Adult Competencies and Employment Outcomes among Older Workers in the U.S. : An

Analysis of the Program for the International Assessment of Adult Competencies

Takashi Yamashita,[1*] Phyllis A. Cummins,[2, 3] Annabelle Arbogast,[3] & Roberto Millar [4]

*corresponding author

1. Department of Sociology, Anthropology, and Health Administration and Policy, University of

Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250

Email: yamataka@umbc.edu

Phone: 4104553979

Fax: 4104551154

2. Scripps Gerontology Center, Miami University

396 Upham Hall, 100 Bishop Circle, Oxford, OH 45056

3. Department of Sociology & Gerontology,

375 Upham Hall, 100 Bishop Circle, Oxford, OH 45056

4. Gerontology, Ph.D. Program, University of Maryland, Baltimore

655 W. Baltimore Street, Baltimore MD 21201

Adult Competencies and Employment Outcomes among Older Workers in the U.S. : An

Analysis of the Program for the International Assessment of Adult Competencies

Abstract

A growing segment of the U.S. workforce --- older workers --- face challenges such as a greater chance of being unemployed for a longer period of time than younger workers and skill obsolescence in contemporary societies. In an age of fast-paced economic and technological change, ongoing investment in human capital in the form of skill training represents a potential strategy for improving older workers' employment prospects. However, empirical evidence is lacking on the relationship between basic skill competencies and employment outcomes for older workers in general. This study analyzed nationally representative data of adults aged 45-65 (n = 2,169) from the Program for the International Assessment of Adult Competencies (PIAAC). Literacy skills were used as the main measure of competencies. Results from multinomial logistic regression identified statistically significant positive associations between literacy skills and employment among older workers. Implications for research, policy, and practice are discussed.

Key words: population aging; retirement; adult education; lifelong learning; life course

Adult Competencies and Employment Outcomes among Older Workers in the U.S.: An Analysis of the Program for the International Assessment of Adult Competencies

As the U.S. population ages, middle-aged and older workers represent an increasingly large segment of the labor force. 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). Following the Great Recession, older workers experienced relatively long periods of unemployment, placing increased strain on workers, their families, and social welfare programs. Education and training are generally considered as key strategies for addressing these employment-related challenges through improved skills (Carnevale, Smith, & Strohl, 2013; Jacobson, LaLonde, & Sullivan, 2005). However, the relationships between general skill proficiencies and employment outcomes have yet to be rigorously investigated at the population level. In the past, a lack of nationally representative data with valid measures of general skills limited the scope of inquiry on this subject. To address this gap in the literature, the present study analyzed nationally representative data on older workers in the U.S. to examine the associations between literacy skills and employment outcomes. In this study, adults in the pre-retirement age group (45-65) were considered older workers.

Labor Force Participation and Unemployment among Older Workers

With the aging of the U.S. population, older workers constitute a rapidly growing segment of the labor force. For example, approximately 9% of the U.S. labor force was aged 55 –64 years old in 1994 but it is expected to exceed 17% by 2024 (Toossi, 2015). While labor force participation rates have increased in recent years for both men and women aged 55 and older,

participation rates for men and women in the 45 to 54 age group have declined, and the rate of decline was greater in the U.S. than in other countries that are members of the Organization for Economic Cooperation and Development (OECD). Between 2000 and 2014, for example, the participation rate for men aged 45 to 54 declined from 89% to 86% in the U.S., while the rate in the United Kingdom (U.K.) increased from 88% to 91% (OECD, 2015b). Such differential trends of the labor force participation rates by particular age groups may be explained by the segments of older workers who are low-skilled and low educational attainment (Office of the President, 2014). Employment opportunities have shifted from routine manual work to jobs requiring higher cognitive skills (e.g. complex problem-solving with new technologies) (Buera, Kaboski, & Rogerson, 2015; OECD, 2012).

Generally, older workers (45 – 64) have lower rates of unemployment compared to younger workers. However, after becoming unemployed, older workers often face substantially longer periods of unemployment than their younger counterparts. For example, in 2015 the average duration of unemployment was 35.5 weeks and 27.4 weeks for the workers aged 45 – 54, and 27.4 weeks for those aged 25 – 34 (U.S. Bureau of Labor Statistics, 2016). Longer periods of unemployment are of concern in the fast-changing contemporary U.S. labor market because the longer an individual is unemployed, the more their skills depreciate (Abraham, Haltiwanger, Sandusky, & Spletzer, 2016). Additionally, the U.S. may face negative economic consequences. For example, a higher unemployment rate often results not only in lower tax revenue, but also in the greater use of the Social Security Disability Insurance (SSDI) program, which puts tremendous pressure on the Social Security Trust Fund (Daly, Lucking, & Schwabish, 2013). In order to avoid the vicious cycle of unemployment and skill depreciation among the growing segment of older workers, acquiring and maintaining the fundamental skills

employers demand are critical (Czaja & Moen, 2004; Guzman, Pawliczko, Beales, Till, & Voelcker, 2012).

Competencies and Employment

Most new and advanced skills are built on fundamental skills such as literacy (Rudd, Moeykens, & Colton, 2000). Therefore, one may predict that adults who possess proficient literacy skills have an advantage both for achieving and maintaining employment. In fact, the reports of the national data show that adults with greater literacy skills are more likely to be employed than those less proficient in literacy (OECD, 2015a). Moreover, among unemployed individuals, adults aged 55-65 (29%) were more likely to have the lowest two levels of literacy skills than any other age groups (22-26%) (Rampey et al., 2016). Additionally, adults with lower literacy skills, as well as those with lower educational attainment, tend to have physically demanding low-skilled blue-collar occupations, which are generally more challenging to aging workers (Grotlüschen, Mallows, Reder, & Sabatini, 2016; Neumark & Song, 2012; Rho, 2010). In short, existing evidence suggests that there are underlying associations between fundamental skills like literacy and employment outcomes.

In light of these associations, adult education over the life course is crucial. It is clear that inequalities in formal education in earlier life stages as well as adult education translate to a gap in competencies in later life (OECD, 2005). In addition, aging is known to be associated with lower literacy skills, which partially determines readiness to acquire new and advanced knowledge and, in turn, employability (Goodman, Finnegan, Mohadjer, Krenzke, & Hogan, 2013). Given the interactions among education, aging, and competencies, continuous engagement in lifelong learning and adult education is key for addressing inequality in multiple life domains such as employment and well-being (e.g., Desjardins, 2003; MacArthur Foundation

Network on an Aging Society, 2012). Continuous learning and ongoing skill development is also necessary to adapt to the demands of rapid changes in technology and to sustain economic growth (Hulten, 2017; Lisbon European Council, 2000).

Theoretical Framework

This study is guided by two theories: human capital theory and practice engagement theory. Human capital can be defined as "productive wealth embodied in labor, skills, and knowledge" (Tan, 2014, p. 412). Investment in education and training leads to the improvement in one's competencies. As such, both individuals and societies benefit from education and training of labor force through enhanced productivity and employment opportunities (Becker, 1962). If unemployed workers lack human capital for jobs that are in demand, their employment prospects are limited (Wanberg, 2012). Globalization and automation of work by new technology, along with more rapid skill obsolescence, have increased the need for ongoing investments in human capital among older workers (Farkas, 2009; Schuetze, 2007). In this context, readiness to learn new skills or general competencies is critical. In this study, following the approach taken by the OECD (OECD, 2016a), we employed literacy skills as an indicator of general competencies. On a related note, numeracy is often considered a critical component of basic competencies. However, this study focuses on literacy skills because literacy skills constitute more a general competency than numeracy, which is specific to quantitative tasks as well as certain occupations/industries (PIAAC Literacy Expert Group, 2009). Also, literacy and numeracy are known to be highly correlated, and therefore, literacy skills provide a strong indicator of competency (e.g., Green & Riddell, 2013; Yamashita & Kunkel, 2015). An examination of literacy skills and employment outcomes should be conducted first, before more specialized competencies such as numeracy.

Practice engagement 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, 2009; Sheehan‐Holt & Smith, 2000). 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 et al., 2016; Reder, 2015). Indeed, Reder (2012) and Desjardins (2003) argue that engaging in literacy practices in a variety of settings (e.g., formal and informal education settings) is associated with improvements in literacy skill proficiency over time. As such, the use of literacy skills should be taken into account when examining literacy skills and employment outcomes. 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 explore a fuller range of possible interventions. The present study examines these factors and can inform future research on the associations between education, skill proficiencies, skill use, and employment outcomes in the older workforce.

Research question and hypothesis

While the proportion of older workers has been increasing in the U.S. labor market, several challenges have emerged, including the employment disadvantages among low-skilled workers and potential economic consequences at the societal level (e.g., increased use of social welfare programs) and at the individual level (risk of poverty and economic insecurity in retirement). Although educational attainment is difficult to alter in the older population, literacy skills are more malleable over the life course (Hatch, Feinstein, Link, Wadsworth, & Richards, 2007). Existing data suggest that literacy skills are related to employment outcomes (Goodman et

al., 2013). A logical next step is to rigorously document the associations between literacy skills and employment outcomes among older workers, to identify interventions and inform the development of education programs to help older workers obtain new and in-demand skills. This study addressed the following research question: are literacy skills and use of literacy skills associated with employment status among older workers in the U.S.? It is hypothesized that literacy skills, as well as use of literacy skills, are associated with employment status. Specifically, it is hypothesized older workers with greater literacy skills as well as greater use of literacy skills are more likely to be employed than their counterparts.

Methods

Data

The data were obtained from the Program for the International Assessment of Adult Competencies (PIAAC) U.S. module public use file. PIAAC is a survey organized by the OECD and conducted by each participating country. The goal of PIAAC is to assess and compare basic skills and a broad range of competencies of adults from participating countries. The assessment emphasizes cognitive and workplace skills necessary for participation in the global economy. Skills assessment, such as PIAAC, are important to confirm that adult learning opportunities are meeting the needs of all adults. Between 2008 and 2016, 33 countries participated in the first two rounds of the survey and an additional five countries are currently participating in round three (NCES, 2017).

The U.S. PIACC data were collected between 2011 and 2014 to generate nationally representative data of adults ages 16 to 74. In addition to obtaining detailed demographic, socioeconomic and employment related information, PIAAC employed a sophisticated literacy assessment (described below), which offers a unique opportunity to examine the role of literacy

skills. The survey respondents were recruited using complex sampling techniques (i.e., four-stage stratified probability methods). Therefore, PIAAC provided a series of sampling weights including the final sample weight and 80 replicate weights to correctly estimate nationally representative results. Other detailed information about PIAAC has been published elsewhere (National Center for Education Statistics, 2016a, 2016b). This study focused on adults aged 45-65 years old. After excluding the cases (about 12%) with missing values for any variable of interest, the final analytic sample size was 2,169. Given all analyses were done with the sampling weights, replicate weights as well as the plausible values (discussed below), no missing data imputation was carried out.

Measures

Outcome variable. Employment status was examined using three categories: employed (reference group), unemployed, and out of the labor force. Employment includes full time, part time and self-employed. The unemployed are not employed but looking for a job, whereas out of the labor force status includes those currently not employed and not looking for work. At the time of this study, the three-category employment status is the most commonly used employment categories with the PIAAC research (AIR PIAAC Team, n.d.).

Predictor variables. Literacy skills were assessed based on performance in a series of literacy-related tasks in the PIAAC. Briefly, a selected set of literacy tasks was administered, and literacy skills were statistically estimated using the item response theory and latent regression models with the background (e.g. demographic) information. PIAAC provides 10 sets of plausible values, which are derived mean literacy scores from the estimated distribution of performance. More technical and mathematical details about the derivation and calibration of the plausible values have been published elsewhere (for example, see OECD, 2016b).

Covariates. Age was recorded in age groups. The PIAAC public use file does not provide continuous age information (e.g., years). Age was constructed as an ordinal variable with 4 levels, from youngest to oldest. The youngest age group in this study was age 45-49, followed by 50-54, 55-59 and 60-65 years old. Sex was coded as a dichotomous dummy variable (women or men). Race was also coded as a dichotomous dummy variable (white or non-white). Preliminary analyses included more detailed racial/ethnic groups; however, sample sizes for most racial/ethnic minority groups were insufficient for reliable estimations in subsequent analyses. Education was coded as a dichotomous variable indicating whether or not the respondent had a college education or higher (Associate, Bachelor, Doctorate). Given the distribution of the data and conceptual separation (e.g., the secondary higher education), the two categories of educational attainment were chosen. Self-rated health was coded as a dichotomous variable [positive (excellent, very good, good) vs. negative (fair, poor)]. In light of the overall distribution (e.g., low counts in the poor health category), self-rated health was dichotomized. Use of literacy skills was assessed using indices of the use of reading skills and writing skills in everyday life, which were derived from eight (e.g., read directions and instruction, articles in the newspaper) and four (e.g, write letters or memos, fill in forms) skill use items, respectively (OECD, 2016b). A higher value indicates greater use of relevant skills.

Statistical Analysis

In order to incorporate the plausible values and PIAAC specific sampling weights into the statistical analysis, we used the SAS macro program developed by the International Association for the Evaluation of Educational Achievement (IEA, 2017). 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.). The final sample weight (SPFWT10) and 80 replicate weights (SPFWT1 –

SPFWT80) were applied for all analyses. Weighted descriptive statistics were computed for all

variables of interest in this study.

Multinomial logistic regression was used to examine the differential effects of literacy

skills and use of literacy skills on employment status with three nominal categories (Hosmer,

Lemeshow, & Sturdivant, 2013). Specifically, the likelihood of being employed versus

unemployed, and being employed versus out of the labor force, were simultaneously modeled as

a function of literacy skills, use of literacy skills, and covariates. An unconditional model (i.e., a

model without the covaraites) was examined first; then a fully conditionally model (i.e., a model

with covariates added) was constructed. This model-building step is one strategy to rule out an

artificial relationship. The model fit was assessed using the Akaike Information Criterion (AIC)

(Hosmer et al., 2013). The AIC is one of the common model fit indices and a smaller value

indicates a better model fit. The estimated coefficients were converted to odds ratios for

interpretation. The odds ratios were one of the recommended interpretations and were obtained

by exponentiating the esitmated coefficients (i.e., log-odds) (Allison, 2012). When the odds ratio

is grater than 1 or less than 1, the effect of the predictor variable is positive [e.g., more likely to

be unemployed than employed (reference group)] or negative [e.g., less likely to be unemployed

than employed (reference group)], respectively. Statistical significance was assessed at the alpha

level of 0.05.

Results

Table 1 shows the weighted descriptive statistics by employment status. The final sample

size for each group only includes respondents with complete information. The average literacy

skills scores (out of 500) were approximately 280, 260 and 272 for the employed, unemployed

and out of the labor force groups, respectively. While the index of reading skill use at home

seemed to be similar across the groups, the out of the labor force group had a slightly lower

index than other two groups. The age distribution is comparable for the employed and

unemployed, but the out of the labor force groups had a larger proportion of the older age group

(age 60-65). The employed group had a slightly greater proportion of men, highly educated

individuals, whites, and positive health compared to the unemployed and out of the labor force

groups. However, these are descriptive statistics, and each group had a different sample size;

therefore, the interpretation should be approached with caution.

Table 2 presents the results of the multinomial logistic regression analyses including the

unconditional and fully conditional models. With regards to the employed versus unemployed

groups, literacy skills and use of writing skills at home were statistically significant in the

unconditional model. However, only literacy skills were statistically significant ($p < 0.01$) after

adjusting for the covariates. Specifically, for every one-point increase in literacy skills, the odds

ratio of being unemployed was lower (0.993 times odds). In other words, there was an

approximately 0.7% ($1 - 0.993 = 0.007$) reduction in the odds ratio when the literacy skills score

increased by 1 points, holding all other variables constant. In addition, women, those with less

than a college education, and those with poorer health were more likely to be unemployed versus

employed.

With regard to the employed versus out of the labor force groups, only literacy skills

were statistically significant ($p < 0.001$). After adjusting for the covariates, the statistical

significance remained the same. For every one-point increase in literacy skills, the odds ratio of

being out of the labor force was lower (0.992 times odds). In other words, there was about a

0.8% ($1 - 0.992 = 0.008$) reduction in the odds ratio when the literacy skills score increased by 1

points, holding all other variables constant. In addition, older workers, women, those with less than a college education, and those with poorer health were more likely to be out of the labor force versus employed. Given the AIC, the fully conditional model (AIC = 2,758.851) showed a better model fit than the unconditional model (AIC = 3,045.858).

Discussion

Given the increasing yet segmented labor force participation of older adults in the U.S. and potential consequences both at the individual and societal levels, this study examined two malleable factors --- literacy skills and use of literacy skills --- in relation to employment outcomes. Results from the weighted multinomial logistic regressions showed that literacy skills were positively associated with being employed compared to being unemployed or out of the labor force, after adjusting for demographic, socioeconomic and health characteristics among adults aged 45 to 65. Although the statistical interpretation of the literacy skills score and its impact on employment status may not be intuitive, this analysis of nationally representative data showed the positive association between literacy skills and the chance of being employed. That is, the hypothesis was partially supported.

In light of human capital theory, fundamental skills such as literacy skills might be indicators of one's competencies and in turn, employability (Wanberg, 2012). Adults who are in the labor force and competent are most likely have the option to stay employed. However, when considering the mechanism, it is not clear whether the respondents worked because they enjoyed working or they needed to work for economic reasons. By the same token, among the out of the labor force group, some may have been able to retire comfortably because of their literacy skills, while others may have been unable to find a job due to their poor literacy skills and thus withdrew from the labor market. While we can only speculate on the implications of low

literacy scores for those ages 45 – 54 who are out of the labor force, they are cause for concern because of declines in labor force participation rates for males in that age group over the past two decades (Maestas, Mullen, & Strand, 2015).

The use of literacy skills, both reading, and writing, was not associated with employment status. In view of practice engagement theory, the use of literacy skills may merely be a promoter of basic skills but not be directly associated with employment outcomes. In other words, it is possible that the use of literacy skills may be completely mediated by the skills and therefore, was not directly related to employment outcomes. From a different perspective, as suggested by the education and employment outcome research (e.g., Harvey, 2000), not all training and education programs are designed to promote employability per se. The use of literacy skills could have been motivated by factors unrelated to employability. Additionally, what makes one employable could significantly vary depending on the situation (e.g., industry, other qualifications, levels of tasks at work) (Hillage & Pollard, 1998). Furthermore, the measurement of literacy skills use needs more scrutiny. In PIAAC, the measure for use of literacy skills was derived from a series of self-reported frequencies. Although the PIAAC skill use measure is one of the most systematic assessments, its validity and relevance to employment outcomes have yet to be established. At the same time, our finding about the use of literacy skills and employment outcomes among older workers needs an additional investigation to clarify the underlying mechanisms. Future research is needed to examine specific types of reading and writing activities, valid measurement of skill use, the associations by industry, and any interactions between the use of skills at home and at work.

The results from this study suggest a few preliminary policy implications. Although understudied, older adults are an important component of the U.S. labor force and are essential

for continued economic growth. 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 that facilitate opportunities for employment-related training and education programs. In this context, the wider benefits of adult education and training may include not only maintaining or enhancing basic skills but also improving outcomes in other life domains (e.g., health, social networks) both at the individual level and at the aggregate level (e.g., community, society) (Schuller, 2004).

As such, policy efforts including the timely provision of occupational training and education programs, continuous prevention of unemployment, and timely facilitation of re-employment are needed. Close monitoring of employment trends among older adults, as well as early intervention for disadvantaged groups (e.g., long-term unemployed and low-skilled workers), should receive increased policy attention. Relatedly, one of the main findings from this study --- the positive relationship between literacy skills and employment outcomes -- could be incorporated into adult education and training programs to motivate sustained engagement on the part of older adults (Reder & Bynner, 2009). Although the government and public sector agencies are expected to play an important role in funding adult education and training programs, especially for the unemployed, job training is generally viewed as a responsibility that is shared by the public sector, the individual, and the employer (Cummins, Kunkel, & Walker, 2015; MacArthur Foundation Network on an Aging Society, 2012). Finally, it is critical to develop and test effective literacy-focused adult education interventions to promote and maintain the employability of older workers. Toward this end, policymakers and other stakeholders in labor and education may need to adopt a collaborative, interdisciplinary approach.

Limitations

Several limitations in this study must be acknowledged. In this study, the key concepts including competency, basic skills, literacy and employability were in alignment with PIAAC, and as such, the external validity to different contexts or sub-populations may be somewhat limited. For example, observed associations between literacy skills and employment outcomes may not hold for all occupations or geographic locations. Additionally, the employment status classification in this study could be calibrated in future research. A decomposition of "out of labor force" to more detailed categories (e.g., retired, permanently disabled, no desire to work) would be critical, although such sub-classification will most likely result in insufficient sample sizes for complex statistical analyses with the PIAAC data. Second, regardless of workers' skill levels, employment opportunities are heavily influenced by economic conditions and therefore, individual skills may be meaningful only in relation to the counterparts (e.g., highly skilled versus limited skills). Possible omitted variable bias also cannot be ruled out. For example, a few traditional demographic characteristics, such as the continuous age, marital status, income (in a continuous measure), and asset information were not available in the PIAAC public use file. However, PIAAC arguably is the only nationally representative data with the sophisticated literacy measures, and such strength of the data is worth noting. Additionally, because this study used cross-sectional data, it was not possible to closely examine age, period and cohort effects or infer causality. These potential effects may be especially important for older workers because the collective behaviors (e.g., attitudes toward education and finance) of each cohort could be significantly influenced by historical and economic trends or events (e.g., Great Depression) over the life course (Elder, 1998).

Contributions

Despite the limitations, this study made several contributions. First, this study analyzed nationally representative data, making it more relevant to adult education and labor policy discussions than case studies. The PIAAC data are the most recent and comprehensive national data on skills and employment research. Additionally, the literacy skill measures adopted in PIAAC are methodologically sound and relatively unique (OECD, 2016b). Adopting the PIAAC literacy skill measures with the appropriate survey sampling weights added a new piece of evidence to literacy and employment research. Moreover, the relationships between literacy skills and employment status of understudied older workers were examined with statistical adjustments to the relevant demographic, socioeconomic, and health characteristics although the majority of published reports provide relatively simple comparisons (e.g., employment status by the skill levels) (Goodman et al., 2013). Finally, the nationally representative findings and statistical methods adopted in this study can serve as a foundation for further examination of specific aspects of literacy skills and employment outcomes.

Conclusion

Given the increasing labor force participation rates at older ages, gaining a better understanding of the relationship between literacy skills and employment status has grown more relevant. A skilled labor force is necessary to meet the needs of employers and ensure continued economic growth. This study used PIAAC data to examine a nationally representative sample of workers aged 45 to 65 (considered the "pre-retirement phase"). Results of the regression analyses showed that the greater literacy skills are associated with greater chance of being employed than being unemployed or out of labor force among workers in the pre-retirement phase in the U.S. Since literacy can be seen as the malleable foundation to navigate in the labor market with dynamic demands in skills, education and labor policies should incorporate the continuous

competency training into future discussion and practice. Such effort may support the older workers in general and those with disadvantaged competencies in particular, and in turn, strengthen the employability of workers over the life course. Further research should replicate the findings from this study in a variety of settings (e.g., industries, geographic locations), and identify the specific pathways between the competencies and employment outcomes in hopes to inform education as well as labor policies for the well-being of older workers.

Declaration of Conflict of Interests

The authors declare no conflict of interests.

Funding

References

Abraham, K. G., Haltiwanger, J. C., Sandusky, K., & Spletzer, J. (2016). The Consequences of Long Term Unemployment: Evidence from Matched Employer-Employee Data. *National Bureau of Economic Research Working Paper Series, No. 22665*. doi:10.3386/w22665

AIR PIAAC Team. (n.d.). *What you need to consider before working with PIAAC data*.

Retrieved from Washington, DC:

https://static1.squarespace.com/static/51bb74b8e4b0139570ddf020/t/57ebf7cd9f7456253

2dd2df3/1475082297812/WorkingWithPIAACData_updated+092816.pdf

Allison, P. D. (2012). *Logistic regression using SAS: theory and application* (2 ed.). Cary, NC:

SAS Institute, Inc.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of political

economy, 70*(5, Part 2), 9-49.

Buera, F. J., Kaboski, J. P., & Rogerson, R. (2015). *Skill based structural change*. Retrieved

from Cambridge, MA: http://www.nber.org/papers/w21165

Butrica, B. (2011). Making a case for working longer at older ages. *Public Policy and Aging

Report, 21*(2), 22-26.

Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Projections of jobs and education

requirements through 2020*. Retrieved from Washington, DC:

https://cew.georgetown.edu/wp-content/uploads/2014/11/Recovery2020.FR_.Web_.pdf

Cummins, P. A., Kunkel, S. R., & Walker, R. M. (2015). *Adult Education and Training

Programs for Older Adults in the U.S.: National Results and Cross-National

Comparisons using PIAAC Data*. Retrieved from

https://static1.squarespace.com/static/51bb74b8e4b0139570ddf020/t/55de28c6e4b0daf2d

66f69ea/1440622790514/Cummins_Kunkel_Walker_PIAAC.pdf

Czaja, S. J., & Moen, P. (2004). Technology and employment. In R. W. Pew & S. B. Van Hemel

(Eds.), *Technology for adaptive aging* (pp. 150-178). Washington, DC: The National

Academic Press.

Daly, M. C., Lucking, B., & Schwabish, J. A. (2013). *The future of social security disability insurance*. Retrieved from http://www.frbsf.org/economic-research/files/el2013-17.pdf

Desjardins, R. (2003). Determinants of literacy proficiency: a lifelong-lifewide learning perspective. *International Journal of Educational Research, 39*(3), 205-245.

Elder, G. H. (1998). *Children of the great depression*. New York: Westview Press.

Farkas, G. (2009). Human capital. In D. Carr (Ed.), *Encyclopedia of the life course and human development* (pp. 243-247). Farmington Hills, MI: MacMillan Reference USA.

Feyrer, J. (2007). Demographics and productivity. *The Review of Economics and Statistics, 89*(1), 100-109.

Goodman, M., Finnegan, R., Mohadjer, L., Krenzke, T., & Hogan, J. (2013). *Literacy, numeracy, and problem solving in technology rich environments among U.S. adults: Results from the Program for the International Assessment of Adult Competencies 2012 - first look* Retrieved from Washington, DC: https://nces.ed.gov/pubs2014/2014008.pdf

Green, D. A., & Riddell, W. C. (2013). Ageing and literacy skills: Evidence from Canada, Norway and the United States. *Labour Economics, 22*, 16-29. doi:https://doi.org/10.1016/j.labeco.2012.08.011

Grotlüschen, A., Mallows, D., Reder, S., & Sabatini, J. (2016). *Adults with Low Proficiency in Literacy or Numeracy* Retrieved from Paris, France: http://dx.doi.org/10.1787/5jm0v44bnmnx-en

Guzman, J. M., Pawliczko, A., Beales, S., Till, C., & Voelcker, I. (2012). *Ageing in the twenty-first century: A celebration and a challenge.* Retrieved from New York: https://www.unfpa.org/sites/default/files/pub-pdf/Ageing%20report.pdf

Harvey, L. (2000). New realities: The relationship between higher education and employment. *Tertiary Education & Management, 6*(1), 3-17.

Hatch, S. L., Feinstein, L., Link, B. G., Wadsworth, M. E. J., & Richards, M. (2007). The Continuing Benefits of Education: Adult Education and Midlife Cognitive Ability in the British 1946 Birth Cohort. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 62*(6), S404-S414.

Hillage, J., & Pollard, E. (1998). *Employability: developing a framework for policy analysis*. Sudbury, United Kingdom: DfEE Publications.

Hosmer, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (3 ed.). Hoboken, NJ: John Wiley & Sons, Inc.

IEA. (2017). Help manual for the IEA IDB analyzer (Version 4.0). Hamburg, Germany. Retrieved from www.iea.nl/data.html

Jacobson, L., LaLonde, R., & Sullivan, D. G. (2005). Estimating the returns to community college schooling for displaced workers. *Journal of Econometrics, 125*(1), 271-304.

MacArthur Foundation Network on an Aging Society. (2012). *Promoting life-long learning in an Aging Society*. Retrieved from http://www.agingsocietynetwork.org/files/lifelong%20learning%20brief%20.pdf

Maestas, N., Mullen, K. J., & Strand, A. (2015). Disability Insurance and the Great Recession. *The American economic review, 105*(5), 177-182.

National Center for Education Statistics. (2016a). *PIAAC U.S. household public use file codebook*. Retrieved from Washington, DC: http://www.oecd.org/skills/piaac/publicdataandanalysis/

National Center for Education Statistics. (2016b). Program for the International Assessment of

      Adult Competencies (PIAAC) 2012/2014: U.S. national supplement public use data files-

      household. Retrieved from

      https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2016667rev

Neumark, D., & Song, J. (2012). *Barriers to Later Retirement: Increases in the Full Retirement*

      Age, Age Discrimination, and the Physical Challenges of Work. Retrieved from Ann

      Arbor, MI: http://www.mrrc.isr.umich.edu/publications/Papers/pdf/wp265.pdf

OECD. (2005). *Learning and living: First results of the adult literacy and life skills survey*.

      Retrieved from Paris, France: http://www.oecd.org/edu/innovation-

      education/34867438.pdf

OECD. (2012). *Literacy, numeracy and problem solving in technology-rich environments:*

      Framework for the OECD Survey of Adult Skills. Retrieved from

      http://www.oecd.org/skills/piaac/PIAAC%20Framework%202012-

      -%20Revised%2028oct2013_ebook.pdf

OECD. (2015a). *Education at a glance 2015: OECD indicators*. Retrieved from

      http://www.oecd-

      ilibrary.org/docserver/download/9615031e.pdf?expires=1506362426&id=id&accname=g

      uest&checksum=26F9DEF353E2E3652BB95A2761BCA3B6

OECD. (2015b). OECDStatExtracts. Retrieved from http://stats.oecd.org/

OECD. (2016a). *The Survey of Adult Skills: Reader's Companion*. Retrieved from Paris, France:

      http://dx.doi.org/10.1787/9789264258075-en

OECD. (2016b). *Technical report of the survey of adult skills (PIAAC)*. Retrieved from

      https://www.oecd.org/skills/piaac/_Technical%20Report_17OCT13.pdf

PIAAC Literacy Expert Group. (2009). *PIAAC literacy: a conceptual framework*. Retrieved from

    Paris, France: http://www.oecd-

    ilibrary.org/docserver/download/220348414075.pdf?expires=1515604002&id=id&accna

    me=guest&checksum=409F276EB836F837C9381FC1B657DCE2

Rampey, B. D., Finnegan, R., Goodman, M., Mohadjer, L., Krenzke, T., Hogan, J., & Provasnik,

    S. (2016). *Skills of U.S. unemployed, young, and older adults in sharper focus: Results*

    from the Program for the International Assessment of Adult Competencies (PIAAC)

    2012/2014: First look Retrieved from Washington, DC:

    https://nces.ed.gov/pubs2016/2016039.pdf

Reder, S. (2009). Scaling up and moving in: Connecting social practices views to policies and

    programs in adult education. *Literacy and Numeracy Studies, 16*(2), 35-50.

Reder, S. (2012). *The Longitudinal Study of Adult Learning: Challenging Assumptions*.

    Retrieved from Montreal, Canada:

    http://www.centreforliteracy.qc.ca/sites/default/files/CFLRsrchBrief_Chllngng_Assmptn

    s.pdf

Reder, S. (2015). Expanding emergent literacy practices: Busy intersections of context and

    practice. In M. G. Santos & A. Whiteside (Eds.), *Low educated second language and*

    literacy acquisition: Proceedings of the Ninth Symposium (pp. 1-29). San Francisco, CA:

    Lulu Publishing Services.

Reder, S., & Bynner, J. (2009). Introduction: The need for longitudinal studies in adult literacy

    and numeracy edcuation. In S. Reder & J. Bynner (Eds.), *Tracking adult literacy and*

    numeracy skills: Findings from longitudinal research (pp. 1-26). New York: Routledge.

Rho, H. J. (2010). *Hard work? Patterns in physically demanding work among older workers*. Retrieved from Washington, DC: http://cepr.net/documents/publications/older-workers-2010-08.pdf

Rudd, R. E., Moeykens, B. A., & Colton, T. C. (2000). Health and literacy: a review of medical and public health literature. In J. P. Comings, B. Garner, & C. Smith (Eds.), *The Annual Review of Adult Learning and Literacy* (pp. 158-199). San Francisco, CA: Jossey-Bass Publishers.

Schuetze, H. G. (2007). Individual learning accounts and other models of financing lifelong learning. *International Journal of Lifelong Education, 26*(1), 5-23.

Schuller, T. (2004). Three capitals: a framework. . In T. Schuller, C. Preston, A. Hammond, A. Brassett-Grundy, & J. Bynner (Eds.), *The benefit of learning: The impact of education on health, family life and social capital* (pp. 12-33). New York: Routledge Falmer.

Sheehan-Holt, J. K., & Smith, M. C. (2000). Does basic skills education affect adults' literacy proficiencies and reading practices? *Reading Research Quarterly, 35*(2), 226-243.

Tan, E. (2014). Human capital theory: A holistic criticism. *Review of Educational Research, 84*(3), 411-445.

Toossi, M. (2015). *Labor force projections to 2024: the labor force is growing, but slowly*. Retrieved from Washington, DC: https://www.bls.gov/opub/mlr/2015/article/pdf/labor-force-projections-to-2024.pdf

U.S. Bureau of Labor Statistics. (2016). *Labor statistics from the Current Population Survey: Table 10. Employment status of the civilian noninstitutional population by educational attainment, age, sex, race, and Hispanic or Latino and Non-Hispanic ethnicity, Annual Average 2015*. Retrieved from Washington, DC: http://www.bls.gov/cps/

Wanberg, C. R. (2012). The individual experience of unemployment. *Annual review of psychology, 63*, 369-396.

Yamashita, T., & Kunkel, S. R. (2015). An International Comparison of the Association Among Literacy, Education, and Health Across the United States, Canada, Switzerland, Italy, Norway, and Bermuda: Implications for Health Disparities. *Journal of Health Communication, 20*(4), 406-415. doi:10.1080/10810730.2014.977469

Table 1: Weighted Descriptive Summary of the Respondents age 45-65 by the Employment Status

Variables	Employed (n = 1,370)	Unemployed (n = 310)	Out of 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	20.86%	21.05%	43.90%
Sex			
Female	51.64%	60.16%	66.37%
Male	45.36%	39.84%	33.63%
Education			
College degree or higher	48.55%	35.22%*	27.48%
High school or less than higher school education	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	10.70%	24.20%	43.53%

Notes:
1. Final sampling weights and replicate weights were applied.
2. The sample sizes were unweighted.

Table 2: Estimated Odds Ratios from the Multinomial Logistic Regressions

| | Employed vs. Unemployed | | | | Employed vs. Out of Labor Force | | | |
| | Unconditional model | | Fully conditional model | | Unconditional model | | Fully conditional model | |
Variables	B (SE)	OR	B (SE)	OR	B (SE)	OR	B (SE)	OR
Literacy skills	-0.011 (0.002)***	0.989	-0.007 (0.002)***	0.993	-0.012 (0.001)***	0.988	-0.008 (0.002)***	0.992
Reading at home index	0.040 (0.129)	n.s	0.088 (0.138)	n.s	-0.002 (0.104)	n.s	0.101 (0.110)	n.s
Writing at home index	0258 (0.088)**	1.294	0.268 (0.092)	n.s	-00137 (0.072)	n.s	-0.134 (0.079)	n.s
Age Group (4 levels)			0.038 (0.077)	n.s n.s			0.501 (0.065)***	1.650
Sex (Women)			0.313 (0.158)*	1.367			0.701 (0.156)***	2.017
Education (College degree or higher)			-0.339 (0.181)*	0.691			-0.350 (0.128)**	0.705
Race (White)			-0.339 (0.184)	n.s			0.184 (0.167)	n.s
Self-rated health (positive health)			-0.768 (0.203)***	0.464			-1.580 (0.146)***	0.206

Model fit (AIC)	
Unconditional model	3045.858
Fully conditional model	2758.851

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; B = estimated coefficient; SE = estimated standard error; OR = odds ratio; n.s. = not significant

Note:
1. The final sample weight and replicate weights were applied.
2. AIC is based on the mean AIC from 10 models with the plausible values
3. 10 plausible values were used for the literacy skills