

**Title:** Defining the Percentage of Pigs Raised without Antibiotics for a Label Claim –  
**NPB #20-160**

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**Industry Summary:** Consumer demand for pork carrying various claims of alternative production practices is constantly changing and determining the size of these markets is critical for research and development efforts as well as advertising and promotional activities. The pork industry doesn't want to spend too much in a market when return may be low, but also doesn't want to under invest in a high growth, fast moving market. The overriding objective of this project is to provide information the pork industry can utilize to define the percentage of pigs raised without antibiotics for a label claim. Several approaches were used to assess market share. Existing literature and public information were collected, reviewed, and a summary provided to establish baseline values on antibiotic use in pork production. U.S. Department of Agriculture, National Animal Health Monitoring System (NAHMS) swine studies and Agricultural Resource Management Surveys (ARMS) for hogs were the focus of the baseline summary. Data from USDA's Agricultural Marketing Service were then used to examine trends in premiums paid for non-carcass merit characteristics and market information for pork cuts from specialty programs. Limitations in existing literature, public information, and available data are identified and discussed. A targeted survey of individuals within the pork packing industry was then used to obtain expert opinion about the percentage of pigs eligible and pounds of pork marketed with an antibiotics claim. The information and data from a variety of different sources helps corroborate numbers.

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## Key Findings

- All existing NAHMS swine studies and ARMS hogs costs and returns surveys have been conducted prior to the U.S. Food and Drug Administration issuing and implementing antimicrobial use policy changes. This limits their usefulness in defining the current percentage of farms and/or percentage of pigs raised without antibiotics for a label claim. A NAHMS swine study will be conducted in 2021. A 2020 ARMS hog survey was conducted. Results for both the NAHMS and ARMS studies are not typically available until several years after data collection; however, once data is available it will provide updated baseline values on antibiotic use in pork production.
- The USDA-AMS National Weekly Direct Swine Non-Carcass Merit Premium (LM\_HG250) report includes an “other” catch-all category for “Animal Welfare, Antibiotic Free, Diet/Feed, Genetics, Meat Quality, Process Verified Program, Sow Housing, and Weight.” The range in the “other” premium is quite large. The difference between the high end of the range and low end of the range was \$14.75 per cwt in 2018, \$19.08 per cwt in 2019, \$26.53 per cwt in 2020, and \$29.08 in the first five months of 2021. The weighted average was \$3.72, \$4.68, \$5.72, and \$6.09 per cwt in 2018, 2019, 2020, and 2021 year-to-date, respectively. Premium values do not provide any indications on the quantity of hogs eligible or marketed with claims of alternative production practices (including antibiotic claims). They do, however, provide some signal on what packers believe is the profit maximizing price for hogs with such attributes.
- Comparing data in the USDA-AMS National Weekly Pork Report FOB Plant – Specialty (LM\_PK650) report along with the USDA-AMS National Weekly Comprehensive Pork (LM\_PK680) report provides an upper benchmark of the percentage of federally-inspected pork production that is marketed with animal-raising claims, including but not limited to just antibiotic claims. Since August 2019, specialty cuts, trimmings, and processed pork products has averaged 5.1% of the comprehensive wholesale pork trade. This percentage has been slightly increasing over the last two years. The volume of specialty product varies greatly by primal. Specialty rib products as a percentage of the comprehensive rib product volume, at 19.4%, is the highest average across all primals. Loin specialty products are second at 10.8% and belly products third at 7.5%.
- Based on opinions expressed by surveyed individuals within the pork packing industry, about 8% of annual commercial barrow and gilt slaughter in the United States is eligible for a “Raised Without Antibiotics” claim. The percentage of annual U.S. commercial barrow & gilt slaughter eligible for a “No sub-therapeutic antibiotics” claim is estimated to be higher. Survey respondents indicated that on average, about 50 pounds per carcass is typically marketed with an antibiotic claim.
- The organic market is an indicator of the supply and demand for pork products raised without antibiotics. Products labeled as organic by USDA must be produced without antibiotics fed or administered to pigs at any point in their life. The organic label, however,

refers to many other attributes of the product, not just the absence of antibiotics used in production. Hence, the production and sales of organic pork products may reflect demand for these other attributes. Organic hog and pig production makes up a small share of total U.S. pork production. Certified organic farms represent about 0.2% of the total hog and pig farms in the United States. Certified organic sales represent roughly 0.01% of the total U.S. hog and pig sales.

- Providing additional published information or reports and/or providing market information in finer granularity would be an important avenue for USDA-AMS together with industry to assess. For example, could head counts be added to the LM\_HG250 report and disaggregation of the “other” category to separately publish “antibiotic free” information? Similarly, could “antibiotic free” load counts and pounds be published separately in the LM\_PK650 report? This information may or may not be publishable because of the existing confidentiality guidelines. Assessing if publishing would be possible if volumes over multiple weeks, months, or even years were combined is an avenue for further research. A forum for asking these questions, and more, is the annual USDA Data Users meeting. The offering of new reports or new data has often originated from requests of pork market participants.

**Keywords:** Animal-raising claims, Antibiotic claims, No Antibiotics Administered, No Added Antibiotics, No Antibiotics Ever, Raised Without Antibiotics, Non-carcass merit premiums, Pork, Specialty programs

**Scientific Abstract:** Same as industry summary.

## Introduction

Consumers are interested in the practices used in producing their food, asking for increased transparency and more information on production practices (Tonsor, Wolf, and Olynk, 2009). One of several examples is antibiotic use in livestock production (Nayga, 1996; Lusk, Norwood, and Pruitt, 2006; Olynk, Tonsor, and Wolf, 2010; McKendree et al., 2013; Picardy, Cash and Peters, 2020). Livestock producers respond to this consumer interest by providing verifiable information regarding production practices. Many production practice claims are credence attributes. Caswell and Mojduszka (1996) define credence attributes as characteristics in which quality cannot be assessed even after the product is purchased and consumed. For example, at no point before, after, or during consumption of meat products is a consumer able to determine whether and how antibiotics were used.<sup>1</sup> For this same reason, verification of credence attributes cannot be provided through traditional testing methods. Producers, processors, and retailers may voluntarily choose to label process-based attributes of their products or may be required to do so by government regulations (Caswell, 1998).

The U.S. Department of Agriculture, Food Safety and Inspection Service (USDA-FSIS) oversees the use of all labels for meat and poultry products. This authority is granted under the Federal Meat Inspection Act (FMIA) and the Poultry Products Inspection Act (PPIA).<sup>2</sup> There are strict rules regarding the content and appearance of labels. The placement and prominence of mandatory information is specified by regulation with up to eight specific information requirements for each product label. These include: product name, inspection legend and establishment number, handling statement, net weight statement, ingredients statement, address line, nutrition facts, and safe handling instructions (USDA-FSIS, 2007, 2019; AMSA, 2015). Labeling requirements are intended to inform consumers about what they are purchasing and consuming, prevent deception from false or misleading labels, assist consumers in making value comparisons between products, and prevent injury to the public's health from the sale of misbranded products (CAST, 2015). Unfair competitive advantages are also prevented because all establishments under state and federal inspection must comply with the same label requirements and standards (USDA-FSIS, 2019).

In addition to mandatory labeling, voluntary, process-based label claims are increasingly being used to distinguish meat and poultry products. Consumers rely on information that firms provide via voluntary label claims to make choices that reflect their preferences. All labels with special statements and claims, including animal-raising claims, need to be submitted to FSIS for approval prior to being used on the product.<sup>3</sup> Labels with animal-raising claims, as is the case

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<sup>1</sup> All meat, poultry and dairy foods sold in the U.S. are free of antibiotic residues, as required by federal law (CDC, 2021). If livestock do get sick and require antibiotics, farmers must follow strict U.S. Food and Drug Administration guidelines for the proper dosage, duration and withdrawal time (Iowa Farm Bureau, 2020). As an additional layer of protection, the U.S. Department of Agriculture, Food Safety and Inspection Service samples meat and poultry products, as part of the National Residue Program, to ensure they are free of antibiotic residues (UDSA-FSIS, 2020).

<sup>2</sup> An in-depth discussion of these laws and the scope of what constitutes a label is discussed in USDA-FSIS (2007).

<sup>3</sup> This is in accordance with 9 CFR 412.1 (c)(3). 9 CFR 412.1 refers specifically to the Code of Federal Regulations; Title 9 – Animals and Products; Chapter III – Food Safety and Inspection Service, Department of Agriculture; Subchapter E – Regulatory requirements under the Federal Meat Inspection Act and the Poultry Products Inspection Act; Part 412 – Label Approval; Section § 412.1 - Label approval.

with all labels with special claims, must be submitted to the Labeling and Program Delivery Staff, Office of Policy and Program Development in USDA-FSIS with specific documentation to support all such claims that appear on that label (Federal Register, 2016). Examples of animal-raising claims include, but are not limited to: raised without antibiotics, organic, grass-fed, free-range, and raised without the use of hormones.

The U.S. Department of Agriculture's Agricultural Marketing Service (USDA-AMS) originally proposed thirteen U.S. Standards for Livestock and Meat Marketing Claims, including antibiotic claims, as a notice and request for comments on December 30, 2002 (Federal Register, 2002).<sup>4</sup> At that time, claims relating to the absence of antibiotic drug residues were allowed but were later phased out (USDA-FSIS, 2007). More generally, because raised without antibiotics was a relatively new label claim, USDA-FSIS did not yet have an exact standard published or a clear definition established. As such, firms were able to develop their own standards for raised without antibiotics label claims and submit them to the FSIS for approval with supporting documentation (Bowman et al., 2016). To help facilitate the approval process for labels bearing animal raising claims, subsequent guidance documents have included definitions for frequently used claims and have detailed the supporting documentation required for each specific claim that appears on the label (Federal Register, 2016).

In December 2019, USDA-FSIS (2019) released a labeling guideline on the documentation needed to substantiate animal raising claims for label submissions. Specific to negative antibiotic use for livestock and red meat, the following guidelines were outlined. To use the "Raised Without Antibiotics" claim, source animals cannot be administered antibiotics in their feed, water or by injections at any point in the production process. This includes ionophores which are recognized as antibiotics by USDA-FSIS. Examples of this type of claim include, but are not limited to: "Raised Without Antibiotics", "No Antibiotics Administered", "No Added Antibiotics", "No Antibiotics Ever", and "Raised Antibiotic Free". Specifically, "Raised Antibiotic Free" and "No Added Antibiotics" were two examples of claims that were added that may be used to disclose the fact that animals were not administered antibiotics at any point in the animal production process.

In addition, information on claims that include the term "sub-therapeutic antibiotics" were added to ensure that consumers understand that the claim means that antibiotics may only be administered in the event of an illness and includes the circumstances for which USDA-FSIS will approve labels bearing these claims. Specifically, USDA-FSIS will approve a claim that states that animals have not been administered sub-therapeutic antibiotics if the claim is part of a complete claim that explain what the term "sub-therapeutic" means. An example would be, "No sub-therapeutic antibiotics. Animals do not receive antibiotics on a daily basis; animals only receive antibiotics in the case of illness." Other examples of this claim that USDA-FSIS is likely to find to be truthful and not misleading include: "Pork Raised with No Sub-Therapeutic Antibiotics Ever, animals may be given antibiotics for the treatment of illness" or "Pork Raised

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<sup>4</sup> There were nine live animal production claims that included: antibiotic use, breed, free range, geographic location, grain fed, hormone use, livestock identification, preconditioning, and vitamin E supplementation. Four other standards were proposed for claims relating to meat product characteristics which included: aged meat, electrical stimulation, and tenderness.

with No Sub-Therapeutic Antibiotics, Animal do not receive antibiotics on a daily basis only in the case of illness.”

The documentation needed to support these claims includes: 1) a detailed written description explaining controls for ensuring that the animals are not given antibiotics from birth to harvest or the period of raising being referenced by the claim including feed formulation; 2) a signed and dated document describing how the animals are raised to support that the claims are not false or misleading; 3) a written description of the product tracing and segregation mechanism from time of slaughter or further processing through packaging and wholesale or retail distribution; and 4) a written description for the identification, control, and segregation of non-conforming animals/product (e.g., if raised without the use of antibiotics need to be treated with antibiotics due to illness) (USDA-FSIS, 2019).

A USDA-FSIS (2020) compliance guideline for label approval, issued in July 2020, provided updated information about the types of labels that must be submitted to USDA-FSIS for approval. This guideline also provided examples of statements and claims that do not need to be submitted to USDA-FSIS and may be generically approved. For example, once a label is approved by USDA-FSIS for compliance, there are several changes that can be made to the label that do not require resubmission to USDA-FSIS. For changes to be made to these labels, without submission to USDA-FSIS, the change must be unrelated to the special statement or claim. Changing the name of the cut of meat or poultry for a label previously approved with an animal raising claim (e.g., raised without antibiotics) would qualify. A specific example would include changing the name from pork chop to pork tenderloin. The change is generically approved provided the source of the pork is the same as documented in the previously approved label. In this case, changing the name of the cut of pork will not affect the special statement or claim. Another example is changing an approved claim to a synonymous claim (e.g. changing from “No Antibiotics Used” to “Raised Without Antibiotics”).

Audit and accreditation programs are offered by USDA-AMS to provide producers and suppliers of agricultural products the opportunity to certify production processes used. The USDA Process Verified Program (PVP) is one such program available.<sup>5</sup> USDA-AMS verifies the documented programs through independent, third-party audits. The program is voluntary and paid for through hourly user-fees. Once a USDA PVP is approved, applicants may develop promotional materials associated with their process verified points, use the USDA PVP shield in accordance with program requirements and market themselves as “USDA Process Verified” (USDA-AMS, 2021a).

## **Objectives**

Consumer demand for pork carrying various claims of alternative production practices is constantly changing and determining the size of these markets is critical for research and development efforts as well as advertising and promotional activities. The pork industry doesn’t want to spend too much in a market when return may be low, but also doesn’t want to under invest in a high growth, fast moving market. The overriding objective of this project is to

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<sup>5</sup> The official listing of approved USDA Process Verified Programs is available at <https://www.ams.usda.gov/sites/default/files/media/Official%20ListingPVP.pdf>

provide information the pork industry can utilize to define the percentage of pigs raised without antibiotics for a label claim. We aim to:

1. Provide a review and reporting of existing literature and public information to establish baseline values on antibiotic use in pork production.
2. Use publically available data from USDA's Agricultural Marketing Service to examine trends in premiums paid for non-carcass merit characteristics and market information for pork cuts from specialty programs.
3. Survey pork packers to obtain information about the percentage of pigs eligible and pounds of pork marketed with an antibiotics claim.

## **Materials & Methods**

The analysis requires synthesis of existing information, gathering of new data, and developing a framework for identifying the extent to which consumers are able to purchase pork with label claims regarding antibiotic use. First, U.S. Department of Agriculture (USDA) data from the National Animal Health Monitoring System (NAHMS) swine studies and the Agricultural Resource Management Survey (ARMS) are used to examine trends in antibiotic use in pork production. Beyond assessing trends, important context is provided on where existing data collection and reporting efforts could be expanded to address data gaps and provide additional insights into antibiotic stewardship practices.

Estimates from each separate survey data series, e.g., NAHMS swine studies in 1995, 2000, 2006, and 2012, are comparable over time because of the consistent way in which the surveys were conducted and processed. Surveys had a broad national coverage, represented the same target population, involved a complex sampling scheme designed to represent the target population, were conducted by the same organization (USDA's National Agricultural Statistics Service (NASS)), and collected much of the same information in a similar format. Also, definitions used to summarize and present data were similar across the various years. The two data sources, i.e., NAHMS and ARMS, however, use different sampling methods, collected data in different years and thus are not directly comparable. NAHMS surveys farms with more than 100 head while ARMS collects data from farms with more than 25 head. Both the NAHMS and ARMS studies rely on voluntary participation.

The organic market is another indicator of the supply and demand for pork products raised without antibiotics. Products labeled as organic by USDA must be produced without antibiotics fed or administered to pigs at any point in their life (Sneeringer et al., 2015). The organic label, however, refers to many other attributes of the product, not just the absence of antibiotics used in production. Hence, the production and sales of organic pork products may reflect demand for these other attributes. Appendix A provides a summary of the organic pork market from farm-level production to retail using publically available data.

Livestock Mandatory Reporting (LMR) conducted by USDA-AMS provides essential market information to industry participants, thereby, enhancing decision making and market efficiency. The LMR Act of 1999 established slaughter swine market reporting requirements for federally inspected (FI) swine processing plants that slaughter an average of more than 100,000 head of barrows and gilts (or a company, termed "person" in the regulations, that slaughters more than 200,000 head of sows and/or boars) annually (e-CFR, 2008).

Federally inspected slaughter accounts for the majority of pork production. Total commercial U.S. hog slaughter in 2020 was 131.563 million head, of which 130.782 million head, or 99.4%, was FI with non-federally inspected, state-inspected, or custom-exempt slaughter accounting for 780,800 head or 0.6%. Barrow and gilt slaughter is the vast majority of FI hog slaughter (97.2% in 2020), with the remaining comprised of sow and boar slaughter (USDA-NASS, 2021). Federally inspected plants slaughtering over 100,000 head annually account for the majority of pork production. In 2020, packing plants that slaughtered 100,000 head or more accounted for 98.6% of the FI hog slaughter.

Currently, as part of LMR, USDA-AMS reports two weekly reports that speak to prices (premiums) and/or quantities for animal raising claims. The National Weekly Direct Swine Non-Carcass Merit Premium (LM\_HG250) report includes the premium for an aggregated category of process-based claims. “Antibiotic Free” is included in the catch-all category. The National Weekly Pork Report FOB Plant – Specialty (LM\_PK650) report includes prices and quantities for pork cuts from specialty programs. “Antibiotic Free” is one of the specialty programs. Unfortunately the information from the LM\_HG250 report and LM\_PK650 report is not further disaggregated but provides recent trends, and in the latter case, an upper benchmark of the percentage of FI pork production that is marketed with animal-raising claims.

Given limitations in the existing literature, public information, and available data, we rely, in part, on a pork packer survey to estimate the percentage of pigs eligible and pounds of pork marketed with an antibiotics claim. Those who are in the best position to provide this information are those who are in these procurement markets. Dr. Steve Meyer, Consulting Economist to the National Pork Board, maintains a detailed database of hog slaughter plants and capacity (Meyer, 2020). This pork packer list and contact information was leveraged for the survey.

The survey was sent as an email and packers were given several weeks to respond. They were asked to provide an estimate of percentage of annual commercial barrow & gilt slaughter in the United States would be eligible for an antibiotic claim, with two different types of claims provide. They were also asked to provide an estimate of how many pounds per carcass is typically marketed with an antibiotic claim. The survey instrument is provided in Appendix B. The use of a percentage value, and pounds per carcass designation, in the survey was done to link the results of the survey to USDA published slaughter data.

## **Results**

*Objective 1: Provide a review and reporting of existing literature and public information to establish baseline values on antibiotic use in pork production.*

NAHMS swine studies involve the use of questionnaires administered to U.S. swine producers to establish nationally representative estimates of health and management practices—including information about antibiotic use. Surveys are voluntary and data was first collected in 1990, followed by studies in 1995, 2000, 2006, and 2012. In 2007, data was collected from small-enterprise swine operations; however, no antibiotic usage information was reported for the study. The repeated nature of NAHMS studies allows examination of health and management practices over time.

Tables 1 and 2 describe changes in antibiotic use for 2000, 2006, and 2012 in breeding females and for 2006 and 2012 in nursery and/or grower/finisher pigs (USDA-APHIS-VS-NAHMS, 2017). The percentage of sites that used antibiotics to treat breeding females for disease did not change substantially from 2000 to 2012. A higher percentage of sites in 2012 than in 2006 gave nursery and grower/finisher pigs any antimicrobials in feed or water for any reason. Overall, more sites used feed rather than drinking water as the method of antibiotic delivery.

**Table 1. Percentage of sites that gave antibiotics to any breeding females to treat a disease condition during the 12 months before the study interview, by study:**

Percent Sites					
Study					
Swine 2000		Swine 2006		Swine 2012	
Percent	Std. error	Percent	Std. error	Percent	Std. error
61.3	(4.9)	74.1	(3.9)	59.5	(5.3)

Source: USDA-APHIS-VS-NAHMS (2017).

**Table 2. Percentage of sites that gave nursery and/or grower/finisher pigs any antimicrobials in feed or water for any reason during the 6 months before the study interview, by production type and by study:**

Production type	Percent Sites							
	Water*				Feed*			
	Study							
	Swine 2006		Swine 2012		Swine 2006		Swine 2012	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	
Nursery	34.9	(3.9)	66.6	(5.5)	80.2	(3.3)	89.4	(3.0)
Grower/finisher	47.5	(3.6)	74.3	(4.8)	80.2	(2.6)	91.2	(2.0)

\*Does not match previous estimates because of elimination of "Other" category.

Source: USDA-APHIS-VS-NAHMS (2017).

The 2006 NAHMS swine study data (USDA-APHIS-VS-NAHMS, 2007), as compiled by Sneeringer et al. (2015), indicates that a larger portion of operations administered antibiotics to nursery-age hogs for disease prevention than for growth promotion (Table 3). The percentage of sites feeding nursery-age pigs antibiotics for growth promotion declined in 2006 compared to prior years. In 2000, 82.7% of sites with nursery-age pigs administered antibiotics in feed for

growth promotion (USDA-APHIS-VS-NAHMS, 2002), compared to 24.5% in 2006 (USDA-APHIS-VS-NAHMS, 2007; Sneeringer et al., 2015).

**Table 3. Percentage of sites that gave any pigs an antimicrobial or feed additive, by type of pig, primary reason given, and route of administration, 2006**

	Percentage of sites with:					
	Nursery-age pigs			Grower/finisher		
	Route of administration			Route of administration		
	Injection	Feed	Water	Injection	Feed	Water
Growth promotion	1.4	24.5	0.5	1.0	55.1	0.2
Disease prevention	20.9	50.9	14.6	10.8	37.5	3.7
Respiratory disease treatment	48.6	17.0	17.7	63.7	29.0	42.4
Enteric disease treatment	19.1	14.8	9.9	15.9	17.1	15.8
Polyserositis/meningitis treatment	25.1	0.7	4.8	14.3	0.0	0.9
Parasite treatment	0.0	6.8	0.4	0.0	0.0	0.0
Other treatment	10.4	0.1	0.7	12.1	1.6	0.6
<b>Any reason</b>	<b>83.1</b>	<b>82.3</b>	<b>40.3</b>	<b>75.6</b>	<b>83.6</b>	<b>47.9</b>

Note: The statistics indicate the percentage of the sites using the treatment, not the percentage of pigs treated at the facility. Source: Sneeringer et al. (2015). Compiled from USDA-APHIS-VS-NAHMS (2007).

The USDA-APHIS-VS-NAHMS (2020) “Antimicrobial Use and Stewardship on U.S. Swine Operations, 2017” study was an in-depth examination of antimicrobial use and stewardship practices on U.S. swine sites.<sup>6</sup> The study collected information about antimicrobial use and stewardship practices from July 1, 2016 through December 31, 2016. Data for the study were collected from swine sites with at least 1,000 market pigs. In total, producers from 196 swine sites provided data.

Table 4 describes the use of antimicrobials administered to market pigs (all nursery-age and grower/finisher-age pigs) via water, feed, or injection and by size of site. Overall, 97.6% of sites gave any (one or more) antimicrobials to market pigs by any route, while 78.4% gave antimicrobials in water, 93.5% in feed, and 92.4% by injection. The percentage of sites that used antibiotics, and by route, was not substantially different by the size of the site.

Table 5 describes the administration of medically important antimicrobials, i.e., any antimicrobial the U.S. Food and Drug Administration (FDA) deems medically important with respect to the use of that class of antimicrobials for therapeutic use in human medicine, to market pigs via route and by site size (USDA-APHIS-VS-NAHMS, 2020). Overall, 76.0% of sites gave market pigs any (one or more) medically important antimicrobials in water, and 88.6% administered medically important antimicrobials in feed. Similar to the use of any antimicrobials, there were no substantial differences by size of site in the percentages of sites that gave market pigs medically important antimicrobials.

<sup>6</sup> A site is defined as one geographic location or address that functions as a unit to house one or more production phases in swine rearing. A site can also be a part of an operation or it can be the whole operation, if the operation has only one site (USDA-APHIS-VS-NAHMS, 2020).

**Table 4. Percentage of sites that gave market pigs any antimicrobials, by route of administration and by size of site, July 1, 2016 through December 31, 2016**

Route of administration	Percent Sites							
	Size of Site (number of market pigs)							
	Small (1,000–1,999)		Medium (2,000–4,999)		Large (5,000 or more)		All sites	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Water	71.3	(10.6)	84.8	(3.5)	71.7	(8.4)	78.4	(4.9)
Feed	94.1	(3.3)	91.6	(2.2)	97.9	(1.4)	93.5	(1.6)
Injection	89.6	(4.8)	93.2	(2.3)	94.4	(3.1)	92.4	(2.0)
Water or feed	96.4	(2.5)	93.5	(2.0)	98.4	(1.2)	95.3	(1.4)
Any of the above	100.0	(—)	95.4	(2.1)	100.0	(—)	97.6	(1.3)

Source: USDA-APHIS-VS-NAHMS (2020).

**Table 5. Percentage of sites that gave market pigs any medically important antimicrobials,\* by route of administration and by size of site, July 1, 2016 through December 31, 2016**

Route of administration	Percent Sites							
	Size of Site (number of market pigs)							
	Small (1,000–1,999)		Medium (2,000–4,999)		Large (5,000 or more)		All sites	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Water	71.3	(10.6)	83.0	(4.2)	64.2	(7.6)	76.0	(5.5)
Feed	87.6	(5.6)	87.0	(3.5)	94.0	(3.0)	88.6	(2.9)
Water or feed	94.9	(3.1)	92.0	(2.2)	97.9	(1.4)	94.0	(1.6)

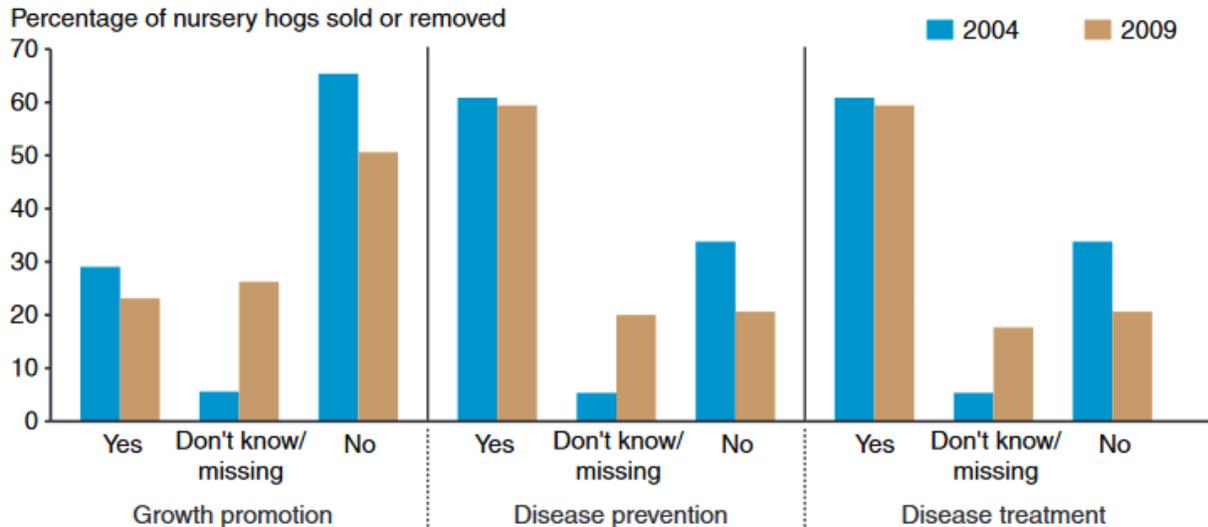
\* See Appendix II in USDA-APHIS-VS-NAHMS (2020) and USHHS-FDA-CVM (2003) for more information.  
Source: USDA-APHIS-VS-NAHMS (2020).

The Agricultural Resource Management Survey, or ARMS, is sponsored jointly by USDA's Economic Research Service (ERS) and NASS. It is a multiphase series of interviews with farm operators about their production practices, financial condition, and household well-being. The 1998, 2004, 2009, and 2015 ARMS versions contained detailed questions on the production and marketing practices, expenses, and revenues associated with U.S. hog production. The 2015

data has not yet been made publically available in any reports. ARMS data is valuable for analyses of antibiotics use in pork production because it has a large representative sample of producers and researchers can link antibiotic use questions to production and financial outcomes, the use of other practices and inputs, and to farm, enterprise, and operator attributes.

The 2004 and 2009 ARMS hogs costs and returns surveys collected information about feeding antibiotics for disease treatment, disease prevention, and growth promotion. Analysis of these data suggest that the use of antibiotics in hog production declined between 2004 and 2009. Fewer farrow-to-finish and feeder-to-finish producers fed antibiotics for growth promotion and disease prevention in 2009 than in 2004 (McBride and Key, 2013). The share of farrow-to-finish farms feeding antibiotics to nursery pigs declined seven percentage points for both growth promotion (38% to 31%) and disease prevention (62% to 55%), whereas the share feeding antibiotics to promote growth among finishing hogs declined 20 percentage points (43% to 23%) from 2004 to 2009. Among feeder-to-finish operations, the share using antibiotics for growth promotion (42% to 35%) and disease prevention (58% to 49%) declined 7 and 9 percentage points, respectively, between 2004 and 2009 (McBride and Key, 2013). Sneeringer et al. (2015) find that among producers with nursery-age pigs, the percentages of nursery hogs reportedly administered antibiotics for growth promotion, disease prevention, and disease treatment all fell slightly (Figure 1).<sup>7</sup>

**Figure 1. Percentage of nursery-age hogs sold or removed from operations that administered antibiotics via feed or water, by purpose, 2004 and 2009**



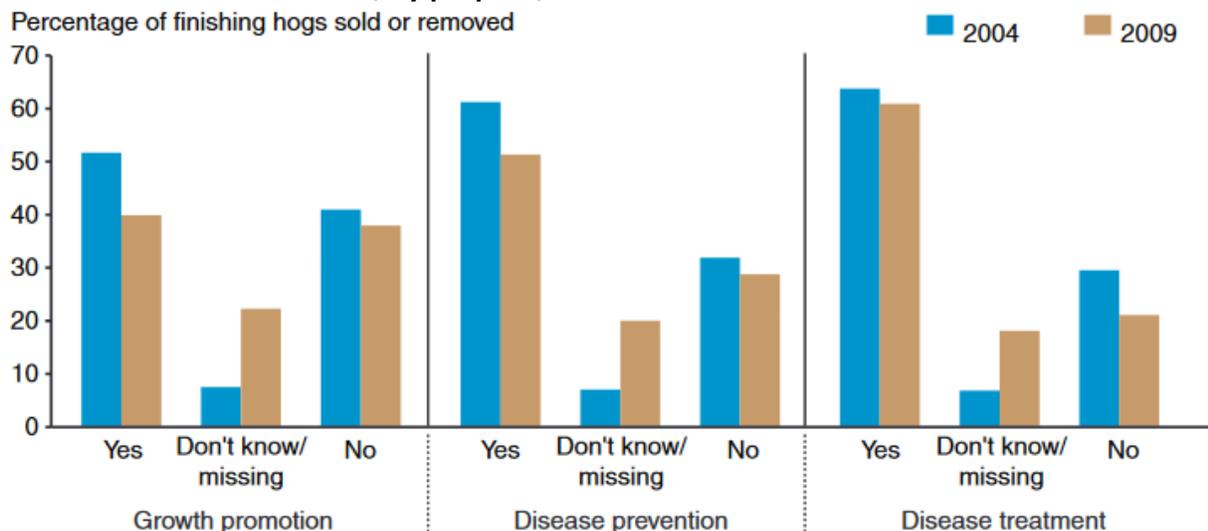
Source: Sneeringer et al. (2015). USDA-ERS calculations from the ARMS 2004 and 2009 Hogs Costs and Returns.

For operations with finishing hogs, the ARMS data show decreases between 2004 and 2009 in the proportion of hogs administered antibiotics for growth promotion (52% to 40%), disease prevention (61% to 51%), and disease treatment (64% to 61%) (Figure 2). Much of the

<sup>7</sup> In 2004, respondents had the option to answer “yes” or “no” to questions on administration of antibiotics via feed or water; nonresponse was coded as “missing.” In 2009, respondents were given the additional option of answering “don’t know” Sneeringer et al. (2015).

decline in antibiotic use for growth promotion between 2004 and 2009 was among the largest hog producers (5,000 head or more), but antibiotic use was still lowest among the smallest producers (McBride and Key, 2013).

**Figure 2. Percentage of finishing hogs sold or removed from operations that administered antibiotics via feed or water, by purpose, 2004 and 2009**



Source: Sneeringer et al. (2015). USDA-ERS calculations from the ARMS 2004 and 2009 Hogs Costs and Returns.

Table 6 reports 2009 ARMS data for the percentage of operations, and head sold or removed, that administered antibiotics via feed or water to hogs at different stages of growth. About 40% of pigs in the nursery and finishing stages of production did not receive antibiotics for either growth promotion or disease prevention, and that figure could approach 60%, because about 20% of hogs were raised by growers that stated they did not know if antibiotics are in the feed (Sneeringer et al., 2015). Hog farm operators using production contracts (contract grower) generally receive feed from the contractor, so they may not know about antibiotic use in feed.

In 2009, reporting of antibiotic use varied by whether there was a production contract. According to Sneeringer et al. (2015) the proportion of both nursery and finishing hogs reportedly administered antibiotics via feed or water for growth promotion, disease prevention, or disease treatment was lower for contract than noncontract production (Table 7). However, the proportion of hogs removed from operations stating they do not know whether antibiotics are administered is much higher for contract production. This makes it difficult to ascertain whether contract production is more or less likely to involve the use of antibiotics.

**Table 6. Proportion of hog producers using antibiotics, by type of hog and purpose of use, 2009**

Type of hog	Percentage of operations that use antibiotics for:				
	Growth promotion	Disease prevention	Either growth promotion or disease prevention	Disease treatment	Any use
<b>Nursery hogs</b>					
Operations					
Yes	33	62	65	48	73
Don't know	8	5	5	5	5
Head sold or removed					
Yes	23	59	60	59	77
Don't know	26	20	21	18	17
<b>Finishing hogs</b>					
Operations					
Yes	30	44	50	44	61
Don't know	16	14	14	13	12
Head sold or removed					
Yes	40	51	59	61	74
Don't know	22	20	20	18	17

Notes: The "yes" responses in the "Either..." and the "Any use" categories are the sum of the responses of "yes" to use for at least one indicated purpose. The "no" responses are those who respond "no" to use for any of the indicated purposes. The "don't know" responses are those who respond "don't know" to use for all of the indicated purposes or respond "no" or "don't know" in combination.

Source: Sneeringer et al. (2015). USDA-ERS calculations from the ARMS 2009 Hogs Costs and Returns.

**Table 7. Proportion of hogs sold or removed from operations reporting antibiotic use, by reason for use, contract status, and type of hog; 2009**

	Administration of antibiotics via feed or water					
	Yes		Don't know		No	
	Contract	Non-Contract	Contract	Non-Contract	Contract	Non-Contract
<b>Nursery hogs sold or removed</b>						
Growth promotion	0.22	0.28	0.29	0.07	0.48	0.65
Disease prevention	0.55	0.86	0.22	0.05	0.22	0.10
Disease treatment	0.55	0.86	0.20	0.05	0.22	0.10
<b>Finishing hogs sold or removed</b>						
Growth promotion	0.32	0.57	0.30	0.05	0.38	0.38
Disease prevention	0.45	0.65	0.27	0.05	0.28	0.30
Disease treatment	0.58	0.67	0.24	0.05	0.18	0.28

Source: Sneeringer et al. (2015). USDA-ERS calculations from the ARMS 2009 Hogs Costs and Returns.

The ARMS do collect information regarding why antibiotics are not used. Specifically, the 2009 ARMS asked swine producers, "Was the decision not to feed antibiotics to finishing

hogs voluntary or part of a marketing program?”<sup>8</sup> If antibiotics were not fed, producers were asked, “Did you receive a price premium for not feeding antibiotics to finishing hogs?” This information has never been published in any publically available reports. There is a procedure for requesting special tabulations of ARMS data with the requests being reviewed and completed when the requested estimates are not published elsewhere and several criteria are met.<sup>9</sup> We requested and subsequently received a special tabulation for the 2009 ARMS data pertaining to antibiotic use (Table 8).

In 2009, 33% of operations in the ARMS data did not feed antibiotics to finishing hogs voluntarily or as part of a marketing program. A majority of these operations (80.2%) did this voluntarily. Only 13.2% of the finishing operations that did not feed antibiotics, received a price premium. This number could be marginally higher because about 19% of the operations stated they did not know if they received a price premium for not feeding antibiotics to finishing hogs.

**Table 8. Proportion of hog producers not feeding antibiotics to finishing hogs voluntary or as part of a marketing program, 2009**

	Percentage of operations	
Was the decision not to feed antibiotics to finishing hogs voluntary or part of a marketing program?	4.2	Response refusal
	62.4	Not applicable
	<i><u>If NOT fed for growth promotion or disease prevention</u></i>	
	26.7	Voluntary (80.2)
	6.6	Marketing program (19.8)
Did you receive a price premium for not feeding antibiotics to finishing hogs?	73.3	Not applicable
	<i><u>If antibiotics NOT fed</u></i>	
	3.5	Yes (13.2)
	5.1	Don't Know (19.1)
	18.1	No (67.7)

Source: USDA-ERS calculations from the ARMS 2009 Hogs Costs and Returns.

Notes: Tabulations for operations that had any finishing hogs in 2009. Percentage in parenthesis are calculated using the subset of operations that did not feed antibiotics.

NAHMS and ARMS studies are conducted periodically (generally, every 5–7 years), leading to a series of point-in-time estimates rather than providing any ongoing real-time estimate of antibiotic use during the interim periods (USDA, 2014). There is a need to identify sustained, stable, reliable data for tracking antibiotic use and marketing practices in pork production. For that, we turn to USDA-AMS and LMR data.

<sup>8</sup> The 2015 ARMS asked swine producers, “Was the decision not to feed antibiotics to finishing hogs voluntary or part of a marketing program?” However, there was an error in the questionnaire, i.e., reference to nursery pigs instead of finishing pigs, which may have impacted producer’s responses and thereby summary results. Even if the results were not impacted, because the data would be for a period prior to FDA issuing and implementing antimicrobial use policy changes the data’s usefulness in defining the current percent of farms and percentage of pigs raised without antibiotics for a label claim would be limited.

<sup>9</sup> More information about requesting an ARMS special tabulation is available at <https://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices/contact-us/#request>.

*Objective 2: Use publically available data from USDA’s Agricultural Marketing Service to examine trends in premiums paid for non-carcass merit characteristics and market information for pork cuts from specialty programs.*

Many hogs in the United States are marketed using a base price, which is then adjusted up or down given carcass characteristics. Signals being sent on desired weight and quality characteristics are different across packers and include premiums and discounts for lean percentage, sort loss, backfat, and/or loin depth. These price adjustments can change over time but are relatively stable. Additionally, packers often pay premiums if hogs possess extrinsic attributes valued by consumers. The premiums paid for non-carcass merit characteristics reflect market conditions and may be affected by shifts in supply and/or demand.

The premium categories in the USDA-AMS National Weekly Direct Swine Non-Carcass Merit Premium (LM\_HG250) report include adjustments for volume, transportation, delivery time, breed, pork quality assurance, beta agonist free, and other. The other category is a catch-all for premiums that do not fit the other categories. Premiums are reported on a dollars per hundred pounds (\$ per cwt) carcass weight basis. A range is provided for each category as is the weighted average.

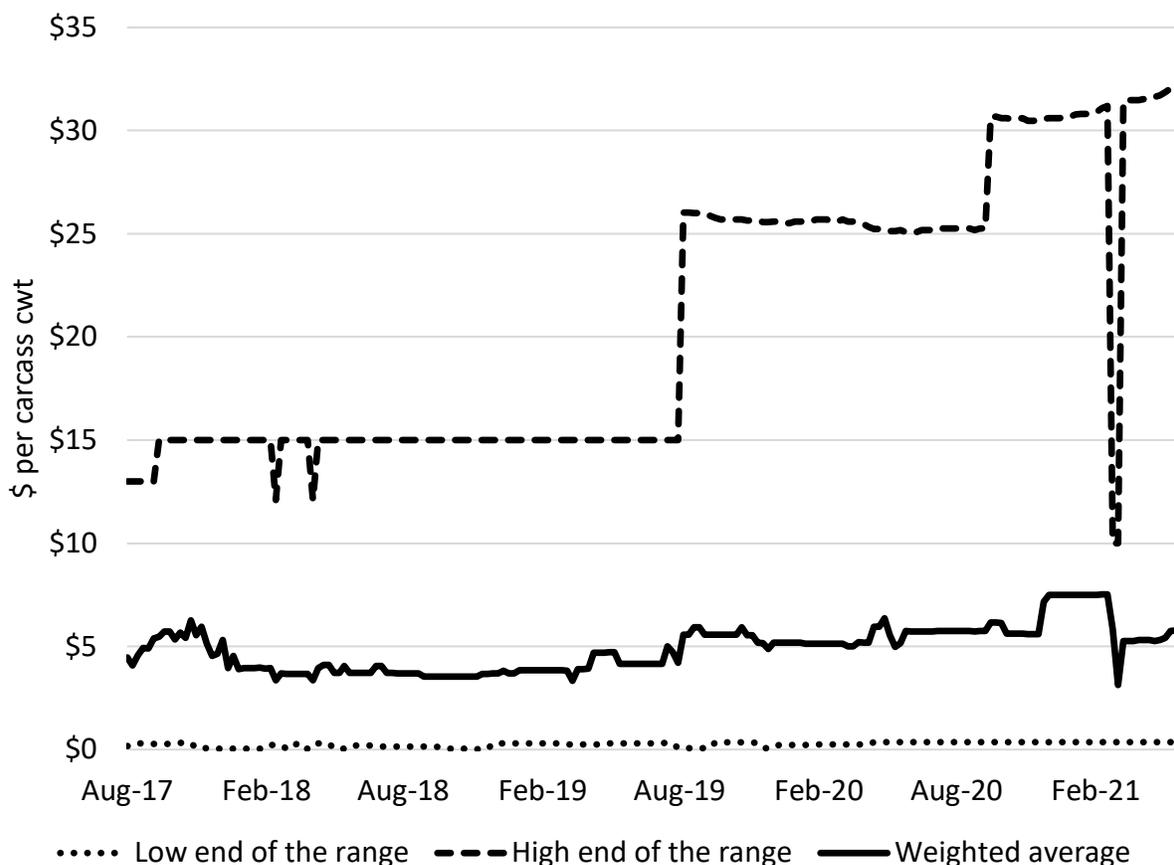
Until recently, premiums for characteristics such as hogs raised without antibiotics or process verified programs were not published. This may have been because there was not enough information to meet confidentiality guidelines.<sup>10</sup> Starting in August 2017, USDA began including all “other” premiums in one category. The other category is defined by USDA to include: “Animal Welfare, Antibiotic Free, Diet/Feed, Genetics, Meat Quality, Process Verified Program, Sow Housing, and Weight.” As may be expected, the range in the other premium is quite large. The difference between the high end of the range and low end of the range was \$14.75 per cwt in 2018, \$19.08 per cwt in 2019, \$26.53 per cwt in 2020, and \$29.08 in the first five months of 2021 (Figure 3). The weighted average was \$3.72, \$4.68, \$5.72, and \$6.09 per cwt in 2018, 2019, 2020, and 2021 year-to-date, respectively.

A few conditioning comments should be offered prior to any further interpretation of these data. The value of market information depends upon the level of aggregation in the published data. Combining all “other” non-carcass merit premiums together addresses confidentiality constraints and allows the data to be published. However, combining the premiums reduces the content of the market information that is discernable. For example, it is unknown how much of the “other” premium value is attributable to the “Antibiotic Free” premium and how much may be due to a possible bundle of other characteristics, i.e., animal welfare, antibiotic free, diet/feed, genetics, meat quality, process verified program, sow housing, and/or weight. Furthermore, if premiums with divergent market values are combined, e.g., hypothetically the antibiotic free premium is increasing while premiums for process verified programs are decreasing, this could result in published market information that is difficult to interpret or of little value. The tradeoff is clear, aggregation might increase publishing ability, but at the cost of information content and value.

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<sup>10</sup> Protecting identity of reporting entities and maintaining confidentiality of individual transactions is required by the Livestock Mandatory Reporting Act of 1999. For more information visit <https://www.ams.usda.gov/sites/default/files/media/ConfidentialityGuidelines.pdf>

**Figure 3. National Weekly Direct Swine Non-Carcass Merit Premium: Other**



Data source: USDA-AMS National Weekly Direct Swine Non-Carcass Merit Premium (LM\_HG250) report.  
 Notes: Week ending August 5, 2017 through the week ending May 29, 2021.

The Swine Contract Library (SCL) contains a listing of contracts offered by packers to swine producers for the purchase of swine (Federal Register, 2010). The SCL is intended to aid in the price discovery process and provide equal access to market information for all market participants. As of April 5, 2021 the various Swine Packer Marketing Contract Summary reports list specific “antibiotic free” premiums.<sup>11</sup> These values range from \$0.50 to \$13.00 and include such language as “based on volume” and “first year antibiotic free premiums are set by quarterly incentives”. From these summary reports its unclear if these values are listed on a per cwt or per head basis. On a few occasions premiums are explicitly stated as per head but otherwise no denomination is listed.

Premium values do not provide any indications on the quantity of hogs eligible or marketed with an antibiotic claim. They do, however, provide some signal on what packers believe is the profit maximizing price for hogs with such attributes. Premiums are the result of demand as well as additional costs to produce pork with an antibiotics claim. Consequently, to

<sup>11</sup> More information about the Swine Contract Library and the publically available reports are available at <https://www.ams.usda.gov/rules-regulations/packers-and-stockyards-act/regulated-entities/swine-contract-library>.

determine whether to target this market, producers need to understand both the added cost to produce for the “Raised Without Antibiotics” market and the price elasticity of demand for the product.

It is important to recognize that just because a packer pays a premium for a hog that was “Raised Without Antibiotics” or had “No sub-therapeutic antibiotics,” the entire carcass may not capture a premium in the marketplace. That is, the premium cannot be re-captured evenly across all the pork cuts harvested from the hog. Rather, sellers will have to recover the premium paid from those cuts for which there is demand of such attributes. Other cuts or grinds may simply be marketed at regular commodity price. For this, we turn to prices and quantities in the pork market downstream from processing.

Wholesale pork reporting, as part of the LMR, began in 2013 at the request of industry participants. Wholesale pork prices are summarized into a carcass equivalent value by USDA-AMS. A carcass equivalent is not so much a price, but a value derived from individual pork cut prices and put on a carcass equivalent basis. So, it is a rather broad measure and has many assumptions, which are periodically adjusted by USDA using industry input.<sup>12</sup> A set of yields are used to aggregate individual cuts into the pork primal components—loin, butt, picnic, rib, ham, and belly.<sup>13</sup> Then another set of yield proportions are applied to primals to derive the aggregate cutout, which is a carcass equivalent value. Ongoing (i.e. daily and weekly) changes in the cutout values are due to the underlying prices for cuts which are weighted by quantity sold. This weighted average causes items sold in largest quantity to have the most effect on the cutout. The loin primal constitutes the largest share of the cutout value, followed by the ham, belly, picnic, butt, and rib (USDA-AMS, 2021b).

The USDA-AMS National Weekly Pork Report FOB Plant – Specialty (LM\_PK650) report includes market information for pork cuts from specialty programs including but not limited to open pen gestation, crate free, antibiotic free, no-antibiotics ever, pre-priced and labeled, color graded, breed specific, quality graded, and organic. The market data on animal raising claims is presented in aggregate with no way of obtaining specific, disaggregated information for “antibiotic free” or “no-antibiotics ever”. Again, confidentiality guidelines are the likely cause of this aggregate publishing.<sup>14</sup> Available from the LM\_PK650 report is the total load count (and pounds) of cuts, trimmings and processed products, and the pounds, price range, and weighted average price of specific cuts from specialty programs. Pork cuts are for all destinations, sales types, delivery periods, refrigeration types, packaging styles (unless specified), and added ingredients. To determine, very roughly, how many hogs are represented in the reported weekly quantity of specialty pork products, we divide the total pounds of pork by a 210-pound carcass. Since August 2019, this weekly head count has averaged approximately 61,000 head with a maximum of just over 104,000 head and minimum of about 42,000 head.

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<sup>12</sup> The USDA's pork carcass cutout value is the estimated value of a standardized 55-56% lean, 215-pound carcass based upon industry-average cut yields and average market prices of sub-primal pork cuts. USDA surveys packers in July and updates the cut yields the following January if necessary (USDA-AMS, 2021b).

<sup>13</sup> Sub-primal fabrication also produces by-products of varying type and quantity. These by-products (such items as trimmings, bone, fat and skin) have value that must be added into the primal value to fully account for all parts of the carcass (USDA-AMS, 2021b).

<sup>14</sup> As the number of specialty programs and/or pork sub-primal product specifications increases, the more likely confidentiality clauses are binding, thereby necessitating aggregation.

The USDA-AMS National Weekly Comprehensive Pork (LM\_PK680) report can be used as a basis for comparison, and includes the value and volume of all reported wholesale pork trade (including exports) with the exception of specialty pork product.<sup>15</sup> USDA-AMS began publishing the LM\_PK650 report on August 5, 2019 and the LM\_PK680 report on May 23, 2019. As such, comparisons can be made since August 2019. The reports cover the market activity from Monday through Friday of the prior week. Table 9 shows the total load count (one load equals 40,000 pounds) of specialty pork products (LM\_PK650) as a percentage of the total load count in the comprehensive (LM\_PK680) report.

**Table 9. Load Count of Specialty Pork Products as a Percentage of Comprehensive Load Count, by Total and Primal, August 2019 to May 2021**

	Mean	Median	Minimum	Maximum	Std. Dev.
Cuts, Trimmings, Processed	5.2	4.8	3.5	12.0	1.3
Loin	10.8	10.1	5.4	26.4	3.6
Butt	2.7	2.6	1.8	6.8	0.7
Picnic	2.4	2.2	1.4	7.1	0.8
Rib	19.4	17.0	4.5	61.0	9.1
Ham	0.7	0.6	0.2	1.6	0.3
Belly	7.5	7.4	2.5	13.9	2.7
Trimmings	5.0	5.0	1.0	7.9	1.2
Variety	0.0	0.0	0.0	0.0	0.0
Added Ingredients	0.0	0.0	0.0	0.0	0.0

Data source: USDA-AMS National Weekly Pork Report FOB Plant–Specialty Sales (LM\_PK650) and National Weekly Comprehensive Pork (LM\_PK680) reports, compiled by the Livestock Marketing Information Center.

Notes: Week ending August 2, 2019 through the week ending May 28, 2021.

Since August 2019, specialty cuts, trimmings, and processed pork products has averaged 5.1% of the comprehensive volume. The median has been 4.8%. This ratio peaked at 12.0% for the week ending May 1, 2020. It is important to remember that due to COVID-19 related disruptions that the largest national slaughter reduction occurred the week ending May 2, 2020 when barrow and gilt slaughter was down 36.3% compared with the same week in 2019 (Hayes et al., 2021). During this time, the increased specialty volume as a percentage of the comprehensive volume was reflective of both an increase in specialty and decrease in comprehensive product.<sup>16</sup> Besides the months of March through June 2020 the maximum specialty volume of all cuts, trimmings, and processed products as a percentage of the comprehensive volume was 7.1% with an overall average of 4.9% (Figure 4).

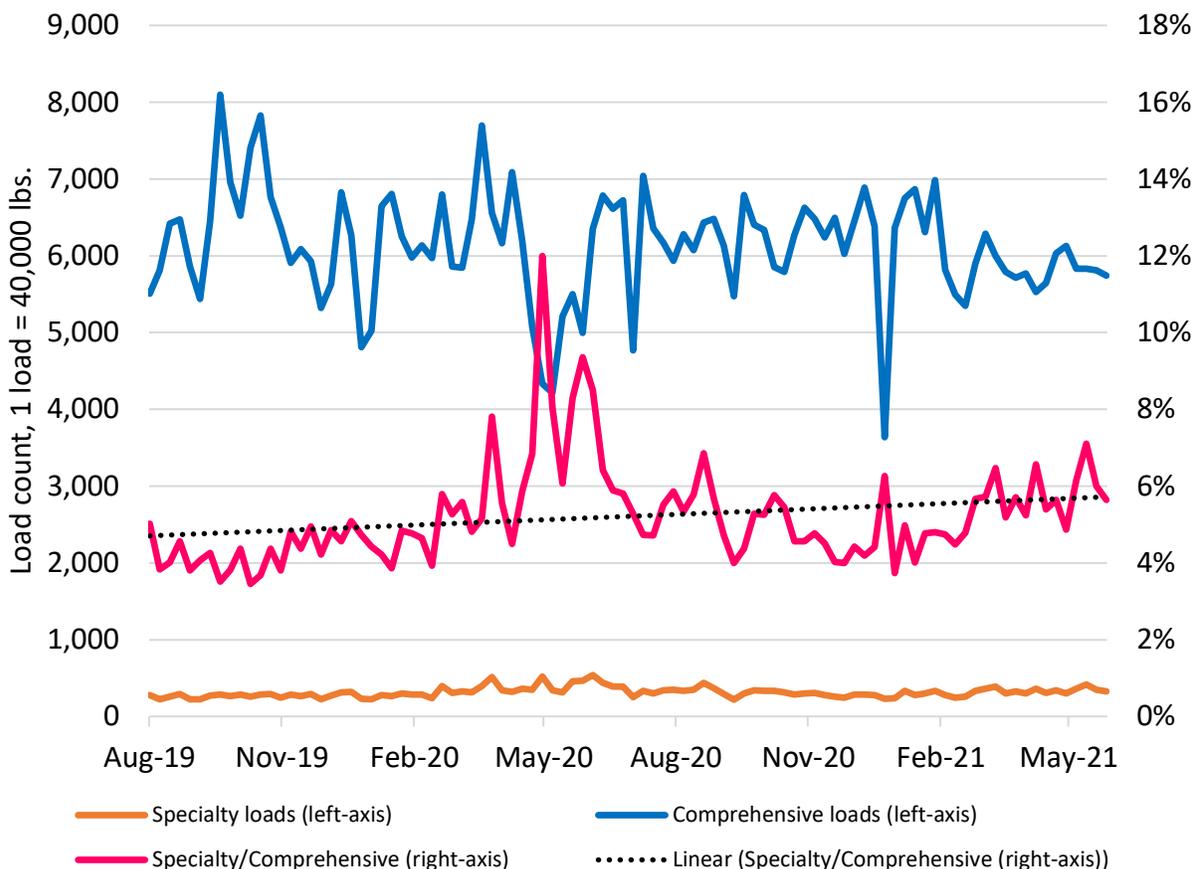
The volume of specialty product varies greatly by primal. Specialty rib products as a percentage of the comprehensive rib product volume, at 19.4%, is the highest average across all primals. Loin specialty products are second at 10.8% and belly products third at 7.5%. This

<sup>15</sup> On January 4, 2021, USDA expanded the report to capture the emerging market for actual carcass transactions (USDA-AMS, 2021b).

<sup>16</sup> There were increased efforts to find alternative outlets outside the conventional or typical processing channels for market-ready hogs when slaughter capacity was severely impacted. This may have led to more hogs and/or more pork products that were already eligible for an antibiotic claim to be marketed in such a manner.

suggests that garnering premiums for specialty higher-end cuts is easier. Regardless, the take home point is that the specialty product pork volume compared to the comprehensive volume is relatively small; however, it has been increasing over the last two years as shown by the linear trend line.

**Figure 4. Load Count of Pork Cuts, Trimmings, Processed Products, Specialty and Comprehensive, August 2019 to May 2021**



Data source: USDA-AMS National Weekly Pork Report FOB Plant–Specialty Sales (LM\_PK650) and National Weekly Comprehensive Pork (LM\_PK680) reports, compiled by the Livestock Marketing Information Center.  
 Notes: Week ending August 2, 2019 through the week ending May 28, 2021.

Table 10 shows each primal as a percentage of the total load volume by report. Also included are industry-average primal cut yields that are used to translate primals to a carcass equivalent. The similarities between industry-average primal cut yields and comprehensive volumes, subject to accounting for trimming and value added, is expected. It reflects the hog-buying and wholesale pork-selling markets to be strongly in line with the fixed proportions of pork production.

For the specialty pork market, the higher percentages for loin, trimmings, rib, and belly reflect a spectrum of the many products, derived from these primals, which carry animal raising claims. While a viable market (characterized by premiums) for “antibiotic free” center-cut boneless chops may well exist, a parallel market for “antibiotic free” variety meats may be very

small or even non-existent. The economic situation that follows is that pork producers face higher costs of raising hogs that can only be offset by potential premiums on a subset of items originating from their hogs (Tonsor, 2018).

**Table 10. Each Primal as a Percentage of Total Volume by Report, May 2019 to May 2021**

	Loin	Butt	Picnic	Rib	Ham	Belly	Trimming	Variety	Ingredients	Added
Specialty (LM_PK650)	36.2 (4.6)	6.4 (1.4)	2.2 (0.6)	18.2 (5.3)	3.2 (1.5)	14.0 (4.5)	19.9 (5.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Comprehensive (LM_PK680)	17.9 (1.9)	12.3 (1.3)	4.7 (0.7)	5.2 (1.1)	22.6 (2.3)	9.7 (1.4)	20.4 (2.5)	5.2 (1.9)	2.1 (0.6)	2.1 (0.6)
Weight/Yield Pork Cutout	25.3	10.2	11.3	4.8	24.6	16.1	NA	7.7 <sup>a</sup>	NA	NA

Data source: USDA-AMS National Weekly Pork Report FOB Plant–Specialty Sales (LM\_PK650) and National Weekly Comprehensive Pork (LM\_PK680) reports, compiled by the Livestock Marketing Information Center.

Notes: Week ending August 2, 2019 through the week ending May 28, 2021. Standard deviations in parenthesis. <sup>a</sup> Jowl=1.5; Neck Bones=1.8; Tails=0.2; Front Feet=1.0; Hind Feet=1.3; Cut Loss=2.0.

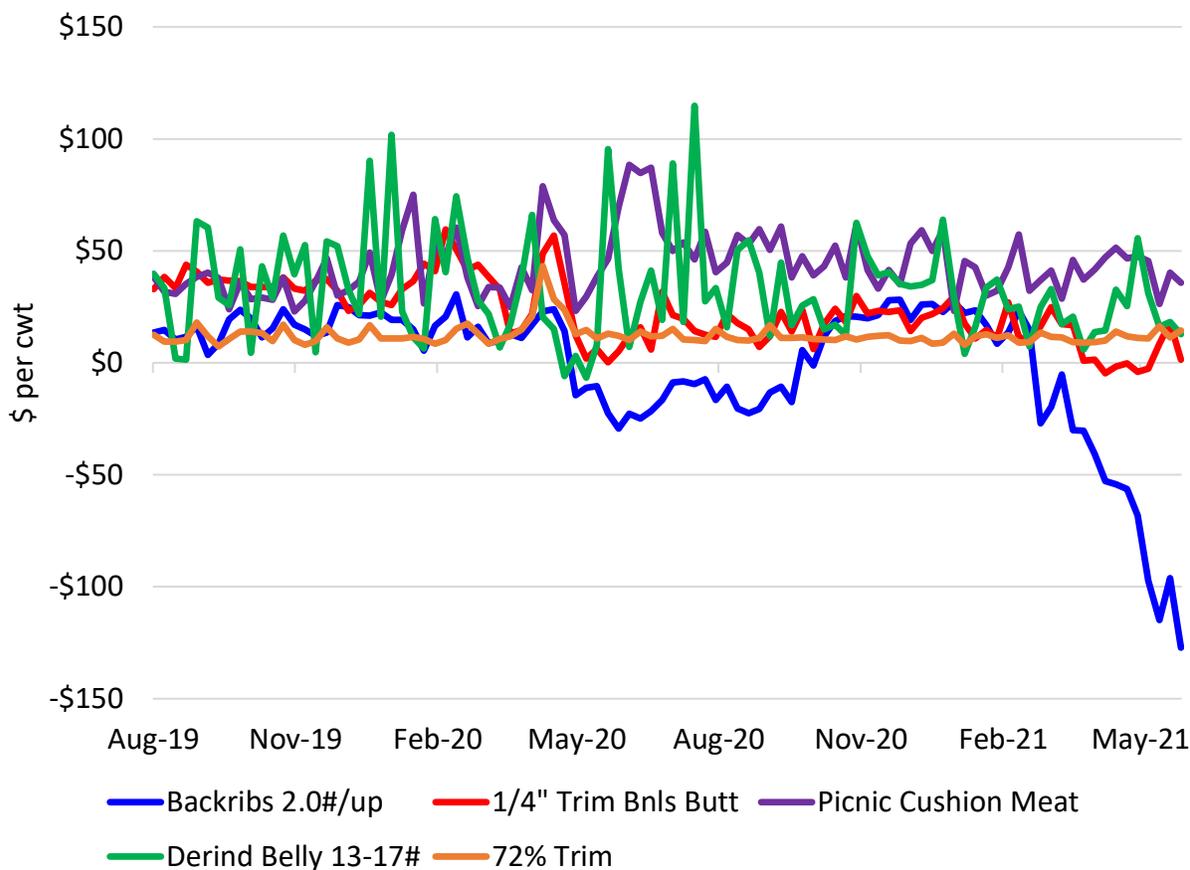
Hog producers and pork processors often use prices, or price differences, for strategic and operational decision making. USDA-AMS publishes four National Weekly Pork reports that vary by sale type, including negotiated sales (LM\_PK610), formula sales (LM\_PK620), forward sales (LM\_PK630), and export sales (LM\_PK640). These sale prices can be compared to prices of specialty sales (LM\_PK650) to identify wholesale product premiums. Baker (2020) provides a detailed discussion of these reports, and in general, wholesale pork reporting. Formula pork sales have represented 50.1% of all reported pork wholesale volume since August 5, 2019, followed by negotiated sales (27.6%), export sales (12.7%), and forward sales (9.6%).

Figure 5 compares the wholesale prices of specialty pork products against the weighted average price of those same products in conventional markets. For example, specialty Derind Belly 13-17# sales are compared with the weighted average price of negotiated, formula, and forward sales of comparable products. Here we choose the specialty products with the largest volumes, by primal, for purposes of presentation. In total, there are 18 specialty products regularly listed in the LM\_PK650 report.

The difference between specialty and commodity backribs 2.0#/up, 1/4" Trim Bnls Butt, Picnic Cushion Meat, Derind Belly 13-17#, and 72% Trim prices averaged \$7.92, \$26.58, \$44.72, \$35.46, and \$12.62 per cwt, respectively, from week ending August 2, 2019 through week ending January 1, 2021. No product series indicates a strong tendency for increasing premiums. In fact, specialty products do not always garner a price premium, or prices can be rather comparable. For instance, during May-September of 2020 and in late-February through May of 2021 the backribs 2.0#/up specialty price was below the conventional price. The decreased backribs 2.0#/up specialty premium in 2021 is reflective of large increase in the conventional price (weighted average of negotiated, formula, and forward sales) and only a marginal increase in the specialty price. Hence, this is a case where pork sellers may pay a premium for a hog with certain extrinsic attributes but market the pork, more of it, or certain cuts as

conventional. Exact procurement and marketing decisions would, in part, be dictated by any contractual agreements and logistics of product movement.

**Figure 5. Weekly Wholesale Specialty to Commodity Pork Price Differentials, Primal Products**



Data source: USDA-AMS National Weekly Pork Report FOB Plant–Negotiated Sales (LM\_PK610), Formula Sales (LM\_PK620), Forward Sales (LM\_PK630), and Specialty Sales (LM\_PK650) reports, compiled by the Livestock Marketing Information Center.

Notes: Week ending August 2, 2019 through the week ending May 28, 2021.

*Objective 3: Survey pork packers to obtain information about the percentage of pigs eligible and pounds of pork marketed with an antibiotics claim.*

In April and May 2021, 42 individuals were identified and asked to complete a short, three question survey.<sup>17</sup> All individuals were employed by pork packers with representation from a number of pork packing companies, geographical regions, and sizes of packing plants. Individuals supplied information based on estimated U.S. averages, not experiences within their own companies or packing plants. If the latter would have been the case, a survey that collected data from the entire population (a census) would have been needed. This would have been very difficult, if not impossible, to obtain. The survey was facilitated by Dr. Steve Meyer as

<sup>17</sup> The email survey was first distributed on April 22, 2021. Reminder emails were sent to non-respondents on April 28, 2021 and May 6, 2021.

he had the contact information and a working relationship with the surveyed individuals. Completed questionnaires from 8 out of 42 individuals surveyed were returned, a 19% response rate. Table 11 reports the summary results of the survey.

**Table 11. Survey Results of Pork Packers, N = 8**

	Mean	Median	Min	Max	Std. Dev.
To the best of your knowledge, what percentage of annual commercial barrow & gilt slaughter in the United States would be eligible for a “Raised Without Antibiotics” claim?	8	6	2	25	7
To the best of your knowledge, what percentage of annual commercial barrow & gilt slaughter in the United States would be eligible for a “No sub-therapeutic antibiotics” claim?	50	50	0.5	100	39
To the best of your knowledge, how many pounds per carcass is typically marketed with an antibiotic claim?	54	50	30	80	17

Based on opinions expressed by the individual experts that were surveyed, about 8% of annual commercial barrow and gilt slaughter in the United States is eligible for a “Raised Without Antibiotics” claim. Using a 2020 commercial hog slaughter of 131.563 million head this would amount to about ten million hogs. With a range of 4% to 25% there is some disagreement on the share of hogs available for such an antibiotic claim. This is not unexpected as we asked for the number of hogs eligible for the antibiotics claims, not necessarily marketed in such a manner. Also, we asked for global assessments even if the individual experts’ assessments would have differed by company or packing plant.

The percentage of annual commercial barrow & gilt slaughter in the United States estimated to be eligible for a “No sub-therapeutic antibiotics” claim is much greater at 50% on average. The likely reason for the almost complete range of responses, i.e., 0.5% to 100%, from the surveyed individuals is because many definitions of antibiotic use and the terminology employed is left largely open to interpretation. Smith et al. (2019) suggests that, “Misunderstandings about whether specific examples of antimicrobial use comply with the principles of antimicrobial stewardship may originate from confusion regarding the underlying therapeutic intent” and that “Concise definitions of prevention, control, and treatment of individuals and populations are necessary to avoid confusion and to help veterinarians clearly communicate their intentions when prescribing or recommending antimicrobial use.”

Survey respondents indicated that on average, about 50 pounds per carcass is typically marketed with an antibiotic claim. A somewhat wide distribution of responses is shown for the pounds per carcass marketed. It is important to remember that packers are paid for the weight of primal cuts of a processed carcass. Each packer may manage slaughter, cutting, packaging, and marketing differently. All carcass components, including byproducts, contribute to income. The pounds marketed with an antibiotic claim provide a signal on what packers believe is the

profit maximizing volume of pork with such an attribute. This can vary by packer, within a year, and over time.

## Discussion

All existing NAHMS swine studies and ARMS hogs costs and returns surveys have been conducted prior to the U.S. Food and Drug Administration (FDA) issuing and implementing antimicrobial use policy changes.<sup>18</sup> The only available data are about ten years old, or older, at this point. Because the data are for a period prior to the new antibiotic use guidelines the data's usefulness in defining the current percentage of farms and/or percentage of pigs raised without antibiotics for a label claim is limited. For example, using a convenience sample of swine veterinarians, Rademacher, Pudenz, and Schulz (2019) find evidence that the new regulations resulted in decreased antibiotic use in feed. The most common response was a 21% to 30% perceived decrease in antibiotic use, but nearly a third of respondents believe that the reduction is anywhere from 50% to 100%.

We are unaware if any new questions about antibiotic use will be added to any forthcoming NAHMS swine studies and ARMS hogs costs and returns surveys. At a minimum, the customary questions should remain. The next NAHMS swine study, originally planned for 2020, will now be conducted in 2021.<sup>19</sup> Results are not typically available until several years post data collection. For example, results from the 2012 NAHMS swine study (and survey) first became available in January 2015 and other reports released in February 2016 and August 2017. A 2020 ARMS hog survey was conducted, with data collection occurring in 2021. In that version of the survey, producers are asked, "If antibiotic use was purposely limited, was this for a marketing program?" This question is asked for both nursery pigs and finishing pigs. If the results of this question are not published, requesting a special tabulation would be prudent.

Much attention is given to the role of reported prices within Livestock Mandatory Reporting (LMR), but LMR also mandates reporting of volume (i.e., head, loads, pounds) information. Confidentiality guidelines precluded publishing antibiotic claim market information directly. For example, the National Weekly Direct Swine Non-Carcass Merit Premium (LM\_HG250) report includes an "other" catch-all category for "Animal Welfare, Antibiotic Free, Diet/Feed, Genetics, Meat Quality, Process Verified Program, Sow Housing, and Weight." In addition, without head counts to accompany premiums, nothing can be said about the quantity of hogs eligible or marketed with an antibiotic claim.

The vastness of wholesale pork data, be it the number of cuts, value added, branding, specialty programs, and other differentiation challenges market information reporting. For example, without aggregating all specialty programs, confidentiality guidelines would prevent publishing much of this data. The National Weekly Pork Report FOB Plant – Specialty

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<sup>18</sup> Full implementation of FDA's Guidance for Industry document #209 and #213 and the VFD final rule was set for December 2016 with enforcement commencing on January 1, 2017 (Federal Register, 2012, 2015; USDHH-FDA-CVM, 2012, 2013).

<sup>19</sup> In light of the substantial market disruptions due to COVID-19, the original timelines for the 2020 NAHMS Swine Study was revised. Data collection from swine operations with 1,000 or more pigs and will take place between June 2021 and January 2022 and data collection from swine operations with fewer than 1,000 pigs and will take place between June and July 2021.

(LM\_PK650) report includes market information for pork cuts from specialty programs including but not limited to open pen gestation, crate free, antibiotic free, no-antibiotics ever, pre-priced and labeled, color graded, breed specific, quality graded, and organic. This data provides an upper benchmark of the percentage of federally-inspected pork production that is marketed with animal-raising claims, including but not limited to just antibiotic claims. Since August 2019, specialty cuts, trimmings, and processed pork products has averaged 5.1% of all reported wholesale pork trade (including exports but excluding specialty products). This percentage has been slightly increasing over the last two years.

While the wholesale pork data provides a rough estimate for the percentage of pork marketed with an antibiotics claim it is a sustained, stable, and reliable data series that is valuable for examining broad trends. Furthermore, it is in line with responses provided by surveyed individuals within the pork packing industry. They estimate that about 8% of annual commercial barrow and gilt slaughter in the United States is eligible for a “Raised Without Antibiotics” claim. In general, the percentage of annual commercial barrow & gilt slaughter in the United States eligible for a “No sub-therapeutic antibiotics” claim is estimated to be higher.

As discussed in this report, there are many methods that can be used to calculate market size. Data can be collected from a variety of different sources and it’s often useful to use a variety of data points to help corroborate numbers. Periodic updating of the information provided here would be valuable to evaluate market conditions, monitor trends, and identify any possible emerging patterns. Furthermore, USDA-AMS occasionally publishes new reports or new information within existing reports that contain relevant data for understanding the size of alternative markets. Examples include the weekly specialty pork report first released in August 2019 and the addition of the “other” category to the non-carcass merit premium report in August 2017. Many of these new reports or new data originated from requests of pork industry participants. One key forum for providing requests is the annual USDA Data Users meeting. This meeting often has several USDA agencies involved as formal presenters with non-USDA parties present as attendees providing feedback and suggestions.

## Appendix A. Organic Pork Production

USDA's National Agricultural Statistics Service (NASS) released the 2019 Organic Survey on October 22, 2020. It was part of the 2017 Census of Agriculture program with the primary purpose of the survey to collect value of sales information at the commodity level along with acreage, production, and practices data for a variety of certified organic crop and livestock operations. The Certified Organic Survey is required by law under the "Census of Agriculture Act of 1997," Public Law 105-113 (Title 7, United States Code, Section 2204g) (USDA-NASS, 2020). This was the sixth comprehensive organic survey USDA conducted with previous ones occurring in 2008, 2011, 2014, 2015, and 2016.

According to the National Organic Program (NOP), the USDA's National Organic Standards Board determined a national standard that "animals raised on an organic operation must meet animal health and welfare standards, not be fed antibiotics or growth hormones, be fed 100% organic feed and have access to the outdoors" (USDA-NASS, 2020). The NOP states that all farms, ranches and handling operations displaying the "USDA Organic" seal must be certified organic by the state or by a private agency accredited by USDA, to ensure standards are followed. Farms that follow the National Organic standards and have less than \$5,000 in annual sales can be exempt from certification. The exempt farms may use the term "organic," but may not use the "USDA Organic" seal. The 2019 Organic Survey published data from producers that were certified organic.

Table A1 shows the number of certified organic hogs and pigs farms, inventory and sales levels, and sales value. There were 166 certified organic swine farms in the United States in 2019. This represented a 10% increase from 2016, the latest comparable year. As the number of organic farms has increased, so too have sales of certified organic hogs and pigs. Farms sold 26,179 certified organic hogs in 2019, almost 50% more than the 17,818 head in 2016. In value, 2019 sales totaled over \$8.1 million, an increase of 18% from 2016. In 2019, the average sales per certified organic hogs and pigs farm was 191 head which equated to \$59,167 or \$310 per head using simple averages. For broad context, based on the USDA Livestock, Poultry & Grain Market News report LM\_HG201 National Daily Direct Hog Prior Day Report—Slaughtered Swine the average income for 2019 was \$148 per head for all producer sold barrows and gilts under all purchase types.

We are unaware of any USDA report, or other source, for regularly reported organic hog prices or price premiums. One reason is organic pork production is by and large not a spot market business, it's a program. Producers don't treat it as an option. They develop long-term supply relationships predominantly using forward contracts to help ensure a 12-month supply meets a 12-month demand. Still, organic hog and pig production makes up a small share of total U.S. pork production. There were 66,439 U.S. hog and pig farms in 2017, so certified organic farms represented about 0.2% of the total farms. Total U.S. hog and pig sales in 2017 was 235.3 million head with the number of certified organic sales representing 0.01% of the total.

**Table A1. Certified Organic Hogs and Pigs Inventory and Sales: 2019**

Geographic area	Inventory			Value of Sales		
	Farms	Peak	December 31, 2019	Farms	Number	Dollars
United States	166	19,285	15,041	137	26,179	8,105,916
California	6	1,395	(D)	6	(D)	(D)
Illinois	2	(D)	-	2	(D)	(D)
Indiana	4	(D)	(D)	4	(D)	(D)
Iowa	19	6,991	5,458	17	8,927	3,368,316
Kansas	3	(D)	(D)	3	(D)	(D)
Kentucky	5	156	97	5	131	48,615
Maine	7	354	30	6	330	62,800
Maryland	1	(D)	(D)	-	-	-
Massachusetts	9	262	183	7	241	99,684
Michigan	6	1,093	1,060	3	1,442	438,882
Minnesota	10	776	384	8	798	173,094
Montana	2	(D)	(D)	2	(D)	(D)
Nebraska	5	276	192	5	184	64,485
New Hampshire	1	(D)	(D)	1	(D)	(D)
New Jersey	1	(D)	(D)	1	(D)	(D)
New York	22	319	227	12	134	41,832
Ohio	5	54	38	2	(D)	(D)
Pennsylvania	13	1,462	1,139	13	(D)	792,763
Rhode Island	1	(D)	(D)	1	(D)	(D)
Tennessee	1	(D)	(D)	1	(D)	(D)
Vermont	9	138	108	8	141	57,451
Virginia	4	920	520	4	1,058	423,200
Washington	3	(D)	(D)	3	42	16,829
Wisconsin	27	2,480	1,874	23	2,911	1,026,716

Notes: (D) Withheld to avoid disclosing data for individual farms. - Represents zero.

Source: USDA-NASS (2020).

The USDA-AMS Weekly Retail Organic Price Comparison (WA\_LO101) report provides advertised retail prices at major supermarkets for items identified as “organic” and items identified as “conventional” for all regions. The report has been available in its current form since February 25, 2020. The data is gathered from publicly available sources including store circulars, newspaper ads, and retailer websites. Weighted average prices of organic and conventional products are reported as well as the calculated dollar per pound and percentage organic premium. In addition, the report includes the number of stores advertising each

product. The number of stores, prices, and premium are only reported within weeks when both conventional and organic products are both advertised within sampled stores.

The number of stores advertising organic pork products is relatively low. From February 2020 through May 2021, the weekly average of stores advertising organic pork has typically been less than 1% of sampled stores. Table A2 shows the percentage of sampled stores advertising organic pork by product. Analysis is limited to where at least five weekly comparisons can be made. Sliced bacon, 1 lb. packages is the most frequently advertised organic pork product with 29 weekly comparisons available. After sliced bacon, deli ham, packaged/sliced ham, and fresh tenderloin are the most frequently advertised products. On a percentage of stores basis, Canadian bacon and center-cut bone-in chops are the most commonly advertised organic pork products.

Table A2. Percentage of Stores Advertising Organic Pork by Product

Pork Product	Obs.	Mean	Median	Min	Max	Std. Dev.
Backribs	5	1.9	0.5	0.3	5.3	2.2
Breakfast sausage, link/patty	6	0.8	0.2	0.1	2.0	0.9
Canadian bacon	5	11.6	10.1	1.5	23.1	10.4
Center-cut chops bone-in	8	7.6	0.5	0.2	45.3	15.7
Center-cut chops boneless	5	1.2	0.3	0.3	4.7	2.0
Deli ham	16	0.2	0.2	0.1	0.3	0.1
Italian sausage	8	1.1	0.3	0.1	6.6	2.2
Packaged/sliced ham, 1 lb./less	9	1.5	0.6	0.1	4.8	1.6
Sliced bacon, 1 lb. package	29	1.0	0.6	0.0	6.1	1.3
Tenderloin, fresh	9	0.5	0.5	0.3	0.8	0.2

Data source: USDA-AMS Weekly Retail Organic Price Comparison (WA\_LO101) report.

Notes: Analysis is limited to where at least five weekly comparisons can are made. Week ending February 27, 2020 through the week ending June 3, 2021.

Table A3 shows the dollar per pound premium while Table A4 shows the percentage premium. These are national, aggregate premiums. Organic premiums could vary greatly by region. Seasonality also likely exists. Quality differences are not reported but could potentially impact premiums. Averaging across all 28 pork products, over the February 2020 – May 2021 period, the premium for organic was \$4.76 per pound. The maximum was \$14.29 per pound for one product one week while the minimum was -\$0.60: a discount. On only three occasions in the data was an organic pork product at a discount to the conventional product.

Organic price premiums can differ week to week. For example, packaged/sliced ham has sold for \$6.88 per package higher than the conventional counterpart on average but the range in premium over the last 15 months has been -\$0.35 to \$13.39. Premiums can also differ greatly by product. The premium for organic deli ham, ranged from \$0.97 to \$14.29 per pound, with an average of \$9.95 per pound. Organic backribs premiums ranged from \$1.50 to \$2.67 per pound, with an average of \$2.30.

Table A3. Dollar per Pound Organic Premium by Pork Product

Pork Product	Obs.	Mean	Median	Min	Max	Std. Dev.
Backribs	5	2.30	2.41	1.50	2.67	0.46
Breakfast sausage, link/patty	6	3.32	2.66	0.17	7.98	3.17
Canadian bacon	5	9.25	9.43	7.06	10.69	1.45
Center-cut chops bone-in	8	2.73	2.90	-0.60	4.67	1.66
Center-cut chops boneless	5	2.35	2.77	-0.02	3.77	1.55
Deli ham	16	9.95	10.49	0.97	14.29	2.85
Italian sausage	8	2.67	2.99	0.59	3.63	1.10
Packaged/sliced ham, 1 lb./less	9	6.88	5.77	-0.35	13.39	4.83
Sliced bacon, 1 lb. package	29	4.65	4.30	0.05	10.77	2.75
Tenderloin, fresh	9	5.02	4.81	4.12	7.04	0.91

Data source: USDA-AMS Weekly Retail Organic Price Comparison (WA\_LO101) report.

Notes: Analysis is limited to where at least five weekly comparisons can be made. Week ending February 27, 2020 through the week ending June 3, 2021.

Table A4. Percentage per Pound Organic Premiums by Pork Product

Pork Product	Obs.	Mean	Median	Min	Max	Std. Dev.
Backribs	5	56.2	58	43	68	9.9
Breakfast sausage, link/patty	6	84.7	69	4	199	80.5
Canadian bacon	5	106.6	107	63	141	31.3
Center-cut chops bone-in	8	110.0	124	-23	201	66.8
Center-cut chops boneless	5	71.0	86	-1	117	46.9
Deli ham	16	152.6	154	18	252	46.2
Italian sausage	8	78.5	80	17	127	35.5
Packaged/sliced ham, 1 lb./less	9	117.4	97	-6	255	88.6
Sliced bacon, 1 lb. package	29	90.4	81	1	207	54.1
Tenderloin, fresh	9	139.8	151	100	179	28.1

Data source: USDA-AMS Weekly Retail Organic Price Comparison (WA\_LO101) report.

Notes: Analysis is limited to where at least five weekly comparisons can be made. Week ending February 27, 2020 through the week ending June 3, 2021.

The WA\_LO101 report only provides a cursory view on volume and price premiums of organic pork products. At the retail level there is increased complexity because of the number of different products involved and alternative market outlets which include grocery store, food service, and internet on-line shopping. Relative to retail grocery, scanner data could be used to provide a more complete picture.

## Appendix B. Survey Instrument

*The following email message was first sent on April 22, 2021 to pork packers.*

Dr. Lee Schulz of Iowa State University has asked me to assist him in an important research project on behalf of the National Pork Board. Part of my assistance is providing contact information for the survey which you find below.

Consumer demand for pork carrying various claims of alternative production practices is constantly changing and determining the size of these “alternative” markets is critical for the National Pork Board to prioritize its programming and spending. Your suppliers (and many of you) are investing hard-earned dollars in the efforts of the Pork Checkoff. Just a few minutes of your time will, we hope, provide information that will make the use of those funds more efficient and effective.

Though I am assisting Dr. Schulz in this project, your individual responses to his questionnaire will be seen only by him and kept in strictest confidence. Please help make his project a resounding success by providing the information he seeks.

Steve R. Meyer, Ph. D.  
Consulting Economist to the National Pork Board

As a member of the pork packing community, would you please complete this short, 3 question survey? Your responses will be used to help estimate the percentage of pigs raised without antibiotics for a label claim. This study is being conducted by Lee Schulz, Iowa State University, and is supported by the National Pork Board. Your participation is entirely voluntary but highly encouraged and would be greatly appreciated. All responses will be kept in strictest confidence. Data will be analyzed and released in summary form only, with no identifying information. To respond, simply hit Forward to this email -> copy and paste [lschulz@iastate.edu](mailto:lschulz@iastate.edu) into the To address line -> enter your responses where indicated below -> and send.

### Question 1.

To use the “Raised Without Antibiotics” claim, source animals cannot be administered antibiotics in their feed, water or by injections at any point in the production process. This includes ionophores which are recognized as antibiotics by the U.S. Department of Agriculture Food Safety and Inspection Service. Examples of this type of claim include, but are not limited to: “Raised Without Antibiotics”, “No Antibiotics Administered”, “No Added Antibiotics”, “No Antibiotics Ever”, and “Raised Antibiotic Free”.

To the best of your knowledge, what percentage of annual commercial barrow & gilt slaughter in the United States would be eligible for this claim?

\_\_\_\_\_ %

**Question 2.**

A claim that states that animals have not been administered sub-therapeutic antibiotics is possible if the claim is part of a complete claim that explains what the term “sub-therapeutic” means. An example would be “No sub-therapeutic antibiotics. Animals do not receive antibiotics on a daily basis; animals only receive antibiotics in the case of illness.” Other examples may include: “Pork Raised with No Sub-Therapeutic Antibiotics Ever, Animals may be given antibiotics for the treatment of illness” or “Pork Raised with No Sub-Therapeutic Antibiotics, Animals do not receive antibiotics on a daily basis, only in the case of illness.”

To the best of your knowledge, what percentage of annual commercial barrow & gilt slaughter in the United States would be eligible for this claim?

\_\_\_\_\_ %

**Question 3.**

We understand that just because a premium is paid for a hog that was “Raised Without Antibiotics” or had “No sub-therapeutic antibiotics,” the entire carcass may not capture a premium in the marketplace. That is, the premium cannot be re-captured evenly across all the pork cuts harvested from the hog. Rather, sellers will have to recover the premium paid from those cuts for which there is demand of such attributes. Other cuts or grinds may simply be marketed at regular commodity price.

To the best of your knowledge, how many pounds per carcass is typically marketed with an antibiotic claim?

\_\_\_\_\_ pounds per carcass

Thank you for your valuable assistance with this important project.

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