Working Paper

Digitalization, Automation, and Older Black Women: Ensuring Equity in the Future of Work

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Abstract

Older Black women have always worked outside the home despite limited occupational opportunities. In 1940 more than three-fourths of Black women worked as either private household workers or farm laborers. Since then, Black women have increased their educational attainment and moved in large numbers into clerical and professional occupations. Despite these advances, Black women aged 40 and older remain concentrated in a small number of occupations—almost half of older Black women work in just 20 occupations out of more than 400. Many of the occupations that older Black women work in are disproportionately low wage occupations. Automation and other technologies threaten many of the jobs older Black women work in including low wage jobs, middle-skill jobs that pay well but do not require a bachelor's degree and professional jobs that require a bachelor's degree or more. The risks of automation threatens to increase economic inequality—either through the growth of low-wage occupations where older Black women are disproportionately employed, or by increasing the risk of automation or digital skills substituting for workers in middle-skilled and professional occupations. Older Black workers are trying to keep up with the digital skills, technological, and educational requirements necessary for the future of work but these efforts are resulting in increased student loan debt—especially for older Black women—but not necessarily better jobs or earnings.

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INTRODUCTION: Black Women in the Labor Market and the Threats and Promises of Automation

Black women have always worked outside the home despite limited occupational options, and their labor – paid and unpaid—has been central to the health and stability of their families and their communities. Goldin (1977) reports that as far back as 1890 Black women's labor force participation was more than twice as high as their White counterparts. White women had a labor force participation rate of 16.3 percent compared with 39.7 percent for non-White women, the vast majority of whom were Black women.[1] Even among married women, White women's labor force participation rate was just 2.5 percent while for married non-white women it was 22.5 percent (Goldin 1977). Black women's labor force participation rates remain the highest of women from any of the largest racial and ethnic groups, and in in 2017 was 60.3 percent compared with 56.4 percent for White and Hispanic women (Bureau of Labor Statistics 2018).

Despite their high labor force participation, Black women have historically been concentrated in a small number of occupations with low pay and poor working conditions. For example, in 1940 more than three-fourths of Black women worked as either private household workers or farm laborers (Cunningham and Zalokar 1992; King 1992). After the passage of the 1964 Civil Rights Act (CRA), which explicitly banned discrimination in hiring, pay, training, and promotions based on race, ethnicity and/or sex by large employers, Black women moved into a range of new occupations including clerical jobs where most workers did not need postsecondary educational credentials and the jobs paid relatively well, especially compared with the alternatives available to Black women (King 1993). Black women also increased their representation in professional occupations (Alonso-Villar and del Rio 2017, King 1993).

In spite of these gains, Black women of all ages remain concentrated in a small number of occupations and, unfortunately, many of the workers in these occupations may be at risk of displacement by technological change. Automation, artificial intelligence, and digitalization have spread rapidly over the last few decades, eliminating some jobs and changing the nature of work in others while also increasing the returns to digital skill; these trends are projected to accelerate substantially during the coming decades (Manyika et al 2017a, Muro 2017). While experts in the field produce conflicting predictions about how technology will impact job growth, there is a clear consensus that highly skilled and better educated workers will likely fare better in the future of work while those workers with less education and fewer skills face a greater risk of being replaced by automation (Autor 2015, Chen 2017, Frey and Osborne 2013).

[1] According to the US Census Bureau <https://www.census.gov/population/www/documentation/twps0076/twps0076.html>, Appendix Table A-1, in 1890 the US population was 87.5 percent White, 11.9 percent Black, 0.4 percent American Indian, Eskimo, and Aleut, 0.2 percent Asian and Pacific Islander, and the share of Hispanic origin is not available.

Irrespective of the technological potential to replace tasks through technology, it is likely that the need for digital skills will increase, including in fields such as care work that currently have very low levels of digitalization (Muro et al 2017; Hegewisch, Childers, and Hartmann 2019).

This paper focuses on the ways that automation, increased digitalization, and other technological changes between 2000 and 2016 may have impacted the employment and earnings of older Black women workers and how changes that are projected for the future are likely to impact them and their families. This paper highlights the importance of older Black women's employment and earnings for their future and for their family's future. Because Black women are less likely than their White and Asian counterparts to have an associates or bachelor's degree (Hess et al. 2015), they are potentially more vulnerable to replacement by technology. Black women also have substantial caregiving responsibilities which can make it difficult for them to obtain more education and training. Older Black women may also be more at-risk of being replaced by automation/AI than younger Black women because they have been out of school longer and may be less familiar with current technology. At the same time Older Black women are often social and economic anchors within their families and communities ensuring there will be wide-ranging impacts of their displacement. Yet, if older Black women are provided with opportunities and access to the training and education needed for the new jobs of tomorrow, this can also have large impacts on their families and communities.

Key research on automation, digitalization, and the future of work are reviewed, the degree to which increased automation and digitalization have impacted the employment and earnings of older Black women is assessed, and, to the extent possible, occupational projections and assessments of the current technological ability to replace human workers with technology are applied to the occupations of women and men by race, ethnicity, and age to better understand the degree of risk facing different groups of workers. Given the growing importance of postsecondary education for access to good jobs, the paper discusses the costs and benefits of obtaining college level education and provides data on older Black women's exposure to student debt. Finally, this paper lays out some basic policy proposals that can make the transition to the future of work smoother for all workers while ensuring that the process does disproportionately harm any particular group of workers. The paper will begin with a review of the important role of Older Black women for their families and communities.

Older Black Women are Social and Economic Anchors in Their Families and Communities

Older Black Women Provide Critical Economic Support to Their Families

Older Black women without a college degree are concentrated in low wage jobs but they still often serve as social and economic anchors in their families and communities. Table 1 below shows that in 7 of the 20 most common occupations for older Black women—comprising 15.1% of all employed older Black women—their earnings are below the poverty level for a family of four ($24,563 in 2016; Semega, Fontenot, and Kollar 2017). In just six of older Black women's 20 most common occupations are they paid more than the median earnings for all employed women, $41,554, and five of these typically require a bachelor's degree or more for entry. While the share of Black women with a bachelor's degree is increasing, they remain less likely than their White counterpart to hold an advanced degree—25.7 percent of Black women 25 and older hold a bachelor's degree compared with 38.3 percent of White women (National Center for Education Statistics 2018).

Table 1. Almost Half of Black Women Aged 40 and Older Are Concentrated in Just 20 Occupations

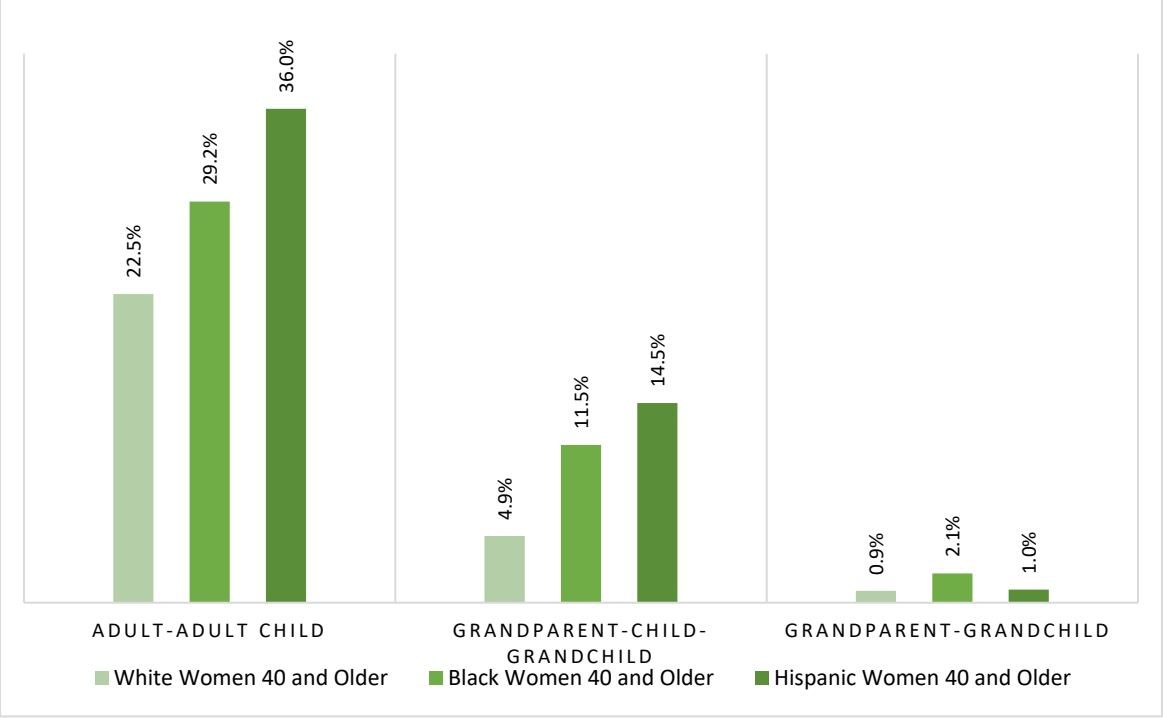
	Number of Black Women 40+	% of Employed Black Women 40+ in the Occupation	% of All Employed Women 40+ in the Occupation	Median Full-Time, Year-Round Earnings for Black Women 40+	Typical Education Required for Entry
Nursing, psychiatric, and home health aides	337,440	7.3%	2.4%	$27,403	Some college
Registered nurses	185,308	4.0%	4.4%	$69,015	Bachelor's degree
Secretaries and administrative assistants	174,192	3.8%	5.6%	$38,567	High school
Elementary and middle school teachers	144,235	3.1%	4.3%	$50,746	Bachelor's degree
Personal care aides	140,588	3.1%	1.8%	$23,296	High school
Maids and housekeeping cleaners	124,962	2.7%	2.4%	$20,999	No formal credential
Customer service representatives	123,630	2.7%	2.0%	$34,999	High school
Licensed practical and licensed vocational nurses	111,920	2.4%	1.1%	$40,515	Some college
Childcare workers	95,034	2.1%	1.5%	$23,296	High school
Cashiers	92,829	2.0%	1.9%	$23,140	No formal credential
Miscellaneous managers, including funeral service managers and postmasters and mail superintendents	91,125	2.0%	2.5%	$70,902	Bachelor's degree
Janitors and building cleaners	86,881	1.9%	1.5%	$22,999	No formal credential
Cooks	82,623	1.8%	1.3%	$19,999	No formal credential
Social workers	82,329	1.8%	1.0%	$45,580	Bachelor's degree
Office clerks, general	75,020	1.6%	1.6%	$35,451	High school
Teacher assistants	67,911	1.5%	1.5%	$23,296	Some college
Accountants and auditors	66,986	1.5%	1.9%	$55,821	Bachelor's degree
Retail salespersons	64,671	1.4%	2.0%	$27,348	No formal credential
First-line supervisors of office and administrative support workers	62,733	1.4%	1.5%	$48,618	High school
First-line supervisors of retail sales workers	57,870	1.3%	1.9%	$35,522	High school
Total for all occupations	4,603,839	49.3%	44.0%	$42,999	

Note: Earnings are for women working at least 50 weeks per year and 35 hours per week. Black women are non-Hispanic.

Source: IWPR Automation and the future of work database; for methodology and sources see Appendix A.

The most common occupations for older Black women show that a substantial proportion of them work in professional occupations with decent earnings, such as nurses, teachers, management, and accountants. Yet, as discussed above, many of these occupations are low-skilled and have low earnings. Even with such low earnings, Black women are the primary or co-breadwinner in 81 percent of households with children (Anderson 2016).[2] Black women also often have especially substantial caregiving responsibilities—one in six live with someone ages 15 or older with a disability (DuMonthier et al., 2017). Older Black women may have even more caregiving responsibilities as many have sole or shared responsibility for the care of their grandchildren (Baugh, Taylor, and Bates 2016, Grossman and Webb 2016, Smith-Ruiz 2008). Figure 1 shows that just over two percent of older Black women have their grandchild living with them while another 11.5 percent have both their adult child and their grandchild living in the same household. Figure 1 also shows that older Hispanic women are even more likely than older Black women to have their adult children in the same household but are only half as likely to have sole responsibility for their grandchildren.

Figure 1. Women Aged 40 and Older with Adult Children and Grandchildren Living in the Same Household, 2016



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes.
Source: IWPR Analysis of American Community Survey Data from the Integrated Public Use Microdata Series.

[2] Breadwinner here is defined as bringing in 40 percent or more of household income. This includes single mothers and married mothers whose income is crucial to the economic wellbeing of the family.

Therefore, if older Black women are displaced in the labor market, the loss of earnings have the real potential to impact their children and grandchildren in a myriad of ways including meeting basic needs such as housing, food, clothing, and transportation, as well as broader needs such as ensuring they obtain a quality education. Meeting these needs is crucial not just from a justice perspective but because meeting them or not will have real implications for the ability of the children and grandchildren to contribute to the economy as adults.

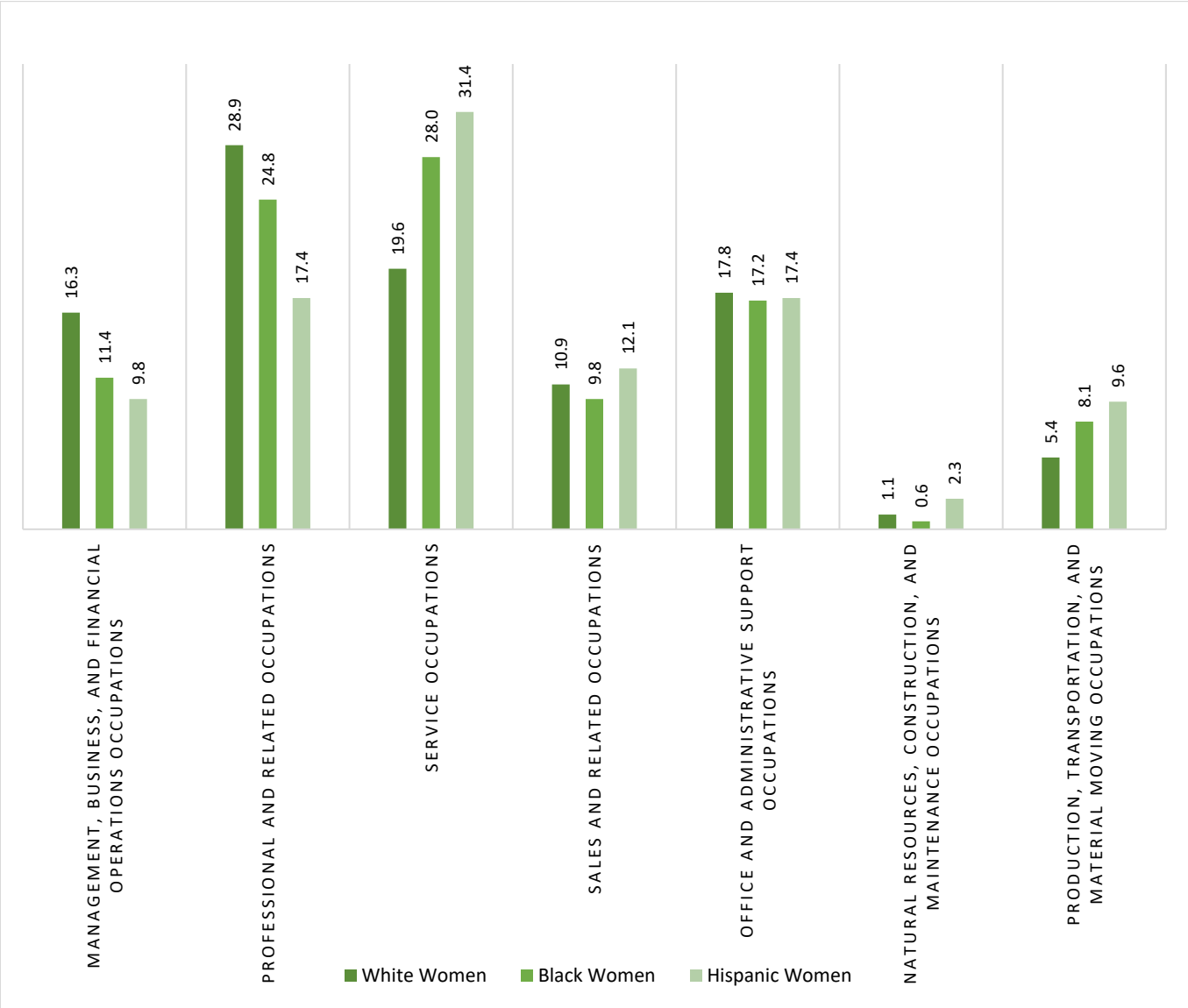
Many Women, Especially Black and Hispanic Women, Will Be Insecure in Retirement

While it is important to focus on the potential impacts that technology and automation will have on Black women's families and what that means for the economy and the society of the future, it is also important to understand what this will mean for working Black women themselves when they retire. Generally, economic security in retirement depends on a three-legged stool of personal savings, employer-provided retirement benefits in the form of a pension, and social security.[3] Black women start with lower earnings than their White counterparts. Black women working full-time, year-round earn just 79 percent of their White female counterpart's median annual earnings ($36,735 compared with $46,513) and just 61 percent of White male's median earnings ($60,388; Hegewisch 2018). Hispanic women fare even worse earnings just $32,001, just 53 percent of White male earnings. Because women earn less than men, especially Black and Hispanic women, they are less able to build substantial personal savings.

In terms of employer-provided retirement benefits, the jobs that many Black and Hispanic women are concentrated in do not provide workers with access to pension plans. Figure 2 shows that more Black and Hispanic women work in service occupations than any other broad occupational group. Data from the National Compensation Survey show that in service occupations just 47 percent of workers even have access to either a defined benefit or defined contribution plan and just 30 percent participate in one of these plans. Office and administrative support occupations are somewhat better with 60 percent of workers participating in a retirement plan. Professional and related occupations do provide many more of their workers with retirement benefits—71 percent of all workers in these jobs participate in a pension plan and for specific detailed occupations such as school teachers 82 percent participate.

[3] This includes both defined benefit pensions (the benefit workers will receive after retirement is defined when the employee joins the plan and benefits are guaranteed, ensuring the worker and his/her family a stable source of income) and defined contribution accounts (employer and employee contribute to the account with the employer often matching, up to a point, the contribution of the employee; benefits are not guaranteed). While defined benefit pensions plans were once common, today only about 20 percent of workers have them as employers increasingly shift to defined contribution plans (Morrissey 2016, Wiatrowski 2012).

Figure 2. Black and Hispanic Women Disproportionately Work in Service Jobs



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes.
Source: IWPR compilation of data from the U.S. Bureau of Labor Statistics Bureau of Labor Statistics 2019a.

That leaves many older women, especially Black and Hispanic women relying solely on social security during retirement. Relying on social security alone will leave too many of today's workers economically insecure, even more so for Black and Hispanic women (Fischer and Hayes 2013).

Black and Hispanic women also have little wealth, in part due to their lower pay, to help them weather economic downturns or help provide security in retirement (Shaw et al. 2019). The Black-White wealth gap is much larger than the wage gap—median White wealth is twelve times higher than that for Black households ($134,000 compared with $11,000; Gould 2017). The wealth gap was exacerbated by the Great Recession when Black and Hispanic families lost much of the wealth—the median wealth of Black middle-class families fell by 47% and the wealth of Hispanic middle-class families fell by 55% (Jones 2017; Kochhar and Cilluffo 2017). Older Black workers may face an even more difficult situation. Fifty-two percent of Black seniors are economically insecure—they are unable to meet their basic day-to-day needs—and 83 percent do not own enough assets to last them for the remainder of their lives. This means that when older Black and Hispanic women reach retirement they must rely on their children or other family members, effectively undermining their children's ability to build wealth and maintaining the cycle of inequality and economic insecurity (Meschede, Sullivan, and Shapiro 2011).

Black women are also less likely to be able to build personal savings because Black women's social networks have fewer resources embedded in them—their friends and relatives have fewer economic resources compared with their White counterpart—often forcing working Black women to stretch the resources they do have to help provide economic support to friends and family who are more likely to ask for a gift or loan. This helping behavior increases as their income rises (O'Brien 2012). Together, these facts diminish Black women's ability to build an economic safety net to meet their own basic needs or prepare for their future. Eighty-three percent of Black seniors do not have enough assets to meet their needs throughout retirement (Guzman and Vulimiri 2015).

Automation, and the Future of Work: What the Experts Say

Automation, artificial intelligence, and digitalization are on-going processes that are eliminating some jobs, creating new and different jobs, and changing the nature of work in others while also increasing the returns to digital skill; these trends are projected to accelerate substantially during the coming decades (see for example Autor 2015, Frey and Osborne 2013, Manyika et al. 2017a,b; Muro et al. 2017). According to some experts, technological advances will increase productivity and will displace workers, especially those in predictable jobs with routine tasks (Autor, Levy, and Murname 2003; Brynjolfsson and McAfee 2011; Frey and Osborne 2013). While lower skilled occupations are particularly likely to be threatened by displacement, workers in white collar and creative jobs are also at risk of losing their jobs to automation or artificial intelligence because while these jobs involve high levels of knowledge, they often also involve substantial levels of data processing and routine analysis, tasks that are particularly prone to technological substitution as AI develops. These experts point to the sheer speed at which technology is advancing and the number of tasks that were thought to be beyond automation that computers now match or exceed human abilities to do including image and speech recognition, natural language processing, and predictive analytics (Brynjolfsson and McAfee 2011; Brynjolfsson, Mitchell, and Rock 2018). Schwab (2016) argues that these transformations are happening at a speed that is unmatched historically and that it constitutes a fourth industrial revolution that is evolving at an exponential pace.

Frey and Osborne (2013), based on detailed task descriptions from the O*Net database and a panel of technological experts, calculate the potential for an occupation's tasks to be automated. They found that, given current technology, 47 percent of total US jobs have a 70 percent or higher potential for automation over a 10- to 15-year timespan.

These predictions have caused some in the media and among policy-makers and experts to express serious concerns about the future of work. While there is general agreement that automation, robotics, and machine learning will have large impacts on the jobs of tomorrow, other experts take a more optimistic view of these impacts. These experts focus on the potential of automation to complement human labor and increase output which, in turn, should increase the demand for labor and create more jobs (Autor 2015). He argues that increases in productivity in one industry can increase demand in other industries due to increased household income, thereby increasing the number of jobs in, for example, restaurants, haircare, and even personal service. Researchers in this camp view automation as eliminating the mundane parts of work and freeing workers up to focus on the creative, interactive, problem-solving parts of their jobs. They show that historically women's work has particularly benefitted from a shift towards less routine work (Black and Spitz-Oener, 2010).

Much of this work breaks jobs down into different tasks and assess the degree to which those tasks can be automated. According to research by Manyika et al. (2017a), less than 5 percent of

U.S. occupations are fully automatable using technology available today but at least 60 percent of occupations have at least 30 percent of their activities that could technically be automated. They divide work tasks into seven types of activities that workers perform and estimate what share of a worker's time is spent doing that activity. They rank three types of activities as having a high potential for automation: predictable physical work, data processing, and data collection. They estimate that together these activities account for more than half (51 percent) of all performed work hours. The remaining four types of activity have a much lower potential for automation and include unpredictable physical work, interfacing with stakeholders (personal interactions), applying expertise (decision making, planning, and creative tasks), and managing people. Based on this analysis they estimate that 46 percent of work hours in the United States—the equivalent of 61 million full-time jobs—have the potential for workers to be displaced by automation or artificial intelligence by 2030.

Thus, the more an occupation's job duties are collecting data, processing data, or involves predictable physical activities, the higher the potential for automation. For example, in management occupations they estimate that just 20 percent of the worker's time is spent on activities that could be automated—processing and collecting data—while in Office and Administration occupations (Secretaries and Administrative workers is the third most common occupation for older Black women, as shown in Table 1 above) they estimate that 64 percent of a worker's time is spent in highly automatable activities. In the financial services and insurance sector, where many office and administrative workers are employed, Manyika et al. (2017a) estimate that these workers spend 50 percent of their time collecting and processing data—insurance sales agents gather consumer or product data, securities and financial sales agents prepare sales and other contracts, and bank tellers verify the accuracy of financial data—all activities that robotic process automation technology can do much more quickly.

Yet, projections about the disappearance of occupations have often been wrong. Jobs have changed in response to technology rather than the jobs disappearing completely. Bank tellers, for example, spent most of their time taking deposits and cashing checks before the ATM was introduced in the 1970s (Bessen 2015). After ATMs became common in the 1990s, according to Bessen (2015), tellers became part of the "relationship banking team" focusing on those aspects of their jobs that could not be automated such as forming relationships with small business customers and selling them financial services and products. Recent data, however, suggests that the occupation is now declining in response to further changes in the banking sector (Hegewisch, Childers, and Hartmann 2019).

Just as tasks within occupations may change, so the mix of occupations in the economy will also change. Manyika et al. (2017b) project that by the year 2030 between 400 and 800 million people globally could be displaced by automation and other technology. They expect many of these workers, between 75 to 375 million of them, to have to move into new occupations. In the U.S. these workers will be displaced from office support jobs, food serving, hotel, and travel workers, jobs that disproportionately employ Black workers without a B.A. degree, but also

including ‘accountants and auditors’, one of the most common occupations for Black women 40 and older (See Table 1 above). They will need to prepare for jobs that are growing like educators, managers and executives, and technology professionals, all jobs that require at least some postsecondary education. This will require workers to gain new skills. In the U.S. alone they estimate that up to one-third of the 2030 workforce might need to learn new skills for a new occupation.

The Impact of Digitalization and Automation on Older Black Women's Employment and Earnings from 2000 to 2016

There has been a substantial increase in the use of digital technology and automation in occupations over the last two decades, a trend that research indicates accelerates during economic downturns such as the Great Recession (Hershbein, and Kahn 2017). For example, Muro et al. (2017) found that the digitalization score increased in 517 of 545 detailed occupations between 2002 and 2016. While online shopping remains a small share of all retail sales, the share of shopping done online has increased substantially over the last 20 years, more and more people have shifted their banking to mobile banking, and brick and mortar stores are increasingly installing self-check-out machines (Federal Reserve Bank of St. Louis 2018, Merry 2018, Orel and Kara 2014, US Census Bureau 2018b). The next section of this report examines whether and to what extent technological changes between 2000 and 2016 had an impact on the employment, unemployment, and earnings of Black women aged 40 and older.

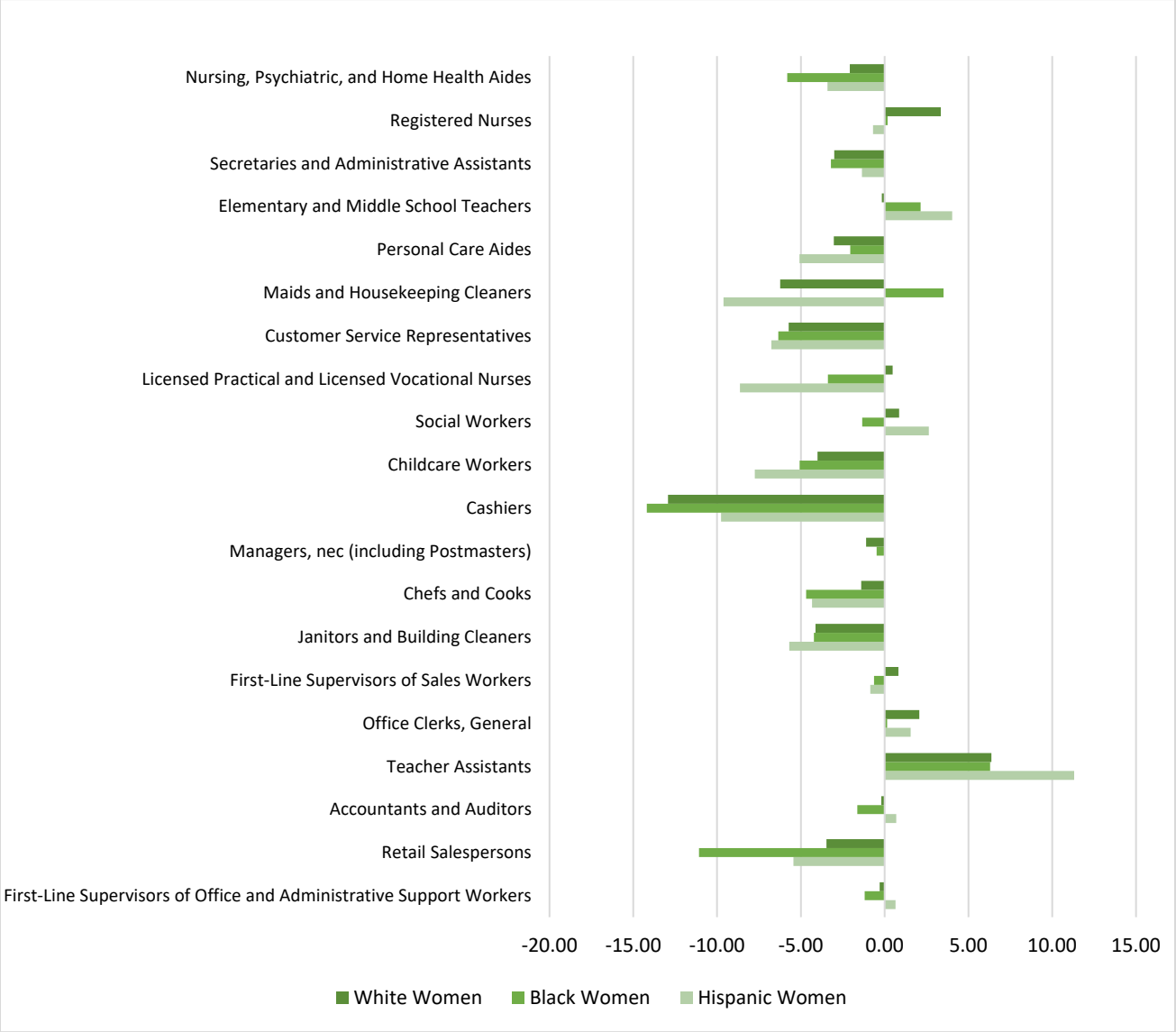
Black Women's Labor Force Participation, Employment and Unemployment

The results indicate that there has been little impact on older Black women's employment. The analysis is based on trends in the 100 most common occupations for older Black women in which 88 percent of older Black women work.[4] The data show that the total number of jobs increased in 84 of the 100 most common occupations for older Black women with some of the largest increases in their most common occupations—Personal Care Aides, Registered Nurses, Accountants and Auditors, and Social Workers. Where there were declines in employment, the numbers were generally small with declines of 50,000 workers or less. The absolute number of older Black women employed also increased in all but 7 occupations, most of which were declining including Postal Service Clerks and First-line Supervisor of Production.

The data did show that changes in automation and increased digitalization could have had some detrimental impacts on the share of older Black women employed full-time. The data showed that of the 100 largest occupations for older Black women, the share of older Black women employed full-time declined in 18 occupations. The data also show that where the share of women working full-time declines for older Black women, it also declines for older Hispanic and White women. It was not possible to determine whether this reflected the impact of automation and digitalization, the movement of older Black women into part-time work as a way to ease into retirement, or some combination of both; analyses of changes in working hours for women of all ages, however, also find a strong decline in full-time year-round work for retail related occupations (Hegewisch, Childers, and Hartmann 2019). Figure 3 below shows the changes between 2000 and 2016 in the share of women working full-time by race and ethnicity in the most common occupations for older Black women.

[4] See Appendix B for the list of the 100 most common occupations for older Black women and the share of workers that are women and the share that are Black, White, and Hispanic women.

Figure 3. The Share of Black Women 40 and Older Working Full-Time Declined the Most among Cashiers and Retail Salespersons



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes. Full-time is defined as working 35 or more hours per week.
Source: IWPR Black Women and the Future of Work Database; for methodology and sources see Appendix A.

These data support the likelihood that the decline in full-time work is due to a combination of factors because the specific occupations where the large declines occurred were assessed to be at comparatively high risk of technological substitution by Frey and Osborne (2013), including

cashiers, retail salespersons, and customer service representatives. The data also showed substantial declines in full-time employment among nursing, psychiatric, and home health aides and childcare workers—occupations that do not have a high risk of being automated, and indeed have grown substantially, but tend to be characterized by low pay and low job quality (Hartmann, Hayes, Huber, Rolfes-Haase, and Suh 2019).

There was little change in either labor force participation or unemployment rates for White, Black, or Hispanic women. For example, the labor force participation rate for Black women aged 45 to 54 increased just one-tenth of one percentage point (from 73.3 to 73.4 percent) while the rate for Hispanic women increased by one percentage point (from 66.3 to 67.3 percent). The labor force participation rate for White women aged 45 to 54 fell by just over two percentage points (from 76.6 to 74.5 percent; Bureau of Labor Statistics 2002, Bureau of Labor Statistics 2016).

Black Women's Earnings Have Fallen in Many Occupations Despite Increased Education

Table 6 below shows the change in median annual earnings for women by race and ethnicity for the 20 most common occupations for older Black women. Older Black women's earnings fell in in 13 of these occupations compared with a decline in earnings in eight of the occupations for White women and nine occupations for Hispanic women. Further, in most occupations with a decline in earnings, the decline was larger for older Black women than for older White or Hispanic women in the same occupation. In the most common occupation for older black women—nursing, psychiatric, and home health aides—Black women's earnings fell by $1.942 while the median earnings for White and Hispanic earnings fell by $948 and $843 dollars respectively. The largest declines in earnings was among Elementary and Middle School Teachers (-$5,149) and customer service representatives (-$5,944) where the decline is more than twice that of their White counterparts (-$2,104 and -$1,730 respectively).

Table 2. Despite Increased Education, Black Women's Earnings Fell in Many of Their Largest Occupations

	Change in Median Earnings for White Women 40 and Older	Change in Median Earnings for Black Women 40 and Older	Change in Median Earnings for Hispanic Women 40 and Older	Percentage Point Change in Share of BW40 W BA+, 2000 to 2016
Nursing, Psychiatric, and Home Health Aides	-$948	-$1,942	-$843	2.9%
Registered Nurses	$7,956	$6,838	$6,029	11.2%
Secretaries and Administrative Assistant	$558	-$1,957	-$1,127	8.9%
Elementary and Middle School Teachers	-$2,104	-$5,149	-$2,354	-1.5%
Personal Care Aides	$100	$938	$735	3.4%
Maids and Housekeeping Cleaners	-$380	$39	$157	1.6%
Customer Service Representatives	-$1,730	-$5,944	-$5,317	3.8%
Licensed Practical and Licensed Vocational Nurses	$873	-$1,406	-$1,922	-0.1%
Social Workers	$399	-$136	$1,681	3.1%
Childcare Workers	$2,337	-$459	$2,092	4.6%
Cashiers	-$1,427	-$615	-$358	2.6%
Managers, nec (including Postmasters)	$12,117	$9,837	$110	17.3%
Chefs and Cooks	-$249	-$703	-$563	2.3%
Janitors and Building Cleaners	-$1,228	-$1,175	-$528	2.3%
First-Line Supervisors of Sales Workers	$4,265	$5,065	$517	2.4%
Office Clerks, General	$588	-$1,579	$1,463	8.9%
Teacher Assistants	-$662	-$1,158	$2,538	10.2%
Accountants and Auditors	$9,694	$3,140	$6,280	13.0%
Retail Salespersons	$2,237	$239	-$153	4.9%
First-Line Supervisors of Office and Administrative Support Workers	$3,295	-$290	$284	17.5%

Note: White and Black women are non-Hispanic while Hispanic women may be of any race;. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes at the detailed occupation level.
Source: IWPR Black Women and the Future of Work Database; for methodology and sources see Appendix A.

The fourth column of Table 6 shows the change in educational attainment between 2000 and 2016 for older Black women. Older Black women's educational attainment increased in all but two of the most common occupations. In occupations where older Black women's education increased the most—Managers, nec (including Postmasters) and Accountants and Auditors—the median earnings of women from each racial and ethnic group increased, although the earnings of older White women increased more than the earnings of older Black women. However, among Secretaries and Administrative Assistants and Teacher Assistants—both occupations with substantial increases in the share of older Black women workers with a bachelor's degree or more—older Black women's earnings fell.

The decline in earnings can reflect several different factors that can reduce worker's earnings even when the share of women with a BA or higher in each occupation increases. Bivens and Shierholz (2018) argue that the decline in workers' wages is due largely to the erosion of their bargaining power relative to their employers'. This loss of bargaining power can result from the "steady erosion of union coverage" which would allow workers to collectively bargain for better wages and benefits, high levels of unemployment such as during and after the Great Recession which gives employers the power to control wages, and the threat of automation may mean that many workers increase their education and training while being willing to accept lower wages. Unemployment rates skyrocketed during the Great Recession and were particularly high for Black and Hispanic women (Childers and McLean 2017).

Black Women's Increased Educational Attainment Means More Debt

Between 2000 and 2016 older Black women's educational attainment increased overall from 16.8 percent having at least a bachelor's degree to 24.8 percent. There were also increases for older White (25.5 to 37.3) and Hispanic (10.6 to 17.4) women. The increase in education was not evenly spread across women working in different occupations. Among human resource managers, for example, the share of Black women with a bachelor's degree increased by 17.6 percent and among 'Other Business Operations and Management' the share of Black women with a bachelor's degree increased by more than 30 percent (IWPR Analysis of American Community Survey Data).

These investments in education and training should increase women's opportunities in the labor market and help them keep up with changes brought about by technology. Women generally have steadily increased their level of educational attainment and have surpassed men in completing bachelor's degrees. Older Black women have also improved their rates of college attendance in an effort to secure good jobs (defined here as job that pays a living wage, provides health care, and provides employer supported pensions). Research indicates that the share of good jobs held by workers with only a high school diploma has declined since the 1990s, while the share of good jobs held by workers with some college or a bachelor's degree has grown substantially (Carnevale, Strohl, Cheah, and Ridley 2017) illustrating the importance of having some postsecondary educational training.

While post-secondary education may be a prerequisite for access to better jobs, it also incurs costs. Many workers who do have some postsecondary education also tend to have substantial amounts of student loan debt. Table 3 shows the share of all women with different levels of student loan debt by race and ethnicity. Over half of Hispanic women and 40.1 percent of White women have no student loan debt compared to just 23.6 percent of Black women. Black women are also the most likely to have a cumulative debt of $26,500 or more while Hispanic women are the least likely.

Table 3. Black Women are the Most Likely to Have Student Loan Debt of $26,500 or More

Cumulative amount borrowed	No Debt	Student Loan Debt up to $5,999	Student Loan Debt of $6,000-$13,499	Student Loan Debt of $13,500-26,499	$26,500 or more
Total	41.2%	13.7%	14.6%	14.9%	15.6%
White	40.1%	13.7%	14.8%	15.3%	16.0%
Black or African American	23.6%	14.8%	17.1%	20.4%	24.2%
Hispanic or Latino	51.1%	14.6%	14.2%	10.8%	9.4%

Note: White and Black women are non-Hispanic, Hispanic women may be of any race.
Source: U.S. Department of Education, National Center for Education Statistics, 2015-16 National Postsecondary Student Aid Study (NPSAS:16).

Table 4 shows that for women aged 40 and older, even fewer students have no debt—41.2 percent of all women compared with 34.1 percent of women aged 40 and older—and almost a quarter (23.2%) have student loan debt of $26,500 or more. Black women aged 40 and older are the most likely to have student loan debt of $26,500 or more—33 percent compared to 21 percent of their White counterparts and 19 percent of their Hispanic counterparts.

Table 4. Older Black Women are the Least Likely to Not Have Any Student Loan Debt

Cumulative amount borrowed	No Debt	Student Loan Debt up to $5,999	Student Loan Debt of $6,000-$13,499	Student Loan Debt of $13,500-26,499	$26,500 or more
Total	34.1%	14.2%	14.9%	13.7%	23.2%
White	36.6%	14.1%	14.9%	13.4%	21.0%
Black or African American	18.8%	15.2%	15.8%	17.2%	33.0%
Hispanic or Latino	40.5%	13.6%	17.3%	9.2%	19.4%

Note: White and Black women are non-Hispanic, Hispanic women may be of any race.
Source: U.S. Department of Education, National Center for Education Statistics, 2015-16 National Postsecondary Student Aid Study (NPSAS:16).

One reason Black women generally, and older Black women in particular, tend to have higher levels of student loan debt is their greater tendency to attend private, for-profit colleges which are more expensive than public 2- and 4-year schools. Table 5 shows the distribution of women across the different types of institutions by race and ethnicity. While the majority of women in each racial and ethnic group shown in Table 5 attend public 4-year and public 2-year institutions, column four shows black women are more likely than their White and Hispanic counterparts to attend private for-profit institutions, 17 percent compared with 8 and 12 percent respectively.

Table 5. Black Women are More Likely than White or Hispanic Women to Attend Private, For-Profit Colleges

Institution sector (4 with multiple)	Public 4-year	Private not-for-profit 4-year	Public 2-year	Private for profit
Total	30%	14%	35%	10%
White	32%	16%	33%	8%
Black or African American	27%	12%	32%	17%
Hispanic or Latino	27%	10%	40%	12%

Note: Rows do not sum to 100 percent because 'others' and 'attended more than one' are omitted; Women ages 40 years and older; White and Black women are non-Hispanic, Hispanic women may be of any race.
Source: U.S. Department of Education, National Center for Education Statistics, 2015-16 National Postsecondary Student Aid Study (NPSAS:16).

Table 6 shows that distribution for women aged 40 and older by race and ethnicity. These data show that older women are less likely their younger counterparts to attend a public 4-year university (18% and 30%), but they are more likely to attend public 2-year (44% and 35%) and private for-profit colleges (15% and 10%). Older Black women are the most likely to attend private, for-profit colleges (20%) although older Hispanic women (16%) also attend these more expensive schools at a higher rate than the rate for all older women.

Table 6. Older Women are Most Likely to Attend Public 2-Year Colleges

Institution sector (4 with multiple)	Public 4-year	Private not-for-profit 4-year	Public 2-year	Private for profit
Total	18%	14%	44%	15%
White	19%	15%	47%	12%
Black or African American	18%	15%	36%	20%
Hispanic or Latino	17%	11%	48%	16%

Notes: Rows do not sum to 100 percent because 'others' and 'attended more than one' are omitted; Women ages 40 years and older; White and Black women are non-Hispanic, Hispanic women may be of any race.
Source: U.S. Department of Education, National Center for Education Statistics, 2015-16 National Postsecondary Student Aid Study (NPSAS:16).

Private, for-profit schools attract many Black and Hispanic students, low-income students, and student parents because the schools promise to provide a streamlined course of study that will get students to work quickly (Anderson, Reichlin, and Gault 2017, Cottom 2017, Holland and DeLuca 2016). The cost of tuition and fees at these institutions are higher than at public and not-for-profit institutions—the tuition at private, for-profit schools for the 2014-15 school year were more than twice the cost of tuition and fees at public schools ($13,971 and $6,371 respectively; National Center for Education Statistics 2015). Not only are students at these

schools often graduating with more debt, they are also more likely to leave school without a degree (Carnevale, Van Der Werf, Strohl, and Repnikov 2018, Holland and DeLuca 2016). Black women's overrepresentation at private, for-profit school means that in trying to prepare for the future of work, they are more likely to end up with higher student loan debt but less likely to have a degree.

There has Been Little Change in Racial Occupational Segregation among Women

As discussed above, the risk of technological substitution varies considerably by occupation. On the whole, women tend to be concentrated in different occupations than men, and face different threats from technological change (Hegewisch, Childers, and Hartmann 2019). While occupational segregation—the differential distribution of groups of workers across occupations—is not as marked between different groups of women as it is between women and men, it is nevertheless substantial. Historically, Black, White, and Hispanic women have been concentrated in different occupations. In 1960, for example, over half of black or white women would have needed to move into an occupation they were underrepresented in for both groups to have the same occupational distribution. Occupational segregation is often measured using the Index of Dissimilarity (Duncan and Duncan 1955). The index of dissimilarity ranges from 0 to 100 where 0 represents identical distributions of workers from both groups across occupations and a value of 100 indicates complete segregation such that no workers from the 2 groups work in the same occupation.

Table 7 examines whether there were any changes in segregation for women aged 25 to 39 and for women aged 40 and older. The data shows that in 2000 about 24 percent of Black or White women aged 25 to 39 and 25 percent of Black or White women aged 40 and older would need to move into an occupation in which their group was under-represented for both groups to have the same occupational distributions. Segregation is lower for Black and Hispanic women in both age groups (index=20). The data for 2016 show little difference in segregation for Black and White women or for Black and Hispanic women. Automation and other technological changes have not increased or reduced occupational segregation among women as about one-quarter of Black and White women and Black and Hispanic women over 40 would still need to change occupations for both groups to have the same occupational distribution.

Table 7. Segregation Indices for 2000 and 2016

	2000		2016	
	Black and White Women	Black and Hispanic Women	Black and White Women	Black and Hispanic Women
Women 25 to 39	24	20	27	21
Women 40 and older	25	20	25	25

Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Data in this table utilizes the 'occ' variable from the American Community Survey. This analysis used the same 431 detailed occupations for 2000 and 2016. Asian women are not included due to small sample sizes in detailed occupations.
Source: IWPR Black Women and the Future of Work Database; for methods and sources see Appendix A.

Automation and other technological changes within occupations between 2000 and 2016 could raise or lower levels of racial occupational segregation among women in different ways including automating jobs in occupations that are more racially integrated or by opening opportunities for more educated workers when workers differ in levels of educational attainment by race and ethnicity. Technology can also help to reduce segregation by, for example, allowing workers to apply for jobs online where their qualifications can be seen before their race, ethnicity, or gender.

Black Women, Automation, and the Future of Work

In this section of the report, the future of work and what that means for older workers, particularly older black women, is examined. Table 8 below shows the 20 most common occupations for older Black women in 2014-16, together with the 2016 to 2026 occupational growth projections from the Bureau of Labor Statistics (BLS) , the risk of technological substitution as assessed by Frey and Osborne (2013), and the digitalization score for each occupation, as assessed by Muro et al. (2017). Together these provide a mixed picture for the job prospects of older Black women, at least based on the occupations in which they are currently concentrated. [5]

The Bureau of Labor Statistics occupational projections for each detailed occupation on the whole suggest only small declines in total job numbers.[6] Although the projected declines are small—a decline of 4.8 percent for Secretaries and Administrative Assistants, -0.8 percent for Cashiers, and -1.0 percent for Office Clerks, General—two of these occupations pay relatively well while not requiring a postsecondary educational credential for entry. In contrast, those occupations projected to add the largest numbers of new jobs, Personal Care Aides and

[5] Some occupations in the BLS data have been combined to match the occupational classification used in the 'Occ' variable from the Integrated Public Use Microdata Series (IPUMs). These projections are weighted averages of the projections that were combined.
[6] The BLS methodology for projecting job growth is based on an assumption of full employment, given projected changes in the total size of the population of working age; for a discussion of the BLS methodology compared to other estimates of automation related employment growth, see Hegewisch, Childers, and Hartmann 2019.

Nursing, Psychiatric, and Home Health Aides —an increase of 38.6 percent and 24.0 percent—both have low median earnings, $22,000 and $25,322 respectively.

A different estimate of change is provided based on Frey and Osborne's probability scores for the potential of occupations to replace workers with automation. Six of the 20 most common occupations for older Black women have automation potential scores above 90 percent. These probability scores may over-estimate the potential for job loss, especially in the short-run, because the adoption of automation depends on more than the technical ability to automate jobs but also include the costs of adopting the technology and the willingness of the public to accept a technological substitution. Yet, they highlight the potential exposure to technical disruption for workers in these occupations.

Finally, Table 8 shows the digitalization score for each of the most common occupations for older Black women. The digitalization score represents the use and importance of computers and electronics in the occupation (Muro et al 2017). Five of the most common occupations for older Black women fall into the lower one-third of digital scores (0 to 33) and 18.8 percent of all Black women 40 and older work in these occupations. The remainder of the occupations are in the middle third of the distribution (34 to 66) and employ 30.4 percent of black workers aged 40 and older. Higher digital scores are associated with higher earnings—Muro et al (2017) found a $292.00 wage increase for a one-point increase in an occupation's digital score—and the data in Table 8 is consistent with this finding.

Table 8. Six of the 20 Most Common Occupations for Older Black Women Have a Very High Potential for Automation

Occupation	Projected Percent Change in Employment, 2016 to 2026	Frey/Osborne Automation Potential Scores	Digital Score 2016	Median Earnings for ALL FTYR Workers, 2014-16
Nursing, psychiatric, and home health aides	24.0	0.40	26	$25,322
Registered nurses	14.8	0.01	54	$63,812
Secretaries and administrative assistants	-4.8	0.92	62	$36,464
Elementary and middle school teachers	7.4	0.06	59	$50,000
Personal care aides	38.6	0.74	14	$22,000
Maids and housekeeping cleaners	6.1	0.69	14	$20,299
Customer service representatives	4.9	0.55	61	$32,478
Licensed practical and licensed vocational nurses	12.3	0.06	50	$37,958
Childcare workers	6.9	0.08	18	$20,299
Cashiers	-0.8	0.97	36	$20,258
Miscellaneous managers, including funeral service managers and postmasters and mail superintendents	7.6	0.26	59	$76,120
Janitors and building cleaners	9.9	0.66	18	$27,348
Cooks	6.1	0.90	23	$20,299
Social workers	16.9	0.02	52	$43,000
Office clerks, general	-1.0	0.96	55	$34,000
Teacher assistants	8.4	0.56	42	$22,284
Accountants and auditors	10.0	0.94	65	$60,896
Retail salespersons	1.7	0.92	46	$32,000
First-line supervisors of office and administrative support workers	3.4	0.01	64	$48,619
First-line supervisors of retail sales workers	3.8	0.28	37	$40,000

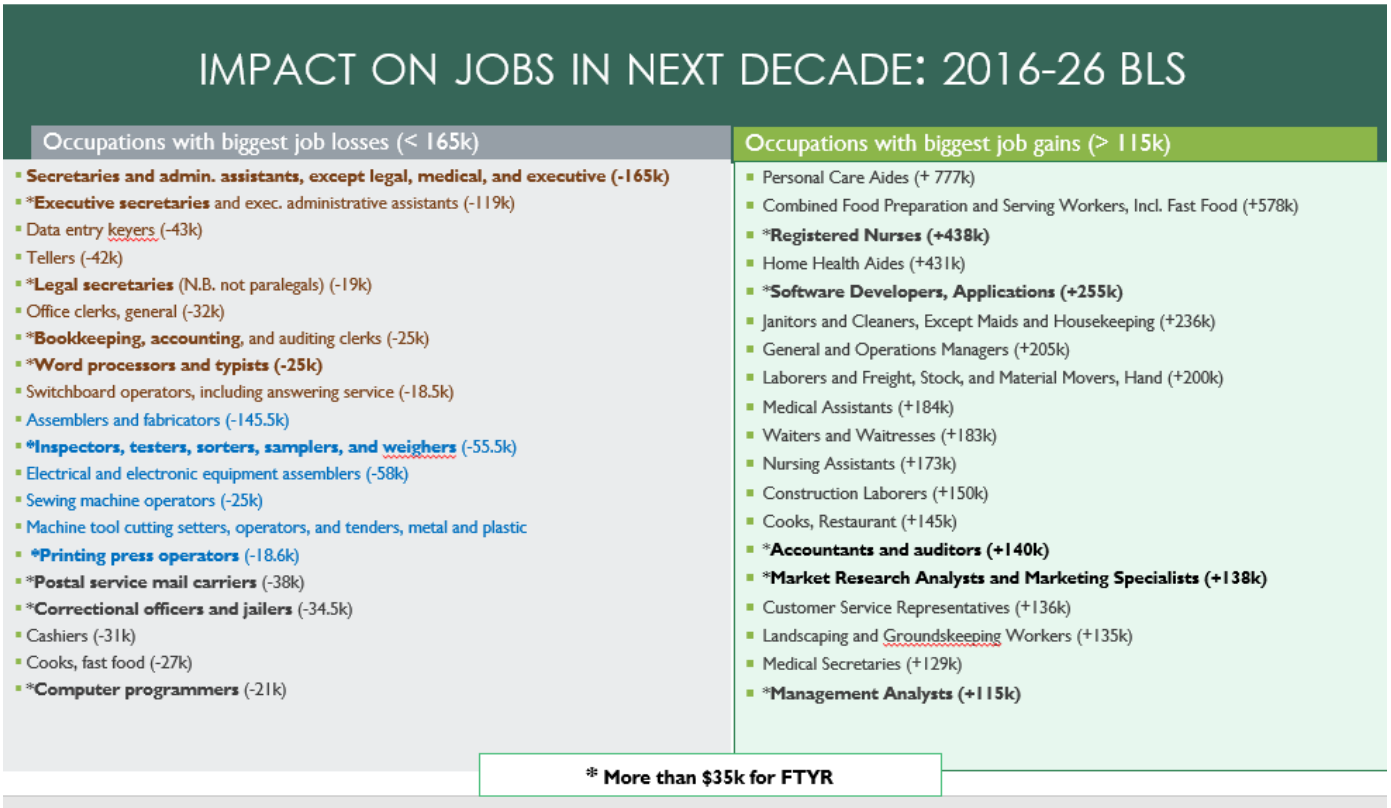
Note: Data in this table utilizes the 'occ' variable from the American Community Survey. Full-time year-round defined as work of at least 50 weeks per year, 35 hours per week.
Source: IWPR Black Women and the Future of Work Database; for methodology and sources see Appendix A.

Overall, Table 8 suggests that the projected growth in some of the lowest paying occupations could lead to increasing economic inequality between older Black women and their White counterparts if they remain over-represented in these occupations and no improvements to the quality of work in these occupations occur. Also concerning is the increased use of technology to match workers with jobs using platforms like Care.com which can make working conditions

and access to work-related benefits worse and may pose particular challenges for older workers with lower digital literacy and who may be less familiar with social media (Ticona, Mateescu, and Rosenblat 2018).

Figure 4 below shows the 20 occupations which the Bureau of Labor Statistics projects will lose the largest numbers of jobs by 2026, the 20 occupations projected to add the largest numbers of jobs, and the total number of jobs they project to be gained or lost. The occupation of Secretaries and Administrative Assistants is projected to lose the largest numbers of jobs, 165,000, and Executive Secretaries is projected to lose 119,000. The job losses are relatively small especially when compared the projected job gains. Personal care aides are projected to add 777,000 jobs while Combined Food Preparation and Serving Workers is projected to add 578,000 jobs. These are relatively low-wage jobs, but some better-paying jobs are also projected to grow. Registered Nurses which has annual earnings of $63,812 is projected to add 438,000 jobs and accountants and auditors is projected to 140,000 jobs and has median earnings of $60,896. Both occupations, however, typically require a bachelor's degree for entry.

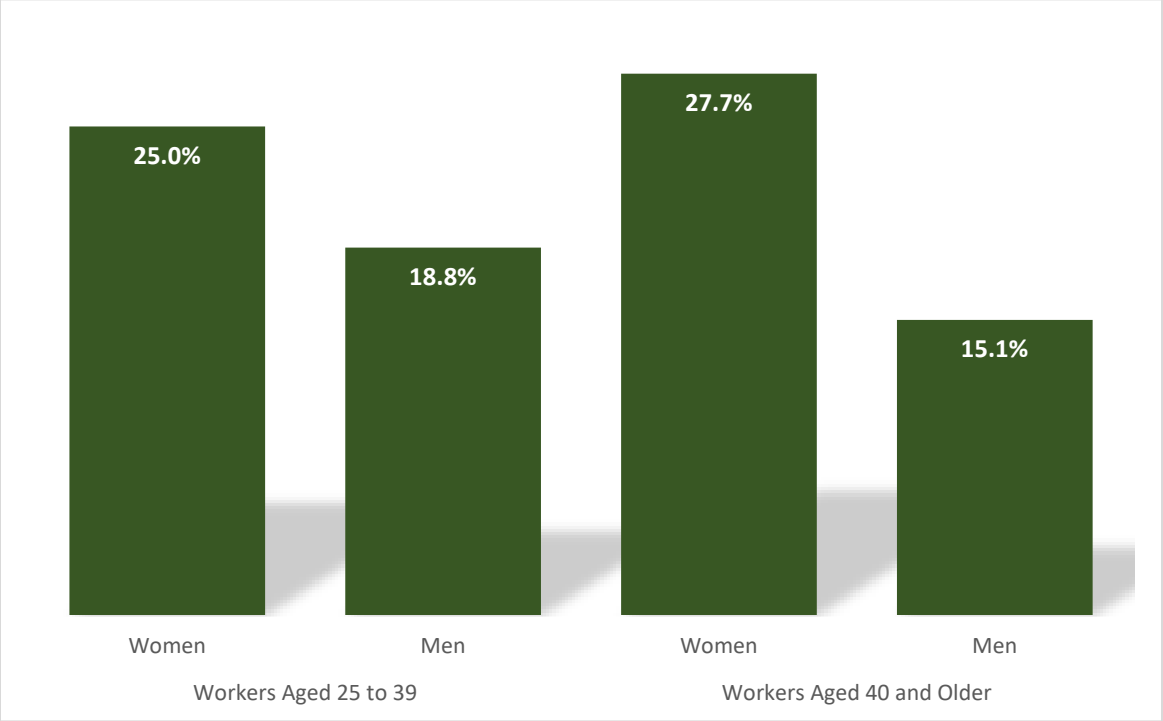
Figure 4. Many Jobs with the Largest Projected Growth are Low-Wage Jobs While Many Jobs Projected to Decline Have Better Pay



Source: IWPR compilation based on Bureau of Labor Statistics occupational projections https://data.bls.gov/projections/occupationProj.

Figure 5 below shows the share of women and men by age in occupations with a 90 percent or greater risk of automation based on Frey and Osborne's research. About one-quarter of women in each age group—25 percent of younger women and 27.7 percent of older women—work in occupations with a 90 percent or greater potential for workers to be displaced by automation. In both age groups more women than men work in these occupations with the highest potential for automation but the gap is larger for older workers than for younger workers (6.2 and 12.6 percentage points respectively).

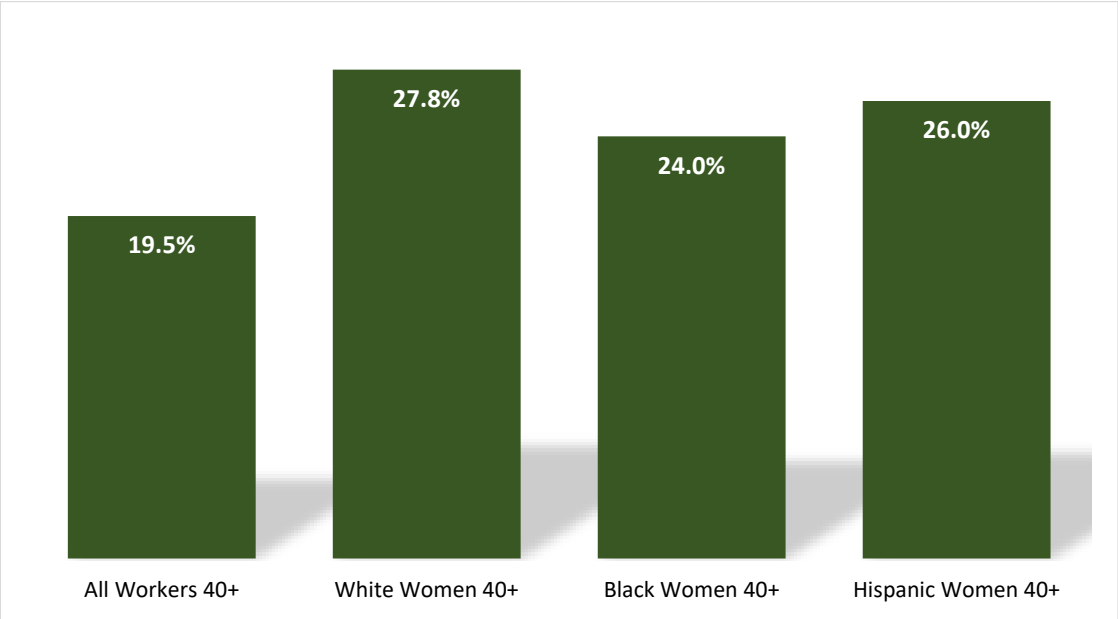
Figure 5. Women are More Likely than Men to Work in Occupations with a 90% or Greater Risk of Automation



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes.
Source: IWPR Black Women and the Future of Work Database; for methods and sources see Appendix A.

Figure 6 shows the share of older women workers by race and ethnicity who work in occupations with a 90 percent or greater potential for automation. This shows that about one-in-four women work in these occupations. The largest numbers of White women (27.8%) work in these occupations followed by Hispanic women (26.0%) and older Black women (24.0%)

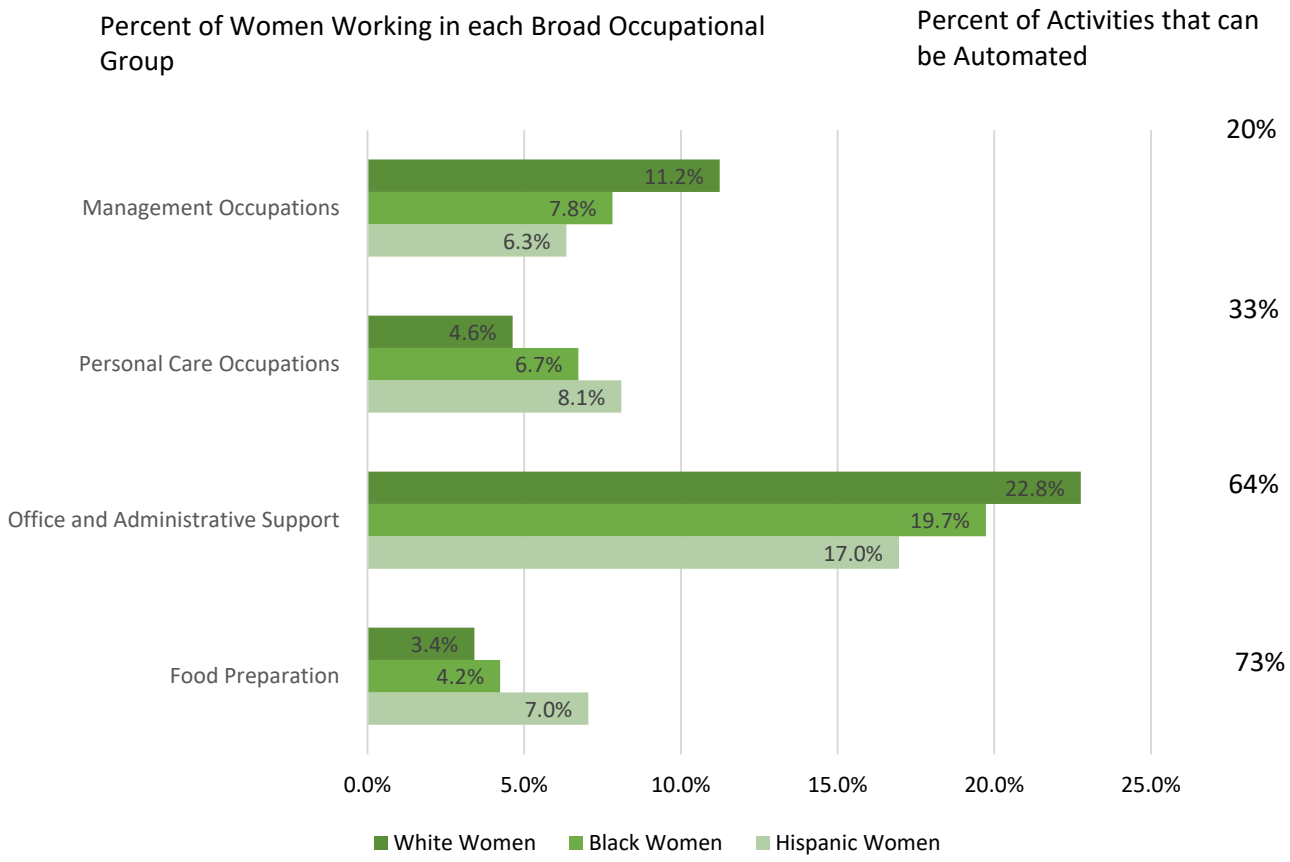
Figure 6. About One-Quarter of Women 40+ from Each Racial/Ethnic Group are in Occupations with a 90% or Greater Risk of Automation



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes.
Source: IWPR Black Women and the Future of Work Database; for methods and sources see Appendix A.

Figures 7 and 8 below add up the share of activities for four broad occupational groups that are estimated to have a high potential for automation (shown on the right side of the graph) and calculates the share of women by age, race, and ethnicity employed in these occupations (shown in the bars of the graph).

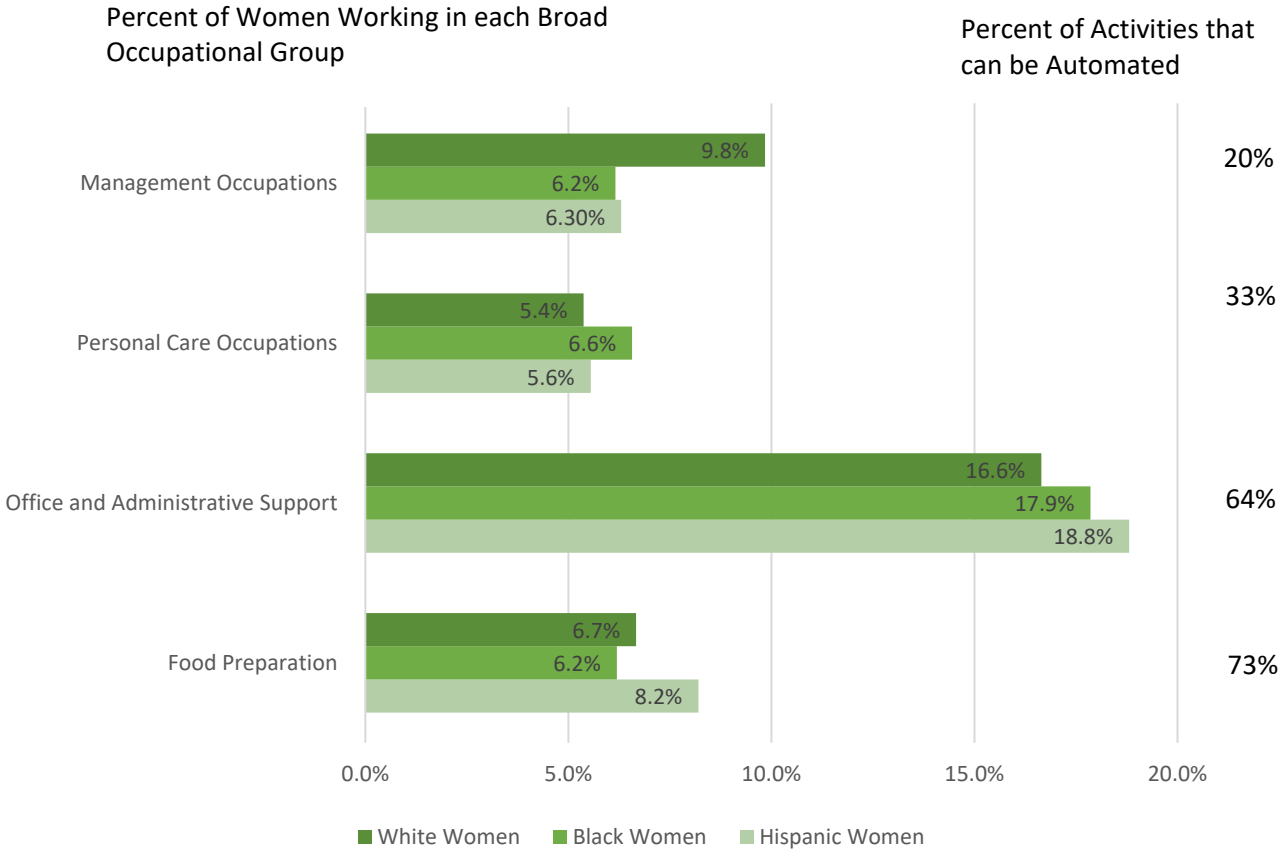
Figure 7. About One-in-Four Women 40+ Work in Occupations Where More than 60% of Activities Can Be Automated



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes.

Source: IWPR Black Women and the Future of Work Database; for methods and sources see Appendix A. Share of activities with high potential for automation taken from Manyika et al. 2017, A Future that Works: Automation, Employment, and Productivity.

Figure 8. Younger Women 25 to 39 Are Most Likely to Work in Office and Administrative Jobs Where 64% of Activities can be Automated



Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes.
Source: IWPR Black Women and the Future of Work Database; for methods and sources see Appendix A. Share of activities with high potential for automation taken from Manyika et al. 2017, A Future that Works: Automation, Employment, and Productivity.

Figures 7 and 8 shows that the broad occupational group with the highest proportion of activities with high potential for automation is 'Food Preparation and Serving Occupations' (73% of activities can be automated). Hispanic women have the largest share of workers employed in these occupations but the total share remains less than ten percent for both older and younger Hispanic women. Less than five percent of older Black or White women work in these occupations while just over five percent of younger Black women and younger White women do. In contrast, the largest share of women workers across all of the racial/ethnic groups shown in Figures 7 and 8 work in 'Office and Administrative Support Occupations' where 64 percent of activities have a high potential for automation.

The broad occupational groups with the lowest share of activities that have a high potential for automation ('Management Occupations' with 20% of activities that can be automated and 'Personal Care Occupations' with 33% of activities than can be automated) also employ relatively small shares of workers across the racial ethnic groups shown and for each age group. This smaller share of activities in these occupations that have a high automation potential may make these more likely to adopt technologies that complement workers skills and abilities while the high share and nature of the work in 'Food Preparation and Serving', for example, may make these occupations more likely to adopt technologies that will replace workers. In 'Management Occupations', for example, those activities replaced by technology would likely make managers more productive because they can spend more time on those activities that do not currently have a high potential for automation. The technologies in 'Food Preparation and Serving Occupations' include using touchpads to order food and robots to flip hamburgers, mix drinks, and even deliver food, technologies that serve as replacements for 'Waiters and Waitresses,' 'Bartenders,' and 'Food Delivery Drivers'.

Conclusion: Older Women Workers and the Future of Work

Almost half (49.3 percent) of older Black women work in their 20 most common occupations and younger Black women Aged 25 to 39 are only slight less concentrated in these same occupations (46.9% percent). Despite great progress over the last 50 years and substantial educational gains, older and younger Black women remain over-represented in a small number of occupations, many with low wages and few benefits. Occupational projections from the Bureau of Labor Statistics indicate that some of these jobs will add hundreds of thousands of new jobs by 2026. Older Black women's most common occupations that are projected to add the greatest numbers of new jobs includes Personal Care Aides (777 thousand new jobs), Registered Nurses (438 thousand), and Home Health Aides (431 thousand; see Figure 4 above).

Further, estimates of the risk of automation are low for some of these care occupations—the risk of Nursing, Psychiatric, and Home Health Aides is 40 percent and the risk for Registered Nurses is just one percent (see Table 8). This indicates that, to the extent that these occupations remain among the most common occupations for older Black women, they will enjoy some job protection and benefit from job growth. Although these jobs may be plentiful, they are low-quality jobs with low pay and often lacking the employment benefits like health insurance, pensions, and access to paid leave that would provide economic security for workers and their families. This will increase economic inequality if the quality of these jobs isn't improved.

Other common occupations for older Black women have a high potential for automation to displace workers. These occupations include some low-paying occupations like Cashiers, and Cooks, Fast Food. Both occupations have a risk of automation that is over 90 percent (see Table 8). Other occupations with a high potential for automation include relatively well-paying occupations that do not require a college degree like Secretaries and Administrative Assistants and Office Clerks, General and well-paying jobs for college-educated workers like Accountants and Auditors. The risk of automation displacing workers in these jobs—either because automation replaces workers or because the job changes and requires different and more advanced skills—does not have to create a crisis because workers can be provided with access to job training and skill development opportunities that will allow them to make the transition to the new jobs that emerge. This should include increased access to postsecondary educational institutions like public 2-year and 4-year colleges and universities and on-the-job training.

The data in this report shows that many women are putting forth the effort to try to increase their skills and obtain the educational credentials they need. In trying to increase their educational attainment Black women, and older Black women in particular, are more likely to attend private, for-profit schools and this has resulted in many leaving school—whether they graduate with the desired certificate or degree or leave the program without the credential—with high levels of student debt and too many unable to use find jobs in their chosen fields.

To prepare today's workers for tomorrow's labor market, we must begin improving career and technical education, and increasing access to community colleges and four-year colleges and universities for older workers who may have childcare responsibilities along with responsibilities to care for parents or other family members. This will require not only ensuring that everyone has access to our postsecondary educational institutions but also that investments are made in affordable childcare, assistance obtaining help with eldercare, and increased access to paid leave to allow flexibility for older workers to balance work and family.

To ensure that post-secondary educational institutions are providing the training that employers are seeking, public policy can be used to create incentives for employers, state and local government, and community colleges to form partnerships that ensure the college curriculum teaches in-demand skills and that students have opportunities for high-quality internships and apprenticeships with actual employers and access to on-the-job training.

The student loan crisis should be addressed for those who have already amassed large amounts of student debt and to prevent the next cohort of students from needing to go into debt to finance their education.

Issues of access to postsecondary education and job training and reducing student's debt are not just issues for older workers. Because the adoption of robotics and automation will be an on-going process that plays out over decades, the impact of change in many of these occupations will likely have an even larger impact on today's 25- to-39-year-olds when they make up the older workers in the future. The process of upgrading the skills and education of the workforce for the jobs of tomorrow should include these younger workers

The world of work will change as we move forward, and it is crucial that public policy begin to focus on ways to ensure that all workers have the opportunity to prepare for this future and to gain the skills and credentials necessary to be successful in the labor market. This is especially important for older Black workers who are central to the economic well-being of their families and communities. Whether older Black workers are provided with the supports necessary to prepare for the labor market of tomorrow will not only impact these worker's well-being today and their ability to prepare for their retirement tomorrow, it will also impact their ability to provide their children and grandchildren with the resources they will need to be productive employees and citizens tomorrow.

Appendix A. Methodology

Research Questions

The research in this report seeks to provide insight into the ways that automation and other technological changes may impact the employment and earnings of older Black women workers. The specific questions this research sought to answer are:

1. Given older black women's educational and occupational profiles, what is the potential for automation to displace them from well-paid jobs in the future?

2. Did the increased use of digital technology and automation between 2000 and 2016 displace older Black women, especially those in well-paying jobs?

3. What are the implications of these occupational shifts for the well-being and economic security of older Black women and their families?

4. What public policies can help temper these effects?

Older Black Women and the Future of Work Databases

Research that has estimated the impact of technological change on work and workers has produced divergent narratives about the jobs that are likely to increase or decline but older women workers, and older Black women workers, in particular, are not examined. This report seeks to examine the impacts of automation, artificial intelligence, and digitalization on these workers between 2000 and 2016 and the potential impacts on these workers in the future. To do this, IWPR developed two separate databases: one to estimate the potential impact of automation and other technology on women's employment and earnings in the future and one to allow us to look at changes in women's employment and earnings since 2000. Together, these databases are known as the IWPR Older Black Women and the Future of Work databases.

Occupational Projections Database

The first database was designed to allow IWPR to estimate the potential impacts of automation and other technological changes on women workers aged 40 and older by race and ethnicity. To create this database we recreated the digitalization scores for detailed occupations developed by Muro, Liu, Whiton, and Kulkarni (2017) from the Brookings Metropolitan Policy Program for detailed Occupational Information Network (O*NET) occupations. These scores are standardized measures of the O*Net variables capturing the importance of knowledge of computer technology and the centrality of using computers and electronic technology on the job. The standardized scores range from 0 to 100 with occupations with scores above 60 labeled 'high digital jobs', those with scores below 33 are labeled 'low digital jobs', and those with scores in between labeled '-medium digital jobs'.

These detailed occupations and their digital scores were then matched to the Bureau of Labor Statistics (BLS) 2016-2026 occupational projections. This is used to estimate the share of women by race and ethnicity who are at risk of job growth or loss through 2026. These estimates were then matched to the detailed 'occ' variable in the American Community Survey (ACS) which was used to calculate women's occupational distributions by race and ethnicity, their earnings, educational attainment, and full-time employment. This matching process required that some detailed occupations be aggregated to match the detailed occupational classification of the ACS (For example, Cooks, restaurants and Cooks, fast food were combined to match the 'Cooks' in the ACS 'Occ' variable). To this data, Frey and Osborne's (2013) estimated probabilities of automation was matched to these detailed occupations. IWPR was then able to estimate the share of women aged 40 and older whose occupation would be threatened based on the specific occupations they were clustered in and the estimated probabilities of automation based on Frey and Osborne (2013) and the BLS estimates of job growth/job loss.

Historical Database (2000 to 2016)

The second database was designed to allow IWPR to assess how changes in the digitalization of occupations and increased automation and other technological advances from 2000 to 2016 has impacted the employment and earnings of women by race and ethnicity. This databased combined data from the 2000 census bureau with 2014-2016 ACS data to allow us to estimate change over time. Three years of data are used for the 2014-2016 ACS because of its much smaller sample size to ensure there were large enough samples to calculate employment and earnings for detailed occupations by sex, race, and ethnicity.

To ensure comparability between the occupational classification schemes over time, the 'Occ2010' variable was used. This variable reclassified occupations in 2000 and 2014-2016 to match the 2010 classification scheme so they are all compatible over time.

To estimate change in segregation for Black and White women and for Black and Hispanic Women, IWPR calculated the index of dissimilarity (Duncan and Duncan 1955) to measure segregation across 431 detailed occupations in 2000 and in 2014-2016. The index of dissimilarity ranges from 0 to 100 where 0 represents identical distributions of workers from both groups across occupations and a value of 100 would indicate complete segregation such that no workers from the 2 groups work in the same occupation.

Other Analyses

Manyika et al (2017a) has a different approach to estimating the impact technology will have on employment. Because they do not provide their estimates of the share of worker's tasks that can be automated for detailed occupations, we were unable to include their estimates in our database, but we still wanted to get a sense of what their estimates would mean for older

women workers from each racial and ethnic group. They do provide estimates of the share of tasks that can be automated for some broad occupational groups including 'Management Occupations', 'Personal Care Occupations,' 'Office and Administrative Support Occupations,' and 'Food Preparation Occupations'. We do estimate the share of women by race and ethnicity employed in each of these broad occupational groups separately.

Appendix B.

Table 9. The 100 Most Common Occupations for Black Women 40 and Older, 2014-16

	White women's share of all workers 40+, 2014-16	Black women's share of all Workers 40+, 2014-16	Hispanic women's share of all Workers 40+, 2014-16	Women's Share of all workers 40+, 2014-16
Nursing, Psychiatric, and Home Health Aides	34.9%	32.7%	14.1%	81.6%
Registered Nurses	66.7%	9.7%	4.3%	80.8%
Secretaries and Administrative Assistants	76.2%	7.8%	8.3%	92.3%
Elementary and Middle School Teachers	62.7%	7.0%	6.4%	76.2%
Personal Care Aides	40.0%	17.1%	18.1%	75.2%
Maids and Housekeeping Cleaners	28.8%	12.3%	40.9%	82.0%
Customer Service Representatives	46.1%	11.1%	8.3%	65.5%
Licensed Practical and Licensed Vocational Nurses	54.2%	23.0%	7.4%	84.6%
Social Workers	47.3%	17.1%	8.6%	73.1%
Childcare Workers	49.8%	16.3%	23.1%	89.2%
Cashiers	50.5%	10.1%	10.7%	71.3%
Managers, nec (including Postmasters)	24.7%	3.1%	2.5%	30.4%
Chefs and Cooks	24.6%	8.3%	13.2%	46.1%
Janitors and Building Cleaners	15.1%	5.3%	12.0%	32.4%
First-Line Supervisor of Sales Workers	28.9%	3.1%	3.8%	35.9%
Office Clerks, General	59.8%	10.3%	9.9%	79.9%
Teacher Assistants	64.0%	11.0%	12.6%	87.6%
Accountants and Auditors	45.6%	5.7%	4.2%	55.5%
Retail Salespersons	35.7%	4.3%	6.0%	46.0%
First-Line Supervisors of Office and Administrative Support Workers	46.4%	7.2%	6.1%	59.7%
Human Resources, Training, and Labor Relations Specialists	49.3%	10.9%	6.1%	66.2%
Education Administrators	47.3%	8.6%	5.2%	61.1%
Bus and Ambulance Drivers and Attendants	27.2%	10.6%	5.0%	42.8%
Receptionists and Information Clerks	68.4%	10.1%	10.2%	88.7%

Medical Assistants and Other Healthcare Support Occupations, nec	57.0%	13.8%	11.9%	82.6%
Bookkeeping, Accounting, and Auditing Clerks	73.2%	5.8%	6.7%	85.7%
Counselors	48.9%	11.9%	6.4%	67.2%
Security Guards and Gaming Surveillance Officers	9.1%	8.8%	2.9%	20.7%
Preschool and Kindergarten Teachers	66.2%	15.0%	11.8%	93.0%
Medical and Health Services Managers	52.3%	8.5%	5.2%	66.1%
Hairdressers, Hairstylists, and Cosmetologists	60.6%	8.9%	12.4%	82.0%
Assemblers and Fabricators, nec	21.7%	6.9%	8.2%	36.9%
Stock Clerks and Order Fillers	27.1%	5.5%	7.7%	40.3%
Office and administrative Support Workers, nec	55.4%	10.6%	7.8%	73.8%
Postsecondary Teachers	37.6%	3.9%	2.6%	44.1%
Financial Managers	41.5%	4.7%	4.3%	50.5%
Other production workers including semiconductor processors and cooling and freezing equipment operators	15.5%	4.4%	7.6%	27.6%
Billing and Posting Clerks	66.3%	10.1%	8.8%	85.3%
Computer Scientists and Systems Analysts/Network systems Analysts/Web Developers	21.8%	3.6%	1.8%	27.2%
Machine Feeders and Offbearers	28.6%	6.6%	0.3%	35.5%
Insurance Claims and Policy Processing Clerks	62.3%	13.2%	6.7%	82.1%
Inspectors, Testers, Sorters, Samplers, and Weighers	21.0%	5.7%	8.2%	35.0%
Other Teachers and Instructors	47.9%	6.0%	4.0%	57.9%
Food Preparation Workers	33.9%	8.7%	19.5%	62.1%
Word Processors and Typists	61.6%	13.4%	9.1%	84.2%
Health Diagnosing and Treating Practitioners, nec.	56.4%	10.3%	6.5%	73.1%
Data Entry Keyers	57.0%	12.4%	8.6%	78.0%
Human Resources Managers	44.7%	7.1%	5.4%	57.2%
Sheriffs, Bailiffs, Correctional Officers, and Jailers	13.4%	10.1%	2.5%	26.0%
Food Service and Lodging Managers	30.8%	4.1%	5.5%	40.4%

Social and Community Service Managers	49.9%	8.7%	4.5%	63.1%
Property, Real Estate, and Community Association Managers	35.2%	4.9%	5.1%	45.2%
Taxi Drivers and Chauffeurs	29.2%	6.7%	2.0%	37.9%
Pumping Station Operators	0.0%	27.6%	0.0%	27.6%
First-Line Supervisor of Food Preparation and Serving Workers	40.3%	9.1%	9.0%	58.4%
Management Analysts	32.0%	3.6%	1.9%	37.6%
Waiters and Waitresses	49.7%	4.3%	11.4%	65.4%
Secondary School Teachers	47.2%	4.2%	4.6%	56.0%
Claims Adjusters, Appraisers, Examiners, and Investigators	40.9%	10.6%	5.0%	56.5%
Clinical Laboratory Technologists and Technicians	49.6%	10.0%	5.4%	65.0%
Lawyers, and judges, magistrates, and other judicial workers	25.5%	2.3%	1.7%	29.5%
Police Officers and Detectives	8.6%	3.6%	2.2%	14.4%
Other Business Operations and Management Specialists	39.7%	5.4%	3.7%	48.8%
First-Line Supervisor of Production and Operating Workers	12.1%	2.6%	3.0%	17.7%
Paralegals and Legal Assistants	69.6%	6.9%	8.5%	84.9%
Insurance Sales Agents	34.1%	4.3%	4.3%	42.8%
Medical Records and Health Information Technicians	67.6%	13.2%	5.9%	86.8%
Laundry and Dry-Cleaning Workers	23.2%	12.0%	22.5%	57.7%
Special Education Teachers	67.6%	9.5%	7.3%	84.4%
Real Estate Brokers and Sales Agents	46.8%	2.4%	4.3%	53.5%
File Clerks	57.3%	10.7%	8.5%	76.4%
Shipping, Receiving, and Traffic Clerks	22.8%	4.1%	5.4%	32.4%
Postal Service Mail C	28.6%	5.5%	3.2%	37.4%
Dispatchers	39.1%	8.4%	5.1%	52.6%
Food Servers, Nonrestaurant	37.0%	16.8%	12.6%	66.5%
Managers in Marketing, Advertising, and Public Relations	33.9%	2.2%	2.9%	39.0%
Postal Service Clerks	27.6%	13.9%	4.3%	45.9%
Packaging and Filling Machine Operators and Tenders	17.8%	8.8%	27.2%	53.8%
Chief executives and legislators/public administration	20.2%	1.2%	1.3%	22.7%

Physicians and Surgeons	18.5%	2.0%	1.8%	22.3%
Food preparation and serving related workers, nec	34.5%	10.4%	17.6%	62.5%
Computer Support Specialists	20.0%	3.9%	2.1%	26.0%
General and Operations Managers	20.6%	2.0%	2.2%	24.8%
Payroll and Timekeeping Clerks	68.7%	9.7%	7.9%	86.2%
Interviewers, Except Eligibility and Loan	53.3%	14.9%	10.2%	78.4%
Production, Planning, and Expediting Clerks	44.1%	5.7%	4.7%	54.5%
Health Technologists and Technicians, nec	38.7%	15.2%	5.7%	59.6%
Software Developers, Applications and Systems Software	12.8%	1.9%	0.9%	15.6%
Credit Counselors and Loan Officers	42.3%	5.9%	4.6%	52.9%
Bank Tellers	72.6%	8.4%	7.0%	88.1%
Sales Representatives, services all other	20.4%	1.1%	2.4%	24.0%
Recreation and Fitness Workers	59.5%	5.5%	5.2%	70.1%
Sales Representatives, Wholesale and Manufacturing	25.0%	2.8%	2.4%	30.2%
Purchasing Agents, Except Wholesale, Retail, and Farm Products	41.8%	5.4%	3.3%	50.5%
Bill and Account Collectors	49.1%	12.4%	8.0%	69.6%
Flight Attendants and Transportation Workers and Attendants	50.7%	10.9%	6.6%	68.1%
First-Line Supervisor if Housekeeping and Janitorial Workers	20.2%	6.1%	11.0%	37.3%
Combined Food Preparation and Serving Workers, Including Fast Food	50.5%	8.6%	11.4%	70.5%
Metal workers and plastic workers, nec.	10.7%	3.8%	5.5%	20.0%
Computer and Information Systems Managers	21.4%	2.3%	1.3%	25.0%

Note: White and Black women are non-Hispanic while Hispanic women may be of any race. Women from other racial groups (Asian/Pacific Islander, Native American, Other Race, and Multiracial) are not shown separately due to small sample sizes in detailed occupations.

Source: IWPR Black Women and the Future of Work Database; for methods and sources see Appendix A.

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