



# Did Apprentices Achieve Faster Earnings Growth Than Comparable Workers?

## Findings from the American Apprenticeship Initiative Evaluation



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### Overview and Key Findings

In 2015, the U.S. Department of Labor (DOL) launched the American Apprenticeship Initiative (AAI) to expand registered apprenticeship in the United States. The brief examines the earnings growth of AAI apprentices compared to the earnings growth for comparable workers during the same period. We limited the sample to apprentices who started their program by 2018 and had a valid Social Security Number so that we could match their earnings records and follow them for 2.5 years after registration. We define comparable workers as workers with earnings records in the U.S. Census Bureau's Quarterly Workforce Indicators (QWI) who have the same sex, race, ethnicity, age, education level, and state residence as AAI apprentices. This brief also describes how the AAI apprentices' earnings growth varied by different demographic and occupational factors. The purpose of these comparisons is not to yield an estimate of the impact of apprenticeship on participant earnings but to provide context for the earnings of AAI apprentices before, during, and up to 2.5 years after entering their programs. While it does not demonstrate impact or effectiveness, the information is useful to policymakers, state and local workforce agencies, and prospective apprentices by showing how apprentice earnings gains compare with comparable workers over the same period. Key findings include:

- AAI apprentices initially earn less than comparable workers, but catch up early in the apprenticeship, and ultimately earn more than comparable workers. AAI apprentices' quarterly earnings increased 43 percent from quarter 4 before the start of the apprenticeship to quarter 10 after starting the apprenticeship, whereas comparable worker quarterly earnings increased by 16 percent, a 27-percentage point difference.

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- Earnings patterns for subgroups of AAI apprentices mirror those for all AAI apprentices. For all demographic subgroups—including men, women, White, Black, and Hispanic apprentices—apprentices began their apprenticeships with lower earnings than comparable workers in the corresponding subgroup, but their earnings increased at a faster pace through the apprenticeship and eventually they earn more than comparable workers.
  - Between 4 quarters prior to the apprenticeship start date and 10 quarters following, women AAI apprentices' quarterly earnings grew at a faster pace (62 percent) than women comparable workers (19 percent), a 43 percentage point difference. Women AAI apprentices' earnings growth also outpaced that of men AAI apprentices (36 percent), suggesting apprenticeship may be a strategy for closing the pay gap.
  - Black and Hispanic AAI apprentices' earnings increased at a faster pace (38 percent and 54 percent, respectively) relative to comparable Black (15 percent) and Hispanic (18 percent) workers. Earnings growth for White AAI apprentices was like that of Black AAI apprentices.
- Earnings for AAI apprentices who were newly hired and those who were incumbent workers increased relative to comparable workers, but the increase was faster for new workers. Between 4 quarters prior to the apprenticeship start date and 10 quarters following, earnings growth for AAI apprentices who were new hires (93 percent) exceeded earnings growth for comparable workers (20 percent). Earnings growth for apprentices who already worked for the employer (incumbent workers) (19 percent) also exceeded growth for comparable workers (13 percent).
- Earnings growth for AAI apprentices increased relative to comparable workers for all occupations, although information technology (IT) and healthcare apprentices experienced faster quarterly earnings growth than did construction and manufacturing apprentices. Between 4 quarters prior to the apprenticeship start date and 10 quarters following, AAI apprentices' earnings grew faster than those of comparable workers in all occupations: IT (95 percent versus 15 percent), healthcare (82 percent versus 21 percent), construction (39 percent versus 16 percent), and manufacturing (27 percent versus 16 percent).



## Introduction

The U.S. Department of Labor (DOL) launched the American Apprenticeship Initiative (AAI) in 2015 to increase registered apprenticeships in occupations outside of construction and expand opportunities to underrepresented populations, including women and people of color.<sup>1</sup> Apprenticeship is a structured work-based training program that combines classroom instruction (related technical instruction, or RTI) with paid on-the-job learning (OJL) provided by a mentor at the employer's worksite. Apprenticeships provide training in a specific occupation and deliver occupational skills that are recognized and transferable across employers. Apprenticeships that are registered with either DOL's Office of Apprenticeship or a federally recognized State Apprenticeship Agency adhere to guidelines around the duration of RTI and OJL (Box 1). A sponsor—often an employer or a consortium of employers—is responsible for the apprenticeship program and maintains the Standards of Apprenticeship, which documents the RTI, OJL, wage increases, and other aspects of the apprenticeship.<sup>2</sup>

Studies of apprenticeship in the United States document strong apprentice earnings growth, especially for participants in registered apprenticeship programs. For example, Reed et al.'s (2012) study of registered apprenticeship in 10 states documents large and statistically significant earnings gains from participation in apprenticeship programs relative to a comparison group of individuals accepted into but who did not participate in an apprenticeship program. Unlike this brief, which uses a group of comparable workers as a reference point, Reed et al. (2012) conducted a rigorous impact study of 21,426 registered apprentices using a matched comparison group. The authors estimated that 6 years after starting an apprenticeship program, earnings of the average apprentice were \$6,595 higher than the earnings of non-participants with the same earnings history and characteristics.

### Box 1: Elements of Registered Apprenticeship

- **Approval** by DOL's Office of Apprenticeship or a State Apprenticeship Agency, or sometimes both
- **Related technical instruction (RTI)** of at least 144 hours in a physical or virtual classroom
- **On-the-job learning (OJL)** of at least 2,000 hours overseen by a mentor at the employer site
- **Wage increases** over the course of the apprenticeship which can be tied to time in the program or to demonstration of skill competency
- An **industry-recognized credential** upon completion of the apprenticeship
- A **Standards of Apprenticeship** document that formally describes the work process schedule (skill standards) and specifies the RTI, OJL, and wage progression for the registered apprenticeship program
- A **sponsor** to oversee the program and maintain the *Standards of Apprenticeship* and basic data on apprentices; sponsors can be employers, consortia of employers, unions, community colleges, state or local workforce agencies, or non-profits
- A **written apprenticeship agreement** between an apprentice and either the program sponsor or an apprenticeship committee acting as an agent for the sponsor

Source: Gardiner et al (2021)

1 With funding from the H-1B user fees paid by employers sponsoring foreign workers on H-1B visas, DOL made five-year awards to 46 grantees to develop new registered apprenticeship programs or expand existing ones in nontraditional occupations (i.e., those outside of construction), including in advanced manufacturing, healthcare, and information technology (IT) and to expand registered apprenticeships to underrepresented populations. In 2020, DOL announced that grantees could apply for an extension of up to 12 months to their five-year grants, through September 30, 2021.

2 For details on Standards of Apprenticeship and regulation of apprenticeship, see <https://www.dol.gov/agencies/eta/apprenticeship/policy/regulations>.

They estimated that over a lifetime, apprentices' earnings are \$98,718 higher than workers in the comparison group and that apprenticeship program completers earn \$240,037 more than workers in the comparison group.

Hollenbeck and Huang (2016) found similar impacts of registered apprenticeship on participant earnings in Washington State relative to a matched comparison group of individuals who entered employment offices and had the same earnings history and characteristics as the apprentices.<sup>3</sup> They found that apprentices' quarterly earnings were \$3,715 higher than the quarterly earnings of the comparison group, with estimated lifetime earnings gains of \$258,676. Dula (2021) replicated these findings in the most recent matched comparison group impact study of workforce programs in Washington State.

Because about two-thirds of these registered apprenticeships are in the construction sector, most of the documented earnings growth reflects the experiences of registered apprentices in this industry.<sup>4</sup> This brief, prepared as part of the DOL-funded evaluation

of AAI, offers evidence on the quarterly earnings patterns of apprenticeships in a range of occupations represented in AAI apprenticeship programs, in the years before, during, and up to 2.5 years after the start of the apprenticeship for most AAI apprentices.<sup>5</sup> This is the first study to track the earnings of such apprentices with reliable data and to examine how their earnings growth differs from the earnings growth of comparable workers.

This brief builds on the AAI outcomes study, which found that five quarters (1.25 years) after their expected apprenticeship end date, the average AAI apprentice experienced earnings growth of \$17,500, or a 50 percent increase over their earnings before the apprenticeship (Walton, Gardiner, and Barnow 2022). It complements the outcomes study analysis by comparing the earnings trends of AAI apprenticeship participants with earnings of workers of a similar age, race, sex, educational attainment, and location (state). Using the same quarterly wage records as the outcomes study, along with data from the U.S. Census Bureau's Quarterly Workforce Indicators (QWI),<sup>6</sup> this brief documents the earnings trends of a sample of AAI apprentices from four quarters (1 year) before entering their apprenticeship through 10 quarters (2.5 years) after their apprenticeship start date.

3 Hollenbeck and Huang's (2016) analysis included 3,424 registered apprentices in 2010 and 2011, 313,660 in the comparison group in those years, 2,974 registered apprentices in 2012 and 2013, and 175,456 in the comparison group in those years.

4 See industry breakdown in "Federal Data: Active Apprentices by Industry for Fiscal Year 2018" at [https://www.doleta.gov/oa/data\\_statistics2018.cfm](https://www.doleta.gov/oa/data_statistics2018.cfm).

5 The AAI Evaluation included three other sub-studies: an implementation study, an employer return on investment study, and an assessment of an employer engagement strategy. The evaluation included 45 grantees because one grant ended prior to the start of data collection for the AAI evaluation.

6 QWI data can be accessed at: <https://www.census.gov/data/developers/data-sets/qwi.html>.



The brief answers the following research questions:

1. How do earnings trends for all AAI apprentices vary relative to comparable workers?
2. How do earnings trends for AAI apprentices vary by gender, race, and ethnicity, and how do these trends differ from the earnings trends of comparable workers?
3. How do the earnings trends for AAI apprentices differ between incumbent workers<sup>7</sup> and new workers and how do their earnings trends differ from the earnings trends of comparable workers?
4. How do earnings trends for AAI apprentices vary by occupation, and how do earnings changes within occupations differ from the earnings trends of comparable workers?

The findings yield new evidence on how the earnings growth experienced by registered apprentices in nontraditional occupations compare with earnings trends of comparable workers. The remaining sections of this brief first describe the data used and analysis methods for this brief. The brief then provides context for the findings by summarizing other studies of apprentice wage gains. Next, it presents findings by research question. It concludes with implications of the findings.



<sup>7</sup> Incumbent workers are defined as apprentices who were already employed by the employer who operated the apprenticeship program prior to beginning their apprenticeship.

## Data and Methods

Assessments of the net impact of training programs on participant earnings compare earnings gains associated with the training to the costs of the programs, including tuition and foregone earnings during training (the loss in earnings sometimes experienced during program enrollment when participants are not working). Researchers often use an impact study design to estimate the gain in earnings attributable to a program. Such a study calculates the difference between the earnings trajectories of randomly assigned program and control groups.<sup>8</sup> The AAI evaluation does not include an impact study, thus observed earnings gains cannot be attributed solely to the apprenticeship program. Still, the data collected for the outcomes study yields valuable information about the trajectory of AAI apprentice earnings compared to earnings paths of comparable workers.

This brief draws on three data sources: the DOL's Apprenticeship Quarterly Performance Report (Apprenticeship QPR); the U.S. Department of Health and Human Services, Office of Child Support Enforcement's National Directory of New Hires (NDNH)<sup>9</sup>; and the U.S. Census Bureau's Quarterly Workforce Indicators (QWI). The Apprenticeship QPR consists of data submitted by grantees to DOL that describe the pre-program characteristics and in-program experiences of AAI apprentices. The QWI was selected for this analysis because both the NDNH and the QWI compile the same administrative wage records reported by employers to state Unemployment Insurance programs, which states then report to the federal government. One difference is that the QWI measures earnings of workers for their primary job only (thus omitting any additional jobs), while the NDNH data include earnings from all jobs held during the quarter.

We use the NDNH to measure quarterly earnings for AAI apprentices. We used individual-level data with detailed characteristics for all AAI apprentices in the Apprenticeship QPR to match apprentices to their NDNH earnings records. For the purposes of this brief, we limited the sample to apprentices who started their program by 2018 and had a valid Social Security Number so that they could be matched to their earnings records for an extended period. These criteria brought the total sample to about 3,800 apprentices. The matched NDNH data allowed us to track earnings growth throughout the course of an apprenticeship, as well as post-apprenticeship earnings for those who completed their apprenticeships during the follow-up period.

To contextualize the earnings changes that AAI apprentices experience, we compare the apprentice's quarterly earnings over time to average quarterly earnings of comparable groups of workers of a similar age, educational attainment, race and ethnicity, sex, and state using QWI data. This source includes information from all states and thus constitutes a quarterly state-level panel dataset covering the employment and earnings of nearly all workers in the country.<sup>10</sup>

The QWI provides tabulations at the state level of earnings records separately by age and sex, educational attainment and sex, and race and ethnicity. To derive quarterly earnings for the comparable workers, we match all three QWI earnings files with the Apprenticeship QPR data

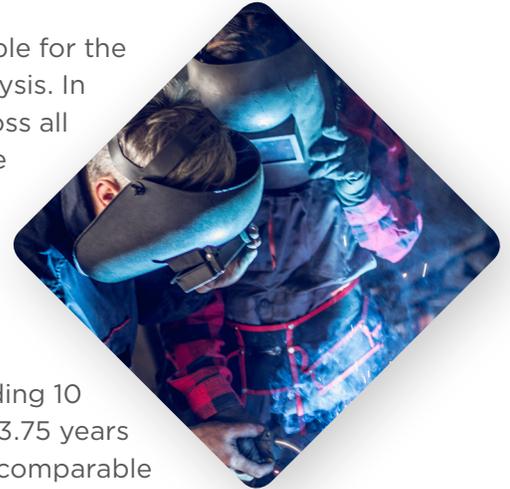
8 Impact studies commonly assign, at random, applicants to a group that can access the training (program group) and a group that cannot, but this group can access other resources in the community (control group). Differences in earnings between the groups is attributed to the program.

9 More information on NDNH data can be accessed at: <https://www.acf.hhs.gov/css/training-technical-assistance/overview-national-directory-new-hires>.

10 The QWI data is built from state unemployment insurance records and information on federal workers reported by the Office of Personnel Management. Jobs not covered by the unemployment insurance system will not be included in the QWI data.

based on the apprentice's state, age, sex, educational attainment, and race and ethnicity.<sup>11</sup> While these characteristics do not change in the Apprenticeship QPR data, we match apprentices to progressively older workers in the QWI earnings files as the apprentices age over the study period. For example, an apprentice aged 22 years old in the year before entering the apprenticeship would be matched to a QWI group in the same age category for that year. As the apprentice ages (e.g., to 24), the QWI comparable group would change to an older group in subsequent years. We calculated the earnings of comparable workers as the average of quarterly earnings for workers in the three matched QWI earnings files.

One shortcoming of these comparisons is that the NDNH data is available for the same cohort of apprentices over the 4-year period included in this analysis. In contrast, the data on comparable workers in the QWI are averages across all workers matching the AAI apprentices' characteristics at a point in time but do not track a single cohort of workers. The QWI data, therefore, provide what is referred to as a "synthetic cohort" comparable to the longitudinal data collected on apprentices, a synthetic group of controls using cross sections that change as the apprentice sample ages.<sup>12</sup>



For each calendar quarter beginning 4 quarters (1 year) before and ending 10 quarters (2.5 years) after the apprenticeship start date (15 quarters, or 3.75 years in total), we compare the earnings of AAI apprentices with earnings of comparable workers. The data allow us to observe wage growth over time, and how the amount and pace of that growth may differ for apprentices and comparison workers. For apprentices entering programs lasting more than 2.5 years, earnings through quarter 10 after the start date may reflect in-program earnings.

Since QWI earnings data are available only for those with an earnings record, we restricted the AAI apprentice sample to apprentices who had positive quarterly earnings in a quarter, excluding apprentices who were not employed during a quarter. All apprentices were employed during their enrollment quarter because registered apprentices are paid employees. As a result, the earnings levels reported in this brief represent average earnings for employed apprentices.<sup>13</sup> This also means that the sample size varied by quarter depending on whether apprentices were employed in each quarter. If apprenticeship increases participants' quarterly earnings both by increasing their hourly wage rate and by reducing their probability of unemployment, our analysis understates that earnings growth for apprentices.

The data match with NDNH included quarterly earnings through the end of 2020. Since the sample includes AAI apprentices entering programs by the end of 2018, some apprentices had post-entry earnings data for only 8 to 10 quarters after enrollment in their apprenticeships. For this reason, we limited the follow-up period to 10 post-enrollment quarters. In addition to not providing an impact estimate for AAI apprentices, this method is limited by the fact that the QWI only reports average wages for individuals who work in a quarter and does not include comparable individuals who did not work. This restricted us to only comparing the earnings of employed workers and not all individuals.

<sup>11</sup> The purpose of a matched group of comparable workers is to show what apprentices might have earned in the absence of the apprenticeship. Since apprentices could and did work in a variety of occupations and industries before the apprenticeship program, we do not constrain comparable workers to have the same industry and occupation as the apprenticeship training. The QWI does include industry information but does not include information on occupations.

<sup>12</sup> See Deaton (1985) for a detailed discussion of the synthetic cohort method, its strengths, and its drawbacks.

<sup>13</sup> In contrast, the earnings outcomes reported in the Outcomes Study report (Walton, Gardiner and Barnow 2022) include apprentices with zero earnings.

## AAI Apprentice Earnings Growth Findings

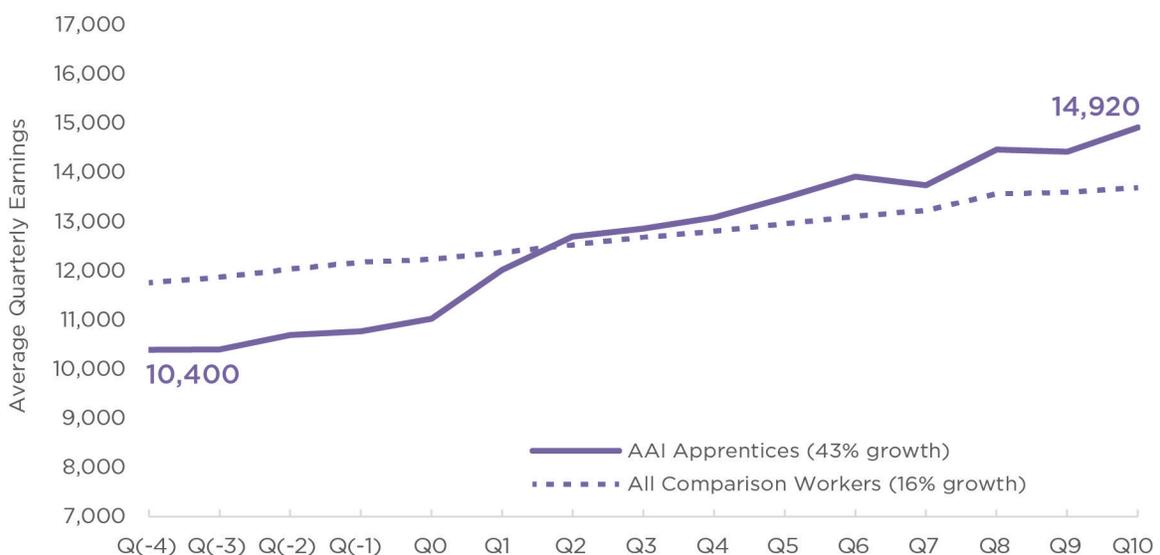
The section presents earnings growth for AAI apprentices relative to comparable workers. As noted above, these comparisons help to put apprentice wage levels and trajectories in context, but they do not provide causal impact estimates. This section also explores growth rates between subgroups of apprentices. The section is organized by research question.

### RQ1. How do earnings trends for all AAI apprentices vary relative to comparable workers?

- **AAI apprentices earn less than comparable workers in the year before their apprenticeship program, but quickly catch up with and surpass the quarterly earnings of comparable workers after the second quarter after the start of their apprenticeship.**

AAI apprentices initially earn less than comparable workers, but they more than catch up during the apprenticeship (Exhibit 1). As shown, comparable workers earned about \$1,300 more per quarter than AAI apprentices in quarter 4 before the apprenticeship start date. However, the AAI apprentices started closing the earnings gap soon after the start of the apprenticeship. The fact that AAI apprentice earnings increased by 16 percent relative to the 5 percent increase of comparable workers between quarter 4 prior to the apprenticeship and quarter 1 after starting the apprenticeship suggests that apprentices did not lose earnings from their participation in apprenticeship, as is common in other training programs where participants may forgo paid employment during training.

**Exhibit 1: Average Quarterly Earnings Trends of AAI Apprentices and Comparable Workers, Four Quarters Pre-Enrollment through Ten Quarters Post-Enrollment**



Source: American Apprenticeship Initiative (AAI) Apprenticeship QPRs matched to National Directory of New Hires (NDNH) earnings records and Quarterly Workforce Indicators (QWI) data on workers with similar age, race, sex characteristics and state. N=3,734 AAI apprentices in the first quarter after the starting quarter who had positive quarterly earnings. Each AAI apprentice has its own comparison worker average from the QWI. Quarters are numbered in reference to Q0, which is the calendar quarter that the AAI apprentice begins their apprenticeship. AAI apprentice Q(-4) and Q10 wages are labeled.

By 2.5 years (10 quarters) after entering the apprenticeship, the AAI apprentices earned about \$1,000 more on average per quarter than comparable workers (\$14,920 compared to \$13,694). Average quarterly earnings of the AAI apprentices rose by 43 percent from 1 year before entering the apprenticeship until 2.5 years after starting. In contrast, the earnings of comparable workers increased by only 16 percent during the same period.

- **The fastest period of earnings growth for AAI apprentices is during the first two quarters of their apprenticeship program.**

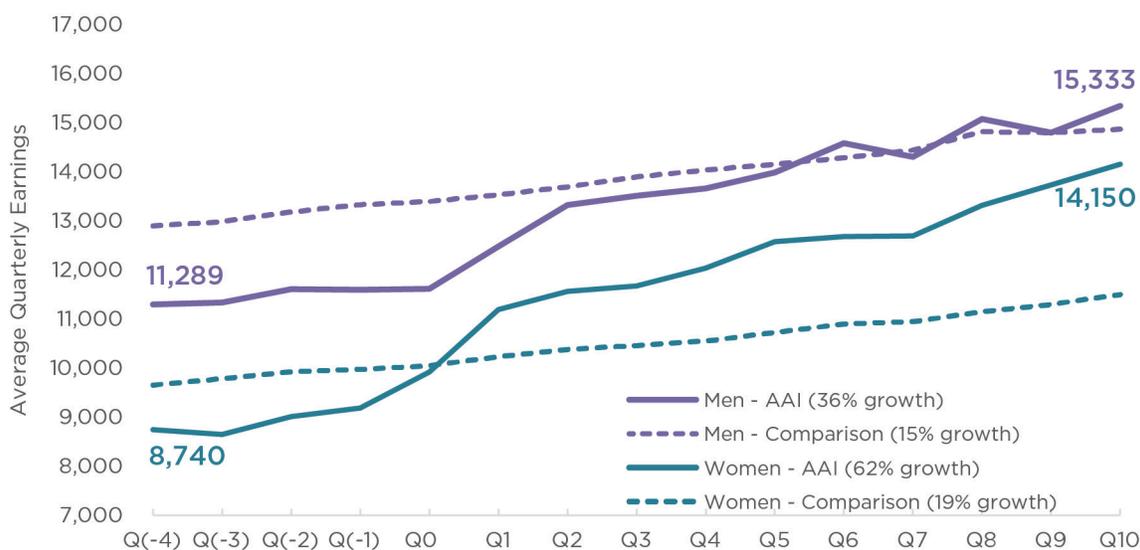
Exhibit 1 shows a steep increase in the quarterly earnings of AAI apprentices occurs during the first two quarters after entering the apprenticeship. Between quarter 0 and quarter 2, AAI apprentices' earnings increased 15 percent (from \$11,026 to \$12,701), compared to 2 percent (from \$12,235 to \$12,531) for comparable workers. From that point onwards, apprentice earnings outpace the earnings of comparable workers, and continue through quarter 10 after the start of the apprenticeship, at which point AAI apprentices earned 9 percent more than comparable workers (\$14,920 versus \$13,694).

## RQ2. How do earnings trends for AAI apprentices vary by gender, race, and ethnicity, and how do these trends differ from the earnings trends of comparable workers?

- **Both women and men AAI apprentices experienced higher earnings growth than comparable workers who are men. Women AAI apprentices had higher growth than men AAI apprentices.**

The general earnings patterns for demographic subgroups of AAI apprentices mirror those for all apprentices. As Exhibit 2 shows, between quarter 4 prior to the apprenticeship start

**Exhibit 2: Average Quarterly Earnings Trends for AAI Apprentices and Comparable Workers, by Gender, Four Quarters Pre-Enrollment through Ten Quarters Post-Enrollment**



Source: American Apprenticeship Initiative (AAI) Apprenticeship QPRs matched to National Directory of New Hires (NDNH) earnings records and Quarterly Workforce Indicators (QWI) data on workers with similar age, race, sex characteristics and state. N=2,419 men and N=1,312 women AAI apprentices in the first quarter after the starting quarters who had positive quarterly earnings. Each AAI apprentice has its own comparison worker average from the QWI. Quarters are numbered in reference to Q0, which is the calendar quarter that the AAI apprentice begins their apprenticeship. AAI apprentice Q(-4) and Q10 wages are labeled.

and quarter 10 following it, women AAI apprentices (solid blue line) achieved larger earnings growth than comparable women workers (dashed blue line): 62 percent versus 19 percent, or a 43 percentage point difference. As with all AAI apprentices, the biggest gains for women AAI apprentices occurred at the start of the apprenticeship itself. During the first quarter, their earnings were 28 percent higher than their earnings four quarters before starting (\$11,187 versus \$8,740). Women AAI apprentices outpaced comparable women workers during quarter 1 and continued to do so throughout the observation period. By quarter 10, women apprentices earned nearly \$2,700 more than comparable women workers.

For men AAI apprentices (purple solid line), most of the earnings gains relative to the comparable workers (dashed purple line) occurred after the apprenticeship started. Between quarter 0 and quarter 6 after starting their apprenticeship, men AAI apprentices' quarterly earnings grew 26 percent, while comparable workers' earnings grew 7 percent. From quarter 6 onwards, men AAI apprentices and comparable workers had similar quarterly earnings.

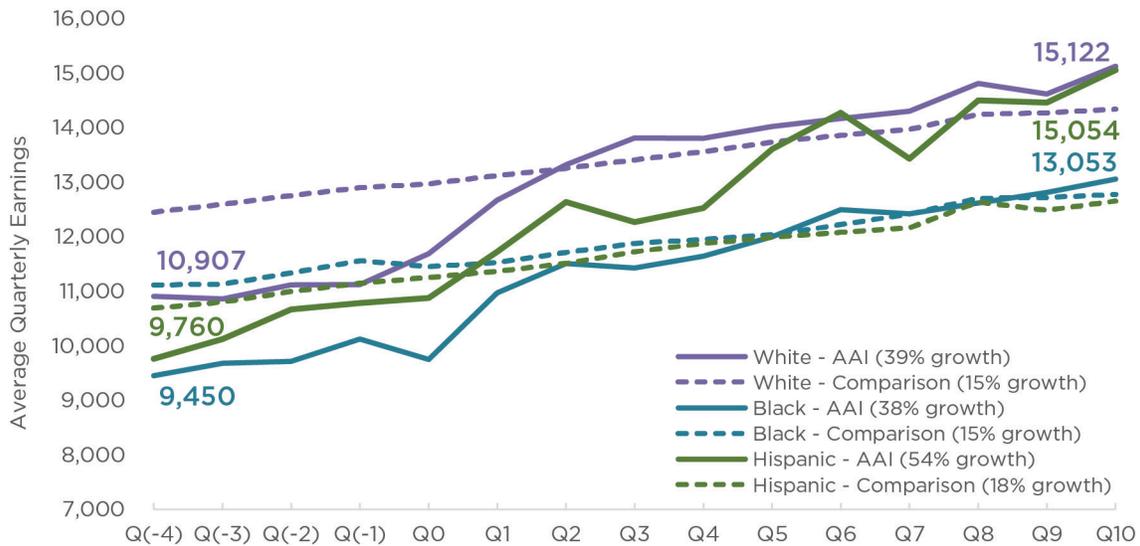
Although both women and men AAI apprentices experienced earnings growth, women AAI apprentices' earnings growth exceeded that of men AAI apprentices' earnings growth by 26 percentage points between four quarters prior and 10 quarters after enrollment (62 percent versus 36 percent).

The pay gap between women and men AAI apprentices closed substantially by quarter 10 after the start of the apprenticeships. In quarter 4 prior to starting their AAI apprenticeship, women AAI apprentices' quarterly earnings were 77 percent of men AAI apprentices' average. Two and a half years after the start of their AAI apprenticeships, women AAI apprentices' average quarterly earnings were 92 percent of the average earnings of men AAI apprentices. The relative earnings gains for women AAI apprentices might suggest that registered apprenticeship is a potential strategy for closing the gender pay gap, although a causal impact study would strengthen this inferential claim.

- **All AAI apprentices, regardless of race and ethnicity, experienced larger earnings gains than comparable workers.**

Overall, AAI apprentice earnings gains relative to comparable workers were higher for Hispanic workers than for White or Black workers from four quarters before the apprentices' enrollment to 10 quarters after (Exhibit 3). Hispanic AAI apprentices' (green solid line) quarterly earnings increased 54 percent from quarter 4 prior to the apprenticeship start date and 10 quarters following, compared to 18 percent for comparable Hispanic workers (green dashed line), a 36 percentage point difference. Quarterly earnings growth was about the same for Black (blue solid line) and White (purple solid line) AAI apprentices (38 and 39 percent, respectively) and their respective comparable workers (both 15 percent), a 23 percentage point difference. Hispanic AAI apprentices start earning more than comparable workers as soon as the apprenticeship begins, whereas White AAI apprentices do so starting in quarter 2, and Black AAI apprentices in quarter 5. AAI apprentices of other races and ethnicities and other underrepresented populations are not discussed here because of restricted sample sizes. These apprentices are discussed in more detail in Walton, Gardiner, and Barnow (2022).

### Exhibit 3: Quarterly Earnings Trends for AAI Apprentices and Comparable Workers, by Race and Ethnicity, Four Quarters Pre-Enrollment through Ten Quarters Post-Enrollment



Source: American Apprenticeship Initiative (AAI) Apprenticeship QPRs matched to National Directory of New Hires (NDNH) earnings records and Quarterly Workforce Indicators (QWI) data on workers with similar age, race, sex characteristics and state. N=1,727 white, N=732 Black, and N=569 Hispanic AAI apprentices in the first quarter after the starting quarters who had positive quarterly earnings. Each AAI apprentice has its own comparison worker average from the QWI. Quarters are numbered in reference to Q0, which is the calendar quarter that the AAI apprentice begins their apprenticeship. AAI apprentice Q(-4) and Q10 wages are labeled.

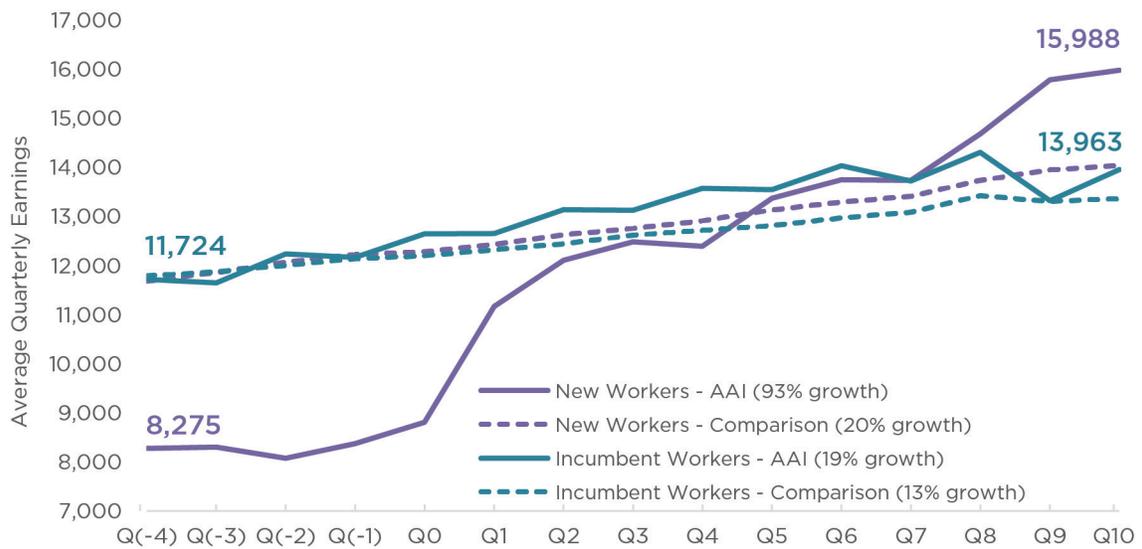
### RQ3. How do the earnings trends for AAI apprentices differ between incumbent workers and new workers and how do their earnings gains differ from the earnings gains of comparable workers?

- **New hire and incumbent worker AAI apprentices had higher earnings growth relative to the earnings growth of comparable workers. New hire AAI apprentices had much higher earnings growth than incumbent worker AAI apprentices.**

Often, employers use apprenticeship to upgrade the skills of their existing (incumbent) workers (Gardiner et al. 2021). Slightly more than half of AAI apprentices (53 percent) are incumbent workers. As Exhibit 4 shows, AAI apprentices of new and incumbent workers had strikingly different earnings trajectories.

At quarter 4 before the apprenticeship start, new worker AAI apprentices (solid purple line) had average quarterly earnings of \$8,275, or almost \$3,500 less per quarter than did comparable workers, who earned an average of \$11,687 in that quarter (dashed purple line). By quarter 10 after entering the apprenticeship, new worker AAI apprentices earned almost \$2,000 more per quarter than comparable workers earned. New worker AAI apprentices experienced a 93 percent growth in earnings between quarter 4 prior to the apprenticeship start date and quarter 10 after starting the apprenticeship, while comparable workers' earnings grew 20 percent during that period, a difference of 73 percentage points.

### Exhibit 4: Average Quarterly Earnings Trends for New Worker and Incumbent AAI Apprentices and Comparable Workers, Four Quarters Pre-Enrollment through Ten Quarters Post-Enrollment



Source: American Apprenticeship Initiative (AAI) Apprenticeship QPRs matched to National Directory of New Hires (NDNH) earnings records and Quarterly Workforce Indicators (QWI) data on workers with similar age, race, sex characteristics and state. N=1,697 new worker and N=2,016 incumbent worker AAI apprentices in the first quarter after the starting quarters who had positive quarterly earnings. Each AAI apprentice has its own comparison worker average from the QWI. Quarters are numbered in reference to Q0, which is the calendar quarter that the AAI apprentice begins their apprenticeship. AAI apprentice Q(-4) and Q10 wages are labeled.

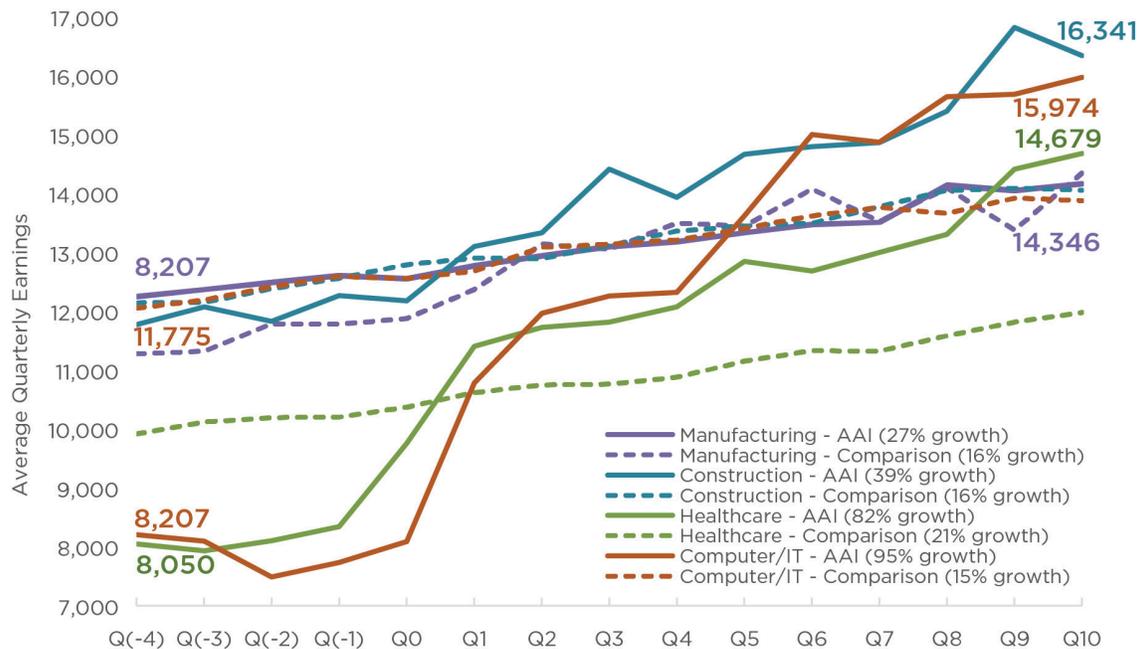
Incumbent worker AAI apprentices (solid blue line) have similar earnings to comparable workers (dashed blue line) prior to the apprenticeship start date. Incumbent worker AAI apprentices achieved higher earnings growth than comparable workers, especially in quarters 1 through 8 after the apprenticeship began. Over the full period observed (quarter 4 prior to starting the apprenticeship through 10 quarters after), incumbent worker AAI apprentices' earnings increased 19 percent, while those for comparable workers increased 13 percent, a difference of 6 percentage points. Relative to new worker AAI apprentices, incumbent worker apprentices had slower earnings growth (93 percent versus 19 percent) and earned about \$2,000 less than new workers in quarter 10.

#### RQ4. How do earnings trends for AAI apprentices vary by occupation, and how do earnings changes within occupations differ from the earnings trends of comparable workers?

- AAI apprentices in all occupations had higher earnings growth relative to comparable workers. Earnings growth was faster for information technology (IT) and healthcare AAI apprentices relative to manufacturing and construction AAI apprentices.

The earnings gains of AAI apprentices varied widely across occupations, but on average, AAI apprentices in all occupations experienced faster growth in earnings than comparable workers during the period studied (Exhibit 5). In particular, healthcare and IT apprentices had the lowest quarterly earnings prior to starting their apprenticeship, but experienced the fastest earnings growth.

## Exhibit 5: Average Quarterly Earnings Trends for AAI Apprentices and Comparable Workers, by Occupational Group, Four Quarters Pre-Enrollment



Source: American Apprenticeship Initiative (AAI) Apprenticeship QPRs matched to National Directory of New Hires (NDNH) earnings records and Quarterly Workforce Indicators (QWI) data on workers with similar age, race, sex characteristics and state. N=1,527 manufacturing, N=232 construction, N=678 healthcare, and N=375 information technology AAI apprentices in the first quarter after the starting quarters who had positive quarterly earnings. Each AAI apprentice has its own comparison worker average from the QWI. Quarters are numbered in reference to Q0, which is the calendar quarter that the AAI apprentice begins their apprenticeship. Data labels are excluded to avoid crowding. The average AAI manufacturing quarterly earnings in Q(-4) was \$12,253 and in Q10 was \$14,161. The average AAI construction quarterly earnings in Q(-4) was \$12,141 and in Q10 was \$14,055. The average AAI healthcare quarterly earnings in Q(-4) was \$9,916 and in Q10 was \$11,976. The average AAI information technology quarterly earnings in Q(-4) was \$12,055 and in Q10 was \$13,878.

Healthcare AAI apprentices (green solid line) begin to earn more per quarter than comparable workers (green dashed line) starting in the first quarter of the apprenticeship. By quarter 10 after the apprenticeship start date, healthcare AAI apprentices' earnings increased 82 percent from quarter 4 prior to the apprenticeship, while comparable workers' earnings increased by 21 percent during this period. By quarter 10, healthcare AAI apprentices earned \$2,700 more than comparable workers (\$14,679 in average quarterly earnings compared to \$11,976).

IT AAI apprentices (orange solid line) began earning more than comparable workers (orange dashed line) in quarter 5 after starting their apprenticeship, and continued to earn more in subsequent quarters. By quarter 10, IT AAI apprentices earned almost \$2,100 more than comparable workers. IT AAI apprentices experienced a 95 percent growth in earnings between quarter 4 prior to the apprenticeship start and quarter 10 following the start, while comparable workers' quarterly earnings increased by 15 percent, a difference of 80 percentage points.

Much of the earnings growth for IT AAI apprentices and healthcare AAI apprentices occurred early in the apprenticeship. IT apprentices and healthcare apprentices experienced 31 percent and 42 percent increases in earnings, respectively, from the period before the apprenticeship to the first quarter of the apprenticeship.

Construction AAI apprentices (blue solid line) and manufacturing AAI apprentices (purple solid line) had faster earnings growth from quarter 4 prior to their apprenticeships through quarter 10 after starting their apprenticeships than did comparable construction workers (blue dashed line) and manufacturing workers (dashed purple line): 39 percent and 27 percent, respectively. The lower gains for AAI apprentices registered in manufacturing and construction occupations is associated with the higher earnings of workers prior to entering apprenticeships in these fields. Another factor that may explain the differential earnings gains of manufacturing and construction apprentices is that relative to IT and healthcare apprenticeships, which are about 1.4 years in duration, manufacturing and construction AAI apprenticeships are longer, on average (2.8 years and 3.4 years, respectively) (Walton, Gardiner, and Barnow 2022). Thus, the 2.5 years post enrollment follow-up period captures the in-program earnings for most manufacturing and construction apprentices.

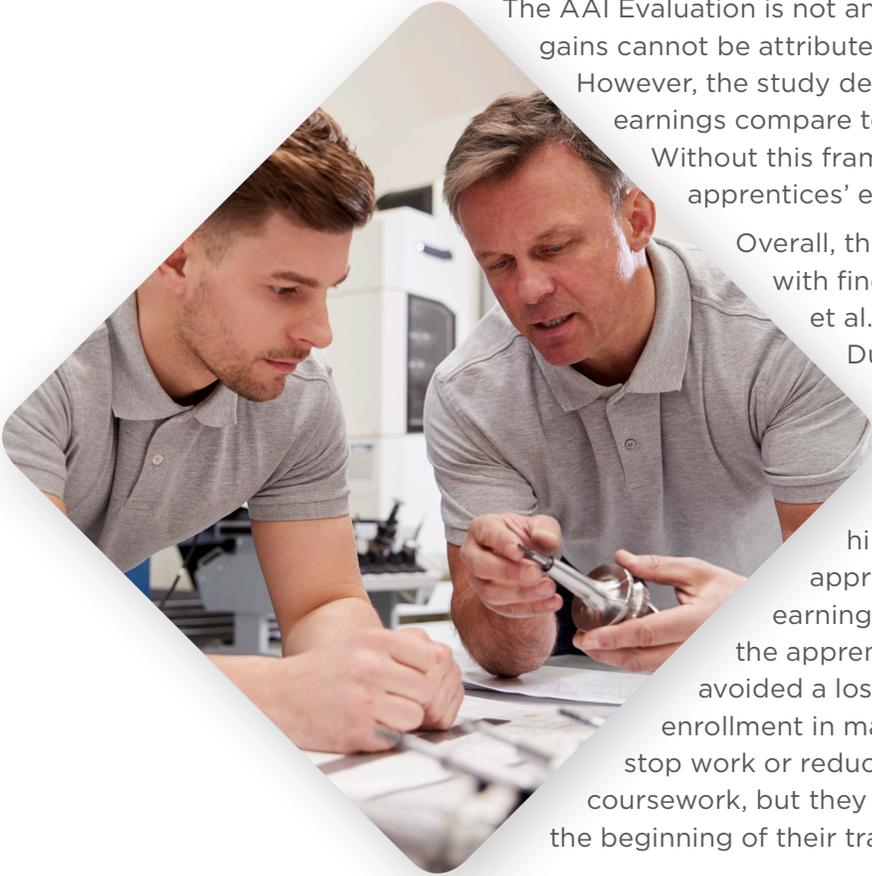


## Implications of Findings

The analysis of AAI outcomes study data yields important insights about the wage growth experienced by a sample of AAI apprentices. This brief documents AAI apprentices' earnings before and after the apprenticeship relative to comparable workers, including for demographic and occupational subgroups. The results capture the timing as well as the absolute and relative levels of earnings gains among subgroups of apprentices. Key findings are:

- Nearly all AAI apprentice subgroups experienced a sharp increase in earnings from a year before the start of their apprenticeship and early in their apprenticeship, and through the tenth quarter after the start of the apprenticeship. The observed trends align with the apprenticeship model, in which apprentices earn a lower wage at the start of their apprenticeship, when they have not mastered competencies, and experience earnings gains during the apprenticeship itself, in line with regular wage increases as apprentices master occupational skills (Lerman 2019). For most subgroups, AAI apprentices earned less than comparable workers before the apprenticeship, caught up during the apprenticeship, and often saw more rapid growth in earnings than comparable workers by 10 quarters following the start of the apprenticeship. Only incumbent workers and construction apprentices had earnings as high as comparable workers during the quarters prior to the apprenticeship.
- AAI apprentices newly hired by the employer and AAI apprentices in IT occupations (regardless of incumbency status) achieved the largest increases in apprenticeship earnings (93 percent and 95 percent, respectively). Comparable workers to the IT AAI apprentices saw gains in earnings of only 20 percent and 15 percent, respectively (Exhibit 5). New worker and IT apprentices had lower earnings than comparable workers a year before their apprenticeships. Apprentices in both subgroups showed no sign of catching up with comparable workers before the apprenticeship and had lower earnings in the second quarter before their apprenticeship than they did four quarters before their apprenticeship. Both subgroups experienced an increase in earnings in the quarter at which they entered; over the first four quarters (first year) after entering, the apprentices' earnings caught up with those of comparable workers. In subsequent quarters, both newly hired apprentices and IT apprentices experienced more rapid growth in earnings than did comparable workers.
- Examining earnings over 15 quarters (the four quarters prior to the apprenticeship and 10 quarters following the start quarter) reveals insights not always captured by comparing two points in time. For example, AAI apprentices experienced large earnings gains at the time of apprenticeship enrollment, and steady but more modest gains during the apprenticeship itself. After 2 years, the steady growth in earnings for the full sample of apprentices began to level off, as shown in Exhibit 1.

- Relative earnings trends differ by ethnicity but not by race. Both White and Black AAI apprentices had earnings well below comparable workers in the four quarters prior to apprenticeship, reached parity with them soon after the apprenticeship begins, and then kept pace with comparable workers. In contrast, Hispanic apprentices also saw an increase in earnings with the start of the apprenticeship and continued to outpace comparable workers through the 10 quarters after enrolling in an apprenticeship (Exhibit 3).
- A follow-up period of 10 quarters (2.5 years) after enrollment in an apprenticeship is too short for judging the post apprenticeship earnings of manufacturing and construction apprentices, which typically last 2.8 and 3.4 years, respectively (Walton, Gardiner, and Barnow 2022). Additionally, given the relative lengths of apprenticeship programs, the earnings of manufacturing and construction apprentices through quarter 10 reflect their in-program earnings, whereas the observation period is long enough to capture post program earnings for healthcare and IT apprentices, which typically last 1.2 and 1.4 years, respectively (Walton, Gardiner, and Barnow 2022). This suggests the potential value of a longer-term outcomes or impact study of registered apprentices.



The AAI Evaluation is not an impact study. Therefore, earnings gains cannot be attributed solely to the apprenticeship.

However, the study demonstrates how AAI apprentices' earnings compare to the earnings of comparable workers. Without this frame of reference, it is difficult to place apprentices' earnings experiences in context.

Overall, the results of this analysis are consistent with findings from impact studies (e.g., Reed et al. 2012; Hollenbeck and Huang 2016; Dula 2021) indicating high returns to apprenticeships. What is most striking is the earnings increase in the initial quarters following apprenticeship enrollment for workers who are newly hired by their employer. These AAI apprentices experienced the highest rate of earnings growth during the initial quarters of the apprenticeship. These apprentices not only avoided a loss in earnings often associated with enrollment in many training programs, as participants stop work or reduce their hours to accommodate coursework, but they increased their earnings even during the beginning of their training.

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## About This Brief

Funded by the H-1B visa program, the U.S. Department of Labor (DOL) American Apprenticeship Initiative (AAI) supported 46 grantees across the country to expand registered apprenticeship into new sectors, such as healthcare, and to populations underrepresented in apprenticeships. The grants originally operated from October 2015 to September 2020, and grantees could request an extension of up to 1 year (through September 2021). In 2016, DOL commissioned an evaluation of the AAI grants to build evidence about the effectiveness of registered apprenticeship for apprentices and employers. This brief examines in detail the earnings gains of AAI apprentices relative to non-apprentices with similar characteristics. The key data sources are earnings records from the U.S. Department of Health and Human Services, Office of Child Support Enforcement's National Directory of New Hires, program records from the DOL Apprenticeship Quarterly Performance Report, and earnings data from the U.S. Census Bureau's Quarterly Workforce Indicators.

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