systems for the time period covered in this talk. Large scale modern production in the Midwestern US will typically average $2.00 per finished pig today, with a range of $1.00 to $3.25 per pig.[4]

Against the background of increasing mortality, it is important to note that overall productivity is increasing. Pigs grow faster today (**Figure 5**), to higher end weights (**Figure 6**), more efficiently (**Figure 7**) leading to greater throughput (lbs/sow/year – **Figure 8**). The rate of productivity growth is increasing industry wide (**Figure 9**).

So, throughput and efficiency are improving, yet more wean to finish pigs die today than ever before. Depending on your viewpoint, this is either a growing problem (animal well being) or an opportunity – part of an economic system that works but could be improved by decreasing mortality.

Before leaving the problem of livability it is worthwhile to look at another food animal species – dairy cattle. As you can see in **Figure 10**, we are not the only group with this problem. Arguably the dairy industry is facing more imposing trends both in mortality and Vet Med expenditures / cow. The figures represented are USDA estimates – similar in some respects to the NAHMS work in pigs, so they may not represent all segments of the industry. It is also important to note that the overall improvement in productivity seen in pigs has also occurred in dairy (**Figure 11**).

The possible causes

Genetics have changed dramatically over the past 50 years with the application of statistical tools and quantatative selection programs across species (**Figures 11, 12, 13**). If anything the rates of improvement have accelerated over the past 10 years.

There are, however, "undesirable side effects of selection for high production" as reviewed by Rauw et.al.[5] Selection for production traits in poultry is associated with an increase in mortality, skeletal problems, circulatory problems (ascitis) and reduced immunological competence. Early work in pigs indicated selection for lean tissue growth rate was negatively correlated with leg weakness.[6] Frank

Figure 4

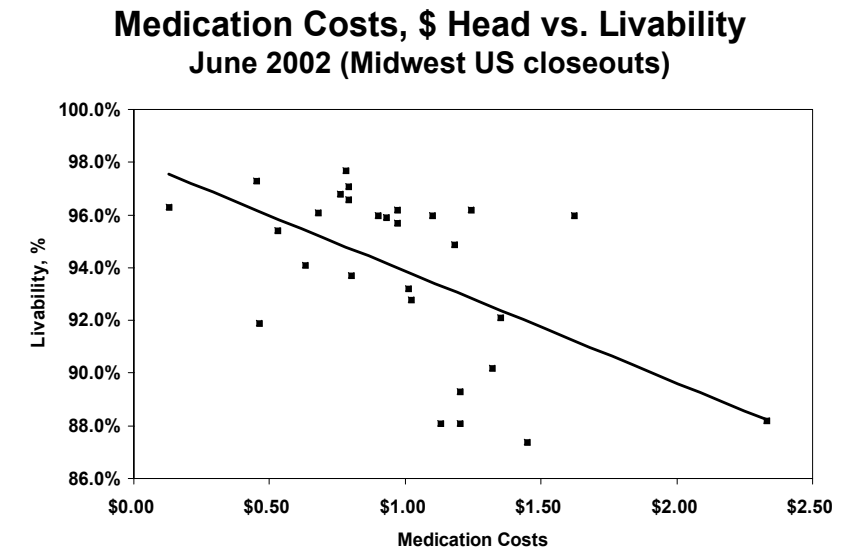
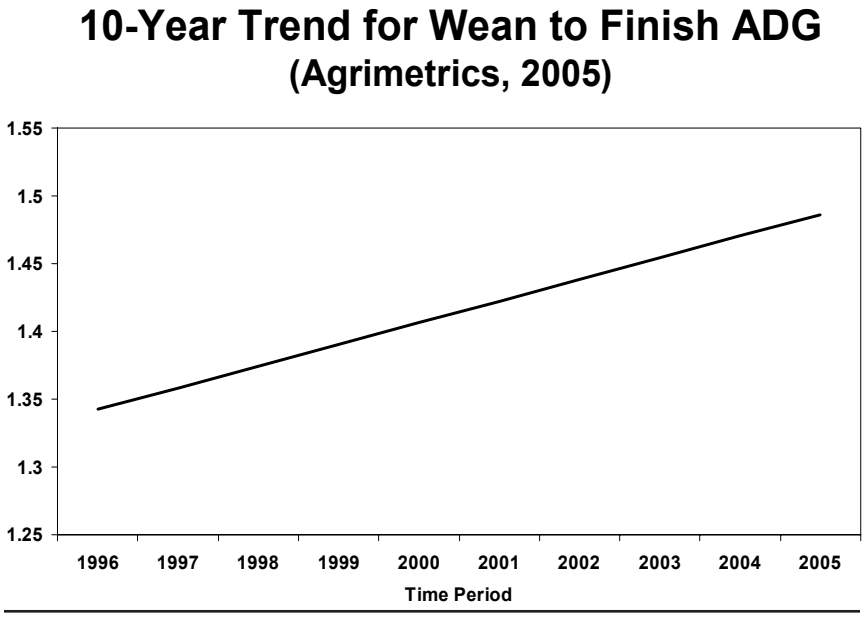


Figure 5



et.al. showed evidence for a genetics x disease interaction as well.[7] The leaner the genotype, the greater the reduction in performance and increase in mortality with disease challenge.

So, selection for production traits over time may have contributed to a decrease in livability. Economics have driven those selection programs. It is unlikely, with the exception of certain niche programs, that we will want to reverse the improvements made through modern genetic selection.

There have been significant system changes outside of genetics over the past 15 years that may well be contributing to the change in wean to finish mortality.

Herd size has increased substantially over that time frame. On the positive side (besides the overall economic advantages that have driven scale), larger herd size has led to greater use of all in / all out pig flow. Multi-site pig production is common today. It wasn't 15 years ago. Larger herd size has likely changed disease dynamics too. Population sizes per site have increased in many cases, and we still may not fully understand what impact multi-site production has had on overall herd immunity.

The labor situation has also changed as herds and systems have gotten larger. The sow / worker ratio has roughly doubled over the past 15 years from 150 to 300 or more to one in many herds today. In addition, the change from primarily owner operator units to larger companies and contract production has changed the face of labor in pig units. While difficult to measure, some would argue that animal husbandry has suffered.

What about the diseases themselves? How do they differ today from 15 years ago? In 1990, the industry dealt with APP, Rhinitis, Dysentery, *Mycoplasma*, TGE, PRV, Salmonellosis, Mange, and, of course, PRRS was starting. Today PRRS, *Mycoplasma*, SIV, H. *parasuis*, and increasingly PCVAD are issues. These lists aren't meant to be all inclusive, and the issue of wean to finish disease will be described in more detail in a subsequent talk. Many of the diseases listed for 1990 are still with us; they just seem to be controlled better today. The point to be made is that, at least on paper, the disease situation appears to be improved today compared to 15 years ago. I have focused on infectious diseases – we may actually be dealing with more non-infectious diseases (for example gastric ulceration and torsion) than we did 15 years ago.

The problem is fixable

Clearly the problem I have described does not affect all farms or systems. **Figure 14** represents closeouts from the same system as Figure 4. You will notice that the average livability in 2004-2006 is up from 2002 and less Vet Med expenditures / pig are being spent. The basic health status of the system didn't change – less water medications and more targeted injectables were used in 2006. **Figure 15** describes a typical increase in system mortality (represents approximately

Figure 6:

10-Year Trend for Wean to Finish FCR
(Agrimetrics, 2005)

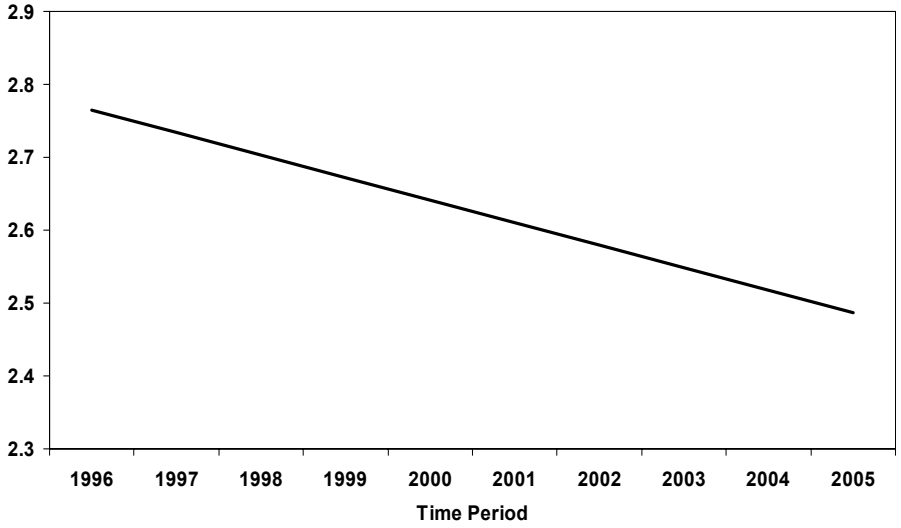


Figure 7:

Average Hot Carcass Weight
1965 – 2004 (Ron Plain, U of Missouri)

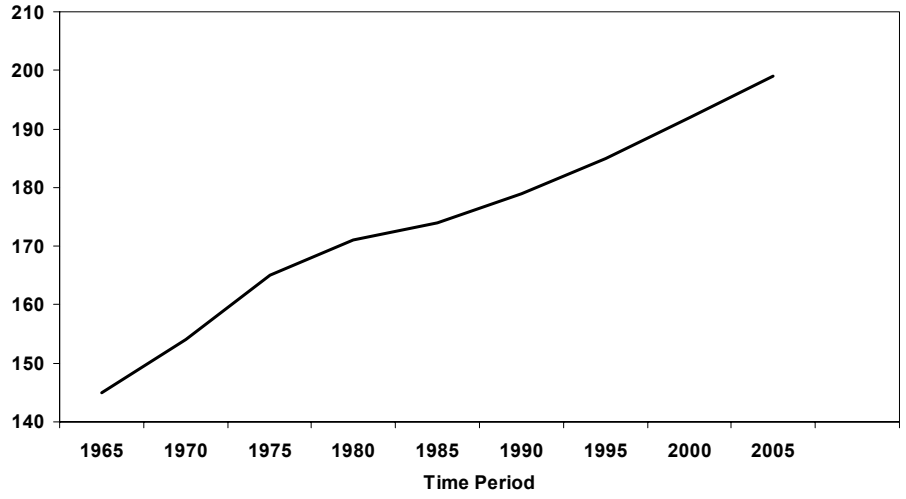


Figure 8:

Pounds per Sow per Year
(Agrimetrics, 2005)

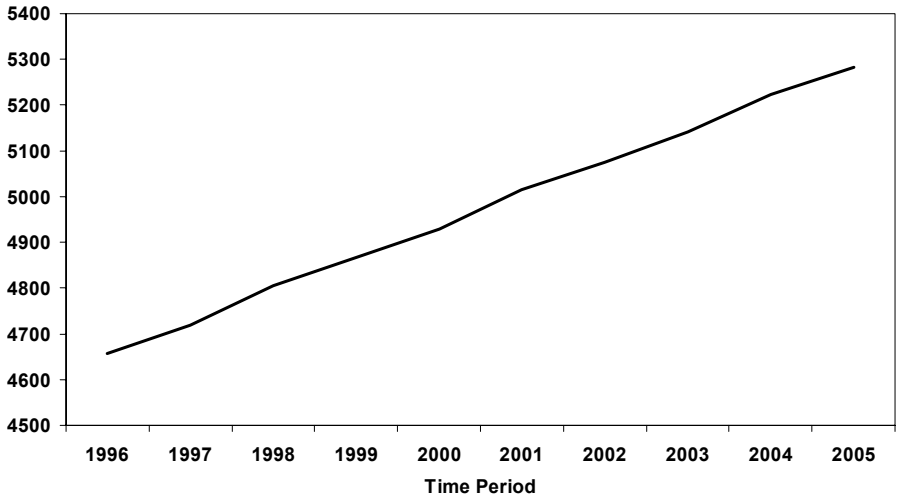


Figure 9:

Annual U.S. Pork Production per Sow
1960 – 2004 (Ron Plain, U of Missouri)

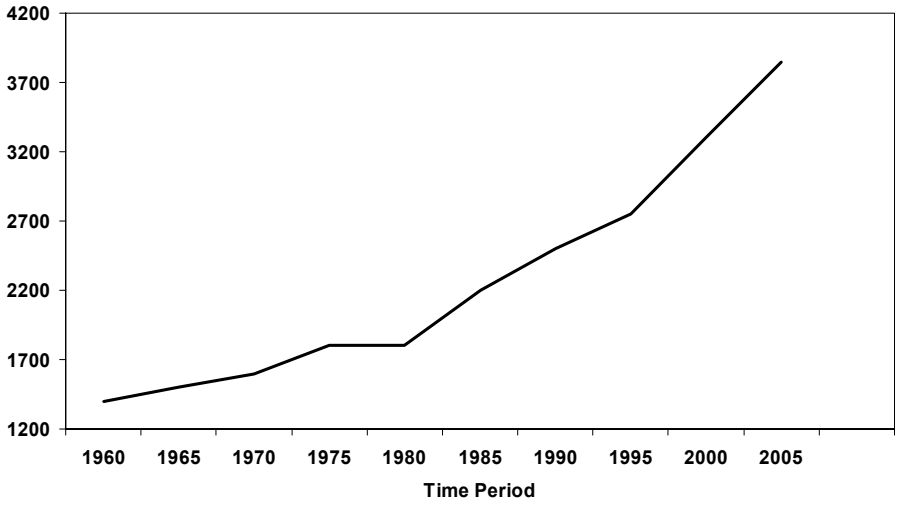


Figure 10:

U.S. Dairy Mortality and Medication Costs
(1990 – 2004, USDA and Informa Economics)

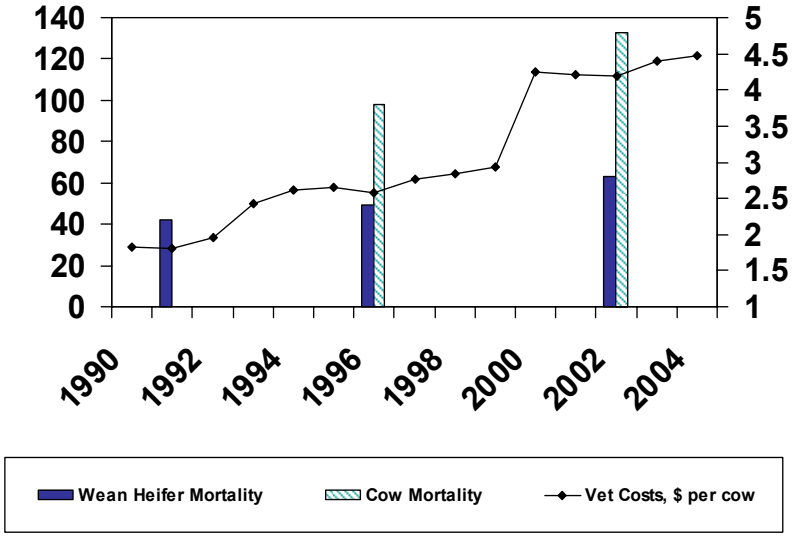


Figure 11:

Trends in Milk Yield for U.S. Holstein Cows
1970 – 2000 (Weigal, U of Wisc.)

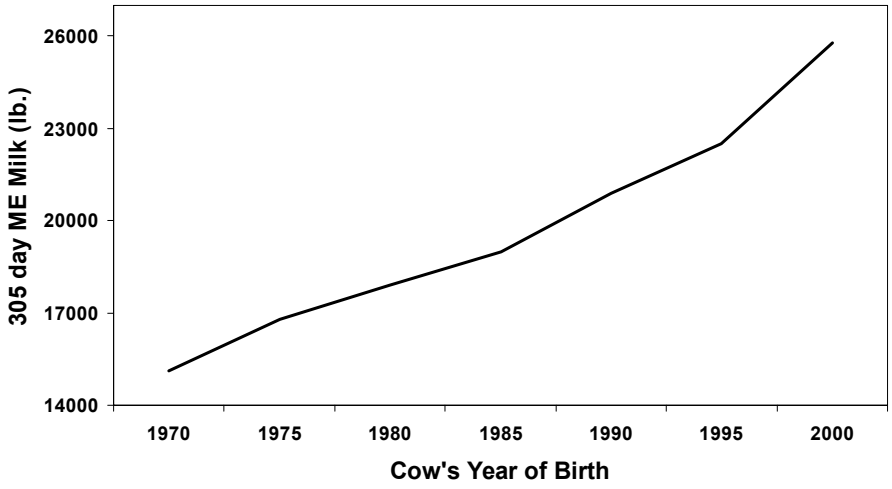
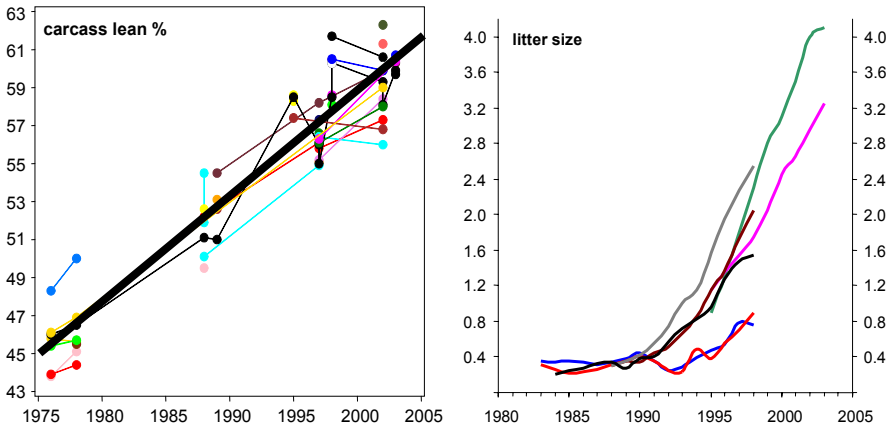


Figure 12:

Broiler Days to Market
1934 – 2004 (Merial)

Figure 13:

Genetic Trends in Multiple Pig Lines (Knap)



400K pigs per year) in 2001-2002. This trend is effectively reduced with management changes post 2002. What type of management changes? Life-time gilt development, sow farm vaccination programs that send predictable immunity downstream, wean age increase, single farm sow flows to wean to finish facilities, and changes in nursery vaccination timing have all improved mortality. It is beyond the scope of this paper (and me, for that matter) to describe exactly how to fix the problem and it, no doubt, differs for different farms and systems. The point I'm trying to make is that there are examples of producers that have made it work. We don't have to accept erosion in wean to finish livability. Perhaps we need to spend more time studying examples of success?

What about poultry? **Table 1** summarizes the tremendous improvement in US broiler performance over the last 80 years. Not only have throughput and efficiency improved dramatically, mortality has also dropped steadily over the same time period and has held relatively stable over the past 10 years. Over the same 10 year period, broiler vac-med costs per bird have also remained relatively stable. So, it looks like they've done it in broilers. Again the obvious question is how? Just as good examples in pigs should be studied, it would seem prudent for us to study what the broiler industry has done and not hide behind " they have the advantage of the egg."

Figure 14:

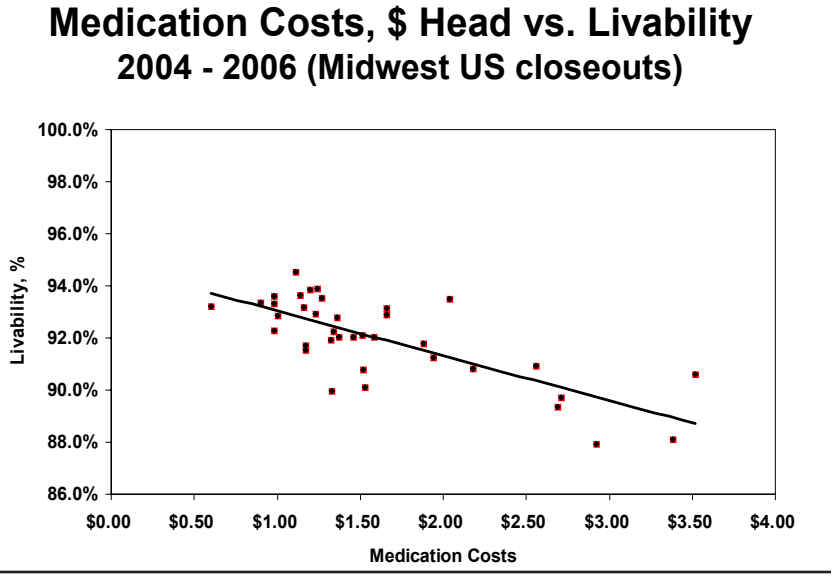
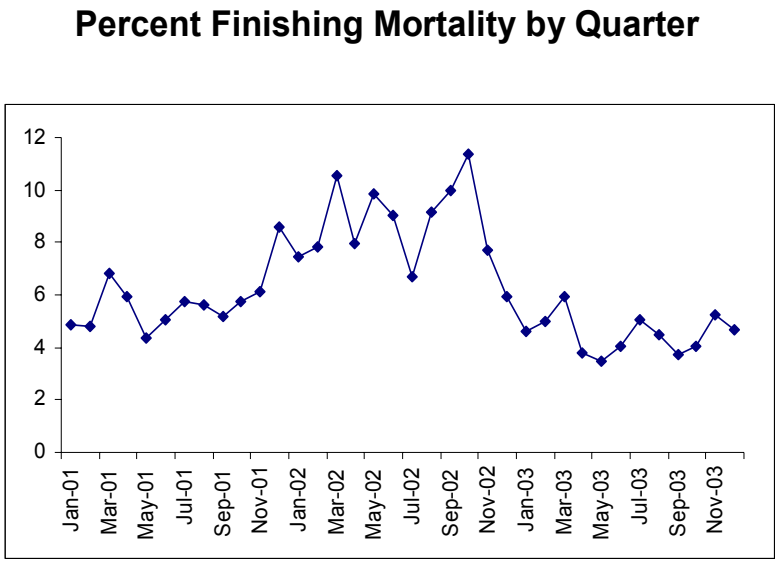


Figure 15:



One thing broiler breeding stock companies have done is to successfully adjust their breeding programs to take into account fitness related traits.[8] They have selected for livability, disease resistance, leg strength, and heart/lung function. They have adjusted their breeding objectives to balance unfavorable trends related to livability with production traits.

Is it possible to select for robustness/livability in pigs? Yes, and it is being done today. As Knap and Wang state in their paper: "genetic antagonisms between production and robustness can be neutralized by inclusion of the robustness trait in the breeding objective, combined with proper selection methods." Mortality rates in PIC lines show low heritabilites – not different than typical reproduction traits which have, nonetheless, been improved significantly in the last 15 years (Figure 13). Mortality rates and production traits can be improved at the same time, as there are not strong genetic correlations between most of them. What is needed are proper selection tools including representative databases. A multivariate BLUP system with mortality data collected at the commercial level, in addition to the nucleus, in representative environments (including disease) is required. Those systems of data collection and selection methods that follow have been put into place over the past 5 years. In addition to the tools listed above, disease resistance and robustness in commercial environments are areas where DNA marker assisted selection will likely have an impact. Nucleus herds operate under high health conditions in order to

Table 1: U.S. Broiler Performance 1925 to present (National Chicken Council)

Year	Market Age Average Days	Market Weight	Feed to Meat Gain: lb. of feed per lb. of gain	Mortality %
1925	112	2.50	4.7	18
1935	98	2.86	4.4	14
1945	84	3.03	4.00	10
1955	70	3.07	3.00	7
1965	63	3.48	2.4	6
1975	56	3.76	2.10	5
1985	49	4.19	2.00	5
1995	47	4.67	1.95	5
2005	44	5.25	1.90	4

obtain maximum expression of genetic potential and to be able to safely disseminate genetic improvement downstream. Using markers allows us to select for disease resistance and response to challenging environments without replicating that disease challenge at the nucleus level. An early example of this type of use was with F18 *E. coli*.[9]

Reducing mortality in today's production systems while controlling health expenditures would seem to be a central responsibility of veterinarians. While there are several examples where veterinarians have contributed to the solution of this problem, industry averages show us we are not keeping pace. There is certainly an argument to be made that without veterinary intervention livability would suffer more, and I think that is valid (although difficult to measure) – but we have not gained over the past 15 years. So what changes have occurred on the veterinary side over those years?

One area that has been essentially static, in my opinion, is the training of veterinarians. The curriculum in veterinary schools today is similar to that of 15 years ago. As demand for veterinarians is dominated by the companion animal branch of the profession, multi-species training of veterinarians is also dominated by the companion animal approach. We are taught medicine, observation, problem solving including response to treatment, and individual animal care. There is a limited foundation in statistical methods, epidemiology, economics, scientific methods, and other population based decision approaches. Over the same time period swine veterinarians are being made responsible for the health of more and more pigs. In 1990 sow to veterinarian ratios of 25k to one were not uncommon. Today 75K to one is not uncommon. For veterinarians trained to improve systems by observing pigs, it is now quite often physically impossible to do so. There is ever more data generated for veterinarian use today and veterinarians need additional training (see the extra sessions at this meeting for example) beyond that received in a standard veterinary school program. We need to turn the data into knowledge, to be trained to make data based decisions.

So how do we address this disconnect and turn out properly trained swine veterinarians? Continuing education is part of the answer and is readily available. The question for today is should we go further? Should we split training for veterinarians into Food Animal Veterinary Science and Companion Animal Veterinary Medicine? The specific category training would necessarily lead to the need for specific licensure of veterinarians, something that has no doubt stopped this idea from being tried. My fear is that if we don't change our approach the industry will pass the profession by. We often discuss in meetings how the swine industry is going the way of poultry. Look around at how many veterinarians are significantly involved in modern poultry production. Not many. We are still in a position to grow with our industry, but to do that I believe we need to understand the financial ramifications of our recommendations and we need to be able to make data based decisions. The idea of split training is certainly not new, but in the words of the late Al Leman perhaps it is time for us to "Be Bold."

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