

Copyright
by
Vu Hoang Dao
2018

TECHNOLOGY AND ELDERLY WELL-BEING

by

Vu Hoang Dao, BS

THESIS

Presented to the Faculty of

The University of Houston-Clear Lake

In Partial Fulfillment

Of the Requirements

For the Degree

MASTER OF ARTS

in Behavioral Science

THE UNIVERSITY OF HOUSTON-CLEAR LAKE

MAY, 2018

TECHNOLOGY AND ELDERLY WELL-BEING

by

Vu Hoang Dao

APPROVED BY

Amy Lucas, PhD, Chair

Mike McMullen, PhD, Committee Member

APPROVED/RECEIVED BY THE COLLEGE OF HUMAN SCIENCES AND
HUMANITIES:

Samuel Gladden, PhD, Associate Dean

Rick Short, PhD, Dean

Dedication

For my late parents.

Acknowledgements

I am greatly indebted to the support of my family in the pursuit of my master's degree. Without their understanding and encouragement, this academic achievement would not be realized.

ABSTRACT

TECHNOLOGY AND ELDERLY WELL-BEING

Vu Hoang Dao
University of Houston-Clear Lake, 2018

Thesis Chair: Amy Lucas, PhD

Technology impacts human life. The well-being of elderly persons may be impacted by the advances of today's technology such as smartphones, social networking, and wearable devices. A sample of 120 persons who are 55 years of age or above participated in an online survey to probe the relationship between today's technology and the well-being of elderly people. Data obtained from the survey suggest that elderly individuals who report using technology are more likely to believe that using technology can lead to better physical, psychological, and social health than elderly individuals who do not use technology.

TABLE OF CONTENTS

List of Figures	ix
Chapter	Page
CHAPTER I: INTRODUCTION.....	1
CHAPTER II: LITERATURE REVIEW	3
Role of technology	3
Technology that enhances physical, psychological, and social well-being	5
Societal implications/applicability.....	6
CHAPTER III: METHODS.....	8
Sample.....	8
Measures	10
Dependent variable: Elderly well-being	10
Independent variables: use of technology.....	11
Control variables.....	12
CHAPTER IV: RESULTS.....	13
Data Analysis	13
Descriptive Statistics.....	13
The survey respondents.....	13
Smartphone ownership.....	16
How often respondents use their smartphone	23
How often respondents use social media	26
Response to the feeling of loneliness.....	29
Response to question "Staying socially connected lessens loneliness"	33
Response to question "Self-driving cars enhance mobility"	37
Response to question "Wearable devices help monitor health"	41
Response to question "Technology makes life easier"	44
Response to question "Health would improve with the application of technology"	47
Response to question "You wish to learn new technology"	51
Inferential statistics	52

"Smartphone ownership" and "How often respondents use their phone"	52
"Smartphone ownership" and "How often respondents use the social media"	53
"Smartphone ownership" and "Health would improve with the application of technology"	54
"How often respondents use smartphone" and "Health would improve with the application of technology"	55
"How often respondents use smartphone" and "How often respondents use the social media"	56
"You often feel lonely" and "Staying socially-connected lessens loneliness"	57
"Staying socially-connected lessens loneliness" and "Technology makes life easier"	58
"Self-driving cars enhance mobility" and "Wearable devices help monitor health"	59
"Self-driving cars enhance mobility" and "Technology makes life easier"	60
"Wearable devices help monitor health" and "Technology makes life easier"	61
"Wearable devices help monitor health" and "Health would improve with the application of technology"	62
"Self-driving cars enhance mobility" and "Health would improve with the application of technology"	63
"Technology makes life easier" and "Health would improve with the application of technology"	64
"You wish to learn new technology" and "You have been hospitalized in the past fiveyears"	65
CHAPTER V: DISCUSSION.....	67
Findings regarding descriptive statistics	67
Findings regarding inferential statistics	69
CHAPTER VI: CONCLUSION	74
REFERENCES	76
APPENDIX.....	78

LIST OF FIGURES

Figure	Page
Figure 1A: Where the respondents come from	9
Figure 1B: Device types respondents use	9
Figure 2: The Percent of Respondents by Age Group	13
Figure 3: The Percent of Respondents by Race	14
Figure 4: The Percent of Respondents by Gender	15
Figure 5: Respondents by Education	16
Figure 6: Smartphone Ownership of Respondents	17
Figure 7: Smartphone Ownership by Gender	17
Figure 8: Smartphone Ownership by Age	18
Figure 9: Smartphone Ownership by Race	19
Figure 10: Smartphone Ownership by Education	21
Figure 11: Smartphone Ownership by Total Household Income	22
Figure 12: How Often Respondents Use Their Smartphone by Age.....	23
Figure 13: How Often Respondents Use Their Smartphone by Race	24
Figure 14: How Often Respondents Use Their Smartphone by Gender.....	25
Figure 15: How Often Respondents Use Social Media	26
Figure 16: How Often Respondents Use Social Media by Age.....	27
Figure 17: How Often Respondents Use the Social Media by Race	28
Figure 18: How Often Respondents Use Social Media by Gender	29
Figure 19: Response to the Question "You Often Feel Lonely" by Age	30
Figure 20: Response to the Question "You Often Feel Lonely" by Race.....	31
Figure 21: Response to the Question "You Often Feel Lonely" by Gender	32
Figure 22: Response to the Question "Staying Socially-Connected Lessens Loneliness"	33
Figure 23: Response to the Question "Staying Socially-Connected Lessens Loneliness" by Age.....	34
Figure 24: Response to the Question "Staying Socially-Connected Lessens Loneliness" by Race.....	35

Figure 25: Response to the Question "Staying Socially-Connected Lessens Loneliness" by Gender.....	36
Figure 26: Response to the Question "Self-Driving Cars Enhance Mobility"	37
Figure 27: Response to the Question "Self-Driving Cars Enhance Mobility" by Age.....	38
Figure 28: Response to the Question "Self-Driving Cars Enhance Mobility" by Race.....	39
Figure 29: Response to the Question "Self-Driving Cars Enhance Mobility" by Gender	40
Figure 30: Response to the Question "Wearable Devices Help Monitor Health" by Age.....	42
Figure 31: Response to the Question "Wearable Devices Help Monitor Health" by Race.....	43
Figure 32: Response to the Question "Wearable Devices Help Monitor Health" by Gender	44
Figure 33: Response to the Question "Technology Makes Life Easier" by Age.....	45
Figure 34: Response to the Question "Technology Makes Life Easier" by Race	46
Figure 35: Response to the Question "Technology Makes Life Easier" by Gender	47
Figure 36: Response to the Question "Health Would Improve with the Application of Technology" by Age.....	48
Figure 37: Response to the Question "Health Would Improve with the Application of Technology" by Race	50
Figure 38: Response to the Question "Health Would Improve with the Application of Technology" by Gender.....	51
Figure 39: Response to the Question "You Wish to Learn New Technology"	52
Figure 40: Correlation between Smartphone Ownership and How Often Respondents Use Phone.....	53
Figure 41: Correlation between Smartphone Ownership and How Often Respondents Use Social Media.....	54
Figure 42: Correlation between Smartphone Ownership and the Notion that Health Would Improve with the Application of Technology	55
Figure 43: Correlation between How Often Respondents Use Smartphone and the Notion that Health Would Improve with the Application of Technology	56
Figure 44: Correlation between How Often Respondents Use Smartphone and How Often Respondents Use Social Media.....	57

Figure 45: Correlation between the Notion One Often Feels Lonely and the Notion that Staying Socially-Connected Lessens Loneliness.....	58
Figure 46: Correlation between the Notion that Staying Socially-Connected Lessens Loneliness and the Notion that Technology Makes Life Easier	59
Figure 47: Correlation between the Notion that Self-Driving Cars Enhance Mobility and the Notion that Wearable Devices Help Monitor Health	60
Figure 48: Correlation between the Notion that Self-Driving Cars Enhance Mobility and the Notion that Technology Makes Life Easier	61
Figure 49: Correlation between the Notion Wearable Devices Help Monitor Health and the Notion Technology Makes Life Easier.....	62
Figure 50: Correlation between the Notion that Wearable Devices Help Monitor Health and the Notion that Health Would Improve with the Application of Technology	63
Figure 51: Correlation between the Notion Self-Driving Cars Enhance Mobility and the Notion that Health Would Improve with the Application of Technology	64
Figure 52: Correlation between the Notion that Technology Makes Life Easier and the Notion that Health Would Improve with the Application of Technology	65
Figure 53: Correlation between the Notion You Wish to Learn New Technology and the Notion You Have Been Hospitalized in the Past Five Years	66

CHAPTER I: INTRODUCTION

Advances in information technology offer potential benefits regarding healthcare for the elderly. For example, smartphones and social media enable the elderly to stay more socially-connected, which benefits them by preventing adverse circumstances such as falls, increased hospitalization, loneliness, and dementia. Wearable devices can help monitor blood pressure and summon calls in cases of emergency. Self-driving vehicles someday can take elderly people to the doctor's office for appointments, enabling them to be more independent from others' assistance.

Most of us have elderly parents to care for, or it is we ourselves who are aging and will soon need additional care. We live in the information technology age. Smartphones, smart TVs, the Internet, Google, Facebook, Twitter, YouTube, GPS, digital cameras, emails, and text messages have become a reality in society. The impact of technology is widespread and profound, which brings about a lot of changes in almost every aspect of human life. Indeed, it is difficult to imagine what the world would be like without the existence of technology that has become so familiar to us. Technological devices and technology have the ability to make life better for all, including the elderly. Certainly technology can contribute to the well-being of the elderly and help with their everyday lives.

I am studying the impact of information technology on the elderly because I want to know if progress in information technology enables us to live a happier life. I think this is an important study because applications of information technology exist in almost every aspect of human life. If information technology helps the elderly live more

comfortably in the last phase of their lives, it means information technology contributes considerably to the well-being of humankind. It is the last years in a person's life when he/she may face illness, feel helpless, and become dependent on the care of other people. His/her well-being then is deeply at stake, and if technology can do anything to help the elderly at that time, it would be considered a positive contribution.

In this current study, I will focus on the elderly's attitudes toward technological advances and/or devices that can be used to assist the elderly in their daily lives because they are variables that may impact the diagnosis, treatment, and health maintenance for elderly people. For instance, wearable devices that monitor blood pressure can help in the diagnosis and treatment of cardiovascular diseases, or the fitbit wristband can help keep track of activities and vital signs. Furthermore, this study will also focus on the health of the elderly, including their sicknesses and illnesses, their daily needs for normal activity, their medical treatment, and their health maintenance because these are the variables that most show the benefits of the application of technology.

CHAPTER II: LITERATURE REVIEW

Role of technology

According to a Pew research report that asks what has brought about the biggest improvement in life in the past 50 years, 42% of American adults give credit to technology more than any other advancement (Strauss 2017). And when asked what will contribute to the biggest improvements to life in the next 50 years, 22% of Americans predict the improvements will come from technology while another 20% of respondents say they will come from medicine and health (Strauss 2017).

It is often thought that technology is for young people. However, in a study conducted on 240 elderly people in the Centers for the Elderly in Cuenca, Spain, 49.31% of the respondents, i.e., the largest percentage, want to enroll in a class of information and communications technology for the sake of just learning (Gonzalez, Ramirez, and Viadel 2012). So we can see that the elderly are eager to learn about technology. Another 22.6% of the respondents wish to learn about computers, and the percentage of those who enroll in the class for the purpose of keeping their mind active is 8.21% (Gonzalez et al. 2012). Those who enroll in the class just to participate, establish relationships, or satisfy their curiosity account for 2.73%, 4.1%, and 6.16% respectively (Gonzalez et al. 2012). Other researchers have found that technology benefits the health and well-being of the elderly and that technology can help improve the physical and cognitive wellness of the elderly if motor and cognitive exercises make use of the available technological tools (Callari, Ciairano, and Re 2012). Their research also notes a trend of increasing use of technology by the elderly once they trust and accept the technology (Callari et al. 2012).

Technology opens up a whole new horizon of help to elderly people. Adaptive technologies such as hearing-aids, programmable pill boxes, and wearable emergency-call buttons can help elderly people with issues of physical deficits (Jordan et al. 2016). In addition, the tremor spoon invented by Google, which applies the same technology to stabilize cameras in recording sports events, enables elderly people with shaking hands to feed themselves (Jordan et al. 2016). Smart homes equipped with environmental sensors can help detect elderly people's vital signs and safety concerns such as falls and excessive room temperatures (Jordan et al. 2016). A smart bed is designed with a sleep IQ monitor to track elderly people's heart rate, breathing, and movement, and it is able to give information to improve the user's sleep (Jordan et al. 2016). Seniors could make use of a long list of devices, ranging from fall detectors to hip protectors to fire alarms to movement detectors (Miskelly 2001). In addition, assistive medication technology offers considerable relief to elderly people. Some examples of how medication technology can assist the elderly include the Cadex Medication Reminder watch (with reminder text messages about the name and strength of medication), the MedPrompt's Medical Paging System (displaying alerts on the pager screen about medication, dosing, and instructions), the Talking Prescription reminder (a device attached to the bottom of a pillbox that can record a 60-second message to remind the patient to take his/her pills), the Monitored Automatic Medication dispenser (capable of dispensing 25 different pills each time, up to 6 times daily, operative for up to 30 days without reloading, and capable of giving alerts if medications are not dispensed or used up), and the On-Time RX PDA (a hand-held

device giving drug names, dosages, and directions that prompts patients to take medications) (Logue 2002).

Technology that enhances physical, psychological, and social well-being

To measure how technology helps to improve the quality of life, certain standards may be used to develop an evaluation system based on technology that is derived from artificial intelligence research (Atanasova and Karashtranova 2016). These notions include, among other standards, the health approach, which measures physical, psychological, and social well-being levels as an indicator of quality of life (Krupka et al. 2011).

Health is almost always an important concern for seniors. So enhancing the quality of life in the later phase of human life also means taking good care of one's health. In their research, Gonzalez and his co-workers found that elderly people access and learn technology because technology helps them "to communicate and be active" (2012:591). Thus technology plays a role in enhancing their social well-being because it enables the elderly to stay connected and maintain active communications with their friends and family. Miskelly (2001) includes an array of technological devices in his study (door alerts, movement detectors, electronic calendars/speaking clocks, pressure mats, hip protectors, health monitors, fall detectors, video-monitoring) that help enhance the physical well-being of the elderly. He concludes that "assistive technology can make an important contribution to the care of elderly people in institutions and at home" (Miskelly 2001:458). Additionally, technology can help enhance the psychological well-being of the elderly. Jordan and his co-researchers (2016) indicate that seniors who have

to remain home due to their health condition can attend religious services and maintain contact with support groups by means of online church services and conference call technology. So conclusively we can say that technology helps enhance the physical, psychological, and social well-being of the elderly.

Societal implications/applicability

The authors in the previous studies have done an excellent job demonstrating how technology can help the elderly. People may get interested in technology when they are young, but technology can stay with them and assist them considerably as they enter old age. The current generation of elderly people may not be familiar with technology because in the days of their youth, information technology as we now know it did not exist. These elderly people belong to the Silent Generation (1925-1945), and some of them belong to the Baby Boomers (1946-1964). Members of the Silent Generation were born and grew up during the years of the Great Depression and World War II. As of 2015, there are about 28 million Americans in this group according to the U.S. Census Bureau (2015). Regarding the Baby Boomers, they were born after World War II during a surge in child births and grew up during the years of the Civil Rights Movement and the Vietnam War. As of 2015, there are about 75 million Americans in this group according to the U.S. Census Bureau (2015). So about a hundred million Americans from these two generations are aging, and there is a large need for their health care.

At present, technology is developing at a quick pace and even shows signs of acceleration. This study looks at whether elderly people believe that those who use technology are better-off than those who do not, along with how technology impacts their

well-being. Members of both the Silent Generation and Baby Boomers comprise the sample of this study so the results of this study can lend insights into how technology impacts these generations. In the current study, I plan to test the following hypothesis: elderly individuals who report using technology will report better physical, psychological, and social health than elderly individuals who do not use technology.

CHAPTER III: METHODS

Sample

The population for this study is adults over age 55 in the United States. These are individuals who can be considered members of either the Baby Boomer or the Silent Generation. The sample for this study was recruited through Survey Monkey. Any participant who was 55 years or older in Survey Monkey's participant pool was eligible to participate and invited to complete the online questionnaire (See Appendix). The questionnaire is composed of 20 questions that collect demographic information, as well as a respondent's use and attitudes toward technology. One hundred and twenty elderly persons completed the online questionnaire. Initially, I intended to collect data from senior centers and nursing homes/assisted living homes in Houston based on different geographical locations of the city and its surrounding areas, e.g., Southeast, Northeast, Southwest, Northwest, Pearland, Sugarland, Katy, etc. This data collection method ran into difficulties finding nursing homes and nursing home residents who were willing to participate in the project. Therefore, the project changed to an online survey that recruited from Survey Monkey's research participant pools. Refer to Figure 1A and 1B for some descriptive information provided by Survey Monkey regarding their participant pools in terms of their geographic locations and how they complete the online surveys.

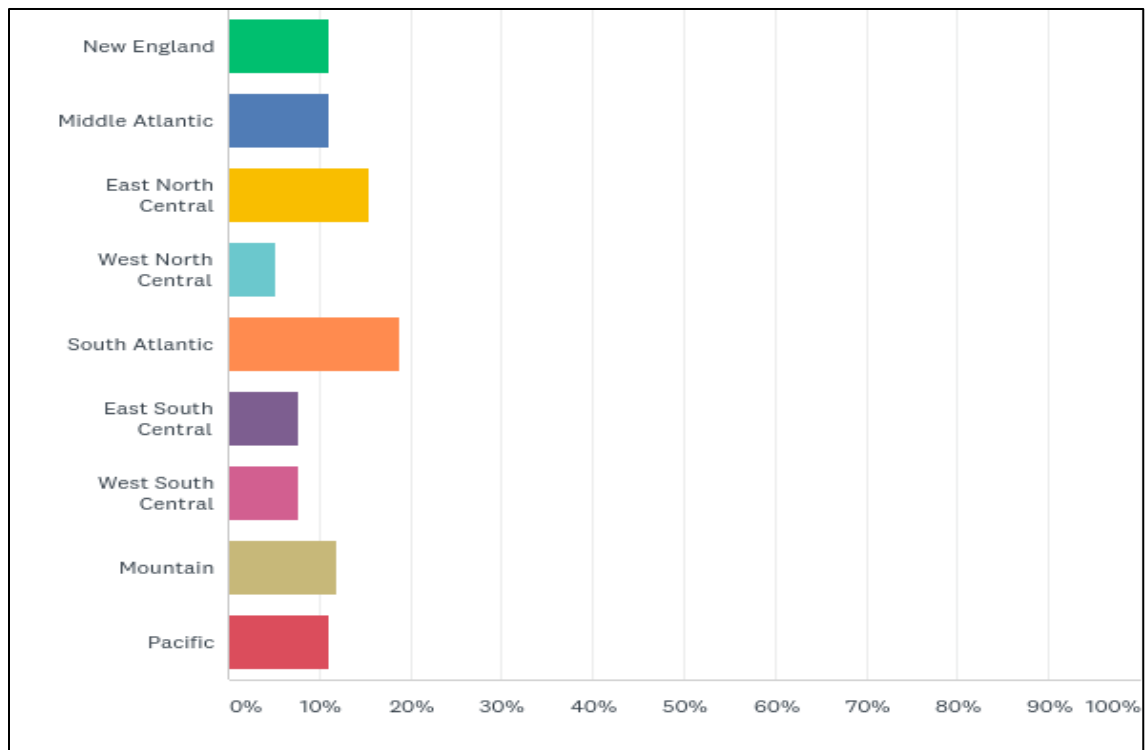


Figure 1A: Where the respondents come from

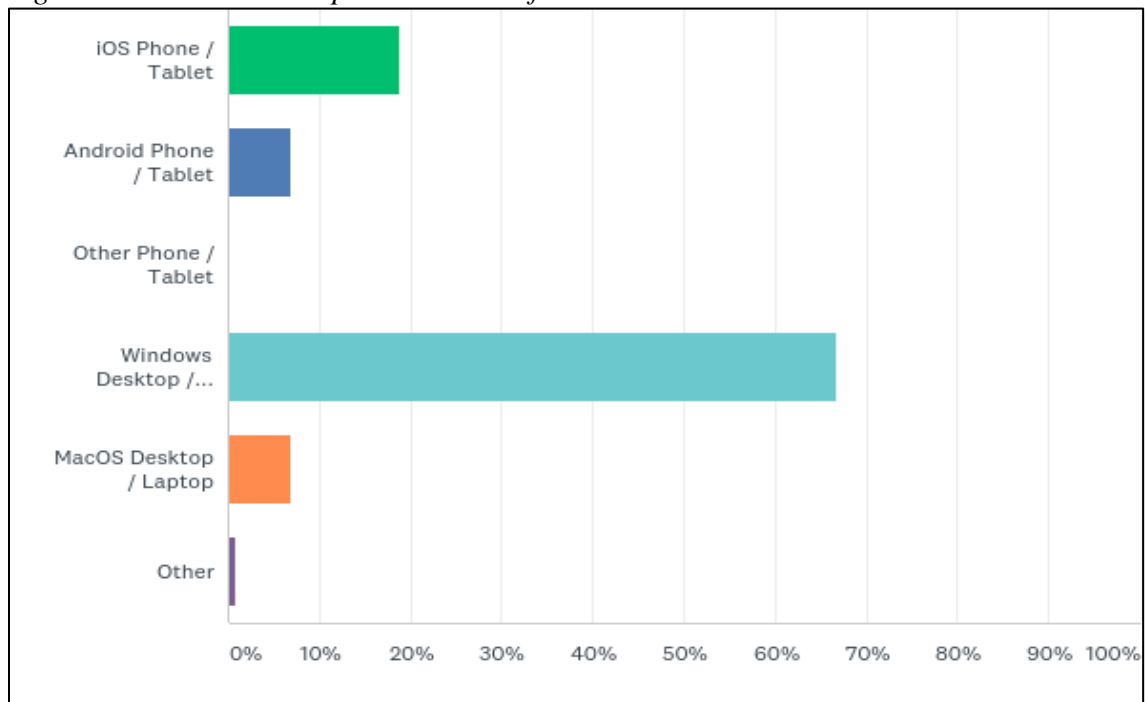


Figure 1B: Device types respondents use

Measures

Dependent variable: Elderly well-being

Elderly well-being measures are constructed from questions that probe into the physical, psychological, and social well-being of the respondent. Regarding physical well-being, the measure is constructed from the two questions: (1) *In the past five years, how many times have you been hospitalized?* and (2) *In the past five years, how many times have you fallen?* Responses to these two questions are coded so that 0 indicates "none," 1="1 time," 2="2 times," 3="3 times," and 4= "4 or more times." Moreover, an additional question on mental health measures another dimension of the respondent's health: *Have you ever been diagnosed with dementia?* Responses to this question are coded so that 0 indicates "refused," 1="don't know," 2="no," and 3="yes."

As far as psychological well-being is concerned, the measure is constructed from two questions: (1) *Do you often feel lonely?* and (2) *Does staying socially-connected help alleviate your loneliness?* Responses to these questions are coded so that 1 indicates "strongly disagree," 2="somewhat disagree," 3="neither agree nor disagree," 4="somewhat agree," and 5="strongly disagree."

As for social well-being, the measure is constructed from the two questions: (1) *If you have a smartphone, how often do you use it to talk, send emails or text messages to family and friends?* and (2) *How often do you use online social network, e.g. Facebook, Twitter, etc?* Responses to these questions are coded so that 0 indicates "refused," 1="never," 2="a few times per year," 3="a few times per month," 4="a few times per week," and 5="very often."

Independent variables: use of technology

The study also considers independent variables that are likely to impact the dependent variable, i.e., respondent's well-being. One such variable is the availability of and access to technology. The measure for this variable is constructed from the two questions: (1) *Do you use any technological device to monitor your health?* and (2) *Do you use a smartphone?* Responses to these questions are coded so that 0 indicates "refused," 1="no," and 2="yes."

Additionally, I also measure the respondent's attitudes and opinions about the application of technology and the benefits that may follow. To this effect, the following four questions are constructed: (1) *Self-driving cars will enhance the mobility of elderly people?* (2) *Wearable devices assist elderly people in monitoring their health?* (3) *Technology makes your life easier?* (4) *Your overall health condition would improve with the application of technology?* Responses to these questions are coded so that 1 indicates "strongly disagree," 2="somewhat disagree," 3="neither agree nor disagree," 4="somewhat agree," and 5="strongly disagree."

The question on self-driving cars is designed to examine how respondents think about the future progress of technology and whether the progress will have any applicable benefit for the elderly respondent. The question on wearable devices probes into present day technology and its application for elderly respondents. The other two questions are designed to collect the respondent's judgment on the positive effects of technology.

Control variables

In addition, variables that may impact both a respondent's use of technology and their health are also measured. In particular, there are demographic measures such as race, gender, marital status, age, educational level, household income, and religion. As for race, responses are coded so that 1 indicates "Other," 2="Asian," 3="Hispanic," 4="Black," and 5="White." Regarding gender, responses are coded so that 0 indicates "Other," 1="female," and 2="male." Regarding marital status, responses are coded so that 1 indicates "Other," 2="divorced," 3="widowed," 4="single," and 5="married." As far as age is concerned, 1="55-59 years old," 2="60-69 years old," 3="70-79 years old," 4="80-89 years old," and 5="90 years old or more." As for educational level, 1="less than high school," 2="high school/GED," 3="some college," 4="associate's degree," 5="bachelor's degree," 6="master's degree," and 7="doctoral degree." Regarding household income, 0="blank or prefer not to answer," 1="\$0-\$9,999," 2="\$10,000-\$24,999," 3="\$25,000-\$49,999," 4="\$50,000-\$74,999," 5="\$75,000-\$99,999," 6="\$100,000-\$124,999," 7="\$125,000-\$149,999," 8="\$150,000-\$174,999," 9="\$175,000-\$199,999," and 10="\$200,000 and up." As far as religion is concerned, 0="none," 1="other," 2="Buddhist," 3="Hindu," 4="Muslim," 5="Jewish," and 6="Christian."

CHAPTER IV: RESULTS

The analysis for this study encompasses two stages. First, I present descriptive statistics of my sample and their use of technology. I also examine whether there are any differences in technology use by demographic variables. Then, I present inferential statistics. In particular, I examine the correlation between a respondent's use of technology and their reported health.

Data Analysis

Descriptive Statistics

The survey respondents

A total of 120 respondents gave complete and valid replies to the questionnaire. By age group, 29.17% are 55-59 years old, 53.33% are 60-69 years old, 16.67% are 70-79 years old, and 0.83% are 80-89 years old. Refer to Figure 2.

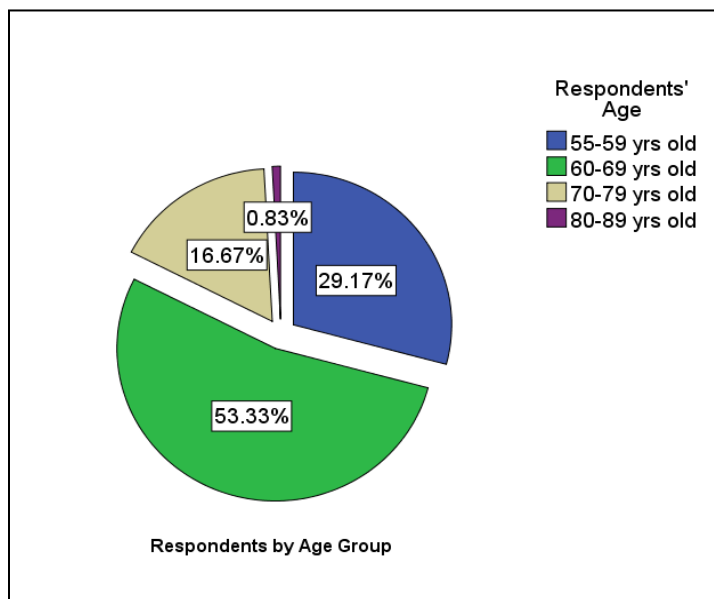


Figure 2: The Percent of Respondents by Age Group

By race, 89.17% of respondents are white, 3.33% black, 1.67% Asian, and 5.83% other. Refer to Figure 3.

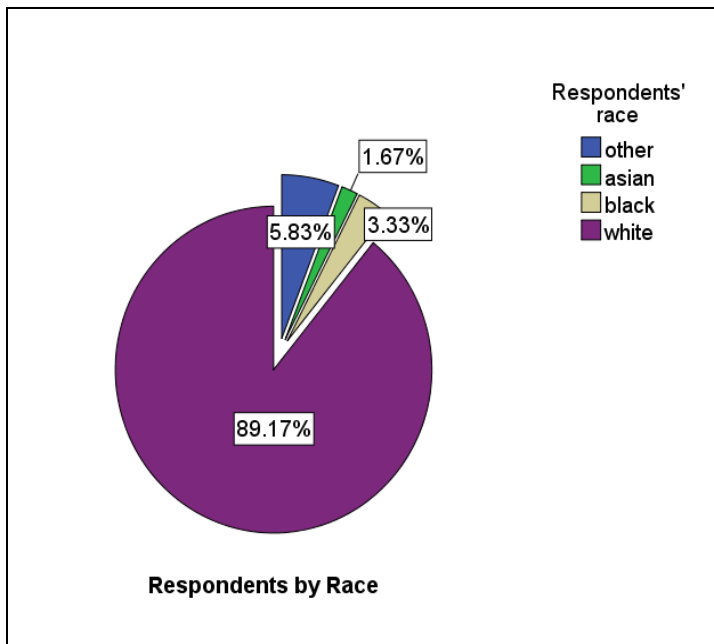


Figure 3: The Percent of Respondents by Race

By gender, 53.33% of respondents are female, and 46.67% are male. Refer to Figure 4.

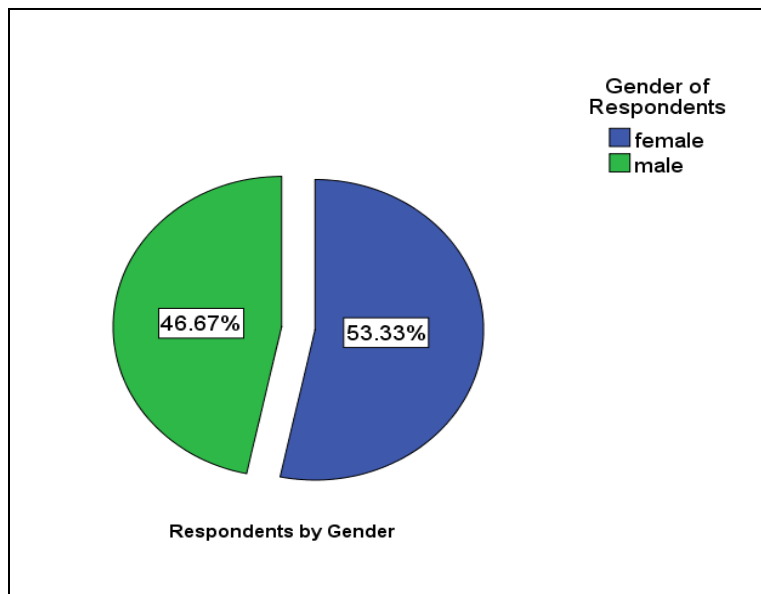


Figure 4: The Percent of Respondents by Gender

By education, the educational attainment of the respondents ranges from less than a high school degree to doctoral degree. The two most dominant groups are those with "some college" (29.17%) and a "bachelor's degree" (25.83%). Next comes the group of those with a "master's degree" (22.5%). Those with an "associate's degree" account for 6.67% of the respondents. At the high end of the range are those with a "doctoral degree" (4.17%), and at the other end are those with a "high school degree/GED" (10%) and less than high school (1.67%). Refer to Figure 5.

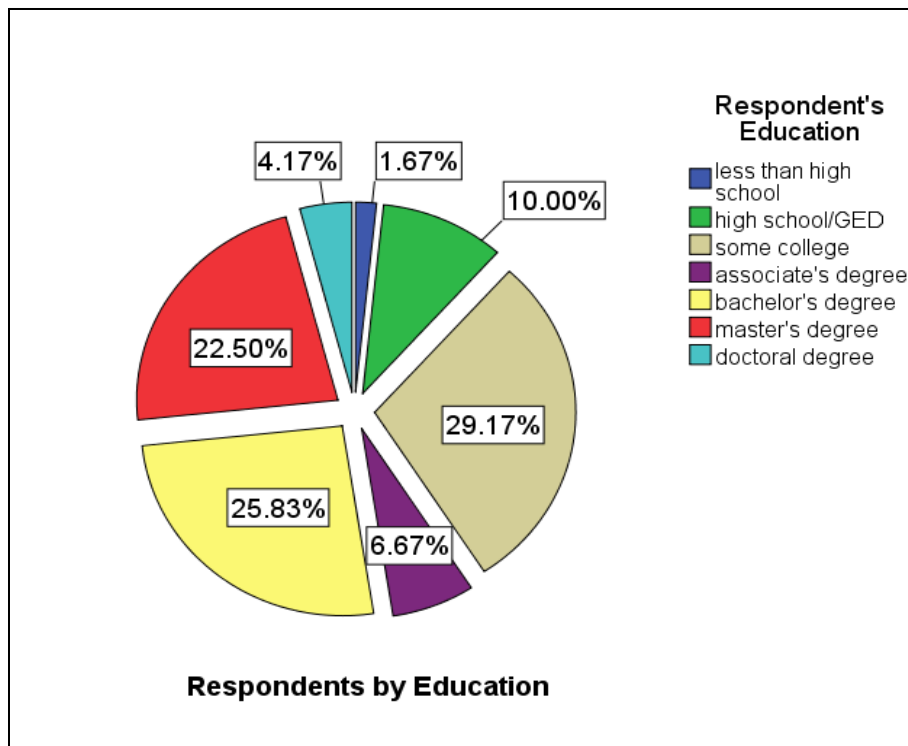


Figure 5: Respondents by Education

Smartphone ownership

In reply to the question, "Do you have a smartphone?" 77.5% of respondents say "Yes," and 22.5% say "No." This means that 3 out of 4 elderly respondents have access to the icon of today's technology. Refer to Figure 6.

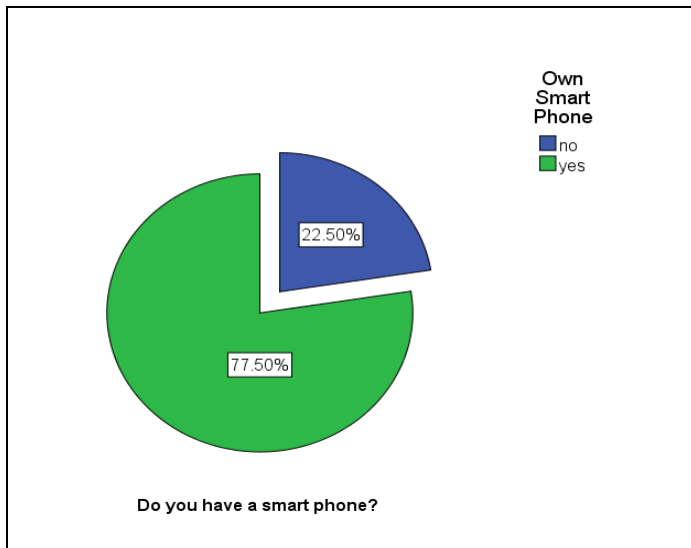


Figure 6: Smartphone Ownership of Respondents

Regarding smartphone ownership, 79.7% of females and 75% of males indicate that they own a smartphone, but 20.3% of females and 25% of males do not. Refer to Figure 7.

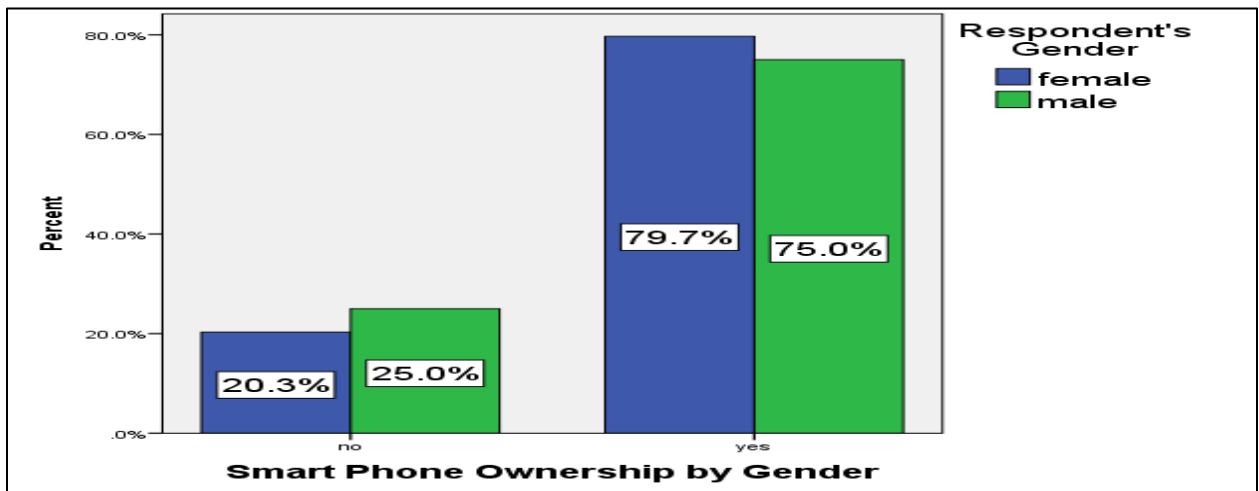


Figure 7: Smartphone Ownership by Gender

In terms of age, 82.9% of respondents in age group 55-59, and 78.1% of respondents in age group 60-69, and 70% of respondents in age group 70-79 report they own a smartphone. On the contrary, 17.1% of respondents in age group 55-59, 21.9% of respondents in age group 60-69, and 30% of respondents in age group 70-79 report they do not own a smartphone. All respondents in age group 80-89 indicate they do not own a smartphone. Refer to Figure 8.

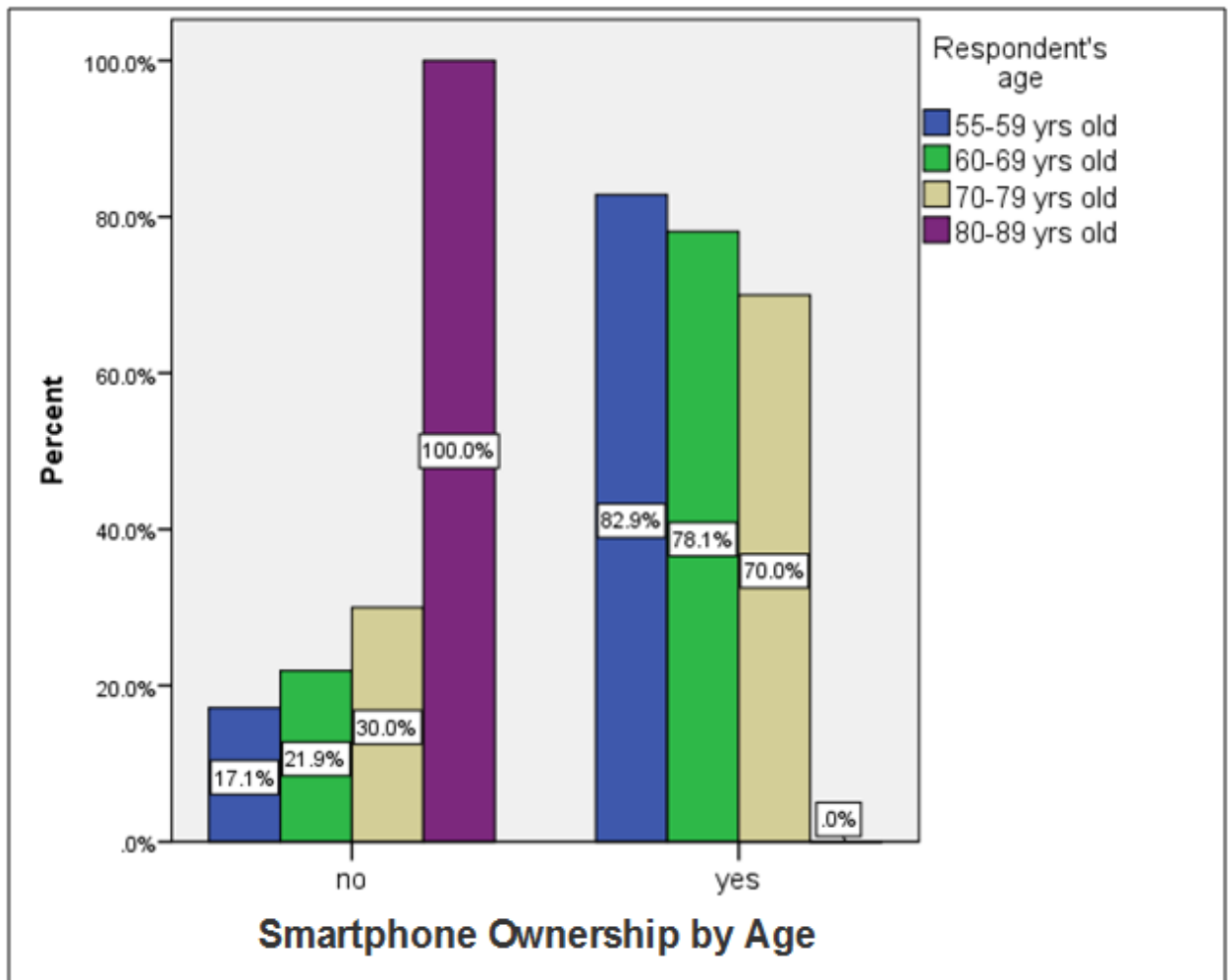


Figure 8: Smartphone Ownership by Age

In terms of race, 100% of Asian and Black respondents report that they own a smartphone. Additionally, 75.7% of White respondents and 85.7% of respondents in the "Other" race group also indicate that they own a smartphone.

On the contrary, 24.3% of White respondents report that they do not own a smartphone. Also, 14.3% of respondents in the "Other" race group report that they do not own a smartphone. Refer to Figure 9.

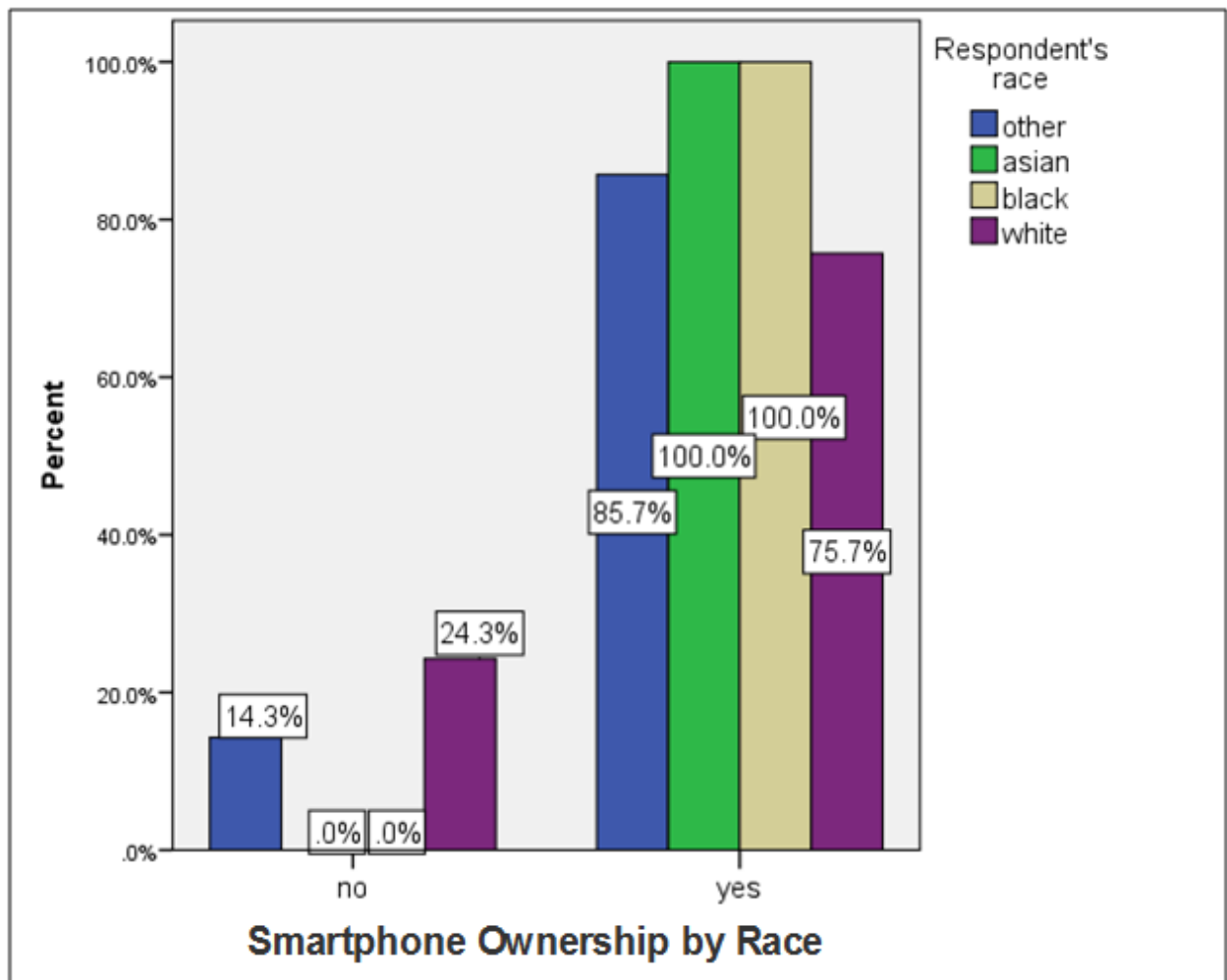


Figure 9: Smartphone Ownership by Race

Smartphone ownership varies by education. In all education groups, respondents who own a smartphone account for a higher percentage than those who do not. Nevertheless, it is noticed that 100% of respondents in the "less than high school" group do not own a smartphone.

In the "high school/GED" group, 25% of respondents do not own a smartphone, and 75% do. In the "some college" group, 17.1% of respondents do not own a smartphone, and 82.9% do. In the "associate's degree" group, 12.5% do not own a smartphone, and 87.5% do. In the "bachelor's degree" group, 29% do not own a smartphone, and 71% do. In the "master's degree" group, 18.5% do not own a smartphone, and 81.5% do. In the "doctoral degree" group, 20% do not own a smartphone, and 80% do. Refer to Figure 10.

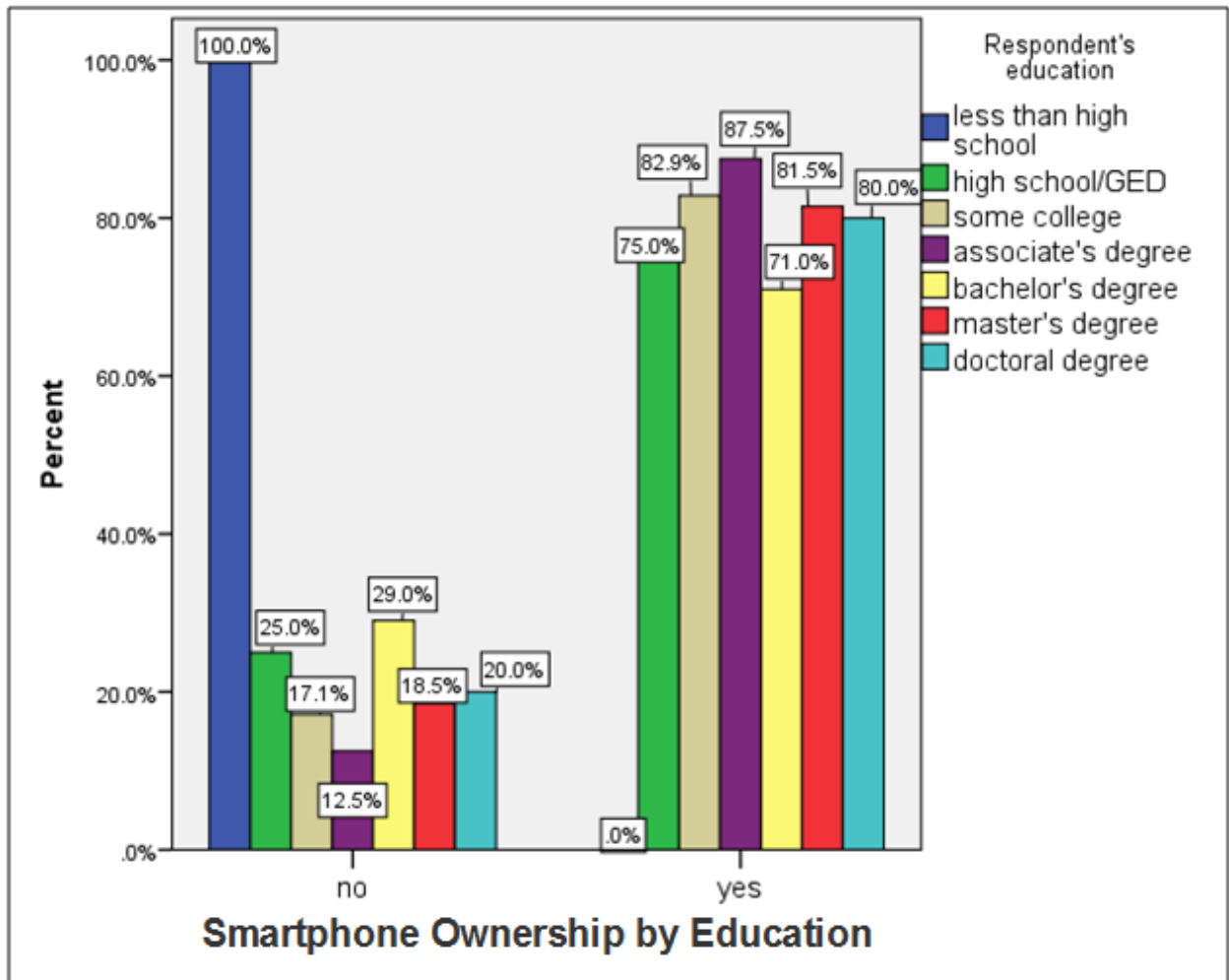


Figure 10: Smartphone Ownership by Education

The general trend is the higher the total household income, the more likely the ownership of a smartphone. In the income group of "\$200,000 and above," 100% of respondents report ownership of a smartphone. In the income group of "\$100,000-\$199,999," 87% of respondents report they own a smartphone. In the income group of "\$50,000-\$99,999," 72% or respondents also report they own a smartphone. In the income group of "\$0-\$49,999," 70.8% of respondents also report they own a smartphone.

On the contrary, 29.2% of respondents in the income group of "\$0 - \$49,999" report they do not own a smartphone. In the income group of "\$50,000-\$99,999," 28% of respondents also report they do not own a smartphone. In the income group of "\$100,000-\$199,999," 13% of respondents report they do not own a smartphone. Refer to Figure 11.

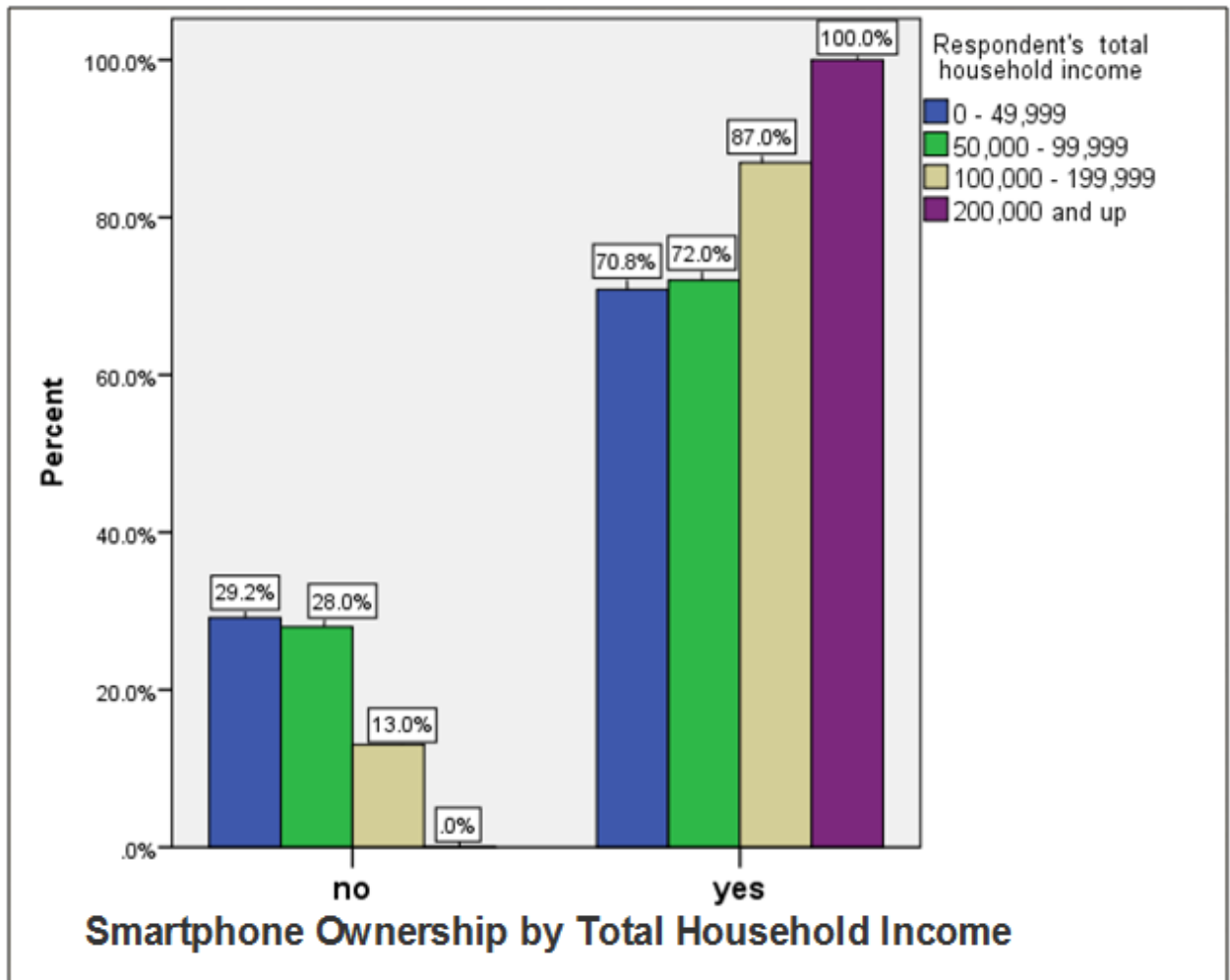


Figure 11: Smartphone Ownership by Total Household Income

How often respondents use their smartphone

In terms of age, 96.6% of respondents in the age group of 55-59 years old report that they use their smartphone very often. In the age group of 60-69 years old, 79.6% of respondents also report that they use their smartphone very often. In the age group of 70-79 years old, 66.7% of respondents report that they use their smartphone very often, too.

Refer to Figure 12.

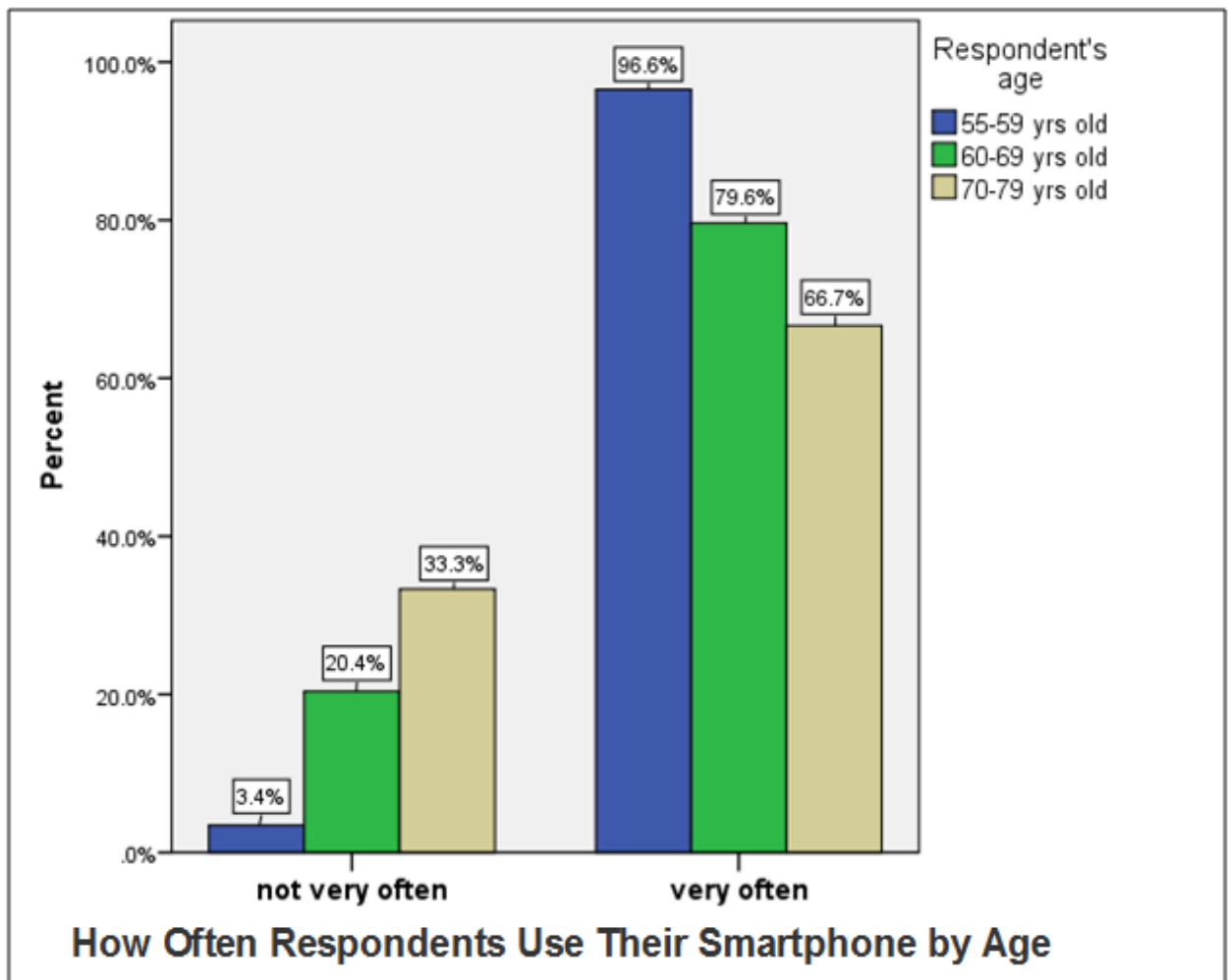


Figure 12: How Often Respondents Use Their Smartphone by Age

In terms of race, 100% of respondents in the Asian group report that they use their smartphone very often. In the Black group, 100% of respondents also report that they use their smartphone very often. In the White group, 81.2% of respondents also report they use their smartphone very often, and 85.7% of respondents in the "Other" race group report they use their smartphone very often, too.

However, 18.8% of respondents in the White group report they do not use their smartphone very often, and 14.3% of respondents in the "Other" race group also report they do not use their smartphone very often. Refer to Figure 13.

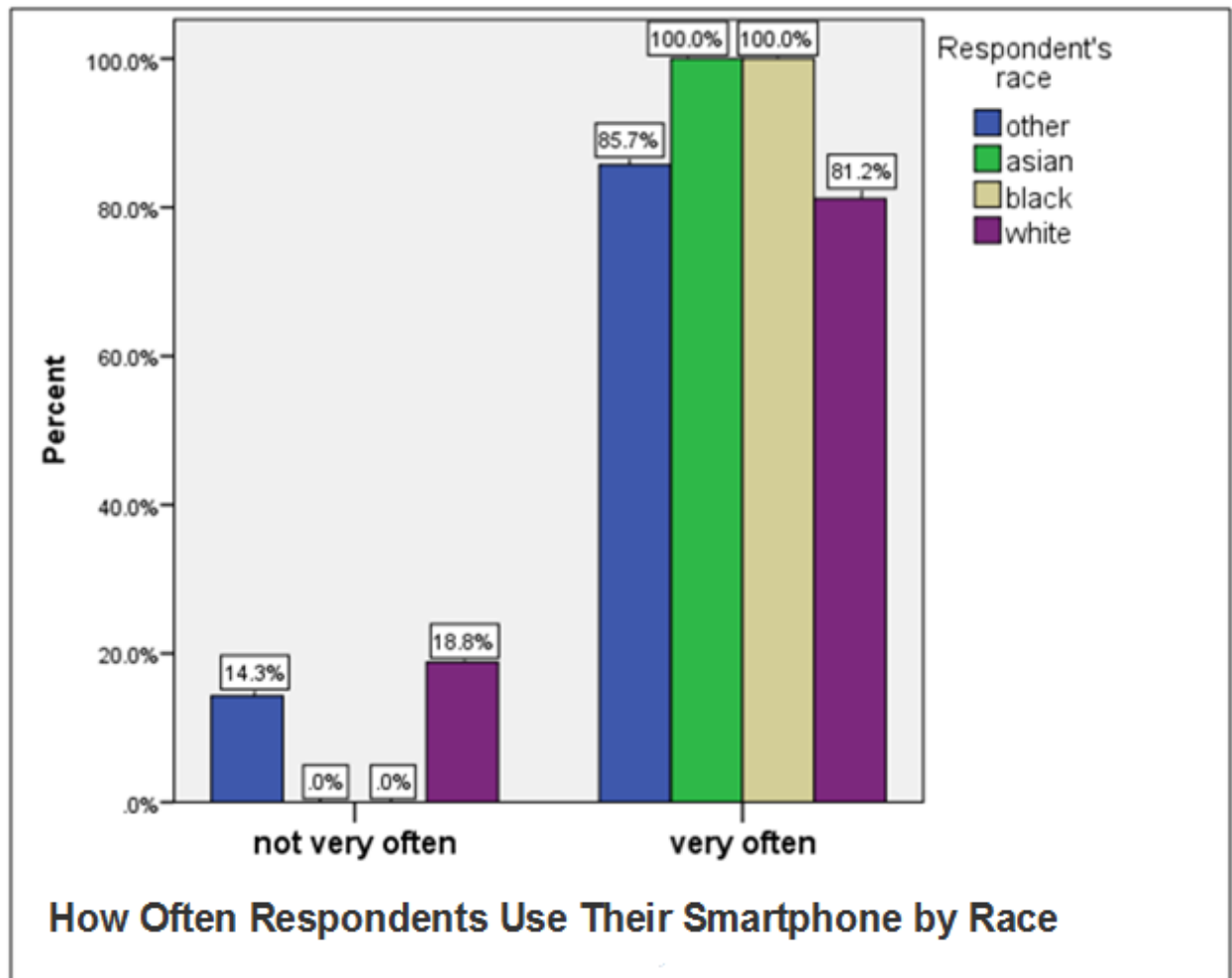


Figure 13: How Often Respondents Use Their Smartphone by Race

In terms of gender, 84.9% of female respondents report they use their smartphone very often, and 64.3% of male respondents do, too. Only 15.1% of female respondents report that they do not use their smartphone very often, and neither do 20% of male respondents. Refer to Figure 14.

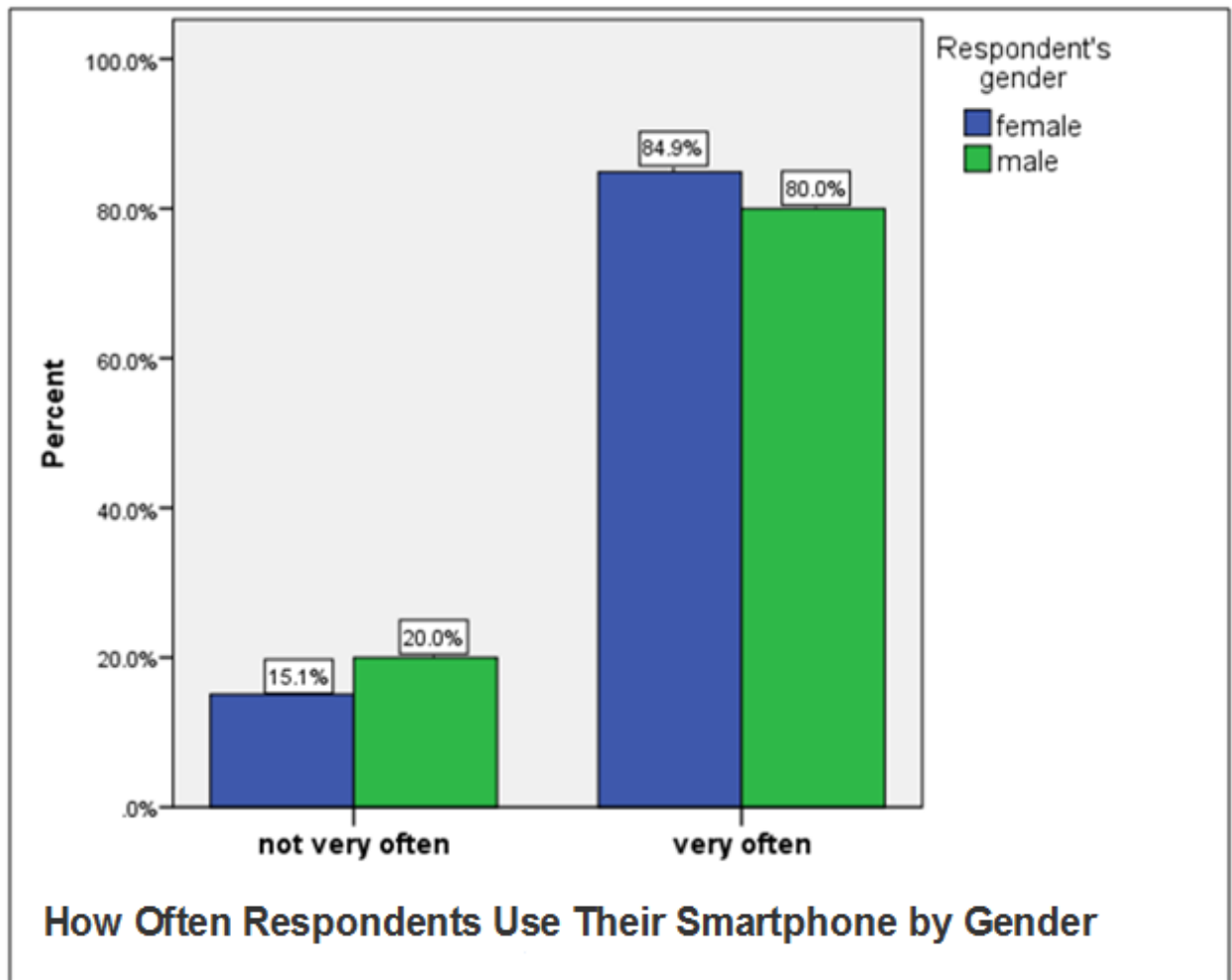


Figure 14: How Often Respondents Use Their Smartphone by Gender

How often respondents use social media

In general, 40% of all respondents report that they use social media very often. Another 18.33% of respondents also report that they use social media a few times a week. Only 10% of respondents use it a few times per month and a few times per year. Lastly, 21.67% of respondents claim that they never use social media. Refer to Figure 15.

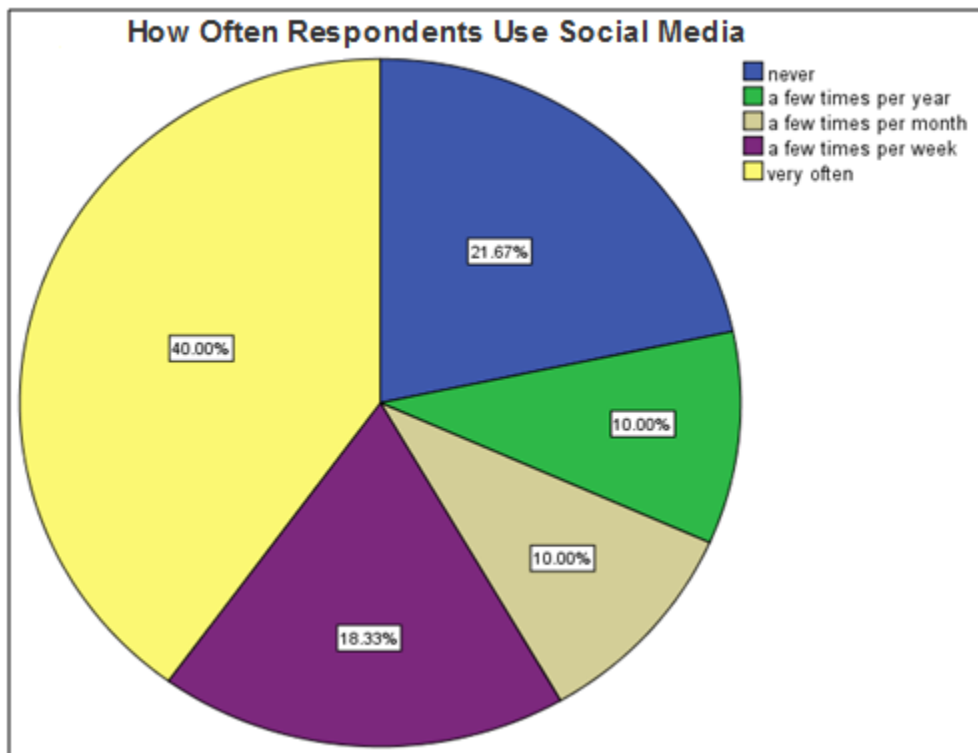


Figure 15: How Often Respondents Use Social Media

In analyzing how respondents use social media in terms of age, survey results indicate that 48.6% of respondents in age group 55-59, 37.5% of respondents in age group 60-69, and 35% of respondents in age group 70-79 report they use social media very often. On the contrary, survey results also show that 8.6% of respondents in age group 55-59, 21.9% of respondents in age group 60-69, and 45% of respondents in age

group 70-79 report they never use social media. Otherwise, respondents of different age groups report that they use social media a few times a year, or a few times a month, or few times a week. Refer to Figure 16.

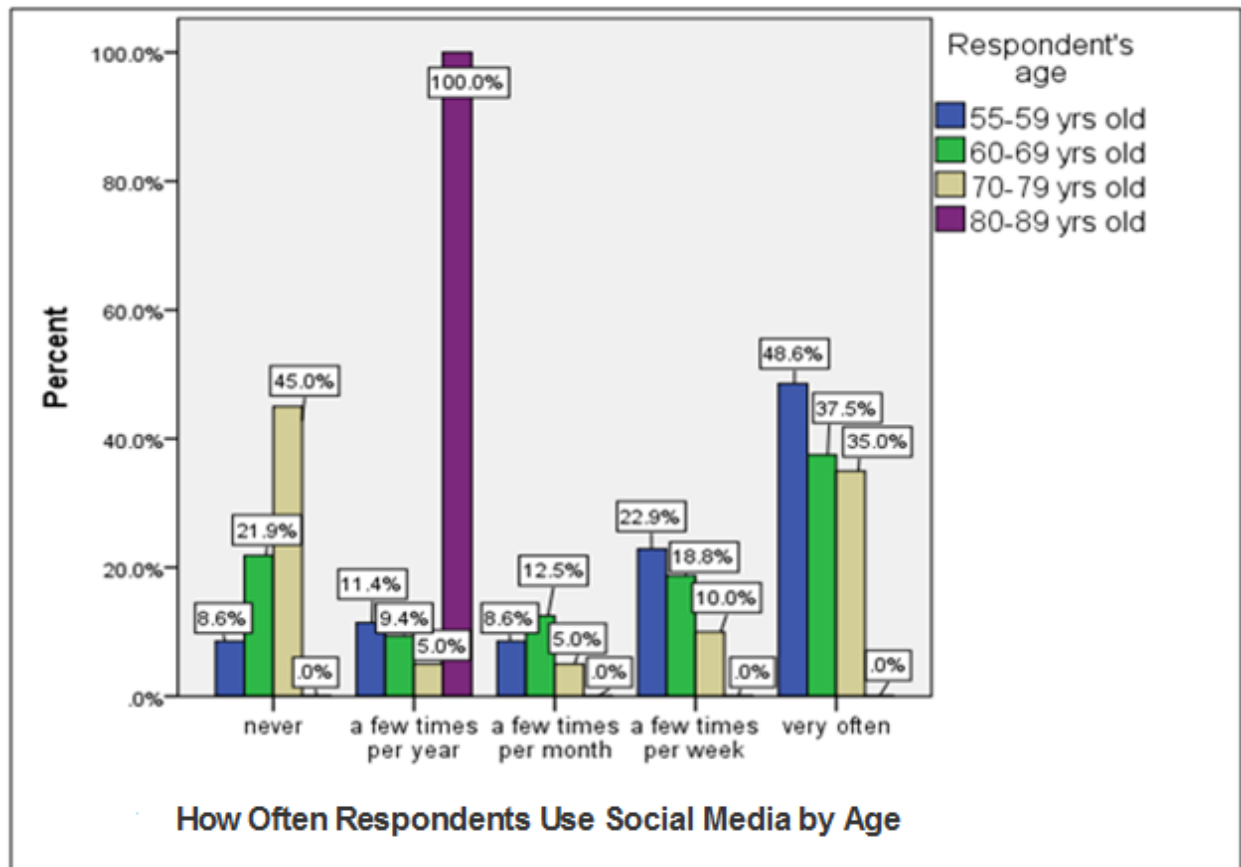


Figure 16: How Often Respondents Use Social Media by Age

Looking at how respondents use social media in terms of race, 39.3% of White respondents use it very often, 18.7% a few times per week, 10.3% a few times per month, 10.3% a few times per year, and 21.5% never. For Black respondents, 50% report they use social media a few times per week, 25% a few times per month, and 25% never. Regarding Asian respondents, 50% report they use social media very often and another 50% never. As far as respondents in the "Other" race group are concerned, 71.4% report

they use social media very often, 14.3% a few times per year, and 14.3% never. Refer to Figure 17.

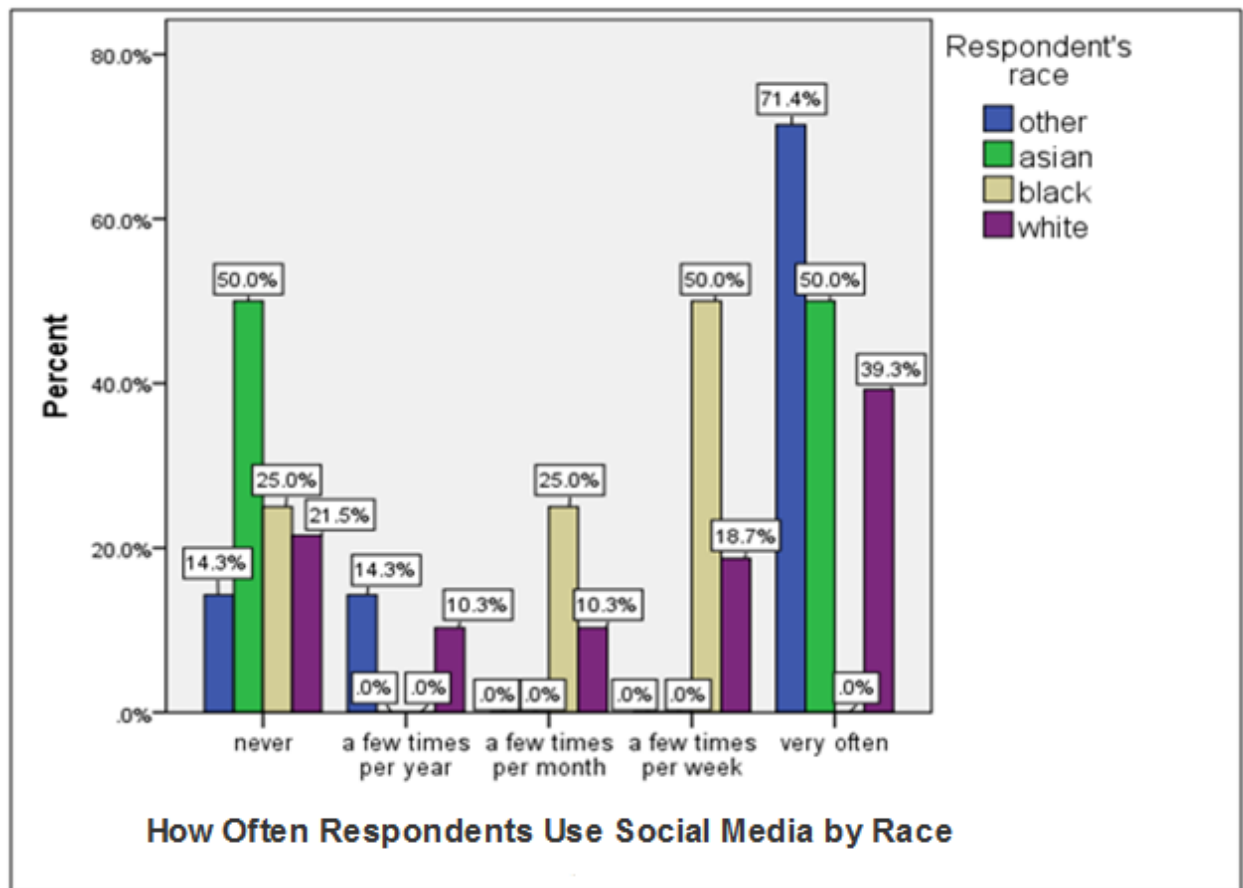


Figure 17: How Often Respondents Use the Social Media by Race

Also regarding the use of social media in terms of gender, the most active category ("very often") indicates that 45.3% of female respondents and 33.9% of male respondents use social media very often. On the contrary, the least active category

("never") shows 17.2% of female respondents and 26.8% of male respondents never use social media. Refer to Figure 18.

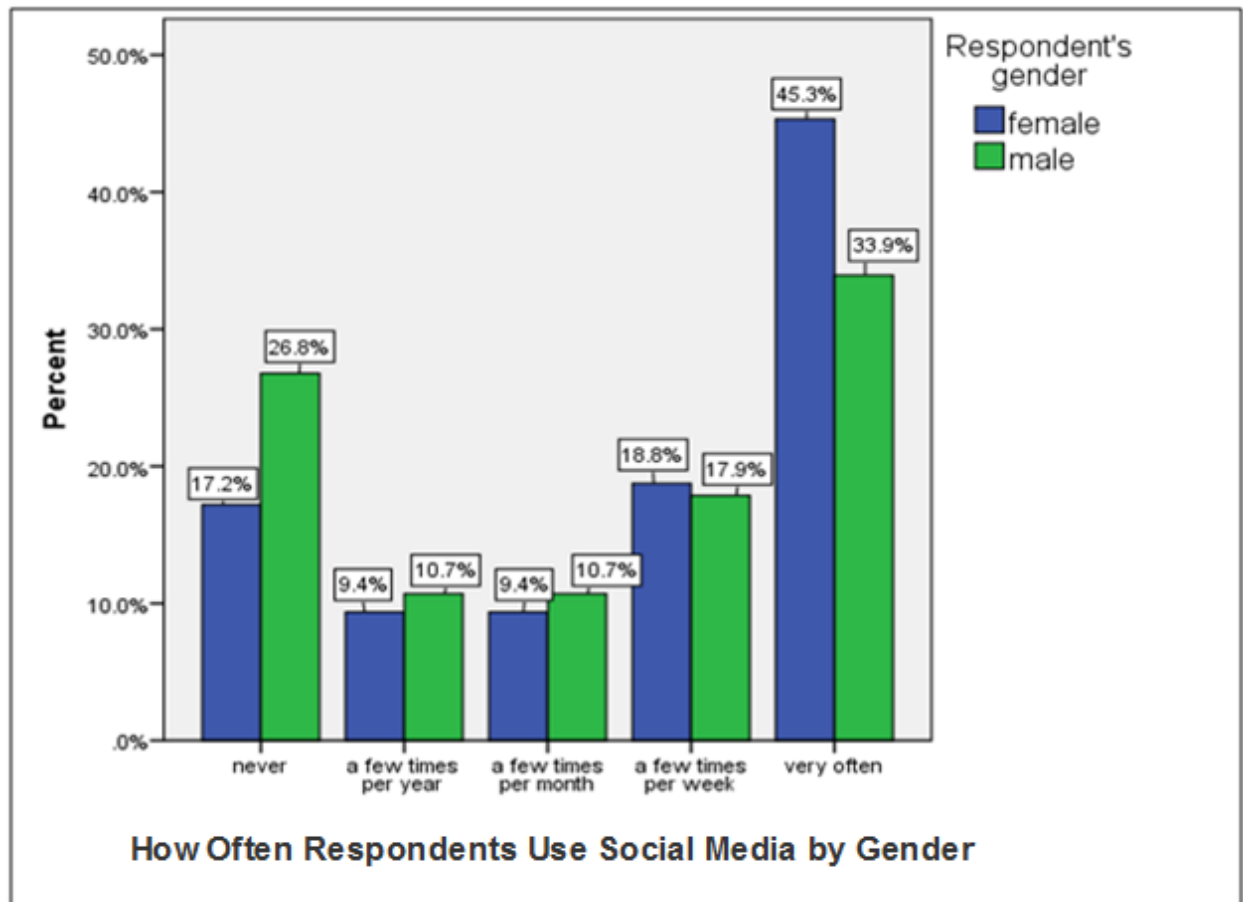


Figure 18: How Often Respondents Use Social Media by Gender

Response to the feeling of loneliness

As far as the response to the feeling of loneliness is concerned, it is interesting to note that across age groups most respondents disagree that they often feel lonely. In terms of age, 80% of respondents in age group 55-59, 62.5% in age group 60-69, and 65% in

age group 70-79 report they do not often feel lonely. All respondents in age group 80-89 report they do not often feel lonely.

Some other respondents neither agree nor disagree that they often feel lonely. They account for 14.3% of respondents in age group 55-59, 15.6% in age group 60-69, and 20% in age group 70-79. Of those who agree that they often feel lonely, 5.7% are in age group 55-59, 21.9% in age group 60-69, and only 15% in age group 70-79. Refer to Figure 19.

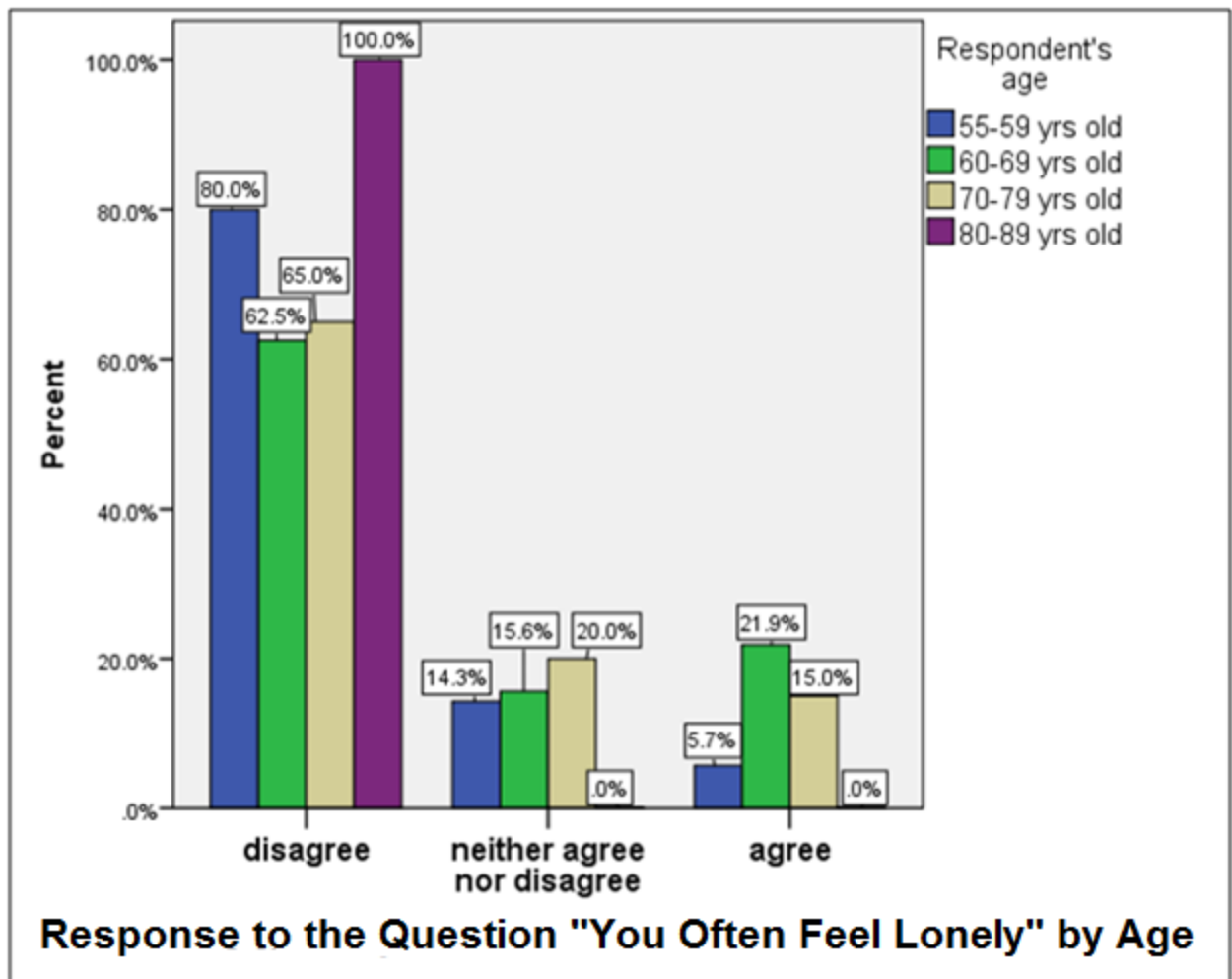


Figure 19: Response to the Question "You Often Feel Lonely" by Age

Regarding the same question on feeling lonely, in terms of race, 50% of Asian respondents and another 50% of Black respondents disagree that they often feel lonely. As far as White respondents are concerned, 69.2% of the respondents also report they do not often feel lonely. For those in the "Other" race group, 71.4% report they do not often feel lonely, either. 50% of Asian respondents are Asian, 25% of Black respondents, and 15.9% of White respondents report being neutral. 25% of Black respondents 15% of White respondents, and 28.6% of the "Other" race group agree that they often feel lonely. Refer to Figure 20.

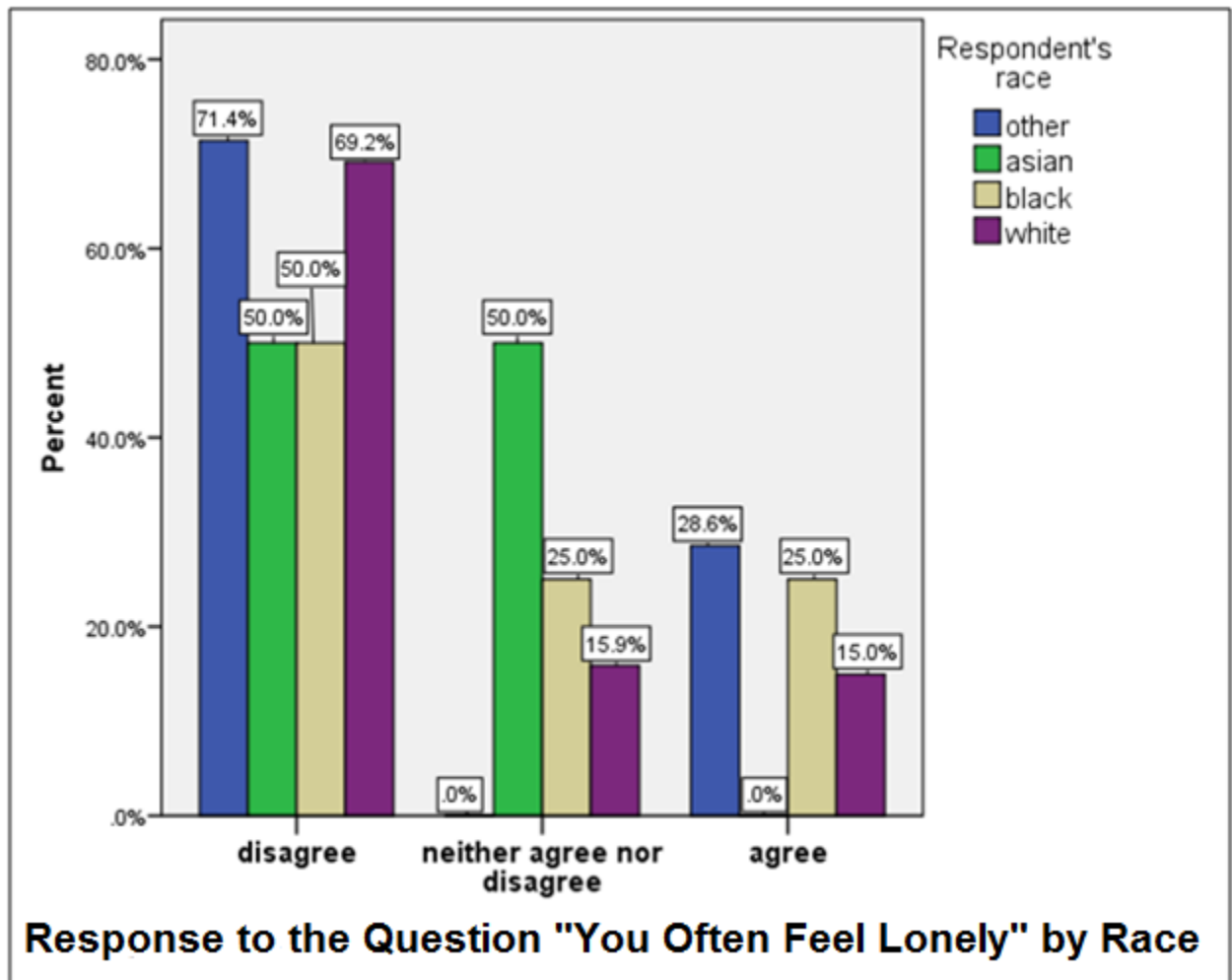


Figure 20: Response to the Question "You Often Feel Lonely" by Race

Responding to the question of feeling lonely, 68.8% of female respondents and 67.9% of male respondents report they do not often feel lonely. On the other hand, 10.9% of female respondents, and 21.4% of male respondents report they are neutral on the topic of loneliness while 20.3% of female respondents and 10.7% of male respondents report they often feel lonely. Refer to Figure 21.

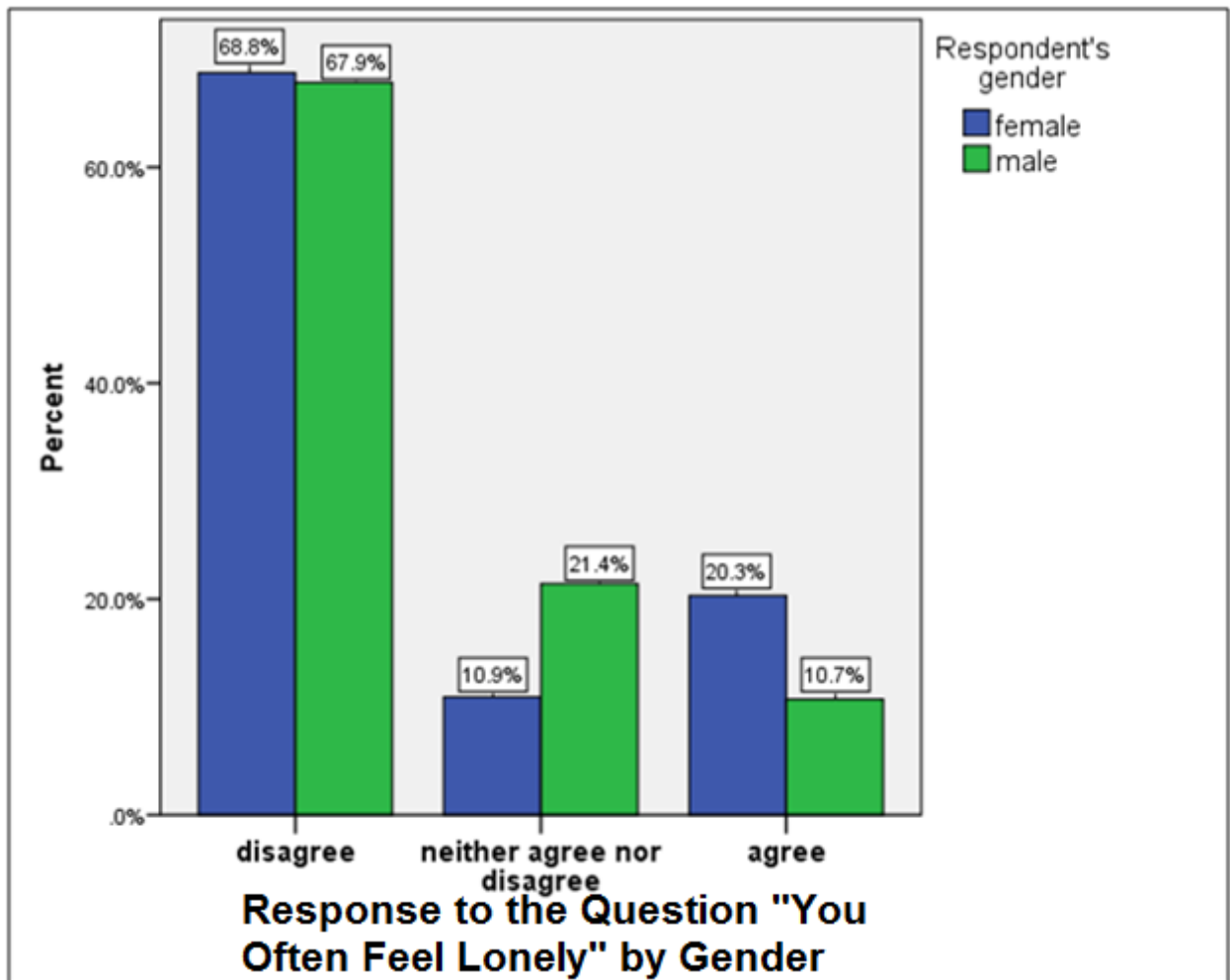


Figure 21: Response to the Question "You Often Feel Lonely" by Gender

Response to question "Staying socially connected lessens loneliness"

In general, when asked whether staying socially-connected helps alleviate loneliness, 69.17% of respondents express their agreement. Only 12.5% of them disagree. Another 18.33% hold a neutral opinion. Refer to Figure 22.

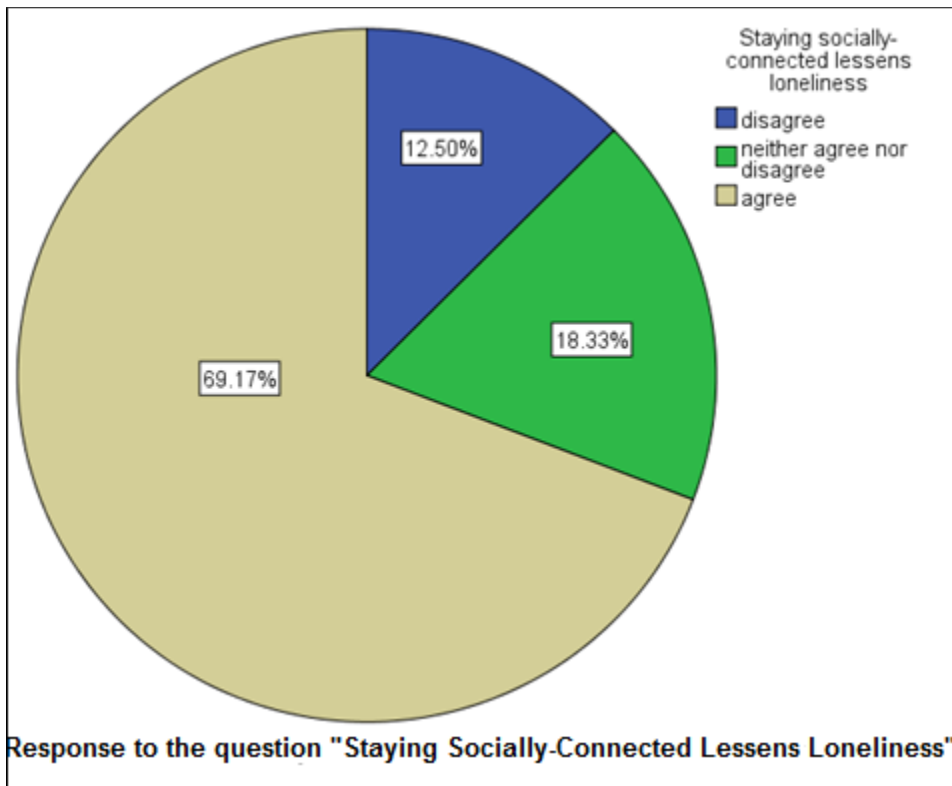


Figure 22: Response to the Question "Staying Socially-Connected Lessens Loneliness"

In response to the question whether staying socially-connected helps alleviate loneliness, in terms of age, 57.1% of respondents aged 55-59, 75% of respondents aged 60-69, and 75% of respondents aged 70-79 indicate their agreement.

On the contrary, 17.1% of respondents in age group 55-59, 9.4% of respondents in age group 60-69, and 10% of respondents in age group 70-79 disagree that staying

socially-connected lessens loneliness. All respondents in age group 80-89 disagree. For those who state their neutral opinion, 25.7% are in the age group of 55-59, 15.6% in the age group of 60-69, and 15% in the age group of 70-79. Refer to Figure 23.

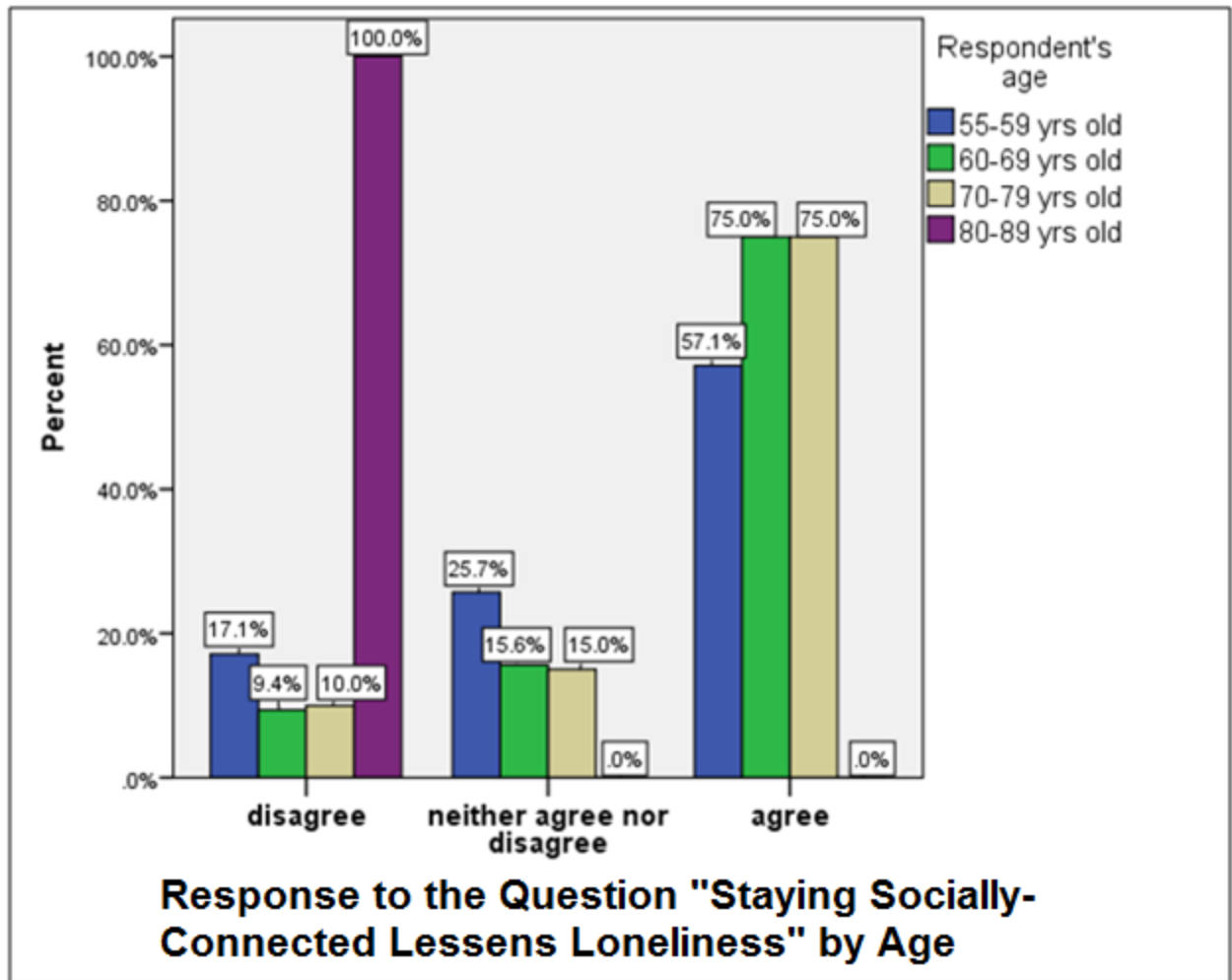


Figure 23: Response to the Question "Staying Socially-Connected Lessens Loneliness" by Age

In terms of race, 100% of Asian respondents, another 100% of Black respondents, 66.4% of White respondents, and 85.7% of respondents of the "Other" race group agree

that staying socially-connected lessens loneliness. Of those who disagree that staying socially-connected helps alleviate loneliness, in terms of race, 3.1% of White respondents and 14.3% of respondents who belong to the "Other" race group disagree. On the other hand, 20.6% of White respondents neither agree nor disagree. Refer to Figure 24.

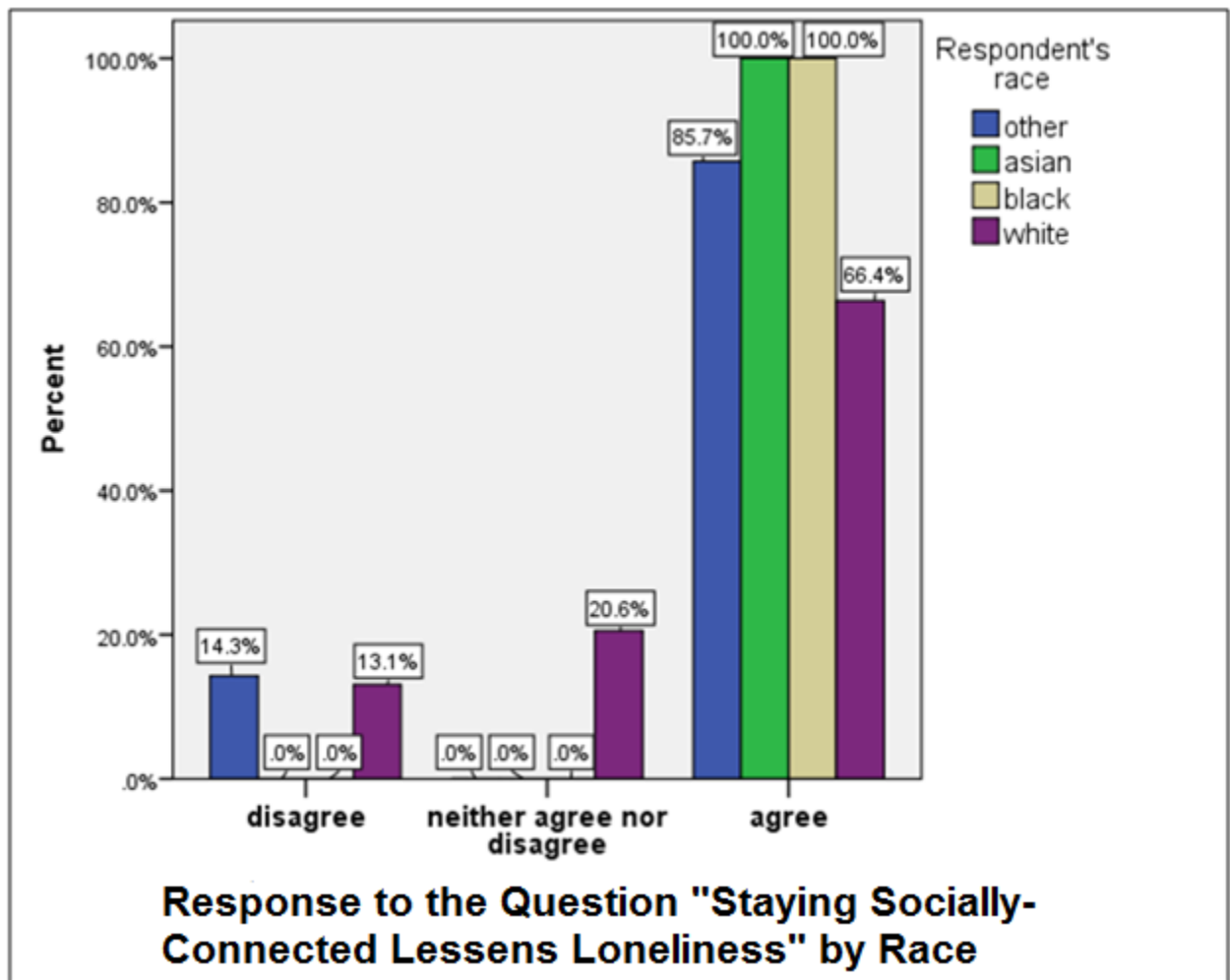


Figure 24: Response to the Question "Staying Socially-Connected Lessens Loneliness" by Race

In terms of gender, regarding response to the question whether staying socially-connected helps alleviate loneliness, 70.3% of female and 67.9% of male respondents agree. On the contrary, 7.8% of female and 17.9% of male respondents disagree that staying socially-connected helps alleviate loneliness. Those who neither agree nor disagree account for 21.9% of female and 14.3% of male respondents. Refer to Figure 25.

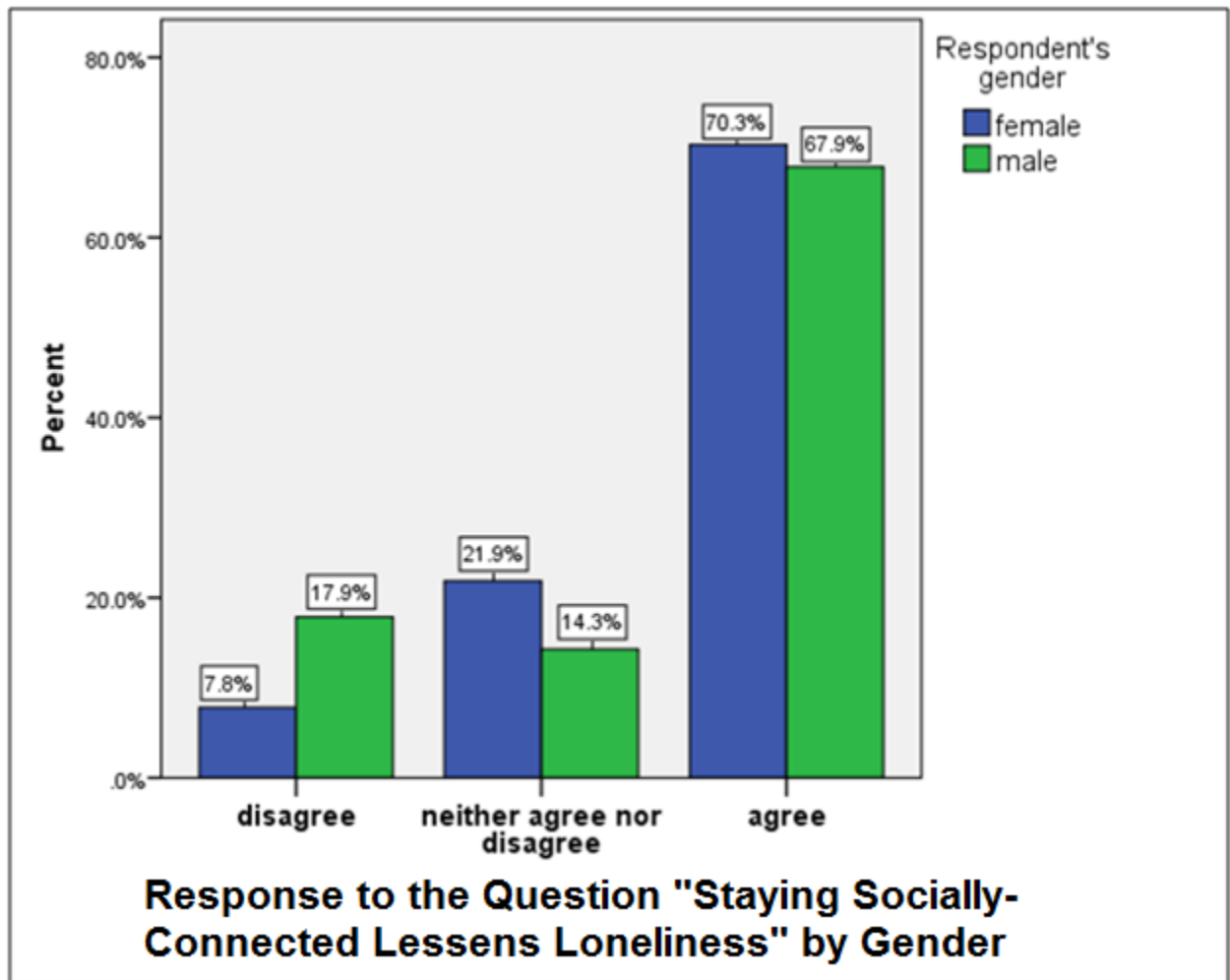


Figure 25: Response to the Question "Staying Socially-Connected Lessens Loneliness" by Gender

Response to question "Self-driving cars enhance mobility"

In response to the question whether self-driving cars enhance mobility, 45.83% of respondents express their agreement. On the contrary, 29.17% of other respondents disagree while another 25% hold a neutral opinion. Refer to Figure 26.

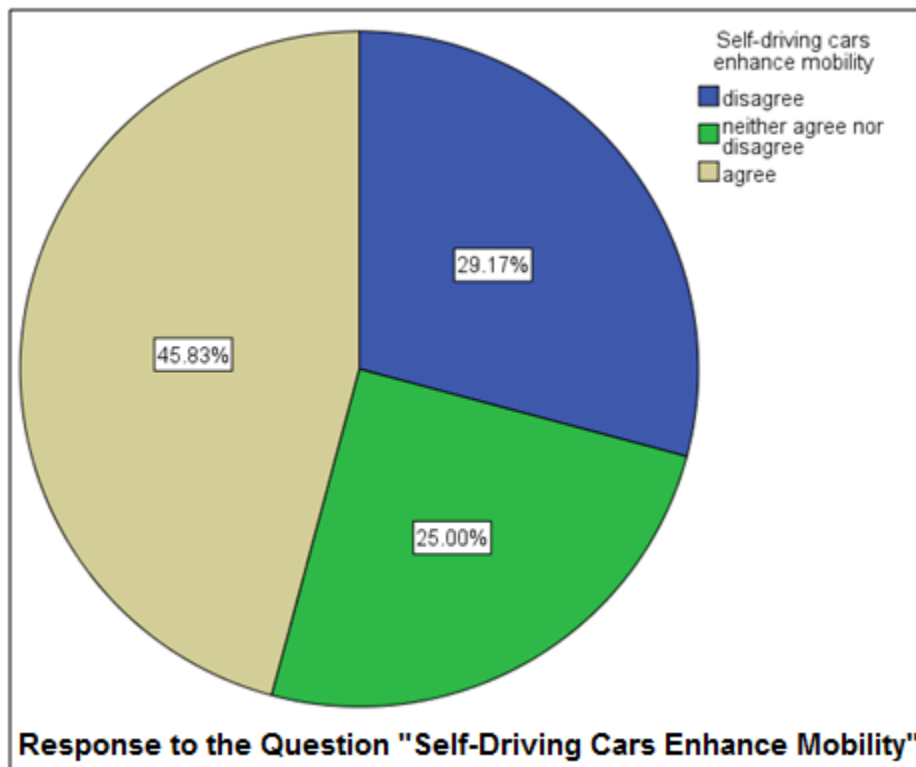


Figure 26: Response to the Question "Self-Driving Cars Enhance Mobility"

In response to the question whether self-driving cars enhance mobility, in terms of age, 40% of respondents in age group 55-59, 50% of respondents in age group 60-69, and 45% of respondents in age group 70-79 indicate their agreement.

Additionally, 28.6% in the age group of 55-59, 21.9% in the age group of 60-69, 25% in the age group of 70-79, and 100% in the age group of 80-89 have a neutral

opinion to the question. Furthermore, 31.4% of 55-59 year olds, 28.1% of 60-69 year olds, and 30% of 70-79 year olds disagree that self-driving cars enhance mobility. Refer to Figure 27.

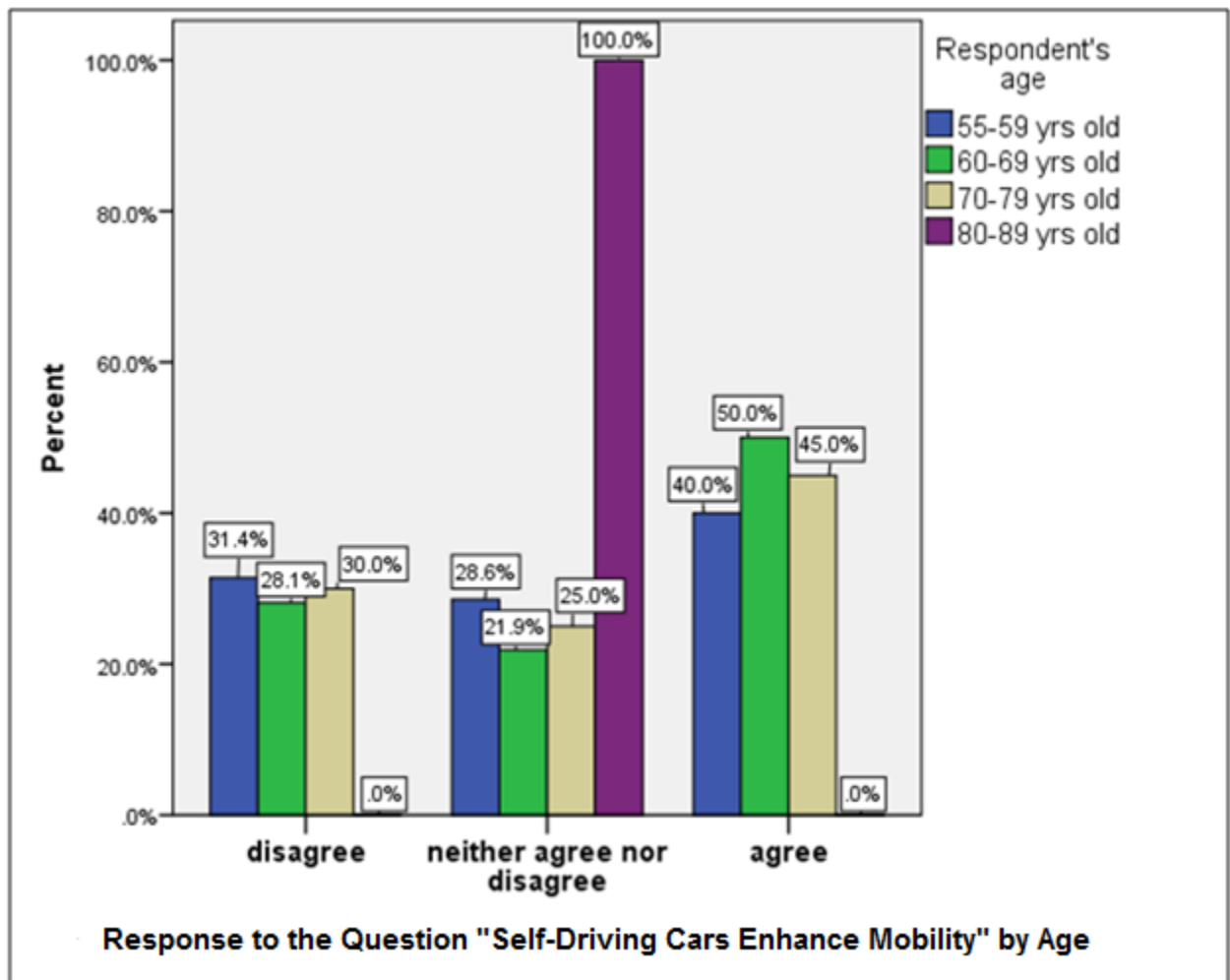


Figure 27: Response to the Question "Self-Driving Cars Enhance Mobility" by Age

In terms of race, in response to the question whether self-driving cars enhance mobility, 50% of Asian respondents, another 50% of Black respondents, 43.9% of White

respondents, and 71.4% of respondents in the "Other" race group indicate their agreement that self-driving cars enhance mobility. Fifty percent of Black respondents, 24.3% of White respondents, and 28.6% of respondents in the "Other" race group neither agree nor disagree.

Some other respondents disagree that self-driving cars enhance mobility. Of those who disagree, 31.8% of Whites do and 50% of Asians do. Refer to Figure 28.

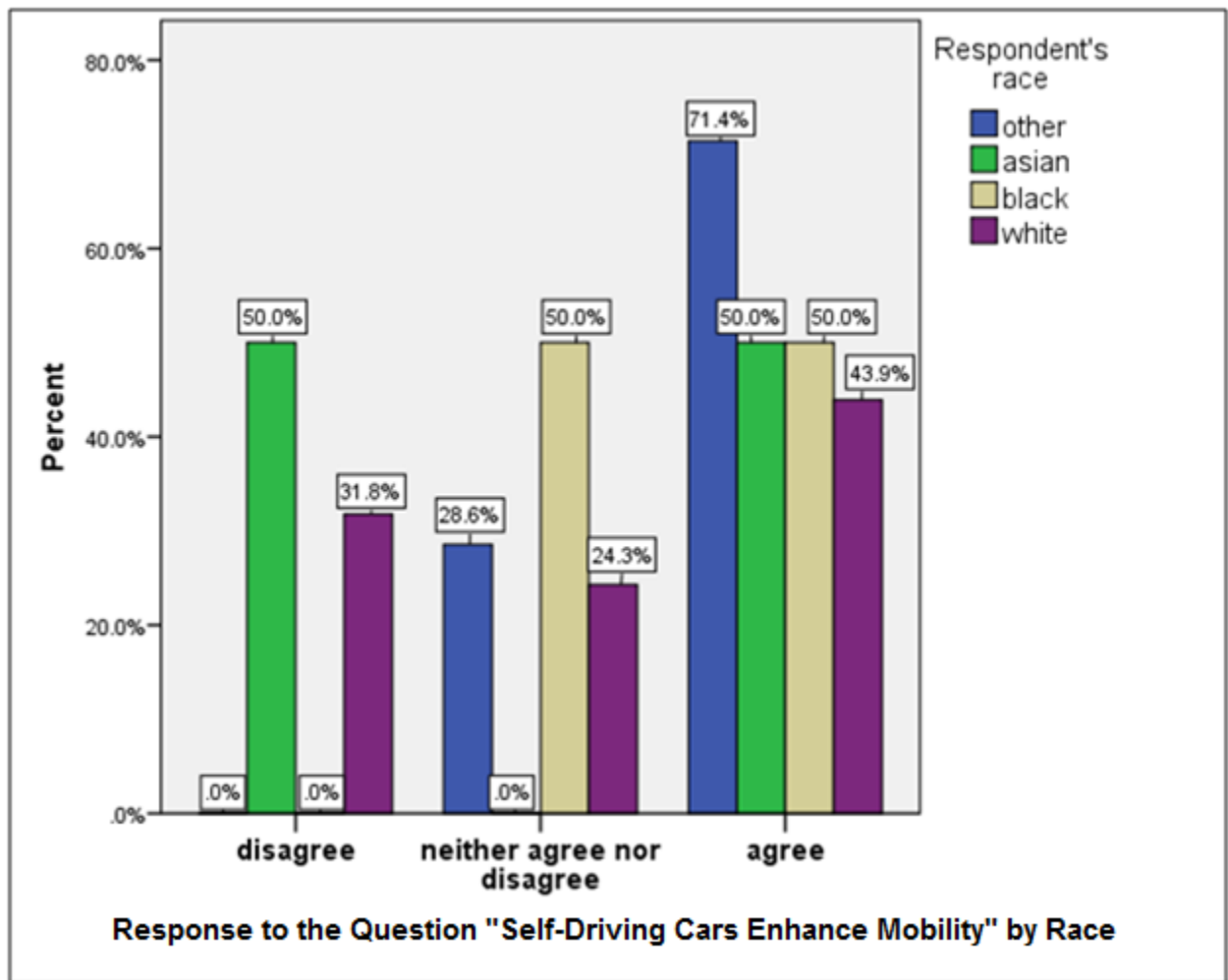


Figure 28: Response to the Question "Self-Driving Cars Enhance Mobility" by Race

In terms of gender, in response to the question whether self-driving cars enhance mobility, 40.6% of female respondents and 51.8% of male respondents indicate their agreement to the question.

Additionally, 32.8% of female and 16.1% of male respondents neither agree nor disagree that self-driving cars enhance mobility. Furthermore, 26.6% of female respondents and 32.1% of male respondents disagree that self-driving cars enhance mobility. Refer to Figure 29.

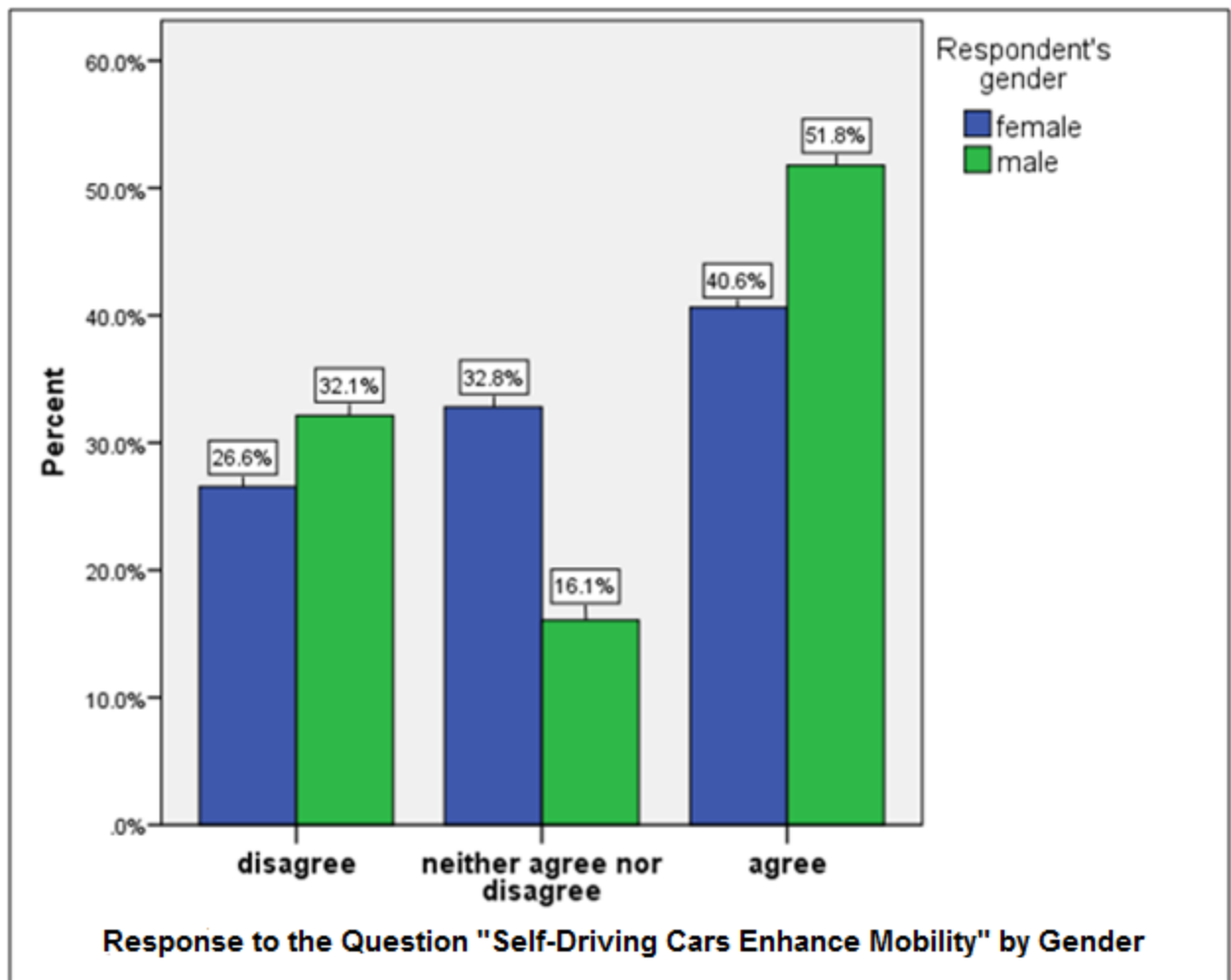


Figure 29: Response to the Question "Self-Driving Cars Enhance Mobility" by Gender

Response to question “Wearable devices help monitor health”

In response to the question whether wearable devices give help in monitoring health, in terms of age, 77.1% of respondents in age group 55-59, 71.9% of respondents in age group 60-69, and 65% of respondents in age group 70-79 agree that wearable devices assist them in monitoring their health. All respondents in age group 80-89 agree too. Additionally, 11.4% of the age group of 55-59, 26.6% of the age group of 60-69, and 30% of the age group of 70-79 neither agree nor disagree. Furthermore, 11.4% of the age group of 55-59, 1.6% of the age group of 60-69, and 5% of the age group of 70-79 disagree that wearable devices help monitor health. Refer to Figure 30.

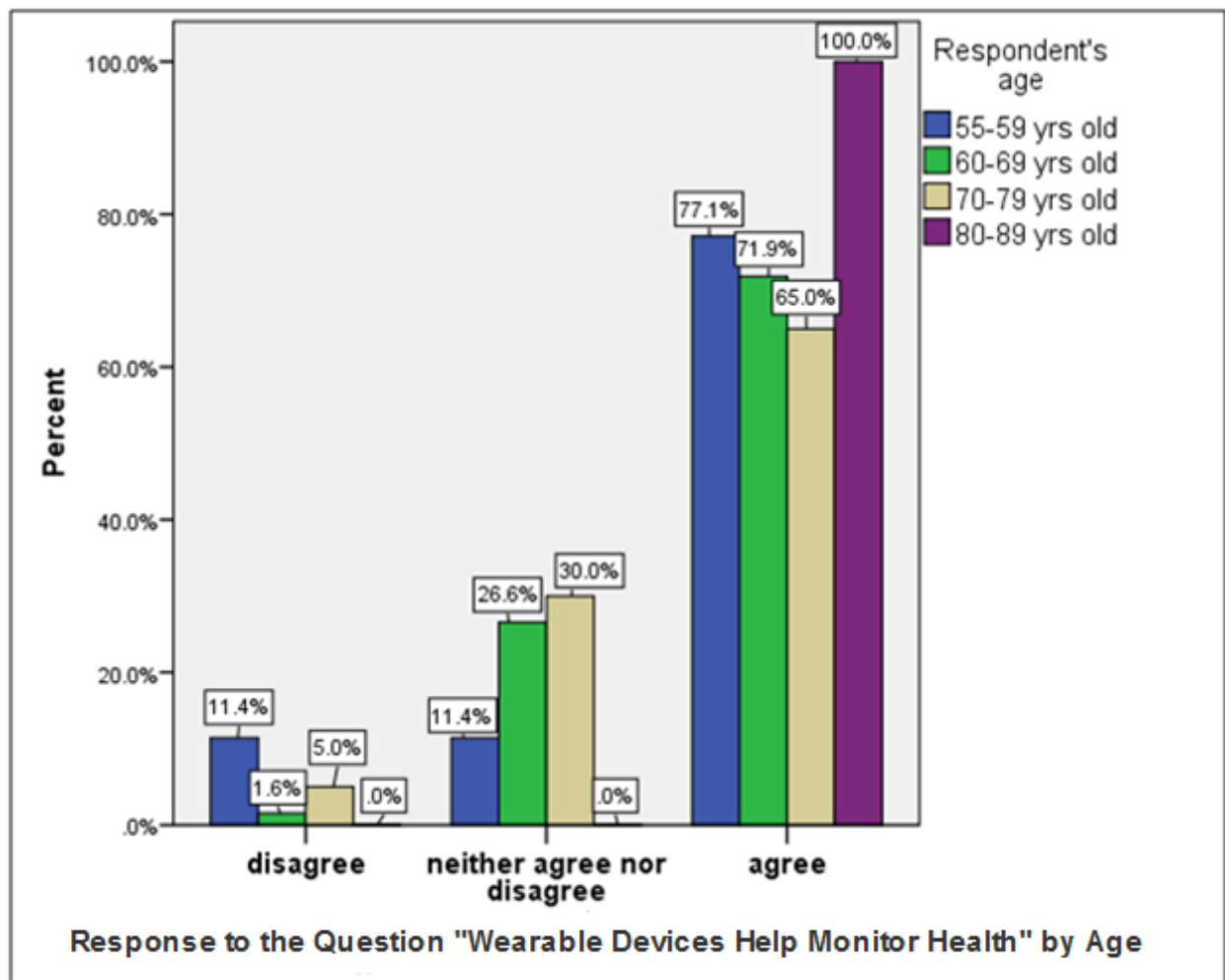


Figure 30: Response to the Question "Wearable Devices Help Monitor Health" by Age

In terms of race, in response to the question whether wearable devices give help in monitoring health, 100% of Asian respondents, 75% of Black respondents, 72% of White respondents, and 71.4% of those in the "Other" race group indicate that they agree wearable devices help them in monitoring their health. On the other hand, 28.6% of "Other" respondents, 25% of Black respondents, and 22.4% of White respondents neither agree nor disagree. Almost no one disagrees to the question except for a small percentage (5.6%) of White respondents. Refer to Figure 31.

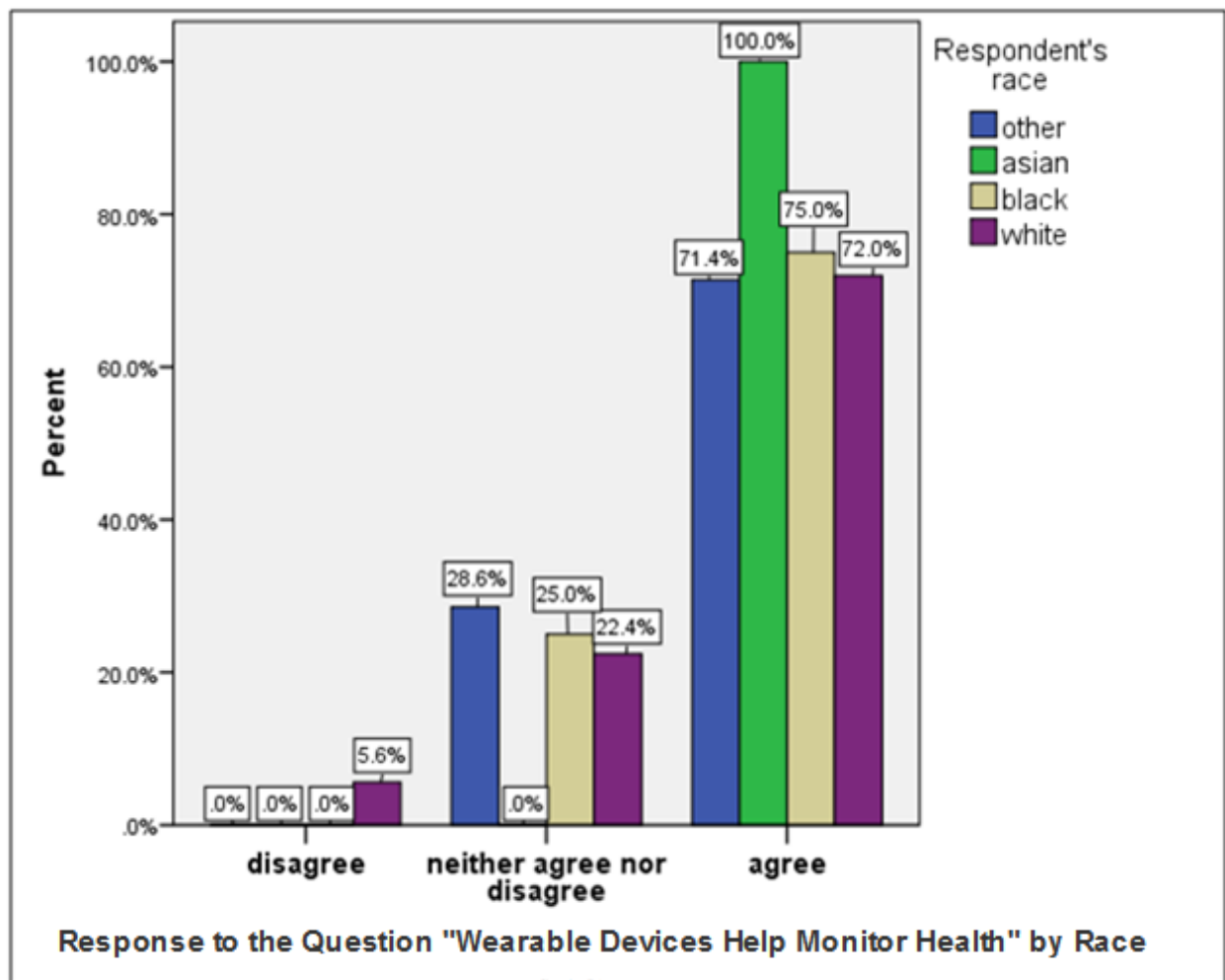


Figure 31: Response to the Question “Wearable Devices Help Monitor Health” by Race

In terms of gender, in response to the same question on wearable devices and health, 68.8% of female respondents and 76.8% of male respondents agree that wearable devices help monitor their health.

Another 25% of female respondents and 19.6% of male respondents indicate they neither agree nor disagree that wearable devices help monitor health. Only 6.3% of female respondents and 3.6% of male respondents state that they disagree that wearable devices help monitor health. Refer to Figure 32.

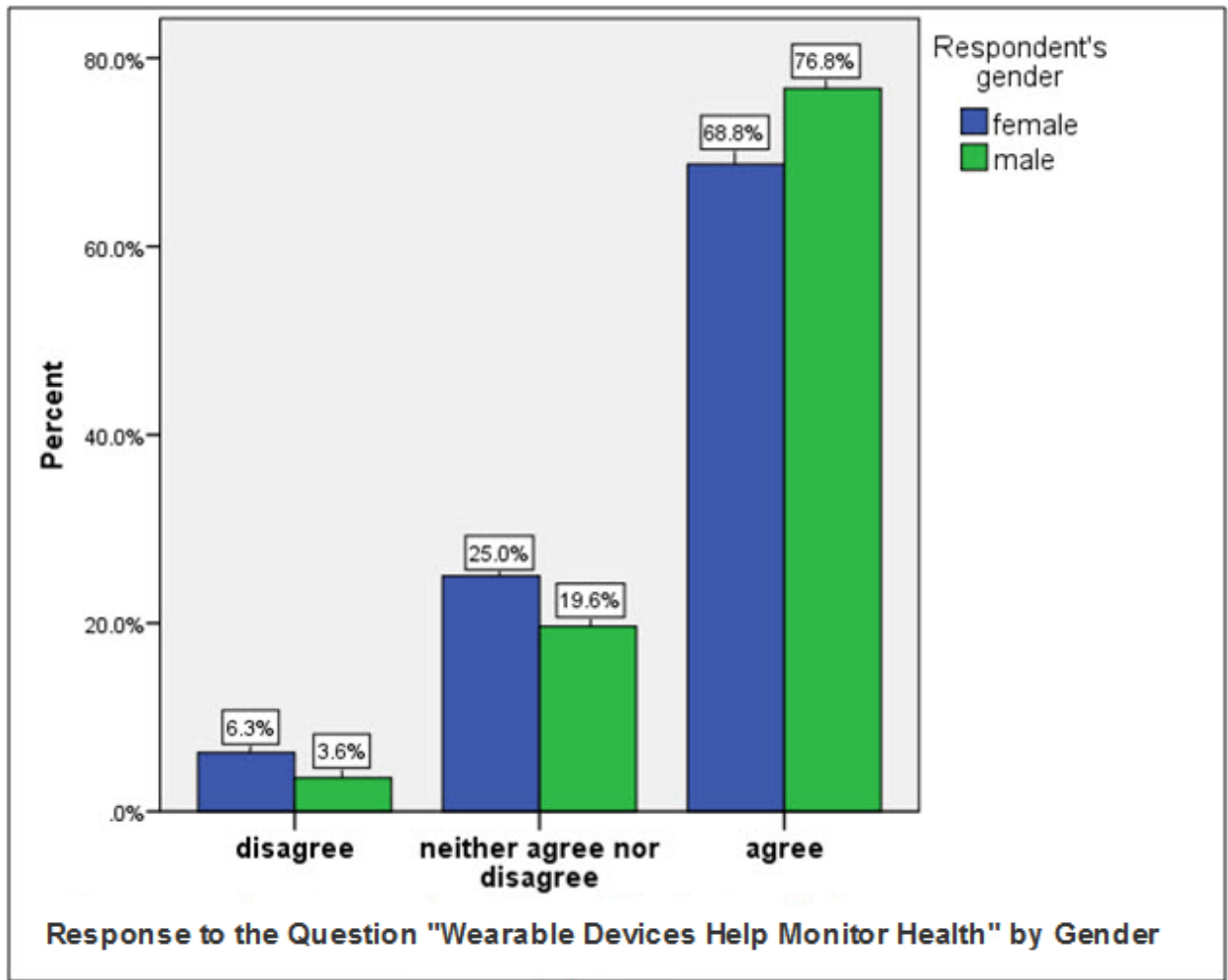


Figure 32: Response to the Question "Wearable Devices Help Monitor Health" by Gender

Response to question "Technology makes life easier"

In response to the question whether technology makes life easier, in terms of age, 74.3% of respondents in age group 55-59, 79.7% of respondents in age group 60-69, and 75% of respondents in age group 70-79 agree that technology makes life easier. All respondents in age group 80-89 also agree. Another 20% of respondents in age group 55-

59, 10.9% of respondents in age group 60-69, and 10% of respondents in age group 70-79 indicate they neither agree nor disagree whether technology makes life easier.

Some respondents disagree. They account for 5.7% in age group 55-59, 9.4% in age group 60-69, and 15% in age group 70-79. Refer to Figure 33.

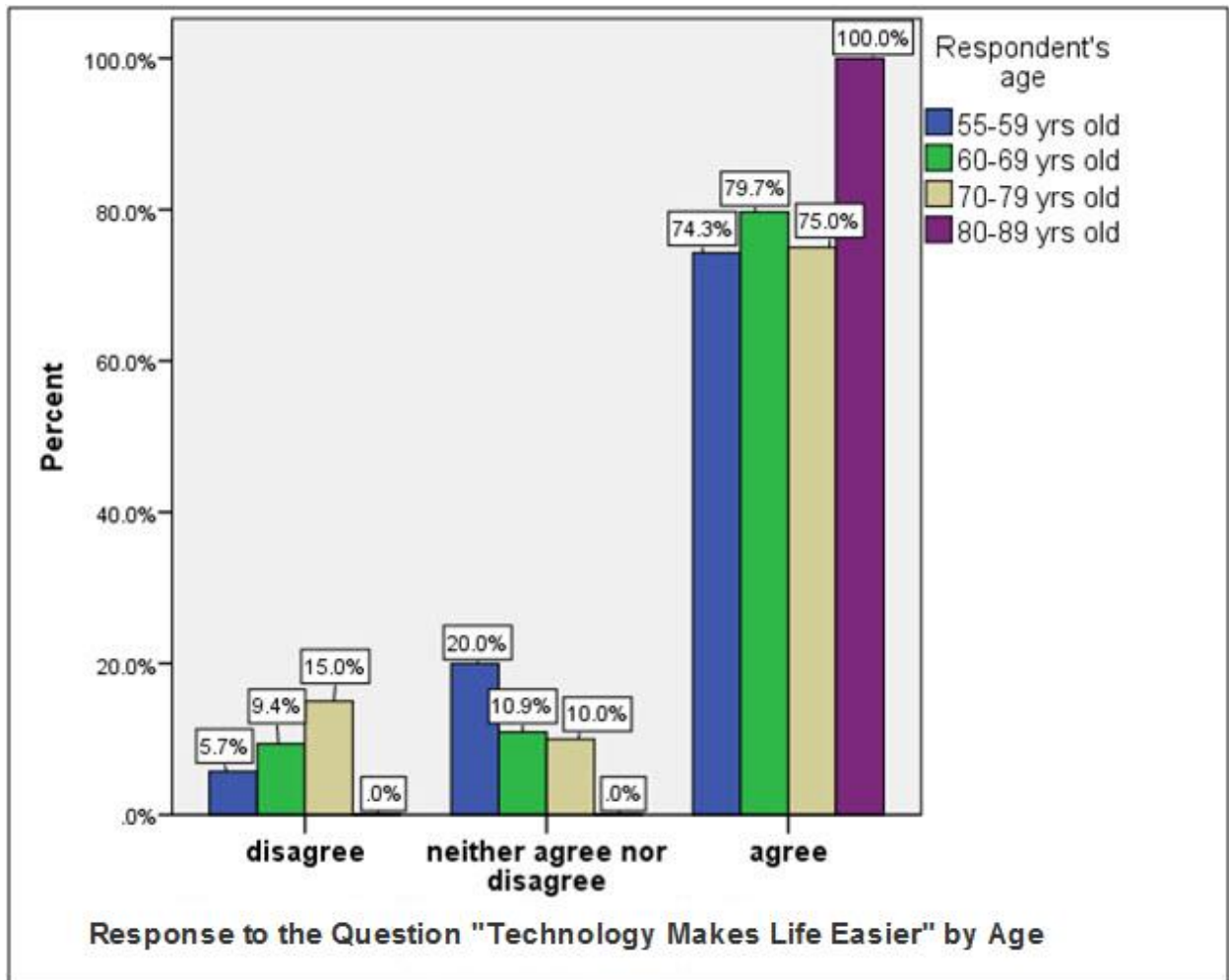


Figure 33: Response to the Question "Technology Makes Life Easier" by Age

In terms of race, in response to the question whether technology makes life easier, 85.7% of respondents in the "Other" race group, 100% of Asian respondents, 75% of Black respondents, and 76.6% of White respondents agree that technology makes life easier. Some respondents neither agree nor disagree. They account for 25% of Black

respondents and 14% of White respondents. Another 9.3% of White respondents and 14.3% of respondents in the "Other" race group indicate their disagreement. Refer to Figure 34.

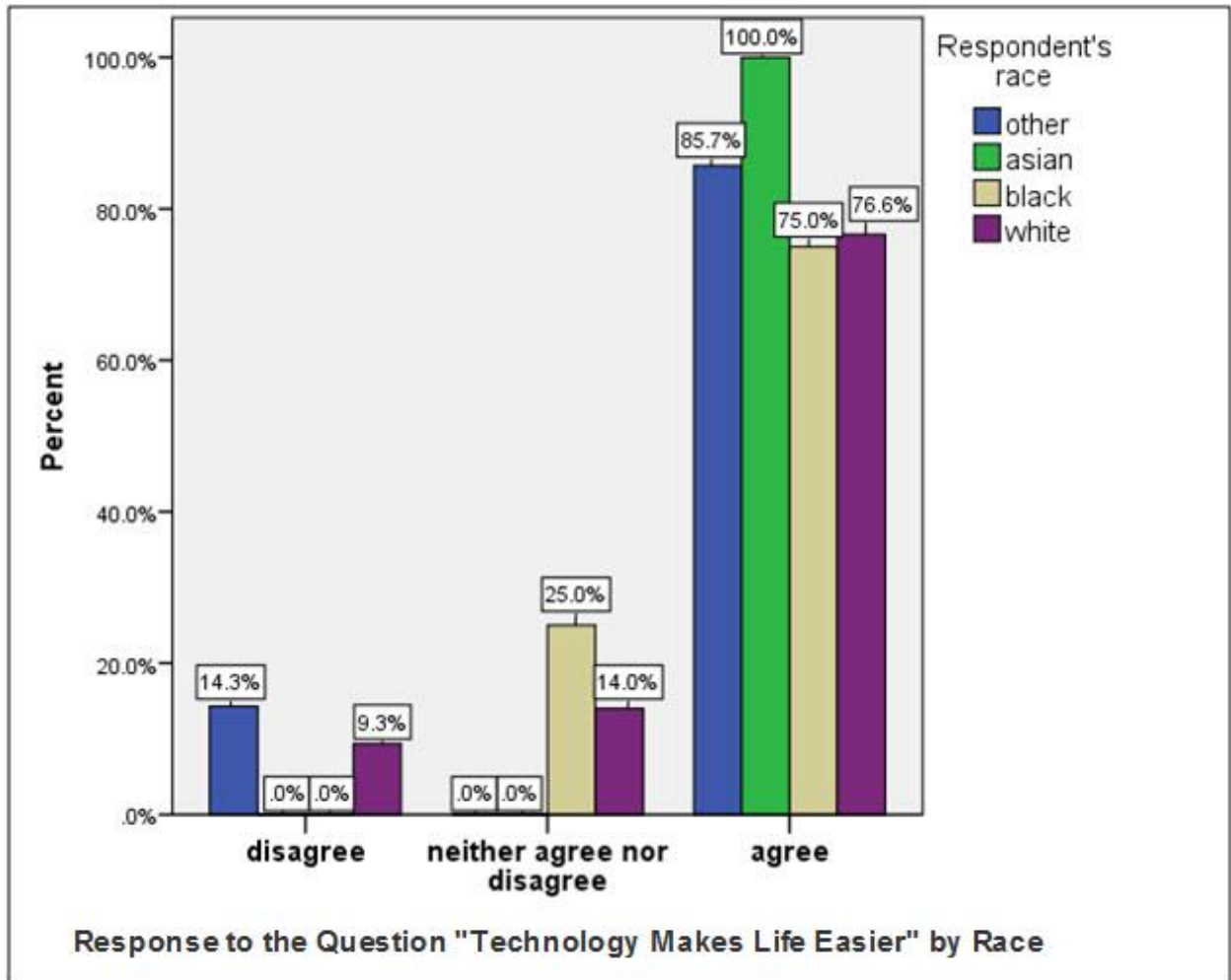


Figure 34: Response to the Question "Technology Makes Life Easier" by Race

In terms of gender, in response to the question whether technology makes life easier, 79.7% of female respondents and 75% of male respondents agree that technology makes life easier. Some respondents neither agree nor disagree to the same question. They account for 10.9% of female respondents and 16.1% of male respondents. Some other

respondents disagree that technology makes life easier. They account for 9.4% and 8.9% of female and male respondents respectively. Refer to Figure 35.

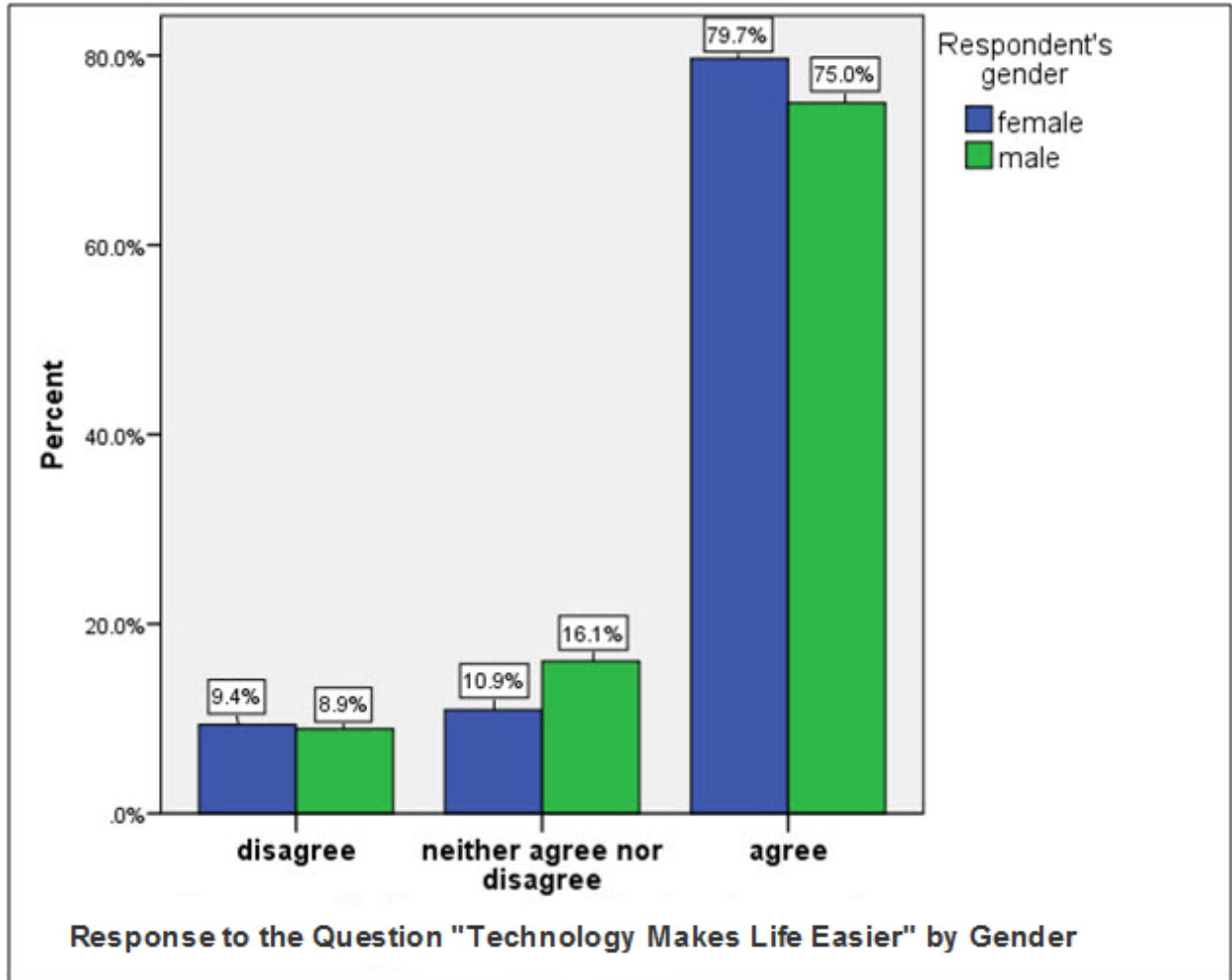


Figure 35: Response to the Question "Technology Makes Life Easier" by Gender

Response to question "Health would improve with the application of technology"

In response to the question whether health would improve with the application of technology, in terms of age, 40% of respondents in age group 55-59, 45.3% of respondents in age group 60-69, and 55% of respondents in age group 70-79 agree that health would improve with the application of technology. All respondents in age group

80-89 agree too. Some respondents neither agree nor disagree. They account for 42.9% of respondents in age group 55-59, 31.3% of respondents in age group 60-69, and 35% of respondents in age group 70-79. Some other respondents disagree that health would improve with the application of technology. They account for 17.1% of respondents in age group 55-59, 23.4% of respondents in age group 60-69, and 10% of respondents in age group 70-79. Refer to Figure 36.

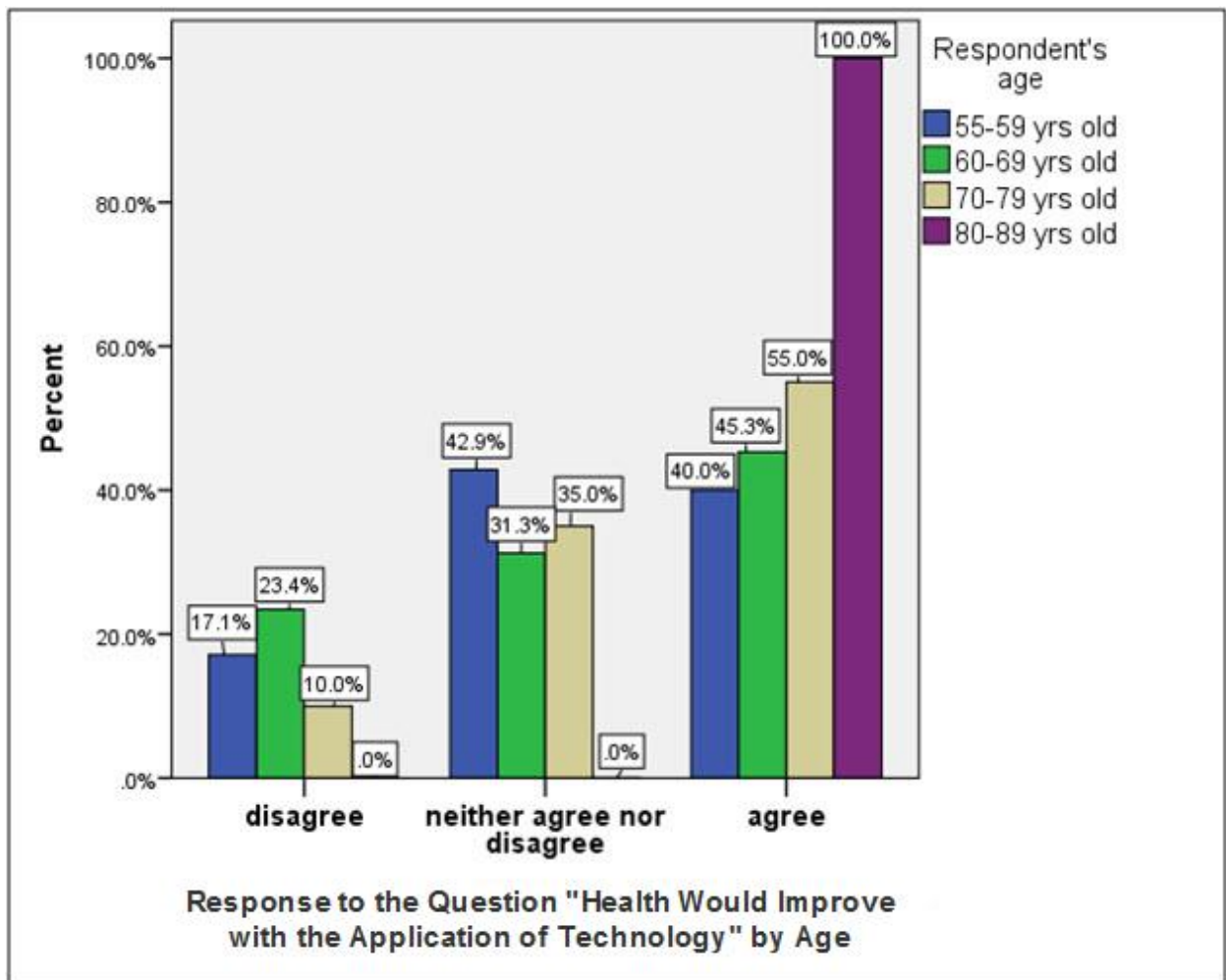


Figure 36: Response to the Question "Health Would Improve with the Application of Technology" by Age

In terms of race, in response to the question whether health would improve with the application of technology, 57.1% of respondents in the "Other" race group, 100% of Asian respondents, 75% of Black respondents, and 43% of White respondents agree that health would improve with the application of technology. Some respondents neither agree nor disagree. They account for 42.9% of respondents in the "Other" race group and 36.4% of White respondents. Some other respondents disagree that health would improve with the application of technology. They account for 25% of Black respondents and 20.6% of White respondents. Refer to Figure 37.

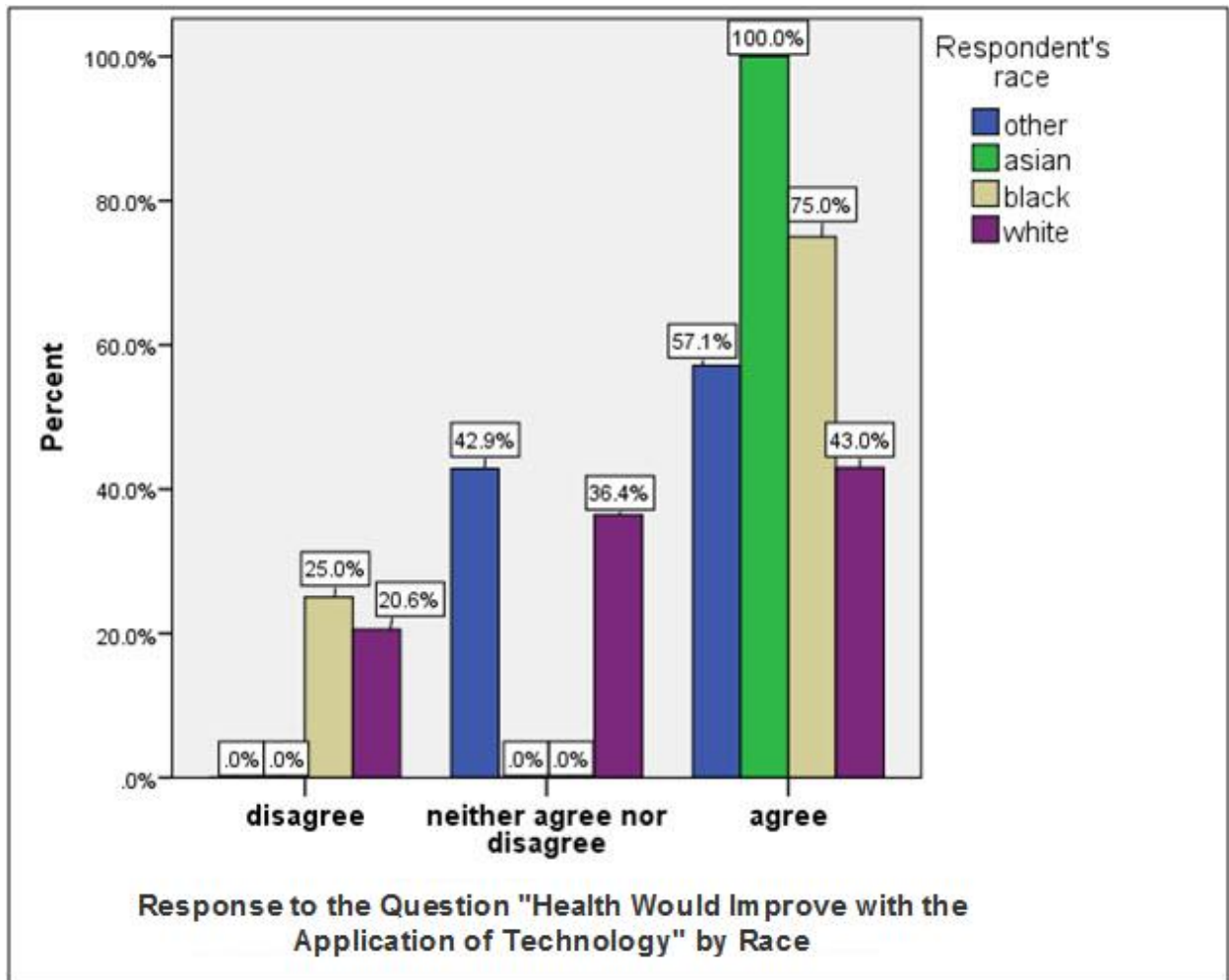


Figure 37: Response to the Question "Health Would Improve with the Application of Technology" by Race

In terms of gender, in response to the question whether health would improve with the application of technology, 37.5% of female respondents and 55.4% of male respondents agree that health would improve with the application of technology. Some respondents neither agree nor disagree. They account for 37.5% of female respondents and 32.1% of male respondents. Some others disagree. They account for 25% of female respondents and 12.5% of male respondents. Refer to Figure 38.

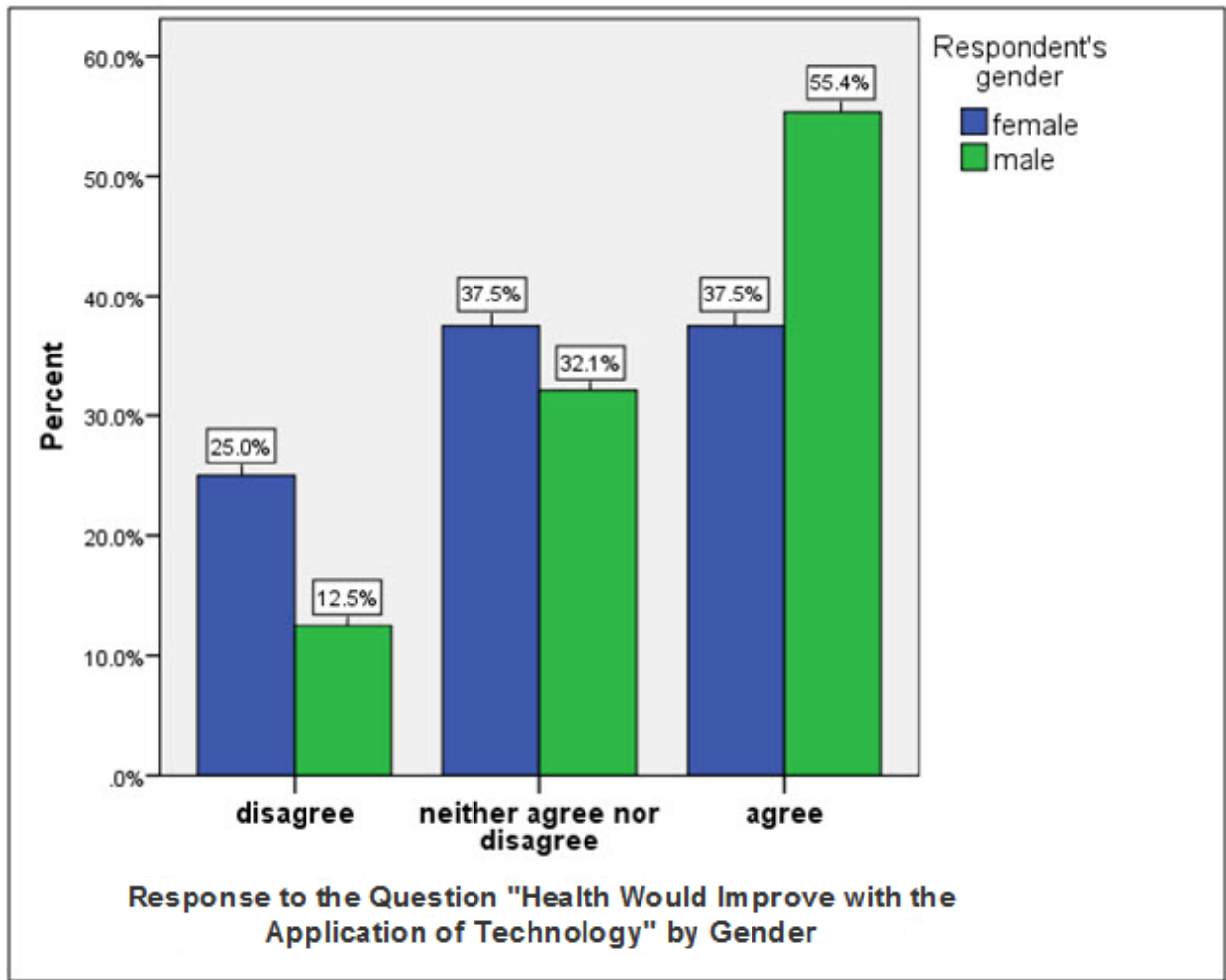


Figure 38: Response to the Question "Health Would Improve with the Application of Technology" by Gender

Response to question "You wish to learn new technology"

Responding to the question whether they wish to learn new technology, 51.67% of respondents indicate they do not wish to learn new technology. However, another 46.67% of respondents express their wish to learn new technology. A small percentage of them, 1.67%, chose not to answer the question. Refer to Figure 39.

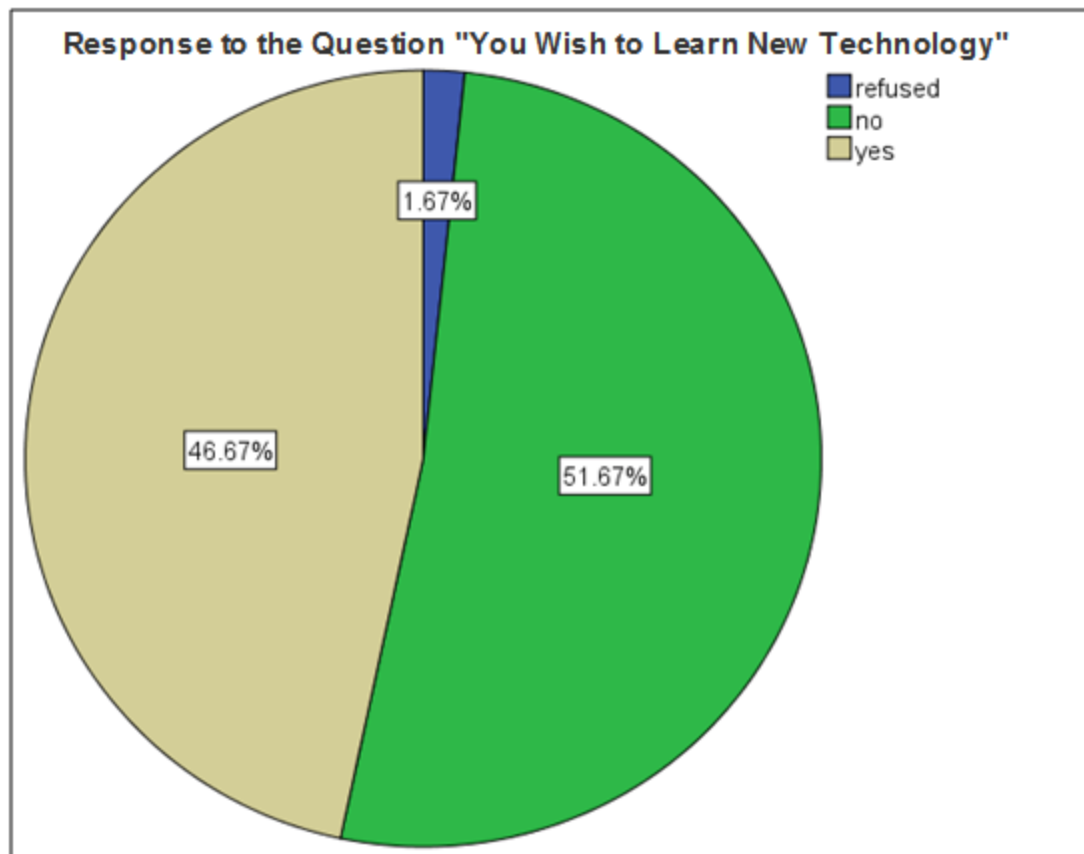


Figure 39: Response to the Question "You Wish to Learn New Technology"

Inferential statistics

"Smartphone ownership" and "How often respondents use their phone"

The "Sig. (2-tailed)" value for the correlation between "smartphone ownership" and "how often respondents use their phone" is less than α , i.e., $p = 0.000$. This indicates there is a statistically significant correlation between the 2 variables, i.e., smartphone ownership and how often respondents use their smartphone. The correlation coefficient is +0.830, which means the relationship between the two variables is a very strong, positive relationship. In other words, respondents who own a smartphone are more likely to use their phone often. Refer to Figure 40.

Correlations				
			Smartphone Ownership	How Often Respondents Use Phone
Spearman's rho	Smartphone Ownership	Correlation Coefficient	1.000	.830**
		Sig. (2-tailed)	.	.000
		N	120	120
	How Often Respondents Use Phone	Correlation Coefficient	.830**	1.000
		Sig. (2-tailed)	.000	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 40: Correlation between Smartphone Ownership and How Often Respondents Use Phone

"Smartphone ownership" and "How often respondents use the social media"

The "Sig. (2-tailed)" value for the correlation between "smartphone ownership" and "how often respondents use social media "is less than α , i.e., $p = 0.000$. This indicates there is a statistically significant correlation between the 2 variables, i.e., smartphone ownership and how often respondents use social media. The correlation coefficient is +0.335, which means the relationship between the two variables is a slightly weak and positive relationship. Respondents who own a smartphone are more likely to use social media. If they do not own a smartphone, they are less likely to use social media. The smartphone appears to be a handy gadget for many people to gain quick access to social media. Refer to Figure 41.

Correlations				
			Smartphone Ownership	How Often Respondents Use Social Media
Spearman's rho	Smartphone Ownership	Correlation Coefficient	1.000	.335**
		Sig. (2-tailed)	.	.000
		N	120	120
	How Often Respondents Use Social media	Correlation Coefficient	.335**	1.000
		Sig. (2-tailed)	.000	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 41: Correlation between Smartphone Ownership and How Often Respondents Use Social Media

"Smartphone ownership" and "Health would improve with the application of technology"

The "Sig. (2-tailed)" value for the correlation between "smartphone ownership" and "health would improve with the application of technology" is less than α , i.e., $p = 0.002$. This indicates there is a statistically significant correlation between the 2 variables, i.e., smartphone ownership and the notion that health would improve with the application of technology. The correlation coefficient is +0.281, which means the relationship between the two variables is a slightly weak and positive relationship. Respondents who own smartphones are more likely to think that health improves with the application of technology. Refer to Figure 42.

Correlations				
			Smartphone Ownership	Health improves with application of technology
Spearman's rho	Smartphone Ownership	Correlation Coefficient	1.000	.281**
		Sig. (2-tailed)	.	.002
		N	120	120
	Health improves with application of technology	Correlation Coefficient	.281**	1.000
		Sig. (2-tailed)	.002	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 42: Correlation between Smartphone Ownership and the Notion that Health Would Improve with the Application of Technology

"How often respondents use smartphone" and "Health would improve with the application of technology"

The "Sig. (2-tailed)" value for the correlation between "how often respondents use smartphone" and "health would improve with the application of technology" is less than α , i.e., $p = 0.012$. This indicates there is a statistically significant correlation between the 2 variables, i.e., how often respondents use smartphone and the notion that health would improve with the application of technology. The correlation coefficient is +0.228, which means between the two variables there is a slightly weak and positive relationship. The relationship means that respondents who often use their smartphone are more likely to think that health would improve with the application of technology. Refer to Figure 43.

Correlations				
			How Often Respondents Use Phone	Health improves with application of technology
Spearman's rho	How Often Respondents Use Phone	Correlation Coefficient	1.000	.228*
		Sig. (2-tailed)	.	.012
		N	120	120
	Health improves with application of technology	Correlation Coefficient	.228*	1.000
		Sig. (2-tailed)	.012	.
		N	120	120

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 43: Correlation between How Often Respondents Use Smartphone and the Notion that Health Would Improve with the Application of Technology

"How often respondents use smartphone" and "How often respondents use the social media"

The "Sig. (2-tailed)" value for the correlation between "how often respondents use smartphone" and "how often respondents use social media" is less than α , i.e., $p = 0.001$. This indicates there is a statistically significant correlation between the 2 variables, i.e., how often respondents use smartphone and how often respondents use social media. The correlation coefficient is +0.305, which means between the two variables there is a slightly weak and positive relationship. This relationship indicates that the more respondents use their smartphone, the more they tend to use social media. On the other hand, the less they use their smartphone, the less they use social media. Refer to Figure 44.

Correlations				
			How Often Respondents Use Phone	How Often Respondents Use Social Media
Spearman's rho	How Often Respondents Use Phone	Correlation Coefficient	1.000	.305**
		Sig. (2-tailed)	.	.001
		N	120	120
	How Often Respondents Use Social Media	Correlation Coefficient	.305**	1.000
		Sig. (2-tailed)	.001	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 44: Correlation between How Often Respondents Use Smartphone and How Often Respondents Use Social Media

"You often feel lonely" and "Staying socially-connected lessens loneliness"

The "Sig. (2-tailed)" value for the correlation between "you often feel lonely" and "staying socially-connected lessens loneliness" is less than α , i.e., $p = 0.012$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion one often feels lonely and the notion that staying socially-connected lessens loneliness. The correlation coefficient is +0.229, which means between the two variables there is also a slightly weak and positive relationship. The relationship means that those respondents who often feel lonely are more likely to believe staying socially-connected helps alleviate loneliness. On the contrary, if they do not often feel lonely, they may not have the need to seek the connection with other people. Hence, they are less likely to believe that staying socially-connected would lessen loneliness. Refer to Figure 45.

Correlations				
			You often feel lonely	Staying Socially-connected lessens loneliness
Spearman's rho	You often feel lonely	Correlation Coefficient	1.000	.229*
		Sig. (2-tailed)	.	.012
		N	120	120
	Staying Socially-connected lessens loneliness	Correlation Coefficient	.229*	1.000
		Sig. (2-tailed)	.012	.
		N	120	120
		*. Correlation is significant at the 0.05 level (2-tailed).		

Figure 45: Correlation between the Notion One Often Feels Lonely and the Notion that Staying Socially-Connected Lessens Loneliness

"Staying socially-connected lessens loneliness" and "Technology makes life easier"

The "Sig. (2-tailed)" value for the correlation between "staying socially-connected lessens loneliness" and "technology makes life easier" is less than α , i.e., $p = 0.001$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that staying socially-connected lessens loneliness and the notion that technology makes life easier. The correlation coefficient is +0.307, which means between the two variables there is a slightly weak and positive relationship. The relationship indicates that those respondents who think staying socially-connected helps alleviate loneliness are more likely to believe that technology makes life easier. On the other hand, if they do not believe staying socially-connected would lessen loneliness, they are less likely to believe technology would make life easier. Refer to Figure 46.

Correlations				
			Staying Socially-connected lessens loneliness	Technology makes life easier
Spearman's rho	Staying Socially-connected lessens loneliness	Correlation Coefficient	1.000	.307**
		Sig. (2-tailed)	.	.001
		N	120	120
	Technology makes life easier	Correlation Coefficient	.307**	1.000
		Sig. (2-tailed)	.001	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 46: Correlation between the Notion that Staying Socially-Connected Lessens Loneliness and the Notion that Technology Makes Life Easier

"Self-driving cars enhance mobility" and "Wearable devices help monitor health"

The "Sig. (2-tailed)" value for the correlation between "self-driving cars enhance mobility" and "wearable devices help monitor health" is less than α , i.e., $p = 0.007$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that self-driving cars enhance mobility and the notion that wearable devices monitor health. The correlation coefficient is +0.247, which means between the two variables there is a slightly weak and positive relationship. The relationship points out that those respondents who think self-driving cars enhance mobility are also more likely to think wearable devices help monitor health. Refer to Figure 47.

Correlations				
			Self-driving cars enhance mobility	Wearable devices help monitor health
Spearman's rho	Self-driving cars enhance mobility	Correlation Coefficient	1.000	.247**
		Sig. (2-tailed)	.	.007
		N	120	120
	Wearable devices help monitor health	Correlation Coefficient	.247**	1.000
		Sig. (2-tailed)	.007	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 47: Correlation between the Notion that Self-Driving Cars Enhance Mobility and the Notion that Wearable Devices Help Monitor Health

"Self-driving cars enhance mobility" and "Technology makes life easier"

The "Sig. (2-tailed)" value for the correlation between "self-driving cars enhance mobility" and "technology makes life easier" less than α , i.e., $p = 0.021$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that self-driving cars enhance mobility and the notion that technology makes life easier. The correlation coefficient is +0.211, which means between the two variables there is a slightly weak and positive relationship. The relationship shows that those respondents who think self-driving cars enhance mobility are also more likely to believe technology makes life easier. On the contrary, those respondents who do not think self-driving cars enhance mobility are also less likely to believe technology makes life easier. Refer to Figure 48.

Correlations				
			Self-driving cars enhance mobility	Technology makes life easier
Spearman's rho	Self-driving cars enhance mobility	Correlation Coefficient	1.000	.211*
		Sig. (2-tailed)	.	.021
		N	120	120
	Technology makes life easier	Correlation Coefficient	.211*	1.000
		Sig. (2-tailed)	.021	.
		N	120	120
*. Correlation is significant at the 0.05 level (2-tailed).				

Figure 48: Correlation between the Notion that Self-Driving Cars Enhance Mobility and the Notion that Technology Makes Life Easier

"Wearable devices help monitor health" and "Technology makes life easier"

The "Sig. (2-tailed)" value for the correlation between "wearable devices help monitor health" and "technology makes life easier" is less than α , i.e., $p = 0.004$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that wearable devices help monitor health and the notion that technology makes life easier. The correlation coefficient is +0.263, which means between the two variables there is a slightly weak and positive relationship. This relationship means that those respondents who think that wearable devices help monitor health are also more likely to think that technology makes life easier. On the contrary, if they do not think that wearable devices help monitor health, they also tend not to think technology makes life easier. Refer to Figure 49.

Correlations				
			Wearable devices help monitor health	Technology makes life easier
Spearman's rho	Wearable devices help monitor health	Correlation Coefficient	1.000	.263**
		Sig. (2-tailed)	.	.004
		N	120	120
	Technology makes life easier	Correlation Coefficient	.263**	1.000
		Sig. (2-tailed)	.004	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 49: Correlation between the Notion Wearable Devices Help Monitor Health and the Notion Technology Makes Life Easier

"Wearable devices help monitor health" and "Health would improve with the application of technology"

The "Sig. (2-tailed)" value for the correlation between "wearable devices help monitor health" and "health would improve with the application of technology" is less than α , i.e., $p = 0.000$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that wearable devices help monitor health and the notion that health would improve with the application of technology. The correlation coefficient is +0.467, which means between the two variables there is a moderately strong and positive relationship. This relationship indicates that those respondents who think wearable devices help monitor health are also more likely to believe that health would improve with the application of technology. On the other hand, if they do not think that wearable devices help monitor health, they are also less likely to believe that health would improve with the application of technology. Refer to Figure 50.

Correlations				
			Wearable devices help monitor health	Health improves with application of technology
Spearman's rho	Wearable devices help monitor health	Correlation Coefficient	1.000	.467**
		Sig. (2-tailed)	.	.000
		N	120	120
	Health improves with application of technology	Correlation Coefficient	.467**	1.000
		Sig. (2-tailed)	.000	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 50: Correlation between the Notion that Wearable Devices Help Monitor Health and the Notion that Health Would Improve with the Application of Technology

"Self-driving cars enhance mobility" and "Health would improve with the application of technology"

The "Sig. (2-tailed)" value for the correlation between "self-driving cars enhance mobility" and "health would improve with the application of technology" is less than α , i.e., $p = 0.000$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that self-driving cars enhance mobility and the notion that health would improve with the application of technology. The correlation coefficient is +0.319, which means between the two variables there is a slightly weak and positive relationship. The relationship indicates that those respondents who think self-driving cars enhance mobility also tend to think that health would improve with the application of technology. On the contrary, if they do not think that self-driving cars enhance mobility, they are also less likely to think that health would improve with the application of technology. Refer to Figure 51.

Correlations				
			Self-driving cars enhance mobility	Health improves with application of technology
Spearman's rho	Self-driving cars enhance mobility	Correlation Coefficient	1.000	.319**
		Sig. (2-tailed)	.	.000
		N	120	120
	Health improves with application of technology	Correlation Coefficient	.319**	1.000
		Sig. (2-tailed)	.000	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 51: Correlation between the Notion Self-Driving Cars Enhance Mobility and the Notion that Health Would Improve with the Application of Technology

"Technology makes life easier" and "Health would improve with the application of technology"

The "Sig. (2-tailed)" value for the correlation between "technology makes life easier" and "health would improve with the application of technology" is less than α , i.e., $p = 0.000$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that technology makes life easier and the notion that health would improve with the application of technology. The correlation coefficient is +0.462, which means between the two variables there is a moderately strong and positive relationship. The relationship means that those respondents who believe that technology makes life easier are also more likely to believe that health would improve with the application of technology. On the contrary, if they do not think that technology makes life easier, they are also less likely to think that health would improve with the application of technology. Refer to Figure 52.

Correlations				
			Technology makes life easier	Health improves with application of technology
Spearman's rho	Technology makes life easier	Correlation Coefficient	1.000	.462**
		Sig. (2-tailed)	.	.000
		N	120	120
	Health improves with application of technology	Correlation Coefficient	.462**	1.000
		Sig. (2-tailed)	.000	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 52: Correlation between the Notion that Technology Makes Life Easier and the Notion that Health Would Improve with the Application of Technology

"You wish to learn new technology" and "You have been hospitalized in the past five years"

The "Sig. (2-tailed)" value for the correlation between "you wish to learn new technology" and "you have been hospitalized in the past five years" is less than α , i.e., $p = 0.003$. This indicates there is a statistically significant correlation between the 2 variables, i.e., the notion that respondents wish to learn new technology and the notion that they have been hospitalized in the past five years. The correlation coefficient is +0.267, which means between the two variables there is a slightly weak and positive relationship. The relationship could be interpreted that those respondents who report they have been hospitalized in the past five years tend to wish to learn new technology. On the contrary, if they have not been hospitalized, they are less likely to wish to learn new technology. Refer to Figure 53.

Correlations				
			You wish to learn new technology	You have been hospitalized in the past 5 years
Spearman's rho	You wish to learn new technology	Correlation Coefficient	1.000	.267**
		Sig. (2-tailed)	.	.003
		N	120	120
	You have been hospitalized in the past 5 years	Correlation Coefficient	.267**	1.000
		Sig. (2-tailed)	.003	.
		N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).				

Figure 53: Correlation between the Notion You Wish to Learn New Technology and the Notion You Have Been Hospitalized in the Past Five Years

CHAPTER V: DISCUSSION

Findings regarding descriptive statistics

In terms of demographics, most of the respondents of the survey are White (89.17%), and more than half of them are female (53.33%). The majority of respondents are in the age group of 60-69 (53.33%). Education-wise, respondents come from different levels, ranging from "less than high school" (1.67%) to "doctoral degree" (4.17%), with "some college" as the mode (29.17%).

Regarding smartphone ownership, the majority of respondents have a smartphone (77.5%). However, 100% of respondents with "less than high school" for their educational attainment report that they do not own a smartphone. Additionally, 50% of respondents with a total household income of "\$0 to \$9,999" also report that they do not own a smartphone. Obviously, income level, which is influenced by educational level to a large extent, has an impact on smartphone ownership.

As far as the use of the smartphone is concerned, all of the Asian respondents (100%) and all of the Black respondents (100%) report they use smartphone very often. In terms of gender, 84.9% of female and 80% of male respondents also report they use smartphone very often. In terms of age, 96.6% of respondents in the age group of 55-59 report they use smartphone very often. So smartphones are used very often across all race, gender, and age groups.

With regards to the use of social media, in general more respondents report using social media often than not across the three categories of race, gender and age. Their use may range from "a few times per year" to "a few times per month" to "a few times per

week" to "very often" with the highest percentage reported at the "very often" level in all the three categories. However, there are still respondents in different groups of race, gender, and age who report to have never used social media at all. About 50% of Asians, 25% of Blacks, 21.5% of Whites, and 14.3% of "Other" race respondents report so. In terms of gender, 26.8% of males and 17.2% of females report that they never use social media. Another 45% of respondents aged 70-79 also report they never use social media.

With regards to feelings of loneliness, most respondents across all categories of race, gender, and age disagree that they often feel lonely. Among those who do agree, more Blacks (25%) than Whites (15%) report that they often feel lonely, and more females (20.3%) than males (10.7%) do, too. Respondents in the age group of 60-69 score the highest percentage (21.9%) among the four age groups who agree they often feel lonely.

As for staying socially-connected lessens loneliness, the majority of respondents in all categories of race, gender, and age agree. It is interesting that more respondents from minority groups (Asians (100%), Blacks (100%), "Other" (85.7%)) agree to the notion than White respondents (66.4%). More females (70.3%) than males (67.9%) agree to the notion. Still, more respondents in the age group of 80-89 disagree with this notion than any other age group.

Regarding the question "Self-driving cars enhance mobility," slightly more respondents agree than disagree to the notion in all three categories of race, gender, and age. Among those who agree, more Asians (50%), Blacks (50%), and "Other" race

respondents (71.4%) agree than Whites (43.9%). More males (51.8%) agree than females (40.6%).

Regarding the question "Wearable devices help monitor health," those who express agreement dominate in all categories of race, gender, and age. The percentage in the case of agreement is about 70% or more in most groups of the three categories. The percentage in the case of disagreement ranges from 0% to 15% in most groups of the three categories.

Regarding the question "Technology makes life easier," the trend repeats here, i.e. those who express agreement also dominate in all categories of race, gender, and age. The percentage of agreement ranges from above 70% to 100% in most groups of the three categories. The percentage in the case of disagreement also ranges from 0% to 15% in most groups of the three categories.

With regards to the question "Health would improve with the application of technology," there are still more respondents who agree than those who disagree; However, the percentage of those who agree no longer dominates as in the case of the above two questions. It is noticed that more Asians (100%), Blacks (75%), and "Other" race respondents (57.1%) agree than Whites (43%). More males (55.4%) agree than females (37.5%). More respondents in age group 70-79 (55%) agree than the other two age groups, i.e., 55-59 (40%) and 60-69 (45.3%).

Findings regarding inferential statistics

Statistically there is a significant correlation between whether respondents own a smartphone and the notion that they believe health would improve with the application of

technology. The correlation coefficient in this case is +0.281. The responses from the participants indicate that people use technical devices, e.g. the smartphone, because technology benefits them. On another note, those respondents who own a smartphone may become used to modern technology, and it may not be long before they discover the potential usefulness technology may bring to them. Therefore, if respondents can see the usefulness that technology can bring them on a daily basis via the smartphone, then they may think that the application of technology would expand further beyond these daily uses into other realms such as medicine and health services.

The survey also uncovers another correlation between how often respondents use their smartphone and the notion that health would improve with the application of technology. The correlation coefficient between the two variables in this case is +0.228. This relationship appears to reinforce the correlation mentioned above between smartphone ownership and the notion that health would improve with the application of technology. It makes sense that a person who owns a smartphone and believes the application of technology benefits health maintenance will have a high frequency use of the tech device he/she owns. The more people trust and know technology, the more they will use tech devices. On the other hand, if people are skeptical of or unfamiliar with the use of technology, they will stay away from tech devices.

Furthermore, responses from the survey indicate there is a statistically significant correlation between feeling lonely and the alleviation of loneliness by staying socially-connected. The correlation coefficient of this relationship is +0.229. It is understandable that people may seek to be socially-connected so as to feel less lonely. The more a person

is surrounded by others, even virtually via social media, the less he/she may feel left on his/her own. In the technology era, access to the Internet and/or the possession of a smartphone makes it easier for people to stay socially-connected and thus lessen the feeling of loneliness.

Results from the survey also show that there is a statistically significant correlation between smartphone ownership and how often respondents use social media. The correlation coefficient in this case is +0.335. Although it may not be true for everyone, a person who has a smartphone is more likely to use social media. It makes sense that smartphone ownership may help contribute to a respondent's participation in social media because with a smartphone respondents can access social media virtually anywhere.

There is also a statistically significant correlation between monitoring health with the use of wearable devices and the belief that technology makes life easier. The correlation coefficient in this case is +0.263. The wearable devices are the actual application of technology in the healthcare field to assist users in keeping track of their vital signs or their motion for fall alert purposes. The correlation between the two variables is one of the most significant correlations the survey seeks to analyze. The results suggest that respondents who believe in the use of wearable devices are also open to the idea that technology aids us in life.

The survey also shows a statistically significant correlation between monitoring health with the use of wearable devices and the belief that health would improve with the application of technology. The correlation coefficient in this case comes up to +0.467,

indicating a significant relationship. The respondents who think that wearable devices help monitor health also think that health would improve with the application of technology. This correlation is also a strong indication that technology and its application in healthcare can positively contribute to the well-being of society in general and of the elderly community in particular.

Additionally, the correlation between the belief that technology makes life easier and the belief that health would improve with the application of technology is another statistically significant correlation the survey has come to uncover. The correlation coefficient in this case is +0.462. This correlation is another finding of the survey. It clearly indicates that technology and its application can contribute to the well-being of the elderly community in particular and of society as a whole. Respondents who think that technology makes life easier also tend to think that health would improve with the application of technology.

Interestingly those respondents who think that self-driving cars enhance mobility may also agree that health would improve with the application of technology. The survey uncovers a statistically significant correlation between the two variables. The correlation coefficient in this case is +0.319. The question about self-driving cars probes the responses whether the application of this new technology would address one of the concerns many elderly people face, i.e., mobility. While the descriptive statistics do not reveal a clear-cut opinion for or against the application of this technology (probably because the technology is still relatively novel and not yet widely applied in real life), respondents who do believe that self-driving cars enhance mobility also are more likely

to believe that health will improve with the application of technology. The correlation in this case appears to enhance the belief that the application of technology would improve healthcare.

The survey also uncovers a statistically significant correlation between a respondent's wish to learn new technology and his/her past hospitalization. The correlation coefficient in this case is +0.267. Maybe after being hospitalized, a person can see the benefit of the application of technology in the treatment of his/her medical condition and in the prevention of future sickness. Thus he/she may start becoming interested in learning or understanding about new technology. Whatever the motivation may be, a person who has been hospitalized is certain to benefit from the possession of more knowledge instead of a lack of knowledge in order to prevent further calamity.

The survey furthermore shows the existence of a correlation between the enhancement of mobility by self-driving cars and the monitoring of health via wearable devices. Statistically this correlation is significant. The correlation coefficient in this case is +0.247. This kind of correlation could be viewed as a mutual support of the two variables. Those who have had experience in using wearable devices tend to think that self-driving cars are just another application of a novel technology to make life easier. On the other hand, those who think that self-driving cars enhance mobility for the elderly may think that the application of this novel technology is just about to follow the footsteps of the previous generation of technology.

CHAPTER VI: CONCLUSION

The results of this study are by no means intended to be comprehensive. The survey, however, provides descriptive statistics based on the collected data. The data are primarily collected online via a convenience sampling method with the participation of 120 respondents. Therefore, the data are limited to the scope of this research only, i.e., the data are not sufficiently representative of the whole population.

Since there is a positive correlation between smartphone ownership and the health will improve with the application of technology, it can be deduced that those elderly respondents who use technology (if using the smartphone is taken symbolically as using technology) also believe that they can benefit from the application of technology in the maintenance of their health. This finding suggests that elderly respondents who own/use technology may have better health outcomes than those who do not. Future studies could build from this one to better test whether or not that is in fact the case.

The survey also points out (1) the positive correlation between owning/using smartphones and the use of social media, and (2) the positive correlation between staying socially-connected and the alleviation of loneliness. These findings suggest that elderly respondents who use technology may also benefit socially and psychologically from the use of technology. Teaching the elderly to be technologically literate and working to ensure the elderly have access to technology may have important social, psychological, and health benefits for our population. Future studies could build from this one by following a sample of elderly adults over time to better understand how technology may lead to better elderly well-being.

Moreover, results from the survey also reveals a positive correlation between the thinking that self-driving cars enhance mobility and the thinking that technology makes life easier. This is interesting. The self-driving car is a novel technology not widely applied in real life yet. The positive correlation in this case shows that those elderly people who look forward to future technological development also hold a more optimistic view about life than those who are skeptical about technology.

Furthermore, the survey shows that those elderly respondents who have experienced hospitalization in the past five years tend to wish to learn about new technology. This positive correlation from the statistics suggests that those who have had health challenges may wish to learn about new technology to better help their health.

New breakthroughs in technology will bring about more applications to serve the elderly population, and thus more research on technology and elderly well-being may be needed in the future. Since this study is based on a convenience sampling method, the results fall short of being representative of the entire population. Additionally, those who are recruited for this study appear to be familiar with online surveys. It would be interesting to know how the elderly who are not as comfortable with online surveys feel about technology. A face-to-face interview or a survey conducted in person may allow the researcher to better obtain viewpoints that are representative of the elderly population in the United States. Future research projects on technology and its application with regards to the elderly population remains worthwhile because it is a study on our own well-being as we all eventually age.

REFERENCES

- Atanasova, Irena, and Elena Karashtranova. 2016. "A Novel Approach for Quality of Life Evaluation: Rule-Based Expert System." *Social Indicators Research: An International and Interdisciplinary Journal for Quality-of-Life Measurement*. 128(2):709-722.
- Callari, Tiziana C., Silvia Ciairano, and Alessandra Re. 2012. "Elderly-Technology Interaction: Accessibility and Acceptability of Technological Devices Promoting Motor and Cognitive Training." *Work*. 41 (Supplement 1):362-369.
- Gonzalez, Antonio, M. Paz Ramirez, and Vicente Viadel. 2012. "Attitudes of the Elderly Toward Information and Communications Technologies." *Educational Gerontology*. 38(9):585-594.
- Jordan, Cathleen, David Cory, Scott Sainato, and Peter Lehmann. 2016. "Technology's Promise to Elders." *Health & Social Work*. 41(2):71-73.
- Krupka, J., J. Mandys, J. Svobodova, and M. Augustinova. 2011. "Modelling of Sustainable Systems." *Scientific papers of the University of Pardubice*. 16(19):102-114.
- Logue, Rebecca M. 2002. "Self-Medication and the Elderly: How Technology Can Help." *The American Journal of Nursing*. 102(7):51-55.
- Miskelly, Frank G. 2001. "Assistive Technology in Elderly Care." *Oxford Journals*. 30(6):455-458.
- Strauss, Mark. 2017. "Four-in-Ten Americans Credit Technology with Improving Life Most in the Past 50 Years." Washington, DC: Pew Research Center, Retrieved

January 18, 2018 (<http://www.pewresearch.org/fact-tank/2017/10/12/four-in-ten-americans-credit-technology-with-improving-life-most-in-the-past-50-years/>)

U.S. Bureau of the Census. 2015. "Total US Population by Age and Generation."

Retrieved January 22, 2018 (<https://knoema.com/infographics/egydzc/us-population-by-age-and-generation>)

APPENDIX

Questionnaire

1. Do you use a smartphone?
 - a. Yes
 - b. No
 - c. Refused (not stated)

2. If you have a smartphone, how often do you use it to talk, send emails or text messages to family and friends?
 - a. N/A
 - b. Very Often (almost daily)
 - c. A few times per week
 - d. A few times per month
 - e. A few times per year
 - f. Never

3. How often do you use online social media, e.g. Facebook, Twitter, etc?
 - a. Very Often (almost daily)
 - b. A few times per week
 - c. A few times per month
 - d. A few times per year
 - e. Never

For the following questions, please rate how much you agree or disagree with each statement.

	a.	b. Agree	c. Unsure/Neutral	d. Disagree	e. Strongly
--	----	----------	-------------------	-------------	-------------

	Strongly agree				disagree
4. You often feel lonely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Staying socially-connected helps alleviate loneliness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Self-driving cars will enhance the mobility of elderly people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Wearable devices assist elderly people in monitoring their health.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Technology makes your life easier.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Your overall health condition would improve with the application of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

technology.					
-------------	--	--	--	--	--

10. Do you use any technological device to monitor your health?
 - a. Yes
 - b. No
 - c. Refused (not stated)

11. Do you wish to learn new technology in order to maintain/monitor your health?
 - a. Yes
 - b. No
 - c. Refused (not stated)

12. In the past five years, how many times have you been hospitalized?
 - a. None
 - b. 1 time
 - c. 2 times
 - d. 3 times
 - e. 4 or more times

13. In the past five years, how many times have you fallen?
 - a. None
 - b. 1 time

- c. 2 times
 - d. 3 times
 - e. 4 or more times
14. Have you ever been diagnosed with dementia?
- a. Yes
 - b. No
 - c. Refused (not stated)
 - d. Don't know
15. How old are you?
- a. 55-59 years old
 - b. 60-69 years old
 - c. 70-79 years old
 - d. 80-89 years old
 - e. 90 years old or more
16. What is your gender?
- a. Male
 - b. Female
 - c. Other
17. What is your marital status?
- a. Married
 - b. Single
 - c. Widowed
 - d. Divorced
 - e. Other

18. What is your race? (Check all that apply)

- a. White
- b. Black
- c. Hispanic
- d. Asian
- e. Other

19. What is your religious affiliation?

- a. Christian
- b. Jewish
- c. Muslim
- d. Hindu
- e. Buddhist
- f. None
- g. Other

20. What is your educational level?

- a. Less than high school
- b. High school diploma/GED
- c. Some college
- d. Associate's degree
- e. Bachelor's degree
- f. Master's degree
- g. Doctoral degree