Change Over Time in Educational Attainment for Deaf Individuals from 2008-2018

Carrie Lou Garberoglio[1]
Paige M. Johnson[1,2]
Adam Sales[1,2]
Stephanie W. Cawthon[1,2]

Abstract

Educational attainment is a crucial contributor to postsecondary achievement for deaf people, as a key component of narrowing employment gaps. Fewer deaf people complete high school and postsecondary education than their hearing peers, resulting in severe educational attainment gaps. However, secondary data analyses of the American Community Survey revealed areas of optimism related to the change over time in educational attainment for deaf people from 2008 to 2018. In general, attainment appears to be steadily improving for deaf people, with demonstrated growth in high school, associate, and bachelor's degree completion. Differences in growth occurred across gender, race, and ethnicity. Educational attainment gaps between deaf and hearing people narrowed over time for high school and associate degree completion, but stayed stable for bachelor's degree completion. Findings can drive changes in policy and practice that facilitate greater educational attainment for deaf people.

Keywords: deafness, postsecondary outcomes, transition, longitudinal studies

Completing high school and continuing education and training after high school is becoming increasingly important for maximizing quality of life in the United States. Educational attainment may result in immediate benefits of gaining content knowledge and skills, but has significant implications that persist over longer periods of time as people enter the workforce. Many of the fastest growing jobs in the United States (73%) now require specific postsecondary degrees or certifications as criteria for employment and 60% require at least an associate or bachelor's degree (Hogan & Roberts, 2015). Thus, higher educational attainment has become the standard expectation, or the norm (Carnevale et al., 2010). As postsecondary degree attainment increases, economic benefits increase on a national scale as well as at the state level (Zaback et al., 2012). Across the world, the average educational attainment rates in a country are strongly linked to equitable income distribution (Gregorio & Lee, 2002). Educational attainment increases employment opportunities, enables career advancement, and garners increased earnings.

The benefits of educational attainment are seen not only in employment settings, but also in general life outcomes. Educational attainment has a positive relationship with marital stability (Heaton, 2002), health-related quality of life (Tsimpida et al., 2018), and reduced child mortality (Breierova & Duflo, 2004). People who have completed high school are more likely to have a checking account, volunteer, and register to vote than those who did not complete high school (Newman et al., 2010). Furthermore, higher educational attainment rates have been significantly associated with longer life expectancies (Barro & Lee, 1994) which is true for men, women, people of all races and ethnicities, and across age (Olshansky et al., 2012). Similarly, there are negative consequences of not completing high school. High school non-completers are more likely to be unemployed, receive state and federal financial support, and be incarcerated (Sum et al., 2009). Among those with disabilities, young adults who do not complete high school are significantly more likely to be involved with the criminal justice system. For example, 72%

[1] National Deaf Center on Postsecondary Outcomes; [2] University of Texas at Austin

of non-completers had been stopped by police for something other than a traffic violation, compared to 44% of completers, and 48% of non-completers had been arrested, compared to 21% of completers (Sanford et al., 2011). Educational attainment may have more value for populations that experience systemic marginalization, like deaf people.

For deaf people in particular, educational attainment appears to have the same benefits as it does for hearing people, but in some cases may be even more important. Analyses of the American Community Survey have demonstrated that as educational attainment increases among deaf people, income gaps between deaf and hearing people may significantly narrow (Walter & Dirmyer, 2013) or disappear (Garberoglio et al., 2019). Among deaf people without a high school degree, the employment gap is around 26%, narrowing to 13% for those with a bachelors' degree and 12% for those with a masters' degree or above (Garberoglio et al., 2019). These findings indicate that educational attainment can be an important contributor to narrowing employment gaps between deaf and hearing people.

Educational attainment is also strongly linked to economic outcomes for deaf people. Deaf college graduates have higher levels of career mobility, enhanced earnings, reduced likelihood of relying on federal benefits, and increased likelihood of stable employment (Schley et al., 2011; Walter et al., 2002; Walter & Dirmyer, 2013). Deaf people who have a bachelor's degree may earn between 52% to 66% more than those who have not completed a bachelor's degree (Garberoglio et al., 2019; Schley et al., 2011). Deaf people who do not have postsecondary education are at risk for underemployment and unemployment, more likely to have shorter job tenure, and may rely on social security income (Houston et al., 2010). Educational attainment appears to be an important tool to narrow the economic gaps between deaf and hearing people (Garberoglio et al., 2019).

In addition, educational attainment is related to general life outcomes for deaf people. Higher educational attainment among deaf people is related to health outcomes such as lower cardiovascular risk (McKee et al., 2014). Deaf people with a college degree report lesser difficulty in understanding health information (Kushalnagar & Kushalnagar, 2018). They also seem to be more comfortable with communicating and finding information related to health care by using online platforms to communicate with healthcare providers (Ryan & Kushalnagar, 2018) and seeking out health information online (Kushalnagar & Kushalnagar, 2018). Deaf people with college degrees also report stronger self-efficacy and greater personal resources (Hintermair, 2007). Educational attainment clearly plays an important role in the lives of deaf people, contributing to employment, earnings, and well-being.

Recognizing the need for skilled employees who can meet the competitive demands of the modern workforce, current legislation and public policy are designed to facilitate conditions that support continuing education and training for all people. The U.S. government set a college degree attainment goal to be achieved by 2020 where at least 60% of 25-34 year-olds will complete an associate or bachelor's degree (U.S. Department of Education, 2012). It was estimated that 50% more associate and bachelor's degree completers from this age group is needed before the goal can be reached (U.S. Department of Education 2016). Since the passage of the ADA, postsecondary education and training programs have become more accessible for deaf people, who are now enrolled in a wide variety of educational programs across the United States. Vocational rehabilitation funding is also available to support postsecondary education and training for disabled and deaf people across the country. In a 2017 study of deaf people, however, only 27.7% had completed an associate degree, and 18.8% had completed a bachelor's degree (Garberoglio et al, 2019). Thus, even with these policy, legislative, and financial commitments, educational attainment gaps continue to persist for deaf populations.

Change over Time in Educational Attainment by Demographic Characteristics

While completion rates have steadily increased over time for high school (McFarland et al., 2018a), and postsecondary degrees (McFarland et al., 2018b; Nettles, 2017; U.S. Census Bureau, 2017), this growth in educational attainment is inconsistent across people of different races, ethnicities, genders, and disabilities. Thus, focusing only on the overarching outcome of this higher educational attainment goal by 2020 may mean that people with multiple marginalized identities fall through the cracks. The implications of this goal, in other words, may exacerbate educational attainment disparities and further reinforce pre-existing inequities in the workplace, particularly among Black, Native American, and Latinx populations (Nettles, 2017).

Gender

Women complete high school and attain associate and bachelor's degrees at a higher rate than men (McFarland et al., 2018b; Ryan & Bauman, 2016; U.S. Census Bureau, 2019). Since 1967, women have been steadily showing increases in college completion

(Ryan & Bauman, 2016). However, gender differences in completion rates appear to vary depending on the level of educational attainment and age. In 1978, women aged 25 and older surpassed their male counterparts in associate degree completion (National Center for Education Statistics, 2018) but did not catch up to bachelor's degree completion rates for men until fairly recently (Ryan & Bauman, 2016). However, younger women aged 25 to 29 surpassed their male peers in bachelor's degree completion in 1996 (Stoops, 2003). While overall educational attainment rates for women have steadily increased over time, those gains are most visible among younger women.

Race and Ethnicity

Across race and ethnicity, Asian American and White people consistently complete high school and college at higher rates than people of other races and ethnicities (McFarland et al., 2018b; Nettles, 2017; Ogunwole et al., 2012; Ryan & Bauman, 2016). Although high school completion rates between Asian American and White people are comparable, more Asian American people hold associate and bachelor's degrees than White people (McFarland et al., 2018b; Ogunwole et al., 2012). High school completion gaps between Latinx and White students, as well as Black and White students, have narrowed since 2000 (Musu-Gillette et al., 2016). For college degree completion, Asian Americans are the highest educated of all races and ethnicities, with 50% having completed a bachelor's degree or higher, followed by Whites (29%), African Americans (18%), Native Hawaiian and other Pacific Islanders (14%), and Alaskan Natives and Native Americans (13%; Ogunwole et al., 2012). These patterns are also observed when examining associate degree completion rates (McFarland et al., 2018b). In general, steady growth across all levels of educational attainment was visible for all races and ethnicities except for Alaskan Natives or Native Americans (McFarland et al., 2018b; Ryan & Bauman, 2016). Younger Asian Americans and Pacific Islanders did not demonstrate significant growth over time in educational attainment, but this group had already reached the 2020 goal in 2014 (Nettles, 2017).

When considering the intersection of gender, race, and ethnicity, women earn college degrees at a higher rate than men across all race and ethnicity groups (DiPrete & Buchmann, 2013; Nettles, 2017; Shapiro et al., 2017). The gender gap is the largest for Black people (DiPrete & Buchmann, 2013; Nettles, 2017; Shapiro et al., 2017). Black women were the first to obtain higher levels of education than their male peers, while Asian American and White women have only recently started surpassing White men in educational attainment (DiPrete & Buchmann, 2013). Furthermore, Black and Latino men represent the majority of all postsecondary students who withdraw from college (Cook & Cordova, 2007; Greene et al., 2008; King, 2000). The intersectional oppressions involved with gender, race, and ethnicity clearly play a role in the educational experiences and opportunities available to people .

Disability

Generally, adults with a disability are less likely to graduate from high school and obtain college degrees than adults without a disability (Ryan & Bauman, 2016; Bureau of Labor Statistics, 2015). While many young adults with disabilities enroll in postsecondary education, a high percentage of these students do not successfully complete their degree programs (Newman et al., 2011). Educational attainment patterns across race and ethnicity for people with disabilities are consistent with patterns in the general population, with Asian American and White disabled people completing college degrees at higher rates than Black and Latinx disabled people (Goodman et al., 2017). Within race and ethnicity groups, those with disabilities were significantly less likely than their nondisabled counterparts to obtain a bachelor's degree or higher. Additionally, high school dropout rates are consistently higher among male students of color with disabilities (i.e., Black, Latinx, and Native American) (Faircloth et al., 2014). Educational attainment rates among people with disabilities vary across disability groups, and are lowest among people with multiple disabilities (Garberoglio et al., 2019; Newman et al., 2011).

From 1990 to 2005, postsecondary enrollment rates significantly increased for youth with disabilities, at a faster rate than in the general population (Newman et al., 2010). A closer look at the impact of disability type, race, and ethnicity shows variation in growth over time in postsecondary enrollment. Young adults who were deaf, or had learning disabilities, intellectual and developmental disabilities, or emotional disturbances showed significant growth over time in postsecondary enrollment, while other disability categories did not show the same growth (Newman et al., 2010). This growth in enrollment was strongest at two-year colleges and Career and Technical Education (CTE) schools, and weakest at four-year colleges. For four-year college enrollment, the only growth by disability category was found among people with learning disabilities. Across race and ethnicity, only White young adults with disabilities showed overall growth in postsecondary en-

rollment of any type, while Black young adults with disabilities showed an increase in enrollment in two-year colleges. As the data on educational attainment growth among disabled populations are sparse, these enrollment data allow for an understanding of potential growth over time.

Deaf People

Deaf people are more likely to complete college degrees than those from many other disability groups (Newman et al., 2011), but educational attainment rates continue to lag behind their hearing peers (Garberoglio et al., 2019). Postsecondary enrollment rates for deaf people have increased since the 1980s, in large part due to legislative action and increased accessibility of educational environments, as is true for other disability groups (Newman et al., 2011; Wagner et al., 2005). Despite increasing access to educational systems, current educational attainment rates for deaf people continue to lag behind their hearing peers, with attainment gaps ranging from 6% for high school completion to 15% for bachelors' degree completion (Garberoglio et al., 2019). An understanding of educational attainment over time for deaf people must explore all the intersecting oppressions that play a role in educational experiences and opportunities. More deaf women than deaf men complete high school and have a bachelor's degree or higher, as in the general population (Garberoglio et al., 2019). Despite promising educational attainment trends among deaf women, educational attainment gaps between deaf and hearing women persist. These educational attainment gaps are more severe for deaf people of color and deaf disabled people (Garberoglio et al., 2019). In order to narrow achievement gaps between deaf and hearing people, it is necessary to identify if educational attainment is increasing over time among deaf people, and if so, to what extent, and for whom .

Root Causes of Educational Attainment Gaps Between Deaf and Hearing People

The reasons for educational attainment gaps between deaf and hearing people are many, and the root causes run deep. People navigate through many complex systems in order to reach their educational goals, and face multiple barriers on the way that could derail their plans, consciously or unconsciously. The many identities that people possess play an important role in the journey towards their educational goals, and influence the opportunities available to them and the cultural dynamics that they are required to manage. Many root causes for those educational attainment gaps are similar to those found in the general population, but some may be magnified due to the deaf experience or experienced uniquely by deaf people.

Deaf people navigate a world where there is significant negative bias about the capability of deaf people to succeed (Mousley & Chaudoir, 2018). Lower expectations for deaf people are found in schools and also at home (Newman, 2005; Smith, 2013). Almost half of parents (43%) did not believe that their deaf child would be able to complete a four-year degree program, and only 45% believed that their child would enroll in any type of postsecondary institution (Newman, 2005). Yet, postsecondary enrollment rates for deaf youth easily exceed the expectations of their parents, with 75% of deaf young adults enrolling in postsecondary education (Newman et al., 2011). While lower expectations of deaf people are prevalent across settings, these expectations may have greater impact for deaf youth of color (Simms et al., 2008).

Within educational settings in secondary schools, placement and course-taking have significant impact on students' readiness for future educational pathways. Deaf students who take more academically rigorous coursework during high school are more likely to enroll in postsecondary education (Newman et al., 2017). Deaf students who are less academically prepared may be more likely to leave college (Lang, 2002). Students who take more advanced coursework during high school are more likely to continue on and succeed in college (Tyson et al., 2007). However, deaf students are less likely than their hearing peers to take advanced coursework in high school, such as foreign language or advanced math courses (Nagle et al., 2016). Within the population of deaf students, not all deaf students receive the same opportunities. Studies demonstrate that even when Black and White young deaf students read at similar levels, 16% of the Black students were placed in grade-level classes, in contrast with 58% of White students (Wilkens, 2009). Deaf Black students are also more likely to be placed in special education settings than deaf White students (Kluwin, 1994). Those differential placements may play a role in weakening learning opportunities for Black deaf students and other deaf students of color. Assessments of deaf youth's academic achievement while in secondary school show that White deaf students perform better than Latinx and Black deaf students on passage comprehension, social sciences, and science subtests (Marschark et al., 2015). This speaks more to systemic barriers for deaf youth of color, including potential biases in test development and administration, than to innate abilities . Yet, these assessments are also a key part of the enrollment process for postsecondary education and training, and thus low scores on those assessments limit opportu-

nities for deaf youth of color. The cumulative effects of biases, differential placements, and lower expectations during secondary school impact deaf people's likelihood of enrolling in, and succeeding in, postsecondary settings.

Once deaf people complete high school and enroll in postsecondary institutions, there are multiple complex factors that may contribute to their likelihood of successfully completing the program. Deaf students feel less integrated in the "university family" than their hearing peers do (Foster et al., 1999), and this experience of not being socially integrated in the institution is a strong predictor of leaving college (Stinson & Walter, 1992; Tinto, 1987). The quality of accommodations (e.g., interpreting, real-time captioning, etc.) may be a moderating factor in deaf students' satisfaction with social integration and retention. In a study, 48% of deaf students identified interpreters as a barrier to classroom participation because they were not available or present, not familiar with the content, not visible from the position of the student, or were mismatched in terms of signing modalities between the student and the interpreter (Foster et al., 1999). However, the role of accommodations in the relationship between social integration and retention of deaf students have not been investigated in sufficient depth (see Lang, 2002).

For many marginalized students, receiving a degree or certificate is not the only purpose served by postsecondary education. Formulating one's identity by affiliating with a community is a crucial aspect of the college experience (Maramba & Velasquez, 2012). Developing those community affiliations within higher education institutions is often more challenging for deaf students, particularly those with multiple marginalized identities. Research has shown, for example, that deaf students of color believe there is a shortage of diverse deaf representation within postsecondary settings, even at deaf universities (Parasnis et al., 2005; Stapleton, 2015). In the Stapleton (2015) study, deaf women of color at hearing universities reported feeling that they did not have adequate opportunities to strengthen their racial and ethnic identity affiliations. Overall, these studies show that culturally competent support for deaf college students of color is severely lacking in postsecondary environments (Parasnis et al., 2005; Stapleton, 2015, 2016; Stapleton & Croom, 2017).

Despite these important findings, however, there is a paucity of research on deaf students of color, which results in assumptions about best practices for supporting the success of deaf students being made based on research on predominantly White deaf students. Therefore, educational attainment disparities must be addressed not only for the deaf population as a whole, but also for deaf people who possess multiple marginalized identities. This is a necessary, and highly strategic, approach to reducing economic disparities for deaf people. Within the general population, educational disparities are strongly linked to income inequality across the world (Gregorio & Lee, 2002). Narrowing educational attainment gaps is a key strategy for systemic change to increase equity for deaf people and within deaf communities. In order to do so, it is necessary to understand how educational attainment for deaf people has changed over time, and if the field is moving in the right direction. If not, this is an invitation for growth. This paper explores the following questions:

1. How has the average level of educational attainment among deaf Americans changed over time, between the years of 2008-2018?
   a. How do these trends differ across gender, race, and ethnicity?
2. Have educational attainment gaps between deaf and hearing Americans narrowed over time, between the years of 2008-2018?
   b. How do these changes in attainment gaps differ across gender, race, and ethnicity?

Methods

A secondary analysis of the American Community Survey was conducted to identify trends between 2008 and 2018 in educational attainment for deaf and hearing Americans between the ages of 25 and 65, and the change over time in educational attainment gaps between deaf and hearing Americans. The "hearing difficulty" variable was introduced into the ACS in 2008, thus analyses begin with 2008. We focus on the proportions, over time, of people who completed at least a high school, associate, or bachelor's degree, across gender, race, and ethnicity.

Data Sources

The data for this project were taken from the Public Use Microdata Sample (PUMS) in the 2008-2018 American Community Survey (ACS) conducted by the U.S. Census. The ACS gives us the largest possible representative sample of deaf people in the United States. The PUMS provides a confidential subset of the ACS for the public to analyze. The ACS is a legally mandated questionnaire that is typically used to determine how federal funds are allocated from region to region. The ACS randomly samples homes and group quarters, and gathers data pertaining to their residents. The PUMS dataset includes person-level

weights, designed for estimates of individual-level quantities (such as educational attainment) that generalize to the entire US population or to subsets of interest. These weights account for both the complex sampling scheme as well as non-response. The PUMS also contains a set of 80 replicate weights, to be used in standard error estimation. More information on the ACS can be found at www. census.gov/programs-surveys/acs/about.html.

The sample of interest in these analyses was non-institutionalized people ages 25–64 in the 50 states and Washington, DC. Institutional group quarters include correctional facilities, nursing homes, and mental hospitals. The U.S. Census collects data on functional limitations rather than disability or identity labels, so we used the variable "hearing difficulties" to track deaf people. The survey respondents who stated that they were deaf, or had extreme difficulty hearing, were used to represent the deaf population in these analyses. The final sample of deaf people included more than 39,000 deaf people per year. The comparison group, what we call "hearing people," were those who did not report having any "hearing difficulties." For the most part, the data for the group of hearing people are largely comparable to data for the general population. But for comparison purposes, this analysis focuses on people in the general population who did not report any type of "hearing difficulties," which allows for an understanding of what educational experiences may be unique to the deaf population.

Data Analysis

Estimating Attainment Rates

We used one-year ACS PUMS individual-level data, with person weights, to estimate the proportions of each subpopulation of interest in each year who had attained at least a high school degree, at least an associate degree, or at least a bachelor's degree. To estimate each proportion, we defined an indicator variable that is equal to one for subjects who have attained the educational level in question or higher, and then took the weighted sample mean of that indicator variable among members of the subpopulation of interest, using ACS person weights. We estimated standard errors (shown in Tables 1, 2, and 3) with the successive difference replication method using the person replication weights provided with the PUMS (U.S. Census Bureau, 2018, pp. 12-13).

Analysis of Trends Over Time

Linear regression coefficients regressing the measure of attainment on a linear year variable are used to identify trends over time. True trends are unlikely to be linear; however, the coefficient from the linear model can still be interpreted as the average linear change over the course of the study period (2008-2018). In particular, positive coefficients indicate increasing trends, on average—this would not rule out plateaus or decreasing trends over part of the study period—it refers only to overall averages. Estimated trends adjust for age, since age is a strong predictor of educational attainment, and changes in the age composition of the population may induce changes in average educational attainment, even absent policy relevant effects. Since age predicts educational attainment, in many cases this has the effect of reducing residual error and increasing precision, even if age compositions remained constant.

We estimated trends separately for each education level we considered (high school, associate, or bachelor's degrees, or higher), for deaf and hearing people in each subgroup. Our strategy had two steps. First, we estimated attainment rates, as described above, for each age, 25-64, and subgroup of interest. Let these estimates be denoted as $\hat{p}_{ay}^{dls}$ where the superscript *d* indexes deaf or hearing people, *l* denotes level of education, s denotes subgroup, and subscript *a* denotes age, and *y* denotes year. For instance, $\hat{p}_{35,2013}^{deaf,HS,Latinx}$ would denote the 2013 proportion of deaf Latinx people of age 35 who had at least a high school diploma, and $\hat{p}_{35,2013}^{deaf,HS,All}$ would be the proportion of all deaf people age 35 in 2013 who had attained at least a high school diploma.

Next, we regressed these estimated proportions on age fixed-effects and a linear year term,

$$\hat{p}_{ay}^{dls} = \alpha_{\alpha}^{dls} + \beta^{dls}{}_{y} + \epsilon_{ay}^{dls}$$

using weighted least squares (WLS); we report the trend for deaf or hearing people for education level l in subgroup s is $\hat{\beta}^{dls}$, the estimated coefficient on the linear *y* term. α_{α}^{dls} are fixed effects for each age. Note that within each model, only subscripts *a* and *y* vary; superscripts *d*, *l* and *s* remain constant.

WLS is a variant of the usual ordinary least squares (OLS) model. Whereas OLS estimates coefficients by minimizing the sum of the squared residuals from a model, $\sum_i (Y_i - \hat{Y}_i)^2$, WLS minimizes the weighted sum $\sum_i w_i (Y_i - \hat{Y}_i)^2$. Weights w_i may be chosen to be inversely proportional to residual variances (Aiken, 1935), to maximize precision, or to estimated average slopes for a target population (see Pfeffermann, 1993 for a general discussion of the use of weights in survey regressions). With properly chosen weights, the regression model above is equivalent to an OLS regression on individual-level data, where the dependent variable is a dichotomous indicator

of attainment and the independent variables are the same–fixed effects for age and a linear time trend. Instead, we weighted each observation according to estimated age distribution in the overall U.S. population in 2018, so weights $w_{ay}^{dls} = Prop_{2018}(\alpha) / \sum_{al} w_{ay}^{dls}$ where $Prop_{2018}(\alpha)$ is the estimated proportion of the 2018 U.S. population of age *a*, and the denominator, $\sum_{al} w_{ay}^{dls}$ ensures that the weights sum to one. This choice of weights estimates trends in educational attainment, with the age distribution held constant at the estimated 2018 distribution.

While a multilevel model, which partially pools data across subgroups, has a number of statistical advantages (Gelman et al., 2012), we chose to estimate each trend in a separate model, for two reasons. First, our estimation strategy hews closer to the design principles of the ACS (for instance, in our use of survey weights). Second, our strategy allowed for the straightforward, computationally-feasible two-stage estimation strategy described above. For confidence intervals, and *p*-values, we used heteroskedasticity-consistent standard errors (MacKinnon & White, 1985). Heteroskedasticity-consistent standard errors relax the standard least squares assumption that the variance of regression errors ϵ_{ay}^{dls} is constant across cases. This assumption is particularly suspect in our case. Regression errors ϵ_{ay}^{dls} are composed of two parts: the difference between estimated and true population proportions, $\hat{p}_{ay}^{dls}$ and p_{ay}^{dls}, and the difference between the model's prediction and the true population proportion. Both of these components may vary between age groups or years. Additionally, the dependent variable of the regression is a proportion, which is constrained to be between zero and one; as the model's prediction approaches these limits, the variance of the regression error necessarily changes.

Analysis of Attainment Gaps

Age is an important predictor of deafness, as well as educational attainment. Gaps in attainment between deaf and hearing people, therefore, are typically due to a combination of differences in attainment due to deafness and differences in the distribution of age between deaf and hearing people. Since our interest is in the former, we accounted for age in all estimates of trends in attainment gaps.

To estimate trends in attainment gaps in a particular subgroup s (e.g., African Americans), we first estimated attainment rates for that subgroup for each age, for deaf and hearing people, across all 11 years of the dataset, $\hat{p}_{ay}^{dls}$. We then fit the model:

$$\hat{p}_{ay}^{dls} = \alpha_{\alpha}^{dls} + \beta 1 y + \beta 2 DEAF{:}y + \epsilon_{ay}^{dls}$$

where α_{α}^{dls} is a fixed effect for age-deafness (i.e., 25 years old deaf, 25 years old hearing, 26 years old deaf, etc.), β_1 is the linear trend for hearing people, and the interaction term β_2 represents the trend in the attainment gap between deaf and hearing people (we include the full set of age-deafness fixed effects instead of an intercept and stand-alone term for deafness). As above, we fit this model with WLS, weighting the regression according to 2018 overall age distribution, and estimated confidence intervals and *p*-values using heteroskedasticity-consistent standard errors.

Multiplicity Adjustment and Hypothesis Tests

We conducted hypothesis tests and computed the p-values testing for trends in deaf people's attainment and attainment gaps over time, and corrected these p-values for multiplicity. We conducted multiplicity adjustments separately in our study of achievement trends and in achievement gap trends. We corrected the tests for overall trends in high school, associate degree, and bachelor's degree gaps using the Holm procedure (Holm, 1979). We corrected the p-values for subgroup-specific trends using the Benjamini-Hochberg procedure, which controls the "false discovery rate" (Benjamini & Hochberg, 1995).

To compare trends in attainment or in gaps between males and females, overall and within racial/ethnic groups, we compared the ratio of the difference in estimated trends to the standard error for the difference (computed as $\sqrt{(SE_1^2 + SE_2^2)}$, where SE_1 and SE_2 are the estimated standard errors for the two trends) to a standard normal distribution. To compare trends between racial/ethnic groups, we first conducted an omnibus test for any difference between groups (using the meta-analysis Q-test; Cooper et al., 2010). When this test yielded a significant result, we tested pairwise differences between categories. We adjusted all pairwise tests (between genders and between racial/ethnic groups) using the Benjamini-Hochberg procedure.

All analyses were conducted in R (R Core Team, 2018) using the tidyverse and estimatr packages (Blair et al., 2019; Wickham et al., 2019), and all replication code and more detailed tables of results are available at github.com/nationalDeafCenter/educationalAttainmentTrends.

Results

High School Attainment

From 2008 to 2018, high school completion rates for deaf people grew by roughly 4 percentage points–a rate of 0.5 percentage points per year (PPY) ($p < 0.001$) (Table 1, Figure 1). When the sample was restricted to deaf people ages 25-34, the estimat-

ed trend over time was 0.6 PPY ($p < 0.001$). High school completion trends were similar for deaf men and women, at 0.4 ($p < 0.001$), and 0.5 ($p < 0.001$) PPY, respectively. Trends varied between racial/ethnic subgroups ($p<0.001$): high school completion increased for deaf Latinx (1.1 PPY; $p < 0.001$), African American (0.8 PPY; $p < 0.001$) and White people (0.4 PPY; $p < 0.001$), for both males and females. High school completion increased faster for Latinx than for White, Asian or Pacific Islander, or Native American deaf people ($p<0.01$) and increased faster for African Americans than for white people ($p<0.01$). Estimated trends for other racial and ethnic groups were too imprecise to draw conclusions.

Trends in High School Attainment Gaps

From 2008 to 2018, the age-adjusted hearing-deaf gaps in high school completion narrowed from roughly 7.6 in 2008 to 4.9 in 2018, a trend of roughly -0.27 PPY ($p < 0.001$), where the negative sign indicates a narrowing gap (Table 1). Curiously, this achievement gap trend is not apparent in the 25-34 age group; instead, it appears to have been driven largely by changes in the proportions of deaf, but not hearing, people ages 35-54 reporting high school diploma attainment. The high school gap appeared to narrow more for women (-0.34 PPY; $p < 0.001$) than for men (-0.24 PPY; $p < 0.001$) though the difference in trends is not statistically significant. Nevertheless, as of 2018 the high school completion gap remains higher for women, at 6.13, compared to 3.72 for men. Across race and ethnicity, the high school gap narrowed for White people (-0.3 PPY; $p < 0.001$), and African American people (-0.4 PPY; $p < 0.001$). Among African American people, narrowing the gap appears to be driven largely by African American women, for whom the gap trend was particularly pronounced—0.6 PPY ($p < 0.001$). There was little evidence of different trends between racial and ethnic groups, or within racial and ethnic groups between genders.

Associate Degree Attainment

From 2008 to 2018, associate degree completion rates for deaf people grew by roughly 5 percentage points–a rate of 0.7 PPY ($p < 0.001$) (Table 2, Figure 2). When the sample was restricted to deaf people ages 25-34, the estimated trend over time was 0.8 PPY ($p < 0.001$). Associate degree completion trends were similar for deaf males and females, at 0.6 ($p < 0.001$) and 0.7 ($p < 0.001$) PPY, respectively. Trends were more similar for deaf Latinx (0.6 PPY; $p < 0.001$), deaf African American (0.7 PPY; $p < 0.001$), and deaf White people (0.7 PPY; $p < 0.001$). Estimated trends for other racial and ethnic groups were too imprecise to draw conclusions. Within racial and ethnic categories, trends in associate degree completion were similar between deaf females and deaf males, or were too imprecise to draw conclusions.

Trends in Associate Degree Attainment Gaps

From 2008 to 2018 the age-adjusted hearing-deaf gaps in the proportion of people earning at least an associate degree narrowed from roughly 15.9 in 2008 to 14.6 in 2018, a trend of roughly -0.11 PPY ($p < 0.05$) (Table 2). This trend appears to be driven entirely by changes in in the deaf-hearing associate degree gap for men, which narrowed by approximately -0.29 PPY ($p < 0.001$). The trend in the gap for men was faster than for women ($p<0.01$), which was estimated as 0.01 PPY ($p = 0.87$). Trends in the associate degree gap for age or racial/ethnic categories were mostly too small or measured with too much noise to draw conclusions. One exception is the trend in the gap for White males, which was -0.27 PPY ($p < 0.001$), more pronounced than for White females ($p<0.01$) and comparable to the estimated trends in gaps African American and Latinx males, -0.31 and -0.23 PPY, respectively, which, however, were not statistically significant due to imprecision.

Bachelor's Degree Attainment

From 2008 to 2018, Bachelor's degree completion rates for deaf people grew by roughly 3 percentage points–a rate of 0.5 PPY ($p < 0.001$) (Table 3, Figure 3). When the sample was restricted to deaf people ages 25-34, the estimated trend over time was 0.6 PPY ($p < 0.001$). Bachelor's degree completion trends were somewhat higher for deaf females than males ($p<0.01$), at 0.6 ($p < 0.001$), and 0.4 ($p < 0.001$) PPY, respectively. Trends were similar for deaf Latinx (0.5 PPY; $p < 0.001$), deaf African American (0.5 PPY; $p < 0.001$), and deaf White people (0.5 PPY; $p < 0.001$). Estimated trends for other racial and ethnic groups were too imprecise to draw conclusions. Trends were higher ($p<0.01$) for white women than for white men; comparisons between men and women within other racial and ethnic categories were too imprecise to draw conclusions.

Trends in Bachelor's Degree Attainment Gaps

The trend in the deaf-hearing gap in Bachelor's degree attainment was estimated as -0.05 PPY; this estimate was statistically insignificant ($p = 0.22$). However, the bachelor's degree gap for men did appear to narrow, at a rate of -0.15 PPY ($p < 0.001$). None of the other subgroups we studied exhibited a statistically significant trend at the bachelor's degree gap from 2008 to 2018.

Table 1

Percentage of Deaf People Completing High School or Higher: 2008 to 2018

	Rates (%)		Trends (Percentage Points/Year)	
Grouping	2008	2018	Deaf Attainment	Deaf-Hearing Gap
Overall	80.1 (0.3)	84.2 (0.3)	0.46 (0.03)***	-0.27 (0.03)***
25-34	80.2 (0.9)	85.5 (0.8)	0.56 (0.08)***	-0.08 (0.08)
		Sex		
Male	80.7 (0.3)	84.4 (0.3)	0.44 (0.04)***	-0.24 (0.04)***
Female	78.9 (0.4)	84.0 (0.4)	0.52 (0.05)***	-0.34 (0.05)***
		Race/Ethnicity		
African American	72.3 (0.8)	81.1 (1.0)	0.83 (0.10)***	-0.43 (0.10)***
American Indian	80.4 (1.7)	81.1 (1.8)	0.03 (0.23)	0.18 (0.23)
Asian/Pacific Islander	75.2 (1.9)	78.5 (1.6)	0.36 (0.17).	-0.12 (0.18)
Latinx	57.1 (1.0)	68.1 (1.0)	1.09 (0.10)***	-0.19 (0.10)
Other	82.6 (1.5)	85.2 (1.5)	0.34 (0.16)	-0.02 (0.17)
White	84.4 (0.3)	87.9 (0.2)	0.41 (0.04)***	-0.28 (0.04)***
		Race/Ethnicity: Male		
African American	73.0 (1.2)	81.5 (1.3)	0.72 (0.15)***	-0.28 (0.15)
American Indian	82.5 (1.9)	82.8 (2.0)	0.02 (0.28)	0.23 (0.29)
Asian/Pacific Islander	78.0 (2.1)	80.1 (2.0)	0.36 (0.25)	-0.18 (0.25)
Latinx	58.0 (1.3)	68.5 (1.3)	1.07 (0.13)***	-0.17 (0.13)
Other	84.8 (2.0)	83.6 (2.0)	0.12 (0.21)	0.17 (0.22)
White	84.3 (0.3)	87.6 (0.3)	0.41 (0.05)***	-0.28 (0.05)***
		Race/Ethnicity: Female		
African American	71.5 (1.4)	80.7 (1.3)	1.02 (0.15)***	-0.64 (0.15)***
American Indian	77.4 (3.0)	78.5 (3.4)	0.11 (0.33)	0.07 (0.35)
Asian/Pacific Islander	72.1 (2.7)	76.7 (2.3)	0.31 (0.26)	-0.01 (0.26)
Latinx	55.7 (1.4)	67.7 (1.4)	1.12 (0.15)***	-0.25 (0.15)
Other	79.4 (2.6)	87.5 (2.1)	0.60 (0.27)*	-0.25 (0.28)
White	84.5 (0.5)	88.4 (0.4)	0.41 (0.05)***	-0.27 (0.05)***

Note. Standard errors are in parentheses. All results were computed from the ACS PUMS single year data, with person weights. *$p < .05$. **$p < .01$. ***$p < .001$ (corrected for multiplicity)

Figure 1

High School Degree Attainment 2008-2018

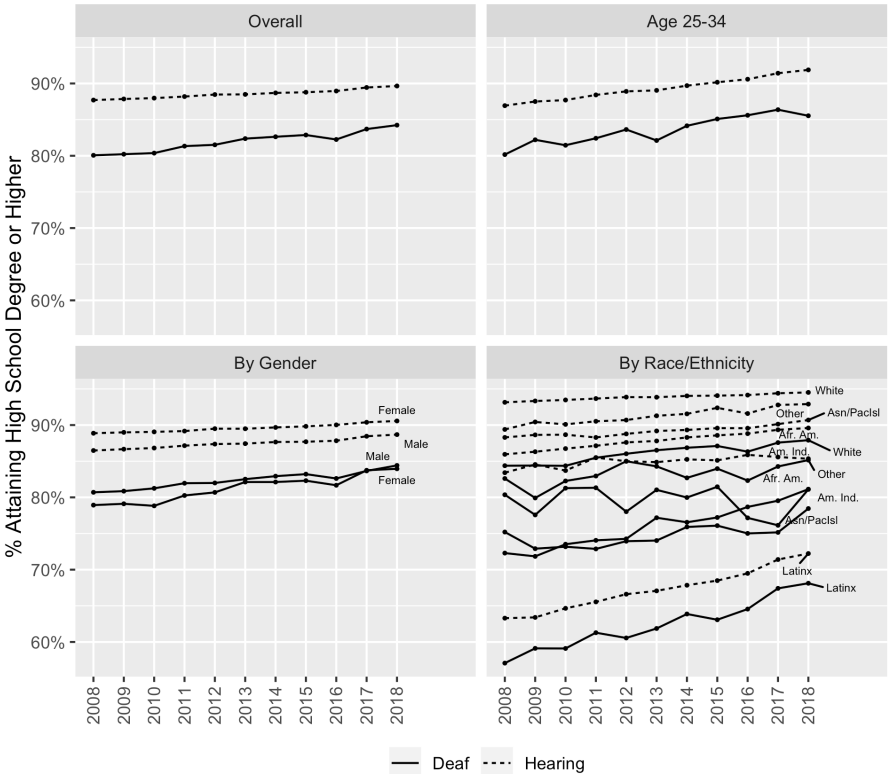


Figure 2

Associates Degree Attainment 2008-2018

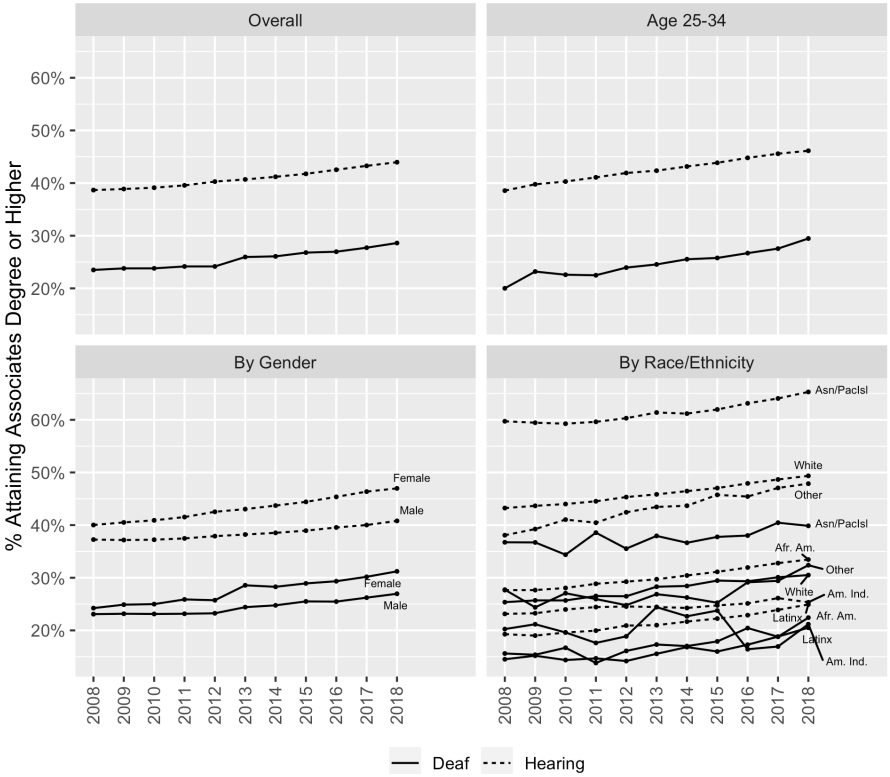


Table 2

Percentage of Deaf People Attaining an Associate Degree or Higher: 2008 to 2018

	Rates (%)		Trends (Percentage Points/Year)	
Grouping	2008	2018	Deaf Attainment	Deaf-Hearing Gap
Overall	23.5 (0.2)	28.6 (0.3)	0.65 (0.04)***	-0.11 (0.05)*
25-34	20.0 (0.9)	29.5 (1.0)	0.77 (0.10)***	-0.03 (0.10)
		Sex		
Male	23.1 (0.3)	27.0 (0.4)	0.62 (0.05)***	-0.29 (0.05)***
Female	24.2 (0.4)	31.2 (0.5)	0.72 (0.06)***	0.01 (0.07)
		Race/Ethnicity		
African American	15.6 (0.9)	22.4 (1.0)	0.71 (0.11)***	-0.09 (0.11)
American Indian	20.2 (2.2)	21.2 (1.9)	0.05 (0.27)	0.19 (0.29)
Asian/Pacific Islander	36.7 (2.3)	39.9 (1.7)	0.37 (0.23)	0.19 (0.23)
Latinx	14.5 (0.7)	20.5 (0.7)	0.59 (0.08)***	-0.05 (0.08)
Other	27.7 (2.1)	32.4 (2.2)	0.50 (0.21)*	0.38 (0.21)
White	25.4 (0.3)	30.5 (0.3)	0.70 (0.05)***	-0.07 (0.06)
		Race/Ethnicity: Male		
African American	15.7 (1.3)	21.6 (1.3)	0.76 (0.14)***	-0.31 (0.14)
American Indian	22.4 (2.9)	18.4 (2.5)	-0.29 (0.32)	0.20 (0.37)
Asian/Pacific Islander	36.3 (2.6)	39.1 (2.5)	0.14 (0.32)	0.27 (0.32)
Latinx	14.4 (1.0)	21.5 (0.9)	0.62 (0.11)***	-0.23 (0.11)
Other	28.5 (2.9)	27.7 (2.4)	-0.15 (0.29)	0.80 (0.30).
White	24.5 (0.4)	28.2 (0.4)	0.67 (0.06)***	-0.27 (0.06)***
		Race/Ethnicity: Female		
African American	15.5 (1.0)	23.4 (1.4)	0.67 (0.16)***	0.12 (0.15)
American Indian	17.3 (3.0)	25.7 (3.1)	0.22 (0.47)	-0.06 (0.52)
Asian/Pacific Islander	37.2 (2.9)	40.6 (2.6)	-0.05 (0.33)	0.75 (0.34)
Latinx	14.7 (1.0)	19.2 (1.0)	0.50 (0.13)***	0.17 (0.13)
Other	26.6 (2.8)	39.8 (3.9)	0.65 (0.34).	0.39 (0.35)
White	27.0 (0.5)	34.4 (0.7)	0.76 (0.07)***	0.11 (0.09)

Note. Standard errors are in parentheses. All results were computed from the ACS PUMS single year data, with person weights. *$p < .05$. **$p < .01$. ***$p < .001$ (corrected for multiplicity)

Table 3

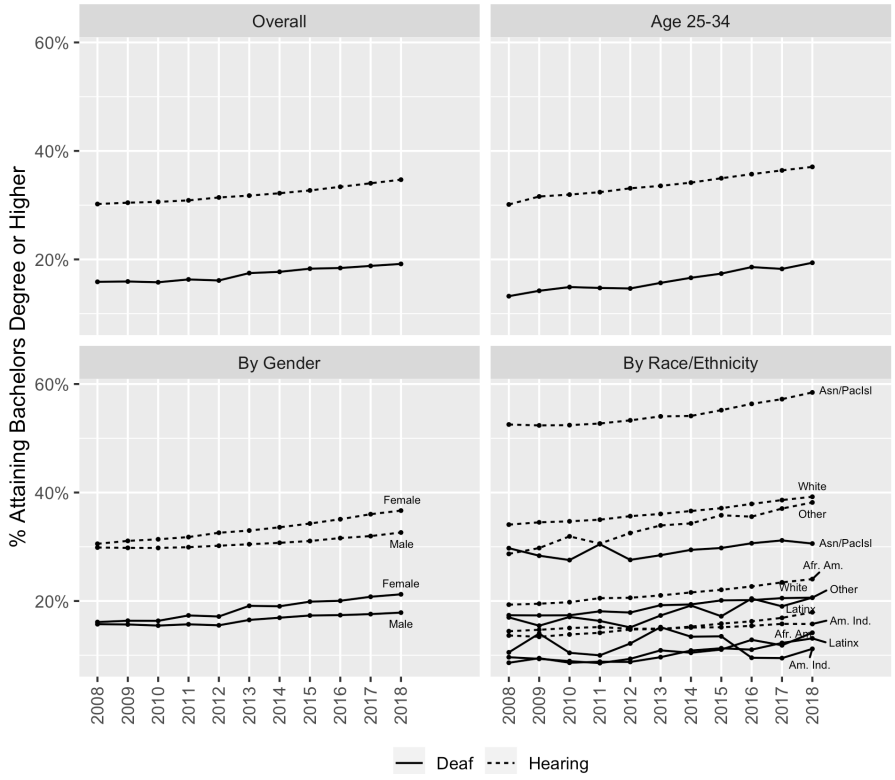
Percentage of Deaf People Attaining a Bachelor's Degree or Higher: 2008 to 2018

	Rates (%)		Trends (Percentage Points/Year)	
Grouping	2008	2018	Deaf Attainment	Deaf-Hearing Gap
Overall	15.9 (0.2)	19.2 (0.3)	0.49 (0.04)***	-0.05 (0.04)
25-34	13.2 (0.8)	19.4 (0.8)	0.59 (0.08)***	0.06 (0.08)
		Sex		
Male	15.7 (0.3)	17.9 (0.3)	0.40 (0.04)***	-0.15 (0.04)***
Female	16.1 (0.4)	21.2 (0.5)	0.62 (0.05)***	-0.01 (0.06)
		Race/Ethnicity		
African American	9.6 (0.8)	14.2 (0.8)	0.52 (0.08)***	-0.04 (0.09)
American Indian	10.5 (1.6)	11.2 (1.7)	-0.09 (0.22)	0.04 (0.29)
Asian/Pacific Islander	29.7 (2.4)	30.6 (1.7)	0.17 (0.21)	0.42 (0.22)
Latinx	8.6 (0.6)	13.1 (0.6)	0.47 (0.06)***	-0.08 (0.07)
Other	17.0 (1.7)	20.6 (1.9)	0.34 (0.18).	0.50 (0.19)
White	17.4 (0.3)	20.6 (0.3)	0.53 (0.04)***	0.00 (0.06)
		Race/Ethnicity: Male		
African American	9.7 (1.1)	13.5 (1.1)	0.44 (0.11)***	-0.13 (0.12)
American Indian	12.1 (2.3)	10.6 (2.1)	-0.35 (0.32)	-0.37 (0.43)
Asian/Pacific Islander	29.7 (2.8)	29.8 (2.4)	-0.13 (0.32)	0.56 (0.32)
Latinx	8.5 (0.8)	13.4 (0.8)	0.45 (0.08)***	-0.18 (0.09)
Other	17.7 (2.4)	17.5 (1.9)	-0.11 (0.28)	0.77 (0.32)
White	17.0 (0.3)	18.9 (0.4)	0.43 (0.05)***	-0.12 (0.05)
		Race/Ethnicity: Female		
African American	9.6 (0.9)	15.0 (1.2)	0.60 (0.13)***	0.00 (0.13)
American Indian	8.3 (1.9)	12.0 (2.6)	0.15 (0.41)	-0.22 (0.59)
Asian/Pacific Islander	29.7 (3.2)	31.4 (2.5)	-0.04 (0.31)	0.80 (0.33)
Latinx	8.8 (0.9)	12.7 (0.8)	0.45 (0.10)***	0.06 (0.10)
Other	15.9 (2.3)	25.6 (3.4)	0.58 (0.31).	0.36 (0.33)
White	18.2 (0.5)	23.6 (0.6)	0.67 (0.07)***	0.07 (0.09)

Note. Standard errors are in parentheses. All results were computed from the ACS PUMS single year data, with person weights. *$p < .05$. **$p < .01$. ***$p < .001$ (corrected for multiplicity)

Figure 3

Bachelors Degree Attainment 2008-2018



Discussion

From 2008 to 2018, educational attainment among deaf people in the United States has steadily increased, with greater numbers of deaf people completing high school, associate, and bachelor's degrees. This is not unexpected; educational attainment has shown steady growth for people in the United States over time (McFarland et al., 2018b; Nettles, 2017; U.S. Census Bureau, 2017). The essential question to ask is if the growth in diploma and degree completion among deaf people is narrowing educational attainment gaps between deaf and hearing people. The answer is complex; what we have learned is that in some cases, the educational attainment gap is narrowing, and in others it is not. Educational attainment gaps between deaf and hearing people are narrowing in high school completion, narrowing to a lesser extent for associate degree completion, and staying stagnant for bachelor's degree completion. High school completion among deaf individuals increased from 80.1% in 2008 to 84.2% in 2018. From 2008 to 2018, associate degree completion increased from 23.5% to 28.6%, while bachelor's degree completion increased from 15.9% to 19.2%. Trends in educational attainment over time also differ across gender and among racial and ethnic groups. In sum, despite optimistic trends of growth over time in educational attainment among deaf populations, that growth is not yet robust enough for deaf people to catch up with educational attainment levels in hearing populations, particularly for deaf people of color.

Across levels of educational attainment, the gaps between deaf and hearing people narrowed the most over time for high school completion, with very little discernible change over time in postsecondary degree completion gaps. There are vast differences between secondary and postsecondary educational systems that may contribute to differences in trends across levels of educational attainment for deaf people. Secondary schools are expected to comply with school accountability systems, compulsory attendance policies, and federal regulations related to ensuring a free appropriate public education and special education services for students with disabilities. These multilayered systems of oversight may mean that there is a greater likelihood for deaf students to successfully complete their education in secondary programs. Postsecondary settings, although obligated to comply with the Americans with Disabilities Act and Section 504, have less oversight in policies and practices related to deaf students' access to educational opportunities. There are far greater chances for deaf students to fall through the cracks in postsecondary settings, whether that happens during the application process or while enrolled. Postsecondary education and training are becoming increasingly more important to stay competitive in the global, fast-paced job market, and deaf people cannot afford to lag behind their hearing peers in postsecondary educational attainment.

Traditionally, many people in the United States who pursue higher education have completed at least a bachelor's degree by the age of 25. Deaf people between the ages of 25 and 34 are demonstrating higher completion rates over time, from 80.2% in 2008 to 85.5% in 2018 for high school completion, from 20% in 2008 to 29.5% in 2018 for associate degrees, and 13.2% in 2008 to 19.4% in 2018 for bachelor's degrees. However, this growth is insufficient to make a discernible impact on educational attainment gaps between deaf and hearing people in this age group. Deaf people are a very long way away from attaining the ambitious goals for postsecondary degree completion set by the U.S. Department of Education (Nettles, 2017), which is particularly salient for young adults. In the United States, this age group, also known as millennials, is highly educated, on average (Frey, 2018). Younger deaf people who are entering the labor force are competing for jobs against their hearing peers who are more likely to have college degrees. In a competitive job market, this means deaf people have even greater barriers to surmount when looking for work.

Deaf women and men are both demonstrating growth in educational attainment over time. However, robust educational attainment trends among women in the general population (McFarland et al., 2018b) indicate that completion rates should be higher among deaf women than they currently stand. Indeed, the high school completion gap between deaf and hearing people is higher for women than for men (6.13% vs. 3.72%, respectively). While deaf women were narrowing the gap in high school completion, they were not doing so for associate or bachelor's degrees. In those cases, deaf men were narrowing the gap. Looking at completion rates among deaf women, while promising, do not give us the full picture. Placing deaf women's educational attainment data in comparison with their hearing female peers, or their deaf male peers, shows us that deaf women are not reaching educational attainment goals commensurate with their peers.

Across gender, race, and ethnicity, demonstrated growth in educational attainment was present for deaf Black, Latinx, and White people across all levels of education. Growth was largest among deaf Black and Latinx people in high school completion, increasing from 72.3% in 2008 to 81.1% in 2018 and 57.1%

in 2008 to 68.1% in 2018, respectively. Black deaf women, in particular, are significantly narrowing the gap in high school completion between Black deaf women and Black hearing women. While demonstrated growth was present among deaf Black and Latinx communities, the educational attainment rates in these communities continue to lag behind national educational attainment data, particularly those of Asian American and White people. Accelerated growth rates are needed in order to narrow the gaps not only between deaf and hearing people, but also within deaf communities. While Asian Americans are the highest educated racial and ethnic group in the deaf community, growth in educational attainment was not visible among deaf Asian Americans and Pacific Islanders, which may be partially due to smaller sample sizes, but is also reflective of large variance in educational attainment within this population.

Despite increasing postsecondary enrollment among deaf young adults from 1990 to 2005 (Newman et al., 2010), policy initiatives established by the U.S. government to encourage degree completion (U.S. Department of Education, 2012), and greater access to a range of postsecondary education and training opportunities for deaf people, educational attainment rates among deaf people have not increased enough to truly level the playing field. Deaf people continue to be underemployed and underpaid in the workforce (Garberoglio et al, 2019), and frequently experience discrimination when applying for work or promotions on the job. Having more postsecondary education and training makes deaf people more competitive in the workplace, and increases available opportunities (Garberoglio et al., 2019). The findings from this study indicate that the field has much more work to do in terms of creating optimal conditions for success for deaf people. Enrollment in postsecondary settings is not enough. Growth in degree completion is not enough. We must see accelerated growth in educational attainment among populations that have historically been marginalized, to truly narrow achievement gaps.

Policy initiatives that are designed to increase educational attainment on a national level (U.S. Department of Education, 2012), while well intended, may be neglecting to address structural inequities that prevent marginalized populations from benefiting from those policies, initiatives, and programs (Nettles, 2017). Educational attainment gaps across the nation are visible across gender, race, ethnicity, and disability. As the population of the United States becomes increasingly diverse, including people with disabilities who expect greater access to education and the workplace, it is essential to address structural inequities while designing and implementing new policies, initiatives, and programs. A focus on overarching goals for educational attainment may only exacerbate gaps for marginalized groups and amplify pre-existing employment, economic, and health disparities among marginalized populations.

Limitations

This study is not without its limitations. We recognize that using broad categories of race and ethnicity misses important data about within-group variability and complexity. For instance, the educational attainment of Asian people in the United States varies widely, often showing a relationship with the country of origin (de Brey et al., 2019, López et al., 2017). Citizenship and immigration status are also linked to educational attainment across race and ethnicity (Everett et al., 2011; Musu-Gillette et al., 2017). However, throughout this paper we try to emphasize that educational attainment gaps across gender, race, ethnicity, and disability are directly linked to systemic barriers that prevent marginalized people from attaining their educational goals, not innate characteristics of individuals themselves (O'Connor & Fernandez, 2006). The second limitation was that sample sizes became increasingly smaller when narrowing the unit of focus, such as when looking at Native American deaf women. Our statistical analyses were conservative; thus, those smaller sample sizes may not have enough power to identify the effects of time on educational attainment. The third limitation is related to the dataset in general, which is designed to capture the broadest possible spectrum of people in the United States, and thus loses important nuance that is needed when discussing deaf people and deaf communities. The American Community Survey does not capture disability-specific characteristics, or features that are unique to the deaf experience such as sign language usage, age of language acquisition, age at onset of deafness, or decibel level (Garberoglio, 2017).

Conclusion

This study aims to shed light on educational attainment gaps across gender, race, and ethnicity within the deaf population. The results from this study can help guide policy decisions and implementation of services that are needed in order to increase educational attainment for deaf people, particularly deaf people of color. The onus of eliminating educational attainment gaps should not fall on deaf people themselves, but on the systems in which they navigate. Educational attainment gaps are an indicator of systemic barriers and failures, not individual deficien-

cies (O'Connor & Fernandez, 2006). Institutional readiness to serve deaf people is as important, if not more so, than individual readiness (Cawthon et al., 2014). Systemic barriers are malleable. Individual characteristics are less so.

Institutional readiness to serve deaf students needs to involve systemic planning and multiple levels of collaboration, both within and between institutions. Schools that are operating with limited resources, particularly for serving a small segment of the student body, can capitalize on creative collaborations with other schools or programs that have more specialized resources or greater capacity to serve deaf students. For instance, schools could consider ways to develop student organizations or other support systems for deaf students that tap into broader community networks outside of the school. Schools must be strategic and intentional when planning strategies for maximizing the educational experiences of deaf students on campus. Deaf students cannot rely on accessing informal opportunities for engagement or gaining information from incidental learning that typically happens on campus between students, or between students and staff. Those opportunities that are part and parcel of the typical hearing student experience are not immediately accessible to deaf students without intentional planning on the part of the institution, or most often happens, on the part of the student. Schools must be proactive in planning accessibility of all events and activities on campus and making the campus community more welcoming of deaf students (Johnson & Fann, 2016). Professionals who are familiar with deaf students, preferably those who are deaf themselves, also seem to be key elements of effective educational experiences for deaf students, including academic advisors (Johnson & Fann, 2016) and mentors (Listman & Dingus-Eason, 2018). In order to improve the educational experiences of deaf students in secondary and postsecondary schools, institutions should aim to make improvements on multiple levels of their system from enrollment, assessment and placement, advising, mental health counseling, academic support services, student life, classroom experiences, and disability services.

Future research can build on preexisting bodies of work that explore the lived experiences of deaf people of color in educational settings, like Black deaf college students (Stapleton, 2015, 2016; Stapleton & Croom, 2017) and Latinx deaf high school students (García-Fernández, 2014). Much more work needs to be done in this area. The vast majority of educational research about deaf people does not account for important within-group differences. Deaf people are not all the same. Educational research, policy, and practice must recognize the systemic barriers, structural inequities, and intersectional oppressions that are experienced by deaf people of color. To eliminate educational attainment gaps between deaf and hearing people, large-scale structural change is needed on multiple levels of the systems in which deaf people navigate. Gradual growth is not enough.

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About the Authors

Carrie Lou Garberoglio received her B.A. degree in humanities from New College of California and Ph.D. from University of Texas at Austin. Her experience includes working as a preschool teacher for deaf children at a bilingual Waldorf school and teaching statistics and research methods at the University of Northern Colorado. She is currently the Co-Director of the National Deaf Center on Postsecondary Outcomes at the University of Texas at Austin. Her research interests include psychological factors involved with transition for young deaf adults, and strategies for mitigating systemic disparities within deaf communities. She can be reached by email at: carrielou@utexas.edu.

Paige Johnson received her B.A. degree in psychology from Gallaudet University and is currently pursuing a doctoral degree in School Psychology at the University of Texas at Austin. She is a graduate research assistant at the National Deaf Center on Postsecondary Outcomes. Her research interests include identifying factors across settings that contribute to and perpetuate outcome disparities in deaf individuals across the lifespan. She can be reached by email at: paige.johnson@utexas.edu.

Adam C Sales received his B.S. degree in physics and mathematics from Johns Hopkins University and Ph.D. in statistics from the University of Michigan. His experience includes working as a high school teacher in Newark, NJ, post-doctoral research at Carnegie Mellon University and the RAND Corporation and statistical consulting at the University of Texas College of Education. He is currently an assistant professor of Mathematical Sciences at Worcester Polytechnic Institute. His research interests focus on causal inference using administrative or high-dimensional data, especially in education research. He can be reached by email at asales@wpi.edu.

Stephanie W. Cawthon received her B.A. and M.A. degrees in psychology from Stanford University and Ph.D. in educational psychology from University of Wisconsin Madison. Her expertise is in accessibility and equity for students with disabilities, with a special focus on deaf students and English learners. She is currently a professor in the Department of Educational Psychology at the University of Texas at Austin. She can be reached by email at: stephanie.cawthon@austin.utexas.edu.