A WORD FROM...

Tom Barr, AMS Director of Programs and Outreach[1]

Photo is courtesy of Tom Barr.

The Mathematical and Statistical Sciences Annual Survey (`https://www.ams.org/annual-survey`) provides information on the academic mathematical and statistical sciences community that is quantitative, relevant, reliable, and timely. From its inception in 1957 as a simple salary study of 42 of the "best" programs in the country, it has grown to encompass a wide array of characteristics of the professional milieu in almost all of the approximately 1,514 programs in four-year institutions across the US and its territories. With the advisement of the Joint Data Committee (JDC, `https://www.ams.org/comm-all.html`), three AMS staff members (Colleen Rose, Kayla Roach, and myself) carry out the data collection, analysis, and table preparation. In collaboration with the chair of the JDC (Amanda Golbeck), we prepare five major reports that appear in *Notices* each year, plus a number of special-request analyses based on data collected but not explicitly part of the reports. I've been involved since my arrival at the AMS in 2015, and more recently I have moved to serving as director of programs, a role with broader responsibilities regarding the Survey. Thus, I'm especially happy to reflect on this program and offer some perspective.

How We Do the Survey

The AMS staff carry out a census using four different questionnaires that are completed by chairpersons or other departmental staff at various times throughout the year. These focus on (1) the characteristics of new doctorate recipients and their beginning employment experiences, (2) departments' faculty recruitment, hiring, and attrition, (3) faculty salaries, and (4) characteristics of departments such as faculty size and demographics, numbers of majors, and numbers of graduate students. For the purposes of the Survey, these programs are grouped into eight strata (five tiers of mathematics programs plus applied math, statistics, and biostatistics) comprising 328 PhD-granting programs, 178 master's-granting programs, and 1,008 bachelor's-granting programs. The lists of institutions as well as the survey forms are available through the Annual Survey web page. Analysis of the gathered information yields six reports (five statistical plus the listing of PhD recipient names) that appear in *Notices* roughly a year after the survey instruments are sent out. These reports, along with data tables on which they are based, are housed on the Annual Survey web pages. This repository now serves as the definitive archive of Survey information, and any updates or errata appear there.

How We Decide What Questions to Ask

In the early days of the Survey, the Joint Data Committee or its predecessors wrote the questions for the survey, and the chair of the committee, along with AMS staff, were the authors of the reports. That influence on the present-day questionnaires and reports is evident, though now the JDC plays more of an advisory role to staff. In order to track parameters over time, the questions and analytical methodology shouldn't vary a lot year-to-year, so questionnaire adjustments have tended to be incremental. At the AMS, we regularly receive queries from the community that indicate ongoing interest in such questions as the proportions of tenured faculty in R1 departments who are women, the percentages of first-year graduate students who drop out after one year, or the fraction of PhDs completed in US universities by international students. These questions can be answered because the parameters are either tracked explicitly over time in the Survey reports or are directly inferable from them. Interest in longitudinal perspective like this tends to keep the Survey questions stable year-to-year.

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[1]*The opinions expressed here are not necessarily those of the* Notices *or the AMS.*

On the other hand, the needs of the community change over time, and we receive new questions from chairpersons, AMS leadership, committees, and others that would be desirable to incorporate into the Survey. We work to address these when possible with incremental changes to the survey forms and corresponding parts of the reports. Other queries can be answered, for instance, by a cohort salary study or an analysis of student enrollments, where data already gathered can be scrutinized from a perspective different from that of the Survey reports. In the wake of the COVID-19 pandemic, it has become clearer than ever that one-off studies to look at emergent changes in such activities as recruitment, research, teaching, learning, and career development are needed. One of the challenges ahead is to balance our efforts between the traditional, year-by-year tracking of parameters and the "snapshot" surveys we have begun to contemplate.

Often, statistically-based questions about undergraduate mathematics and statistics education that are beyond the scope of the Annual Survey can instead be studied through the Conference Board of Mathematical Sciences (CBMS) Survey of Undergraduate Programs (`https://www.ams.org/cbms2020`). The AMS has administered this comprehensive, national survey on behalf of CBMS every five years for at least the past five decades, and it contains a great deal of information about such topics as instructional staff, curriculum, teaching methods, and course delivery in both two-year and four-year institutions offering undergraduate math and statistics.

Statistical Trends Over the Years

Most parameters that are tracked in the Annual Survey do not vary rapidly, and the changes tend to be monotonic. Here are a few examples of general recent trends. The reports and tables give a great deal more detail.

One significant focus area is PhD production and the employment experiences of degree recipients. For the sequence of years ending June 30, 2008 to June 30, 2018, the number of doctorates granted in the mathematical sciences increased from 1,378 to 1,960 (`https://www.ams.org/phds-awarded`). These numbers translate to an average annualized growth rate of about 3.6%. Over the same period, the fraction of new doctorates who are women has ranged from a high of 32% in 2008 to a low of 25% in 2018, and the fraction who are US citizens has fluctuated between 45% and 49%. Survey reports break these and many other numbers down by department groups, research concentration areas, and employment sectors.

The longest of the Annual Survey reports is the Departmental Profile (`https://www.ams.org/demographics`), which captures data on faculty employment status and demographics, undergraduate and graduate course enrollments, numbers of bachelor's and master's degrees awarded, counts of full-time graduate students, and more. A few factoids from it are:

- Across the 1,514 departments in the Survey frame, the estimated number of full-time mathematical and statistical sciences faculty is between 25,000 and 26,000. In recent years the percentage of full-time faculty who hold tenure has crept downward, and this is corroborated by a decrease from 52% to 46% in the period 2014 to 2018 in the percentage of open faculty positions that were tenure-eligible.
- Interesting insights and inferences can be made from data on graduate students. For instance, in the years 2008 to 2017, the reports show explicitly that the number of full-time graduate students grew from an estimated 10,883 to 13,896, for an annual increase of about 3.6%. During this period, the percentage of under-represented minorities in graduate programs increased from about 9% to 13%. The percentage who were women held steady year-to-year at about 30%. A persistence in this last percentage might seem inconsistent with the wider fluctuation in the percentage of women completing PhDs mentioned above. However, the 30% figure is an integral over all age groups of graduate students, whereas the percentage of women completing PhDs is essentially the percentage of women in the last age group.

While it may be a somewhat antiquated practice, reading tables can often yield a lot more insight than huge amounts of narrative or web searches. I invite anyone interested to peruse the rich assortment of tables in the Annual Survey reports on the web page (`https://www.ams.org/annual-survey`)!

Data → Information → Knowledge → Action

What is actionable? That question persists for me as we contemplate the future of Survey activities at the AMS. On the one hand, many times I have heard statements that begin, "It would be nice to know…," an entrée to perhaps a countable infinity of possible work steps. My response in some of those instances may contain the question, "What do you expect to do with the answers?" This actionability criterion can be a guide forward as we consider ways of making our Survey work nimbler and the end products more relevant. The AMS is well positioned in the community to collect data—we have good relationships with departments, and we appreciate the diligence of chairs and administrative staff around the country in completing our surveys—and to turn that data into useful information. The next steps in the sequence rely on the wider mathematical and statistical community—and especially its leaders—to utilize this sort of information to form knowledge of the professional milieu and training pipeline so that sensible and productive actions are likely to follow.

With continuing and renewed support for our efforts from the participating societies, we look forward to more years of providing the math and statistics community with actionable, distinctive, and timely information that is deeply important to the health of our profession.