## Measurement of sex and gender identity in the Behavioral Risk Factor Surveillance Survey, 2014 to 2020

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## Abstract

**Background:** Sex and gender identity influence numerous aspects of health, health behavior, and health outcomes. Effective measurement of sex and gender identity can be challenging. Questions measuring gender identity were added as an optional module of the Behavioral Risk Factor Survey (BRFSS) in 2014. In 2014, participant sex was recorded based on interviewer perception but by 2016 it was asked of participants directly. The wording of the sex question was modified multiple times between 2014 and 2020. This study explores how BRFSS participants responded to gender identity and sex questions from 2014 to 2020.

**Methods:** We used grouped bar plots to examine the relationship between responses on gender identity and sex for each year and line graphs to determine if there were trends over time in how transgender participants reported sex.

**Results:** About 70% of participants who identified as transgender male-to-female reported male sex while about 30% reported female sex. Participants who identified as transgender female-to-male reported female sex 65% of the time and reported male sex 35% of the time. Despite changes in sex question wording, these percentages were relatively consistent over time.

**Conclusion:** There was variation in how transgender participants reported their sex regardless of sex question wording. Reported sex is used in computing health-related variables and in routing participants to questions about birth control, pregnancy, HPV vaccines, and cancer screenings. Without better measurement, it is challenging to assess health and health risks and develop effective guidelines, programs, and policies to protect and improve the health of transgender people.

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## Background

In 2021, a Gallup poll found that .6% or 60 out of every 1000 Americans, reported that they identify as transgender.22 The percentage varied by age group, with the cohort born in 1997-2002 reporting 1.8% of survey participants identified as transgender compared to 1.2% in the previous cohort and just .3% in the cohort born before 1946. Transgender people are individuals whose biological sex, or sex recorded at birth, differs from their gender identity.16,20 Gender identity is how a person identifies and conceptualizes their own gender and is different from biological sex and sexual orientation.16,32 Sex and gender identity both have implications for health, health care, and health outcomes.1,19,25,26

Conducting research to understand factors that influence health, health care, and health outcomes is important for creating guidelines, policies, and programs that protect and improve health. Given the roles of sex and gender identity in health, many social science and health surveys seek to measure sex, and a growing number also collect gender identity information. Until recently, measurement of gender identity was not commonly included as a survey item27 and measurement of sex was often done by an interviewer guessing the sex of the participant3 or asking “what is your sex?” and recording either male or female. Researchers have frequently treated gender as a synonym for sex.21,24,33

For decades there have been calls and attempts to improve the measurement of sex and gender identity.24,33 In the meantime, researchers are utilizing data sets that include many different ways of measuring these concepts. One of these data sets that is commonly used is the Behavioral Risk Factor Surveillance Survey (BRFSS), which collects data on health behaviors, health conditions, and the use of health-related services from U.S residents. The Centers for Disease Control and Prevention collect BRFSS participant data each month over telephone. It is considered the world’s largest health survey system, collecting data from over 400,000 individuals yearly.13

Until 2014, the BRFSS did not include questions about gender identity. In 2014, the sexual orientation and gender identity (SOGI) module was offered and 19 states included it in the survey this first year. The number of states including the SOGI module increased over time to 33 states in the most recent data release in 2020.14 The gender identity question included in the SOGI is: “Do you consider yourself to be transgender?” The follow-up question for those who answered yes was, “Do you consider yourself to be 1. Male-to-female, 2. Female-to-male, or 3. Gender nonconforming?” Prior to offering the optional SOGI module to all states, a few states included their own gender identity questions in some years (e.g., Massachusetts in 2007 to 20099).

Although a gender identity question was added, the wording of the sex question did not make any distinction between sex and gender for several years. In 2014 and 2015, the interviewer selected the sex of the participant given the prompt: “Indicate sex of respondent. Ask only if necessary.” In 2016, the prompt changed to, “Are you…” with the options of Male, Female, and Refused and a note, “Note: This may be populated from information derived from screening, household enumeration. However, interviewer should not make judgement on sex of respondent.” So, 2016 was the first year of the BRFSS that the interviewer was not permitted to guess the sex of the participant.

In 2017 the question remained, “Are you…” with responses of Male, Female, and Refused. The note for interviewers changed to all capital letters, presumably for emphasis, “INTERVIEWER NOTE: THIS QUESTION MUST BE ASKED EVEN IF INTERVIEWER HAD PREVIOUSLY ENTERED SEX IN THE SCREENING QUESTIONS. IT WILL NOT BE ASKED OF PERSONS WHO HAVE SELF-IDENTIFIED SEX IN LL HOUSEHOLD ENUMERATION.” There was also a second note, “CATI NOTE: THIS QUESTION MAY BE POPULATED BY LANDLINE HOUSEHOLD ENUMERATION ONLY. IT MAY NOT BE POPULATED BY INTERVIEWER ASSIGNMENT OF SEX DURING THE SCREENING FOR CELL PHONE OR PERSONS LIVING IN COLLEGE HOUSING.”

In 2018, the BRFSS interviewers asked, “What is your sex? or What was your sex at birth? Was it…” and gave the possible responses of Male and Female. It is unclear from the BRFSS documentation how interviewers selected one of the two questions. In 2019, the interviewer asked, “Are you male or female?” In 2019 there was also a separate “Sex at Birth Optional Module” that included the question, “What was your sex at birth? Was it male or female?” The separate sex at birth question was asked of a subset of about 65 thousand participants and a combined sex variable was created that classified people based on their response to the sex at birth question if asked and, if sex at birth was not asked or if the reply was “Don’t know/Not Sure” or “Refused,” used the response to the sex question. In the 2020 survey administration, the 2019 sex at birth prompt was adopted as the sex question for all participants, “What was your sex at birth? Was it male or female?”

In a 2021 paper,20 Howerton and Harris found that BRFSS participants from 2015 to 2019 who reported having the same transgender gender identity sometimes had different answers for the sex question. For example, some participants who identified as female-to-male transgender identity reported their sex as male and others reported their sex as female. Likewise, among those who identified as male-to-female transgender identity, some reported their sex to be male and others reported their sex to be female. This has likely led to numerous published scientific papers examining sex differences or using sex as a covariate and potentially including participants whose sex recorded at birth was something other than their self-reported sex recorded in the BRFSS data.

The implications of how sex is measured impacts which questions participants are asked and how multiple variables are computed in the BRFSS. For example, the BRFSS variable for heavy drinking codes a male as a heavy drinker at 14 or more alcoholic drinks per week and a female as a heavy drinker at 7 or more alcoholic drinks per week. Questions related to pregnancy and pregnancy or birth-related health conditions are only asked of those who report being female sex and questions about human papilloma virus (HPV) screening and vaccination and birth control type and behavior differ for those who select male or female sex. Likewise, questions about mammograms, breast exams, Pap tests, and prostate specific antigen (PSA) tests are only asked of people who report being in a specific sex category.

We sought to better understand the relationship between sex and gender identity responses in the BRFSS data from 2014 (the first year of the gender identity question) to the most recently released year of data in 2020. Specifically we answer three questions: (1) What is the relationship between sex and gender identity responses for participants over this seven year period?; (2) How has the relationship between measured sex and gender identity changed as the sex question changed over this seven year period?; and (3) Did the version of the sex question that specified “at birth” result in different patterns of sex and gender identity reporting compared to other years?

## Methods

We imported the BRFSS data sets from 2014 through 2020 directly from the Centers for Disease Control and Prevention website. We used R statistical software version 4.1.1,28 the RStudio (version 1.4.1717) interactive development environment,29 and a function from version 2.4.3 of the haven package36 to import the data and compute descriptives statistics. We used the tidyverse,35 lemon,15 and cowplot37 software packages in R to manage and visualize the data. Code to reproduce this work is available at [URL redacted for review].

## Results

### What is the relationship between sex and gender identity responses for participants over this seven year period?

We found that about 70% of participants in the 2014 to 2020 BRFSS who identify as transgender male-to-female report male sex while about 30% report female sex (Figure 1). During the same time frame, participants who identify as transgender female-to-male report female sex 65% of the time and report male sex 35% of the time. With the exception of 2017, there was a higher percentage of male-to-female transgender participants reporting themselves to be male sex compared to the percentage of female-to-male transgender participants reporting themselves to be female sex.

FIGURE 1 HERE

### How has the relationship between measured sex and gender identity changed as the sex question changed over this seven year period?

Although the sex question asked of participants changed multiple times from 2014 to 2020 (Figure 1), the percentage in each transgender group choosing male and female remained relatively stable for both groups (Figure 2). The transgender male-to-female group ranged from 67% to 74% male sex with no apparent pattern given the question wording changes (Figure 2). The transgender female-to-male group ranged from 66% to 75% female sex with a pattern of decline in responding “female” to the sex question from 2014 to 2020 (Figure 2).

FIGURE 2 HERE

### Did the version of the sex question that specified “at birth” result in different patterns of sex and gender identity reporting compared to other years?

The structure of the 2019 survey provides some additional information about differences in response patterns when including or not including “at birth” in a sex question. In 2019, there was more variability in responses among participants who were asked their sex (Figure 3a) compared to participants who were asked their sex at birth (Figure 3b). However, when the sex at birth version of the question was adopted for everyone in 2020 (Figure 3c), the distribution of responses was somewhere between the responses from those who responded to the sex question in 2019 and those who responded to the sex at birth question in 2019.

FIGURE 3 HERE

## Discussion

About 70% of participants in the 2014 to 2020 BRFSS who identify as transgender male-to-female reported male sex while about 30% reported female sex. During the same time frame, participants who identify as transgender female-to-male reported female sex 65% of the time and reported male sex 35% of the time. These values were relatively consistent over the seven administrations of the survey; there were some minor shifts year-to-year in the sex distribution in the male-to-female group and a relatively steady increase in reporting male sex in the female-to-male group. One exception was for the participants who answered the optional module on gender identity in 2019. When asked their sex at birth, 85% of the male-to-female transgender group chose male. The value of the sex variable is used in computing some health related variables (e.g., heavy drinking) and in routing participants to questions about birth control, HPV vaccines, cancer screenings, and other preventive health behaviors.

The lack of *accurate* population-level epidemiological data for transgender people is problematic.12 For example, population-level research is lacking on breast cancer among transgender people, even though many take hormone replacement therapy which could influence breast cancer risk.12 In addition to limited existing evidence, the existing evidence may be inaccurate. For instance, a study using BRFSS data relied on the *Are you transgender?* question and the sex question to classify people as transgender men and transgender women31 before analysis of the associations between a five category variable (cisgender men, cisgender women, transgender men, transgender women, and gender non-conforming) and several cancer screening tests including pap and PSA tests. While both transgender men and transgender women were asked about mammogram, transgender women were not asked about pap tests and transgender men were not asked bout PSA. In this case, with the way these groups were classified by the authors, those who reported male sex but transgender status female-to-male, and therefore may have a cervix and not a prostate (n = 212), would have been asked the PSA screening question and not the Pap screening question. Likewise, those who reported female sex but male-to-female transgender status, and therefore may have a prostate and not a cervix (n = 319), would have been asked the Pap screening question but not the PSA. So, out of the 1,779 transgender male-to-female or female-to-male participants, this strategy likely missed appropriate screening questions for 531 people31 or 30% of participants.

Similar inadequate data storage in medical records is exacerbating this problem. For example, although most transgender men still have a cervix, they are less likely to be screened for cervical cancer compared to their cisgender counterparts17 with one of the reasons being that some health systems base screening invitations on the sex listed in medical records.8 Lack of screening for transgender people can lead to later diagnoses and more severe disease.7,38 It is clear that our existing tools are inadequate for collecting, storing, and using data effectively for transgender people.

In addition ineffective direct measurement of sex, the BRFSS includes computed variables that rely on the value of the sex variable to classify participants. Two of these variables are are *heavy drinking* and *binge drinking*. These measures classify participants as heavy drinkers or binge drinkers based on the number of drinks they report having in a week and their sex. They do not consider gender identity in classification; the threshold for heavy drinking is quite different for males (14 drinks per week) compared to females (7 drinks per week), while the binge drinking definition differs by a single drink per episode (5 for males, 4 for females). Given participant responses for sex vary within a single gender identity, these thresholds may not be accurately capturing heavy or binge drinking for transgender participants. In one example of how this impacts research, Azagba et al.2 did not include sex as a covariate in logistic regression models computing the odds of binge drinking for different transgender groups compared to cisgender groups. Perhaps not surprising, the findings suggested that female-to-male transgender participants have a lower odds of binge drinking compared to cisgender males and male-to-female transgender participants had higher odds of binge drinking compared to cisgender females.2 Given the importance of understanding alcohol consumption in the transgender population,18 a way of classifying hazardous alcohol consumption that takes into consideration individual attributes rather than relying solely on self-reported sex could improve accuracy of this measure and thus improve the quality of research on alcohol use among transgender people.

There are at least two possible ways to reduce the current limitations on accurate population level data for transgender people. First, the BRFSS (and other data collection and storage tools) could build in the flexibility to ask all of the questions currently asked of only male sex or only female sex for any person who identifies as transgender. In this way we can ensure more accurate information about important cancer screenings, health conditions, and health behaviors among transgender people. Second, researchers including the sex variable in their work should pay attention to measures of gender identity if they are available and, if gender identity measures are not available, might report on this limitation given that data on reported sex for transgender people is likely a mixture of sex recorded at birth and gender identity.

More flexible and accurate ways of measurement of sex and gender identity are also necessary to protect and improve the health of transgender people.4,6,30 Current ways of asking gender identity include single questions with a transgender option and two-step questions typically asking about sex at birth and gender identity separately.5 While the two-step questions provide more detailed information and have been suggested by some groups as a best practice,10 they are not perfect. Numerous studies suggest drawbacks including a small number of people who would fit the definition of transgender but who do not identify as transgender and a small number of cisgender participants responding that they are transgender because they do not understand the terminology.5 One study also found evidence that some transgender people may misunderstand transgender terminology, with a small number of transgender women self-identifying as transgender men.11 In our study, the two-step question using the “at birth” terminology in 2020 did not result in notable changes in the reporting of sex for those who were transgender from prior years.

While there does not seem to be consensus yet on the best way to measure sex and gender identity as distinct, scientists from different fields continue to examine the data, test options, and develop guidelines. For example, a 2017 study4 examined different ways of measuring sex and gender and consulted with experts to identify a set of three questions, “What sex were you assigned at birth, meaning on your original birth certificate?”; “Which best describes your current gender identity?”; and, for those whose gender identity differs from birth sex, “What gender do you currently live as in your day-to-day life?” A 2021 paper suggests gender identity be measured by two questions, “Which of the following best describes your gender identity? Woman, Man, Non-binary, genderfluid, or gender non-conforming, or Other (please specify)” and “Do you identify as transgender? Yes, No, Other (please specify).”23 Likewise, the National Academies of Sciences, Engineering, and Medicine recommended a two question set for sex and gender identity, “What sex were you assigned at birth, on your original birth certificate? Female, Male, Don’t know, Prefer not to answer” and “What is your current gender? Female, Male, Transgender, (if respondent is American Indian / Alaskan Native) Two-Spirit, I use a different term (free test), Don’t know, Prefer not to answer.”5 In contrast, Thornton et al.34 argue that, as a step toward best practice for gender and sex data collection, ethical measurement could skip the sex question as a filter and use questions that are relevant to a study topic like “Do you have a prostate?” or “Are you breastfeeding?”

Whether one of these options is the key to more effective and accurate data collection remains a question. What is clear, though, is that ineffective data collection, storage, and use is a threat to the health of transgender people. Researchers, public health practitioners, and healthcare workers using these data should be aware of these limitations. More accurate, flexible, and inclusive measurement along with data systems that are more flexible for data collection, storage, and use are strategies that could improve the health and well-being of transgender people.

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## Authorship confirmation/contribution statement

JKH conceptualized the paper, conducted data management and analyses, and lead the writing. OH wrote and edited sections of the paper and reviewed code books for relevant information to include.

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## Figure Legends

Figure 1. Distribution of reported sex among BRFSS participants who reported being transgender female-to-male or transgender male-to-female (2014-2020).

Figure 2. Change over time in reported sex among BRFSS participants who reported being transgender female-to-male or transgender male-to-female (2014-2020).

Figure 3. Difference in reported sex when “at birth” was added to the sex question among BRFSS participants who reported being transgender female-to-male or transgender male-to-female (2019-2020).

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