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Evaluating U.S. Household Telemedicine Use in Primary Care Settings

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This is to certify that the doctoral study by

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the review committee have been made.

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Walden University
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Abstract

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By

Robert Osobase

MS, University of Tennessee, 2014

BA, University of Benin, 2003

Doctoral Study Submitted in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

May 2023

Abstract

The COVID-19 pandemic's arrival in the United States restricted access and use of telemedicine in primary care providers (PCPs) settings. Addressing this issue is crucial since telemedicine is a confirmed method of encouraging patients and PCPs to promote quality health care. This quantitative study investigated the association between age, gender, and race, and PCPs offering telemedicine and U.S. household adults using telemedicine during COVID-19 pandemic in 2021. The Donabedian framework, which considers aspects of an organization's structure, process, and outcome, served as the study's foundation, incorporating age, race, and gender as independent variables, and PCPs and US adults as dependent variables. Utilizing a sample size of 786 US household adults from the Research and Development Survey (RANDS), a univariate and multinomial logistic regression analysis showed that women were more likely to use telemedicine and reported that their PCPs provided it. The study also found that adults aged 36 to 49 were more likely to confirm that their PCPs provided telemedicine and to have used it. Hispanics used telemedicine the most, even though adults of other races indicated their PCPs offered it the most. Age, gender, and ethnicity did not significantly correlate with PCPs who offered telemedicine, but did correlate with the use of telemedicine. The study contributes to positive social change by improving policy and provider awareness regarding the use of telemedicine as it relates to patient demographics, age, gender, and race, which should be included as part of telemedicine equity discussions in primary care settings.

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Dedication

This doctoral study is dedicated to my wife, Victoria, and our children, Roberts, Victor, and Rangel, in appreciation of your love, patience, and understanding throughout the course of my study.

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I am most grateful to my committee, Dr. Robert Hijazi committee chair Dr. Lee Wilson Bewley, and Dr. Kristin Wiginton (URR) for their support and encouragement. I offer my heart felt appreciation for all the learning opportunities you provided me.

Completing this project would not have been possible without the support of my fellow students at Walden University, especially Ade Elisha and Stephen Tete.

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Section 1: Foundation of the Study and Literature Review

Introduction

During the COVID-19 pandemic, the transition to telemedicine from in-person visits by ambulatory clinics, particularly in primary care provider (PCP) clinics, may have exacerbated inequitable access to care across age, race, and gender in the United States. Through this study, I sought to establish a link between age, gender, and race as patient demographics; PCPs who offer telemedicine; and telemedicine use among U.S. household adults. PCPs who moved slowly into providing telemedicine may have been influenced by patient demographics of U.S. household adults (Zachrison et al., 2021, p. 9). In terms of physician and patient adoption of telemedicine, “PCPs, among others, were found to have a higher likelihood of taking it on, and the characteristics of patients were not as strongly related with telemedicine adoption" (Zachrison et al., 2021, p. 4). When the prevalence of family physicians providing e-visits and the factors associated with them were investigated, it was discovered that other physicians were more likely to offer e-visits than private practice physicians, particularly if their primary practice was an academic health center/faculty practice, a managed care/health maintenance organization (HMO) practice, hospital-/health system-owned medical practice, workplace clinic, or federal (military, Veterans Administration [VA]/Department of Defense). Zachrison et al. (2021) found that physicians with no official ownership stake or other ownership arrangement had a lower likelihood of offering e-visits than sole owners, and physician-level variation in virtual health care adoption can result in access challenges for patients. Drake et al. (2021, p. 57) investigated the variation in telemedicine adoption by specialty line and patient demographic characteristics following the COVID-19 pandemic's initial peak period.

> “Telemedicine adoption varied by provider, race, and sex, with male patients less likely to use telemedicine (telephone or video) compared to white and female patients, and African American, publicly insured, and older patients less likely to use video compared to white, commercially insured, and younger patients” (Drake et al., 2021, p. 54)

Lintz (2022) stated that "PCPs identified administrative, financial, and technical barriers to offering telemedicine during the pandemic, and a lack of reimbursement was a significant barrier to telemedicine adoption" (p. 5). It is unclear whether there is a link between PCPs who offer telemedicine and telemedicine use in U.S. households based on age, gender, and race. To answer these questions, trends in U.S. households that used telemedicine and who’s PCPs offered telemedicine from 2020 to 2021 were examined using relevant secondary data from the Centers for Disease Control and Prevention (CDC). The study may assist healthcare administrators in determining whether to encourage the use of telemedicine through infrastructure development and funding of specific telemedicine programs. The research may also ensure that PCPs who have invested in telemedicine find ways to not only identify problems, but also improve on their existing programs.

Problem Statement

Given the COVID-19 pandemic, PCPs who transitioned to providing telemedicine at a slower pace helped to increase the rate at which U.S. households used telemedicine

(Zachrison et al., 2021, p. 10). “Administrative, financial, and technical barriers were identified as obstacles to providing telemedicine during the pandemic" (Lintz, 2021, p. 5). As Drake et al. (2021) explained, “while telemedicine adoption varies by specialty, particularly among PCPs, African Americans and male patients were less likely to use telemedicine (telephone or video) than white and female patients, and African Americans, publicly insured, and older patients were less likely to use video than white, commercially insured, and younger patients” (p. 54).

Adoption of telemedicine by patients and providers is limited, and this concern must be addressed to ensure its use, especially because telemedicine remains an evidence-based health promotion strategy that encourages patients to develop attitudes, behaviors, and environments that promote optimal health (Garg et al., 2020).

Implications of the Study

According to Tossaint-Schoenmakers et al. (2021), "studies like these help with "investigating whether there are identifiable indicators in the structure, process, and outcome categories that are related to the successful integration of telemedicine in health care" (p. 2). This study may guide healthcare administrators on whether to encourage the use of telemedicine through the stimulation of infrastructure development and funding specific telemedicine programs. The study may also ensure that PCPs who have invested in telemedicine use find ways of not only identifying problems, but also improving on their established programs. The study may contribute to positive social change by "encouraging PCPs and Healthcare Administrators to remedy a variety of administrative, financial, and technical barriers to offering telemedicine during the pandemic" (Lintz, 2021, p. 5).

The Donabedian model, as a known quality model, covers organizational structure (support staff, healthcare professionals, patients receiving care, and telemedicine), process (healthcare actions and management), and outcomes (quality of visits, experiences of patients, clinic staff, and efficiency). Understanding those factors associated with PCPs offering telemedicine and their impact on telemedicine use by U.S. households can inform targeted quality improvement approaches and communication efforts by encouraging providers to offer telemedicine. Lessons learned from the beginning of the surge of COVID-19 cases can inform organized reduction strategies for likely future disruptions. Clinical administrators can apply the study results to improving access by earmarking telemedicine to at-risk populations requiring additional consideration from them. Lessons learned can also contribute to implementing a comprehensive, dynamic, patient-centered telemedicine system within clinics as applied to a vulnerable population that can be generalized to other difficult-to-reach populations.

Purpose of the Study

The purpose of this quantitative study was to investigate the relationship between age, gender, and race and PCPs offering telemedicine and U.S. households using telemedicine. I sought to evaluate the levels of correlation between each demographic factor and PCPs offering telemedicine and telemedicine use among U.S. household adults. Pearson correlation aided the understanding of the effect of age, gender, and race on PCPs offering telemedicine and U.S. households using telemedicine by determining the statistical significance between the variables in the study. In this analysis, telemedicine use was measured by the following question: "During the coronavirus pandemic, did you have an appointment with your primary care provider by video or by phone?” For providers offering telemedicine, it was measured by the following question: "Does this provider offer telephone or video appointments, so that you don't need to physically visit their office or facility?" (CDC, 2021).

The independent variables in this study were age, gender, and race, while the dependent variables were “primary provider offering telemedicine” and “uses telemedicine.” The research hypotheses included the following: (a) there is a relationship between age and “primary care provider offering telemedicine” and: uses telemedicine” during the coronavirus pandemic, (b) there is a relationship between race and “primary care provider offering telemedicine” and “uses telemedicine” during the coronavirus pandemic, and (c) there is a relationship between gender and “primary care provider offering telemedicine” and “uses telemedicine” during the coronavirus pandemic.

Research Questions and Hypotheses

Research Question 1 (RQ1): What is the relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021?

H1o: There is no significant relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021.

H1a: There is a significant relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021.

Research Question 2 (RQ2): What is the relationship between age, gender, and race and use of telemedicine during the coronavirus pandemic in 2021?

H2o: There is no significant relationship between age, gender, and race and use of telemedicine during the coronavirus pandemic in 2021.

H2a: There is a significant relationship between age, gender, and race and use of telemedicine during the coronavirus pandemic in 2021.

Theoretical Foundations of the Study

The healthcare model is specified in this section. The study, which was investigative, was informed by the Donabedian framework, which was used to explore the influence of age, gender, and race over PCPs offering telemedicine and U.S. household adults' use of telemedicine. The model was developed in 1966 by Avedis Donabedian, who was a physician and health services researcher. Avedis "described structure, process, and outcome measures as having synergistic relationships, and each being important to the evaluation of health care quality" (Binder et al., 2021, p. 240). The Donabedian framework "deals with every relevant aspect of an organization's structure which includes telemedicine, its processes, and outcomes" (Tossaint-Schoenmakers et al., 2021, p. 3).

In the model, structure measures for the independent variable reflect the attributes of the patient by age, gender, and race; the lack of telemedicine acceptance by patients;

the lack of restructured health services to accommodate offering telemedicine; and reimbursement. As for process measures, they are predefined activities executed to achieve specific outcomes. The administrator must plan a network of operations that converts patient demographics to offering of telemedicine by PCPs and U.S. households using telemedicine. The adoption of telemedicine is not only changing delivery processes, but also the required skill sets of clinicians especially. Outcome measures in the model relate to the impact on the patient or U.S. households, which is demonstrated by an increase in the use of telemedicine by age, sex, or race. Strategic objectives should be driven by the needs and expectations of the patients.

In the Donabedian model, establishing the relationship between age, gender, and race and providers offering telemedicine and U.S. households' use of telemedicine is very important because it is imperative to incorporate every U.S. household's role as the care receiver into that of the organizational structure, especially telemedicine, and the deployment of human resources to the daily care processes because they need to be aligned with the desired results (Tossaint-Schoenmakers). The target population of the study included U.S. households surveyed between 2020 and 2021, which is relevant to healthcare administration because patient demographics contributed to whether providers offered, or U.S. households used the technology while patients were quarantined at home due to the COVID-19 virus. Adoption of telemedicine by patients and providers was limited, and this concern needs to be addressed to ensure telemedicine's utilization, especially as telemedicine remains an evidence-based health promotion strategy that aims to encourage patients to create attitudes, behaviors, and environments to promote optimal health.

Nature of the Study

This study was a correlational study using secondary data from a CDC database within a quantitative methodology to analyze the relationship between age, gender, and race and telemedicine use by U.S. households and primary care providers offering telemedicine (CDC, 2021). The target population was U.S. households using PCPs. Pearson's correlation was used to measure the association's strength and direction between variables measured on at least a nominal scale. Only quantitative data that were general and not tailored specifically to this study and that might correctly provide answers to the research question retrieved from the shared public website were utilized, especially published articles and journals. The research question was used as a guide to retrieve relevant secondary data, which were quantitative from the CDC database. Creswell & Creswell (2018) published a textbook on a research design that focused on qualitative, quantitative, and mixed methods approach where they explained quantitative linear regression research design and found that Pearson correlation can aid with the understanding of the effect of one variable on another.

Literature Search Strategy and Keywords

Multiple databases and articles were targeted for the literature review, including Google Scholar, PubMed, JSTOR, and ProQuest, among others. The purpose was to locate solid information relevant to the research topic. Data were retrieved from a CDC database to determine the relationship between PCPs offering telemedicine and U.S.

households' use of telemedicine. Investigating the obvious relationship between the variables was a prescription for motivating healthcare administrators and PCPs in addressing barriers to adopting telemedicine use in PCP clinics.

Literature Review

Drake et al. (2021) “investigated variations in telemedicine adoption by specialty line and patient demographic characteristics following the initial peak period of the coronavirus disease 2019 pandemic, when in-person visits resumed and visit volume returned to pre-pandemic levels" (p. 51). Encounters from six service lines, including nonurgent primary care, were extracted, and risk ratios were calculated to assess the relative use of telemedicine compared to in-person encounters and telemedicine modality by patient race, age, gender, and insurance type" (Drake et al., 2021, p. 54). Drake et al. discovered that, “Telemedicine adoption varied by provider, race, and sex, with male patients less likely to use telemedicine (telephone or video) compared to white and female patients, and African American, publicly insured, and older patients less likely to use video compared to white, commercially insured, and younger patients. (p. 55). Administrators must have valuable insights into variations in telemedicine use, implementation, and financing in primary care settings, particularly the importance of balancing patient and clinic-level implementation factors to promote long-term, equitable telemedicine integration.

Literature Related to Primary Care Providers' Adoption of Telemedicine

DerMartirosian et al. (2022, p. 2) investigated the patient, provider, and site-level characteristics of any virtual and video-based care provided in primary care. They conducted an interrupted time series (ITS) design using VA administrative/clinical electronic healthcare data and discovered that the percentage of telehealth and video use increased from 13.9 to 63.1% and 0.3 to 11.3%, respectively, before and after COVID-19 onset (DerMartirosian et al., 2022, p. 2). They also discovered that non-Hispanic African Americans (36.3%) and Hispanics (34.4%, vs. 35.3% for Whites, p.1) were more likely to use telephone than video, and women (for all age groups, except 75+) were more likely to use video than telephone. DerMartirosian et al. maintained that it is critical to understand how all clinics can systematically increase access to both telephone- and video-based primary care services while also ensuring equitable care for all patient populations.

Callaghan et al. (2022, p. 1) used data from an original national survey of 625 PCPs conducted from May 14 to May 25, 2021, to investigate the frequency of physician telehealth use before and during the pandemic, as well as intended use after the pandemic. They discovered that,

> “the proportion of primary care physicians using telehealth frequently increased from 5.3% (95% CI 3.5, 7.0) before the pandemic to 46.2% (95% CI 42.3, 50.2) during the pandemic, implying that policy change may be required to facilitate long-term growth of telehealth” (Callaghan et al., 2022, p. 4)

Zachrison et al. (2021, p. 2) investigated the factors associated with the likelihood of early adoption of virtual health care by physicians and patients in a large regional health care system by analyzing data from physicians providing ambulatory care through a large New England health care system using administrative health system databases. They discovered that "primary care providers and behavioral health providers had higher odds of being early adopters than other providers, and patient characteristics were less strongly associated with physician adoption" (Zachrison et al., 2021, p. 5). This demonstrates that variation in physician adoption of virtual health care can cause access issues for their patients.

Education, a change practice used in telemedicine implementation, improves patient and provider experiences, potentially leading to improved health outcomes (Downing, 2021, p. 1). Downing (2021, p. 1) used the Donabedian model to guide a cross-sectional, modified version of the Telemedicine Objective Structured Clinical Exam survey. The study indicated that providers with only on-the-job training felt knowledgeable and confident when using telemedicine, except when conducting physical exams and making diagnoses. According to the study, future PCP degree programs should include telemedicine training, particularly addressing physical assessment and diagnosis skills in telemedicine.

"The lack of reimbursement was found to be a significant obstacle to telemedicine adoption, and finance to telemedicine usage was negatively associated with telemedicine use," according to a study of barriers to telemedicine use among primary healthcare providers in a clinic in North Texas during the COVID-19 pandemic (Lintz, 2021, p. 5). The study was significant because it emphasized the importance of closing administrative, financial, and technological gaps to encourage healthcare providers to use telemedicine.

Peabody et al. (2019, p. 869) used a cross-sectional practice demographic questionnaire for 7,580 practicing family physicians to investigate the prevalence of family physicians providing e-visits and their associated factors. Bivariate statistics were computed, and logistic regression was used to investigate factors associated with offering e-visits at the physician and practice levels. The researchers discovered that if their primary practice was an academic health center/faculty practice, a managed care/health maintenance organization (HMO) practice, a hospital-/health system-owned medical practice, a workplace clinic, or federal facility (military, VA/Department of Defense), other physicians were more likely to offer e-visits. This finding indicates that physicians with no official ownership stake or other ownership arrangement were less likely to offer e-visits than sole owners. Because "physicians in HMOs and VA settings are more likely to provide e-visits," "reimbursement may be a significant barrier for private practice physicians" (Peabody et al., 2019, p. 872).

Literature on Telemedicine Adoption in the U.S. Adult Population

Adepoju et al. (2022, p. 458) conducted a retrospective study using electronic records to assess provider and patient-level factors associated with telemedicine use in community-based family practice clinics. A three-level mixed-effects logistic regression model with provider and patient as random effects was used to investigate the predictors of telemedicine use. Non-Hispanic White patients had 61% higher odds of a telemedicine visit than Hispanics, and non-Hispanic Black patients had 32% higher odds of a telemedicine visit. Uninsured people, on the other hand, had a lower likelihood of using telemedicine. Those who lived in metropolitan areas or in medically underserved areas had a better chance of getting a telemedicine appointment. The fact that provider characteristics were not significantly associated with telemedicine use suggests that a greater emphasis should be placed on patient characteristics specific to the population served.

Fischer et al. (2020, p. 2) considered the prevalence of videoconferencing visits to be unknown and attempted to quantify the use of and willingness to use telehealth modalities among the U.S. population. The results of a survey of 2,555 people revealed that "49.2% overall were willing or very willing to use videoconferencing visits, while Black people, those over the age of 65, and those with less education were less likely to express willingness" (Fischer et al., 2020, p. 7). Primary care providers must concentrate their efforts on patient groups, particularly those who are older or have less education, and payer policies that support other forms of telemedicine may be appropriate to improve access.

Rodriguez et al. (2021, p. 488) used descriptive statistics to show trends in the use of telephone, video, and in-person visits between March 1 and June 1 of 2021, particularly between April 23 and June 1 of 2021, which began 1 month after the shift to telemedicine during the coronavirus pandemic. The findings revealed disparities in telemedicine access that may have exacerbated existing racial, ethnic, and language-based disparities in chronic disease outcomes, as well as COVID-19 case rates and mortality. Rodriguez et al. recommended that institutions carefully monitor telemedicine visit use across patient demographics and provide patients, clinicians, and practices with the tools they need to promote equitable access to all telemedicine modalities. The patient population served by each primary care center differs, which may influence the decision to implement telemedicine (Lin et al., 2018, p. 1968).

Eberly et al. (2020, p. 1) conducted a retrospective medical record review of all patients scheduled for telemedicine visits in primary care and specialty ambulatory clinics at a large academic health system from March 16 to May 11, 2020. The electronic medical record revealed age, race/ethnicity, gender, language, median household income, and insurance type. The findings revealed that older patients, Asian patients, and non-English-speaking patients used telemedicine less frequently, while older patients, female patients, Black patients, Latinx patients, and poorer patients used video less frequently. Inequities in access to telemedicine care exist and should be addressed.

Pierce and Stevermer (2020, p. 2) examined 7,742 family medicine encounters at a single U.S. institution during the first month of the COVID-19 public health emergency (PHE). The demographics of those who used telehealth during the PHE were compared to those who had face-to-face visits at the same time. The results showed that telehealth use was higher for women and those aged 65 and older in the first 30 days of telehealth expansion. Telehealth visits were reduced for rural residents and people of color, and full audio-video telehealth visits were reduced for older patients, people of color, and people from cities. Pierce and Stevermer (2020) reported that "significant disparities in telehealth use by age and race during the COVID-19 PHE" (p. 1).

Rodriguez et al. (2020) assumed in their study that "patients with limited English proficiency posed unique challenges in terms of integrating telemedicine and ensuring equity” (p. 489). They used data from the California Health Interview Survey, which included 84,419 respondents from 2015 to 2018, to see if there was a link between limited English proficiency and telemedicine visits. It was discovered that patients with limited English proficiency used telemedicine at a lower rate than those who were proficient (Rodriguez et al., 2020, p. 489). Patients with limited English proficiency were also found to have nearly half the odds of using telemedicine, implying that healthcare administrators should prioritize limited English proficiency when promoting telemedicine equity and closing digital divides (Rodriguez et al., 2020, p. 489).

Stevens et al. (2021, p. 2) investigated ambulatory clinics transitioning to telehealth during the COVID-19 pandemic and how this may have exacerbated disparities in care across age, race, and gender. They conducted a retrospective cohort study of outpatient visits between March 2 and June 10, 2020, and compared them to the same period in 2019. They also compared them by racial designation, gender, and age. The findings revealed that, of all telehealth visits, Black and White patients accessed telehealth more than Asian patients, and that rapid telehealth implementation did not follow previous patterns of health care disparities. This study found that for telehealth users, patients over the age of 65, Blacks, Asians, and Hispanics were less likely to use video technology, which may reflect technology concerns.

Literature Summary

Telemedicine adoption varies by provider, race, and sex, especially where significant disparities have been shown to exist in its use during COVID-19 (Drake et al., 2021, p. 54; Pierce & Stevermer, 2020, p. 4). An effective way of improving patient and provider experience through telemedicine is to focus on enhancing technology interoperability and usability and providing sufficient training for efficient telemedicine use (Sun et al., 2021, p. 2539). There is a need for administrators to focus on patient characteristics specific to the population served (Adepoju et al., 2022, p. 460). Administrators must conduct a needs assessment; gain leadership and management support and commitment; identify champions; ensure that there are adequate resources; gain stakeholder trust, acceptance, and buy-in; and provide training and education (Kho et al., 2020, p. 7). The need to remedy administrative, financial, and technical gaps to motivate healthcare providers to utilize telemedicine is also stressed (Lintz, 2021, p. 5).

Definition of Terms

Telehealth and *telemedicine* have various definitions, depending on who is responding to the question. As it is commonly used, *telehealth* is a broader term that includes telecommunication tools such as phone calls, text messages, emails, or more sophisticated online health portals that allow patients to communicate with their providers (Weigel et al., 2020, p. 2). *Telemedicine*, on the other hand, is defined as the provision of clinical services (either in real-time or asynchronously) between patient and clinician and/or clinician and clinician when the two parties are physically remote from one another, using some form of information-communication technology (Shaver, 2022, p. 2).

Population as used in this study is defined by a representative sample of U.S. adults aged 18 and over. Population was categorized into race (Hispanic origin, Black, non-Hispanic, White non-Hispanic, or Other non-Hispanic), age group (18–34 years, 35–49 years, 50–64 years, and 65 years and over), and sex (male or female) (National Library of Medicine, 2022).

Primary care providers (PCPs) include advanced registered nurse practitioners (ARNPs), physician assistants, medical doctors (MDs), and Doctors of Osteopathic Medicine (DOs) who specialize in internal medicine or family practice (National Library of Medicine, 2022).

Assumptions

During the conduct of the study, the knowledge presented in the literature review was assumed to be accurate, especially as it contained information from peer-reviewed research done in the past. All information presented in the literature review was refined and used based on the findings of the empirical study. It was assumed in the study that there exists a relationship between age, race, and gender and "provider offers telemedicine" and "uses telemedicine." The data analysis was expected to disclose the validity of the assumption, especially if there was likely to be a correlation between the variables being studied. It was also assumed that the data collection process and findings were objective and without bias.

Scope and Delimitations

The scope of the study was descriptive in nature, concluding with data provided within the context of the U.S. household adult population using telemedicine and PCPs offering telemedicine as variables under investigation. Generalization of the study is limited only to the U.S. adult population based on race, age, and gender while ignoring other factors such as education, geographical location, and income that may be important to the investigation. Thus, the study was limited only to information necessary for the investigation.

Limitations

This study had several limitations. First, panel surveys from which data were extracted have more sample bias and less accuracy than traditional survey methods. Second, the cross-sectional nature of this analysis with only 2 months of data made it difficult to infer causality. Third, because of the limitations of the data, it was difficult to study the intensity of telemedicine use among adult U.S. households. Finally, the reasons for not using telemedicine were based on self-reports by adult U.S. households, which did not capture all the barriers for providers offering telemedicine. Considering these limitations, it is believed that findings are still instructive for policy development.

Significance and Relevance

By studying the U.S. household adult population's use of telemedicine and providers offering telemedicine, which is assumed to be dependent on age, race, and gender, administrators can gain an understanding of the structure, process, and outcome indicators related to the integration of telemedicine (Tossaint-Schoenmakers et al., 2021, p. 19). Such understanding can ensure “the implementation of changes that follow a known process improvement model to maintain high-quality clinical outcomes as well as engagement between providers and patients" (Binder et al., 2021, p. 252). Information from the study can be used in other healthcare provider settings where the need for telemedicine use is related or can be compared to ensure better patient outcomes.

Section 2: Research Design and Data Collection

Methodology

Research Design

Correlational research design was used in this study to effectively answer questions asked. As a research design, its objective was to find whether there were any differences in the characteristics of U.S. households as a population, depending on whether they had been exposed to their PCPs offering telemedicine (Lau & Kuziemsky, 2017, p. 213). This study determined whether there exists a relationship between age, race, and gender and PCPs offering telemedicine and U.S. households using telemedicine in the United States.

Study Population

The study population included all U.S. household adults aged 18 years and over from COVID-19 Round 3 of the Research and Development Survey (RANDS), which included panelists recruited in 2019 and 2020. The samples were defined by race and Hispanic origin (grouped by [a] Hispanic, [b] Black non-Hispanic, and [c] White non-Hispanic or other non-Hispanic), age group as 18–34 years, 35–49 years, 50–64 years, and 65 years and over; sex (male or female), education defined by associate's degree/some college or less and bachelor's degree or above; annual household income (less than $75,000 and more than $75,000), and providers offer telemedicine yes, no (CDC, 2021). By studying the U.S. population where there is documentation of evidence of telemedicine use among U.S. households using telemedicine and PCPs offering telemedicine, it is possible to gain insight into the association between age, gender, and race and PCPs offering telemedicine and uses of telemedicine among adults in the United States.

Sampling and Sampling Procedures

The sample size of 5,458 included in this study was drawn from the 7,852 panelists invited by the Naturally Occurring Retirement Community (NORC) sampled independently from previous rounds between May 17, 2021, and June 30, 2021. There was an overall completion rate of 69.5%, and of the 5,458 completed interviews, 4,181 (76.6%) were completed via web administration and 1,277 (23.4%) were completed via telephone. The research was conducted among the 5,458 adult U.S. population for administrators to improve and increase the use of telemedicine in the PCP setting. Effect size and sample size calculations in G Power are not available for a multinomial logistic regression, but a binomial regression was used to calculate the sample size of 786. The CDC through the National Center for Health Statistics (NCHS) and U.S. Census Bureau provided relevant data needed for the study. All data were retrieved from both the NCHS and U.S. Census Bureau databases, and based on Pearson's correlation coefficient, the strength and direction of the relationship between the variables were measured (CDC, 2021).

Operationalization of Variables and Validity

The samples retrieved from the CDC were appropriate to the study because the instruments measured the concept, behavior, and idea that they purported to measure and distinguished between every participant by race, gender, and age with and without the quality to be measured (Sürücü & Maslakçı, 2020, p. 2700). The samples for this study were randomly selected independently from NORC's AmeriSpeak Panel designed to obtain a representative sample of U.S. adults aged 18 and over (CDC, 2021). Structured interviews or questions were used to assess U.S. adults on their use of telemedicine and access healthcare.

The RANDS was developed by the NCHS (CDC, 2021). The survey was conducted in response to the COVID-19 pandemic to provide estimates of providers offering telemedicine and estimates of telemedicine use among U.S. households. The input variables investigated in the study were PCPs offering telemedicine, while the output variable was the number of U.S. adults by race, gender, and age who indicated that their PCPs offered telemedicine. The independent variables were age, race, and gender, and the dependent variables were "providers offer telemedicine" and "uses telemedicine." Both input and output variables were used in calculating scores. The analysis of multinomial logistic regression was conducted by including all the listed variables to establish a level of significance that would inform the overall purpose of the research study. To establish whether there was a significant correlation between the independent variables and the dependent variables stated in the hypothesis, multinomial logistic regression was used.

Table 1

Independent and Dependent Variables

Variable type	Variable	Variable scale
Dependent nominal variable	PCP offers telemedicine	Yes, No, Don't know, Web skip, Refused
Dependent nominal variable	Uses telemedicine	Yes, No, Don't know, Web skip, Refused
Independent continuous variable	Age	18–34 years, 35–49 years, 50–64 years, and 65 years and over
Independent nominal variable	Gender	Male, Female
Independent nominal variable	Race	Hispanic origin, Hispanic, Black non-Hispanic, White non-Hispanic, or other non-Hispanic

Table 2

Input and Output Variables for Analysis

Variable type	Variable
Output variables	PCP offering telemedicine
	Uses telemedicine
Input variable	Age variation using telemedicine
	Sex variation using telemedicine
	Race variation using telemedicine

Data Analysis

I evaluated the data using descriptive statistics. The analysis began by determining the independent variables age, race, and gender and the dependent variables “primary care provider offers telemedicine” (yes, no, don’t know, web skip, refuses) and “uses telemedicine” (yes, no, don’t know, web skip, refused). The next step was the conduct of a multinomial logistic regression analysis to evaluate or predict the relationship between the independent variables and the dependent variables. The multinomial logistic regression was performed using SPSS software and tested for hypotheses related to pseudo *R*-squared, coefficients for each factor, and *P*-value for each coefficient. To test for relationship between the independent variables and dependent variables, their scores were regressed jointly. Scatterplots were used in classifying the relationships among the variables.

Threats to Validity

The use of a correlational study exposed the research to threats of validity, especially confounding variables where education, geographical location, and chronic conditions were eliminated as variables when determining “primary care providers offer telemedicine” and “uses telemedicine.” There were also other confounding variables related to telemedicine use among U.S. household adults, which included gender identity, sexual orientation, education, and disability.

The interpretation of the multinomial logistic regression model used in the study must be considered, especially as it assumed probability distributions that included underlying assumptions, such as assumptions of normality, homoscedasticity, and independence of errors (Real et al., 2016, p. 1). In the model, it was assumed that a relationship existed between variables being investigated, and that every sample observed was independent of the others.

Ethical Procedures

This study did not include any interaction with human subjects, though data retrieved from the CDC may have contained information on U.S. household adults. No personal data or information were included in the study to ensure that individuals were protected. All data collected from the CDC for the analyses will be used and stored for not more than 2 years after the publication of findings of the research and will afterward be discarded permanently. All data in hard copies will be destroyed, thus making sure that there are no traces. Consent sought from the CDC was included in the study, and the university's Institutional Review Board (IRB) supervised data analysis and conclusions indicated in the study. It was important that confidentiality was taken into consideration throughout the data collection process, and that only authorized persons were allowed to access the data.

Summary

As earlier stated, the purpose of this study was to investigate the correlation between age, race, and gender and PCPs offering telemedicine and U.S. household adults using telemedicine. The significance of the study involves "how healthcare administrators can effectively remedy a variety of administrative, financial, and technical barriers to offering telemedicine" (Lintz, 2021, p. 6). As indicated in previous studies, "structure, process, and outcome indicators are potentially related to the integration of telemedicine" (Tossaint-Schoenmakers et al., 2021, p. 6). An effective way of improving the patient and provider experience through telemedicine is to focus on enhancing technology interoperability and usability while providing sufficient training for efficient telemedicine use (Sun et al., 2021, p. 2539). The purpose of this study was to prove that there is a correlation between the variables investigated using the correlational design method and multivariate model.

Section 3: Presentation of the Results and Findings Section

Introduction

Purpose

When physicians and their patients are physically remote from each other, telemedicine allows physicians to provide clinical services to their patients using some form of information-communication technology, such as phone and video conferencing (Shaver, 2022, p. 2). Given the advent of the COVID-19 pandemic, PCPs were known to transition to telemedicine use at a slow pace (Zachrison et al., 2021, p. 10). Race, gender, and age were among factors known to contribute to telemedicine access and use by physicians and patients (Drake et al., 2021, p. 54). Using data from 5,458 U.S. household adult respondents from NORC panelists, this study assessed the association or relationship between age, race, and sex and PCPs offering telemedicine and use of telemedicine among U.S. household adults. The study suggests that healthcare administrators need to focus on race, age, and gender of patients as an important dimension, which can help promote telemedicine equity and decrease the divide.

Research Questions

RQ1: What is the relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021?

H1o: There is no significant relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021.

H1a: There is a significant relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021.

RQ2: What is the relationship between age, gender, and race and uses of telemedicine during the coronavirus pandemic in 2021?

H2o: There is no significant relationship between age, gender, and race and uses telemedicine during the coronavirus pandemic in 2021.

H2a: There is a significant relationship between age, gender, and race and uses telemedicine during the coronavirus pandemic in 2021.

Data Collection of Secondary Data Set

For the study sample, a pooled secondary analysis of data from RANDS during COVID-19 between May 17, 2021, and June 30, 2021, was performed. For the survey, 5,458 interviews were completed with 7,852 panelists who were sampled independently, and 4,181 (76.6%) of the 5,458 were completed via web administration while 1,277 (23.4%) were completed via telephone. The first analysis to be evaluated involved the association of age, race, and gender and primary care provider offering telemedicine. The first primary outcome was "offered telemedicine" measured by the following question: "In the last 2 months, has this provider offered you an appointment with a doctor, nurse, or other health professional by video or by phone?" The second outcome, which was "uses telemedicine," was measured by the following question: "In the last 2 months, have you had an appointment with a doctor, nurse, or other health professional by video or by phone?" Thus, the second analysis to be evaluated involved the association of age, race, and gender and uses of telemedicine. The survey definition of telemedicine referred to video or phone. Using G* power *z*-tests calculation with a probability error of 0.05, 786 was the total minimum sample needed for statistical significance at a critical *z* of 1.95996. Using SPSS, a random sample of 786 was pulled from the total number of 5,458 interviews for the analyses, which enhanced the external validity or generalizability of the results.

Covariates

Covariates were chosen for these analyses because past studies showed that they had influence on access and use of telemedicine. Higher education and higher income were viewed as factors associated with higher probability of telemedicine utilization (Dahlgren et al., 2021, p. 9). Thus, the covariates included in these analyses were education (categories: associate’s degree/some college or less and bachelor’s degree or above), and annual household income (with Categories 1 through 16).

Baseline Descriptive and Demographic Characteristics of the Sample

Table 3

Demographic Characteristics of Participants

Baseline characteristic	*n*	%
Gender		
Male	365	46.4
Female	421	53.6
Race		
White	500	63
Black	116	14.8
Other	58	7.4
Hispanic	112	14.2
Age		
18–35	195	24.8
36–49	146	18.6
50–64	195	24.8
65 and over	250	31.8

Note. $N = 786$.

Descriptive Statistics

Table 4

Descriptive Statistics of Key Variables

Variable	Range	Variance	Mode	Median	*M*	*SD*
Age	3	1.366	4	3	2.64	1.168
Gender	1	.249	2	2	1.54	.499
Race	3	1.205	1	1	1.72	1.097

Note. *N* = 786.

Univariate Analyses for Offers Telemedicine

Table 5

Univariate Analyses for Variable Age

Between-subjects factors			
		Value label	*N*
Offers telemed	-1	-1	400
	1	Yes	152
	2	No	216
	77	Don't know	18
Age category	1	18–35	195
	2	36–49	146
	3	50–64	195
		65 and over	250

Table 5 outlines the number of U.S. household adults by age that fell into each response category. More than half of the sample, totaling 400, had missing responses, and those 65 years and older, totaling 250, were more numerous in the sample than those between 36 to 49 years of age, who, numbering 146, constituted the smallest age grouping. Most adults (216) responded “no” to indicate that their providers did not offer telemedicine, while 18 responded “don’t know.”

Table 6

Descriptive Analyses for Variable Age

Dependent variable: Offers telemed Uses telemed	Age category	Mean	Std. deviation	*N*
-1	18–35	4.28	17.042	117
	36–49	5.61	19.404	74
	50–64	3.07	12.696	107
	> 65	3.43	14.101	115
	Total	3.97	15.677	413
Yes	18–35	.28	.974	36
	36–49	-.17	1.000	36
	50–64	.00	1.013	40
	> 65	.22	.984	54
	Total	.10	.998	16
No	18–35	-.24	.983	42
	36–49	-.31	.963	35
	50–64	-.42	.919	48
	> 65	-.56	.837	81
	Total	-.42	.911	206
Don’t know	36–49	1.00		
	Total	1.00		
Total	18–35	2.57	13.360	195
	36–49	2.73	14.092	146
	50–64	1.58	9.550	195
	> 65	1.45	9.743	250
	Total	2.00	11.565	786

The totals section in Table 6 provides information on where different age groups fell in general, which shows that adults between the ages of 36 and 49 (M = 2.73, *SD=14.09*) were more likely to respond that their providers offered telemedicine, followed by those between 18 and 35 (*M = 2.57, SD = 13.36*). Older adults who were 65 and older were least likely to respond that their PCPs offered telemedicine (*M = 1.45, SD = 9.74).*

Table 7

Tests of Between-Subjects Effects for Age

Dependent variable: Offers telemed							
Source		Type III sum of squares	*df*	Mean square	F	Sig.	Partial eta squared
Intercept	Hypothesis	51.338	1	51.338	.413	.521	.001
	Error	95783.723	769.664	124.449 [a]			
TELEMEDUSE	Hypothesis	3402.832	3	1134.277	17.976	< .001	.432
	Error	4477.080	70.954	63.098 [b]			
Age_Categ	Hypothesis	64.509	3	21.503	.643	.605	.160
	Error	339.090	10.136	33.456 [c]			
TELMEDUSE*Age_Categ	Hypothesis	164.065	6	27.344	.209	.974	.002
	Error	101256.514	773	130.992 [d]			

[a] .057 MS(Age_Categ) + .003 MS(TELMEDUSE*Age_Categ) + .940 MS(Error). [b] .655 MS(TELMEDUSE*Age_Categ) + .345 MS(Error). [c] .941 MS(TELMEDUSE*Age_Categ) + .059 MS(Error). [d] MS(Error).

In Table 7, I looked for a significance level below the established alpha level of .05 on the relationship between age and the dependent variable "offers telemedicine." As shown, age is .160, which is not statistically significant and not related to "offers telemedicine." However, age with its interaction with "uses telemedicine" shows a significant *p*-value of .002; as such, age is related to "uses telemedicine."

Table 8

Descriptive Analyses for Variable Gender

Dependent variable: Offers telemed				
Uses telemed	Gender	Mean	Std. deviation	*N*
-1	Male	3.14	14.071	203
	Female	4.77	17.083	210
	Total	3.97	15.677	413
Yes	Male	.21	.984	76
	Female	.00	1.006	90
	Total	.10	.998	166
No	Male	-.35	.943	86
	Female	-.47	.888	120
	Total	-.42	.911	206
Don't know	Female	1.00		1
	Total	1.00		1
Total	Male	1.71	10.625	365
	Female	2.25	12.330	421
	Total	2.00	11.565	786

Table 8 with the dependent variable “offers telemedicine” provides information on means for different genders who responded “yes” (coded 1 with 166 in total), “no” (coded 2 with 206 in total), or “don’t know” (coded 77 with only one individual in total), and those with missing values (coded -1 with 413 in total). The totals section provides information on where males and females fell in general, which indicates that females (*M = 2.25, SD = 12.330*) were more likely to respond that their PCPs offered telemedicine than males (*M = 1.71, SD = 10.625*).

Table 9

Tests of Between-Subjects Effects for Gender

Dependent variable: Offers telemed							
Source		Type III sum of squares	*df*	Mean square	F	Sig.	Partial eta squared
Intercept	Hypothesis	35.116	1	35.116	.278	.598	.000
	Error	92278.024	730.539	126.315 [a]			
TELEMEDUSE	Hypothesis	3331.858	3	1110.619	11.673	.005	.841
	Error	629.001	6.611	95.147 [b]			
GENDER	Hypothesis	31.592	1	31.592	.390	.586	.138
	Error	196.918	2.431	81.003 [c]			
TELMEDUSE*GENDER	Hypothesis	155.975	2	77.988	.600	.549	.002
	Error	101317.200	779	130.061 [d]			

[a] .040 MS(GENDER) - .004 MS(TELMEDUSE*GENDER) + .964 MS(Error). [b] .670 MS(TELMEDUSE*GENDER) + .330 MS(Error). [c] .942 MS(TELMEDUSE*GENDER) + .058 MS(Error). [d] MS(Error).

Table 9 shows that the relationship between gender and “offers telemedicine” is not statistically significant, with a *p*-value of .586, and also not statistically significant with its interaction with “uses telemedicine” at .549.

Table 10

Univariate Analyses for Variable Race

Between-subjects factors			
		Value label	*N*
Offers telemed	-1	-1	400
	1	Yes	152
	2	No	216
	77	Don’t know	18
Race	1	White	500
	2	Black	116
	3	Other	58
	4	Hispanic	112

Table 10 outlines how many U.S. household adults fell into each racial category (i.e., White, Black, other, and Hispanic). As can be seen, White had the highest number at 500 while Other, at 58, was the lowest. Concerning “offers telemedicine,” most adults (216) indicated “no,” while 18 indicated “don’t know.”

Table 11

Descriptive Analyses for Variable Race

Dependent variable: Offers telemed

Uses telemed	Race	Mean	Std. deviation	*N*
-1	White	3.31	14.003	262
	Black	3.31	14.523	55
	Other	10.09	25.273	33
	Hispanic	4.10	16.499	63
	Total	3.97	15.677	413
Yes	White	.12	.998	102
	Black	.12	1.008	32
	Other	.17	1.030	12
	Hispanic	-.10	1.021	20
	Total	.10	.998	166
No	White	-.35	.939	136
	Black	-.38	.942	29
	Other	-1.00	.000	13
	Hispanic	-.50	.882	28
	Total	-.42	.911	206
Don't know	Hispanic	1.00		1
	Total	1.00		
Total	White	1.66	10.296	500
	Black	1.51	10.125	116
	Other	5.55	19.662	58
	Hispanic	2.17	12.540	112
	Total	2.00	11.565	786

Table 11 provides information on means for different races who responded “yes” (coded 1 with 166 in total), “no” (coded 2 with 206 in total), or “don’t know” (coded 77 with only one individual in total), and those with missing values (coded -1with 413 in total). Results show that adults of other race (*M= 5.55, SD=19.66*) were most likely to respond that their PCPs offered telemedicine, followed by Hispanic (*M = 2.17, SD=12.54*). Black participants were least likely to respond that their providers offered telemedicine (*M=1.51, SD=10.13*).

Table 12

Tests of Between-Subjects Effects for Race

Dependent variable: Offers telemed Source		Type III sum of squares	*df*	Mean square	F	Sig.	Partial eta squared
Intercept	Hypothesis	84.696	1	84.696	.680	.410	.001
	Error	75630.284	607.428	124.509 [a]			
TELMEDUSE	Hypothesis	3199.370	3	1066.457	8.899	< .001	.494
	Error	3276.327	27.339	119.840 [b]			
RACETHNICITY	Hypothesis	184.881	3	61.627	.553	.662	.193
	Error	770.879	6.918	111.433 [c]			
TELMEDUSE* RACETHNICITY	Hypothesis	661.740	6	110.290	.851	.531	.007
	Error	100211.915	773	129.640 [d]			

[a] .074 MS(RACETHNICITY) + .004 MS(TELMEDUSE* RACETHNICITY) + .922 MS(Error). [b] .506 MS(TELMEDUSE* RACETHNICITY) + .494 MS(Error). [c] .941 MS(TELMEDUSE* RACETHNICITY) + .059 MS(Error). [d] MS(Error).

In Table 12, we are looking for a significance level below the established alpha level of .05 on the relationship between race and the dependent variable offers telemedicine. As shown, race is .662 which is not statistically significant and therefore not related to offers telemedicine. Race with its interaction with uses telemedicine shows a significant p-value of .531. Thus, race is not statistically significant with uses telemedicine and offers telemedicine.

Univariate Analyses for Uses Telemedicine

Table 13

Univariate Analyses for Variable Age

Between-subjects factors			
		Value label	*N*
Uses telemed	-1	-1	413
	1	Yes	166
	2	No	206
	77	Don't know	1
Age_Categ	1	18–35	195
	2	36–49	146
	3	50–64	195
		65 and over	250

As can be seen in Table 13, for Uses Telemedicine, more than half (413) of the sample was missing, and adults who are 65 and over were more (250) while those between ages 36 to 49 (146) were the lowest. Most adults in the sample (206) responded No while only 1 of them responded Don't know.

Table 14

Descriptive Analyses for Variable Age

Dependent variable: Uses telemed				
Offers telemed	Age category	Mean	Std. deviation	*N*
-1	18–35	.04	1.340	100
	36–49	.39	1.317	80
	50–64	.56	1.352	91
	> 65	.79	1.362	129
	Total	.47	1.371	400
Yes	18–35	1.41	.498	39
	36–49	4.14	14.287	28
	50–64	1.41	.500	34
	> 65	1.35	.483	51
	Total	1.89	6.152	152
No	18–35	-1.00	.000	50
	36–49	-1.00	.000	33
	50–64	-1.00	.000	67
	> 65	-1.00	.000	66
	Total	-1.00	.000	216
Don’t know	18–35	-1.00	.000	6
	36–49	-1.00	.000	5
	50–64	-1.00	.000	3
	> 65	-1.00	.000	4
	Total	-1.00	.000	18
Total	18–35	.02	1.286	195
	36–49	.75	6.485	146
	50–64	.15	1.313	195
	> 65	.40	1.348	250
	Total	.31	3.041	786

In Table 14, those between the ages of 36 and 49 have the highest Mean of .75 while those between 18 and 35 have the lowest Mean= .02. The total’s section in the table shows where different age groups fall in general, and it shows that adults between the age of 36 to 49 (M= .75, SD=6.49) were most likely to respond that they use telemedicine followed by older adults who are 65 and older (M=.40, SD=1.35). Those between the age of 18 to 35 were least likely to respond that they use telemedicine (M=.02, SD=1.29).

Table 15

Tests of Between-Subjects Effects for Age

Dependent variable: Uses telemed							
Source		Type III sum of squares	*df*	Mean square	F	Sig.	Partial eta squared
Intercept	Hypothesis	3.718	1	3.718	.531	.516	.143
	Error	22.349	3.193	7.000 [a]			
TELEMED	Hypothesis	830.505	3	276.835	15.485	< .001	.833
	Error	166.141	9.293	17.878 [b]			
Age_Categ	Hypothesis	20.909	3	6.970	.600	.620	.056
	Error	353.110	30.403	11.614 [c]			
TELMED*Age_Categ	Hypothesis	164.083	9	18.231	2.243	.018	.026
	Error	6257.341	770	8.126 [d]			

[a] .974 MS(Age_Categ) + .026 MS (Error). [b] .965 MS(TELMED*Age_Categ) + .035 MS (Error). [c] .345 MS(TELMED*Age_Categ) + .655 MS(Error). [d] MS(Error).

In Table 15, we observe that the relationship between age and Uses Telemedicine is not statistically significant with a p value of .056, but statistically significant when interacting with Offers Telemedicine at .026.

Table 16

Descriptive Analyses for Variable Gender

Dependent variable: Uses telemed				
Offers telemed	Gender	Mean	Std. deviation	*N*
-1	Male	.26	1.371	186
	Female	.65	1.347	214
	Total	.47	1.371	400
Yes	Male	1.38	.488	74
	Female	2.38	8.572	78
	Total	1.89	6.152	152
No	Male	-1.00	.000	98
	Female	-1.00	.000	118
	Total	-1.00	.000	216
Don’t know	Male	-1.00	.000	7
	Female	-1.00	.000	11
	Total	-1.00	.000	18
Total	Male	.12	1.302	365
	Female	.47	3.969	421
	Total	.31	3.041	786

Table 16 gives us information on where people fall in general, and it shows that females are more likely to respond that they use telemedicine (M=.47, SD=3.97) than males (M= .12, SD=1.30).

Table 17

Tests of Between-Subjects Effects for Gender

Dependent variable: Uses telemed

Source		Type III sum of squares	*df*	Mean square	F	Sig.	Partial eta squared
Intercept	Hypothesis	1.579	1	1.579	.232	.714	.188
	Error	6.809	1	6.809 [a]			
TELEMED	Hypothesis	780.437	3	260.146	33.630	.008	.971
	Error	23.207	3	7.736 [b]			
GENDER	Hypothesis	6.809	1	6.809	.844	.366	.029
	Error	224.951	27.881	8.068 [c]			
TELMED*GENDER	Hypothesis	23.207	3	7.736	.939	.421	.004
	Error	6409.891	778	8.239 [d]			

[a] MS(GENDER). [b] MS(TELMED*GENDER). [c] .339 MS(TELMED*GENDER) + .661 MS(Error). [d] MS(Error).

In Table 17, we are looking for a significance level below the established alpha level of .05 on the relationship between gender and the dependent variable uses telemedicine. As shown, gender is .366 is not statistically significant and therefore not related to uses telemedicine. Gender with its interaction with offers telemedicine shows a significant p-value of .421. As such gender is not statistically significant with uses telemedicine or offers telemedicine.

Table 18

Univariate Analyses for Variable Race

Between-subjects factors			
		Value label	*N*
Uses telemed	-1	-1	413
	1	Yes	166
	2	No	206
	77	Don’t know	1
Race	1	White	500
	2	Black	116
	3	Other	58
	4	Hispanic	112

Table 18 outlines how many United States Household adults by race fell into each category of White, Black, Other, or Hispanic. As can be seen, White has a higher number of 500 while Other is 58 as the lowest. Most adults (206) indicated No while only 1 of them indicated Don’t know.

Table 19

Descriptive Analyses for Variable Race

Dependent variable: Uses telemed

Offers telemed	Race	Mean	Std. deviation	*N*
-1	White	.48	1.376	248
	Black	.47	1.346	60
	Other	.69	1.391	29
	Hispanic	.35	1.381	63
	Total	.47	1.371	400
Yes	White	1.44	.498	101
	Black	1.33	.480	27
	Other	1.00	.000	7
	Hispanic	5.88	18.333	17
	Total	1.89	6.152	152
No	White	-1.00	.000	142
	Black	-1.00	.000	27
	Other	-1.00	.000	18
	Hispanic	-1.00	.000	29
	Total	-1.00	.000	216
Don't know	White	-1.00	.000	9
	Black	-1.00	.000	2
	Other	-1.00	.000	4
	Hispanic	-1.00	.000	3
	Total	-1.00	.000	18
Total	White	.22	1.330	500
	Black	.30	1.294	116
	Other	.09	1.302	58
	Hispanic	.80	7.384	112
	Total	.31	3.041	786

Table 19 shows that Hispanic race are most likely to respond that they use telemedicine (M=.80, SD= 7.38) followed by Black race (M=.30, SD= 1.29) Adults from other race were least likely to respond that they use telemedicine (M=.09, SD=1.30).

Table 20

Tests of Between-Subjects Effects for Race

Dependent variable: Uses telemed

Source		Type III sum of squares	*df*	Mean square	F	Sig.	Partial eta squared
Intercept	Hypothesis	8.006	1	8.006	.697	.454	.159
	Error	42.375	3.688	11.489 [a]			
TELMED	Hypothesis	520.000	3	173.333	7.204	.006	.666
	Error	260.938	10.845	24.060 [b]			
RACETHNICITY	Hypothesis	36.187	3	12.062	.734	.545	.107
	Error	300.737	18.301	16.433 [c]			
TELMED* RACETHNICITY	Hypothesis	269.506	9	29.945	3.746	< .001	.042
	Error	6155.909	770	7.995 [d]			

[a] .859 MS(RACETHNICITY) + .141 MS(Error). [b] .732 MS(TELMED* RACETHNICITY) + .268 MS(Error). [c] .384 MS(TELMED* RACETHNICITY) + .616 MS(Error). [d] MS(Error).

In Table 20, we can observe that the relationship between race and uses telemedicine is not statistically significant with a p-value of .545, but statistically significant with its interaction with offers telemedicine at <.001. The result indicates that race is only statistically significant with providers offering telemedicine when the dependent variable is uses telemedicine.

Statistical Assumptions for Multinomial Logistic Regression

In multinomial logistic model, it is assumed that data are case-specific and that the independent variables age, gender, and race each has a single value for each case. The model also assumes that the dependent variables primary care provider offers telemedicine and uses of telemedicine cannot be perfectly predicted from the independent variables for any case. The dependent variables in the study are measured at the nominal level which fulfill the assumption of the model, and all three independent variables are treated as categorical (Nominal) for the purpose of multinomial logistic regression. There is independence of observations, and the dependent variables are mutually exclusive and exhaustive categories. The response options for the dependent variables are mutually exclusive since they do not overlap one another, and the survey response options are collectively exhaustive.

There is no multicollinearity which only occurs when there are two or more independent variables that are highly correlated with each other. For multicollinearity, 1 is the lowest value we can go for the value of VIF. Higher values of Variance Inflation Factor (VIF) are associated with multicollinearity with an accepted cut-off of 2.5. In the coefficients table for each independent variables alternated, lower values of VIF denote no levels of multicollinearity and they positively impact the regression model. For the collinearity diagnostics tables, the condition index for all variables is less than 30 which is the conventional threshold and indicates no problem with collinearity. The variance proportion, none of the dimensions indicate collinearity as there are no two variables on each going above the threshold of .50.

Table 21

Multicollinearity: Age

Coefficients [a]			
		Collinearity statistics	
Model		Tolerance	VIF
1	Level of education	.885	1.131
	Gender	.980	1.020
	Level of income	.864	1.157
	Race	.987	1.013

[a] Dependent variable: Age_Categ.

Table 22

Multicollinearity: Gender

Coefficients [a]			
		Collinearity statistics	
Model		Tolerance	VIF
1	Level of education	.880	1.137
	Level of income	.865	1.156
	Race	.941	1.063
	Age_Categ	.926	1.080

[a] Dependent variable: Gender.

Table 23

Multicollinearity: Race

Coefficients [a]			
		Collinearity statistics	
Model		Tolerance	VIF
1	Level of education	.879	1.137
	Level of income	.862	1.160
	Age_Categ	.969	1.032
	Gender	.977	1.023

[a] Dependent variable: Race.

Table 24

Collinearity Diagnostics: Age

Collinearity diagnostics [a]

Model	Dimension	Eigenvalue	Condition index	Variance proportions (Constant)	Level of education	Gender	Level of income	Race
1	1	4.530	1.000	.00	.00	.00	.01	.01
	2	.266	4.128	.00	.01	.00	.08	.82
	3	.129	5.926	.00	.00	.38	.40	.11
	4	.054	9.197	.04	.42	.38	.50	.03
	5	.022	14.506	.95	.57	.24	.01	.03

[a] Dependent variable: Age_Categ.

Table 25

Collinearity Diagnostics: Gender

Collinearity diagnostics [a]

Model	Dimension	Eigenvalue	Condition index	Variance proportions (Constant)	Level of education	Level of income	Race	Age_Categ
1	1	4.447	1.000	.00	.00	.01	.01	.01
	2	.293	3.894	.00	.00	.02	.70	.09
	3	.178	5.005	.00	.01	.30	.04	.43
	4	.061	8.517	.05	.34	.67	.15	.21
	5	.020	14.729	.95	.65	.01	.10	.25

[a] Dependent variable: Gender.

Table 26

Collinearity Diagnostics: Race

Collinearity diagnostics [a]								
				Variance proportions				
Model	Dimension	Eigenvalue	Condition index	(Constant)	Level of education	Level of income	Age_Categ	Gender
1	1	4.623	1.000	.00	.00	.01	.01	.00
	2	.182	5.039	.00	.01	.23	.53	.00
	3	.125	6.082	.00	.00	.25	.20	.43
	4	.052	9.401	.02	.49	.48	.05	.32
	5	.018	15.944	.97	.50	.03	.21	.25

[a] Dependent variable: Race.

Table 27

Statistics

		Gender	Race	Age_Categ
N	Valid	786	786	786
	Missing	0	0	0
Mean		1.54	1.72	2.64
Median		2.00	1.00	3.00
Mode		2	1	4
Std. deviation		.499	1.097	1.169
Variance		.249	1.205	1.366
Skewness		-.143	1.215	-.198
Std. error of skewness		.087	.087	.087
Range		1	3	3
Minimum		1	1	1
Maximum		2	4	4

There should be no outliers. The Skewness for age group which is -.198 and gender -.143 indicate that the tails of their distribution curve are longer on the left side and that the outliers of their distribution curve are further out towards the left and away from the mean on the right. As for race, the skewness is positive 1.215, which indicates that the tail of the distribution curve is longer on the right side and that the outliers of the distribution curve are further out towards the right and closer to the mean on the left.

Statistical Analysis Findings Organized by Research Question

Research Question 1

RQ1: What is the relationship between age, gender and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021?

H1o: There is no significant relationship between age, gender, and race and primary care providers offering telemedicine during coronavirus pandemic in 2021

H1a: There is a significant relationship between age, gender, and race and primary care providers offering telemedicine during coronavirus pandemic in 2021.

Analysis and Confidence Intervals Around the Statistics

Prior to performing a multinomial logistic regression, an attempt was made to utilize binomial logistic regression with responses Yes =1 and No = 0 by removing the responses “Don’t Know” and “Missing”. The purpose of removing missing values is because if left in the analyses, they reduce statistical power which leads to the probability that the test will reject the null hypothesis when it is false, and that data can cause bias

(Kang, 2013, pg. 402). A listwise or case deletion was performed to omit cases with the don't know and missing data, and to analyze the remaining data (Kang, 2013, pg. 403). Using listwise deletion reduced the sample size from 786 to 151which is significant, thus making the sample to be biased because it doesn't adequately represent the population. A 151-reduction indicated that data was missing at random (MAR) because the missing responses depended on the set of observed responses (Kang, 2013, pg. 403). The multinomial logistic regression which is an extension of binomial model, where the response variable can have three or more possible outcomes was used for further analyses while retaining don't know and missing values by recoding all missing values with -1 (Hashimoto et al, 2020, pg. 2160).

The p-value, or probability value in logistic regression, tells how likely it is that the data could have occurred under the null hypothesis. For this study, $P > 0.05$ is the probability that the null hypothesis is true. 1 minus the P value is the probability that the alternative hypothesis is true. A statistically significant test result ($P \leq 0.05$) means that the test hypothesis is false or should be rejected. A p-value greater than 0.05 means that no effect was observed.

The confidence interval is the range of values that one expects the estimate to fall between a certain percentage, and the confidence level is the percentage of times one expects to reproduce an estimate between the upper and lower bounds of the confidence interval and is set by the alpha value .05. 95% Confidence Interval for Exp(B) is the Confidence Interval (CI) for each multinomial odds ratio given the other predictors are in the model for outcome offers telemedicine relative to the referent group (N0=0). Both tables for "offers telemed" show that each odds ratio falls within each upper and lower bounds, as such the "true" population multinomial odds ratio lie between the lower and upper limit of the interval for outcomes for offers telemedicine.

Table 28

Offers Telemed Model Fitting Information

	Model fitting criteria	Likelihood ratio tests		
Model	-2 log likelihood	Chi-square	*df*	Sig.
Intercept only	1348.031			
Final	1331.288	16.742	15	.335

The model fitness is assessed using the chi-square statistic. For this table, the chi-square value is 16.742 and the p-value is .335 which is greater than 0.05, as such, the model does not fit the data better than a model with no parameters in it.

Table 29

Offers Telemed Goodness-of-Fit

	Chi-square	*df*	Sig.
Pearson	1321.895	1353	.722
Deviance	1077.485	1353	1.000

The Goodness-of-Fit table contains the Deviance and Pearson chi-square tests help determine if the model exhibits good fit to the data. For this table both test results are not significant and indicate good fit.

Table 30

Offers Telemedicine Pseudo R-Square

Cox and Snell	.021
Nagelkerke	.024
McFadden	.010

The Pseudo R-Square measures are Cox and Snell (.021), Nagelkerke (.024), and McFadden (.010).

Table 31

Offers Telemed Likelihood Ratio Tests

	Model fitting criteria	Likelihood ratio tests		
Effect	-2 log likelihood of reduced model	Chi-square	*df*	Sig.
Intercept	1345.099	13.811	3	.003
Level of education	1337.889	6.601	3	.086
Gender	1332.065	.777	3	.855
Level of income	1335.904	4.616	3	.202
Race	1335.052	3.764	3	.288
Age_Categ	1332.692	1.403	3	.705

Note. The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

For the likelihood ratio tests table, where the p value is less than .05, that variable has a significant overall effect on the outcome. But where the p value is greater than .05, that variable does not have a significant overall association with the outcome. Using the Alpha = .05 threshold, it can be noted that among the variables of interest that none were a significant predictor in the model, and so are the covariates level of education and level of income. Thus, each P > 0.05 in the model is the probability that the null hypothesis is true.

Table 32

Offers Telemed Parameter Estimates

								95% confidence interval for Exp(B)	
	Offers telemed [a]	B	Std. error	Wald	*df*	Sig.	Exp(B)	Lower bound	Upper bound
-1	Intercept	1.509	.581	6.755	1	.009			
	Level of education	-.300	.126	5.661	1	.017	.741	.578	.948
	Gender	-.047	.172	.075	1	.785	.954	.680	1.337
	Level of income	.015	.022	.485	1	.486	1.016	.972	1.060
	Race	.056	.080	.493	1	.483	1.058	.904	1.238
	Age_Categ	-.056	.076	.544	1	.461	.946	.815	1.097
Yes	Intercept	.231	.729	.101	1	.751			
	Level of education	-.136	.158	.750	1	.387	.873	.641	1.188
	Gender	-.103	.215	.230	1	.631	.902	.592	1.375
	Level of income	.027	.028	.900	1	.343	1.027	.972	1.085
	Race	-.079	.104	.577	1	.447	.924	.753	1.134
	Age_Categ	-.052	.094	.307	1	.580	.949	.789	1.142
Don’t know	Intercept	-2.961	1.753	2.853	1	.091			
	Level of education	-.478	.362	1.742	1	.187	.620	.305	1.261
	Gender	.317	.510	.387	1	.534	1.374	.505	3.736
	Level of income	.142	.073	3.838	1	.050	1.153	1.000	1.330
	Race	.264	.202	1.702	1	.192	1.302	.876	1.935
	Age_Categ	-.237	.225	1.107	1	.293	.789	.507	

[a] The reference category is No.

In the parameters table for "Offers Telemed", each value was coded. Yes = 1, No = 0, Don't know = 77, and Missing = -1 with the reference category as No. The predictor variables are categorical and the results in the table provide information that compares each independent variable against the reference category No = 0. If the p-value is less than .05 and the adjusted odds ratio with its 95% confidence interval (CI) is above 1.0, the risk of the outcome occurring increases that many more times versus the reference category outcome. But if the p-value is less than .05 and the adjusted odds ratio with its 95% CI is below 1.0, then the risk of the outcome occurring decreases that many times versus the reference category outcome. And where the p-value is greater than .05, then the 95% confidence interval (CI) for the adjusted odds ratio crosses over 1.0 and the association is non-significant. The first set of coefficients represents comparison between No (0) and Missing (-1). None of the variables of interest (age, gender, and race) were statistically significant predictors, except the covariate level of education (.017). In the model, age was (b = -.056, s.e . = .076, p = .461) which indicates no significance. Gender (b = -.047, s.e. = .172, p = .785) indicated non-significance, and the p-value was greater than .05 (.785). For race (b = .056, s.e. = .080, p = .483) which indicated non-significance, the p-value was greater than .05 (.483).

For the second set of coefficients Yes = 1, there is the comparison of Yes versus No, and none of the predictors were statistically significant in the model. As such, each P > 0.05 was the probability that the null hypothesis is true. In the model, age was (b = .052, s.e. = .094, p = .580) indicating not statistically significant, and the p value was greater than .05 (.580). For gender (b = -.103, s.e. = .215, p = .631) which indicated nonstatistical significance, the p-value was greater than .05 (.631). Race (b = -.079, s.e. = .104, p = .447) indicated non-significance since the p-value was greater than .05 (.447).

The final set of coefficients represent comparison between No = 0 and those who responded Don't Know = 77. None of the variables of interest (age, gender, and race) were statistically significant predictors since each P > 0.05 causing the probability of the null hypothesis to be true. For gender (b = .317, s.e. = .510, p = .534), the p value was greater than .05 (.534)**.** Age (b = -.237, s.e. = .225, p = .293) indicated non significance where the p-value is greater than .05 (.293). As for race (b = .264, s.e. = .202, p = .192) which was not statistically significant, the p-value was greater than .05 (.192).

Research Question 2

RQ2: What is the relationship between age, gender, and race and uses of telemedicine during the coronavirus pandemic in 2021?

H2o: There is no significant relationship between age, gender, and race and uses telemedicine during coronavirus pandemic in 2021.

H2a: There is a significant relationship between age, gender, and race and uses telemedicine during coronavirus pandemic in 2021.

Analysis and Confidence Intervals Around the Statistics

The p-value, or probability value, tells how likely it is that the data could have occurred under the null hypothesis. For this study, P > 0.05 is the probability that the null hypothesis is true. 1 minus the P value is the probability that the alternative hypothesis is true. A statistically significant test result ($P \leq 0.05$) means that the test hypothesis is false or should be rejected. A p-value greater than 0.05 means that no effect was observed.

The confidence interval is the range of values that one expects the estimate to fall between a certain percentage, and the confidence level is the percentage of times one expects to reproduce an estimate between the upper and lower bounds of the confidence interval and is set by the alpha value .05. 95% Confidence Interval for Exp(B) is the Confidence Interval (CI) for each multinomial odds ratio given the other predictors are in the model for outcome uses telemedicine relative to the referent group (Yes). For a given predictor with a level of 95% confidence, it is possible to assume a 95% confidence that the “true” population multinomial odds ratio lies between the lower and upper limit of the interval for outcomes either for uses telemedicine or offers telemedicine relative to the referent group (Yes). The CI is equivalent to the z test statistic if the CI includes one, we’d fail to reject the null hypothesis that a particular regression coefficient is zero given the other predictors are in the model. An advantage of a CI is that it is illustrative; it provides a range where the “true” odds ratio may lie. Both tables for “uses telemed” show that each odds ratio falls within each upper and lower bounds, as such the “true” population multinomial odds ratio lie between the lower and upper limit of the interval for outcomes for uses telemedicine.

Table 33

Uses Telemed Model Fitting Information

	Model fitting criteria	Likelihood ratio tests		
Model	-2 log likelihood	Chi-square	*df*	Sig.
Intercept only	1249.623			
Final	1211.053	38.571	15	< .001

The model fitness is assessed using the chi-square statistic. As shown, the chi-square value is 38.571 and the p-value is <.001 less than 0.05. This proves that there is a significant relationship between the dependent variable and the independent variable in the final model.

Table 34

Uses Telemed Goodness-of-Fit

	Chi-square	*df*	Sig.
Pearson	968.497	1353	1.000
Deviance	975.284	1353	1.000

The table which contains the Deviance and Pearson chi-square tests help determine if the model exhibits good fit to the data. In this case the two test results which are not significant indicate good fit.

Table 35

Uses Telemedicine Pseudo R-Square

Cox and Snell	.048
Nagelkerke	.055
McFadden	.024

The Pseudo R-Square measures are Cox and Snell (.048), Nagelkerke (.055), and McFadden (.024). The model accounts for 2.4% to 5.5% of the variance and represents relatively a descent sized effect.

Table 36

Uses Telemed Likelihood Ratio Tests

Effect	Model fitting criteria -2 log likelihood of reduced model	Likelihood ratio tests Chi-square	*df*	Sig.
Intercept	1232.232	21.180	3	< .001
Level of education	1212.845	1.792	3	.617
Gender	1218.025	6.973	3	.073
Level of income	1234.742	20.689	3	< .001
Race	1214.580	3.528	3	.317
Age_Categ	1222.231	11.179	3	.011

Note. The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

For the likelihood ratio tests table, where the p value is less than .05, that variable has a significant overall effect on the outcome. But where the p value is greater than .05, that variable does not have a significant overall association with the outcome. The results as shown in the table indicates the likelihood ratio of the overall contribution of each independent variable to the model. Using the Alpha = .05 threshold, it can be noted that among the variables of interest which are age, gender, and race, that age group with a value of .011 was the only significant predictor in the model. Level of income as a covariate was also statistically significant <.001.

Table 37

Uses Telemed Parameter Estimates

Uses telemed [a]		B	Std. error	Wald	*df*	Sig.	Exp(B)	95% confidence interval for Exp(B) Lower bound	Upper bound
-1	Intercept	2.539	.616	16.993	1	< .001			
	Level of education	.167	.127	1.719	1	.190	1.182	.921	1.517
	Gender	-.437	.178	6.058	1	.014	.646	.456	.915
	Level of income	-.091	.024	14.832	1	< .001	.913	.871	.956
	Race	-.012	.082	.020	1	.887	.988	.841	1.161
	Age_Categ	-.262	.079	10.887	1	< .001	.770	.659	.899
Yes	Intercept	1.647	.737	5.000	1	.025			
	Level of education	.102	.155	.429	1	.512	1.107	.817	1.500
	Gender	-.306	.216	2.008	1	.156	.736	.482	1.124
	Level of income	-.110	.028	15.250	1	< .001	.896	.848	.947
	Race	-.046	.101	.206	1	.650	.955	.783	1.165
	Age_Categ	-.177	.096	3.411	1	.065	.838	.694	1.011
Don't know	Intercept	-97.337	5.298	337.577	1	< .001			
	Level of education	.546	1.716	.101	1	.750	1.726	.060	49.864
	Gender	16.322	.000		1		12264118.575	12264118.575	12264118.575
	Level of income	-.316	.305	1.070	1	.301	.729	.401	1.327
	Race	15.759	.000		1		6981889.525	6981889.525	6981889.525
	Age_Categ	-.121	1.002	.015	1	.904	.886	.124	6.310

[a] The reference category is No.

In the parameters table for "Uses Telemed", each value was coded. Yes = 1, No = 0, Don't know = 77, and Missing = -1 with the reference category as No. The predictor variables are also categorical and the results in the table provide information that compares each independent variable against the reference category No = 0. If the p-value is less than .05 and the adjusted odds ratio with its 95% confidence interval (CI) is above 1.0, the risk of the outcome occurring increases that many more times versus the reference category outcome. But if the p-value is less than .05 and the adjusted odds ratio with its 95% CI is below 1.0, then the risk of the outcome occurring decreases that many times versus the reference category outcome. And where the p-value is greater than .05, then the 95% confidence interval (CI) for the adjusted odds ratio crosses over 1.0 and the association is non-significant. The first set of coefficients represents comparison between No (0) and Missing (-1). Gender ($p=.014$) and age ($p<.001$) were statistically significant predictors among the variables of interest, except race ($p=.887$). Thus, each $P < 0.05$ for gender and age is the probability that the null hypothesis is false, that there is significant relationship between age and gender, and use of telemedicine during coronavirus pandemic in 2021. And $p > .05$ for race is the probability that the null hypothesis is true. In the model, age is ($b=-.262$, s.e.$=.079$, $p<.001$) indicating statistical significance, where the p value is less than .05 and the 95% confidence interval (CI) (LB= .659, UB= .899) for the adjusted odds ratio is less than 1.0 at .770. Thus, a one-unit increase in the variable age is associated with a .262 decrease in the relative log odds of using telemedicine versus No**.** Gender ($b=-.437$, s.e.$=.178$, $p=.014$) indicates statistical significance, where the p-value is less than .05 (.014), and the 95% confidence interval

(CI) (LB=.456, UB=.915) for the adjusted odds ratio is less than 1.0 at .646. Thus, females coded 0 were 44% more likely to use telemedicine when compared to males coded 1. For race (b= -.012, s.e.=.082, p=.887) indicating non-significance, the p-value is greater than .05 (.887).

For the second set of coefficients Yes=1, there is the comparison of Yes versus No coded 0, and none of the predictors of interest were statistically significant in the model. As such, each P > 0.05 is the probability that the null hypothesis is true. In the model, age is (b= -.177, s.e.=.096, p=.065) indicates not statistically significant, and the p value is greater than .05 (.065). For gender (b= -.306, s.e.=.216, p=.156) which indicates nonstatistical significance, the p-value is greater than .05 (.156)**.** For race (b=-.046, s.e.=.101, p=.650) indicating non-significance, the p-value is greater than .05 (.650)**.**

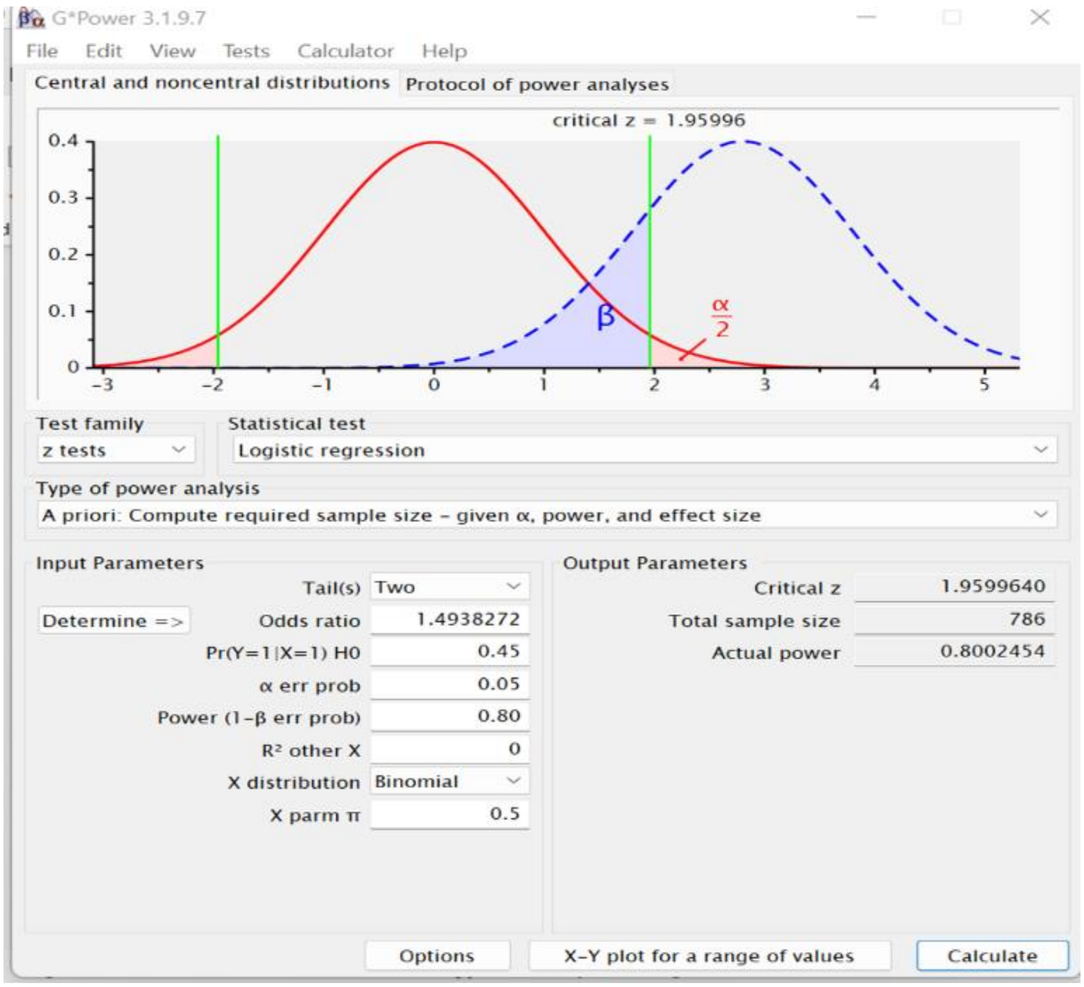
The final set of coefficients represent comparison between No = 0 and those who responded Don’t Know = 77. Of the variables of interest (age, gender, and race), only gender (.000) and race (.000) were statistically significant predictors since each P < 0.05 causing the probability of the null hypothesis to be false, that there is significant relationship between gender, and race and using telemedicine during coronavirus pandemic in 2021. Gender (b=16.322, s.e.=.000, p=.000) where the p value is less than .05 (.000) and the 95% confidence interval (CI) (LB=12264118.575, UB=12264118.575) for the adjusted odds ratio is greater than 1.0 at 12264118.575. Thus, females coded 0 were 16322% more likely to use telemedicine when compared to males coded 1**.** Age (b= -.121, s.e.=1.002, p=.904) indicates non significance where the p-value is greater than .05 (.904). As for race (b=15.759, s.e.=.000, p=.000) which is statistically significant, the p-value is less than .05 (.000) and the 95% confidence interval (CI) (LB=6981889.525, UB=6981889.525) for the adjusted odds ratio is greater than 1.0 at 6981889.525. Thus, the group response Don’t know coded 77 will be more likely to use telemedicine than the group No coded 0.

Effect and Sample Sizes

Effect size and sample size calculations in G Power are not available for a multinomial logistic regression, but a binomial regression was used to calculate the sample size of 786.

Figure 1

Effect Size and Sample Size



Summary

As a result of the Covid-19 pandemic, primary care physicians (PCPs) and their patients transitioned to telemedicine use, especially at a slower pace (Zachrison et al., 2021, p. 10). The study assesses the relationship between age, race, and sex and primary care providers offering telemedicine and use of telemedicine among United States household adults. The study suggests that healthcare administrators need to focus on race, age, and gender of patients as an important dimension to promoting telemedicine equity and decrease the divide. Education and income were included as covariates as they were viewed as factors associated with higher probability of telemedicine utilization (Dahlgren et al., 2021, pg. 9). The first research question in the study states, "what is the relationship between age, gender, and race and uses telemedicine during the coronavirus pandemic in 2021?" The second research question states, "what is the relationship between age, gender and race and providers offering telemedicine during the coronavirus pandemic in 2021?"

Univariate analysis indicated that the highest Means were those between the ages of 36 and 49 with 2.73 for uses telemedicine and .75 for offers telemedicine. Age with a p-value of .160 was not statistically significant, as such had no relationship with offers telemedicine. Also, age was not statistically significant at .056 in its relationship with uses telemedicine. Gender with a p-value of .366 was not statistically significant and therefore not related to uses telemedicine. Result was also not statistically significant at .421 and had no relationship with offers telemedicine. With regards to race, adults from Other race had the highest Mean=5.55 for uses telemedicine while Blacks with M= 1.51 was the lowest. Hispanic race had a higher M=.80 while Other race had the lowest M=.09 for offers telemedicine. Race was not statistically significant for uses telemedicine p=.531 and also not significant for offers telemedicine where p=.662.

To answer the research questions posed, I ran a multinomial logistic regression on "uses telemedicine" and "offers telemedicine". The first set of coefficients for uses telemedicine represents a comparison between No=0 and those with Missing values, the p-values for gender (.014) and age (<.001) was < 0.05 in the model which indicated the probability that the null hypothesis was false. As such there is significant relationship between age and gender and uses telemedicine during coronavirus pandemic in 2021. Race (.887) was not statistically significant, and the null hypotheses was true. For the second set of coefficients Yes, each P > 0.05 in the model for variables of interest is the probability that the null hypothesis is true. For the final set of coefficients Don't know, gender (.000) and race (.000) were positive significant predictors, where the p=.000 for each is less than .05 and the probability that the null hypothesis is false, and there is a significant relationship between gender and race and uses telemedicine during coronavirus pandemic in 2021. Age (.904) was not statistically significant, and the probability that the null hypothesis is true.

For answers to the research question on "primary care provider offers telemedicine", the first set of coefficients represents a comparison between No=0 and those Missing=-1. None of the variables here were statistically significant predictors. For the second set of coefficients Yes=1, none of the predictors were statistically significant in the model. The final set of coefficients Don't Know=77, none of the variables here were statistically significant predictors since each P > 0.05 and the null hypothesis is true.

Transitional Material From Findings

The results in this study identified race and gender as key factors to telemedicine access and use. There have been documentations on factors determining access and use of telemedicine in primary care settings and among them are age, gender, and race. Healthcare administrators need to apply professional interpretation when utilizing these factors, especially as they relate to federal and states laws requiring health programs receiving federal funds like Medicare and Medicaid needing to meet the needs of patients irrespective of their demographic status. Even when federal and state mandates are in place some healthcare facilities and their providers do not take into consideration the demographics of their patients when providing telemedicine. Since the provision of care through telemedicine pose as a challenge to primary care settings, it is important that administrators in those settings put in place means for which providers can remain compliant when providing telemedicine services, especially as it relates to telemedicine implementation during periods of pandemic like that of COVID-19 pandemic.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

Purpose

When physicians and their patients are physically remote from each other, telemedicine allows physicians to provide clinical services to their patients using some form of information-communication technology such as phone and video conferencing (Shaver, 2022, p. 2). With the advent of the COVID-19 pandemic, PCPs were known to transition to telemedicine use at a slower pace (Zachrison et al., 2021, p. 10). Race, gender, and age were among factors known to contribute to telemedicine access and use by physicians and patients (Drake et al., 2021, p. 54). Using data from 5,458 U.S. household adult respondents from NORC panelists, this study assessed the association or relationship between age, race, and sex and PCPs offering telemedicine and use of telemedicine among U.S. household adults. The study suggests that healthcare administrators need to focus on race, age, and gender of patients as important dimensions that can help in promoting telemedicine equity and decrease the divide.

Research Questions

RQ1: What is the relationship between age, gender, and race and primary care providers offering telemedicine during the coronavirus pandemic in 2021?

RQ2: What is the relationship between age, gender, and race and uses of telemedicine during the coronavirus pandemic in 2021?

Univariate Key Findings

Univariate statistics consist of a series of independent analyses of each variable, which are conducted by examining the range of values and describe the pattern of response to the variable and the central tendency of the values (Todorov et al., 2020, p. 4). For this study, a univariate analysis showed that 206 adults in the age category responded "no" to indicate that they did not use telemedicine, while 216 of them responded "no" to indicate that their PCPs did not offer telemedicine. Adults who were between the ages of 36 and 49 had the highest mean (*M = 2.73*) for use of telemedicine, while those who were 65 and over had the lowest mean (*M* = 1.45). For those who indicated that their providers offered telemedicine, adults between the ages of 36 and 49 had the highest mean (*M* = .75), while those between 18 and 35 had the lowest (*M* = .02). Females were more likely to respond that they used telemedicine *(M = .47)* than males (M= .12). Additionally, females *(M = 2.25)* were more likely to respond that their PCPs offered telemedicine than male respondents (*M = 1.71*). With regard to race, "other" had the highest *mean (M = 5.55)* for those who indicated that they used telemedicine, while

Black had the lowest *(M = 1.51*), which was almost same as White *(M = 1.66).* With reference to providers offering telemedicine, Hispanics had the highest mean *(M = .80),* with other race having the lowest (*M = .09).*

The univariate analyses for primary care providers offering telemedicine indicated age having a *p*-value =.160, which is not statistically significant, and as such, not related to primary care providers offering telemedicine. Regarding adults using telemedicine, age had a *p*-value = .056, which is not statistically significant and means that age has no relationship with adults using telemedicine. As for gender and its relationship with either primary care provider offering telemedicine or adult using telemedicine, the *p*-value = .366 for gender in relation to adult using telemedicine is not statistically significant. This result means that gender has no relationship with using telemedicine. With a *p*-value = .586, gender is also not statistically significant and has no relationship with provider offering telemedicine. Race, with a *p*-value = .662, is not statistically significant and therefore not related to primary care provider offering telemedicine. With a *p*-value = .545, which is not statistically significant, race has no relationship with adult using telemedicine.

Statistical Assumptions Key Findings

Assumptions for multinomial logistic regressions were met. Data were case-specific, and the independent variables age, gender, and race each had a single value for each case. The dependent variables PCP offering telemedicine and adult use of telemedicine could not be perfectly predicted from the independent variables for any of the cases. There was no multicollinearity because the coefficient table for each independent variables alternated or had lower values of Variance Inflation Factor (VIF), denoting no levels of multicollinearity, and they positively impacted the regression model. As for the collinearity diagnostics tables, the condition index for all variables was less than 30 as the conventional threshold, indicating no problem with collinearity. In the variance proportion, none of the dimensions indicated collinearity, as there were no two variables going above the threshold of .50.

Multinomial Logistic Regression Key Findings

For uses telemed model fitting information, the chi-square value is 38.571, and the *p*-value is < .001, less than 0.05, which indicates that there is a significant relationship between the dependent variable and the independent variable in the final model. As for offers telemedicine, the chi-square value is 16.742 and the *p*-value is .335, greater than 0.05, which indicates that there is no significant relationship between the dependent variable and the independent variable in the final model**.** For goodness of fit, each result for uses telemed and offers telemed contained information on whether the models exhibited good fit to the data. In each case, test results that were not significant indicated good fit. For results relating to uses telemedicine while using the alpha = .05 as threshold, among the variables of interest, which were age, gender, and race, age group with a *p*-value of .011 was the only significant predictor in the model. For offers telemedicine, none were a significant predictor in the model.

In the first coefficients for uses telemed, gender (.014) and age (< .000) were statistically significant predictors; thus, the probability that the null hypotheses is false, and there is a significant relationship between gender and age and using telemedicine during the coronavirus pandemic in 2021. Race (.887) was not a statistically significant predictor; thus, $p > 0.05$ is the probability that the null hypothesis is true. In the second coefficient yes = 1, none of the variables of interest were statistically significant, thus supporting the null hypotheses that age, gender, and race are not significantly related to using telemedicine. The final set of coefficients for "don't know" = 77 have gender (.000) and race (.000) as statistically significant predictors, and $p < 0.05$ is the probability that the null hypothesis is false, and there is a significant relationship between gender and race and use of telemedicine during the coronavirus pandemic in 2021. It is uncertain why a total of 18 for offers telemedicine and 1 for uses telemedicine from the study population responded "don't know," but data from which the study population were drawn indicated that 76.6% of the total surveys were completed via web administration (CDC, 2021). Because the survey was mostly online, there was already a bias toward those who were more technologically minded and had access to internet services which forced those lacking academic education, especially those who needed assistance from others, to participate (Dopelt et al., 2021, p. 8). In previous research, 37% of patients who claimed that they had not used telemedicine indicated that they did not know if it was offered by their provider (eMDs, 2021). Though respondents appeared to understand telemedicine and its benefits, the lack of satisfaction or interest in its use may also have come from the preference of some patient demographics to meet with their providers involving personal interaction (Dopelt et al., 2021, p. 9).

As for the first, second, and final sets of coefficients for offers telemed, none of the variables were statistically significant predictors. Thus, each $p > 0.05$ is the probability that the null hypothesis is true.

Confidence Intervals Around the Statistics

Both tables for “uses telemed” and “offers telemed” for confidence intervals around the statistics show that each odds ratio falls within each upper and lower bounds. Thus, the “true” population multinomial odds ratio lies between the lower and upper limit of the interval for outcomes for uses telemedicine and offers telemedicine. One can assume 95% confidence that the “true” population multinomial odds ratio lies between the lower and upper limit of the interval for outcomes either for uses telemedicine or offers telemedicine relative to the referent group.

Interpretation

In general, the study findings are consistent with other research studies showing the existence of disparities in telemedicine access and use by age, gender, and race. Deciding to use telemedicine is significantly associated with a patient’s demographic characteristics (Reed et al., 2020, p. 7). Findings in the study neither confirm nor negate previous findings in peer-reviewed literature. The study confirms previous findings relating to gender and use of telemedicine, where one study indicated that patients who were ages 25–39 were most likely to use telemedicine, followed by ages 40–55 years, and then ages 75+ years, but patients ages 10–24 years were less likely to use telemedicine (Drake et al., 2021). In this study, adults between the ages of 36 and 49 (M= .75, SD=6.49) were most likely to use telemedicine, followed by older adults who were 65 and older (M=.40, SD=1.35). Those between the ages of 18 and 35 were least likely to respond that they used telemedicine (M=.02, SD=1.29). The comparison extends knowledge of telemedicine use, as it confirms that telemedicine adoption varies, especially where significant disparities are shown to exist in its use during COVID-19 (Drake et al., 2021; Pierce & Stevermer, 2020). In general, younger adults were more likely to use telemedicine compared to older adults during the pandemic (Miyawaki et al., 2021).

The study also finds that females *(M = .47)* were more likely to use telemedicine than males *(M = .12)* as confirmed by previous studies (Drake et al., 2021, Der-Martirosian et al., 2022). Findings for race in the study neither confirmed nor negated previous findings. The study indicated that Hispanics were most likely to respond that they use telemedicine *(M = .80, SD = 7.38)* followed by Black race *(M = .30, SD = 1.29)*, and Whites *(M = .22, SD = 1.330).* Adults from other race were least likely to respond that they use telemedicine *(M=.09, SD=1.30).* The result negates previous findings where Black, Hispanic, and Asian patients were less likely than white patients to use telemedicine (Drake et al., 2021). Results also confirm another study where patients from racial minority status, Hispanic/Latino ethnicity, significantly increased the likelihood of telemedicine use compared with white patients (Paga´n et al., 2022).

To the best of my knowledge, this is the first study to assess the relationship between patient demographics by age, gender, and race with primary care providers offering telemedicine. As such, it was not possible to confirm or negate previous findings. It adds to the knowledge of how demographics contributes to primary care providers offering telemedicine. The study found that adults between the age of 36 to 49 *(M = 2.73, SD = 14.09)* were more likely to state that their primary care providers offered telemedicine followed by those between 18 to 35 *(M = 2.57, SD = 13.36)*, and ages 50 to 64 *(M = 1.58, SD = 9.55)*. Older adults who are 65 and older were least likely to affirm that their primary care providers offered telemedicine *(M = 1.45, SD = 9.74)*. Females *(M = 2.25, SD = 12.33)* in the study were more likely to indicate that their primary care providers offered telemedicine than males *(M = 1.71, SD = 10.63).* As for race, other race *(M = 5.55, SD = 19.66)* were most likely to indicate that their primary care providers offered telemedicine followed by Hispanics *(M = 2.17, SD = 12.54*), and White *(M = 1.66, SD = 10.296*). Black *(M = 1.51, SD = 10.13)* were least likely to say that their primary care providers offered telemedicine.

The finding confirms a previous study that found that patient characteristics were less strongly associated with physician adopting telemedicine" (Zachrison et al., 2021, p. 5). As for adults using telemedicine, it shows that among the variables of interest (age, gender, and race), they all were statistically significant predictors in the model. The finding confirms other findings that indicated age, especially those who are 25 years and older, were more likely to use telemedicine (Office of the Assistant Secretary for Planning and Evaluation, 2022).

Findings in the Context of Donabedian Framework

Though telemedicine offers many opportunities to improve care efficiency, accessibility, and patient outcomes, many challenges continue to exist in relation to technology interoperability, the digital divide, and usability. Findings in the study shows the existence of disparities in telemedicine access and use by patients based on their age, gender, and race. The finding also shows that age is associated with telemedicine use, though all the variables of interest had no association with primary care providers offering telemedicine. The Donabedian Framework which was developed in 1966 by Avedis Donabedian, "described structure, process, and outcome measures as having synergistic relationships, and each being important to the evaluation of health care quality" (Binder et al., 2021, p. 240). The framework deals with every relevant aspect of an organization's structure, its processes, and outcomes" (Tossaint-Schoenmakers et al., 2021, p. 3).

In the context of the framework, it is very important to incorporate the patients' role as the care receiver into that of the organizational structure (telemedicine) and deploy patients as human resources to the daily care processes since they need to be aligned with the desired results of quality care (Tossaint-Schoenmakers et al., 2021). To optimize patient and provider experience through telemedicine, healthcare administrators as stakeholders need to focus on enhancing technology interoperability and usability and providing sufficient training for efficient telemedicine use (Sun et al., 2021). Organizations must begin to address disparities by examining those discriminatory practices that contribute to racial disparities in access and use of telemedicine. Since patient outcomes are important in assessing the quality of health care they get, structure, processes, and outcomes are organizational measurements that must be understood. Donabedian framework view structure as including telemedicine used for care delivery and the extent to which the instrument prioritizes disparity as a mission of the organization. So long as each patient's satisfaction is important quality outcomes, it will continue to play an important role in sustaining initiatives in primary care settings.

Limitations of the Study

The study had several limitations. The study did not assess all possible covariates as factors that may have relationship with primary care providers offering telemedicine and United States adults using telemedicine. Some of those factors include urbanization and chronic conditions. Secondary data used for the study relied on groups of respondents called panels. Panel surveys have been shown to have more sample bias and less accuracy than traditional survey methods (CDC, 2021). Secondary data did not provide answer to the research questions on providers offering telemedicine. There was also the lack of previous research studies relating to the relationship between age, gender, and race with providers offering telemedicine. The study only applied information about United States adults who have a usual place of care and a provider that offered telemedicine (CDC, 2021). Though state-level telemedicine access and use may vary by states, the study was limited to United States national household adults. The responses Don't know and Missing for both dependent variables which would have allowed for a binomial logistic regression were not removed. After performing a listwise deletion of both responses, sample size was reduced from 786 to 151 which would have made the sample to be biased and unable to represent the population. Thus, the responses may have reduced statistical power which usually lead to the probability that the test will reject the null hypothesis when it is false, and that data can cause bias (Kang, 2013, pg. 402).

Finally, the study did not account for unhoused adults that may contribute to telemedicine use.

Recommendations

Results from the study found differences in telemedicine access and use among patient demographics that may compound disparities in quality outcomes during the corona virus pandemic in 2021. Institutions must monitor telemedicine use across patient demographics and equip patients, clinicians, and practices to promote equitable access to all telemedicine modalities (Rodriguez et al., 2021, p. 488). Also, an effective way of improving patient and provider experience through telemedicine is to focus on enhancing technology interoperability, and usability, and providing sufficient training for efficient telemedicine use (Sun et al., 2021, p. 2539).

Implications for Professional Practice and Social Change

As an implication for professional practice, the patient population served at each primary center varies and can affect the decision to implement telemedicine (Lin et al., 2018, p. 1968). Administrators must conduct a needs assessment, gain leadership and management support and commitment, identify champions, ensure that there are adequate resources, gain stakeholder trust, acceptance, and buy-in, and provide training and education (Kho et al., 2020, p. 7). For positive social change, the reason why telemedicine is not mainstreamed is also due to patient demographics like age, gender, and race related factors. Proactively implementing telemedicine will most likely generate benefits in the long-term, especially beyond the corona virus pandemic, and help with the everyday primary care challenges (Smith et al., 2020). With the Donabedian framework, adding the care receiver as an organizational structure, interpersonal actions as process management, and the satisfaction experience of the health care receiver as outcome are important positive social change (Tossaint-Schoenmakers et al., 2021).

Conclusion

Findings from the study suggest that patient demographics, especially relating to age, gender, and race should be included as part of telemedicine equity discussions in primary care settings, especially since deploying telemedicine among such groups presents as challenges to proving quality patient care. When telemedicine meets the needs of various patient groups is only the time it has the potential of addressing disparities. Healthcare administrators must seek out demographically equitable care when enhancing telemedicine as a technology. The rapid shift to telemedicine during the corona virus pandemic along with the disproportionate impact on underserved populations heightens the importance of technology equity as a public health focus.

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