Pre-existing Disparities and Potential Implications for the Rapid Expansion of Telemedicine in Response to the Coronavirus Disease 2019 Pandemic

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Background: Concerns exist regarding exacerbation of existing disparities in health care access with the rapid implementation of telemedicine during the coronavirus disease 2019 (COVID-19) pandemic. However, data on pre-existing disparities in telemedicine utilization is currently lacking.

Objective: We aimed to study: (1) the prevalence of outpatient telemedicine visits before the COVID-19 pandemic by patient subgroups based on age, comorbidity burden, residence rurality, and median household income; and (2) associated diagnosis categories.

Research Design: This was a retrospective cohort study.

Subject: Commercial claims data from the Truven MarketScan database (2014–2018) representing n = 846,461,609 outpatient visits.

Measures: We studied characteristics and utilization of outpatient telemedicine services before the COVID-19 pandemic by patient subgroups based on age, comorbidity burden, residence rurality, and median household income. Disparities were assessed in unadjusted and adjusted (regression) analyses.

Results: With overall telemedicine uptake of 0.12% (n = 1,018,092/846,461,609 outpatient visits) we found that pre-COVID-19 disparities in telemedicine use became more pronounced over time with lower use in patients who were older, had more comorbidities, were in rural areas, and had lower median household incomes (all trends and effect estimates $P < 0.001$).

Conclusion: These results contextualize pre-existing disparities in telemedicine use and are crucial in the monitoring of potential disparities in telemedicine access and subsequent outcomes after the rapid expansion of telemedicine during the COVID-19 pandemic.

Key Words: telemedicine, disparities, COVID-19

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Telemedicine programs have been identified as potential solutions to overcome various barriers to health care access and subsequent disparities.[1,2] Such barriers include logistical barriers (eg, travel time and clinic wait time), financial barriers (eg, cost of in-person compared with telemedicine visits, transportation costs), care-specific barriers, and, relevant to the coronavirus disease 2019 (COVID-19) pandemic (fear of), the risk of infection.[3,4]

Indeed, the COVID-19 pandemic has prompted a rapid implementation and continuation of telemedicine programs. While, theoretically, this should have reduced certain barriers to care, concerns exist regarding a potential exacerbation of existing disparities in health care access experienced by vulnerable patient populations.[5,6] This may be driven by the fast-paced roll-out with, for example, many initial unknowns regarding reimbursement policies and an oversized focus on technology without sufficient time to evaluate experienced barriers. Another important mechanism behind potential disparities may be the "digital divide," that is, disparities in internet/technology access based on, for example, geographic, social, and economic factors.[7] Such disparities may also include between-group differences in the quality of the telemedicine services delivered to patients, for example, audio-versus audio/video-based telemedicine.[8]

Given that telemedicine has both the potential to increase or decrease care access and disparities, data is needed on pre-COVID-19 telemedicine utilization patterns to better contextualize patterns observed during the COVID-19 pandemic. As such data is currently lacking, we aimed to study: (1) the prevalence of outpatient telemedicine visits before the COVID-19 pandemic by patient subgroups based on age, comorbidity burden, residence rurality, and median household income; and (2) associated diagnosis categories.

METHODS

After institutional review board approval (#2017-016) we retrospectively analyzed adult outpatient visits recorded in the Truven Health MarketScan database[9] (copyright 2017

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Truven Health Analytics Inc.; dataset access was limited to Hospital for Special Surgery employees). Outpatient visits between 2014 and 2018 were included (n = 846,461,609 visits). This dataset includes patient-level private insurance claims from > 100 commercial payers across the United States; thus, many older and lower-income patients that are enrolled in Medicare and Medicaid, respectively may not be included.

Telemedicine visits were defined using current procedural terminology codes 99441-99444, Healthcare Common Procedure Coding System codes G0406-G0408, G0459, G0508-G0509, G0425-G0427, Q3014, T1014, or any code with either a procedure modifier of GT, GQ, or 95 or a location of service listed as "telehealth."[10]

We assessed annual trends in telemedicine utilization by patient subgroup based on patient age (below 54 vs. 55 y and above), comorbidity burden (Charlson comorbidity index categories 0, 1, 2, > 2), urban versus rural residence zip code, and median household income (< $45,000, $45,000–$60,000, > $60,000); these were all represented in line graphs. The cutoff for patient age was chosen to allow for an assessment of the age-based "digital divide" in a commercial dataset where the traditional cutoff of 65 years could not be used as these patients would be eligible for Medicare and thus not included in this dataset. The cutoffs for median household income were based on our team's previous work using this data source.[11,12] Cochran-Armitage trend tests assessed significance of (linear) trends. In addition, "major diagnostic categories" associated with telemedicine visits were identified. These categories represent a widely recognized classification system for grouping medical conditions into 25 categories, mostly by body system.[9]

A multivariable logistic regression model estimated the association between all of the aforementioned study variables (including patient sex and year) and telemedicine utilization. We report odds ratios (ORs) and 95% confidence intervals (CIs). All analyses were performed using SAS statistical software v9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Telemedicine uptake (0.12%; 1,018,092 of 846,461,609 outpatient visits representing 46,421,994 unique patients) generally increased over time. Existing disparities in telemedicine use (ie, differences in utilization patterns comparing 2014–2018) became more pronounced over time with lower use in patients who were older (0.01%–0.17% vs. 0.03% vs. 0.41% in those aged 55 y and above and below 55 y, respectively), had more comorbidities (0.01%–0.14% and 0.03%–0.41% in those with a Charlson comorbidity index of > 2 and 0, respectively), lived in rural areas (0.03%–0.28% and 0.02%–0.37% in those from rural and urban areas, respectively), and had lower median household incomes (0.02%–0.40% and 0.02%–0.52% for those with a median annual household income of <$45,000 and > $60,000, respectively); all trends $P < 0.001$ (Figs. 1A–D). Similar patterns were observed in

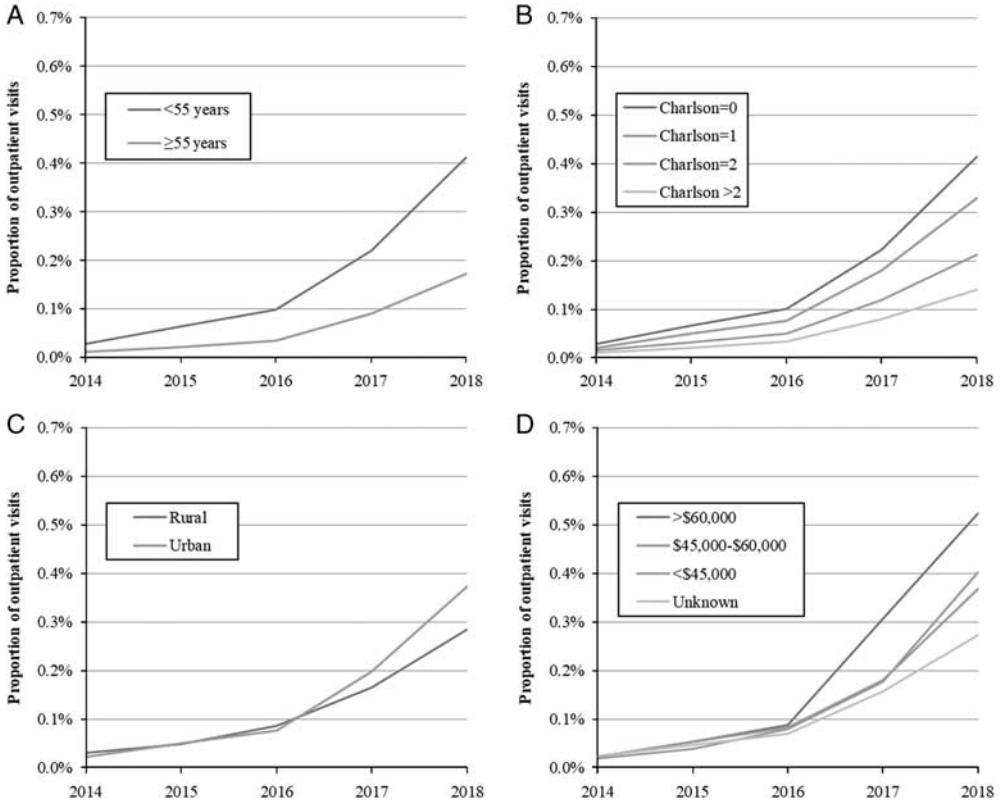

FIGURE 1. Trends in telemedicine use: unique visits by patient age (A), Charlson comorbidity burden (B), urban versus rural residence zip code (C), and median household income (D).

TABLE 1. Telemedicine Use by Study Variables; Absolute (Unadjusted) Numbers on the Left and Adjusted Odds Ratios With 95% Confidence Intervals on the Right

	Telemedicine Utilization				
Study Variable	**No**	**Yes**	**%**	**Odds Ratio**	**95% Confidence Interval**
Sex					
Male	317,436,345	344,123	0.11	Reference	—
Female	528,007,172	673,969	0.13	1.23*	1.23–1.24
Age (y)					
< 55	576,651,224	858,556	0.15	Reference	—
≥ 55	268,791,293	159,536	0.06	0.51*	0.51–0.51
Charlson comorbidity burden					
0	437,870,143	663,541	0.15	Reference	—
1	186,079,401	221,709	0.12	0.76*	0.75–0.76
2	86,934,961	64,963	0.07	0.61*	0.60–0.61
> 2	134,559,012	67,879	0.05	0.47*	0.47–0.47
Residence					
Urban	706,440,175	879,032	0.12	1.04*	1.04–1.05
Rural	96,957,284	103,144	0.11	Reference	—
Median household income					
< $45,000	55,645,303	60,489	0.11	1.04*	1.03–1.05
$45,000–$60,000	338,536,472	399,927	0.12	Reference	—
> $60,000	82,325,799	138,798	0.17	1.38*	1.38–1.39
Unknown	369,935,943	418,878	0.11	0.95*	0.95–0.96
Major diagnostic categories					
Ear, nose, mouth, and throat	78,197,039	328,296	0.42	Reference	—
Mental health	73,313,128	110,202	0.15	0.29*	0.29–0.29
"General health status" (mostly general medicine)	160,155,250	117,717	0.07	0.18*	0.18–0.19
Respiratory disease	28,887,113	74,291	0.26	0.91*	0.90–0.92
Other	564,365,040	387,676	0.07	0.15*	0.15–0.15
Year of visit					
2014	243,292,339	54,924	0.02	Reference	—
2015	152,196,623	76,560	0.05	2.27*	2.24–2.29
2016	153,712,321	119,627	0.08	3.49*	3.45–3.52
2017	146,593,211	261,494	0.18	8.62*	8.54–8.07
2018	149,649,023	505,487	0.34	15.78*	15.64–15.91

*$P < 0.001$.

adjusted analyses (Table 1) with the strongest between-subgroup contrast (in terms of the magnitude of the effect estimates) in telemedicine utilization seen for patients aged 55 years and above (compared with below 55 y: OR: 0.51; CI: 0.51–0.51) and those with a Charlson comorbidity index of > 2 (compared with 0: OR: 0.47; CI: 0.47-0.47); both $P < 0.001$. Four major diagnostic categories represented 61.9% of telemedicine visits: (1) "ear, nose, mouth, and throat"; (2) "mental health"; (3) "general health status" (a variety of codes including rehabilitation and aftercare); and (4) "respiratory diseases." Within these major diagnostic categories (unadjusted data, not shown), similar disparities in telemedicine utilization were observed; however, mental health-related telemedicine was more commonly seen in rural (0.39%) compared with urban areas (0.15%).

DISCUSSION

Using commercial claims data, we observed pronounced age-based, comorbidity-based, residence-based, and household income-based disparities in telemedicine uptake in the 2014-2018 (pre-COVID-19) period, with lower telemedicine use in vulnerable patient populations, that is, those who could theoretically benefit the most from its offering. These disparities exacerbated over time and were also present within major diagnostic categories most commonly associated with telemedicine. Notably, however, the urban-rural divide was reversed for mental health-related telemedicine as it was more commonly seen in rural compared with urban areas; this is likely due to mental health services being among the first to pioneer telemedicine programs, specifically geared towards patients in rural settings.[13]

The findings from this study signify the importance of studying underlying mechanisms for disparities in telemedicine utilization, continued monitoring of these disparities in the fast-paced roll-out of telemedicine programs during the COVID-19 pandemic, and ways to minimize them. Such initiatives could be institution-specific and incorporated into existing quality monitoring programs. On the health system level, monitoring could be incentivized by, for example, incorporating telemedicine utilization into reportable quality measures.

Various mechanisms may be behind the observed pre-COVID-19 patterns in telemedicine utilization. First, given the youth of many telemedicine programs and roll-out in a research setting (as opposed to daily clinical practice), the disparities could be due to various features of the roll-out or the study in question. Indeed, it is for example well established that participation in clinical research is skewed toward patients with higher socioeconomic status and those that live close to urban academic centers, thus greatly favoring these

patient populations.[9] Commonly mentioned study-specific barriers include a perceived lack of access to information, patients' competing demands, and issues related to health insurance coverage.[14] Second, the consistency of the observed disparities across groups may be facilitated by the overlapping and intersecting characteristics of groups of patients. Indeed, many patients that live in rural areas and come from low-income households also have high comorbidity rates compared with more affluent, suburban/urban individuals who are typically healthier.[15] Even though we studied various patient subgroups, the strongest between-subgroup contrast (in terms of the magnitude of the effect estimates) in telemedicine utilization was based on patient comorbidity burden and patient age, thus signifying that some subgroup characteristics may be more important than others in terms of propensity to use telemedicine. The latter is related to the third proposed mechanism behind the observed disparities in telemedicine utilization, that is, barriers pertaining to technology access and competence. Indeed, rural and low-income individuals are more likely to experience issues in access to telecommunication devices and high-speed internet.[16] This "digital divide" does not occur solely due to inadequate access to the internet (or other technology); other factors underlying or perpetuating unequal access to telemedicine include certain expectations regarding use of technology, mistrust of technology or the medical community at large.[17] While this may be relevant to various patient subgroups, elderly patients are a commonly mentioned at-risk subgroup.[18,19]

The aforementioned hypothesized mechanisms behind disparities in telemedicine use are based on the published literature; given the unprecedented nature of the telemedicine roll-out during the COVID-19 pandemic, various other mechanisms may be identified during continuous monitoring of such programs. A recent account from New York City Health+Hospitals, the nation's largest safety-net health care system, provides some important insights.[20] Here, Lau and colleagues describe various pre-COVID-19 initiatives that greatly facilitated the shift from in-person to virtual care during the COVID-19 pandemic, maintaining access to care for the most vulnerable patient populations. Initiatives included an assessment of patients' readiness for virtual care through a survey which resulted in some unexpected insights (for this safety-net population) regarding ubiquitous access to mobile devices and expressed interest in receiving telemedicine services.[20] Other factors that facilitated the successful expansion of telemedicine in this example include a health system-wide unified electronic medical record system, creation of a central "Telehealth Rapid Response Team" (including key information technology, electronic medical record, and clinical leadership representatives) responsible for a smooth but quick scaling of telemedicine solutions.

Another potential source of disparities in telemedicine utilization may be "intervention-generated" as technological innovations can worsen health disparities if they are disproportionately offered to, adopted by, or effective for more affluent and less vulnerable patients.[21] This is likely to be further compounded by the expected heterogeneity in terms of implemented telemedicine programs (eg, audio-only vs. audio/video-based telemedicine) and characteristics of each program's implementation. The latter may include features of a telemedicine program such as the extent of available patient and provider support services, marketing/outreach or the pace of implementation. Here, insufficient support services, lack of patients' awareness of the option of telemedicine instead of an in-person visit, or a fast-paced roll-out with an oversized focus on technology may lead to differences in access to such programs. Indeed, heterogeneity has already been evident in the current telemedicine literature as there is great variation in published telemedicine studies in terms of setting (eg, rural vs. urban) or patient subgroup (eg, chronic diseases such as diabetes mellitus or congestive heart failure).[22] This important limitation of the current literature will impact evaluations of recently implemented or expanded telemedicine programs. Here, hypotheses may be wrongfully accepted or rejected based on failure to take into account the full extent of relevant characteristics of an implemented telemedicine program. Continuous monitoring of (disparities in access to) telemedicine programs during and beyond the COVID-19 pandemic therefore has to be interpreted in the context of such heterogeneity.

Next to hospital-level and program-level implications for policy, health system-level policy implications that flow from our study results (aiming to minimize disparities in telemedicine utilization) include expansion of reimbursement for telemedicine visits (to reduce financial barriers) and more streamlined between-hospital physician credentialing policies and between-state licensing policies regarding the provision of telemedicine services (to reduce regulatory barriers). While various policies facilitating virtual health care delivery were enacted at the beginning of the COVID-19 pandemic,[23,24] by both public and private payers, our study results signify the importance of their continuation in maintaining equal access to care during and beyond the COVID-19 pandemic. During continuous monitoring of telemedicine programs it will be crucial to identify the most effective regulatory policies in terms of maintaining access to care while suspending or modifying policies with limited or no impact.

Limitations of this study include the use of commercial claims and a lack of information on the telemedicine modality utilized. The former matters in terms of reimbursement policies, which were greatly expanded following the onset of the COVID-19 outbreak.[23] The use of private insurance claims also inherently limits the population of patients available for analysis, excluding many older and lower-income patients that are enrolled in Medicare and Medicaid, respectively. The latter limitation matters in terms of the potential for disparities which is greater for video visits, as they require greater technological access and competence to effectively execute the tele-visit. Although the described limitations of this study are valid, our study presents a clear, consistent narrative that telemedicine was being used the least by those for whom it was most intended, in the pre-COVID-19 period. With the exposure of deep-rooted disparities in care during the COVID-19 pandemic, we propose that health care systems have an ethical responsibility to minimize such disparities in telemedicine access while maximizing the equalizing impact of such programs.

In conclusion, we describe disparities in telemedicine utilization in the prepandemic period and these findings are important to contextualize the current fast-paced roll-out of telemedicine programs. Important policy-related implications include continuous monitoring of such programs and research into underlying mechanisms that will ultimately lead to more equal access to telemedicine programs.

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