Ike Sharpless
Second Journal Article Review
Corporate Management of Environmental Issues
Prof. Rappaport
December 6, 2007

Growth Promoting Antibiotics in Broiler Economics: A Surprising Finding

I. Introduction. Poultry industry spokespersons and academic researchers have long assumed that the use of growth promoting antibiotics (GPA) in food animal production is economically profitable. A recent report challenges that assumption. The authors use a three-year Perdue study involving around seven million chickens to gather their data, a method that confers great benefits but also substantial risks. Positively, Graham et al's article is able to draw on a pool of data that includes a far greater number of animal test subjects than previous studies could, and they are able to do so under actual industry conditions. Negatively, Perdue's non-cooperation with the study obfuscates certain essential information necessary to determining confidence intervals and other methodological essentials. On balance, however, the study serves as a substantial weight in favor of GPA elimination on the policymaker's decision-making balance.

The article begins with a brief outline of GPA's history, its proponents and opponents, and the subsequent history of broiler production methods over the last half century. WHO, the AMA, the American Public Health Association, and—since a 1999 ban—the EU oppose GPA, whereas U.S. commercial interests defend it as an economic necessity. It is important to note that banning GPA is not the same as banning antibiotic application in food animal production; the article distinguishes growth promoting antibiotics from therapeutic and prophylactic antibiotics; unlike the latter two, which are applied in higher doses and in water, GPA are low-dose and are added to the poultry feed.

The multivariable nature of increased production efficiency over the last 50 years makes it hard to isolate specific variables responsible for specified amounts of economic gain (interpreted variously) per unit of input. The article cites "selective breeding, controlled environments (lighting, temperature, and humidity), and supplementation of feeds with vitamins and minerals" as the primary changes that have taken place to drive the average weight of broiler chickens up by 50% and both the time required to raise a chicken and its feed requirements down by 35%, respectively. (Graham et al, 80)

Similarly complex is the growing concern over antibiotic resistance and its relevance to GPAs in food animal production. Previous studies have established that GPA contributes to the growth of antibiotic resistant pathogens such as "*Campylobacter, Salmonella, Enterococcus* and *Escherichia coli*" (Graham et al, 80) and, subsequently, to increased human risks. To reinforce the strength of this already-established connection, the authors note that all of the antibiotics used in the Perdue production study (listed in the figure on p. 81) are available as over-the-counter medications for human treatment. The importance of the authors' study, however, is not the risk of antibiotic resistance transference or any other such concerns; rather, the finding that GPAs in the Perdue study are not profitable when all the relevant variables are factored should make policymakers rethink the CBA underpinning their acceptance of GPA use in food animal production.

II. Sources and Methodology. The authors' study is atypical in that they do not engage in any research of their own. Instead, they piggyback on a study conducted from 1998 to 2001 published by researchers employed by Perdue Farms, Inc. The study collected data from two different regions, the Delmarva Peninsula and North Carolina, at 158 paired control-trial chicken houses, surveying around seven million chickens. The houses in the study conformed to standard commercial broiler size and stocking densities; most were equipped with tunnel ventilation and dark-out curtains.

Each paired control trial-house, one with GPA added to feed over its various runs and one without, "was similar in the number of chickens it received, type and size of building, temperature and lighting schedules, and feeding, watering, and ventilation equipment." (Graham et al, 82) The Delmarva Peninsula trials included 13 farms with an average of 9.23 repeated runs per farm, and the North Carolina trials includes six farms with an average of 6.17 consecutive runs.

Whereas both the trial and control houses received coccidiostat antibiotics (coccidiosis entails infection by coccidia of the genera *Cystoisospora*, and is especially damaging to poultry), only the trial houses were given GPAs in the three different kinds of feeds fed to broiler chickens throughout their approximately 52-day life cycle: starter, grower, and withdrawal feeds. The GPA mix included "bacitracin methylene disalicylate, zinc bacitracin, flavomycin, and virginiamycin" (Graham et al, 82). The amounts administered were unspecified, but the authors assume that standard industry quantities would be applied in an industry-sponsored controlled trial run.

Another, more troubling, willful omission in the Perdue study is the absence of inter-trial differences, without which the authors cannot gauge variance and confidence interval data. Instead, the authors calculate average differences and best/worst case scenarios. Also because of the gaps in their data set, the authors use sensitivity analyses to assess various scenarios, especially so because of the importance of "small changes in parameter values." (Graham et al, 83) The Perdue studies, like most similar studies before it, tracks four key variables throughout its study: mortality, average weight, feed conversion ration (FCR), and condemnations. Another potential factor contributing to broiler growth that is mentioned by the authors but not by the Perdue study is the frequency of litter change (not common practice between each flock in the U.S.).

III. Findings. The study accounts for the various inputs using mathematical models balancing the different variables against each other to determine the overall utility of GPAs. The authors track the two possible changes when GPAs are removed, that the number of chickens sold might change and that the payment per chicken might change due to altered weight. The authors' primary finding was that for the Delmarva Peninsula data, "the use of GPAs increases the market value of the chickens by an amount on the order of $0.0016 per chicken, but increases the growing cost by a larger amount of $0.0069." The results are even more striking in North Carolina, where removing GPAs "*increases* the net value of the flock by $0.0009 per chicken." (Graham et al, 85)

IV. Critique and Thoughts. My first thought was that it is infeasible for me to truly assess the validity of the authors' claim, inasmuch as doing so means recalculating all of their calculations. In truth, I was also not able to follow much of the actual math that the authors performed. Assuming that their calculations are correct, however, and given the accurate transposal of the Perdue study data, their conclusion seems valid—and striking—even granting for all the weaknesses that are openly admitted to by the authors.

It should also be kept in mind that this study refers only to the profitability of *growth promoting* antibiotics. This may be an obvious point, but it is an important one to remember; the authors maintain that GPAs account for anywhere from 13-70% of overall antibiotic use—a gaping margin that betokens the woeful state of regulatory oversight in the U.S. food animal production sector. If the true number is nearer to the 70% end of this massive margin of error, then GPA is the primary contributor to antibiotic resistance. If, however, GPA comprises closer to 13% of all antibiotics applied to poultry, then therapeutic and prophylactic antibiotics are the primary contributors to resistance. That being said, it is understandable why the authors focus on GPA: so long as broiler chickens continue to have less than a square foot of space per chicken, it is the only category of antibiotics that can be discarded without dire effects on animal health.

Although none of our case discussions dealt primarily with the question of antibiotics, the question of unintentional resistance is analogous to the issue of pest transference and pesticide resistance in the agricultural biotechnology case. The ideal case response to how to address GPA usage—and antibiotic usage in CAFO facilities generally—is, like in the case of agricultural biotech, removed from the real case. In the ideal agricultural case, integrated pest management minimizes the need to use either GM crops or their coordinated pesticides, while good agricultural practices would yield high returns that could compete with conventional methods. Such a case is not beyond the pale, as much research on economically viable organic agriculture demonstrates.

In the case of livestock production, however, the ideal case verges on unrealizability in the domain of the real; a low stocking density situation that renders unnecessary the antibiotics required at high densities would yield greater economic returns per bird but a substantially lower total monetary yield when economies of scale render per unit input costs unimportant in the face of total costs and total revenue.

Full Article Citation

Graham, Jay P., John J. Boland, and Ellen Silbergeld. "Growth Promoting Antibiotics in Food Animal Production: An Economic Analyis." *Public Health Reports*, Vol 122. January-February 2007.