Telehealth Utilization among Low Income Population during COVID-19: An Analysis of COVID-19 Research Database

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Abstract

The COVID-19 Research Database is a public data platform. This platform is a result of private and public partnerships across industries to facilitate data sharing and promote public health research. We analyzed its linked database and examined claims of 2,850,831 unique persons to investigate the influence of demographic, socio-economic, and behavioral factors on telehealth utilization in the low-income population. Our results suggest that patients who had higher education, income, and full-time employment were more likely to use telehealth. Patients who had unhealthy behaviors such as smoking were less likely to use telehealth. Our findings suggest that interventions to bolster education, employment, and healthy behaviors should be considered to promote the use of telehealth services.

Keywords: healthcare analytics, telehealth, healthcare data platform, digital divide

1. Introduction

COVID-19 created an environment that propelled the use of technology-enhanced services to support patients' access to care. Advanced information and communication technologies in the form of telehealth were highly encouraged to mitigate the ill effects of the contagion.

At the start of the COVID-19 pandemic, telehealth services were quickly supported to increase access to care when in-person visits were not in the best interest of public health and safety. Along with reducing exposure to providers and patients, telehealth is important during the pandemic to improve access to health and social services. Information from the United States (U.S.) based, Center for Disease Control (CDC) estimates that telehealth visits increased 154% in 2020 when compared to the same surveillance week in 2019 (Koonin et al., 2020). Telehealth is a promising tool due to its potential to increase access to care by overcoming geographical barriers and the ability to provide virtual care. It is increasing in acceptance as the standard of care.

Meanwhile, strategies to mitigate inequities during COVID-19 must address the systemic risk to vulnerable populations; without this attention, legislative and reimbursement support for telehealth may not benefit persons at risk in society. Low-income communities are at greater risk for health inequities due to the increased prevalence of chronic ailments, decreased financial resources, and inadequate living conditions. Due to the lack of resources, many persons in low-income positions do not have access to adequate technological support that encourages telehealth use.

This study examines the use of telehealth services among persons in the U.S. who are in low-income positions during the pandemic. Through this research, we hope to contribute to the health information systems research with insights into telehealth utilization. Findings from this study will improve our understanding of the influence of demographic, socio-economic, and behavioral factors on telehealth utilization among vulnerable groups. It will also help to inform telehealth programs to overcome barriers to utilization. Specifically, we aim to find answers to the following research question: *what factors impact the utilization of telehealth among the low-income population?* By understanding the factors that are associated with telehealth, we can more effectively design and implement strategies to promote access and use of telehealth services. The rest of this research-in-progress article is organized as follows: First, we provide the background of this study by discussing telehealth and disparities in telehealth utilization and use. We then outline our research methodology, following with a discussion on the results. And, finally, we offer conclusions and discuss the limitations and ongoing research directions.

2. Related work

In this study, telehealth refers to a wide range of services that are provided by various digital tools such

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as telephone, e-mail, texts, live video, digital prescriptions, etc. (Campos-Castillo, 2021). There are many benefits of telehealth services, such as minimizing direct virus exposure between patients and providers and limiting in-person services to persons diagnosed with COVID-19. As a result, telehealth is touted for quick access to treatment, improved patient satisfaction, and lower cost (Sabesan et al., 2013; Martinez et al., 2018; Sturesson & Groth, 2018; Funderburk et al., 2019; Nord et al., 2019). The World Health Organization suggests there are intersectionality of factors that contribute to health equity; thus we consider socioeconomics, health behaviors, and the health infrastructure (Mananadar et al., 2018). The importance of the health infrastructure (system of care) is highlighted by Donabedian theoretical framework (Bele et al., 2021). Donabedian's structure-process-outcome model of healthcare quality provides an important framework for examining the use of telehealth among vulnerable populations (Kazley et al., 2012). The structure or telehealth will impact the process and outcomes of care (Wade et al., 2017; Kazley et al., 2012). Thus, the structure, telemedicine, will impact the process of care by increasing patients' access to providers that is purported to improve health outcomes (Bele et al., 2021).

The adopted structure (telehealth) must be accessible and used by this population to affect change in outcomes. Consequently, telehealth services that are not fully accessible for various patient groups that experience structural inequities, many of whom identify with racial/ethnic minority groups, persons who lack digital literacy, and persons who experience language barriers (Suphanchaimat et al., 2015). While public health policies may remove barriers to telehealth access and promote an increase in the use of telehealth services, these results were not realized among underserved communities, such as people in low income positions. For example, previous research before the pandemic shows that Older Adults and persons in rural areas are highly deprived of virtual care (Yoon et al., 2018; Anderson & Kumar, 2019; Perrin & Turner, 2019).

Technological barriers limit the adoption of telehealth practices. During the pandemic, while there is a high demand for telehealth, our society is highly impacted by the digital divide. This digital divide includes a lack of internet access, devices and not having enough information and communication technology knowledge. During the pandemic, the Centers for Medicare and Medicaid Services announced support for "broad flexibility" under Medicaid and Children's Health Insurance Programs (Centers for Medicare & Medicaid Services, 2020). However, these temporary waivers were not fully functional, and the reimbursement process were slow and uncertain, delaying access to care (Lame, Leyden & Platt, 2021). The cost of telehealth services varies from $41 to $49, most often fully covered by insurance, however the lack of internet access and computer in the home leads to disparity in the type of telehealth use. (Payan et al., 2021). Among U.S. households about 7% do not own a computer and 12% do not have internet access (McCloud et al., 2016). However among households with less than $25,000 annual income, approximately 35% lack any internet subscription or broadband access, 50% lacked a laptop or desktop computer while 35% lacked a smartphone (Martin, 2021). Internet use decrease substantially for the low income earners: 20% for Whites, 7% for Blacks, 4% for Hispanics, and 5 % for Asians (Yoon et al., 2018). Socioeconomic status was a significant predictor of internet access and computer ownership (Yoon et al., 2018). Among people who had access to the computer and internet, one study suggested that 30% did not use it for health related reasons due to cultural perceptions and preferences (Cau & Pathak, 2021). The most commonly used telehealth services are audio or video. The use of audio or video telehealth services are largely contributed to socioeconomic status perceptions and preferences (Cau & Pathak, 2021; Payan et al., 2021). Given the disparity in computer ownership and internet access, it is not surprising that people in low income positions were higher utilizers of audio only rather than video visits, if they used telehealth at all (Payan et al., 2021).

The lack of resources was aversive to telehealth access. One study shows that older veterans with low income, especially in rural areas, are highly vulnerable due to the negative effect of the digital divide (Ferguson et al., 2021). In addition, services provided through telehealth consultations can also be difficult for the healthcare providers due to the lack of knowledge of how to navigate the digital healthcare system (Kerrigan et al., 2021). Conversely, patients that had insurance, a high school diploma, and were employed were more likely to use telehealth, which could be due to having current access to healthcare, access to internet service and technological devices (Pierce et al., 2020).

Telehealth provides a geographically location-friendly service that is beneficial to the rural or remote population. However, there is still some confusion about the benefits of telehealth for underserved regions (Thomas et al., 2022). People living in the limited broadband access area need much more attention (Ortega et al., 2007). Around 33% of rural Americans have limited access and telehealth visits (Crock Bauerly et al., 2019). Khoong, et al. (2021) show that over 50% were interrupted through internet access during telehealth services.

Previous studies suggest that racial and ethnic minority groups are less likely to use technology for

health-related purposes. Among racial/ethnic groups, Hispanic persons often opt for in-person rather than telehealth visits (Weber et al., 2020; Ramirez et al., 2021). Smith and Bhardwaj (2020) find that White persons are more likely than Black and Hispanic persons to have telehealth visits. In addition, for minority persons who do use telehealth services, telehealth platform utilization was significantly different. Wegermann et al. (2022) found that Hispanic persons had the highest rate of missed telehealth audio and video appointments, and Black persons were more likely to complete a telehealth audio visit. In Anaya, et al. (2021), it has been found that patients with limited English proficiency face a lot of difficulties and receive poor service due to the English-only digital systems.

The inequities noted in telehealth use go beyond racial/ethnicity and are influenced by demographics, socioeconomic status, and health behaviors. To affect sustainable progress towards health equity, we appreciate that the factors that contribute to health inequity are complex. Thus, we take a multifactorial approach to examine this topic. Demographics indicators were selected for their examination in this study due to their extensive use in prior research and contribution to health services utilization and contribution to inequities (Brewer et al., 2020; Pratap et al., 2020; Zimmerman & Anderson, 2019). Prior research suggests that telehealth utilization differs by demographics such as gender, age, education, and language preferences (Chang et al., 2021). Studies note that there are gender differences in telehealth utilization; as males are less likely to use telehealth than females (Pierce et al., 2020; Darrat et al., 2021; Saeed & Masters, 2021; Wegermann et al., 2022). Saeed & Masters (2021) suggest that females have higher telehealth utilization due to caregiver burdens that make attending in-person visits more challenging. As age increases, telehealth use decreases, and among telehealth types, older adults used video visits less than their younger counterparts (Pierce et al. 2020). Other studies also suggest that patients who are 65 years or older tend to utilize video telehealth the least (Pierce & Stevermer, 2020; Sachs et al., 2021; Stevens et al., 2021). Socioeconomic variables such as employment and education are predictive factors in health outcomes and social determinants of health studies (Social Determinants of Health, n.d). Telehealth utilization also differed by socioeconomic factors. Patients that had a high school diploma and were employed were more likely to use telehealth (Pierce et al. 2020). Personal health behaviors such as smoking and alcohol consumption are common health behaviors are linked to social inequities and poor health outcomes (Petrovic et al., 2018; Traina et al., 2019; Ye et al., 2022.). Smoking is the leading cause of morbidity and mortality in the U.S. and disproportionately affect people in lower socioeconomic positions (Vinci et al., 2022). Alcohol consumption is closely link with smoking Vinci et al., 2022). These detrimental social health behaviors are linked to chronic diseases which contribute to healthcare cost, utilization, and poor health outcomes among low income populations (Ye et al., 2022.).

Binge drinking and smoking are health behaviors that associated with socioeconomic inequities, we feel that due to its presence in prior research and contribution to healthcare quality, it warrants consideration in our analysis (Svendsen et al., 2020).

3. Methods

The study period was from March 2020 to April 2021. The COVID-19 Research Database Consortium provided data for the study. The Consortium, facilitated by Datavant, includes private and public partnerships across industries in the U.S. to facilitate data sharing and promote public health research. The database was established with institutional review board approval and an exemption from patient consent with strong HIPPA compliance measures in place. Individual project institutional board approval was not needed. The Consortium provided access to Office Ally and Analytics IQ PeopleCore Consumer linked databases. The Office Ally database provides U.S. claims data from 100 million unique patients and 3.4 billion medical claims. The Analytics IQ PeopleCore consumer database is a U.S. national representation of 242.5 million US adults aged 19 and older. Analytics IQ Peoplecore Consumer data provides consumer and business data on the patient/clinical level. They provide data such as health characteristics, medical care, and social determinants of health to help decision makers better understand their patients/clients. With the linked identifiers (common tokens) provided by COVID-19 Research Database, we joined the Office Ally claim data with Analytics IQ PeopleCore Consumer data, which enables us to retrieve related patient information and examine telehealth utilization across demographics, behaviors, and socioeconomic indicators.

To investigate telehealth utilization in low-income populations, we retrieved claim records, during the study period, of 2.85 million patients whose household income is less than double the Federal Poverty Level (according to 2021 Poverty Guidelines by the U.S. Department of Housing and Urban Development, see Appendix A1). Telehealth claims were identified by screening for current procedural terminology (CPT) modifier codes 95, GT, and GQ. The CPT is a medical code set that is a uniform language for coding and reporting health services and medical procedures. The modifiers 95, GT and GQ are used to supplement the

information by adding extra information about the services that were provided (see Appendix A2). In this case, these codes inform us that the services were delivered via telehealth. The data were aggregated at the patient level to investigate telehealth utilization - whether a patient used telehealth during the study period. A patient with one or more telehealth claims during the study period was assigned a value of 1 to the dependent variable, otherwise 0. Among the patients, 11% had one or more telehealth claims during the study period. Categorical variables were created to stratify patients into groups by the demographics and socioeconomic status listed in Table 1.

Table 1. Description of the patients under study

Dependent variable	Telehealth utilization	No: 2570252 Yes: 280579
Control variable	Total number of claims	Mean: 3.75 Standard deviation: 3.59 Range: 1-16
Independent variable	Gender	Female: 1696378 Male: 1154453
	Age group	65+: 954908 45-64: 1014759 18-44: 881164
	Education	High (Bachelor or higher): 712750 Low (High school or less): 2138081
	Employment	Unemployed: 1395440 Part-time: 667659 Full-time: 787732
	Alcohol	No consumption: 663424 Some consumption: 2187407
	Smoking	Never: 197846 Some: 2415509 Daily: 237476
	Race	White: 1768493 Asian: 55161 Black: 422415 Hispanic: 579641 Other: 25121

We conducted a multiple logistic regression analysis to determine the odds of patients in different groups using telehealth during the study period. A major advantage of logistic regression is that the exponentiated logistic regression coefficients can be conveniently interpreted as odds ratios. In our study, the odds ratios indicate how much the odds of telehealth utilization change versus a reference category (e.g., male group referenced to female group). The total number of claims of each patient during the study period was included in the logistic regression to control its potential impact on the dependent variable.

4. Results

Results from our logistic regression analysis are shown in Table 2. The results depict that male patients are 12% less likely to use telehealth than female patients. Our results also suggest that patients in the age group of 18-44 are 32% more likely to use telehealth than the age group of 65+. Additionally, patients with high school or less education are 5% less likely to utilize telehealth as referenced to patients with Bachelor or higher education. Meanwhile, patients with full-time employment are 15% more likely to use telehealth than patients who are not employed.

Table 2. Odds ratios from logistic regression

Variable	OR	95% CI
Age group (reference: 65+)		
45-64	1.123	[1.108, 1.138]
18-44	1.324	[1.304, 1.345]
Gender (reference: Female)		
Male	0.875	[0.867, 0.883]
Education (reference: Bachelor or higher		
High school or less	0.953	[0.944, 0.962]
Employment (reference: Unemployed)		
Part time	1.067	[1.053, 1.081]
Full time	1.148	[1.133, 1.164]
Alcohol (reference: No consumption)		
Some consumption	1.043	[1.031, 1.055]
Smoking (reference: Never)		
Some	0.811	[0.798, 0.825]
Daily	0.732	[0.716, 0.749]
Race (reference: White)		
Asian:	1.569	[1.528, 1.611]
Black:	0.994*	[0.981, 1.006]
Hispanic:	1.612	[1.596, 1.628]
Other:	1.296	[1.242, 1.352]

*p-value = 0.32. All other coefficients are significant with p-value < 0.01

Income is a contributor to telehealth use among the low-income population. For patients in households with between 3 and 10 members, income is significantly (p-value < 0.01) associated with the percentage of patients having telehealth use at each income level, as shown in Figure 1.

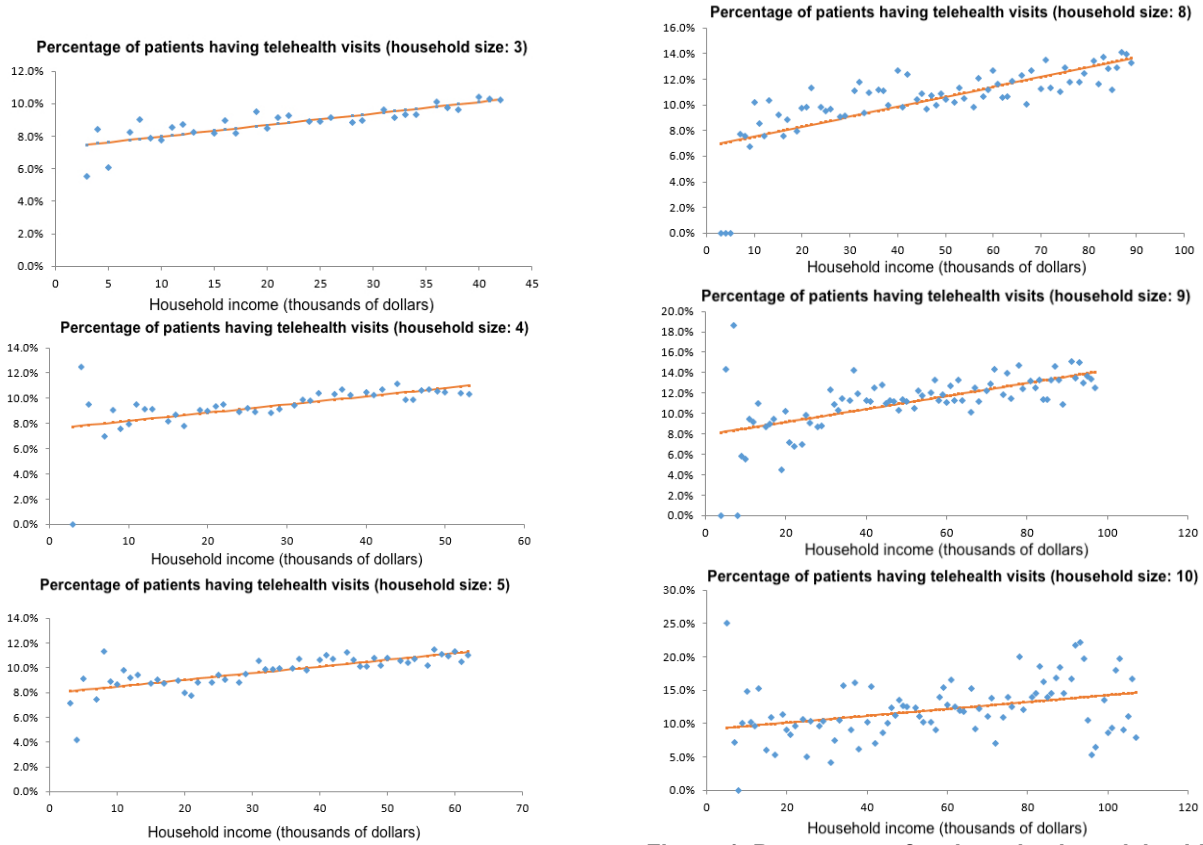

Figure 1. Percentage of patients having telehealth visits at each Income level.

Previous research suggested that Hispanic persons are less likely than White persons to have telehealth visits (Smith and Bhardwaj, 2020; Weber et al., 2020; Ramirez et al., 2021). Our results suggest that Asian and Hispanic patients are more likely to use telehealth than Black patients and White patients. Our study focuses on the low-income population, and this contradictory result indicates that telehealth utilization needs to be comprehensively examined in sub-demographic and socioeconomic groups. A recent Health and Human Services (HHS) issue brief, based on a survey of 808,368 U.S. adults, also suggests that Hispanic persons have an odds ratio of 1.27 for utilizing telehealth as referenced to White persons (Karimi et al., 2022)

Patients with unhealthy behavior, such as smoking, are significantly less likely to use telehealth. Patients who smoke daily are 27% less likely to use telehealth than patients who never smoke. Meanwhile, patients who have some alcohol consumptions are 4% more likely to use telehealth than patients with no alcohol consumption.

5. Discussions

Persons in lower-income positions are associated with fewer resources and less access to telehealth (Anderson et al., 2022). The study examined factors that may influence telehealth utilization. Our study results suggest that age, gender, and race are significant contributors to telehealth use. Our result aligns with previous literature that persons older than 60 years or male are less likely to use telehealth services (Dowler et al., 2021; Sachs et al., 2021). This is not surprising given that younger adults may be engaged with technology (Jaffe et al., 2020). However, trends suggest that Older Adults are moving toward digital technology (Anderson & Perrin, 2017).

Low-income persons demonstrate characteristics that decrease the odds of using telehealth, many of these areas can be overcome. Overcoming modifiable risk factors is key to mitigating inequities in telehealth access. Our study noted that a low education level, having a high school diploma or less, is a significant barrier to telehealth use. This aligns with other studies that suggest that persons with more than a high school diploma show increased utilization of telehealth (Jaffe et al., 2020). Education is a construct under socioeconomic status and has significant implications for health literacy (Hill-Briggs et al., 2021). A lack of education promotes low health literacy which constraints the community's ability to access health-related information and increases the digital divide (Barry et al., 2020; Clare, 2021). Banbury et al. (2020) suggest that when health literacy improved, self-efficacy and self-care management improved.

Persons who were employed were more likely to use telehealth services. Persons with financial concerns were less likely to consider using telehealth for healthcare access (Albon et al., 2021). Younger people may have more computer literacy; however, low-income communities are much less likely to have a computer in the home. Income affects technological literacy which in turn affects the overall use of telehealth (Walia, & Ravindran, 2020). The lack of internet and computer access in the digital health era poses significant barriers to healthcare.

In our study, people with unhealthy behaviors, such as smoking, had lower odds of telehealth use. Another study suggested that the percentage of persons who smoked and had a telehealth visit was 12.4%, as compared to persons who never smoked and had a telehealth visit at 61%; however overall healthcare utilization was lower for persons who were current smokers as compared to individuals who never smoked (Jaffe et al., 2020). The same study also suggests that alcohol consumption was not a deterrent to telehealth or healthcare utilization. In telehealth, the added challenges of computer access, digital literacy and environmental conditions of the patients (private space, noise level etc.,). Given the burden of this modifiable risk factor among this population, it is imperative that strategies be implemented to increase access to this group. There is an increasing number of smoking and alcohol treatment programs offered via telehealth, thus considering these health behaviors in access in equity efforts is warranted.

While this study is not an exhaustive examination of factors that contribute to telehealth use, we did consider important factors that were contributors to inequities in utilization. We recognize that health providers and decision makers have a tremendous responsibility to support persons in vulnerable positions, studies that highlight the complexities of these challenges are insightful to promote equity.

The current study employed a unique population-based data source. This allowed us to examine the low income population that were included in the Office Ally and Analytics IQ databases. We studied socioeconomic, health behavior, and demographic factors in the Hispanic community and determined the odds of using telehealth during a public health crisis. The study used the COVID-19 research database and is subject to the limitations of administrative databases. The validity of the data is reliant upon the facilities to report accurate data and code visits correctly in the Office Ally database. Analytic IQ Peoplecore Consumer data rely on the accuracy of reporting by the consumer. Future studies should consider specific subgroups, countries of origin to identify and support a variety of perspectives in communities more specifically. Focus groups of patients and providers in these communities may explore additional information not captured in surveys and claims data that explicate attitudes and challenges with telehealth access and use.

6. Conclusion

As we seek to promote telehealth utilization, it is imperative that we consider the socio-economic, demographics, and health behaviors. Important modifiable factors that contribute to low telehealth utilization low income populations are income and most notably education status. Thus, we suggest that providers and community health workers provide educational opportunities in ways that foster social and cultural acceptance of digital literacy and health-related technology use. Telehealth programs should be implemented in ways that promote community and cultural acceptance while promoting digital and health literacy. We suggest that future research consider qualitative studies of patients to provide additional information not captured in administrative or

quantitative studies alone. Such information could be used to develop community specific programs that facilitate telehealth access either through educational or access to technology equipment. We recognize the constraints on physicians and other providers and suggest that community health workers may be an ideal liaison between healthcare providers and the patients. Community health workers are engaged with the subgroups and understand more intimately the needs of the community. They are able to provide education and facilitate technology use in meaningful ways that foster decreased anxiety with technology and provide health related information through technology. Alongside education could be full time employment opportunities that provide a pathway out of poverty and a public health infrastructure that considers internet access a basic need for information and healthcare access.

Our results suggest that to facilitate access to telehealth for low-income persons, we must overcome socioeconomic barriers to its use. By focusing on the low-income community, this study seeks to provide professionals with added insight to promote health. The current study employed a unique population-based data source. This study provides a socioeconomic, health behavior, and demographic examination of the low-income community and the odds of using telehealth during a public health crisis. The study used the COVID-19 research database and is subject to the limitations of administrative databases. The validity of the data is reliant upon the facilities to report accurate data and code visits correctly in the Office Ally database. Analytic IQ Peoplecore Consumer data rely on the accuracy of reporting by the consumer. Focus groups of patients and providers in these communities may explore additional information not captured in surveys and claims data that explicate attitudes and challenges with telehealth use.

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Appendix

Table A1. 2021 Poverty Guidelines by the U.S. Department of Housing and Urban Development

Persons in family/household	Poverty guideline
1	$12,880
2	$17,420
3	$21,960
4	$26,500
5	$31,040
6	$35,580
7	$40,120
8	$44,660
For families/households with more than 8 persons, add $4,540 for each additional person.	

Table A2. AMA definitions of modifier code

Modifier code	Definition
95	"*Synchronous telemedicine service rendered via a real-time interactive audio and video telecommunications system*."
GQ	Encounters "*via an asynchronous telecommunications system*."
GT	Encounters "*via interactive audio and video telecommunications systems.*"
For more information, visit https://www.ama-assn.org/practice-management/cpt	