An Examination of PIAAC Data for Unemployed Adults Aged 45–74

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ABSTRACT:

Middle aged and older workers constitute a growing segment of the U.S. labor force. These workers face considerable challenges in the wake of the Great Recession, which have important consequences for the sustainability of social safety net programs and the U.S. economy as a whole. Despite the policy implications of significant unemployment among middle aged and older workers, little is known about specific factors impacting labor market outcomes for this age group, including the role of adult education and training (AET) and literacy and numeracy skills. This study used data from the 2014 Program for the International Assessment of Adult Competencies (PIAAC) National Supplement to examine relationships among educational attainment, participation in AET, skill proficiencies, health, and economic outcomes for U.S. adults ages 45-74 who are unemployed or not in the labor force. Overall, employed adults ages 45 – 65 participate in lifelong learning activities significantly more than the unemployed and out of the labor force groups. On average, the unemployed and out of the labor force groups had significantly lower literacy skills than the employed group among those ages 45-65. There was a positive relationship between literacy skills and self-rated health in both the 45 – 65 and 66 – 74 age groups. Findings are discussed in view of labor, education and public health policies in order to enhance the well-being of middle-aged and older adults in the U.S.

INTRODUCTION

As the U.S. population ages, middle-aged and older workers represent an increasingly large segment of the labor force, accounting for nearly half of all workers. Although the proportion of workers ages 55-64 has increased in recent decades, unemployment among middle-aged and older workers represents a significant concern, creating costly challenges for individual workers and the economy as a whole (Butrica, 2011; Feyrer, 2007). In light of recent demographic and economic trends such as population aging and the Great Recession, it is critical for researchers and policy makers to address urgent challenges faced by unemployed middle-aged and older adults. Following the Great Recession, older workers experienced unprecedented durations of unemployment, placing increased strain on workers, their families, and social welfare programs. Education and training are key strategies for addressing these challenges (Elman & O'Rand, 2002; Jacobson et al., 2005).

Lifelong learning has an important role to play in improving employment outcomes among middle-aged and older workers, who face rising demands for new and improved skills as

age-related functional decline makes physically demanding jobs unsustainable. Following Smith (2002), we define lifelong learning as "an all-purpose learning activity, undertaken on an ongoing basis [begins in the cradle and presumably ends in the grave] with the aim of improving knowledge, skills and competence…it has not to do only with formal education, but also with informal and non-formal ways of learning" (p. 49). Including formal (learning that takes place in education and training institutions and leads to recognized credentials and diplomas), informal (learning that takes place in everyday life and is not necessarily intentional and may not even be recognized by the individuals themselves as contributing to their knowledge and skills), and non-formal (learning that takes place in educational and training settings, but does not typically lead to a formalized credential) (Commission on European Communities, 2000) learning activities as "lifelong learning" coincides with Adult Education and Training (AET) categories in the data used for this research.

The relationships among lifelong learning, skill proficiencies, and employment remain poorly understood. This gap in understanding represents an important barrier to developing or expanding education and labor policies and programs that are associated with better employment outcomes for older workers. The present study draws on data from the Program for the International Assessment of Adult Competencies (PIAAC) to address this gap. This paper examines health and economic well-being in relation to educational attainment, lifelong learning, and skill proficiencies among adults ages 45-74 who are either unemployed or not in the labor force. Through analysis of data from the 2014 PIAAC National Supplement, which includes an oversample of unemployed adults and a new sample of adults ages 66 – 74, , we examine 1) participation in adult education and training (AET) by employment status (i.e., unemployed older adults and those not in the labor force); 2) differences in literacy skill use by employment status (i.e., employed, unemployed and out of the labor force); 3) the differences in literacy skill use across retired, employed, and unemployed; and 4) the relationships among health status, lifelong learning, and skill proficiencies among older adults by employment status. The age groupings in this paper (i.e., 45 – 65 and 66 – 74) are based on those available in the PIAAC data. Because our focus is on middle-aged and older adults, the lower age bound of 45 is appropriate. Additionally, U.S. Bureau of Labor Statistics (BLS) reports data for the 45 – 54, 55 – 64, and 65 – 74 age groups, and in an effort to make comparisons to BLS data, their age groupings were matched where possible.

LITERATURE REVIEW

Although an exhaustive review of the literature on employment, skill proficiencies, and lifelong learning is beyond the scope of this paper, this section provides the theoretical underpinnings of our analysis and a summary of relevant empirical findings. Key theoretical perspectives informing our interpretation of the PIAAC data include human capital and practice engagement theories, which offer explanatory frameworks for the relationships among education, skills, and economic outcomes over the life course. A review of labor market trends, including labor force participation by age group, unemployment patterns, and timing of retirement,

provides a better understanding of the context for our analysis. We discuss the broader significance of these trends by examining the individual and social consequences of unemployment and early retirement among middle-aged and older adults. Citing previous empirical findings, we also address the importance of skill proficiencies as malleable factors linked to key economic and health outcomes. The section concludes with an overview of relevant literature on lifelong learning, which represents one strategy for enhancing skill proficiencies across the life course.

THEORETICAL RATIONALE: HUMAN CAPITAL AND PRACTICE ENGAGEMENT

Human capital and practice engagement theories provide a rationale and framework for understanding factors related to favorable outcomes for middle-aged and older adults participating in education and training programs. Investments in human capital through lifelong learning activities and skill use have the potential to improve skill proficiencies and labor market outcomes.

Human capital theory. Human capital can be defined as "productive wealth embodied in labor, skills and knowledge" (Tan, 2014, p. 412). Broadly speaking, human capital includes things like health as well as education and training. This concept offers a richer way of understanding the characteristics of the labor force, beyond the number of people seeking work. Human capital theory proposes that both individuals and society benefit from investing in education and training. Society benefits through improved economic outcomes, and individuals benefit through improved employment opportunities and higher earnings (Becker, 1962). Globalization and automation of work by new computer and software technology, along with more rapid skill obsolescence, have increased the need for investments in human capital among those currently in the workforce (Farkas, 2009; Schuetze, 2007). In addition, if unemployed workers lack human capital for jobs that are in demand, their employment prospects are diminished (Wanberg, 2012).

Practice engagement theory. This theory proposes that skill engagement and skill proficiency in literacy practices reinforce each other over the life course, and that engagement can occur in a variety of contexts (Desjardins, 2003; Reder, 1994, 2009; Sheehan-Holt & Smith, 2000). Research suggests that interventions designed to promote skill use among low-skilled adults, both at work and outside work, could be an important strategy for raising skill levels over the long term (Grotlüschen, Mallows, Reder, & Sabatini, 2016; Reder, 2015). Engagement in literacy and numeracy activities and increased use of information and communication technologies (ICTs), both at work and outside work, are related to higher literacy, numeracy and problem solving proficiencies (OECD, 2013). For example, Reder (2012) found that engaging in literacy practices in and outside of basic skills programs is associated with improvements in proficiency over time. Learning that takes place in different contexts (e.g., both inside and

outside of formal education settings) can potentially enhance and complement previous learning experiences (Desjardins, 2003).

Taken together, human capital theory and practice engagement theory suggest that analysis of not only education but also skill proficiencies and skill use is needed to achieve a better understanding of the situation of older workers, and to identify a fuller range of possible interventions. The present study examines these factors and can inform future research on possible causal relationships among education, skill proficiencies, skill use, and employment outcomes in this population.

EMPLOYMENT

Trends in labor force participation

Older workers constitute an important and growing segment of the U.S. labor force. The proportion of U.S. workers ages 55 – 64 has experienced a dramatic increase over the past several decades. In 1994, this age group represented 9% of the labor force, and this figure is expected to increase to 17% by 2024 (Toossi, 2015; see Figure A.1 in the Annex). While labor force participation rates have increased since the 1990s for both males and females ages 55 and older, participation rates for males in the 45 to 54 age group have declined over the past decade (see Figures A.2 and A.3), and the rate of decline was greater in the U.S. than in other OECD countries. Between 2004 and 2014, for example, the participation rate for males ages 45 to 54 underwent a significant decline from 88% to 86% in the U.S., while the rate in the United Kingdom (U.K.) increased from 89% to 91% (Organisation for Economic Cooperation and Development (OECD), 2015b).

One reason for the decline in labor force participation for this age group is a reduction in the demand for low-skilled workers and those with less education (Office of the President, 2014). Technological advances, especially the growing ubiquity of ICTs, have contributed to a greater demand for higher-level cognitive skills in the labor force. Employment is moving away from jobs involving routine manual and cognitive tasks, and toward those requiring critical thinking and complex communication skills (OECD, 2012). Moreover, demand for high-skilled workers has increased, creating a competitive advantage for those with greater technical skills (Buera, Kaboski, & Rogerson, 2015). Structural unemployment, a mismatch between the qualifications of job seekers and the qualifications employers require for vacant positions, has also played a role in the decline in labor force participation (Chen, Kannan, Loungani, & Trehan, 2011; Faberman & Mazumder, 2012). In response to these developments, greater opportunities for accessible occupational training and skill-upgrading are needed throughout the life course (Evans, Schoon, & Weale, 2012; Schuetze, 2007). However, older workers often lack access to lifelong learning programs structured to meet their unique needs (Fouarge, Schils & de Grip, 2010; OECD, 2014a; Zwick, 2011).

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Trends in unemployment

While the 45 – 64 age group has a lower rate of unemployment compared to younger workers, if they become unemployed, workers in this age group experience substantially longer durations of unemployment (see Figure A.4). For example, the mean duration of unemployment in 2015 was 35.5 weeks for the 45 to 54 age group and 27.4 weeks for the 25 – 34 age group (BLS, 2015). Compared to the short-term unemployed (i.e., less than 27 weeks), the long-term unemployed are more likely to have greater earnings losses, possibly due to depreciation of skills while unemployed (Abraham, Haltiwanger, Sandusky, & Spletzer, 2016). To avoid extended periods of unemployment, middle-aged and older workers may need to upgrade their current skills or be trained in a new occupation to become reemployed. Learning new skills is especially important for those who need or want to remain in the workforce at older ages (Czaja & Moen, 2003; Guzman, Pawliczko, Beales, Till, & Voelcker, 2012).

Timing of retirement

Although the full retirement age for U.S. workers drawing Social Security benefits is 66[1], many workers elect to retire early or delay retirement. Health and disability are often among the factors informing workers' decisions about the timing of retirement. The decline in labor force participation among males ages 45 to 54 over the past decade coincides with increased claims for Social Security Disability Insurance (SSDI), which have historically gone up during periods of economic downturn. Many claimants never return to the labor force, often moving from unemployment, to SSDI, to out of the labor force (Maestas, Mullen, & Strand, 2015). Given the age-related decline in physical abilities, middle-aged and older adults are often less able to perform physically demanding work and may need to be trained in a new and less physically demanding occupation to avoid early exit from the labor force.

Whereas physical deficits cause some workers to retire before they are eligible to draw full Social Security benefits, the changing economic conditions of retirement in the U.S. lead others to postpone retirement. Gerontologists use the metaphor of a "three-legged stool" to describe traditional sources of retirement income: Social Security, private pensions, and personal savings. During the last few decades, the stool has become more precarious, as workers have seen the guarantee of a monthly pension check all but disappear. Since the 1980s, aging Baby Boomers have witnessed a steep decline in the proportion of workers covered by defined benefit plans, accompanied by a substantial increase in the proportion of workers participating in defined contribution plans (Butrica, Iams, Smith, & Toder, 2009). Facing the prospect of rising post-retirement life expectancy among U.S. workers, many employers have shifted the burden of risk for retirement to employees by introducing defined contribution plans (Turner, 2011). This shift has forced some workers to delay retirement; however, for workers in physically demanding

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[1] For those born prior to 1943, the full retirement age was 65 and for those born between 1943 and 1954, the age for Social Security full retirement benefits is 66 and will gradually increase to 67 for those born in 1960 or later.

jobs, this is not always an option. The rise of defined contribution plans also contributes to growing socioeconomic inequalities among middle-aged and older Americans; low-income workers have to remain in the workforce longer than their high-income peers in order to maintain the same standard of living they enjoyed pre-retirement (Munnell, Webb, & Chen, 2016).

Research from economically developed countries suggests that increasing labor force participation at older ages and delaying retirement could facilitate economic growth by increasing productivity (Clark, Ogawa, Lee, & Matsukura, 2008; Eberstadt & Hodin, 2014; Feyrer, 2007; Franklin, 2014; Golden, 2016) while enhancing individual-level economic security in retirement (Butrica, 2011). In light of recent employment trends that point to unique challenges faced by older workers, a better understanding of factors associated with labor force participation and timing of retirement among older U.S. workers is needed.

Unemployment and early retirement - individual and social consequences

Recent trends in unemployment duration and labor force participation among U.S. workers ages 45 and over have significant implications for middle-aged and older individuals, the U.S. economy, and the old-age welfare state. At the individual level, long-term unemployment and early exit from the labor force increase the risk for economic insecurity. These factors also contribute to cumulative inequality (Ferraro, Shippee, & Schafer, 2009), exacerbating income and wealth disparities within each cohort over the life course. For example, low-income workers and those in physically demanding jobs are disproportionately impacted by the shift from defined benefit to defined contribution pensions and by the growing demand for highly skilled workers, yet they have the fewest resources available to adapt to these changes (Burtless, 2016; Turner, 2011). Similarly, those who have been unemployed for longer periods have more difficulty finding employment than the short-term unemployed (Abraham et al., 2016).

At the societal level, increases in SSDI claims over the past several decades have placed the ongoing viability of the Social Security Trust Fund (Daley, Lucking & Schwabish, 2013) and other social welfare programs at risk. For example, two years after a successful SSDI claim, recipients become eligible for Medicare, regardless of their age. SSDI claims for the 55-64 age group increased from 2.1 million to 5.2 million between 2000 and 2015. Further, SSDI claimants as a percentage of the U.S. population increased from 8.8% to 12.7% for this age group (Social Security Administration, 2016; U.S. Census Bureau, 2000, 2005, 2010, 2015; see Figures A.5 and A.6). Unemployment and early retirement (retirement prior to eligibility for full Social Security benefits) among workers ages 45-74 place additional burdens on social welfare programs that already face mounting political and fiscal pressures.

Skill proficiencies, employment, and health outcomes

Skill proficiencies are important malleable factors associated with employment outcomes. They also represent a component of stratification among middle aged and older workers. Adults face growing challenges the longer they remain in the workforce, and low-skilled workers have less favorable outcomes compared to those with higher skill proficiencies. Adults with low levels of literacy are less likely to be employed than their more literate peers, as are those with lower levels of education, especially at older ages (BLS, 2016; OECD, 2015a). For example, only 74% of U.S. adults at the lowest level of literacy are in the labor force, compared to more than 87% of individuals at the highest levels of literacy (OECD, 2013). Additionally, low-skilled workers and those with lower levels of education are more likely to be employed in low-skilled blue collar occupations (Grotlüschen et al., 2016), which are often physically demanding and may result in early exit from the labor force (Neumark & Song, 2012; Rho, 2010). Women have lower rates of employment and lower earnings than men with the same education, experience, and skill proficiencies; the gap is highest among those with the lowest levels of education (Grotlüschen et al., 2016; OECD, 2015a), and these disparities tend to increase with age (Ferraro et al., 2009)

Skill proficiency has also been linked to health status, physical and cognitive function, and life expectancy (OECD, 2013; Smith et al., 2015; Stine-Morrow, Hussey & Ng, 2015; Yamashita & Kunkel, 2015). For example, researchers have observed a negative association between literacy and cognitive function across gender and racial groups; low literacy has even been found to predict declines in cognitive function better than education (Kavé et al., 2012; Manly, Byrd, Touradji, Sanchez, & Stern, 2004; Stine-Morrow et al., 2015). While not all cases of cognitive decline lead to dementia, the associated costs of dementia (e.g., care, labor force loss) are considerable--as high as $215 billion in 2010, a figure expected to double by 2040 (Hurd, Martorell, Delavande, Mullen, & Langa, 2013). In 2015, Medicaid alone spent approximately $40.6 billion for older adults living with Alzheimer's and other forms of dementia (Alzheimer's Association, 2016).

Health literacy is one mechanism linking skill proficiency to health outcomes (DeWalt, Berkman, Sehridan, Lohr, & Pignone DeWalt et al., 2004; Kickbusch, 2001). Low health literacy is associated with worse physical and mental health among community-dwelling older adults in the U.S. (Wolf, Gazmararian, & Baker, 2005). Proficiency in numeracy and literacy is necessary for understanding the implications of risky behaviors and making informed health decisions. Therefore, prevention and management of both minor and complex health conditions can benefit from improvements in literacy and numeracy skills (Edwards, Wood, Davies, & Edwards, 2012; Lipkus & Peters, 2009). For example, people who read at lower levels are more likely to have adverse health events than those who read at higher levels, possibly due to poor medication adherence and chronic disease management (Cavanaugh et al., 2009; DeWalt et al., 2004).

Employment is another mechanism through which skill proficiency can affect health outcomes. Several studies have found a negative association between unemployment and physical and mental health for both females and males in the U.S. and Europe (Bambra & Eikemo, 2009; Dooley, 2003; Gallo Bradley, Siegel, & Kasl, 2000; Kaleta, Makowiec-Dabrowska, & Jegier, 2008; Schuring, Mackenbach, Voorham, & Burdorf, 2011; Stronks, Van

De Mheen, van den Bos, & Mackenbach , 1997). Schuring and colleagues (2011) found that individuals with poor health were less likely to be re-employed following job loss, but those who did become re-employed saw improvements in self-rated physical and mental health. Using data from the first two waves of the Health and Retirement Study, Gallo et al. (2000) found a similar result among workers over age 50 in the U.S. Controlling for sociodemographic characteristics and health at baseline (1992), late-life involuntary job loss was negatively associated with physical and mental health, whereas re-employment was positively associated with physical and mental health among displaced older workers. A positive relationship between employment and health has also been observed among individuals with low skill proficiencies, controlling for gender (Grotlüschen et al., 2016).

Skill use and lifelong learning

The observed associations among skill proficiencies, employment, and health signal a need for further empirical research on factors impacting skill proficiencies among older adults. Skill use in and beyond the workplace is one factor that can potentially contribute to improved skill proficiencies. Another important subject for research is the role of lifelong learning in shaping skill proficiencies. Continued investments in human capital throughout the life course are necessary to improve employment prospects, increase earnings, and reduce inequalities later in life (Becker, 1993; Farkas, 2002). Skills are becoming obsolete more rapidly so it is necessary to invest in skill upgrades to meet the needs of employers and to realize continued economic growth (Acemoglu & Autor, 2010; Bishop, 1998). Through learning to engage with new technologies, for example, individuals have the opportunity to continue their development and improve their employability as they advance in age (Baltes, Staudinger, & Lindenberger, 1999). Lifelong learning activities benefit workers by enhancing employment opportunities, employers through the availability of a skilled labor force, and the public through increased productivity and reduced demands on social welfare programs.

RESEARCH QUESTIONS

Gaining a better understanding of relationships among skill proficiency, lifelong learning activities, employment, and retirement for middle-aged and older adults is an important and understudied research topic. This study examined outcomes for U.S. residents ages 45 to 74 included in the PIAAC study. We focused on adults who are either unemployed or not in the labor force (in comparison to those who are employed). We examined their characteristics to gain a better understanding of health and economic well-being in relation to educational attainment, adult education and training, and skill indicators including literacy, numeracy, and problem solving skills in the second half of the life course. In addition, the roles skills and technology play in the context of employment status (i.e., employed, unemployed, or out of the

labor force) were explored in the same age groups. Given the decline in labor force participation for males in the 45 to 54 age group, it is important to better understand the characteristics of those ages 45 – 54 who are not in the labor force. Considering recent demographic and economic trends such as population aging and the Great Recession, unemployed middle-age and older adults face numerous challenges, particularly in health and economic well-being. Education and training are widely accepted strategies to address such urgent social problems. We addressed the following research questions:

1. **Lifelong learning:** Are there any differences in participation in adult education and training (AET) programs among those who are employed, unemployed, and out of the labor force, and what are reasons for non-participation?
2. **Employment status:** Are there any differences in literacy skills or use of reading and writing skills at home among those who are employed, unemployed, and out of the labor force?
3. **Retirement**: Are there any differences in literacy skills or use of reading and writing skills at home among those who are retired, employed, and unemployed?
4. **Health**: Are there any relationships among health status, literacy skills, use of reading and writing skills at home, education, and employment status?

METHODOLOGY

DATA

The data we used are from PIAAC, a survey organized by the OECD and conducted by each participating country (NCES, 2016a, 2016b). PIAAC examines a range of skills and assesses skills consistently across participating countries. Twenty-four countries, including the U.S., participated in Round 1 of the survey in 2011-2012, and an additional nine countries participated in Round 2 in 2014-2015. Additionally, a national supplemental survey was completed in the U.S. in 2014, focusing on younger workers, older workers (ages 66 to 74), and an increased sample of unemployed adults. Survey participants were sampled using a four-stage stratified probability method, a complex sampling technique requiring an extensive system of weights and repetitions to accurately run tabulations and regressions. The first round collected data from 5,010 adults and the supplemental survey collected data from 3,660 adults, for a total of 8,670 adults ages 16 to 74 (Hogan et al., 2016; Rampey et al., 2016).

MEASURES

Demographic characteristics

Age was recorded in age groups. The youngest age group in this study was 45-49, followed by 50-54, 55-59, 60-65, 66-70, and 71-74. Age was constructed as an ordinal variable

with 6 levels, from youngest to oldest. In this study, in light of the emphasis placed on employment status, we analyzed the 45-65 and 66-74 age groups separately. Indeed, the sample size of unemployed respondents in the 66-74 age group was insufficient for this study. Sex was coded as a dichotomous dummy variable (1 = female, 0 = male). Race was also coded as a dichotomous dummy variable (1 = white, 0 = nonwhite). Preliminary analysis included more detailed racial/ethnic sub-groups; however, sample sizes for most racial/ethnic minority groups were insufficient for reliable estimations for nationally representative figures. To be consistent across the research questions, we recoded the four racial/ethnic groups (White, Black, Hispanic and Other race) as a dichotomous race variable (white or non-white, which includes "Hispanic," "Black" and "Other") for the final analysis. Although there is no universally accepted standard for the minimum sample size for estimating nationally representative figures with PIAAC data, we used 62 cases as a cut-off point, per the recommendation of statisticians at the Educational Testing Service (ETS) (AIR PIAAC Team, n.d.).

Socioeconomic status

Education was coded as a dichotomous variable indicating whether or not the respondent had a college education or higher (Associate, Bachelor, Doctorate). In the preliminary analysis, we used additional educational attainment levels to examine this variable in greater detail. Owing to insufficient sample sizes in several educational attainment levels, particularly among older age groups, a dichotomous variable was employed in the final analysis.

Employment status was examined in two different ways based on the research questions. For research questions 1, 2 and 4, three dichotomous variables were created: employed (reference group), unemployed, and out of the labor force (unemployed and out of the labor force were each compared to employed). Due to limited sample sizes, only the employed (reference group) and out of the labor force groups were considered in the 66+ age groups. For research question 3, three dichotomous employment variables were created: retired (reference group), employed, and unemployed. Given that approximately one third of the out of the labor force group was retired in the 45 to 65 age group, we examined this sub-group (i.e., retired) of out of the labor force. At the same time, due to limited sample sizes of the unemployed, only the retired, who represent 80% of this age group, and the employed were considered in the 66+ age groups. PIAAC variables that were recoded to create employment variables are shown in Table A.1.A.

Although income information was available in the PIAAC data, income was not examined in this study, because respondents who were not working during the specified time period (e.g., last 12 months) did not have data on income. Given our emphasis on employment status, it was critical to include those who were unemployed and out of the labor force. In addition, more detailed information about pensions, Social Security, and assets was not available for the older age groups. As such, income was not accounted for in this study.

Health

      Self-rated health was dichotomized into good health (excellent, very good and good) and poor health (fair and poor), given the skewed distributions (e.g., small sample sizes in the negative health groups), especially among middle-aged groups.

Literacy skills

      PIAAC data provide 10 plausible values for literacy skills. Plausible values represent the statistically estimated means for responses to literacy-related tasks in the PIAAC. These 10 plausible values were used in our analysis in order to estimate literacy skill scores. The estimated score could range from 0 (the lowest proficiency) to 500 (the highest proficiency). Plausible value-based literacy assessment is known to return more accurate estimates of groups than conventional point estimates (Hogan et al., 2016).

      In the preliminary analysis, inclusion of all proficiency scores available in the PIAAC data--literacy, numeracy and problem-solving skills--resulted in multicollinearity. Numeracy and problem-solving skills were not included due to the high correlations. For the 45-65 age groups, literacy skills were highly correlated with numeracy (weighted Pearson's r = 0.86) and problem solving skills (weighted Pearson's r = 0.78). Among the 66+ age groups, literacy skills were also highly correlated with numeracy (weighted Pearson's r = 0.77) and problem solving skills (weighted Pearson's r = 0.65). Therefore, we used literacy skills as the overall skill proficiency indicator in this study. On a related note, further analysis of numeracy and problem-solving skills is warranted in order to understand their theoretical meanings and specific contribution to a variety of outcomes, such as employment and health. Although numeracy and problem-solving skills were not examined here due to methodological concerns (e.g., multicollinearity) and different theoretical propositions from those we suggested specifically for the literacy skills (e.g., possible unique contributions to the outcome variables in this study), important insights could be gained from including numeracy and problem-solving skills in future research.

Lifelong learning behaviors

      Participation in adult education and training (AET) was coded as a dichotomous variable (1 = participated in any AET in the 12 months preceding the survey, 0 = did not participate in any AET). Participation in formal AET (learning that takes place in educational and training institutions and leads to a recognized credential) and non-formal AET (learning that takes place in educational and training settings but does not typically lead to a recognized credential) were examined. Informal AET was not included in the PIAAC AET measures because AET refers to organized education and training opportunities. Thus, informal AET is not in alignment with the PIAAC AET definition (Grotlüschen et al., 2016). We did consider informal learning through analysis of other variables (see below – reading and writing at home). However, due to limited

sample sizes for formal AET, only participation in nonformal education was examined in the 66+ age groups. Indices for use of reading and writing skills at home were derived from a series of PIAAC survey items measuring skill use at home. These skill use variables represent everyday learning behaviors, such as reading newspapers or books. Eight survey items were used for reading skills (i.e., read --- directions and instructions; letters or memos; articles in newspapers, magazines or newsletters; professional journals or scholarly publications; books, fiction or non-fiction; manual or reference materials; bills, invoices; bank statements or other financial statements; diagrams, maps, or schematics) and four were used for writing skills (write --- letters or memos; articles for newspapers, magazines or newsletters; reports; fill in forms) (OECD, 2016). A higher value on each index means greater use of reading or writing skills at home.

ANALYTIC APPROACH

Sampling weights

PIAAC data provide the survey sampling weights and replicate weights in order to estimate the nationally representative figures and correct standard errors. The final weight (SPFWT10) and the 80 replicate weights (SPFWT1 – SPFWT80) were applied in all estimation procedures.

SAS macro program

Several major commercial statistical packages could have been used to incorporate the sampling weights and replicate weights into estimations of representative figures. However, in order to incorporate the plausible values for literacy, we employed the SAS macro program developed by the International Association for the Evaluation of Educational Achievement (IEA, 2016). The SAS macro program is designed to take the sampling weights, replicate weights and plausible values into account simultaneously. All analyses were conducted using SAS version 9.4 (Copyright © 2013, SAS Institute Inc.).

Weighted descriptive statistics

Weighted descriptive summary statistics were calculated by employment status Depending on the research question, being employed, being out of the labor force or being retired was used as the reference group. Missing values were excluded from the analysis. However, because the set of variables used for each research question varied, the final sample sizes were not the same for all analyses. The final sample sizes for each question are listed in the corresponding tables. For the age group 66 years and older, the analysis was conducted only when the appropriate sample size was available (AIR PIAAC Team, n.d.).

Statistical significance tests and weighted logistic regression analysis

In order to provide the baseline findings for future research and explore the understudied middle-aged and older populations at the national level, the following analytic approach was taken for each research question. Statistical significance was evaluated at the alpha level 0.05. Weighted logistic regression was used to evaluate statistical significance for all questions.

For research question 1, binary logistic regression was used to model AET participation. The first regression modeled AET participation as a function of employment status. The statistical significance indicated whether employment status is associated with AET participation or not. In other words, this analysis evaluated if the individuals who are unemployed or out of the labor force (compared to the employed) are more or less likely to participate in AET. The second regression was to model AET participation as a function of each predictor variable (such as age or sex) separately for each of the three employment statuses (i.e., individuals who are employed, unemployed, or out of the labor force). For example, when AET participation (vs. non-participation) is regressed on sex (female vs. male), the estimated regression coefficient evaluates if employed females are more or less likely to participate in AET than employed males, and similarly for unemployed and out of the labor force groups. However, it does not evaluate whether employed females are more likely to participate in AET than unemployed females. For variables that have more than one category (age for example), dummy variables for each category were used to compare to the reference group.

For research question 2, binary logistic regression was used to model employment outcomes (employed vs. unemployed and employed vs. out of the labor force for the ages 45-65; and employed vs. out of the labor force for 66 years and older). The statistical significance indicated whether literacy skills or use of reading and writing skills at home is associated with employment status.

For research question 3, binary logistic regression was used to model employment outcomes (retired vs. employed; retired vs. unemployed for the ages 45-65; and retired vs. employed for 66 years and older). The statistical significance indicated whether literacy skills or use of reading and writing skills at home is associated with employment status.

For research question 4, binary logistic regression was used to model self-rated health (positive health = excellent, very good, good vs. negative health = fair, poor). The statistical significance indicated whether literacy skills or use of reading and writing skills at home is associated with self-rated health.

RESULTS

EMPLOYMENT STATUS DESCRIPTIVE STATISTICS

We examined the unemployed and out of the labor force categories for ages 45 - 65 to gain a better understanding of these groups (see Table A.1.A for a description of employment variables and weighted descriptive statistics). Of those out of the labor force, 37% are "permanently disabled," 31% are "retired," 14% are "fulfilling domestic tasks or looking after family members." Of those who were not in the labor force and were permanently disabled, 66% rated their health as "fair" or "poor."

ANALYTIC SAMPLES

The final unweighted sample sizes for research questions 1, 2, 3 and 4 were 2,475, 2,169, 2,021 and 2,475 among the 45-65 age group; and 712, 712, 620, and 712 among the 66+ age group, respectively. Unweighted descriptive statistics are included in Table A.1.B. Sample sizes for key sub-groups such as employment status and AET participation are shown in the corresponding tables.

FINDINGS: RESEARCH QUESTION 1

To explore research question 1 ("Are there any differences in participation in Adult Education and Training (AET) programs among employed, unemployed and out of the labor force, and what are the reasons for non-participation?"), weighted descriptive statistics and statistical significance tests (i.e., Wald chi-square test adjusted for age, sex, education and race) were computed. Table A.1.1[2] shows the weighted descriptive summary for PIAAC respondents ages 45-65 by employment status. Individuals who are unemployed or out of the labor force were significantly less likely to participate in AET than those who are employed. Interestingly, compared to lower educational attainment, higher education educational attainment (i.e., associate's degree or higher) was significantly associated with AET participation among all groups, including the employed, unemployed and out of the labor groups. Also, females were more likely to participate in AET than males among those employed as well as those out of the labor force, although no sex difference was observed among the unemployed. Interestingly, among the unemployed group, whites were less likely to participate in AET compared to non-whites.

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[2] Tables are number by research question, so that Table A.1.1 is the first table related to research question one, Table A.1.2 is the second table related to research question one and so forth. Tables related to research question two begin with Table A.2, tables related to research question three begin with Table A.3 and tables related to research question four begin with Table A.4.

Table A.1.2 shows the weighted descriptive summary for PIAAC respondents ages 66-74 by employment status (unemployed were excluded due to the small sample size). Individuals who are employed were significantly more likely to participate in AET. Similar to the findings from middle-aged PIAAC respondents (see Table A.1.1), adults with higher educational attainment were more likely to participate in AET among the employed as well as out of the labor force groups. Additionally, racial differences were observed among those out of the labor force. Specifically, whites were more likely than non-whites to participate in AET in the out of the labor force group. However, due to the small sample size for non-whites, this finding should be considered preliminary and requires more detailed analysis in the future.

Table A.1.3 shows the weighted descriptive summary for formal AET participation in PIAAC respondents ages 45-65 by employment status. Individuals who are employed were significantly less likely to participate in formal AET than those who are unemployed and significantly more likely to participate in formal AET than those out of the labor force. Adults with higher educational attainment were consistently more likely to participate in formal AET than those with lower educational attainment among the employed, unemployed, and out of the labor force groups. Females and whites were more likely to participate in formal AET (as compared to males and whites, respectively) among the employed group. Also, among the unemployed and out of the labor force groups, whites were less likely to participate in AET compared to non-whites.

Table A.1.4 shows the weighted descriptive summary for non-formal AET participation among PIAAC respondents ages 45-65 by employment status. PIAAC respondents who are unemployed or out of the labor force were less likely to participate in non-formal AET than those who are employed. Like other types of AET, adults with higher educational attainment were more likely to participate in non-formal AET than those with lower educational attainment among the employed, unemployed, and out of the labor force groups. Racial/ethnic differences among the employed and sex differences among those out of the labor force were also identified. Specifically, whites were more likely to participate in non-formal AET compared to non-whites among the employed group. Also, women were more likely to participate in non-formal AET than men among the out of the labor force group. Analysis of formal vs. non-formal AET participation by employment status was not conducted for PIAAC respondents ages 66-74 due to the small sample sizes in key sub-groups.

Overall, PIAAC respondents who are unemployed or out of the labor force were less likely than those who are employed to participate in AET, regardless of the type of AET (see Figure A.7). For example, among the 45 to 65 age groups, about 64% of employed participated in AET, whereas about 43% of the unemployed and about 21% of those out of the labor force participated. Additionally, higher educational attainment seemed to be a consistent predictor of AET participation across all types of AET among the 45-65 age group. AET participation patterns by race/ethnicity were not consistent in any of the employment statuses in age 45-65 group.

FINDINGS: RESEARCH QUESTION 2

To explore research question 2 ("Are there any differences in literacy skills or use of reading and writing skills at home among those who are employed, unemployed, and out of the labor force?"), weighted descriptive statistics and statistical significance tests (i.e., binary logistic regressions adjusted for age, sex, education, race, reading and writing indices and literacy skills) were computed.

Results are shown in Tables A.2.1 and A.2.2. Among PIAAC respondents ages 45-65, there were statistically significant differences in literacy skills between individuals who were employed and unemployed or out of the labor force. Those who were unemployed or out of the labor force were more likely to have lower literacy skills than those who were employed. Although there was no significant difference between the employed and unemployed based on sex, females were more likely to be out of the labor force than employed compared to males. Education (i.e., individuals with an associate's degree or higher vs. those without) and self-rated health were both associated with the differences between the employed and unemployed groups, as well as the employed and out of the labor force groups. Specifically, those with greater education and better health were more likely to be employed than to be unemployed or out of the labor force.

Results from the analyses of PIAAC respondents ages 66 -74 showed that adults who reported better health were more likely than those with poorer health to be employed (vs. out of the labor force). However, none of the other predictors, including literacy skills, lifelong learning behaviors, age, sex, education, and race, were associated with employment status in this age group. These findings about the non-significance of sociodemographic characteristics as well as lifelong learning behaviors were some of the most remarkable differences between the younger (age 45-65) and older (age 66 -74) groups. Finally, with regard to the use of reading and writing skills, neither was associated with the differences between the employed and unemployed groups, as well as the employed and out of the labor force groups, among the 45-65 and 66 -74 age groups.

FINDINGS: RESEARCH QUESTION 3

To explore research question 3 ("Are there any differences in literacy skills or use of reading and writing skills at home among those who are retired, employed, and unemployed?"), weighted descriptive statistics and statistical significance tests (i.e., binary logistic regressions adjusted for age, sex, education and race) were computed. Table A.3.1 shows weighted descriptive summary for PIAAC respondents ages 45-65 by employment status, focusing on retirement. Individuals who are employed were more likely to use writing skills at home than those who are retired. Also, those employed were more likely to report good health than those retired. Moreover, the likelihood of being retired (as opposed to employed) was higher for the oldest age groups (60-65) than for other age groups (i.e., 45-49, 50-54, and 55-59).".

With regard to the unemployed, the findings were similar to the employed, except for health among respondents ages 45-65. Individuals who were unemployed were more likely than the retired to use writing skills at home. Also, the likelihood of being retired (as opposed to unemployed) was higher for the oldest age groups (60-65) than for other age groups (i.e., 45-49, 50-54, and 55-59).

Among the 66 -74 age group (Table A.3.2), the only statistically significant difference was found in self-rated health between the retired and employed groups. Adults who reported better health were more likely than those with poorer health to be employed (vs. retired).

For both age groups (45-65 and 66-74), literacy skills and reading at home were not significantly different among the retired, employed, or unemployed groups.

FINDINGS: RESEARCH QUESTION 4

Weighted descriptive statistics for research question 4 ("Are there any relationships among health status, literacy skills, use of reading and writing skills at home, education and employment status?") and statistical significance tests (i.e., binary logistic regressions adjusted for age, sex, education and race) for individuals age 45-65 are presented in Table A.4.1. Adults with greater literacy skills were more likely to report better health. Also, adults with higher educational attainment (those with an associate's degree or higher) were more likely than those with lower educational attainment (those with less than an associate's degree) to report good health. Moreover, those who are unemployed and out of the labor force were less likely to report better health than the employed.

The same analytic approach (with the exception of unemployment status) was used for individuals ages 66-74 (see Table A.4.2). Among this age group, greater literacy skills were associated with better self-rated health. Also, employment status was significantly associated with self-rated health. Specifically, adults who were employed were more likely than those out of the labor force to report good self-rated health.

Among both the 45-65 and 66+ age groups, use of reading and writing skills at home was not associated with self-rated health.

DISCUSSION & CONCLUSIONS

This research project sought to gain an understanding of associations between key human capital indicators and employment among middle-aged and older adults in the U.S. In particular, we examined participation in adult education and training activities, use of practical skills, employment, retirement, and health status.

Participation in Lifelong Learning Activities

Participation in learning activities over the life course is ever more important in an increasingly global and technologically advanced economy. At the same time, the work force in the U.S. is aging and labor market participation at older ages has grown substantially in recent decades (Toossi, 2015). During and following the Great Recession, durations of unemployment for older workers approached one year for some age groups (see Figure A.4) (BLS, 2011, 2013). Workers unable to secure employment after extended periods of unemployment often exited the labor market (Maestas et al., 2015). Despite these trends, overall, unemployed and out of the labor force adults ages 45 – 65 participate in AET significantly less than the employed. This is consistent with patterns previously observed among U.S. adults ages 25-64 (OECD, 2014b). The out of the labor force group, especially those who recently exited the labor market, could benefit from lifelong learning activities, since they would likely have improved employment prospects if their skills were more current or they were trained for a new, less physically demanding occupation (OECD, 2015b).

Employed adults may participate in non-formal learning activities simply because of opportunities available in their workplace, but it is also possible that people who are employed are more likely to be lifelong learners. Greater participation in AET for the employed compared to those out of the labor force in the 66 – 74 age group was also observed. Given the benefits of lifelong learning for health and economic outcomes, the observed disparities in AET participation may exacerbate existing disparities in self-reported health and economic security among older adults.

The exception to greater participation by the employed is for formal AET activities. While a relatively small proportion of adults ages 45 to 65 participate in formal learning, the unemployed are more likely to participate than the employed. At the same time, those out of the labor force were less likely to participate in formal AET than the employed. Presumably, those unemployed are seeking retraining in a more formal setting to become re-employed and may have greater availability of time than the employed. Increased emphasis on formal learning activities by the unemployed could be part of a strategy for improving employment outcomes; however, additional research is needed to establish a causal relationship.

Literacy Skills, Employment, and Health Status

On average, the unemployed and those out of the labor force in the 45 – 65 age group had significantly lower literacy skills than the employed. This is in line with recent research revealing higher labor force participation among U.S. adults at the highest levels of literacy compared to those at the lowest levels (OECD, 2013). Comparing literacy scores by age group and employment status, the lowest literacy scores observed were for those out of the labor force, ages 45 –65 (see Figure A.10). Those out of the labor force in this age group also participated in

AET at lower rates than the employed and unemployed. Because the PIAAC data do not allow us to determine causality, we can only speculate as to the reasons for these differences. However, it is likely that those with greater literacy skills are simply more employable (Grotlüschen et al., 2016; Kutner, Greenberg, & Baer, 2006). For the 66 – 74 age group, there was no significant difference in literacy skills between the employed and out of the labor force groups. Older adults who are employed may be working because they like their job, or to feel productive (although financially they don't need to); or they may be working for economic reasons. Meanwhile, among those out of the labor force, some may have high literacy skills that enabled them to earn more and retire comfortably, whereas others may have poor literacy skills that limited their employability and led to an unplanned withdrawal from the labor force.

There was no significant difference in literacy skills between the retired and employed, or the retired and unemployed. However, people who are employed or unemployed write at home more often than those who are retired among the 45-65 age group. This may reflect a cohort effect; labor market impacts of lower education levels may have increased over time, such that for older cohorts, lower levels of education might not have the same negative implications as for younger cohorts.

There was a positive relationship between literacy skills and self-rated health, which is consistent with previous research (OECD, 2013; Smith et al., 2015; Stine-Morrow, Hussey & Ng, 2015; Yamashita & Kunkel, 2015). There are several potential reasons for this, such as those with greater literacy skills also having greater financial resources for health care. The health care system in the U.S. is quite complex, and those with lower literacy skills may have difficulty navigating the system. In addition, those with greater literacy skills may also be more knowledgeable about healthful behaviors and disease management (DeWalt, et al., 2004). For the oldest age group, age-related health issues (i.e., cognitive decline, poor eyesight, hearing loss) could negatively influence literacy skills. Importantly, positive self-rated health was also associated with being employed (vs. unemployed). This is also consistent with earlier findings (Bambra & Eikemo, 2009; Dooley, 2003; Gallo et al., 2000; Kaleta et al., 2008; Schuring et al., 2011; Stronks et al., 1997). The relationship among literacy skills, employment, and self-rated health requires further examination in future research.

CONTRIBUTIONS TO RESEARCH

This analysis makes several important contributions to research and provides further empirical support for the importance of continued investments in human capital over the life course. The larger sample of unemployed in the 2014 PIAAC National Supplement allowed us to analyze participation in AET in ways that were not previously possible. Unemployed adults ages 45 – 65 participated in AET at lower rates than their employed counterparts, when perhaps they are most in need of additional training. Interestingly, when examining formal AET separately, unemployed adults were more likely to participate than their employed counterparts.

Examination of employment-related variables (see Table A.1.A) allowed us to examine more closely "out of the labor force" and "unemployment" variables for ages 45 - 65. For example, a substantial proportion of the out of the labor force group are not retired. Participation in AET by these groups might provide them with the skills they need to reenter the labor force and improve their financial stability as they approach retirement.

While the summary results from the PIAAC National Supplement report included proportions of adults in each of the literacy levels based on employment status, average scores were not provided and only broad age categories were included (Rampey et al., 2016). The current research includes average literacy scores by employment status and educational attainment for several age groups. We also examined literacy skills by age and health status and the use of skills at home, along with reasons for non-participation.

IMPLICATIONS FOR POLICY AND PRACTICE

Middle-aged and older adults are an important component of the U.S. labor force and are essential for continued economic growth. Despite the importance of this age group to the labor market, they are less likely than their younger counterparts to participate in lifelong learning activities. To remain competitive in an increasingly global economy with rapid technological changes, continued skill upgrades are necessary for people of all ages. Declines in labor force participation rates for the 45 – 54 age group, combined with increases in SSDI claims for that age group, suggest the need for policies and practices that promote participation in lifelong learning activities, so this age group can remain engaged in the work force. Policies that focus on the unemployed, those recently out of the labor force, those with permanent disabilities who could be trained to work in a less physically demanding occupation, and lower income groups who are most at risk for economic insecurity in retirement are especially important. While this will likely require additional funding for publicly sponsored programs, there will be benefits to both individuals and to social welfare programs. Individuals will benefit through an improved employment outlook and the public will benefit by reduced demands on social welfare programs, such as SSDI. While the government plays an important role in funding training programs, job training is generally viewed as a shared responsibility by the public sector, the individual, and the employer (Cummins, Kunkel, & Walker, 2014). Tax credits to employers who provide training and tax deductible lifelong learning accounts for employees in combination with increased funding for government sponsored training programs are examples of policies that encourage a shared responsibility by all involved.

From a practice standpoint, outreach programs by educational providers that inform potential students about the benefits of participation in learning activities and provide information about financial aid could also increase involvement. Reasons for non-participation in AET suggest that affordable AET opportunities that focus on low-income groups, the unemployed, and females could result in increased participation in lifelong learning activities.

Programs that offer financial planning advice, including determining if an individual needs to remain in the labor force to maintain a desired lifestyle, could also increase participation by allowing individuals to make an informed decision about their future. An added benefit of increased participation in AET is the potential for improved health that has been shown to be related to employment and literacy.

FURTHER RESEARCH TO BE EXPLORED

PIAAC is a rich data set that provides opportunities to gain a better understanding of the relationships among skill proficiencies, lifelong learning activities, and labor market outcomes. Analysis of data from the International Adult Literacy Survey (IALS) and the Adult Literacy and Life Skills Survey (ALL), both of which served as models for the background questionnaire and the assessment portion of PIAAC (Goodman et al., 2013), and PIAAC will allow the estimation of age effects and cohort effects related to skill proficiency and employment/labor force participation. In addition, examination of numeracy skills is warranted given the U.S. has increasingly become a quantitative, information and technologically heavy society. Specific literacy skills for quantitative information is most likely associated with the employment prospects and performance at work (e.g., job security). By the same token, health-related information often includes complex numeric concepts (e.g., risks, ratios, relative comparisons). Better understanding of numeracy skills in the context of employment and health will be a logical next step.

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ANNEX

Table A.1.A
Selected Employment Characteristics Ages 45 – 65, and 66 and older (unweighted)

Age	Employment Status n (% of population) (selected categories from variable C_D05)		Out of the Labor Force n (% of population) (cross tabs of selected categories from variables C_D05 and C_Q07)	
45-65	Employed	1,559 (61.62%)	Permanently disabled	209 (37.02%)
	Unemployed	345 (13.64%)	In retirement or early retirement	176 (31.15%)
	Out of the labor force	571 (22.57%)	Fulfilling domestic tasks or looking after a family member	77 (14.39%)
66 and older	Employed	209 (28.89%)	Permanently disabled	56 (10.96%)
	Unemployed	13 (1.71%)	In retirement or early retirement	411 (81.82%)
	Out of the labor force	503 (69.40%)	Fulfilling domestic tasks or looking after a family member	23 (4.17%)

Notes:

1. Variable C_D05 includes categories employed, unemployed, and out of the labor force.

2. Omitted categories from "out of the labor force" cross tabs include employed (n=15), unemployed (n= 69), pupil/student (n=10), and other/refused (n=15)

3. Variable C_Q07 includes categories in retirement or early retirement, permanently disabled, and fulfilling domestic tasks or looking after a family member.

Table A.1.B

Unweighted Descriptive Statistics of the Analytic Samples in PIAAC, Age 45 - 74

	percentage or mean (standard deviation) N = 3,279
Age Group	
45-49	19.30%
50-54	20.37%
55-59	17.99%
60-65	19.49%
66-70	14.85%
71-74	7.99%
Sex	
Female	54.68%
Male	44.32%
Education	
Associate's degree or higher	38.90%
Less than an associate's degree	61.10%
Race	
White	72.31%
Other race	21.69%
Self-rated health	
Excellent, very good and good	76.45%
Fair and poor	23.55%
Literacy	
Reading at home index	3.57 (1.38)
Writing at home index	2.70 (1.67)

Note:
1. Sample size for each analysis varies due to the missing values and partially administered survey items.

Table A.1.B
Selected Employment Characteristics Ages 45 – 65, and 66 and older (unweighted)

Age	Employment Status n (% of population) (selected categories from variable C_D05)		Out of the Labor Force n (% of population) (cross tabs of selected categories from variables C_D05 and C_Q07)	
45-65	Employed	1,559 (61.62%)	Permanently disabled	209 (37.02%)
	Unemployed	345 (13.64%)	In retirement or early retirement	176 (31.15%)
	Out of the labor force	571 (22.57%)	Fulfilling domestic tasks or looking after a family member	77 (14.39%)
66 and older	Employed	209 (28.89%)	Permanently disabled	56 (10.96%)
	Unemployed	13 (1.71%)	In retirement or early retirement	411 (81.82%)
	Out of the labor force	503 (69.40%)	Fulfilling domestic tasks or looking after a family member	23 (4.17%)

Notes:
1. Variable C_D05 includes categories employed, unemployed, and out of the labor force.
2. Omitted categories from "out of the labor force" cross tabs include employed (n=15), unemployed (n= 69), pupil/student (n=10), and other/refused (n=15).
3. Variable C_Q07 includes categories in retirement or early retirement, permanently disabled, and fulfilling domestic tasks or looking after a family member.

Table A.1.1

Weighted[2] Descriptive Statistics by Any Adult Education and Training (AET) and Employment Status among Age 45 – 65

Variables	Employed (n = 1,559)		Unemployed (n = 345)		Out of the labor force (n = 571)	
Any AET	Participants (64.16%)	Non-participants (35.84%)	Participants (43.02%)*1	Non-participants (56.98%)	Participants (21.83%)*1	Non-participants (78.17%)
Age Group						
45-49	63.69%	36.31%	32.68%	67.32%	30.97%	69.03%*
50-54	65.30%	34.70%	45.55%	54.45%	9.92%	90.08%*
55-59	69.12%	30.88%*	42.02%	57.98%	20.49%	79.51%
60-65 (ref)	59.00%	41.00%	52.90%	47.10%	22.31%	77.69%
Sex						
Female	67.59%	32.41%*	39.54%	60.46%	24.68%	75.32%*
Male (ref)	61.41%	38.59%	44.68%	55.32%	14.02%	85.98%
Education						
Associate's degree or higher	81.42%	18.58%*	61.98%	38.02%*	36.66%	73.34%*
Less than an associate's degree (ref)	51.40%	48.60%	33.11%	66.89%	15.70%	84.30%
Race						
White	66.71%	33.29%	40.42%	59.58%*	20.52%	79.48%
Other race (ref)	57.89%	42.11%	46.24%	53.76%	21.67%	78.33%

Notes:

1. Tables are number by research question, so that Table A.1.1 is the first table related to research question one, Table A.1.2 is the second table related to research question one and so forth. Tables related to research question two begin with Table A.2, tables related to research question three begin with Table A.3 and tables related to research question four begin with Table A.4.

2. *1 A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and employment status as the explanatory variable ($p < 0.05$; vs. Employed).

3. * A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and each of the demographic characteristics as the explanatory variable, separately for employed/unemployed/out of the labor force groups [$p < 0.05$; vs. Variable (ref)].

4. (ref) = reference group; for example, age 55-59 compared to age 60-65 (ref); females compared to male (ref).

5. Final sampling weights and replicate weights were applied.

6. n: available sample size in the dataset (unweighted).

Table A.1.2

Weighted Descriptive Statistics by Any Adult Education and Training (AET) and Employment Status among Age 66-74

Variables	Employed (n = 209)		Out of the labor force (n = 503)	
Any AET	Participants (46.38%)	Non-participants (53.62%)	Participants (16.70%)*1	Non-participants (83.30%)
Age 66-70	41.30%	58.70%	16.57%	83.43%
Age 71-74 (ref)	48.22%	51.78%	15.11%	84.89%
Sex				
Female	46.50%	53.50%	17.16%	82.84%
Male (ref)	40.58%	59.42%	14.74%	85.26%
Education				
Associate's degree or higher	52.86%	47.14%*	36.73%	63.27%*
Less than an associate's degree (ref)	37.44%	62.56%	7.05%	92.95%
Race				
White	43.14%	56.86%	17.25%	82.75%*
Other race (ref)	43.65%	56.35%	10.97%	89.03%

Notes:

1. Tables are number by research question, so that Table A.1.1 is the first table related to research question one, Table A.1.2 is the second table related to research question one and so forth. Tables related to research question two begin with Table A.2, tables related to research question three begin with Table A.3 and tables related to research question four begin with Table A.4.
2. *1 A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and employment status as the explanatory variable ($p < 0.05$; vs. Employed).
3. A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and each of the demographic characteristics as the explanatory variable, separately for employed/unemployed/out of the labor force groups [$p < 0.05$; vs. Variable (ref)].
4. (ref) = reference group; for example, age 55-59 compared to age 60-65 (ref); females compared to male (ref).
5. Final sampling weights and replicate weights were applied.
6. n: available sample size in the dataset (unweighted).

Table A.1.3
Weighted Descriptive Statistics by Formal Adult Education and Training (AET) and Employment Status among Age 45 – 65

Variables	Employed (n = 1,559)		Unemployed (n = 345)		Out of the labor force (n = 571)	
Formal AET	Participants (8.17%)	Non-participants (92.23%)	Participants (15.12%)*1	Non-participants (84.88%)	Participants (4.93%)*1	Non-participants (95.07%)
Age Group						
45-49	11.92%	88.08%*	16.16%	83.84%	14.29%	85.71%*
50-54	6.68%	93.32%	13.86%	86.14%	1.90%	98.10%*
55-59	8.64%	91.34%	16.46%	83.54%	5.84%	94.16%*
60-65 (ref)	4.65%	95.35%	13.64%	86.36%	2.10%	97.90%
Sex						
Female	9.71%	90.29%*	15.08%	84.92%	3.58%	96.42%
Male (ref)	5.83%	94.17%	13.30%	86.70%	3.40%	96.60%
Education						
Associate's degree or higher	10.86%	89.14%*	21.89%	78.11%*	6.69%	93.31%*
Less than an associate's degree (ref)	5.34%	94.66%	10.67%	89.33%	2.49%	97.51%
Race						
White	13.07%	86.93%*	21.52%	28.48%*	5.37%	94.63%*
Other race (ref)	11.92%	88.08%	16.16%	83.84%	14.29%	85.71%

Notes:
1. Tables are number by research question, so that Table A.1.1 is the first table related to research question one, Table A.1.2 is the second table related to research question one and so forth. Tables related to research question two begin with Table A.2, tables related to research question three begin with Table A.3 and tables related to research question four begin with Table A.4.
2. *1 A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and employment status as a the explanatory variable (p < 0.05; vs. Employed).
3. * A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and each of the demographic characteristics as the explanatory variable, separately for employed/unemployed/out of the labor force groups [p < 0.05; vs. Variable (ref)].
4. (ref) = reference group; for example, age 55-59 compared to age 60-65 (ref); females compared to male (ref)
5. Final sampling weights and replicate weights were applied.
6. n: available sample size in the dataset (unweighted).

Table A.1.4

Weighted Descriptive Statistics by Non-Formal Adult Education and Training (AET) and Employment Status among Age 45 – 65

Variables	Employed (n = 1,559)		Unemployed (n = 345)		Out of the labor force (n = 571)	
Non-formal AET	Participants (55.98%)	Non-participants (44.02%)	Participants (27.91%)*1	Non-participants (72.09%)	Participants (16.90%)*1	Non-participants (83.10%)
Age Group						
45-49	52.74%	47.26%	20.21%	79.79%	19.32%	80.68%
50-54	59.25%	70.75%	33.59%	66.41%	9.89%	90.11%*
55-59	60.25%	39.75%	25.83%	74.17%	15.98%	84.02%
60-65 (ref)	54.72%	45.28%	35.11%	64.89%	20.63%	79.37%
Sex						
Female	57.88%	42.12%	29.60%	70.40%	21.10%	78.90%*
Male (ref)	55.58%	44.42%	26.24%	73.76%	10.62%	89.38%
Education						
Associate's degree or higher	70.56%	29.44%*	40.09%	59.91%*	29.97%	70.03%*
Less than an associate's degree (ref)	46.06%	53.94%	22.44%	77.56%	13.22%	86.78%
Race						
White	60.56%	39.44%*	30.00%	70.00%	17.45%	82.55%
Other race (ref)	42.82%	57.18%	25.61%	74.39%	15.68%	84.32%

Notes:
1. Tables are number by research question, so that Table A.1.1 is the first table related to research question one, Table A.1.2 is the second table related to research question one and so forth. Tables related to research question two begin with Table A.2, tables related to research question three begin with Table A.3 and tables related to research question four begin with Table A.4.
2. *1 A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and employment status as the explanatory variable ($p < 0.05$; vs. Employed).
3. A binary logistic regression was used for testing the significance using the AET participation as an outcome variable and each of the demographic characteristics as the explanatory variable, separately for employed/unemployed/out of the labor force groups [$p < 0.05$; vs. Variable (ref)].
4. (ref) = reference group; for example, age 55-59 compared to age 60-65 (ref); females compared to male (ref)
5. Final sampling weights and replicate weights were applied.
6. n: available sample size in the dataset (unweighted).

Table A.2.1

Weighted Descriptive Summary for the Respondents age 45-65 by the Employment Status

Variables	Employed (n = 1,370)	Unemployed (n = 310)	Out of the labor force (n = 489)
	Mean (standard deviation) or percentage	Mean (standard deviation) or percentage	Mean (standard deviation) or percentage
Literacy skills	279.89 (49.08)	259.52 (30.79)*	272.31 (48.88)*
Reading at home index	2.59 (0.85)	2.67 (0.56)	2.43 (0.90)
Writing at home index	2.12 (1.04)	2.28 (0.59)	1.82 (1.09)
Age Group			
45-49	28.71%	28.77%	14.51%*
50-54	27.39%	24.53%	17.80%
55-59	23.04%	25.65%	23.79%
60-65 (Ref)	20.86%	21.05%	43.90%
Sex			
Female	51.64%	60.16%	66.37%*
Male (Ref)	45.36%	39.84%	33.63%
Education			
Associate's degree or higher	48.55%	35.22%*	27.48%*
Less than an associate's degree (Ref)	51.45%	64.78%	72.52%
Race			
White	75.29%	61.05%	70.60%
Other Race	24.71%	38.95%	29.35%
Self-rated health			
Good health	89.30%	75.80%*	56.47%*
Poor health (Ref)	10.70%	24.20%	43.53%

Notes:
1. n: available sample size in the dataset (unweighted)
2. Ref = reference group for the categorical variables.
3. A binary logistic regression was used for testing the significance using the employment status as an outcome variable and the demographic characteristics as the explanatory variables (simultaneously in one model), separately for unemployed and out of the labor force groups [$p < 0.05$; vs. Employed].
4. Final sampling weights and replicate weights were applied.

Table A.2.2

Weighted Descriptive Summary for the Respondents age 66-74 by the Employment Status

Variables	Employed (n = 209)	Out of the labor force (n = 503)
	Mean (standard deviation) or percentage	Mean (standard deviation) or percentage
Literacy skills	272.05 (53.10)	257.28 (47.07)
Reading at home index	2.67 (0.72)	2.56 (0.85)
Writing at home index	2.06 (1.02)	2.03 (0.91)
Age Group		
66-70	68.28%	62.61%
71-74 (Ref)	31.72%	37.39%
Sex		
Female	48.57%	56.90%
Male (Ref)	51.43%	43.10%
Education		
Associate's degree or higher	44.24%	35.14%
Less than an associate's degree (Ref)	55.76%	64.86%
Race		
White	85.15%	81.32%
Other race (Ref)	14.85%	26.46%
Self-rated health		
Good health	90.04%	73.54%*
Poor health (Ref)	9.96%	26.46%

Notes:
1. n: available sample size in the dataset (unweighted)
2. Ref = reference group for the categorical variables.
3. A binary logistic regression was used for testing the significance using the employment status as an outcome variable and the demographic characteristics as the explanatory variables (simultaneously in one model), separately for unemployed and out of the labor force groups [$p < 0.05$; vs. Employed].".
4. The respondents who were unemployed excluded in this age group due to the small sample size.
5. Final sampling weights and replicate weights were applied.

Table A.3.1.
Weighted Descriptive Summary for the Respondents age 45-65 by the Employment Status

	Retired (n = 230)	Employed (n = 1,408)	Unemployed (n = 383)
	Mean (standard deviation) or percentage	Mean (standard deviation) or percentage	Mean (standard deviation) or percentage
Literacy skills	273.62 (46.04)	280.51 (48.82)	247.53 (37.36)
Reading at home index	2.64 (0.78)	2.58 (0.83)	2.56 (0.71)
Writing at home index	1.93 (1.03)	2.11 (1.03)*	2.15 (0.72)*
Age Group			
45-49	2.44%	27.95%*	29.57%*
50-54	4.88%	28.11%*	29.27%*
55-59	18.54%	22.89%*	24.09%*
60-65 (Ref)	74.15%	21.04%	17.07%
Sex			
Female	58.59%	51.49%	63.60%
Male (Ref)	41.41%	48.51%	36.40%
Education			
Associate's degree or higher	46.75%	49.18%	25.65%
Less than an associate's degree (Ref)	53.25%	50.82%	74.35%
Race			
White	76.72%	75.26%	61.03%
Other race (Ref)	23.28%	24.74%	38.97%
Self-rated health			
Good health	80.70%	90.39%*	72.24%
Poor health (Ref)	19.30%	9.61%	27.76%

Notes:
1. n: available sample size in the dataset (unweighted)
2. Ref = reference group for the categorical variables.
3. A binary logistic regression was used for testing the significance using the employment status as an outcome variable and the demographic characteristics as the explanatory variables (simultaneously in one model), separately for employed and unemployed groups [$p < 0.05$; vs. Retired].
3. Final sampling weights and replicate weights were applied.

Table A.3.2
Weighted Descriptive Summary for the Respondents age 66-74 by the Employment Status

Variable	Retired (n = 451)	Employed (n = 169)
	Mean (standard deviation) or percentage	Mean (standard deviation) or percentage
Literacy skills	262.45 (44.56)	268.74 (56.19)
Reading at home index	2.63 (0.82)	2.63 (0.73)
Writing at home index	2.07 (0.86)	2.05 (1.01)
Age Group		
66-70	63.47%	70.14%
71-74 (Ref)	36.53%	29.86%
Sex		
Female	54.84%	47.19%
Male (Ref)	45.16%	52.81%
Education		
Associate's degree or higher	39.03%	45.48%
Less than an associate's degree (Ref)	60.97%	54.52%
Race		
White	83.20%	83.80%
Other race (Ref)	16.80%	16.20%
Self-rated health		
Good health	79.05%	89.74%*
Poor health (Ref)	20.95%	10.26%

Notes:
1. n: available sample size in the dataset (unweighted)
2. Ref = reference group for the categorical variables.
   A binary logistic regression was used for testing the significance using the employment status as an outcome variable and the demographic characteristics as the explanatory variables (simultaneously in one model), separately for employed and unemployed groups [p < 0.05; vs. Retired
3. The respondents who were unemployed were excluded in this age group due to the small sample size.
4. Final sampling weights and replicate weights were applied.

Table A.4.1

Weighted Logistic Regression for the Self-Rated Health of Respondents age 45-65

Variables	Estimated coefficient (Standard error)	Odds ratio
Literacy skills	0.01 (0.01)*	1.01
Reading at home index	0.08 (0.10)	1.08
Writing at home index	0.00 (0.09)	1.00
Age 45-49	0.25 (0.14)	1.29
Age 50-54	-0.17 (0.09)	0.84
Age 55-59	-0.15 (0.10)	0.86
Age 60-65	Ref	Ref
Sex Female	0.12 (0.15)	1.13
Male	Ref	Ref
Education		
Associate's degree or higher	0.55 (0.15)*	1.73
Less than associate's degree	Ref	Ref
Race White	-0.19 (0.14)	0.82
Other race	Ref	Ref
Employed	Ref	Ref
Unemployed	-0.77 (0.20)*	0.46
Out of the labor force	-1.59 (0.14)*	0.20

Notes:
1. n: available sample size in the dataset (unweighted)
2. Ref = reference group.
3. A binary logistic regression was used for testing the significance using the health status (excellent, very good and good health vs. fair and poor health) as an outcome variable and the demographic characteristics as the explanatory variables (simultaneously in one model) [p < 0.05]
4. Final sampling weights and replicate weights were applied.

Table A.4.2
Weighted Logistic Regression for the Self-Rated Health of Respondents Age 66-74

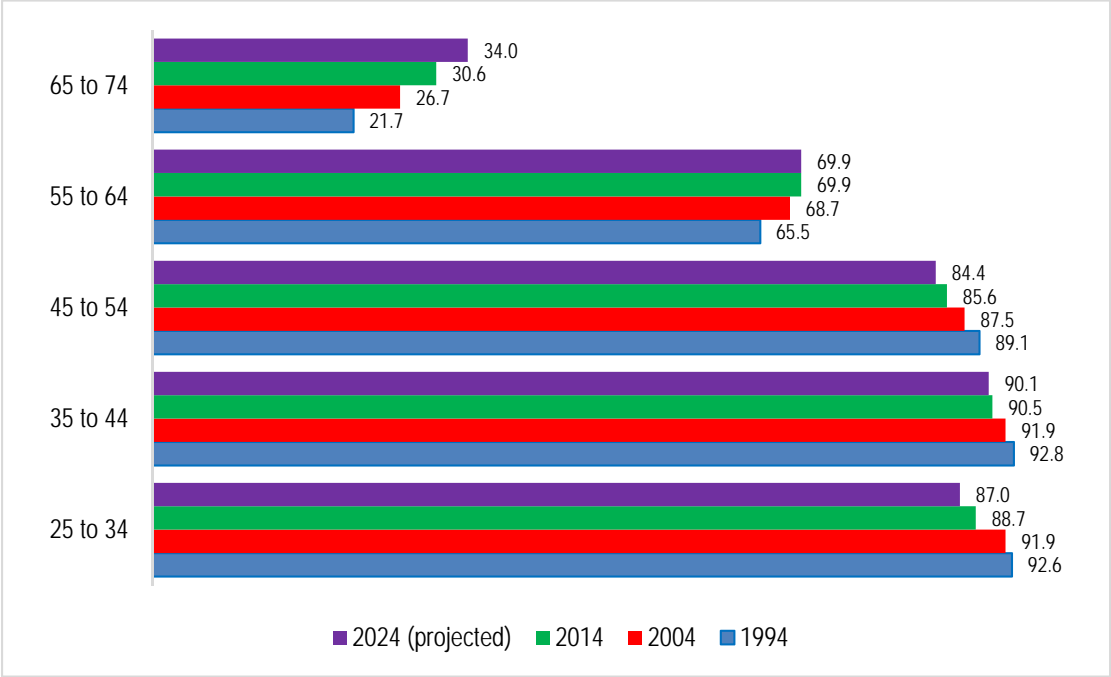| Variable	Estimated coefficient (Standard error)	Odds ratio
Literacy skills	0.01 (0.01)*	1.01
Reading at home index	0.35 (0.19)	1.42
Writing at home index	0.12 (0.13)	1.13
Age 66-70	0.12 (0.12)	1.12
Age 71-74	Ref	Ref
Sex Female	0.02 (0.21)	1.02
Male	Ref	Ref
Education		
Associate's degree or higher	0.37 (0.27)	1.45
Less than associate's degree	Ref	Ref
Race White	-0.05 (0.35)	0.95
Other race	Ref	Ref
Employed	1.06 (0.32)*	2.87
Out of the labor force	Ref	Ref

Notes:
1. n: available sample size in the dataset (unweighted)
2. Ref = reference group
3. A binary logistic regression was used for testing the significance using the health status (excellent, very good and good health vs. fair and poor health) as an outcome variable and the demographic characteristics as the explanatory variables (simultaneously in one model) [$p < 0.05$]
4. Final sampling weights and replicate weights were applied.

Figure A.1. Labor Force Distribution (percentage) in the U.S. by Age Group: 1994 – 2024 (projected)
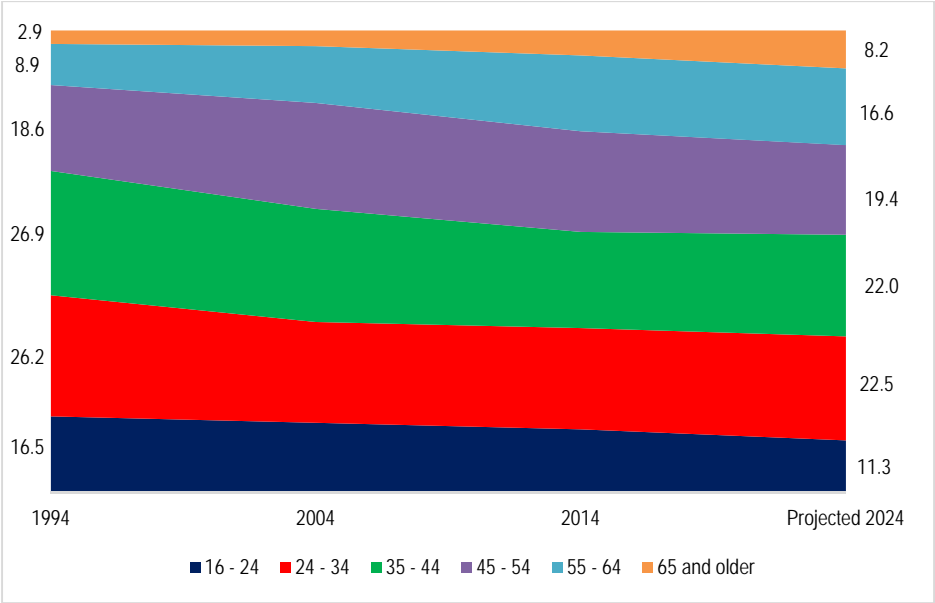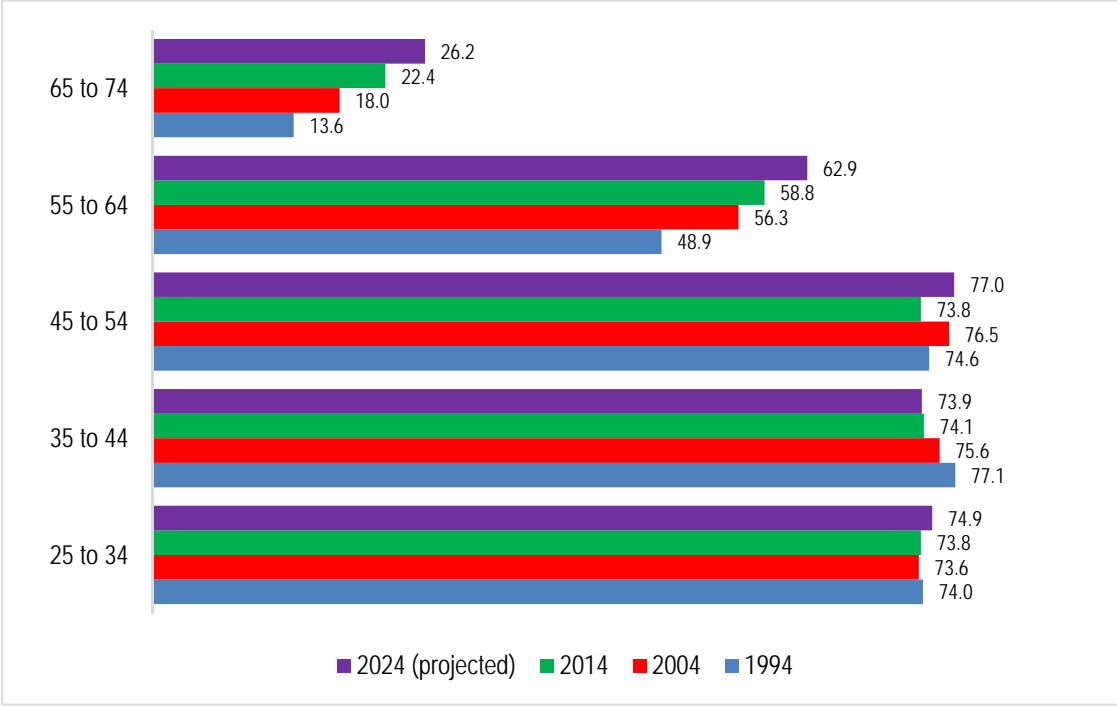

Source: Toossi, 2015.

Figure A.2. Labor Force Participation Rates (percentage) for Males by Age Group: 1994 to 2024 (projected)
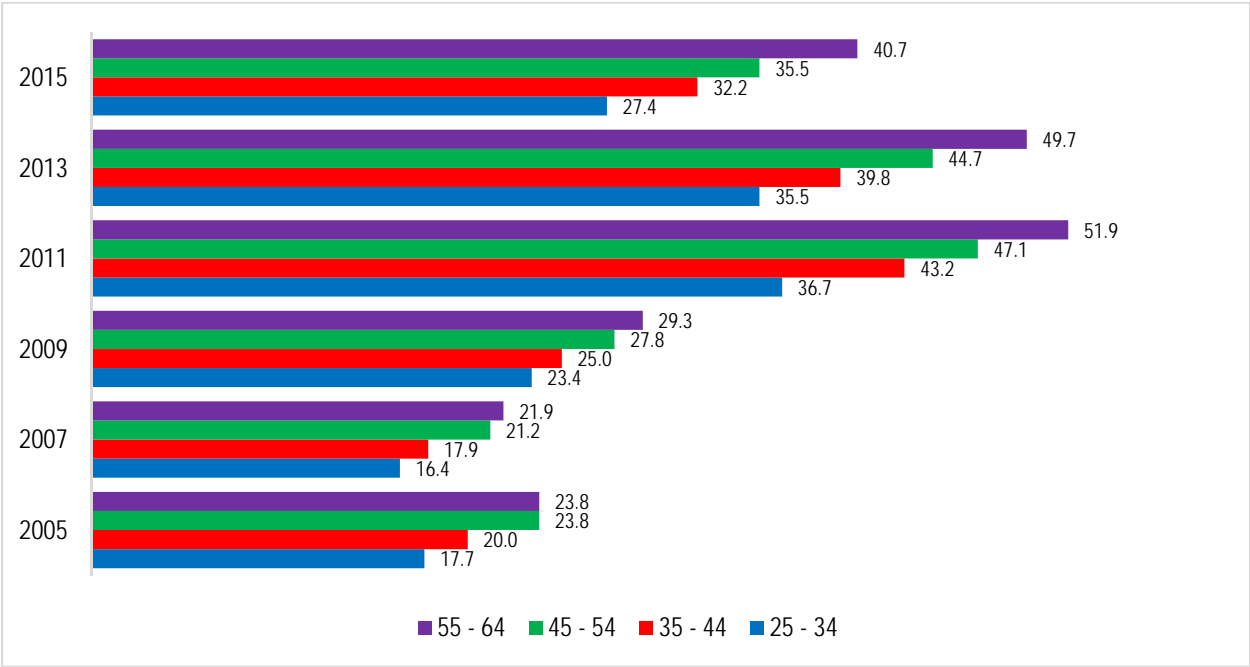

Age Group	2024 (projected)	2014	2004	1994
65 to 74	34.0	30.6	26.7	21.7
55 to 64	69.9	69.9	68.7	65.5
45 to 54	84.4	85.6	87.5	89.1
35 to 44	90.1	90.5	91.9	92.8
25 to 34	87.0	88.7	91.9	92.6

Source: Toossi, 2015.

Figure A.3. Labor Force Participation Rates (percentage) for Females by Age Group: 1994 to 2024 (projected)

Source: Toossi, 2015.

**Figure A.4.** Mean Duration (weeks) of Unemployment by Age Group: 2005 -2015

2015
- 40.7 (55 - 64)
- 35.5 (45 - 54)
- 32.2 (35 - 44)
- 27.4 (25 - 34)

2013
- 49.7 (55 - 64)
- 44.7 (45 - 54)
- 39.8 (35 - 44)
- 35.5 (25 - 34)

2011
- 51.9 (55 - 64)
- 47.1 (45 - 54)
- 43.2 (35 - 44)
- 36.7 (25 - 34)

2009
- 29.3 (55 - 64)
- 27.8 (45 - 54)
- 25.0 (35 - 44)
- 23.4 (25 - 34)

2007
- 21.9 (55 - 64)
- 21.2 (45 - 54)
- 17.9 (35 - 44)
- 16.4 (25 - 34)

2005
- 23.8 (55 - 64)
- 23.8 (45 - 54)
- 20.0 (35 - 44)
- 17.7 (25 - 34)

Legend: ■ 55 - 64 ■ 45 - 54 ■ 35 - 44 ■ 25 - 34

Source: BLS, 2005, 2007, 2009, 2011, 2013, 2015

Figure A.5. Social Security Disability Insurance Claimant Trends (in thousands) by Age Group: 2000 – 2015
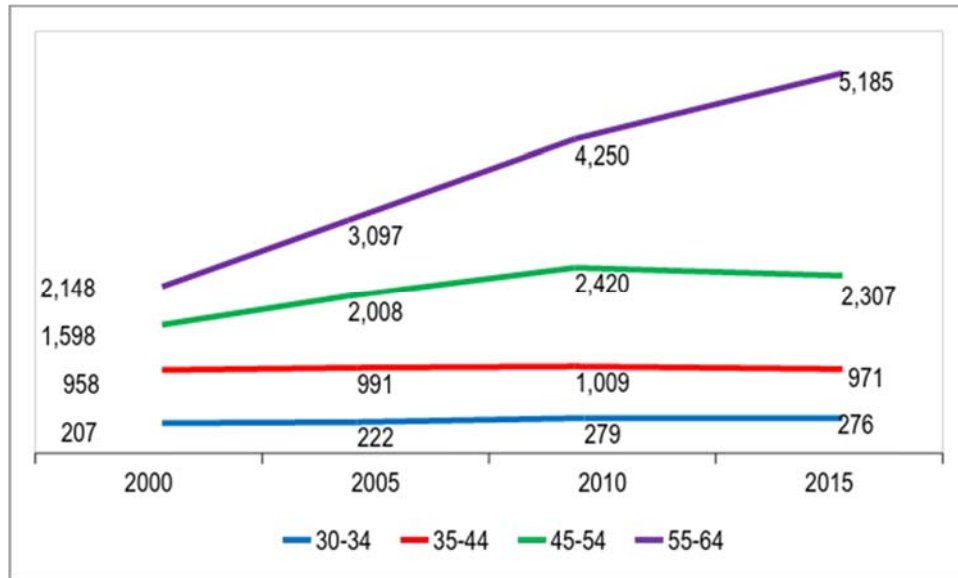

Source: Social Security Administration, 2016.

Figure A.6. Social Security Disability Insurance Claimants as a percentage of the Population 2000 -2015
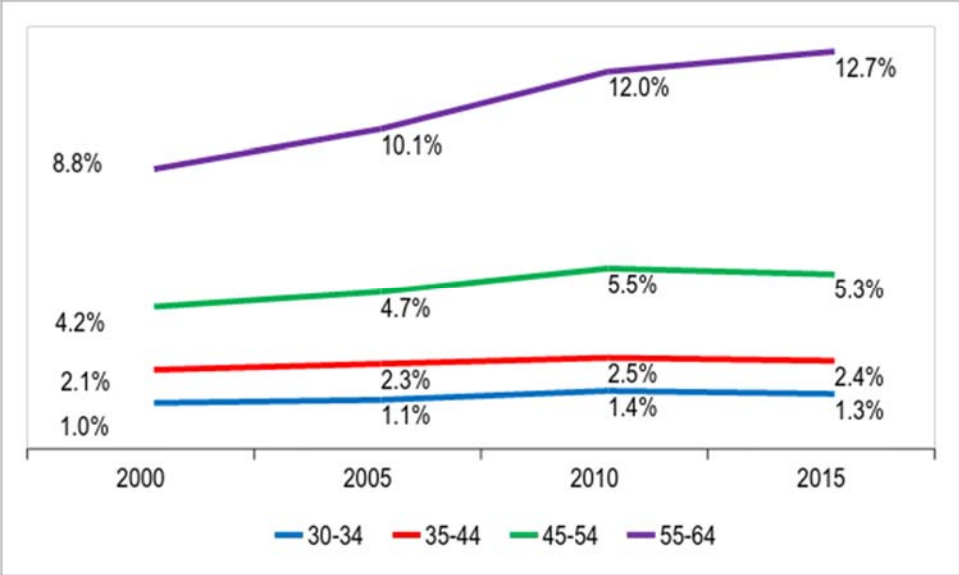
Sources: Authors' calculations based on data from the Social Security Administration (2016) and the U.S. Census Bureau (2000, 2005, 2010, 2015)

Figure A.7. Participation (percentage) in Adult Education and Training (AET) by Age Group and Employment Status
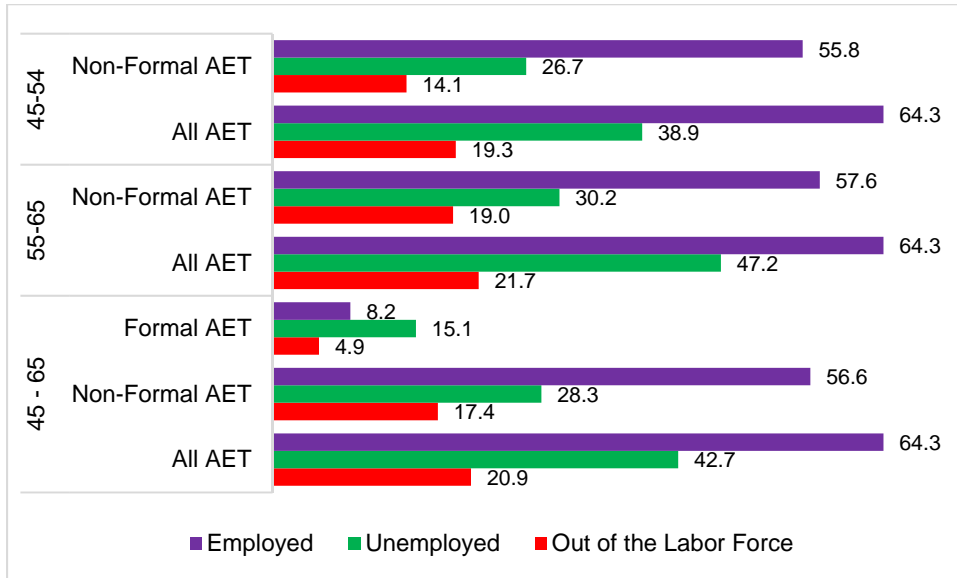
Note: Due to a small *N*, formal AET is only shown for the combined age groups.

Figure A.8. Selected Reasons (percentage) for Non-Participation in Lifelong Learning Activities in the Last 12 Months, by Employment Status, Ages 45 – 65
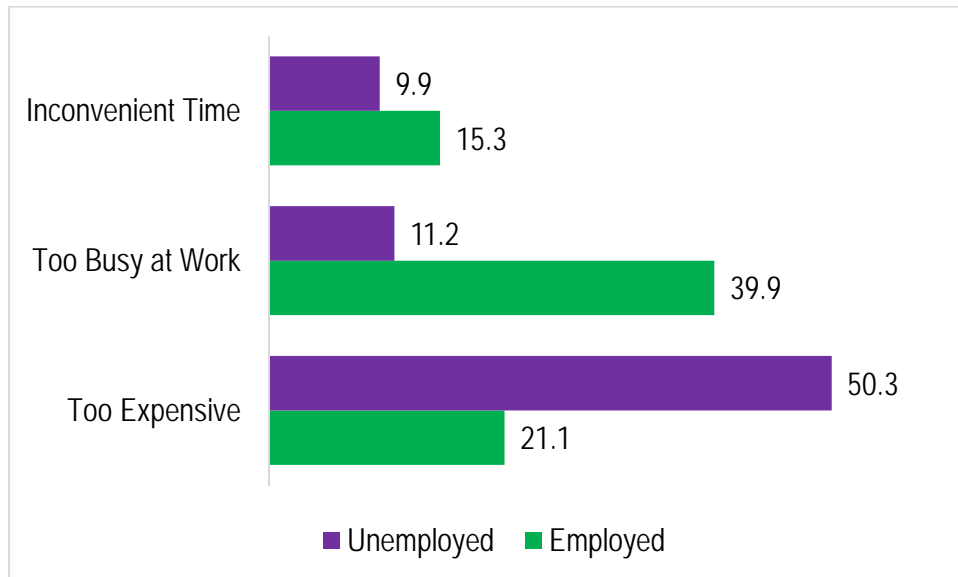
Figure A.9. Selected Reasons (percentage) for Non-Participation in Lifelong Learning Activities by Sex, Ages 45 – 65
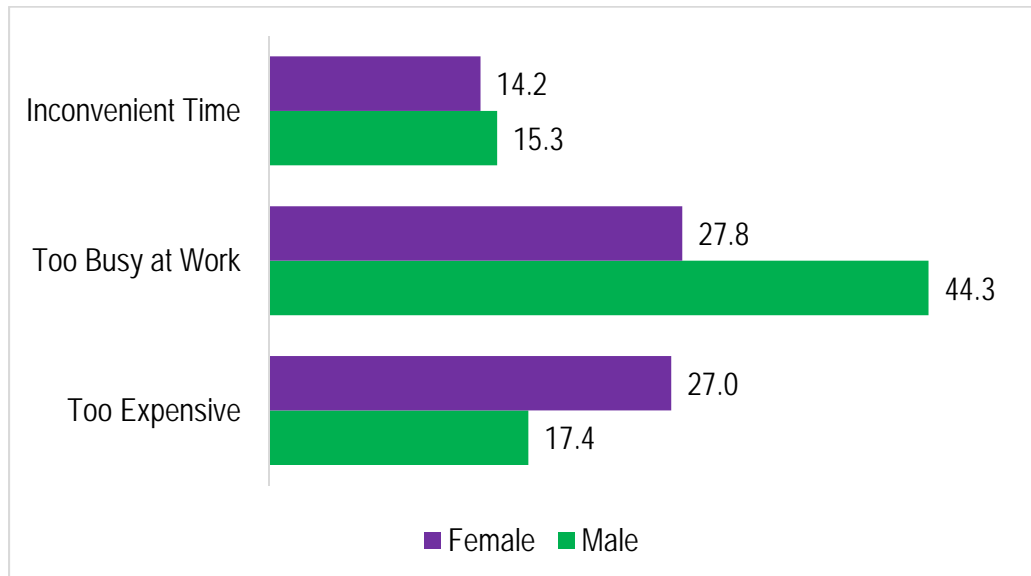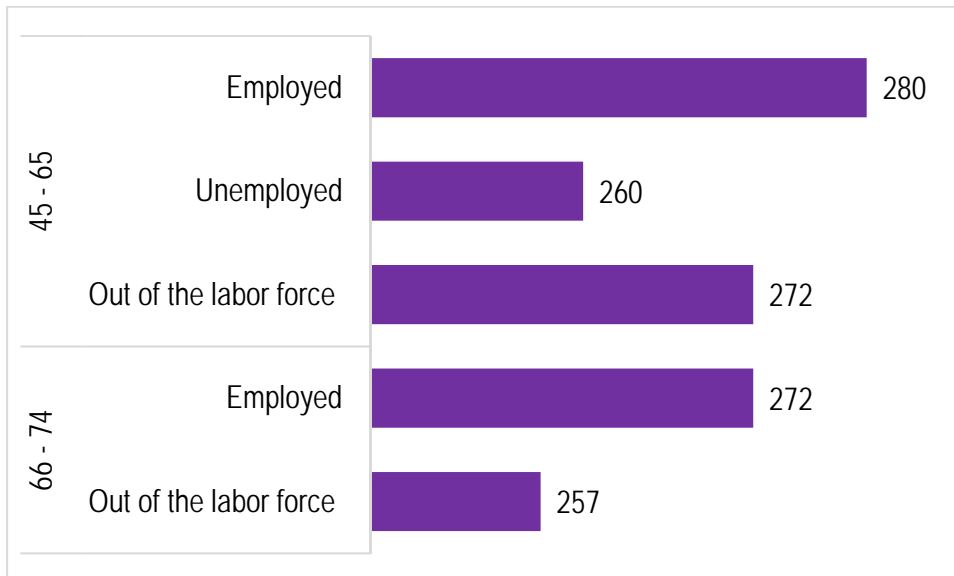
Figure A.10. Average Scores on the PIAAC Literacy Scale (0 – 500) by Age Group and Employment Status

Note: Due to a small *N*, literacy scores are not shown for the unemployed in the 66 to 74 age group. These results are based on the analytical sample included in this study.