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# The Farm Producer Survey: Unit and Item Nonresponse

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## Introduction

The USDA's National Agricultural Statistics Service (NASS) conducts the quinquennial Census of Agriculture in years ending in 2 and 7. The Census is the leading source of information about farms and ranches and the people who operate them. It is the only uniform, comprehensive agricultural data set for every state and county or county equivalent in the United States, including detailed data at the county level with respect to race, ethnicity, and sex.

Since acquiring the census from the US Census Bureau in 1997, NASS has revised and added questions to more fully capture the characteristics of farm producers. NASS now collects data on up to four producers on a single farm. Questions identifying veterans and new or beginning producers have been added. Beginning in 2017, the roles of females, minority, and other underserved producers have been more fully captured through decision-making questions, which enables USDA program agencies to measure progress in serving those traditionally underserved.

NASS is considering adding questions on disability and sexual orientation and gender identity (SOGI) for the 2027 Census of Agriculture. As a first step in this process, in December 2021, NASS conducted the *Farm Producer Study* to assess the potential effect of disability and SOGI questions on the Census of Agriculture's response rates and measurement error. The results of the study may lead to a more robust demographic data product and assist regulatory agencies, producers, state governments, processors, and other USDA agencies in administering and monitoring program effectiveness. These data could also allow NASS to further support other USDA agencies in conducting educational and outreach activities; coordinating related activities helps maximize limited resources and better serve the needs of all producers. The study data have the potential to help determine baseline numbers for outreach efforts to producers with disabilities and lesbian, gay, bisexual, transgender, and queer (LGBTQ+) producers.

The separate data collection of agricultural decision makers' disability and SOGI status is also consistent with the *Executive Order on Advancing Racial Equity and Support of Underserved Communities through the Federal Government*.

## Study

The *Farm Producer Survey* was designed to address the following research questions:

1) Does the presence of disability questions affect either unit or item response rates?
2) Does the presence of SOGI questions affect either unit or item response rates?
3) If both disability and SOGI questions are present, is the effect on unit response rates additive or is some interaction between the sets of questions present?
4) What is the measurement error associated with asking the SOGI questions?

A set of six disability questions were identified (see Figure 1). These have been well tested and used by other government agencies, *e.g.*, the Social Security Administration. Three SOGI questions were identified after cognitive testing that built upon the experiences of others (see Figure 2). The consensus panel of the Committee on National Statistics (CNSTAT), convened to study measurement of sex and SOGI, proposed a set of questions to collect sex and SOGI data (National Academies of Sciences, Engineering, and Medicine 2022). The questions in this study,

for which data collection began prior to the release of the consensus panel's report, are similar, but differ from those the panel proposed. The control questionnaire did not have any disability questions, and it had a single question to determine the sex (male or female) of the respondent. Only information on the respondent was collected; the respondent was not asked to respond on behalf of any other producer associated with that farm.

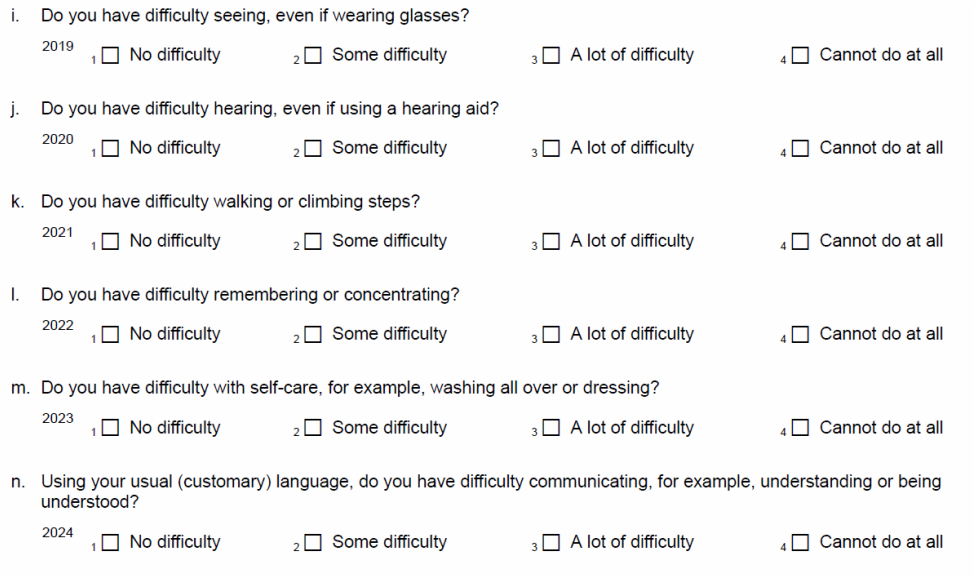


Figure 1. Disability Questions Tested.


Figure 2. SOGI Questions Tested

The target population for the *Farm Producer Study* was all U.S. producers. The sampled population is the responding producer from all active farms on NASS's list frame. The study's sampling frame – like the Census of Agriculture's sampling frame – is comprised of all active farms on NASS's list frame. Four treatment groups were identified: (1) control (none of the test questions were included); (2) only disability questions; (3) only SOGI questions; and (4) both

disability and SOGI questions.

The total sample size was 75,262. The sample size was approximately 12,500 for the control group (treatment 1) and for the treatment group receiving only the disability questions (treatment 2). The sample size for each treatment group with the SOGI questions (treatments 3 and 4) was about 25,000. The two treatment groups with SOGI questions were each split into two subgroups: respondents in one subgroup were asked a confirmation question if their recorded sex at birth differs from their present gender and if they responded via web or computer-assisted telephone interviewing (CATI); respondents in the other subgroup were not asked the confirmation question. Notice that the total sample sizes for the disability and SOGI questions were, respectively, about 37,500 and 50,000. With this design, it was possible to assess whether each set of new questions (disability or SOGI) had an impact on response rates and whether the presence of both sets of new questions had an additive impact on response rates or whether some interaction was present. Dividing the treatment groups with SOGI questions into two subgroups allowed measurement error to be assessed when respondents reported a difference in their sex recorded at birth and their current gender identity.

Separate strata were formed for groups with historical response rates lower than the overall census response rate: LGBTQ+, American Indians/Alaska Natives, Asians/Native Hawaiians and Pacific Islanders, Blacks, Hispanics, and females (farms with only female producers). Based on their 2017 Census of Agriculture response, farms were assigned to the LGBTQ+ stratum if only two producers of the same sex, living in the same household, and with an age difference of no more than ten years were involved in decision making for the farm. Brothers who are the only producers on a farm could satisfy this definition, and a sole producer who is a member of the LBGTQ+ community would not. That is, the LBGTQ+ stratum (stratum 1) definition is an imperfect identifier of farms that should be in that stratum. For strata based on race or ethnicity, the most recent information collected was used to determine stratum membership. As an example, a primary producer could have reported being black and non-Hispanic for the 2017 Census of Agriculture. Unless additional information had been obtained that would lead to a recorded change in race of that producer or a change to another primary producer who is of a different race, that producer's farm would be placed in the black stratum. The strata for American Indians/Alaska Natives (stratum 2), Asians/Native Hawaiians and Pacific Islanders (stratum3), and Blacks (stratum 4) were populated with farms that were not in stratum 1 and whose primary decision maker was of that stratum's race. The Hispanics stratum was comprised of those farms that were not in one of the first four strata and that reported the primary producer was of Hispanic origin. All farms with only female decision makers, as reported in the 2017 Census of Agriculture, and that had not been included in one of the first five strata were placed in the female stratum. Error is also involved with definitions of strata two through six. The responder may not be the decision maker with the characteristic upon which the stratum assignment was based. As an example, the producer who is the primary decision maker could be a black male with a partner who is a white male, placing the farm in the Black stratum; however, the white partner could be the one who responded to the survey. All other farm records were in the final stratum (see Table 1). Notice that farm records were assigned to strata in the order specified. For example, if a farm had an Asian female principal producer, then that farm was assigned to the Asian stratum. Each of these seven strata were further stratified by Census region (see Table 2), state, farm type groups, and farm value of sales groups.

Table 1. Demographic Strata

| Stratum Number | Group |
|---|---|
| 1 | LGBTQ+ |
| 2 | American Indians/Alaska Natives |
| 3 | Asians/Native Hawaiians and Pacific Islanders |
| 4 | Blacks |
| 5 | Hispanics |
| 6 | Females |
| 7 | Others |

Table 2. Census Regions

| **Region 1** | **Region 2** | **Region 3** | **Region 4** | **Region 5** | **Region 6** | **Region7** |
|---|---|---|---|---|---|---|
| Arizona | Connecticut | Idaho | Iowa | Alabama | Florida | Illinois |
| California | Delaware | Montana | Kansas | Arkansas | Georgia | Indiana |
| Colorado | Maine | Oregon | Minnesota | Louisiana | Kentucky | Michigan |
| Nevada | Maryland | Washington | Missouri | Mississippi | North Carolina | Ohio |
| New Mexico | Massachusetts | Wyoming | Nebraska | Oklahoma | South Carolina | Wisconsin |
| Utah | New Hampshire | Alaska | North Dakota | Texas | Tennessee | |
| Hawaii | New Jersey | | South Dakota | | Virginia | |
| | New York | | | | West Virginia | |
| | Pennsylvania | | | | | |
| | Rhode Island | | | | | |
| | Vermont | | | | | |

The control treatment group received a standard four-page questionnaire. In contrast, all other treatment groups received one or more sets of test questions (disability or SOGI). The length of the questionnaire for each treatment group was four pages.

## Data Collection

The data collection plan for this *Farm Producer Study* consisted of the following:

(1) Mailed a traditional paper questionnaire with a cover letter. This mailing-also encouraged reporting on the web.
(2) For all non-respondents, mailed a second traditional paper questionnaire with a cover letter. This mailing also encouraged reporting on the web.
(3) Conducted nonresponse follow-up with enumerators via CATI.

Respondents in the confirmation question subgroup of the two treatment groups with SOGI questions were asked a confirmation question if their recorded sex at birth differs from their reported present gender identity and they responded via the web or by CATI. Respondents in the other subgroup of those treatment groups were not asked the confirmation question. It was anticipated that, with this design and for these two treatment groups, approximately half of the web or CATI respondents who had differing responses to the two questions (sex recorded at birth and present gender identity) would receive the confirmation question.

## Results

The analyses used to address these questions reflect the study design. For unit and item nonresponse, the response variable was whether or not there was a response. The treatments were

in a $2^2$ factorial arrangement of treatments. The two factors were disability questions (present or absent) and SOGI questions (present or absent). Demographic stratum was the third factor in the model. All main effects as well as two-way and three-way interactions were also included. The data were too sparse to include the Census region. A generalized linear model with a Bernoulli response and a logit link function was fit in each analysis. When *F*-tests are conducted, the *p*-value is the probability of observing an *F*-value at least as large as that observed if the null hypothesis is true. Unit and item response rates were estimated by back transforming the least squares means and their associated standard errors, which were on the logit scale. The traditional 5% significance level was used to assess significance. However, *p*-values are provided should the reader want to consider some other level of significance.

All analyses were conducted on the unweighted data, which provides sample average treatment effect (SATE) estimates. These estimates tend not to differ substantially from the population average treatment effects (PATE), *i.e.*, weighted, estimates, and they avoid the loss in statistical power that accompanies a weighted analysis (Miratrix, *et al.* 2018).

Unit nonresponse for both disability and SOGI questions will be evaluated first. Item nonresponse for disability and SOGI questions will be considered next. Finally, measurement error associated with respondents reporting a difference in sex at birth and current gender identity will be addressed.

**Unit Nonresponse**

Of the 75,262 sampled farms, responses were obtained from 34,059, giving a cooperation rate of 45.3%. Of the responders, 2,184 reported that they were out-of-business. These records were included as responders for the analysis of unit nonresponse but were excluded for the item nonresponse analysis.

For the unit response rate, the main effects of the presence of SOGI questions and demographic stratum were significant (respectively, $p < 0.0001$ and $p < 0.0001$, see Table 3). Note: a main effect is the difference in levels of a factor (*e.g.*, presence/absence of SOGI questions) averaged over all other factors. The effect of including disability questions and all two- and three-factor interactions were not significant.

Table 3. Tests of Fixed Effects in the Model of Unit Nonresponse

| **Type III Tests of Fixed Effects** | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | ***p*-value** |
| **SOGI** | 1 | 75234 | 42.74 | <.0001 |
| **Disability** | 1 | 75234 | 1.08 | 0.2991 |
| **Stratum** | 6 | 75234 | 63.68 | <.0001 |
| **SOGI *stratum** | 6 | 75234 | 1.02 | 0.4067 |
| **disability*stratum** | 6 | 75234 | 0.99 | 0.4292 |
| **SOGI *disability** | 1 | 75234 | 0.15 | 0.6983 |
| **SOGI *disability*stratum** | 6 | 75234 | 0.55 | 0.7669 |

Adding disability questions did not have a significant impact on the overall response rates ($p$ = 0.2991). The estimated response rate when disability questions were present was 44.5% (±0.3%) compared to a response rate of 45.0% (±0.3%) when they were not.

The presence of the SOGI questions led to an overall decrease in response rates from 46.3% (±0.4%) when the SOGI questions were not included to 43.3% (±0.3%) when they were, a reduction of an estimated 3%.

The LGBTQ+ stratum response rate of 50.6% was the highest (see Table 4). The response rates for the female (47.0%) and others (48.2%) strata were not significantly different from each other but differed significantly from the response rates of the other strata. The Hispanics (44.8%), Asians/Native Hawaiians and Pacific Islanders (43.5%), and Blacks (43.2%) had response rates that were not significantly different from each other but differed from those of the other strata. The American Indians/Alaska Natives stratum had the lowest response rate of 36.4%.

Table 4. Unit Response Rates and Standard Errors for the Demographic Strata

| **Demographic Stratum Least Squares Means** | | | |
|---|---|---|---|
| **Stratum Number** | **Demographic Group** | **Unit Response Rate*** | **Standard Error** |
| **1** | LBGTQ+ | 0.5065 a | 0.007332 |
| **7** | Others | 0.4819 b | 0.002940 |
| **6** | Females | 0.4696 b | 0.006115 |
| **5** | Hispanics | 0.4478 c | 0.006085 |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.4353 c | 0.006072 |
| **4** | Blacks | 0.4321 c | 0.006060 |
| **2** | American Indians/Alaska Natives | 0.3643 d | 0.005885 |

*Unit response rates with the same letter are not significantly different from each other.

Because the effects of adding the disability or SOGI questions to the Census of Agriculture could differ among the demographic groups, the effects were evaluated within each demographic stratum (see Table 5).

For American Indians/Alaska Natives, Blacks, and Hispanics, the interaction between the presence of disability and SOGI questions was not significant ($p$ = 0.2594, 0.5839, 0.1008, respectively). The presence of a significant interaction between the presence of disability and SOGI questions for the LGBTQ+, Asians/Native Hawaiians and Pacific Islanders, female, and others strata indicates that, for these strata, the presence of disability and SOGI questions each had an effect and that effect differed depending on whether the other set of questions was present (see Figure 3). In addition, the presence of the SOGI questions had a significant effect on

Table 5. Tests of the Effects of the Presence of Disability and SOGI Questions and the Interaction of the Two within Demographic Strata on Unit Nonresponse

| Stratum Number | Demographic Group | Disability*SOGI *p*-value | Disability *p*-value | SOGI *p*-value |
|---|---|---|---|---|
| **1** | LGBTQ+ | 0.0339 | 0.1086 | 0.0169 |
| **2** | American Indians/Alaska Natives | 0.2594 | 0.5187 | 0.0616 |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.0251 | 0.1263 | 0.0169 |
| **4** | Blacks | 0.5839 | 0.4408 | 0.4972 |
| **5** | Hispanics | 0.1008 | 0.4375 | 0.0182 |
| **6** | Females | 0.0013 | 0.9388 | <.0001 |
| **7** | Others | <.0001 | 0.7144 | <.0001 |

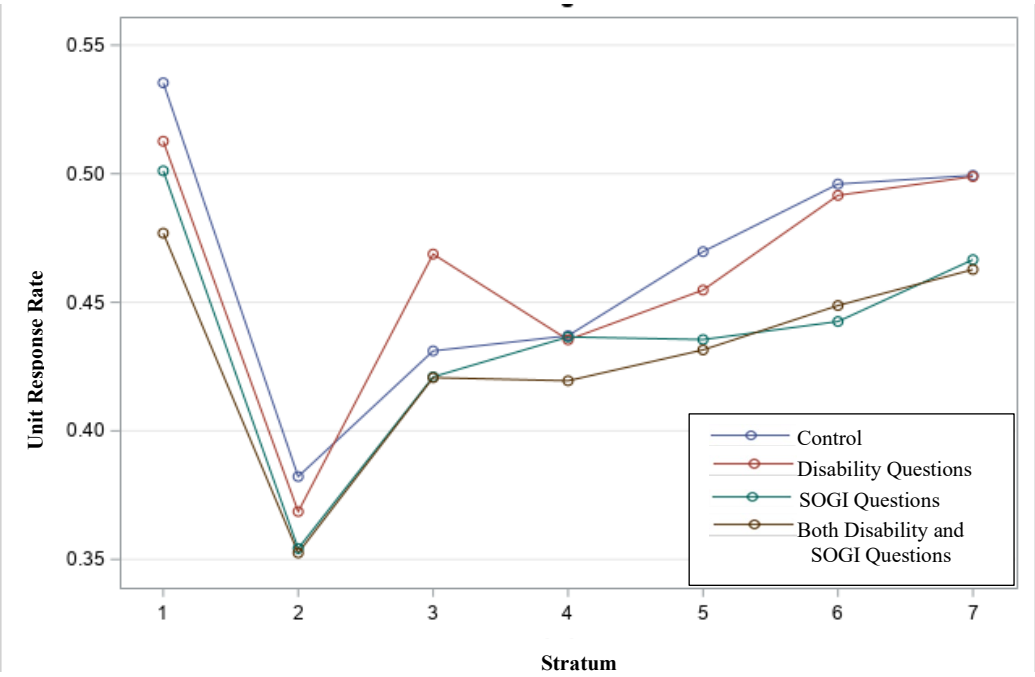


Figure 3. Plot of Treatment Unit Response Rates for Each Stratum

response rates within the Hispanics stratum ($p$ = 0.0182) and a marginal effect within the American Indians/Alaska Natives stratum ($p$ =0.0616). Adding disability questions alone had no significant effect within any of the demographic strata.

For the LGBTQ+ stratum, the effect of adding both disability and SOGI questions to the questionnaire had a smaller impact on the response rates than the sum of the effects for adding only SOGI or only disability questions (see Table 6, Figure 3). Compared to control, adding both disability and SOGI questions resulted in an estimated decrease in response rate of 5.8% ($p$ = 0.0047). Adding the SOGI questions to either the control or the disability questions resulted in a marginally significant decrease in estimated response rate of 3.4% ($p$ = 0.0981) and 3.6% ($p$ = 0.0847), respectively.

Table 6. The Estimated Unit Response Rate for Each Treatment-Stratum Combination.

| Stratum | Demographic Stratum | Control Unit Response Rate (SE) | Disability Unit Response Rate (SE) | SOGI Unit Response Rate (SE) | Disability and SOGI Unit Response Rate (SE) |
|---|---|---|---|---|---|
| **1** | LGBTQ+ | 0.535 (0.017) | 0.513 (0.017) | 0.501 (0.012) | 0.477 (0.012) |
| **2** | American Indians/ Alaska Natives | 0.382 (0.014) | 0.369 (0.014) | 0.354 (0.010) | 0.352 (0.010) |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.431 (0.014) | 0.469 (0.014) | 0.421 (0.010) | 0.421 (0.010) |
| **4** | Blacks | 0.437 (0.014) | 0.435 (0.014) | 0.437 (0.010) | 0.420 (0.010) |
| **5** | Hispanics | 0.470 (0.014) | 0.455 (0.014) | 0.436 (0.010) | 0.432 (0.010) |
| **6** | Females | 0.496 (0.014) | 0.492 (0.014) | 0.442 (0.010) | 0.449 (0.010) |
| **7** | Others | 0.499 (0.007) | 0.499 (0.007) | 0.467 (0.005) | 0.463 (0.005) |

Now consider the Asians/Native Hawaiians and Pacific Islanders stratum. Adding disability questions was marginally significant ($p = 0.0587$), leading to an increase in estimated response rate from 43.1% (±1.4%) to 46.9% (±1.4%). Including only SOGI questions did not have a significant effect on unit response rate compared to the control ($p = 0.5553$). However, having both disability and SOGI questions or only SOGI questions resulted in a significant reduction of an estimated 4.8% when compared to having only disability questions ($p = 0.0055$ and $p = 0.0052$, respectively).

Those in the Hispanics stratum had a significant decrease in unit response rate when SOGI or both disability and SOGI questions were added. The effect of adding SOGI questions resulted in a significant decrease of 3.4% ($p = 0.0469$) if only SOGI questions were added and 3.8% ($p = 0.0263$) if both disability and SOGI questions were added.

In the female stratum, adding the SOGI questions resulted in a significant decrease in the response rate of 5.3% ($p = 0.0020$) if no disability questions were present and 4.7% ($p = 0.0063$) if disability questions were also present.

For the final stratum consisting of all other records, adding the disability questions did not have a significant impact on response rate. Adding SOGI questions with or without disability questions resulted in a significant decrease of 3.7% ($p < 0.0001$) and 3.3% ($p < 0.0001$), respectively.

The estimated response rates were consistently higher for all strata when the SOGI questions were not included (see Figure 4). The extent to which the SOGI questions led to lower unit response rates varied with demographic stratum.

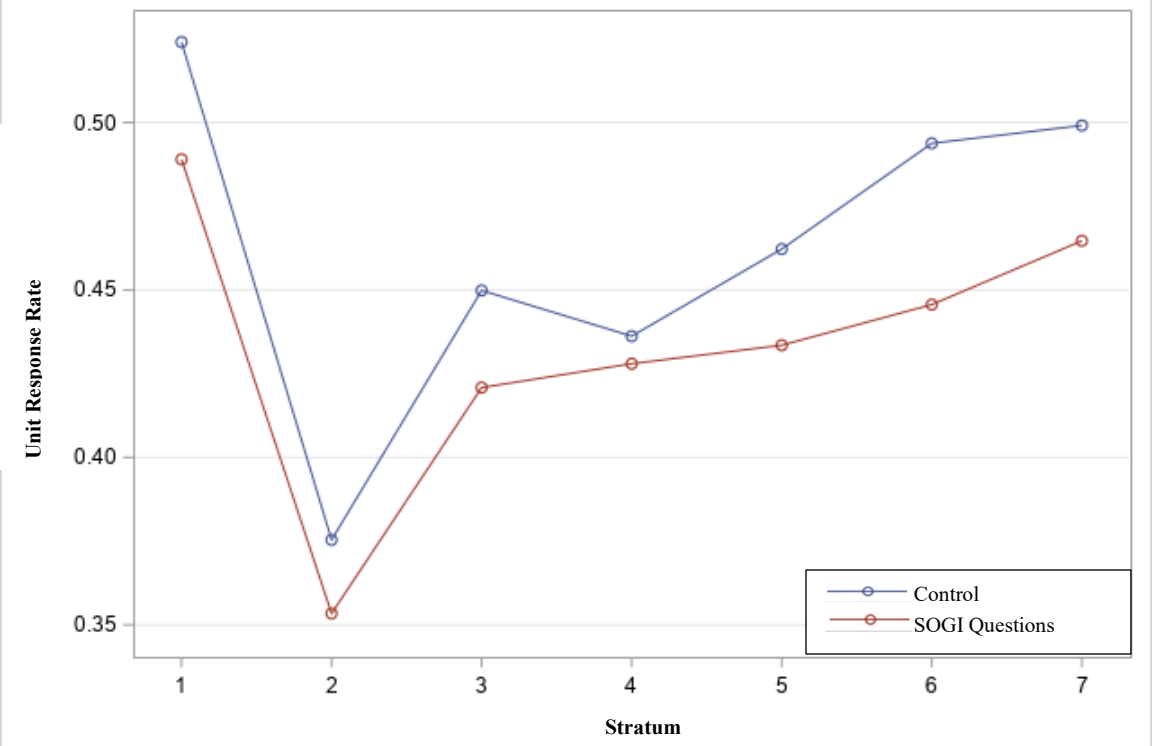


Figure 4. Effect of the Presence of SOGI Questions on Unit Response Rate by Stratum

In summary, compared to the control, adding the disability questions did not result in a significant decrease in response rates for any stratum: LGBTQ+ ($p = 0.1086$), American Indians/Alaska Natives ($p = 0.5187$), Asians/Native Hawaiians and Pacific Islanders ($p = 0.1263$), Blacks ($p = 0.4408$), Hispanics ($p = 0.4375$), females ($p = 0.9388$), and others ($p = 0.7144$). Compared to the control, adding SOGI questions resulted in a significant or marginally significant decrease in response rates for the LGBTQ+ ($p = 0.0981$), Asians/Native Hawaiians ($p = 0.0052$), Hispanics ($p = 0.0469$), females ($p = 0.0020$), and other strata ($p < 0.0001$). The response rate decreased by more than 5% when (1) both disability and SOGI questions were present for the LGBTQ+ stratum and (2) SOGI, but not disability, questions were added for the female stratum.

## Item Nonresponse

*Disability Questions*

The control and only SOGI questions treatments were not included in this analysis as they had no disability questions on their questionnaires. The factors considered in the analysis were question (6 disability questions), treatment (disability only and disability and SOGI questions). For the six disability questions, the item response rate varied significantly with treatment ($p < 0.0001$) and stratum ($p < 0.0001$), but not with question ($p = 0.9922$). None of the two- and three-way interactions were significant ($p > 0.9966$) (see Figure 5). Thus, the response rates to the disability questions are reported by treatment and stratum averaged over question (see Tables 7 and 8).

Table 7. Response Rate to Disability Questions by Treatment *

| Treatment Group | Item Response Rate | Standard Error |
|---|---|---|
| Only Disability Questions | 0.963 a | 0.001 |
| Disability and SOGI Questions, Confirming Question | 0.958 b | 0.002 |
| Disability and SOGI Questions, No Confirming Question | 0.951 c | 0.002 |

*Treatments with different letters had significantly different item response rates to the SOGI questions.

Table 8. Response Rate to Disability Questions by Demographic Stratum *

| Stratum Number | Demographic Group | Item Response Rate | Standard Error |
|---|---|---|---|
| **2** | American Indians/Alaska Natives | 0.975 a | 0.002 |
| **4** | Blacks | 0.969 a | 0.002 |
| **5** | Hispanics | 0.962 ab | 0.002 |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.959 bc | 0.002 |
| **1** | LGBTQ+ | 0.954 c | 0.002 |
| **7** | Others | 0.942 d | 0.001 |
| **6** | Females | 0.921 e | 0.003 |

*Strata with different letters had significantly different item response rates to the SOGI questions.

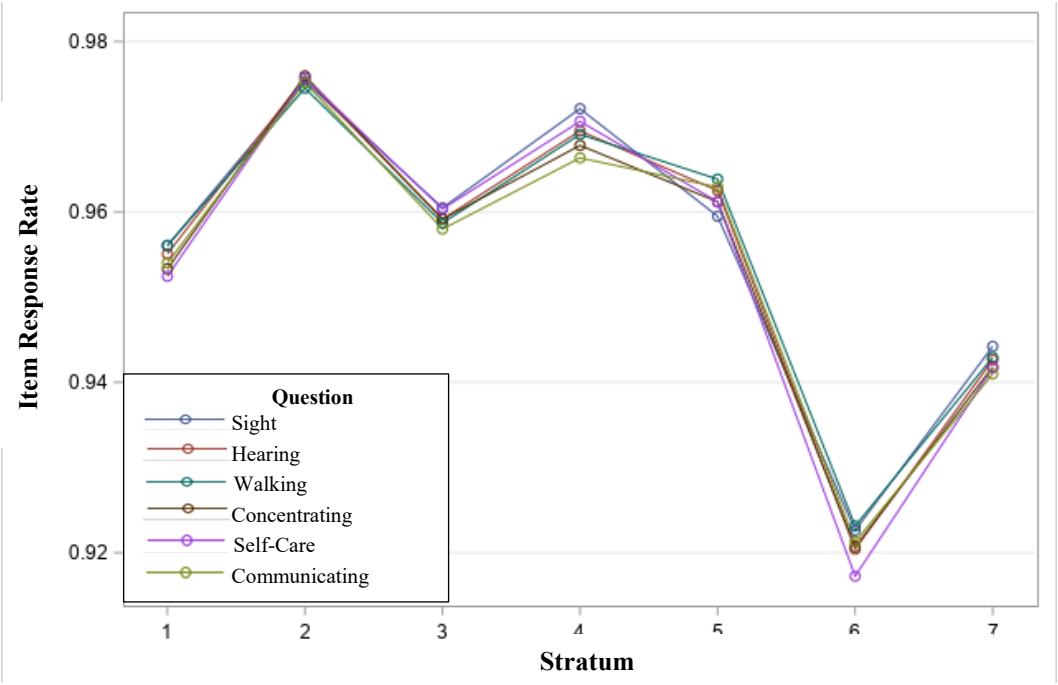


Figure 5. Item Response Rate to the Disability Questions by Stratum

The number of producers reporting a level of disability as "a lot of difficulty" or "cannot do at all" varied with the type of disability and stratum (see Table 9). The observed counts from the study are reported and not the weighted values. Thus, these data cannot be used to estimate the prevalence of disabilities in the population of producers.

Table 9. Number of Producers Reporting Some Level of Disability

| Disability | Stratum | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Totals |
| Sight | 21 | 46 | 30 | 37 | 30 | 43 | 135 | 342 |
| Hearing | 38 | 91 | 53 | 58 | 57 | 50 | 365 | 722 |
| Walking | 57 | 98 | 59 | 102 | 92 | 98 | 335 | 841 |
| Concentrating | 17 | 41 | 36 | 35 | 21 | 27 | 115 | 292 |
| Self-Care | 7 | 19 | 13 | 22 | 10 | 14 | 47 | 132 |
| Communicating | 4 | 19 | 23 | 16 | 9 | 6 | 43 | 120 |

## *SOGI QUESTIONS*

### *SOGI Questions Considered as One Item*

Recall that all versions of the questionnaire had at least one question about sex or gender. For the control and disability only questionnaires, only one question was asked: "What is your sex? " The options provided were male and female, and a response occurs if either option is selected. This question has appeared on previous NASS surveys and the Census of Agriculture. Three SOGI questions were present on the questionnaires with disability and SOGI and SOGI only questions. This initial analysis considers the three questions as a unit, and a response is said to occur if the producer responded to at least one of the three questions.

The item response rate did not differ with the presence of the SOGI questions. The observed item response rate was 96.0% if the SOGI questions were not present and 95.9% when they were. The item response for the sex/SOGI questions differed with stratum ($p < 0.0001$). No other main effect or two- or three-way interaction was significant ($p > 0.4111$). The Blacks and American

Table 10. Item Response Rate for SOGI Questions for Demographic Strata*

| **Stratum Number** | **Demographic Group** | **Item Response Rate** | **Standard Error** |
|---|---|---|---|
| **4** | Blacks | 0.975 a | 0.003 |
| **2** | American Indians/Alaska Natives | 0.971 a | 0.003 |
| **5** | Hispanics | 0.964 b | 0.003 |
| **1** | LGBTQ+ | 0.956 bc | 0.004 |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.955 bc | 0.004 |
| **7** | Others | 0.947 c | 0.002 |
| **6** | Females | 0.933 d | 0.005 |

*Strata with different letters had significantly different item response rates to the SOGI questions.

Indians/Alaska Natives strata had the highest item response rates (97.5 and 97.1, respectively), and the female and others strata had the lowest item response rates of 93.3% and 94.7%, respectively (see Table 9).

Potential differences in item response rate for the individual SOGI questions were explored within each stratum (see Table 11). No main effect of the presence of disability or SOGI questions or the interaction of the two was significant within any of the demographic strata.

Table 11. Test of the Effects of the Presence of Disability and SOGI Questions and the Interaction of the Two within Demographic Strata on Item Nonresponse to the SOGI Questions

| Stratum Number | Demographic Group | Disability*SOGI *p*-value | Disability *p*-value | SOGI *p*-value |
|---|---|---|---|---|
| **1** | LGBTQ+ | 0.2164 | 0.1136 | 0.1566 |
| **2** | American Indians/Alaska Natives | 0.3985 | 0.9940 | 0.1858 |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.8470 | 0.7879 | 0.8008 |
| **4** | Blacks | 0.6770 | 0.2545 | 0.7616 |
| **5** | Hispanics | 0.8078 | 0.5891 | 0.8364 |
| **6** | Females | 0.2165 | 0.3708 | 0.1064 |
| **7** | Others | 0.2833 | 0.4163 | 0.1188 |

*Individual SOGI Questions*

To evaluate the item response rates for the three SOGI questions, only the questionnaires with SOGI questions (with or without the disability questions) were considered. A generalized linear model was used to explore whether item response differed with question and stratum. The response variable was one the question was answered and 0 otherwise. The factors evaluated were the question, the demographic stratum, and the interaction between stratum and question. The interaction between stratum and question was not significant ($p = 0.4373$). Question and stratum were significant ($p < 0.0001$).

The item response rate for the questionnaires that had the traditional sex question with male and female response options was 95.7% (±0.2%), which was significantly greater than the item response rates to any of the three SOGI questions. Further, the item response rates for the three SOGI questions were significantly different from each other (see Table 12 and Figure 6). The item response rate to sex recorded at birth was 0.7% less than the response rate to the gender identity question ($p =0.0094$). The questions on how the respondent's current gender identity and what sex was recorded for them at birth were significantly greater than the response rate to the sexual orientation question ($p < 0.0001$). The item response rate varied with stratum but, because there was no interaction in item response by question and by stratum, the main effect of stratum is reported here (see Table 13).

Table 12. Response Rates for the SOGI Questions

| Question Number | Question | Item Response Rate | Standard Error |
|---|---|---|---|
| **1** | **Gender identity** | 0.953 a | 0.002 |
| **2** | **Sex recorded at birth** | 0.946 b | 0.002 |
| **3** | **Sexual orientation** | 0.903 c | 0.002 |

Table 13. Response Rate to the SOGI Questions by Demographic Stratum *

| Stratum Number | Demographic Group | Item Response Rate * | Standard Error |
|---|---|---|---|
| **4** | Blacks | 0.958 a | 0.003 |
| **2** | American Indians/Alaska Natives | 0.956 a | 0.003 |
| **5** | Hispanics | 0.943 b | 0.003 |
| **3** | Asians/Native Hawaiians and Pacific Islanders | 0.933 c | 0.003 |
| **1** | LGBTQ+ | 0.930 c | 0.004 |
| **7** | Others | 0.920 d | 0.002 |
| **6** | Females | 0.900 e | 0.004 |

*Strata with different letters had significantly different item response rates to the SOGI questions.

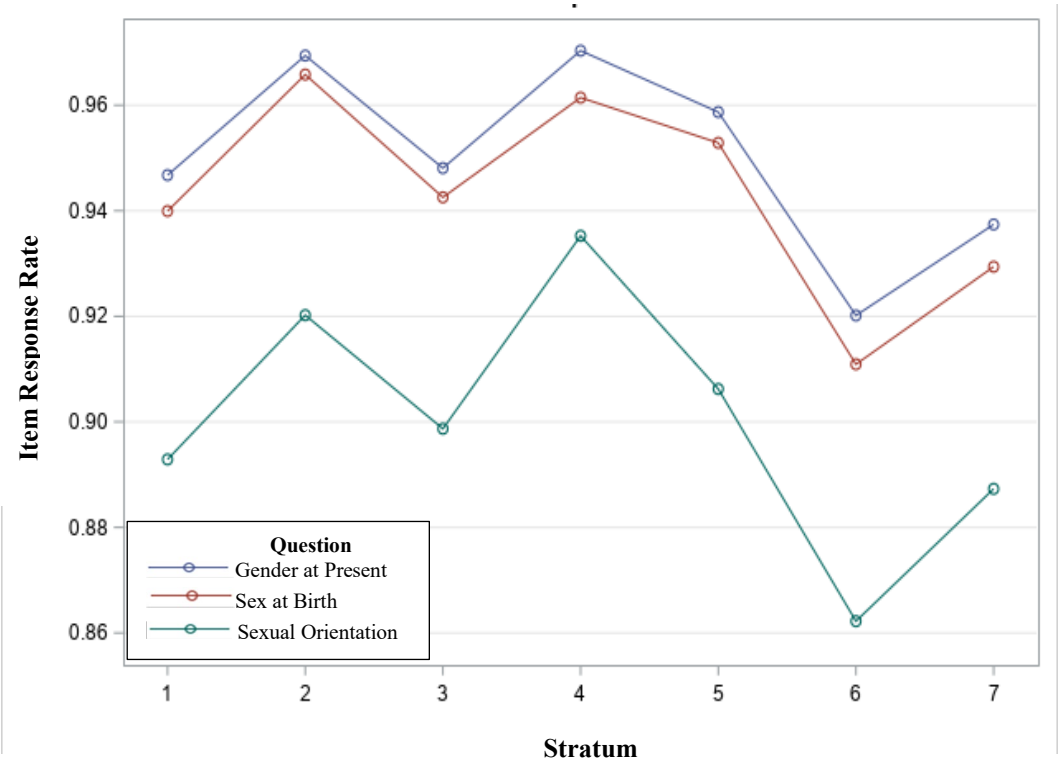


Figure 6. The Item Response Rate for the SOGI Questions by Stratum

The item response rates were significantly different within each stratum ($p < 0.0001$). In all but the others stratum, the response rates to the questions on current gender identity and sex recorded at birth were not significantly different from each other but were significantly different from the response rate on sexual orientation, which was consistently lower (see Figure 6). For the others stratum, the response rate of 93.7% to the gender identity question was significantly greater than the response rate of 92.9% to the sex at birth question.

*Current Gender Identity vs Sex Recorded at Birth*

Of those who received the SOGI questions, some reported current gender identity that was different from their sex recorded at birth (see Table 14). Respondents also reported a spectrum of sexual orientations (see Table 15). All entries in Tables 14 and 15 are unweighted values and cannot be used to provide corresponding estimates of population characteristics.

Table 14. Sex Recorded at Birth and Gender at Present

| Sex Recorded at Birth | Gender at Present | | | | |
|---|---|---|---|---|---|
| | Male | Female | Transgender | Something Else | Totals |
| Male | 15,067 | 18 | 6 | 27 | 15,118 |
| Female | 23 | 4,211 | 6 | 2 | 4,242 |
| Totals | 15,090 | 4,229 | 12 | 29 | 19,360 |

Table 15. Sexual Orientation Reported by Respondents

| Sexual Orientation | Number Responding |
|---|---|
| Gay or Lesbian | 298 |
| Straight | 16,775 |
| Bisexual | 84 |
| None of these | 537 |
| I am not sure | 108 |
| I don’t know what this question means | 1,034 |
| Total | 18,836 |

*Measurement Error*

The respondents who received the SOGI questions were randomly assigned to either receive or not receive a confirming question if their current gender was different from their sex recorded at birth. Of the 19,360 responding to both the sex at birth and current gender identity questions, 82 reported a current gender identity different from sex at birth. Only 33 of the 82 were assigned to a treatment subgroup that was to receive a confirming question. Of these 33, only 7 responded via the web or CATI; the others responded by mail and could not be asked a confirming question. Six (6) of the 7 responded to the confirming question, and all confirmed that their response of having a current gender identity different from the sex recorded at birth was correct. These numbers are too small to draw general conclusions as to the potential measurement error associated with the gender identity questions.

## Discussion

The demographic strata were determined based on data collected from prior Censuses of Agriculture or surveys. Some changes could have occurred in these data. Also, because the disability and SOGI questions were only asked of the person responding and not for other producers on the farm, a producer from an underserved demographic group may not have been included in the responses.

The frequency with which each stratum captured the demographic group of interest was explored (see Table 16). The columns in Table 16 represent the sampling strata, which were determined based on NASS list frame control data. The rows are the demographic groups identified through responses to the questionnaire. An individual may be included in the counts of more than one stratum. For example, a black female would be included in the counts of both the black and female strata. For the LGBTQ+ stratum, only those questionnaires with the SOGI questions could be used to determine reported membership in that stratum. Membership in all other strata could be determined from responses to any of the questionnaires. When SOGI questions were present, sex reported at birth was used to determine membership in the female stratum. Note that these are all unweighted values and thus cannot be used to provide corresponding estimates of population characteristics. In all cases, more respondents of an underserved group were in the stratum established for that group than were in any other stratum. However, not all members of the underserved group were present in any of the sampling strata focused on that group. Therefore, some error in the estimated effects and response rates is present.

Table 16. Number of the Demographic Groups in the Sampling Strata

| Reported Demographic Group | Sampling Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | LGBTQ+ | American Indians/Alaska Natives | Asians/Native Hawaiians and Pacific Islanders | Blacks | Hispanics | Females | Others | Totals |
| LGBTQ+* | 220 | 14 | 25 | 24 | 27 | 45 | 103 | 458 |
| American Indians/Alaska Natives | 54 | 1,918 | 29 | 50 | 92 | 41 | 190 | 2,374 |
| Asians/Native Hawaiians and Pacific Islanders | 30 | 17 | 2,489 | 14 | 32 | 17 | 73 | 2,672 |
| Blacks | 33 | 23 | 8 | 2,820 | 28 | 12 | 67 | 2,991 |
| Hispanics | 71 | 150 | 131 | 29 | 2,320 | 33 | 179 | 2,913 |
| Females | 607 | 583 | 634 | 448 | 434 | 2,454 | 1,402 | 6,562 |

*Membership in this stratum could only be reported for those treatment groups with the SOGI questions.

The response rate decreased 5.8% and 5.3%, respectively, for the LGBTQ+ and female strata when the SOGI questions were present. The item response rate decreased from 95.3% for the gender identity question to 90.3% for the sexual orientation question, a drop of 5%. The item

response rate to the question about sex recorded at birth was 94.6%, which is significantly different from, but similar to, that of the gender identity question. Depending on the need for the information, it may be that asking only the gender identity and sex-reported-at-birth questions would not have the negative impact on unit response rate that was associated with also including the sexual orientation question.

The response rates were not significantly negatively impacted by the presence of the disability questions. Gaining insights into the rate at which various disabilities affect producers can be important to developing programs that can help them continue to farm.

Further research is needed before determining whether these questions can be incorporated into the Census of Agriculture or other surveys. For the Census, information is gathered on up to four producers. Whether a respondent is able and willing to report disabilities or SOGI information on behalf of the other producers needs to be addressed. Further, if the person is willing to report the data, any measurement error associated with this proxy reporting needs to be understood.

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