

B. Collections of Information Employing Statistical Methods

1. Describe the potential respondent universe and any sampling or other respondent selection methods to be used.

Cattle-on-Feed Antimicrobial Use

The Cattle-on-Feed Antimicrobial Use Study has two components: A high capacity component and a low capacity component. The potential respondent universe for the high capacity component is feedlot operations with 1,000 or more cattle-on-feed capacity in 16 states¹. For the low capacity component, the potential respondent universe is feedlot operations with 50-999 head capacity in 13 states.²

Feedlot operations with 1,000 or more head capacity account for approximately 80 percent of all cattle-on-feed in the U.S. (NASS Cattle on Feed, Feb 2016). The 16 States for the high capacity component were chosen because they account for over 97 percent of the cattle-on-feed on operations with 1,000 or more head, and 92 percent of operations with 1,000 or more head capacity (2012 Census of Agriculture).

Although large feedlots account for 80 percent of U.S. cattle-on-feed, the Study includes a low capacity component because low capacity feedlots may have different management practices than large feedlots. The 13 states for the low capacity component account for 92 percent of the inventory on operations with 50-999 head and 91 percent of operations with 50-999 head.

Due to the expected response rates, desired levels of precision, and importance of obtaining data from large operations, all operations with 1,000 or more head capacity in the 16 States on NASS' list frame will be selected to be in the survey. Thus, there is no sampling for the high capacity component of the Study. About 2,200 feedlots meet these criteria (NASS Cattle on Feed, Feb 2016).

For the low capacity component, a sample of about 2,600 operations will be selected from an estimated population of about 13,000 operations with 50-999 head capacity in the 13 states (NASS, 2012 Census of Agriculture).

Swine Antimicrobial Use Study

The potential respondent universe of the Swine Antimicrobial (AM) Use Study is sites in 13 states² with 1,000 or more nursery pigs or grower-finisher pigs. The 13 states were chosen because they account for 93.8% of all operations with 1,000 or more pigs in the US, and 92.1% of inventory on operations with 1,000 or more pigs (NASS 2012 Census of

¹ AZ, CA, CO, ID, IL, IA, KS, MN, NE, NM, OK, OR, SD, TX, WA, WY

² CO, IL, IN, IA, KS, MI, MN, MO, NE, OH, PA, SD, WI

² CO, IL, IN, IA, KS, MN, MO, NE, NC, OH, OK, PA, SD

Agriculture, Appendix C). This survey is limited to operations with 1,000 or more pigs because these operations in the 13 states account for 88.2% of total US pig inventory. Only operations with nursery pigs or grower-finisher pigs are eligible because the vast majority of antimicrobial usage is in these types of pigs. Operations with nursery pigs or grower-finisher pigs are eligible because the vast majority of antimicrobial usage is in these types of pigs.

2. Describe the procedures for the collection of information including:

Cattle-on-Feed Antimicrobial Use

Statistical methodology for stratification and sample selection:

For the high capacity component of the Study, there is no sample selection because all of the approximately 2,200 feedlot operations with 1,000 or more head capacity in the 16 States will be included in the survey (NASS unpublished).

For the low capacity component, eligible operations with 50-999 cattle-on-feed capacity in the 13 States from NASS' List Frame will be stratified by State and by size (50-199, 200-999). The total sample will be allocated to strata based on a weighted average of inventory and number of operations in each stratum. Within each stratum, a simple random sample will be chosen.

Estimation procedure:

The statistical estimation will be done using either SAS survey procedures or SUDAAN. Both software packages use a Taylor series expansion to estimate variances appropriate to the survey design.

Degree of precision needed for the purpose described in the justification:

The overall NAHMS program goal is to develop descriptive statistics with a coefficient of variation (CV) less than 20 percent. Appendix A shows estimates of precision based on the sample sizes, by size category and nationally. Most of the estimated CVs and confidence intervals are within the desired range.

- Unusual problems requiring specialized sampling procedures and data collection cycles:

There are no unusual problems requiring specialized sampling procedures and data collection cycles.

Swine Antimicrobial Use Study

Statistical methodology for stratification and sample selection:

A total of 3,000 operations with 1,000 or more nursery pigs or grower-finisher pigs will be selected from NASS' List Frame from a population of approximately 10,000 operations in the 13 participating states (Appendix E). Although the analysis unit for this survey is a site, NASS' list frame has only operations, some of which can have multiple sites. Therefore the first-stage selection unit is an operation.

The list frame will be stratified by State and by operation size as defined by total number of nursery and grower-finisher pigs (1000-1999, 2000-4999, 5000 or more). The number of operations to be selected within each stratum is based on a weighted proportion of the total population (of operations and inventory) that the stratum represents. In this way, strata with larger operations are sampled with higher selection probabilities so that more of the inventory is captured. Within each stratum, a random sample of operations is selected.

Some operations on the NASS list frame represent multiple sites. A sub-sample of sites will be selected from operations with multiple sites in a State. The number of sites selected depends on the size of the operation. For operations with more than 1 site, if the operation has 2-19 sites, 2 sites will be randomly selected. If the operation has 20 to 49 sites, 7 sites will be randomly selected, and if the operation has 50 or more sites, 15 sites will be randomly selected. An estimated 3,786 sites will be visited for this survey (Appendix F). This was the same process used for NAHMS Swine 2012, although the number of sites selected within operations was smaller.

Estimation procedure:

The sampling design is a stratified random sample with unequal probabilities of selection between strata. The statistical estimation will be done using either SAS survey procedures or SUDAAN. Both software packages use a Taylor series expansion to estimate appropriate variances for the stratified design with unequal weights.

Degree of precision needed for the purpose described in the justification:

The overall NAHMS program goal is to develop descriptive statistics with a coefficient of variation (CV) less than 20 percent. Appendix E shows sample sizes and estimates of precision for 3 prevalence estimates at the regional and national level. The estimated CVs and confidence intervals are within the desired range.

- Unusual problems requiring specialized sampling procedures and data collection cycles:

There are no unusual problems requiring specialized sampling procedures and data collection cycles.

**3. Describe methods to maximize response rates and to deal with issues of non-response:
Cattle-on-Feed Antimicrobial Use**

Study Design:

Minimizing collection of data to that which is absolutely necessary.

Meetings and discussions with industry representatives from the National Cattlemen's Beef Association, (NCBA) have been undertaken to get industry support.

- The survey will be administered in person by a trained APHIS or State veterinarian. Prior to the APHIS visit, NASS will mail out a pre-survey letter, a copy of the survey, and an informational sheet about the study, followed by an in-person visit by a trained NASS enumerator. The NASS enumerator will ask for the producers' participation and, if consenting, the producer will sign a release allowing NASS to turn the contact information over to APHIS. Recent NAHMS studies using similar methods have obtained response rates ranging from 40% to 62% (Appendix B).

NAHMS will develop specialized training for the data collectors to address any potential difficulties with questions.

When NASS enumerators visit the operation to solicit consent for study participation, the enumerators will leave a questionnaire with the producers to give them opportunity to gather the requested information in advance.

Non-response adjustment:

Response rates, given the methods described above, are expected to be approximately 50% for this study. If the respondents differ substantially from the non-respondents there will be the potential for bias. NASS' list frame control data may be available for both respondents and non-respondents to allow for examination of potential differences in the types of responding and non-responding producers. There will be limited opportunity for comparison of antibiotic use estimates because little data exist for the type of information that is to be collected.

- Weights will be calculated to adjust for nonresponse. Weights of non-respondents will be transferred to responding operations that are most similar based on available data. Within categories, the sum of weights of the non-respondents and respondents will be divided by the sum of the weights of the respondents only. This factor will be used to adjust the weights of the respondents within the stratum. All weights for non-respondents will be set to zero.

Swine Antimicrobial Use Study

Study Design:

Minimizing collection of data to that which is absolutely necessary.

Meetings and discussions with swine industry representatives (Pork Board, National Pork Producers Council) have been undertaken to get industry support.

- The survey will be administered in person by a trained APHIS or State veterinarian. Prior to the APHIS visit, NASS will mail out a pre-survey letter, a copy of the survey, and an informational sheet about the study, followed by an in-person visit by a trained NASS enumerator. The NASS enumerator will ask for the producers' participation and, if consenting, the producer will sign a release allowing NASS to turn the contact information over to APHIS. Recent NAHMS studies using similar methods have obtained response rates ranging from 40% to 62% (Appendix D).
- A common problem in some NAHMS studies is that a substantial proportion of selected operations are no longer eligible (out of business, no animals). This usually occurs with smaller operations; however, because only operations with 1000 or more pigs are eligible for this survey, the issue of ineligible operations should be mitigated.

NAHMS will develop and participate in specialized training for data collectors to address anticipated difficulties with questions.

Non-response:

The study is supported by industry representatives who have contributed to the study development.

The mailing of a pre-survey cover letter and information sheet announcing the study will give producers more information on the study and why participation is important.

Non-response adjustment:

Response rates, given the methods described above, are expected to be approximately 50% for this study. If the respondents differ substantially from the non-respondents there will be the potential for bias. There are two approaches that we will use to examine for potential bias. First, NASS' list frame control data may be available for both respondents and non-respondents to allow for examination of potential differences in the types of responding and non-responding producers. Secondly, we can compare estimates from the study with available indicators from other sources. For example, although we do not publish estimates of animal inventory, the study results will allow us to make estimates that we can use to compare against NASS' inventory estimates. There will be limited opportunity for comparison of antibiotic use estimates because little data exist for the type of information that is to be collected.

- The sampling design necessitates the use of weights which are based on the initial selection probabilities, and then adjusted for nonresponse. Weights of non-respondents will be transferred to responding operations that are most similar based on available data. The nonresponse adjustment will use the method of propensity scores, whereby a logistic model is constructed to model the probability of responding. The inverse of this probability is the nonresponse adjustment. All weights for non-respondents will be set to zero.

4. Describe any tests of procedures or methods to be undertaken.

Cattle-on-Feed Antimicrobial Use

An initial version of the proposed Cattle on Feed questionnaire was tested on one large capacity operation. The lessons learned from this test were used to make the questionnaire easier for respondents and improves the quality of the information collected.

Swine Antimicrobial Use Study

An initial version of the proposed Weaned Pig Operations and Weaned Pig Site questionnaires were tested on two swine operations and sites. The lessons learned from these test were used to make the questionnaire easier for respondents and improves the quality of the information collected.

- 5. Provide the name and telephone number of individuals consulted on statistical aspects of the design and the name of the agency unit, contractor(s), grantee(s), or other person(s) who will actually collect and /or analyze the information for the agency.**

Cattle-on-Feed Antimicrobial Use

The statistical aspects of the design were coordinated by Ms. Christine Koprak, Statistician, USDA: APHIS, Veterinary Services, CEAH, Fort Collins, CO, (970) 494- 7325. The actual data collection will be conducted by APHIS. Contact persons for data collection are:

Mr. Gerald Tillman, Chief, Survey Administration Branch, Mail Stop 2024, 1400 Independence Ave., S.W., Washington, D.C. 20250, (202) 720-3895.

Dr. Jack Shere, Deputy Administrator, USDA: APHIS, Veterinary Services, Washington, DC (202) 799-7146.

Analysis of the data will be accomplished by Monitoring and Modeling veterinarians, epidemiologists, and statisticians under the direction of:

Dr. Amy Delgado, Director, Monitoring and Modeling, USDA: APHIS, VS, CEAH, 2150 Centre Avenue, Building B MS2E7, Fort Collins, CO 80526-8117 (970) 494-7302.

Swine Antimicrobial Use Study

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Appendix A: Precision of Estimates

Cattle-on-Feed Antimicrobial Use

Estimates of percent of operations and percent of animals will be reported at the national level and by size category.

Estimates of precision for proportions of .5 and .1 are shown in Table 1. As an example, for the size category 1000-7999 and an expected proportion of 0.5, the coefficient of variation (CV) is 5%. Only one of the estimated CV's in the examples presented in Table 1 exceeds 20%. We believe these CV's err on the high side because the effective sample sizes will likely be higher than those shown here for a design effect of 2.

Table 1. Precision of estimates, by reporting class and by expected proportion, at 95% confidence.

Reporting class	Total Population (N) ¹	Sample size	Number of respondents at 50% response rate	Effective sample size with design effect of 2	Expected proportion	Half-width of confidence interval	Coefficient of variation (%)
High capacity component							
1000-7999	1740	1740	870	435	0.5	0.05	5
					0.1	0.03	14
8000+	449	449	225	113	0.5	0.09	9
					0.1	0.06	28
Total	2189	2189	1095	548	0.5	0.04	4
					0.1	0.03	13
Low capacity component							
50-199	9053	1000	500	250	.5	.06	6
					.1	.04	19
200-999	4273	1611	806	403	.5	.05	5
					.1	.03	15
Total	13326	2611	1306	653	.5	.04	4
					.1	.02	12

¹ High capacity component: NASS Cattle on Feed, February 2016.

Low capacity component: 2012 Census of Agriculture. The largest published size class is '500 or more' head, so we estimated the number of lots with 500-999.

These numbers are for the US; the number of feedlot operations in the participating States will be slightly lower.

Appendix B: Predicted Response Rate

Cattle-on-Feed Antimicrobial Use

A questionnaire and instructions will be left with consenting operations during the initial visit by NASS enumerators. Approximately 2-4 weeks later, an APHIS or State veterinarian will visit the operation to administer the questionnaire. This will allow operators time to compile any necessary records. The time required to complete the questionnaire is expected to be 60 minutes, and response rate to the questionnaire using this data collection technique is predicted to be 50%.

1. Review of previous NAHMS response rates for studies conducted using on-farm enumeration

Year	Questionnaire	Collection dates	Sample	Useable ¹	Useable %	Complete ²	Complete %
2014	General Dairy Management Questionnaire	January 2014	3,554 operations	2,519	70.9	2,194	61.7
2012	General Swine Farm Questionnaire ³	July 2012	5,237 sites	3,067	58.6	2,119	40.5
2011	Feedlot Health and Management Questionnaire (1,000 or more head capacity)	October-December 2011	995	517	52.0	403	40.5

¹Respondent was contacted and provided at least inventory information. Includes operations with zero inventory on hand.

²Respondent provided answers to all or nearly all questions.

³Data collection was partly via CATI (n=2,000) and partly via on-farm enumeration (n=2,600)

Appendix C: Number and percent of operations and pigs in 13 participating states

Swine Antimicrobial Use Study

Hog inventory and number of operations with pigs, operations with 1000+ pigs

State	# operations with pigs	Inventory
CO	18	714,972
IA	3815	19,733,548
IL	672	4,452,458
IN	632	3,523,874
KS	118	1,840,103
MN	1548	7,294,150
MO	272	2,685,463
NC	1011	8,854,463
NE	427	2,789,665
OH	575	1,916,601
OK	81	2,283,159
PA	389	1,013,557
SD	199	1,129,795
Total	9,757	58,231,808
% of U.S. 1000+	93.8	92.1
U.S. 1000+	10,401	63,248,402
U.S.Total	63,246	66,026,785

Source: NASS 2012 Census of Agriculture

These operations and inventories include breeding pigs, which are not part of the target population. However, since only 8.6% of total pigs in the U.S. are breeding pigs (2012 Census of Agriculture), we used the above numbers to approximate the target population of nursery and grower-finisher pigs.

Appendix D: Predicted Response Rate

Swine Antimicrobial Use Study

A questionnaire and instructions will be left with consenting operations during the initial visit by NASS enumerators. For operations with multiple sites, the NASS enumerators will sub-select sites at this time, using a NAHMS-provided site selection scheme. Approximately 2-4 weeks later, an APHIS or State veterinarian will visit the operation to administer the questionnaire. This will allow operators time to compile any necessary records. The time required to complete the questionnaire is expected to be 60 minutes, and response rate to the questionnaire using this data collection technique is predicted to be 50%.

1. Review of previous NAHMS response rates for studies conducted using on-farm enumeration

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¹Respondent was contacted and provided at least inventory information. Includes operations with zero inventory on hand.

²Respondent provided answers to all or nearly all questions.

³Data collection was partly via CATI (n=2,000) and partly via on-farm enumeration (n=2,600)

Appendix E: Sample Calculation

Swine Antimicrobial Use Study

To estimate a sample size, we used the number of operations in each region based on the 2012 Census of Agriculture. Our goal is obtain coefficients of variation less than 20 percent.

The strata for sample selection will be based on State/size combinations; however, reporting of estimates will be done by region (and potentially by size category). Therefore our sample size calculations are based on regions, and we call these reporting classes (to distinguish from selection strata).

The allocation (n) assumes a design effect of 2 and a response rate of 50%. For example, if the total population is 6,007 (Midwest region) and we desire a confidence interval of $.5 \pm .06$, the required sample size, under a simple random sample, would be 255. However, the stratified survey design results in a design effect of approximately 2, based on past NAHMS surveys. Thus, in this example, the sample size needed for the desired precision for the Midwest region is $255 \times 2 \times 2$ (50% response rate) = 1020. The total sample needed is 2,880 (~3000 for simplicity).

Table 1. Number of operations that will be sampled, by reporting class.

Reporting class	Total Population (N)	Sample size (SRS)	Allocation (n)
Midwest	6,007	255	1020
East	2,268	239	956
South	1,482	226	904
Total	9,757	720	2,880

Midwest: CO,SD,NE,MN,IA

East: IL,IN,OH,PA

South: KS,OK,MO,NC

Table 2. Precision of estimates based on sample sizes and expected number of responses outlined in Table 1.

Proportion	Regional		National	
	Half-width of CI	Coefficient of variation (%)	Half-width of CI	Coefficient of variation (%)
.5	.06	6	.04	4
.2	.05	13	.03	7
.1	.04	19	.02	11

These sample size calculations are at the operation level, since the primary selection unit will be an operation. However, the reporting unit will be a site, and, since some operations have

multiple sites, the level of precision will be higher than estimated here. We estimate that 3,000 operations represent 3,786 sites (Appendix F).

Appendix F: Number of sites that will need to be visited

Swine Antimicrobial Use Study

This appendix describes how we arrived at the number of sites with nursery or grower-finisher pigs that will need to be visited for the Swine AM-Use 2017 Study. The survey design will be a 2-stage design, with operations selected from NASS' list frame at the first stage, then sites selected within operations.

For Swine AM-Use 2017, there will be a total of 3,000 operations selected, of which we expect 1,500 to respond. We expect the following size breakout (number of operations) based on the size distribution of respondents from Swine 2012:

1000-1999	2000-4999	5000+	Total
420	480	600	1,500

For operation-level respondents, we expect the following site-number distribution, by operation size

Expected number of operations by number of sites and by size

Number of sites	Operation size (total number of pigs)			Total
	1000-1999	2000-4999	5000+	
1	305	276	84	665
2-19	115	204	325	644
20-49	0	0	129	129
50+	0	0	62	62
Total	420	480	600	1,500

This table includes sites with sows only, so slightly overestimates the number of sites per operation.

Our site-selection scheme instructs the following:

For operations with 1 site, select 1 site
2-19 sites select 2 sites
20-49 sites select 7 sites
50+ sites select 15 sites

Therefore, we expect the following number of site visits:
 $(665*1) + (644*2) + (129*7) + (62*15) = 3,786$