



## Original Contribution

## On-demand synchronous audio video telemedicine visits are cost effective



Garrison Nord, BBA, Kristin L. Rising, MD, MS, Roger A. Band, MD, Brendan G. Carr, MD, MS, Judd E. Hollander, MD\*

Department of Emergency Medicine, Department of Emergency Medicine, Sidney Kimmel Medical College of Thomas Jefferson University, Philadelphia, PA, USA

## ARTICLE INFO

## Article history:

Received 20 July 2018

Received in revised form 3 August 2018

Accepted 7 August 2018

## Keywords:

Telehealth

Telemedicine

Cost effectiveness

Video

Healthcare delivery

Cost

## ABSTRACT

**Introduction:** Claims data raises the possibility that on demand telemedicine programs might increase new utilization, offsetting the cost benefits described in some retrospective analyses.

We prospectively evaluated the cost of a synchronous audio-video on-demand telemedicine taking into account both what patients would have done instead of the telemedicine visit as well as the care patients received after the visit.

**Materials and methods:** We conducted a prospective observational study of patients who received care from an on-demand telemedicine program. At the time of the visit, we surveyed patients about the alternative care that would have been requested, if they had not done the telemedicine visit. We also obtained information following the visit about what further care was received. Using cost data derived from the literature we performed a sensitivity analysis to determine the cost impact of the on-demand telemedicine visit.

**Results:** There were 650 patients enrolled with a mean age of 37 who were 68% female; 74% had their care concerns resolved on the telemedicine visit; only 16% would have “done nothing” if they had not done the telemedicine visit, representing possible new utilization. Net cost savings per telemedicine visit was calculated to range from \$19–\$121 per visit.

**Conclusions:** In our on-demand telemedicine program, we found the majority of health concerns could be resolved in a single consultation and new utilization was infrequent. Synchronous audio-video telemedicine consults resulted in short-term cost savings by diverting patients from more expensive care settings.

© 2018 Elsevier Inc. All rights reserved.

## 1. Introduction

Improvements in multimedia technology and expansion of internet access have enabled increased access to online services as well as convenient alternatives to traditional hospital-based or office-based services [1]. Virtual visits are a type of direct-to-consumer telemedicine in which a patient communicates with a provider via audio and video. Telemedicine visits are offered by a number of private and commercial providers and have grown in prevalence with one commercial provider network citing over 17.5 million members and completing over 952,000 virtual visits in 2016 [2]. Further growth may arise from alternative reimbursement policies, as the Bipartisan Budget Act of 2018 significantly broadened payment policy for telehealth [3]. Support for growth of telemedicine visits in particular comes from offering a unique value proposition in that they can both expand access to patients [4,5] while also reducing costs when compared to alternative care settings [6,7]. The

acute care setting is a particularly interesting target for the deployment of telemedicine given the potential to serve as a replacement for more costly visit to the emergency department.

Published data regarding cost-savings from use of telemedicine in the acute care setting is limited and not well defined [8]. Recent work, using commercial claims data has found mixed results regarding cost savings [9,10]. Most “literature” discussing cost-savings for on-demand telemedicine is presented simply stating that a telemedicine costs less than the alternative visit (for example, emergency department, urgent care, office visit) and often comes commercial marketing materials [6,11,12].

The objective of this study is to determine the financial impact of a synchronous audio and video on demand telemedicine visit in episodic based cost of care, taking into account both what patients would have done had telemedicine not been available, as well what the patients did following the telemedicine visit. Cost and cost effectiveness is one of the 4 domains included in the National Quality Forum (NQF) telehealth measures framework [13]. No prospective studies have evaluated taking into account the actual alternatives that the patients would have used, had the telemedicine option not be available [13].

\* Corresponding author at: Department of Emergency Medicine, Thomas Jefferson University, 1025 Walnut Street, Suite 300, Philadelphia, PA 19107, USA.  
E-mail address: [Judd.hollander@jefferson.edu](mailto:Judd.hollander@jefferson.edu) (J.E. Hollander).

## 2. Materials & methods

### 2.1. Study design

We conducted a prospective observational study of patients who sought care from an academic medical center synchronous audio video on-demand telemedicine program.

### 2.2. Setting & patient population

Jefferson Health launched a pilot program in July 2015 with medical center employees to provide access to an on-demand telemedicine call with an emergency physician. This service was expanded to the general public in September 2015. The platform used, JeffConnect, is available on computer, iOS, and Android devices and provides patients with on-demand care via audio video link with a Jefferson-employed emergency medicine physician 24 h per day, 7 days per week. The cost per visit for an on-demand visit is a \$49 flat fee. For this study, all visits occurring from November 2015 through June 2016 were analyzed. There were no exclusion criteria.

Patients access the JeffConnect app by downloading it from the app store or they can use the service on the web at <https://www.jeffconnect.org>. They create a secure username and password and then have a series of screens where they can enter medical history, medication, allergies and pharmacy information prior to the visit. Readers interested in reviewing the technology can register on the site for no charge and see the all the functionality before initiating the visit. Providers log on from their health system location using a tablet app or Web browser, also with a webcam and microphone. All telemedicine include real-time video and audio. Providers have access to the electronic medical record to review the patient's prior records and document the visit.

### 2.3. Data collected

Demographic data collected on patients included age, gender, and chief complaint. The patient also completed two surveys. A time-of-visit survey was prompted immediately upon completion of the visit. This survey contained the pertinent question, "If you had not used JeffConnect today, where would you have gone instead?" followed by discrete answer options. Choices included ED, urgent care, physician, retail clinic and done nothing.

A follow-up survey was conducted online via SurveyMonkey after the visit. Patients were emailed an access link on the Tuesday following the week after their visit (approximately 10–14 days later). This survey contained the pertinent question, "Did you see another healthcare provider about the same issue within 2-3 days of your telehealth visit?" with similar discrete answer options.

### 2.4. Analysis

The relative response rates to these questions were assessed to determine the rate at which the patients would have used alternatives to the telemedicine visit, as well as the rate of new care utilization (i.e., the percentage of patients that would not have sought any care if they had not completed a telemedicine visit). We conducted this analysis from the patient and payer perspective.

Then, the estimated cost of the alternative care setting was compared to that of the telemedicine visit in order to calculate weighted cost-saving per visit. Cost-estimates for various care settings were derived from existing cost literature and were based upon the variable cost of a visit. Fixed costs and depreciation of the telehealth platform, physician and other health care system expenses were not included in these estimates as we were approaching this from the patient and payer perspective and not attempting to determine whether a health system or provider would have a positive return on investment from

initiating an on-demand telemedicine program. Cost-estimates for the various care settings were utilized to create a range of cost assumptions for each setting. A range of values for each care setting was deemed more appropriate given the variability of cost estimates. The cost savings estimates were calculated at the high and low end of the cost estimate ranges.

## 3. Results

During the study period, 650 patients completed an on-demand video visit (Table 1). The average age of patients was 37 years old and 68% were female. Age and gender demographics for the two surveys were similar.

### 3.1. Time-of-visit survey

The post-visit survey (Table 2) question prompted upon completion of the telemedicine visit was completed by 429 patients (66%). The most frequent response to the question "If you had not used JeffConnect today, where would you have gone?" was "doctor's office" (146, 34%), followed by "urgent care" (143, 33%), "done nothing" (70, 16%), "Emergency Department" (50, 12%), and "retail health clinic" (20, 5%). The 16% of patients who responded "done nothing" are considered new utilization; these are the patients who, at the time of visit, would have not sought treatment if a telemedicine visit were unavailable.

### 3.2. Follow-up survey

The follow-up survey question (Table 2) was completed via SurveyMonkey by 172 patients (26%). Most (127, 74%) reported seeing no healthcare provider in the 2–3 days following the telemedicine visit; 25 (15%) of respondents reported visiting a doctor's office, 9 (5%) went to an ED, 7 (4%) went to urgent care, and 3 (2%) did not specify.

### 3.3. Cost assumptions

The literature values (see Appendix) gathered for each care setting represent varying methodologies and timeframes of cost. To match the scope of the survey question, the cost estimates for each setting are limited to the costs incurred during a single visit and exclude cost of subsequent downstream visits. The following are the estimated index visits cost ranges (Table 3), per setting: emergency department (\$358–\$1595), outpatient physician office visit (\$84–131), telemedicine visit (\$41–\$49), urgent care (\$98–\$163), and retail health clinic (\$66–\$89). These cost ranges are for costs to the patients for payment of services rendered. They are not charges, which may be considerably higher for emergency department visits, nor are they meant to represent actual costs to the health system.

### 3.4. Net cost savings

Using surveyed rates from the post-visit survey as a representation of diversion from an alternate care location, a weighted average cost savings from diversion was calculated to be between \$57 and \$238 per visit (Table 4). Using reported frequencies of care type sought in the 3 days subsequent to the telemedicine visit, a weighted average post-call cost per visit was calculated to be between \$38 and \$118. Combining the savings generated from diversion with the surveyed

**Table 1**  
Demographics.

	Sample	Time-of-visit survey	Follow-up survey
n (%)	650 (100)	429 (66)	172 (26)
Mean age (sd)	37.0 (15.5)	37.3 (14.6)	36.9 (18.4)
Female n (%)	442 (68)	295 (69)	127 (74)

**Table 2**  
Survey results.

	Time-of visit survey	Follow-up survey
ED	12%	5%
Urgent care	33%	4%
Retail health	5%	1%
Doctor's office	34%	15%
Done nothing	16%	74%
Unspecified <sup>a</sup>	0%	2%
Total	100%	100%

<sup>a</sup> Follow-up survey allowed for respondents to leave question blank.

estimate of utilization in the 3 days post-visit yields an approximate cost savings from the care episode. Overall, net cost savings ranged from \$19 to \$121.

#### 4. Discussion

The net cost savings to the patient or payer per telemedicine visit of \$19–\$121 represents a meaningful cost savings when compared with the \$49 cost of an on-demand visit. The primary source of the generated savings is from avoidance of the emergency department, as this is by far the most expensive of the alternative care options provided. Each visit that successfully diverted an emergency department visit to a telemedicine visit generated, on average, cost savings ranging from \$309 to \$1,546. No other alternate care type exceeded \$114 average savings per visit. The 11.5% rate of reported emergency department diversion in this study is in line with other work reporting rates between 5 and 12% [11,12]. The sensitivity to relative proportion of emergency department diversions warrants further consideration and analysis in future studies. Given the low variable cost of a JeffConnect call when compared to each alternative care option, the telemedicine visit represents an opportunity to create savings for any successful diversion from the traditional care settings, but particularly from the emergency department. The magnitude of savings remains less well-defined as evidenced by the range of net cost savings estimates.

This study differs in design from existing cost savings reports in that it sought to measure the impact of utilization after completion of the telemedicine visit on overall cost savings. Existing reports of cost savings do not factor in follow-up costs, treating the telemedicine visit more transactionally. Therefore, they likely overstate the savings by taking a more short-term view of the episode of care.

An important consideration in the cost profile of telemedicine is the potential to generate healthcare utilization that did not exist prior to the product offering. Specifically, patients who seek care via a telemedicine visit that would not have sought care without availability of the care option. Based upon the post-visit survey, 16% of all patients would have done nothing initially, which ultimately represents a modest increased cost when compared with the savings achieved from diversion from other care settings. This diversion rate roughly approximates with non-peer-reviewed claims regarding rates of new utilization that ranged from 10 to 12%, but is notably less than the 90% rate reported in a recent study using commercial claims data to analyze telemedicine costs in acute respiratory infection patients [9].

**Table 3**  
Cost assumptions (see Appendix for source cost assumptions).

	Low	High
ED	\$359	\$1595
Urgent care	\$98	\$163
Physician office	\$84	\$131
Retail health	\$66	\$89
Virtual visit	\$41	\$49

**Table 4**  
Net savings calculation.

Weighted Avg	Low	High
(+) Savings from diversion	\$57	\$238
(−) Costs reported post-visit	\$38	\$118
Net cost savings	\$19	\$121

The methodology that estimated 90% of telemedicine users to be new utilization relied upon the relative rate of change in in-person visits before and after a telemedicine visit between a cohort of telemedicine users and non-users. In that study, users of telemedicine did not reduce their rate of non-telemedicine usage commensurate with the rate of telemedicine use in the year following telemedicine adoption by the commercial insurer. This approach takes a much larger timeframe of diversion for a particular episode of care, meaning it potentially captures utilization that may not have been related to the initial incident. Nonetheless, those findings suggest that enlarging the observed timeframe around the index telemedicine visit could result in a more illustrative picture and capture more ancillary testing or follow-up costs.

In a different approach to telemedicine costs using commercial claims data, one study found that patients were not using telemedicine visits as a first step before seeking in-person care [10]. This study looked at patients experiencing at least one of the top-ten chief complaints of telemedicine users and compared them with comparable cohorts of patients at alternative settings. Telemedicine visit patients had similar rates of follow-up evaluation and management visits as matched patients using other care settings. Continued insight into the impact of telemedicine as a source of new utilization is still needed. Future work might attempt to combine the survey method with claims data to reconcile the existing discrepancy between surveyed utilization and documented utilization.

As adoption of telemedicine grows, an increase in proportion of patients who would have alternatively “done nothing” represents a risk to reduce the overall cost savings of the practice. However, a substantial shift would be necessary to outpace the savings from diversion. Conversely, this population of patients who would have done nothing may represent improved access and incorporation of patients into the healthcare system that might not have participated previously. This might actually prevent more costly care further down the line. Future studies should address these concerns.

Currently on-demand telemedicine charges are not commonly billed under E&M codes. This is, in part, due to lack of reimbursement through CMS and commercial payers. Services may be rendered by health systems, such as ours, but more commonly care is provided through large for-profit provider networks that are not restricted to accepting insurance payments, and therefore they either have contracts directly with employers or accept credit card transactions at the time of the call. Changes in reimbursement policy may increase or decrease the cost savings resulting from a telemedicine visit to the patient.

One limitation of this analysis is that it does not speak to the issue of cost-effectiveness. In that sense, this analysis looks more at the transactional cost of the visit compared with alternatives and excludes fixed costs of the program. It does not look at patient outcomes, care quality, or attempt to assign an economic value added by the service. We did attempt to evaluate the cost or return on investment from the perspective of a health system, where charges as low as \$49 may not allow the health system to operate an on-demand programs with a positive profit to loss ratio unless incorporating down stream revenue. Future studies may also incorporate other financial benefits, such as decreased time lost from work, child and pet care and costs of travel (gas, parking). Not including these items in our study biased it toward the null, thus strengthening the validity of our conclusion.

The cost estimates utilized in the analysis are heavily dependent upon the estimates of literature values. Additionally, the survey itself

is limited in that it asks only about the '2–3 days' following the appointment. Future assessments of financial impact should include data collected prospectively coupled with claims data over a longer time period to determine short and long term financial impact of telemedicine.

## Appendix A. Cost assumptions from relevant telehealth literature

Cost assumptions by care setting			
Care setting	Index visit cost	Source	Note
<b>Emergency Department</b>			
Ashwood et al. <sup>a</sup>	\$674	Claims	Acute respiratory infection
Gordon et al. <sup>b</sup>	\$1,404	Claims	10 most frequent chief complaints
Mehrotra et al. <sup>c</sup>	\$358	Claims	3 complaints, studied retail, not telehealth
HCCI <sup>d</sup>	\$1,595	Claims	Health Care Cost Institute's (HCCI) 2013 Cost and Utilization Report
Medicare <sup>e</sup>	\$943	Claims	Medicare & Medicaid Research Review, 2013 Statistical Supplement.
Teladoc <sup>f</sup>	\$1,477	Proprietary	Teladoc marketing materials
American Well <sup>g</sup>	\$754	Proprietary	American well marketing materials
<b>Physician office</b>			
Ashwood et al. <sup>a</sup>	\$84	Claims	Acute respiratory infection
Gordon et al. <sup>b</sup>	\$109	Claims	10 most frequent chief complaints
Mehrotra et al. <sup>c</sup>	\$106	Claims	3 complaints, studied retail, not telehealth
HCCI <sup>d</sup>	\$98	Claims	Health Care Cost Institute's (HCCI) 2013 Cost and Utilization Report
Medicare <sup>e</sup>	\$83	Claims	Medicare & Medicaid Research Review, 2013 Statistical Supplement.
Teladoc <sup>f</sup>	\$131	Proprietary	Teladoc marketing materials
American Well <sup>g</sup>	\$99	Proprietary	American well marketing materials
<b>Telehealth</b>			
Ashwood et al. <sup>a</sup>	\$41	Claims	Acute respiratory infection
Gordon et al. <sup>b</sup>	\$49	Claims	10 most frequent chief complaints
<b>Urgent care</b>			
Gordon et al. <sup>b</sup>	\$134	Claims	10 most frequent chief complaints
Mehrotra et al. <sup>c</sup>	\$103	Claims	3 complaints, studied retail, not telehealth
HCCI <sup>d</sup>	\$116	Claims	Health Care Cost Institute's (HCCI) 2013 Cost and Utilization Report
Medicare <sup>e</sup>	\$98	Claims	Medicare & Medicaid Research Review, 2013 Statistical Supplement.
Teladoc <sup>f</sup>	\$163	Proprietary	Teladoc marketing materials
American Well <sup>g</sup>	\$140	Proprietary	American well marketing materials
<b>Retail health</b>			
Gordon et al. <sup>b</sup>	\$74	Claims	10 most frequent chief complaints
Mehrotra et al. <sup>c</sup>	\$66	Claims	3 complaints, studied retail, not telehealth
Walgreens <sup>h</sup>	\$89		Advertised price w/o insurance
CVS <sup>i</sup>	\$89		Advertised price w/o insurance

<sup>a</sup> Ashwood JS, Mehrotra A, Cowling D, Uscher-Pines L. Direct-To-Consumer Telehealth May Increase Access To Care But Does Not Decrease Spending. *Health Aff (Millwood)*. 2017;36 [3]:485–491. doi:<https://doi.org/10.1377/hlthaff.2016.1130>.

<sup>b</sup> Gordon AS, Adamson WC, DeVries AR. Virtual Visits for Acute, Nonurgent Care: A Claims Analysis of Episode-Level Utilization. *J Med Internet Res*. 2017;19 [2]. doi:<https://doi.org/10.2196/jmir.6783>

<sup>c</sup> Mehrotra A, Liu H, Adams J, et al. The Costs and Quality of Care for Three Common Illnesses at Retail Clinics as Compared to Other Medical Settings. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2805258/pdf/nihms133894.pdf>. Accessed March 15, 2017.

<sup>d</sup> 2013 Health Care Cost and Utilization Report. Washington, DC; 2014.

<sup>e</sup> CMS. Medicare & Medicaid Research Review, 2013 Statistical Supplement. Baltimore, MD; 2014. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Archives/MMSS/2013.html>.

<sup>f</sup> Teladoc, Inc. Where Are Your Employee's[sic] Receiving Care?; 2014. <http://highmarkwpa.teladoc.com/how-you-save-money/>.

<sup>g</sup> Modahl M. Employer Best Practices in Telehealth. Boston, MA; 2015. <http://go.americanwell.com/rs/335-QLG-882/images/Employer-Best-Practices-eBook.pdf>.

<sup>h</sup> Walgreens. Walgreens Healthcare Clinic Price Menu. <https://www.walgreens.com/topic/pharmacy/healthcare-clinic/price-menu.jsp>. Published 2016.

<sup>i</sup> CVS. CVS Minute Clinic Price List. <https://www.cvs.com/minuteclinic/services/price-lists>. Published 2016.

## References

- [1] Dorsey ER, Topol EJ. State of Telehealth. *Campion EW, ed. N Engl J Med* 2016;375(2): 154–61. <https://doi.org/10.1056/NEJMra1601705>.
- [2] Teladoc I. Teladoc. Purchase, NY: Inc. Annual Report; 2016 <http://ir.teladoc.com/financial-info/annual-reports/default.aspx>.
- [3] <https://www.gpo.gov/fdsys/pkg/BILLS-115hr1892enr/html/BILLS-115hr1892enr.htm>, Accessed date: 28 April 2018.
- [4] Uscher-Pines L, Mehrotra A. Analysis of Teladoc use seems to indicate expanded access to care for patients without prior connection to a provider. *Health Aff (Millwood)* 2014;33(2):258–64. <https://doi.org/10.1377/hlthaff.2013.0989>.
- [5] Ronis SD, McConnochie KM, Wang H, Wood NE. Urban telemedicine enables equity in access to acute illness care. *Telemed* 2017;23(2):105–12. <https://doi.org/10.1089/tmj.2016.0098>.
- [6] Bryant M. Telehealth Vendors Getting Value Out of Partnerships. *HealthcareDive.com*. <http://www.healthcaredive.com/news/payers-telehealth-vendors-getting-value-out-of-partnerships/421463/>. Published June 23, 2016.
- [7] Courneya PT, Palattao KJ, Gallagher JM. HealthPartners' online clinic for simple conditions delivers savings of \$88 per episode and high patient approval. *Health Aff (Millwood)* 2013;32(2):385–92. <https://doi.org/10.1377/hlthaff.2012.1157>.
- [8] de la Torre-Díez I, López-Coronado M, Vaca C, Aguado JS, de Castro C. Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. *Telemed e-Health* 2015;21(2):81–5. <https://doi.org/10.1089/tmj.2014.0053>.
- [9] Ashwood JS, Mehrotra A, Cowling D, Uscher-Pines L. Direct-to-consumer telehealth may increase access to care but does not decrease spending. *Health Aff (Millwood)* 2017;36(3):485–91. <https://doi.org/10.1377/hlthaff.2016.1130>.

## 5. Conclusions

For on-demand care, our results indicate that telemedicine visits represent a short-term cost savings opportunity as they divert patients from more expensive care settings.

- [10] Gordon AS, Adamson WC, Devries AR. Virtual visits for acute, nonurgent care: a claims analysis of episode-level utilization. *J Med Internet Res* 2017;19(2). <https://doi.org/10.2196/jmir.6783>.
- [11] Teladoc, Inc. Where Are Your Employee's[sic] receiving care? <http://highmarkwpa.teladoc.com/how-you-save-money/>; 2014.
- [12] Modahl M. Employer Best Practices in Telehealth. Boston: MA; 2015 <http://go.americanwell.com/rs/335-QLG-882/images/Employer-Best-Practices-eBook.pdf>.
- [13] NQF. Telehealth framework to support measure development. [http://www.qualityforum.org/Telehealth\\_2016-2017.aspx](http://www.qualityforum.org/Telehealth_2016-2017.aspx); 2016–2017, Accessed date: 7 July 2018.