Difference in utilization of assistive technology across two racial groups in the aging population

Shondra Loggins Clay PhD[a],*

Reginald Alston PhD[b]

[a]Counseling Center, University of Illinois at Urbana-Champaign, 610 E. John Street-Office 117, Champaign, IL 61820, USA; [b]Department of Kinesiology and Community Health, University of Illinois, 1206 S. Fourth Street, 2011 Huff Hall, Champaign, IL 61820, USA; *Corresponding author: loggins@illinois.edu

S.L. Clay, R. Alston. Difference in utilization of assistive technology across two racial groups in the aging population. Gerontechonology 2018;17(4):206-214; https://doi.org/10.4017/gt.2018.17.4.002.00 **Background** The utilization of assistive technology (AT) to enhance the quality of life has been well documented by disability researchers. However, the use across Black and White racial groups has been underexplored. **Research Aim** To update and extend the findings of Loggins et. al (Disabil Rehabil Assist Technol. 9(6): 487-92, 2014) by examining the relationship between race, assistive technology (AT) use, selected demographic variables, and access to health care. **Methods** Using the 2015 Behavioral Risk Factor Surveillance System (BRFSS) database, descriptive statistics and logistic regression models were estimated. **Results** Consistent with previous findings, a higher percentage of Blacks used AT (16.7%) compared to Whites (11.6%), and predictive factors of AT use were education, employment status, income level, health coverage, medical costs, and age. Blacks were 25% more likely to use AT compared to Whites; however, Whites who used AT had more favorable demographic identifiers (e.g. married, higher education, more employment, higher income, more health coverage, and fewer concerns with medical costs) compared to Blacks who used AT. In contrast to previous findings, gender was not statistically significant, users of AT have higher income levels, and there were differences in the magnitude of predictors. **Conclusion** Whites and Blacks still have the same predictors of AT use; however, there are still differences in the magnitude. Whereas gender was no longer found to be a significant predictor of AT use, marital status was statistically significant. This study highlights the disruption in the typical pattern of AT use among Whites and Blacks and future research should continue to monitor this changing trend in racial disparities and AT use.

Keywords: assistive technology, race, disparities, disabilities, socioeconomic status (SES)

INTRODUCTION

Characterized as "Any item, piece of equipment or system, whether acquired commercially, modified, or customized, that is commonly used to increase, maintain or improve functional capabilities of individuals with disabilities" (Loggins, 2014; Lewis, 2012; Scherer, 2005), assistive technology (AT) was first mandated by law under the Technology Related Assistance for Individual with Disabilities Act (Tech Act) in 1988 (Public Law, 100-407). After several expansions and legal reauthorizations in 1994, 1998, and 2004, AT became a known entity within the aging population and the rehabilitation community. Many researchers, health care affiliates, gerontological practitioners, and disability advocates have realized the established benefits (Parette, 2008; Agree, 2014; Clay, 2016) of AT, as well as the many potentialities (Andreoni, 2014; Bhowmick, 2017).

Over the past few decades, there has been a number of published research articles discussing the utility of AT to enhance the lives of the aging population (Anderson, 2013; Garcon, 2016) and individuals with disabilities (Hartke, 1998; Tomita, 2001; Scherer, 2005; Clay, 2016). Potential benefits of AT use include assisting with basic activity needs to complete daily tasks and creating a platform to increase individual independence (Agree, 2005; Kaye, 2008; Edyburn, 2015). In 2014, Loggins et. al published an original research article exploring the utilization of assistive technology using data from the national Behavioral Risk Factor Surveillance System (BRFSS) collected in 2007. The purpose of this study was to examine the association of AT to demographic variables (e.g. race, gender, educational attainment, income, employment status), and access to health care. Findings from this research yielded the following results: (1) Among AT users, Whites

in comparison to Blacks were more educated, employed, made more money per year, and had better access to health coverage; (2) Blacks used AT more than Whites and based on logistic estimates, were more likely to use AT compared to Whites; and (3) Significant predictors of AT use were age, gender, education, employment, income, health coverage, and medical costs. The results from this study had many implications for understanding the human aging process and the rehabilitation field especially findings positing the association of AT use and gender in addition to the relationship of AT use and race. Recommendations from the findings about gender suggested an increase in males' awareness about the benefits and potentialities of AT use since results indicated that females used AT more than males. Based on the findings about the association of race and AT use, researchers recommended the continued development of policies to encourage greater adoption of various assistive devices since Blacks used AT more than Whites.

Since the publication of the original article in 2014 using BRFSS data collected in 2007, there have been many new developments. The Centers for Disease Control and Prevention (CDC) has released a more recent version of the BRFSS, with survey data information from 2015 (BRFSS, 2015). As it relates to AT, there has been a vast amount of new products marketed, a host of new services, and new policies implemented through legislative acts. In addition to the ingenuity of the engineering field to foster the development of assistive devices, one of the most significant changes related to AT since the utilization of the BRFSS data from 2007 is the implementation of the Workforce Innovation and Opportunity Act (WIOA) passed in 2014 (Public Law 113-128). One of the core provisions of this legislative act was to ensure that individuals with disabilities could obtain better jobs (e.g. higher wages and benefits) and educational opportunities comparable to individuals without disabilities. Furthermore, the WIOA specifically required state plans to synchronize with AT programs (WIOA 412; WIOA 418). As it relates to human aging, the population of adults with impairments transitioning into the older adult population is increasing (Remillard, 2017).

The World Health Organization (WHO) estimates that over 1 billion individuals currently need assistive devices and by the year of 2050, this number will nearly double to 2 billion with demographic shifts such as an ageing population and an increase in the prevalence of non-communicable diseases (WHO, 2016). The rapidly changing demographic shifts and the new enactment of legislative statutes ensuring equity for individuals with disabilities in the workforce warranted a reanalyses of the utilization of AT. The

objective of this study was to analyze data using the most current version of the BRFSS0 (2015) to compare and extend the findings of Loggins et. al (Disabil Rehabil Assist Techno\ 9(6): 487-92, 2014). The updated study used the same methodological protocol and approach to examine the relationship between race, the use of assistive technology (AT), selected demographic variables (e.g. gender, marital status, educational attainment, income, employment status), and access to health care.

METHODS
Setting and study design
This methodological approach in this updated study was similar to Loggins et. al (2014). At the time of the previous study, the 2007 BRFSS was the most recent version of the dataset. The current study utilized the 2015 BRFSS, which was released in 2016 and was the most current version available. The BRFSS was first implemented in 1984 and collected data related to risk behaviors from 15 states. The database has expanded to one of the largest national surveys collecting data from all 50 states, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands. The 2015 BRFSS assessed factors related to general health (e.g. health status, quality of life), preventive health (e.g. exercise, immunization, nutrition, alcohol consumption, seatbelt use), preventable and chronic diseases, risk behaviors, and access to health care. Data from the 2015 BRFSS were collected via landlines and cellular telephones, capturing interviews conducted in all 50 states, the District of Columbia, Guam, and Puerto Rico. There were over 440,000 respondents to the survey, which provided a robust representation of the state of health. Similar to previous versions of the BRFSS, the 2015 version had three parts: a core questionnaire, optional sections, and specific state questions. Measures from the core questionnaire were used for this study (https://www.cdc.gov/brfss/annual_data/2015/pdf/overview_2015.pdf).

Selection of participants
The 2015 BRFSS provided several questions that assessed variations of racial and ethnic identity. One question particularly grouped race and ethnicity categories with the formatted responses as: (1) White only, non-Hispanic; (2) Black only, non-Hispanic; (3) American Indian or Alaskan Native only, non-Hispanic; (4) Asian only, non-Hispanic; (5) Native Hawaiian or other Pacific Islander only, non-Hispanic; (6) Other race only, non-Hispanic; (7) Multiracial, non-Hispanic; (8) Hispanic; and (9) Don't know/Not sure/Refused. Similar to Loggins, et. al (2014), a targeted sampling approach stratifying the data to only include non-Hispanic White and Black respondents was used for the analyses. The targeted sampling approach has been a preferred methodology used

by researchers exploring racial differences in the utilization of AT (Loggins et. al 2014, Alston et. al 2014; Clay et. al 2016). Other races and missing data were excluded from the data analyses. After stratification, there were 370,412 participants in the general population that were either White (n= 336,066; 90.7%) or Black (n=34,346; 9.3%). The mean age of participants in the general population was 56.8 (SD=16.606). A total of 43,694 individuals used AT, in which 87.4% (n=38,198) were Whites and the other 12.6% (n=5,496) were Blacks. In contrast to the general population, individuals who used AT were "young old" as defined by Forman (1992). The mean age of individuals who used AT was 66.7 (SD=12.726), in which Whites who used AT averaged 67.2 years of age (SD=12.710) and Blacks who used AT averaged 63.7 years old (SD=12.415).

Factors: Predictors and outcomes

The same measures from the 2007 BRFSS in Loggins, et. al (2014) were used for this study. The factors that were assessed in the original article, as well as the current study were assistive technology use, race, gender, educational attainment, employment status, income levels, health coverage, medical costs, and age. Recent literature also exploring the association of AT use and race have also included marital status as a key independent variable (Tshiswaka, 2016; Clay 2016). Albeit marital status was not considered in the original study, it was used in the current study. All variables coded with responses such as don't know, not sure, refused, or missing were excluded from this study.

Assistive technology use (outcome variable)

In the demographic section of the 2015 BRFSS codebook, the variable "Health Problems Requiring Special Equipment (USEEQUIP)" was measured by the question: Do you have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone? (Include occasional use or use in certain circumstances). The response format was dichotomized as 1=yes and 2=no. In this study, AT use was measured by using this question and was formatted as a dichotomous variable (0=no and 1=yes).

Predictors

Gender

The variable "respondents' sex (SEX)" in the original dataset and the new data set was assessed as a dichotomous variable. The possible responses were formatted as male or female.

Marital status

In the original study, marital status was not included in the analyses; however, the variable was selected as a potential predictor of AT in the current study. In the demographic section of the 2015 BRFSS, marital status (MARITAL) was assessed through the possible responses: married, divorced, widowed, separated, never married, and a member of an unmarried couple. In this study, marital status was operationalized as married or not married. Responses such as divorced, widowed, separated, never married, and a member of an unmarried couple were defined as "not married" for this study.

Educational attainment

As a variable in the demographics section of the 2015 BRFSS, education level was assessed by the question: What is the highest grade or year of school you completed? The answer choices were formatted as never attended school or only kindergarten, grades 1-8 (elementary), grades 9-11 (some high school), grad 12 or GED (High school graduate), college 1 year to 3 years (some college or technical school), and college 4 years or more (college graduate). Education was recoded to include 1=HS education or higher or 0=less than HS education.

Employment status

Employment status was measured by eight categories in the original dataset, including: employed for wages, self-employed, out of work for more than 1 year, out of work for less than 1 year, homemaker, student, retired, and unable to work. In this study, employment status was dichotomized to include 1=employed or 0=not employed. Employed as defined as employed, self-employed, or a homemaker. The remaining categories from the original dataset were recoded as not employed in the new dataset.

Income level

The 2015 BRFSS measured income level by asking respondents their annual household income from all sources (INCOME 2). Responses were formatted as: (1) Less than $10,000; (2) Less than $15,000 ($10,000 to less than $15,000); (3) Less than $20,000 ($15,000 to less than $20,000); (4) Less than $25,000($20,000 to less than $25,000); (5) Less than $35,000 ($25,000 to less than $35,000); (6) Less than $50,000 ($35,000 to less than $50,000); (7) Less than $75,000 ($50,000 to less than $75,000); and (8) $75,000 or more. In this study, income was operationalized as a dichotomous variable measuring higher income levels and lower income levels (0 = less than $25,000, 1= more than $25,000). Previous studies have cited the national poverty level to determine the cutoff for dichotomized variables (Loggins, 2014). Consistent with literature, the poverty level for 2017 was used for this study. The poverty threshold for a household of 4 is currently $24,600 (www.hhs.gov). In addition, income levels above the poverty threshold ($25,000) was

Table 1. Descriptive Statistics of Participants, BRFSS 2015

	General Population (n=370,412)		Individuals who use AT (n=43,694 or 12.1%)		Whites who use AT (n=38,198 or 11.6%)		Blacks who use AT (n=5,496 or 16.7%)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Race								
White	336,066	90.7%	38,198	87.4%	38,198	100.0%	n/a	n/a
Black	34,346	9.3%	5,496	12.6%	n/a	n/a	5,496	100.0%
Gender								
Male	154,985	41.8%	16,173	37.0%	14,437	37.8%	1,736	31.6%
Female	215,427	58.2%	27,521	63.0%	23,761	62.2%	3,760	68.4%
Marital Status								
Married	199,817	54.2%	16,115	37.0%	14,898	39.2%	1,217	22.2%
Not Married	168,714	45.8%	27,398	63.0%	23,144	60.8%	4,254	77.8%
Education								
HS Education or higher	348,018	94.2%	38,246	87.8%	34,064	89.4%	4,182	76.4%
Less than HS education	21,336	5.8%	5,308	12.2%	4,020	10.6%	1,288	23.6%
Employment								
Employed	199,621	54.3%	7,632	17.6%	7,047	18.5%	585	10.7%
Not employed	168,249	45.7%	35,839	82.4%	30,969	81.5%	4,870	89.3%
Income								
Income more than $25,000	231,984	76.0%	17,677	51.0%	16,301	53.8%	1,376	31.7%
Income less than $25,000	73,131	24.0%	16,967	49.0%	13,998	46.2%	2,969	68.3%
Health Coverage								
Have health coverage	348,119	94.3%	42,070	96.6%	36,934	96.7%	5,136	93.7%
No health coverage	21,001	5.7%	1,495	3.4%	1,151	3.0%	344	6.3%
Medical Cost								
Medical costs not an issue	337,579	91.3%	38,092	87.6%	33,646	88.4%	4,446	81.3%
Medical costs an issue	32,028	8.7%	5,418	12.4%	4,394	11.6%	1,024	18.7%
Mean Age ± SD	56.81 ±16.606		66.72 ±12.726		67.16±12.710		63.68±12.415	

*Note: AT is defined as "special equipment" in the dataset. *Age <.001

defined as 1=high income levels (income more than $25,000) and incomes lower than the poverty threshold was defined as 0=lower income levels (income less than $25,000).

Health coverage
In the section of health care access in the 2015 BRFSS, the variable for health care coverage was measured by the question: Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs or government plans such as Medicare, or Indian Health service? In the original codebook and this study, the response format for health care coverage was dichotomized as either yes or no.

Medical cost
Health care access was also assessed by the affordability or the financial burden of seeing a doctor. The construct for medical cost was measured as a dichotomous variable (yes or no) through the question: Was there a time in the past 12 months when you needed to see a doctor but could not because of the cost? If an individual responded "yes" to the question, this was coded as 1=yes, medical cost is an issue. If the response was "no", the associated code was 0= no, medical cost is not an issue.

Age
Age was a calculated variable, measuring individuals between a range of 18 and 99 years. The

mean age for the general population (n=370,412) was 56.8 (SD=16.606). A total of 43,694 individuals used AT and the mean age for respondents was 66.7 (SD=12.726).

Statistical analysis

This study used the integrated statistical software, STATA/SE 15, to perform all data analyses. Descriptive statistics were extracted to analyze differences in the general population, individuals who used AT, and specific group dynamics (e.g. Whites and Blacks who used AT). Chi-square analyses were performed to estimate differences in AT use between Whites and Blacks across the varying descriptors (e.g. race, gender, marital status, education, employment, income, health coverage, medical cost, and age). Binary predictor logistic regression models were estimated to determine the maximum likelihood of using AT in the general population, only Whites, and only Blacks.

RESULTS
Descriptive statistics

Descriptive statistics explored differences in the general population and individuals who used AT (*Table 1*). In the general population, 90.7% (n=336,066) were Whites and 9.3% (n=34,346) were Blacks. Stratification of data by gender revealed there were more female respondents (58.2%, n=215,427) compared to male respondents (41.8%, n=154,985). Other demographic descriptors such as marital status, educational attainment, employment status, and income level were dichotomized. In the general population, most participants were married (54.2%), had high educational attainment levels-defined by having a high school education or higher (94.2%), were employed (54.3%), and had income levels higher than the poverty threshold of $25,000 (76.0%). Access to health care was defined by two variables: health coverage and medical cost. In the general population, most participants had health coverage (94.3%) and did not have an issue with medical costs (91.3%). The average age for the general population was 56.81 (SD=16.606).

In the "young old" population of AT users only, results were similar for demographic descriptors such as race, gender, educational attainment, income, and access to health care. A total of 38,198 Whites (87.4%) used AT and 5,496 Blacks (12.6%). Most older individuals who used AT were female (63.0%), had high educational attainment levels (87.8%), income levels higher than $25,000 (51.0%), health coverage (96.6%), and no issues with medical costs (87.6%). Differences from the general population were observed for marital status and employment. For older individuals who used AT, most were not married (63.0%) and were not employed (82.4%). The average age for individuals who used AT (66.72, SD=12.726) was higher than the general population.

Racial differences in the use of assistive technology

Differences in racial group dynamics (Blacks and Whites) were observed in the study. In general, there were more Whites (87.4%) than Blacks (12.6%) that used AT. However, after performing within racial group analysis, findings yielded that Blacks had a higher percentage of individuals who used AT (16.7%) compared to Whites (11.6%). Differences in use of AT across racial groups were statistically significant ($x2$ =713.5, df=1, p<.001).

In the general population of individuals who used AT, we observed a higher use of AT amongst females, individuals who were not married, had a HS education or higher, were not employed, had income levels more than $25,000, had health coverage, and did not have issues with medical costs. Within racial group analyses yielded similar findings for Whites and Blacks who used AT. More whites who used AT were female, not married, had health coverage, and did not have issues with medical costs. However, there were differences income levels for Whites and Blacks who used AT. Whereas more Whites who used AT had income levels more than $25,000, most Blacks who used AT had income levels less than $25,000 (68.3%).

Table 2. Predictors of AT use: BRFSS 2015

	Use AT		
	General Population		
	OR	95% CI		p-value
Blacks (ref=Whites)	1.25	1.21	1.30	<.001
Males (ref=females)	1.01	0.98	1.04	.265
Married (ref=not married)	0.75	0.73	0.77	<.001
HS education or higher (ref=less than HS education)	0.76	0.73	0.80	<.001
Employed (ref=not employed)	0.28	0.27	0.29	<.001
Income more than $25,000 (ref=income<$25,000)	0.48	0.47	0.49	<.001
Health coverage (ref=no health coverage)	1.82	1.70	1.94	<.001
Medical costs issue (ref=medical costs not an issue)	1.93	1.86	2.01	<.001
Age	1.03	1.03	1.03	<.001

Table 3. Predictors of AT use by race: Whites versus Blacks. BRFSS 2015

| | Use AT | | | | | |
| | Whites | | | Blacks | | |
	OR	95% CI		p-value	OR	95% CI		p-value
Males (ref=females)	1.02	1.00	1.05	.091	0.95	0.88	1.02	.165
Married (ref=not married)	0.74	0.72	0.77	<.001	0.81	0.74	0.88	<.001
HS education or higher (ref=less than HS education)	0.76	0.73	0.80	<.001	0.77	0.70	0.85	<.001
Employed (ref=not employed)	0.29	0.29	0.31	<.001	0.18	0.16	0.20	<.001
Income >$25,000 (ref=income<$25,000)	0.48	0.46	0.49	<.001	0.53	0.49	0.58	<.001
Health coverage (ref=no health coverage)	1.79	1.66	1.93	<.001	1.88	1.62	2.18	<.001
Medical costs issue (ref=medical costs not an issue)	1.98	1.89	2.07	<.001	1.72	1.56	1.90	<.001
Age	1.03	1.03	1.03	<.001	1.03	1.03	1.04	<.001

Notable racial differences between Whites and Blacks were further revealed using chi-square analyses to estimate differences across the varying descriptors (e.g. marital status, education, employment, income, health coverage, medical cost, and age). Results yielded a statistically significant difference in marital status and racial group dynamics of AT users ($x2=587.0$, df=1, p<.001). Similarly, a statistically significant difference between Blacks and Whites was observed for other descriptors such as educational attainment ($x2=201.2$, df=1, p<.001), income ($x2=744.9$, df=1, p<.001), health coverage ($x2=153.2$, df=1, p<.001), and medical cost ($x2=225.5$, df=1, p<.001). The variable age also was statistically different for Whites who used AT and Blacks who used AT. The mean age of Whites who used AT was 67.2; whereas, for Blacks, the mean age was 63.7 (p<.001).

Overall, findings revealed that Whites who used AT had more favorable demographic identifiers. A larger percentage of Whites who used AT were married, had higher educational attainment, more employment, higher income levels, more health coverage, and fewer concerns with medical costs compared to Blacks who used AT, in which a higher percentage were not married, had lower educational attainment, less employment, lower income levels, less health coverage, and more concerns with medical costs.

Predictive factors in the use of AT
The methodological approach estimated the maximum likelihood of using AT by employing three binary predictor logistic regression models in three distinct groups: (1) the general population (*Table 2*), (2) only Whites (*Table 3)*, and (3) only Blacks (*Table 3*) The first logistic regression model (LR $x2=34,499.85$, p<.0001, pseudo r2=.1624) in the general population of Blacks and Whites, revealed several significant predictors of AT use including being Black (OR=1.25, CI:

1.21-1.30, p<.001), being married (OR=0.75, CI: 0.73-0.77, p<.001), having higher educational attainment (OR=0.76, CI: 0.73-0.80, p<.001), being employed (OR=0.28, CI: 0.27-0.29 p<.001), having higher income levels (OR=0.48, CI: 0.47-0.49, p<.001), having health coverage (OR=1.82, CI: 1.70-1.94, p<.001), having concerns with medical costs (OR=1.93, CI: 1.86-2.01, p<.001), and older age (OR=1.03, CI: 1.03-1.03, p,>001).
The second binary predictor logistic model for only Whites (LR $x2=29,406.61$, p<.0001, pseudo r2=.1561) yielded significant predictors of AT such as being married (OR=0.74, CI: 0.72-0.77, p<.001), having higher educational attainment (OR=0.76, CI: 0.73-0.80, p<.001), being employed (OR=0.29, CI: 0.29-0.31 p<.001), having higher income levels (OR=0.48, CI: 0.46-0.49, p<.001), having health coverage (OR=1.79, CI: 1.66-1.93, p<.001), having concerns with medical costs (OR=1.98, CI: 1.89-2.07, p<.001), and older age (OR=1.03, CI: 1.03-1.03, p,>001).

The third binary predictor logistic model for Blacks only (LR $x2=4,701.25$, p<.0001, pseudo r2=.1991) revealed the significant predictors of AT were being married (OR=0.81, CI: 0.74-0.88, p<.001), having higher educational attainment (OR=0.77, CI: 0.70-0.85, p<.001), being employed (OR=0.18, CI: 0.16-0.20 p<.001), having higher income levels (OR=0.53, CI: 0.49-0.58, p<.001), having health coverage (OR=1.88, CI: 1.62-2.18, p<.001), having concerns with medical costs (OR=1.72, CI: 1.56-1.90, p<.001), and older age (OR=1.03, CI: 1.03-1.04, p,>001).

DISCUSSION
The purpose of this study was to update the findings from Loggins et. al (2014) using the most recent version of the BRFSS (2015). Our goals were to explore if there were reproducible findings in the current BRFSS dataset and to extend knowledge about AT use by including another

demographic variable (marital status), which was not used in the original study.

Summary of main findings

After reanalyzing predictors of AT use, the relationship between race, the use of assistive technology (AT), selected demographic variables (e.g. gender, marital status, educational attainment, income, employment status), and access to health care was more adequately demonstrated. Most findings for AT use were similar in this study. In both studies, (1) Blacks used AT more than Whites, (2) a larger percentage of Whites who used AT had higher educational attainment, more employment, higher income levels, more health coverage, and fewer concerns with medical costs, (3) a higher percentage of Blacks who used AT had lower educational attainment, less employment, lower income levels, less health coverage, and more concerns with medical costs, (4) Blacks were more likely to use AT compared to Whites, and (5) significant predictors for AT use were education, employment status, income level, health coverage, medical costs, and age.

There were also some observed differences between the two studies that were noteworthy. First, the design slightly differed in this study by adding the predictor variable, marital status, to the model. Results revealed significant differences between Whites and Blacks who used AT and the relationship to marital status. Furthermore, marital status was a significant predictor for use of AT in the general population, for Whites, and for Blacks. Second, there were differences in some of the findings. In the original study, older individuals who used AT had lower income levels. Most older individuals who used AT made less than $25,000 (56.2%). Similarly, a higher percentage of Whites who used AT had lower income levels (53.0%) as well as Blacks who used AT and had lower income levels (74.0%). In this study, the inverse relationship existed. Most individuals who used AT made more than $25,000 annually (51.0%). However, a disparity existed for Whites and Blacks. The trend of higher income levels for users of AT was upheld for Whites (53.8%); however, a higher percentage of lower income levels for Blacks who used AT (68.3%) was confirmed in the current study. The other finding that differed between the two studies was the predictor variable, gender. In the original study, gender was a statistically significant predictor of AT use in the general population, for Whites, and for Blacks. In the current study, gender was not statistically significant.

Other differences between studies existed with the magnitude of predictors of AT use. Even though directionally the predictors were the same, for some variables such as education and access to health care, the magnitude predicting the maximum likelihood of using AT differed. In Loggins et. al (2014), regardless of race, individuals with a HS education or higher were less likely to use AT (OR=0.86, CI: 0.85-0.86, p<.001). In the current study, the same inverse relationship exist. Individuals with a HS education or higher are less likely to use AT. However, in the current study, individuals with a HS education or higher are 24% less likely to use AT compared to 14% in the original study. Similar trends were illustrated for Whites and Blacks. Whites who had a HS education or higher were 24% less likely to use AT compared to 13% in the original study. Blacks who had a HS education or higher were 23% less likely to use AT compared to 17% in the original study. Results suggest an increasing gap between educational attainment levels and use.

The inverse relationship existed for access to health care. In the original study, individuals who had concerns with medical costs were 2 times more likely to use AT. In the current study, the odds of using AT decreased to 1.93 times more likely to use AT if medical costs were an issue. Similarly for Whites, the previous study cited a 2.10 OR for medical costs compared to a 1.98 OR in the current study, and for Blacks, if medical costs were an issue in the original study, individuals were 1.85 times more likely to use AT compared to 1.72 times in the current study. Similar trends were observed for the variable health coverage. Results suggest a decreasing gap in the relationship of access to health care and the use of AT between two group dynamics: those who have access to health coverage/no concerns with medical costs and individuals who do not have access to health coverage/concerns with medical costs.

Observed Differences explained

In the current study, results indicated that more people are using AT than before (12.1% currently compared to 9.8% in the previous study), and more specifically, Blacks are still using assistive devices at the highest rate (16.7% currently, and 12.8% in the previous article). The findings had several implications and could possibly be explained by several reasons including increased awareness, changes in demographic trends (e.g. more disabilities, aging population), or device accessibility (e.g. through health coverage).

The different trend observed in this study compared to the original study for the association of AT use and income is noteworthy and could possibly be explained by device affordability. The first finding indicated that Whites with higher income levels are using AT more than Whites with lower income levels. Whites have higher income levels and can therefore afford assistive devices. Similarly, the unemployment rates are lower for

Whites than Blacks. In contrast, the findings indicated that Blacks with lower income levels are using AT more than Blacks with higher income levels. Blacks with lower income levels may be receiving governmental support to assist with purchasing assistive devices.

There were also observed differences between the original study and the current study in the predictor variables of AT use: even though both studies had the same directionality for the predictors assessed, there were slight differences in the estimate magnitudes. Results indicated a widening gap in AT use between the high and low educational attainment groups, but a decreasing gap in AT use for those who stated medical costs were an issue compared to those who did not have the same concerns with medical costs. Given the correlation between education and income, it would reason that those with higher education would have more income to direct toward health aids such as AT. In addition, the persistent income stagnation of lower- and middle-income workers in comparison to individuals with higher education and wealth in America would further reduce the affordability of AT for those with lower incomes. In a recent article from the Economic Policy Institute discussing wage stagnation, Mishel (2015) explains the inequities in wage growth productivity by exploring trends over the past three decades. Results suggest an enormous growth in wages for the top 1% (138% increase since 1979) compared to very minimal increases for the bottom 90% (15% increase in wages since 1979). Further analyses of hourly wages by different socioeconomic classes revealed that while there has been a 41% increase in hourly wages for individuals in a higher socioeconomic class since 1979, there was only a 6% increase for those in the middle class and a decline (-5%) for workers in a lower class (Mishel, 2015). The inequities in income growth by socioeconomic class may partially explain widening gap in AT use.

The narrowing gap in groups of individuals who had concerns with medical costs versus those who did not may be explained by more accessibility to health care due to cost subsidies (e.g. The Patient Protection and Affordable Care Act). In a brief report from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) through the U.S. Department of Health & Human Services (2014), in the first five months during the enrollment period, there were 4.2 million people who selected a Marketplace plan. In a more recent article from the Congressional Budget Office (2017), the impact of repealing and eliminating the Affordable Care Act is discussed. The repeal of the bill will have a substantial impact on insurance coverage, increasing the number of people without access to insurance to 27 million within a year after the enactment of the repeal. The availability and accessibility of insurance through the Affordable Care Act may explain the narrowing gap in AT use in individuals who had concerns with medical costs verses those who did not have concerns with medical costs.

The narrowing gap between the groups of individuals who had concerns with medical costs versus those who did not have concerns, as well as other differences in utilization of AT between Whites and Blacks, may have promising implications for gerontechnologists in the future as it relates to designing gerontechnology services and products. Results overall emphasize the importance of affordability and accessibility. In the future, as it relates to design and services, gerontechnologists could potentially consider using more cost-efficient parts, which can reduce the cost to the AT user.

CONCLUSIONS

Recent literature exploring the use of AT by selected demographic variables have used a targeted sampling approach, mostly exploring racial differences between White and Black respondents for the analyses. Consistent with literature, this was the preferred methodological approach for this update study. This study confirmed differences in the use of AT between Whites and Blacks in the aging population. Earlier research findings related to race and the use of AT suggest that aging Whites use AT more than Blacks who are older. In this update study, the specific finding that aging Blacks use AT more than aging Whites when performing within proportional analyses may suggest a changing trend in use of AT since the same findings were revealed in the original study. In fact, it is noteworthy to highlight the importance of this study, confirming a disruption in the typical pattern of AT use among aging Whites and Blacks.

The targeted sampling approach was the most appropriate methodological approach consistent with previous research; however, it was also a noted limitation of the current study. Future research should continue to monitor this changing trend in racial disparities and AT use. Additionally, future research can potentially expand on this study by exploring racial differences in more depth examining AT use across racial groups. The prevalence of disability is increasing across racial gradients and therefore, there may be value in expanding this research to analyze the association of AT use and selected demographic variable by other racial/ethnicity groups. Furthermore, a gradient analysis of trends across racial groups will add value to the study by potentially globalizing and extending findings to popula-

tions outside of the United States.

There were also findings that emerged from this replication that slightly differed from the previous study such as changing trends in income levels and the gender predictor variable was no longer found to be a significant predictor of AT use. Similar to expanding this research to explore racial differences, there may be value in exploring AT use by other demographic variables (e.g. income, gender, marital status, etc.).

References

Agree E, Freedman V, Cornman J. Reconsidering substitution in long-term care. When does assistive technology take the place of personal care? Journal of Gerontology 2005; 60: 272-280.

Agree, E. M. (2014). The potential for technology to enhance independence for those aging with a disability. Disability and health journal, 7(1), S33-S39.

Anderson, W. L., & Wiener, J. M. (2013). The impact of assistive technologies on formal and informal home care. The Gerontologist, 55(3), 422-433.

Andreoni, G., Mazzola, M., Perego, P., Standoli, C. E., Manzoni, S., Piccini, L., & Molteni, F. (2014). Wearable monitoring devices for assistive technology: case studies in post-polio syndrome. Sensors, 14(2), 2012-2027.

Behavioral Risk Factor Surveillance System [Internet]. CDC. 2015 [cited 2017-08-07] Available from: (https://www.cdc.gov/brfss/annual_data/annual_2015.html).

Bhowmick, A., & Hazarika, S. M. (2017). An insight into assistive technology for the visually impaired and blind people: state-of-the-art and future trends. Journal on Multimodal User Interfaces, 11(2), 149-172.

Clay, S. L., & Alston, R. (2016). The benefits of assistive technology use by persons with physical conditions: An examination of difficulty levels in areas of functioning. Technology and Disability, 28(3), 111-121.

Congressional Budget Office. (2017). How Repealing Portions of the Affordable Care Act Would Affect Health Insurance Coverage and Premiums. https://www.cbo.gov/system/files/115thcongress-2017-2018/reports/52371 coverageandpremiums.pdf (accessed September 12, 2017).

Department of Health and Human Services [Internet]. HHS Poverty Guidelines. 2012 [cited 2017 August 17] Available from: httpL//aspe.hhs.gov/poverty/12poverty.shtml

Edyburn, D.L. (2015). Expanding the use of assistive technology while mindful of the need to understand efficacy Efficacy of assistive technology interventions (pp. 1-12): Emerald Group Publishing Limited.

Forman, D. E., Berman, A. D., McCabe, C. H., Baim, D. S., & Wei, J. Y. (1992). PTCA in the Elderly: The "Young-Old" versus the "Old-Old". Journal of the American Geriatrics Society, 40(1), 19-22.

Garçon, L., Khasnabis, C., Walker, L., Nakatani, Y., Lapitan, J., Borg, J. & Velazquez Berumen, A. (2016). Medical and assistive health technology: meeting the needs of aging populations. The Gerontologist, 56(Suppl_2), S293-S302.

Hartke R, Prohaska T, Furner S. Older adults and assistive devices: use, multiple-device use, and need. Journal of Aging and Health 1998: 10: 99-116

Kaye, H., Yeager, P., & Reed, M. Disparities in usage of assistive technology among people with disabilities. Assistive Technology: the official journal of RESNA 2008; 20: 194-203.

Lewis A, Cooper R, Seelman K, Cooper R, Schein R. Assistive technology in rehabilitation: Improving impact through policy. Rehabilitation, Research, Policy, and Education 2012; 26: 19-32.

Loggins, S., Alston, R., & Lewis, A. (2014) Utilization of assistive technology by persons with physical conditions: an examination of predictive factors by race, Condition and Rehabilitation: Assistive Technology, 9:6, 487-492, DOI:10.3109/17483107.2013.836683

Mishel, L., Gould, E., & Bivens, J. (2015). Wage stagnation in nine charts. Economic Policy Institute, 6.

Parette, H. P., & Stoner, J. B. (2008). Benefits of assistive technology user groups for early childhood education professionals. Early Childhood Education Journal, 35(4), 313-319.

Public Law 113-128. Workforce Innovatin and Opportunity Act (2013-2014).

Public Law 100-407. The Technology-related Assistance for Individuals with Disabilities Act of 1988.

Remillard, E. T., Fausset, C. B., Fain, W. B., & Bowers, B. J. (2017). Aging With Long-Term Mobility Impairment: Maintaining Activities of Daily Living via Selection, Optimization, and Compensation. The Gerontologist.

Scherer, M. & Glueckauf, R. (2005). Assessing the benefits of assistive technologies for activities and participation, Rehabilitation Psychology, 50, pp. 132–141

StatSoft, Inc [Internet]. Electronic Statistics Textbook. Tulsa, OK: 2012 StatSoft: [cited 2017 August 17] Available from: http://www.statsoft.com/textbook/.

Tomita M, Mann W, Welch T. Use of assistive devices to address hearing impairment by older persons with disablitlies. International Journal of Rehabilitation Research 2001; 24: 279-289.

U.S. Department of Health and Human Services. (2014). Health Insurance Marketplace: March Enrollment Report for the period: October 1, 2013-March 1, 2014. https://aspe.hhs.gov/system/files/pdf/76806/ib_2014mar_enrollment.pdf (accessed September 12, 2017).

World Health Organization [Internet]. Priority Assistive Products List. 2016 [cited 2017 August 17]. Available from: http://apps.who.int/iris/bitstream/10665/207694/1/WHO_EMP_PHI_2016.01_eng.pdf?ua=1