Short communication

Associations of telemedicine vs. in-person ambulatory visits and cancellation rates and 30-day follow-up hospitalizations and emergency department visits

Julianne N. Kubes a, Ilana Graetz b, Zanthia Wiley c, Nicole Franks d, Ambar Kulshreshtha e,f,g

a Office of Quality and Risk, Emory Healthcare, 478 W Peachtree St NW, Atlanta, GA, USA
b Department of Health Policy and Management, Rollins School of Public Health, Emory University, 1518 Clifton Rd, Atlanta, GA, USA
c Division of Infectious Diseases, Emory University School of Medicine, Emory University Hospital Midtown, Medical Office Tower 7th Floor, Atlanta, GA, USA
d Department of Emergency Medicine, Emory University School of Medicine, Emory University Hospital Midtown, Medical Office Tower 7th Floor, Atlanta, GA, USA
e Division of Family and Preventive Medicine, Emory University School of Medicine, 201 Downman Dr, Atlanta, GA, USA
f Department of Epidemiology, Rollins School of Public Health, Emory University, 1518 Clifton Rd, Atlanta, GA, USA
g Office of Quality and Risk, Emory Healthcare, 478 W Peachtree St NW, Atlanta, GA, USA

ARTICLE INFO

Keywords:
Telemedicine
Telehealth
Cancellations
Patient safety
Quality improvement

ABSTRACT

Little is known about cancellation frequencies in telemedicine vs. in-person appointments and its impact on clinical outcomes. Our objective was to examine differences between in-person and video telemedicine appointments in terms of cancellation rates by age, race, ethnicity, gender, and insurance, and compare 30-day inpatient hospitalizations rates and 30-day emergency department visit rates between the two visit types. Demographic characteristics and comorbidities for adults scheduled for an Emory Healthcare ambulatory clinic appointment from June 2020 to December 2020 were extracted from the electronic medical record. Each appointment was identified as either a video telemedicine or in-person clinic appointment. The outcomes were ambulatory clinic cancellation rates, 30-day hospitalization rates, and 30-day emergency department visit rates. Multivariable logistic regression was used to assess differences between appointment types. A total of 1,652,623 ambulatory clinic appointments were scheduled. Ambulatory appointment cancellations rates were significantly lower among telemedicine compared to in-person appointments overall (20.4% vs. 31.0%, p < .001) and regardless of gender, age, race, ethnicity, insurance, or specialty (p < .05 for all sub-groups). Telemedicine appointments were associated with lower 30-day hospitalization rates compared to in-person appointments (AOR: 0.72, 95% CI: 0.71–0.74). There was no difference in 30-day emergency department visit rates between telemedicine and in-person appointment patients (AOR: 1.00, 95% CI: 0.98–1.02). Our findings suggest that there are fewer barriers to attending an ambulatory care visit via telemedicine relative to in-person. Using video telemedicine was not associated with more frequent adverse clinical events compared with in-person visits.

1. Introduction

In response to the COVID-19 pandemic, many healthcare systems rapidly developed telemedicine programs to provide ongoing access for patients to receive ambulatory care from their regular providers (Patel et al., 2021). Prior to the pandemic, payors had concerns about growth in telemedicine and in-person visits and its impact on clinical outcomes. Our objective was to examine differences between in-person and video telemedicine appointments in terms of cancellation rates by age, race, ethnicity, gender, and insurance, and compare 30-day outpatient hospitalizations rates and 30-day emergency department visit rates between the two visit types. Demographic characteristics and comorbidities for adults scheduled for an Emory Healthcare ambulatory clinic appointment from June 2020 to December 2020 were extracted from the electronic medical record. Each appointment was identified as either a video telemedicine or in-person clinic appointment. The outcomes were ambulatory clinic cancellation rates, 30-day hospitalization rates, and 30-day emergency department visit rates. Multivariable logistic regression was used to assess differences between appointment types. A total of 1,652,623 ambulatory clinic appointments were scheduled. Ambulatory appointment cancellations rates were significantly lower among telemedicine compared to in-person appointments overall (20.4% vs. 31.0%, p < .001) and regardless of gender, age, race, ethnicity, insurance, or specialty (p < .05 for all sub-groups). Telemedicine appointments were associated with lower 30-day hospitalization rates compared to in-person appointments (AOR: 0.72, 95% CI: 0.71–0.74). There was no difference in 30-day emergency department visit rates between telemedicine and in-person appointment patients (AOR: 1.00, 95% CI: 0.98–1.02). Our findings suggest that there are fewer barriers to attending an ambulatory care visit via telemedicine relative to in-person. Using video telemedicine was not associated with more frequent adverse clinical events compared with in-person visits.

* Corresponding author at: Department of Family and Preventive Medicine, Emory University School of Medicine, Department of Epidemiology, Emory Rollins School of Public Health, 4500 North Shallowford Rd., Suite 194, Atlanta, GA 30338, USA.

E-mail addresses: julianne.kubes@emoryhealthcare.org (J.N. Kubes), ilana.graetz@emory.edu (I. Graetz), zwiley@emory.edu (Z. Wiley), ncmarti@emory.edu (N. Franks), akulshr@emory.edu (A. Kulshreshtha).

https://doi.org/10.1016/j.pmedr.2021.101629

Received 25 June 2021; Received in revised form 29 October 2021; Accepted 3 November 2021
Available online 5 November 2021

2211-3355/© 2021 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).
new patients and the same practice is followed for both telemedicine and
assigned to telemedicine to avoid risks to other patients and clinic staff.
In the pre-COVID-19 era, there were very limited telemedicine pro-
grams in the United States with barriers such as provider reluctance,
reimbursement issues, and challenges with technology use among pa-
tients. Telemedicine’s rapid adoption and expansion over the past year
presents an opportunity to generate further evidence regarding its
effectiveness and utility and whether it helps to improve patient out-
comes (Roberts and Mehrotra, 2020). Healthcare systems and policy
makers need more information on whether continuing investments in
telemedicine infrastructure are worthwhile for their patients and pop-
ulations. Our study is one of the first large scale studies, encompassing a
diverse physician and patient population, to examine ambulatory clinic
cancellations, hospitalizations, and ED visits in a major academic
healthcare system. We hypothesize that compared with in-person visits,
telemedicine visits have lower cancellation rates regardless of patient
age, gender, race, and insurance, and similar rates of hospitalizations
and ED visits.

2. Methods

2.1. Population

Emory Healthcare (EHC) is the largest healthcare system in the state
of Georgia with more than 2800 physicians and 250 provider locations
in urban, suburban, and rural settings. EHC has 140 group practice loca-
tions and ambulatory service sites in 27 Georgia counties, including 15
officially designated medically underserved counties. EHC began
using Zoom (Zoom Video Communication, Inc., San Jose, CA) in April
2020 to offer telemedicine appointments for ambulatory care visits and
included both an audio and video component in a synchronous format,
which is compliant with the Health Insurance Portability and Account-
ability Act (HIPAA) and approved for clinical use in the United States
(Compliance, 2021). Our study included adult patients (age ≥ 18 years)
scheduled for an ambulatory clinic appointment between June 2020 and
December 2020 within EHC (when patients had a choice of in-person or
telemedicine visit). We selected the above study period because ap-
pointments made between March 2020 and May 2020 were intention-
ally assigned to telemedicine due to the COVID-19 surge in Georgia.

2.2. Measures

We defined a telemedicine appointment as a visit conducted via
video and an in-person appointment as a visit conducted at an ambu-
latory clinic when the patient was physically present. Using the
Andersen framework of health services utilization, we measured pre-
disposing factors including age, sex, gender, race, and ethnicity,
allowing factors including healthcare insurance, and needs factors
including present comorbidities for each patient (Andersen, 1995).
All sociodemographic factors were extracted from the electronic medical
record, with comorbidities identified by billed ICD-10 diagnosis codes. A
Charlson Comorbidity Index (CCI) was calculated for each patient for
risk adjustment (Charlson et al., 1987). We excluded patients with a
positive SARS-CoV-2 (COVID-19) polymerase chain reaction test within
14 days of their appointment, as these appointments were intentionally
assigned to telemedicine to avoid risks to other patients and clinic staff.
EHC patients sign a notice of privacy practices when they establish as
new patients and the same practice is followed for both telemedicine and
in-person clinic appointments. There are policies and systems in place to
ensure patient privacy, such as ensuring telemedicine visits are con-
ducted in a private closed room with no other individuals in the room or
within hearing distance and ensuring the use of waiting rooms to ensure
that other individuals cannot access the visit. For data collection, no
patient identifiers were used, and the study was reviewed and deemed
exempt by the Emory Institutional Review Board review.

The primary process outcome was ambulatory clinic cancellation
rates, defined as the percentage of ambulatory clinic appointments
where the patient cancelled beforehand or did not show to the
appointment. The primary clinical outcomes were 30-day hospitaliza-
tion and ED visit rates, defined as the percentage of ambulatory patients
who were admitted as an inpatient to a hospital or had an ED visit within
30 days of their ambulatory appointment.

2.3. Statistical analysis

Differences in cancellation rates between telemedicine and in-person
appointments and among sub-groups were compared using the Chi-
square test. Multivariable logistic regression was used to compare 30-
day hospitalization and ED visit rates between telemedicine and in-
person appointments, adjusting for age and CCI. Statistical analyses
were performed using R (version 4.0.2; RStudio, Inc., Boston, MA). This
study followed the Strengthening the Reporting of Observational Studies
in Epidemiology (STROBE) reporting guideline (Ghaferi et al., 2021).

3. Results

A total of 1,652,623 ambulatory clinic appointments were scheduled
during the study timeframe and met the inclusion criteria. Of those,
412,936 (25.0%) were telemedicine appointments and 1,239,687
(75.0%) were in-person appointments. Physicians conducted 91% of all
outpatient clinic appointments, while the other 9% were conducted by
an advanced practice provider under the supervision of a physician. The
average age was 59 years (SD 18.4), 61.1% were female, 47.5% were
White, and 35.8% were Black. Nearly half (47.1%) of patients had
commercial or private insurance. The most common comorbidities were
hypertension (53.6%), followed by diabetes (23.6%) and malignancy
(20.1%). Most patients (63.0%) had a low-risk CCI, defined as a CCI <2.
Additional patient characteristics by appointment group are presented in
Supplemental Table 1.

Ambulatory appointment cancellation rates were significantly lower
among telemedicine appointments compared to in-person appointments
(84,211 (20.4%) vs. 383,902 (31.0%), p < .0001, Table 1). Cancellation
rates were lower for telemedicine regardless of gender, age, race,
etnicity, insurance, or specialty (p < .05 for all sub-groups).

Telemedicine visits were associated with lower 30-day hospitaliza-
tion rate compared to in-person appointments (2.1% vs. 2.8%; OR: 0.73,
95% CI: 0.71 to 0.74, Table 2); this result did not change after adjusting
for age and comorbid conditions (AOR: 0.72, 95% CI: 0.71 to 0.74). We
did not find a statistically significant difference in 30-day ED visit rate
between telemedicine and in-person appointments (2.6% vs. 2.6%; OR:
0.99, 95% CI: 0.96 to 1.01) after adjusting for age and comorbid condi-
tions (AOR: 1.00, 95% CI: 0.98 to 1.02).

4. Discussion

In this retrospective cohort study of adult patients receiving ambu-
latory care at a large academic healthcare system, telemedicine visits
were associated with fewer cancellations than in-person visits during the
COVID-19 pandemic; this was true for all population sub-groups.
Moreover, using telemedicine was not associated with worse adverse
clinical events, such as a follow-up ED visit or hospitalization.

Video telemedicine visits offer patients real-time and direct access to
a clinician without leaving their homes. However, some people may face
challenges with internet stability or bandwidth issues depending on

References

Andersen, R. K. (1995). Sociodemographic and clinical factors affecting utiliza-
tion of health services. Milbank Quarterly, 73(4), 529-564.
The large sample size of over 1.5 million clinic appointments provides a smaller margin of error and more closely approximates our patient population. Additionally, our sample represented a diverse patient population including age, gender, race, and geographic area.

4.1. Limitations

There are several limitations to the interpretation and generalizability of our findings. Our study is observational, and the results should not be interpreted as causal. Despite robust adjustment of patient characteristics, there is likely to be unmeasured confounding and our inability to know the reasons for patient cancellations. Finally, we relied on administrative and billing codes to capture visit information and there is potential for misclassification. However, it is likely to be non-differential and only bias the study results towards the null.

5. Conclusions

In conclusion, in a large academic health system during the COVID-19 pandemic, telemedicine appointments were cancelled significantly less than in-person appointments, regardless of age, race, ethnicity, gender, or insurance. Telemedicine appointments were associated with fewer 30-day hospitalizations compared to in-person appointments and had similar rates of ED visits. Telemedicine appointments increase access to healthcare for many sub-groups and may help reduce healthcare disparities. Expansion of telemedicine in the United States and globally warrants more efforts that focus on outcome comparisons to inform policy and clinical practice decisions. Future studies should examine differences in quality of care, patient clinical outcomes, and costs comparing telemedicine to in-person ambulatory visits more generally and for specific chronic conditions. This evidence is critical to ensure payment parity for telemedicine as compared to in-person visits for continued expansion of services for transforming healthcare delivery to safety in the pandemic.
improve population health.

CRediT authorship contribution statement

Julianne N. Kubes: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Validation, Writing – original draft, Visualization. Ilana Graetz: Conceptualization, Methodology, Validation, Writing – original draft, Writing – review & editing. Zanthia Wiley: Methodology, Validation, Writing – original draft, Writing – review & editing. Nicole Franks: Resources, Writing – review & editing, Project administration, Funding acquisition. Ambar Kulshreshtha: Conceptualization, Resources, Writing – review & editing, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to acknowledge Gregory J. Esper, MD, MBA, Associate Chief Medical Officer at Emory Healthcare and Joel Shu, MD, Chief Medical Officer and Chief Quality Officer at Emory Healthcare Network for their insight and consult on this study.

Funding

This work was supported by the National Institute on Aging (grant number K23AG066931), the National Cancer Institute (grant number 5R01CA218155-04), and the Robert W. Woodruff Foundation’s Woodruff Health Sciences Center COVID-19 Center for Urgent Research Engagement (CURE) Award. The funding sources had no role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the article for publication. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmmedr.2021.101629.

References

Andersen, R., 1995. Revisiting the behavioral model and access to medical care: does it matter? J. Health Soc. Behav. 36, 1–10. https://doi.org/10.2307/2137284.