Access and Quality of Care in Direct-to-Consumer Telemedicine

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Abstract

Background: *Direct-to-consumer (DTC) telemedicine serves millions of patients; however, there is limited research on the care provided. This study compared the quality of care at Teladoc (www.teladoc.com), a large DTC telemedicine company, with that at physician offices and compared access to care for Teladoc users and nonusers.* ***Materials and Methods:*** *Claims from all enrollees 18–64 years of age in the California Public Employees' Retirement System health maintenance organization between April 2012 and October 2013 were analyzed. We compared the performance of Teladoc and physician offices on applicable Healthcare Effectiveness Data and Information Set measures. Using geographic information system analyses, we compared Teladoc users and nonusers with respect to rural location and available primary care physicians.* ***Results:*** *Of enrollees offered Teladoc (*n = *233,915), 3,043 adults had a total of 4,657 Teladoc visits. For the pharyngitis performance measure (ordering strep test), Teladoc performed worse than physician offices (3% versus 50%,* $p < 0.01$*). For the back pain measure (not ordering imaging), Teladoc and physician offices had similar performance (88% versus 79%,* $p = 0.20$*). For the bronchitis measure (not ordering antibiotics), Teladoc performed worse than physician offices (16.7 versus 27.9%,* $p < 0.01$*). In adjusted models, Teladoc users were not more likely to be located within a healthcare professional shortage area (odds ratio = 1.12,* $p = 0.10$*) or rural location (odds ratio = 1.0,* $p = 0.10$*).* ***Conclusions:*** *Teladoc providers were less likely to order diagnostic testing and had poorer performance on appropriate antibiotic prescribing for bronchitis. Teladoc users were not preferentially located in underserved communities. Short-term needs include ongoing monitoring of quality and additional marketing and education to increase telemedicine use among underserved patients.*

Key words: *telehealth, telemedicine, commercial telemedicine, emergency medicine/teletrauma*

Introduction

Direct-to-consumer (DTC) telemedicine companies provide consumers around-the-clock access to care for common, nonemergency conditions through phone and live video via Webcam or smartphone applications. The industry is growing rapidly with an approximately 1 million visits in 2014.[1] DTC telemedicine physicians diagnose, recommend treatment, and, if indicated, prescribe medications. Patients and physicians do not have an established relationship, and physicians do not have access to the patient's full electronic health record.

DTC telemedicine offers patients the convenience of receiving care at home or work at any time of day. Telemedicine companies argue they can generate savings for employers, payers, and patients by substituting cheaper virtual visits (approximately $40 dollars per visit) for costlier visits to emergency departments (EDs) or physician offices. They may also save patient time by eliminating travel and reducing time off from work to seek treatment. DTC telemedicine can also potentially increase access where there are physician shortages. Payers and employers frequently offer DTC telemedicine to improve access for underserved, rural populations.

Although DTC telemedicine has the potential to increase access, whether it does so in practice is unclear. DTC telemedicine requires patients to use potentially unfamiliar technology and embrace a different model of care. These might limit the use of DTC telemedicine by underserved populations. Furthermore, concerns about the quality of DTC telemedicine has been expressed by stakeholders such as the Federation of State Medical Boards[2] and the American Medical Association.[3] The concerns are driven by the lack of a physician–patient relationship, limited or no access to medical records, limitations of what can be done in a virtual physical examination, and barriers to diagnostic testing. Together, these limitations could lead to misdiagnosis or poor quality of care.[4–6]

Although there have been several studies of telemedicine services between primary care providers (PCPs) and their existing patients,[5,7] there has been limited prior work on the quality of DTC telemedicine outside of the medical home and

 DOI: 10.1089/tmj.2015.0079

whether DTC telemedicine actually increases access for the underserved. In prior work we have examined antibiotic prescribing in DTC telemedicine[8] but did not look at established quality measures or access to care.

To address this knowledge gap, we studied the care provided by Teladoc (www.teladoc.com), one of the largest DTC telemedicine providers in the United States.[9] Using health plan claims from a large employer in California, we used geographic information system–based analyses to compare Teladoc users and nonusers with respect to location and proximity to alternative sites of care. We also compared the performance of Teladoc and physician offices on applicable Healthcare Effectiveness Data and Information Set (HEDIS) measures.

Study Data and Methods

SETTING

In April 2012, the California Public Employees' Retirement System (CalPERS) first offered Teladoc as a covered benefit for approximately 370,000 members enrolled in its Blue Shield of California health maintenance organization plan. CalPERS is an agency that manages pension and health benefits for California public employees, retirees, and their families, with 1.4 million members receiving health coverage. This study describes CalPERS' experience with Teladoc in the first 19 months of the program, April 2012–October 2013.

HOW TELADOC VISITS ARE PROVIDED

Teladoc is currently offered to 10 million individuals, including members of health plans and employees of companies that have contracted with Teladoc to provide DTC telemedicine services.[9] The vast majority of Teladoc visits occur via telephone, although patients can submit photographs and/or elect to have live video visits. To initiate a Teladoc visit, patients must first create an online account and enter information about their medical history. This information, along with data on patients' Teladoc visits, becomes part of their electronic health record housed within Teladoc. Patients then request a consult with a Teladoc physician via telephone, Internet, or mobile application when they require care. Teladoc physicians respond to requests 24 h/day, 7 days a week. The patient is assigned to an available physician licensed to practice in the patient's state of residence. The physician receives the patient's request, reviews the patient's medical history, and contacts the patient, usually within 16–20 min according to Teladoc's marketing materials. The physician diagnoses the patient's condition, discusses the diagnosis and treatment options, and, if indicated, sends a prescription to the patient's preferred pharmacy. If the patient is judged to need testing, follow-up care, or immediate medical attention, the patient is directed to contact his or her primary care physician or to visit an ED.

DATA SOURCE

CalPERS provided de-identified health plan claims data and enrollment information on all enrollees in their Blue Shield of California health maintenance organization plan. We limited the study population to those between the ages of 18 and 64 years who were continuously enrolled in the CalPERS health maintenance organization plan, and we divided the population into two groups: Teladoc users ($n = 3{,}043$) and nonusers ($n = 230{,}872$). Nonusers included those with no healthcare use during the study period. Teladoc users had at least one visit to Teladoc from April 2012 through October 2013.

Enrollee-level data included sex, age, and zip code of residence. Claim and line-level data included site of care, procedure codes, date of service, diagnoses, and medications prescribed and covered all services paid by CalPERS with dates of service between April 2011 and October 2013. We used data from just before the offer of Teladoc (April 2011–March 2012) to identify comorbidities.

ACCESS TO ALTERNATIVE SITES

To determine whether enrollees were located in an underserved area and had access to alternative sites for care, we geocoded the addresses of in-network PCPs, EDs, and urgent care centers. We also geocoded each enrollee's home residence to his or her zip codes code centroid. Due to Health Insurance Portability and Accountability Act limitations on protected health information, we could not obtain their full address. Of the enrollee zip codes and provider addresses, 94.5% were geocoded with a match score of 80% or higher.

We used five variables to measure patient access: whether the enrollee's zip code fell within a primary healthcare professional shortage area (HPSA) as designated by the Health Resources and Services Administration,[10] whether the enrollee's zip code was classified as rural (versus urban) using Rural-Urban Commuting Area Codes as defined by the U.S. Department of Agriculture,[11] and travel time in minutes from the enrollee's zip code centroid to the nearest in-network PCP, travel time to nearest ED, and travel time to nearest urgent care center. To categorize enrollees as rural versus urban, we used Rural-Urban Commuting Area Codes primary codes, defining urban as a metropolitan area or a nonmetropolitan area with 30% or more of workers commuting to a census-defined urbanized area.[11] To calculate travel time by car, we used the Network Analyst Tool in ArcGIS version 10.2,

with ESRI's Streetmap North America data serving as the network layer.

On the five access variables we compared Teladoc users with nonusers (including both those who used healthcare and those who did not during the study period) using chi-squared tests. We also performed adjusted analyses to assess whether patient location was associated with Teladoc usage during the study period (yes/no). In logistic regression models predicting Teladoc use, we adjusted for age, sex, relation to CalPERS primary beneficiary, healthcare spending prior to the introduction of Teladoc, average income in enrollee zip code, location within a HPSA, rural location, and travel time to the nearest PCP, ED, and urgent care center. All location variables were also assessed in separate logistic regression models to account for potential collinearly.

PERFORMANCE ON HEDIS MEASURES INVOLVING DIAGNOSTIC TESTING

We compared performance on three HEDIS measures to assess quality of care provided at Teladoc. HEDIS is a widely recognized set of performance measures that has been used to measure quality in managed care plans since 1991. HEDIS measures examine processes and outcomes for high-volume acute and chronic conditions as well as preventive care.[12] We reviewed HEDIS 2014 "effectiveness of care" measures[13] and selected all measures that addressed an acute problem managed by Teladoc. For example, we did not include measures related to preventive health screenings or management of chronic illnesses such as asthma or chronic obstructive pulmonary disease. Two of these measures involved use of diagnostic testing: use of low imaging studies for low back pain and appropriate testing for pharyngitis. One additional measure—avoidance of antibiotics in adults with acute bronchitis—assessed the extent to which adults received antibiotics in cases where it was not clinically indicated.

We hypothesized that DTC telemedicine would have higher rates of antibiotic use because of the tendency for providers to practice conservatively when lacking diagnostic information. Also, we hypothesized that Teladoc would have lower rates of diagnostic testing because testing is not available on-site, as is often the case in physician offices, and DTC telemedicine is designed to diagnose and treat patients in one interaction, and obtaining a test would require a follow-up visit.

Avoidance of antibiotics in adults with acute bronchitis captures the percentage of adults 18–64 years of age with a diagnosis of uncomplicated acute bronchitis who were not dispensed an antibiotic prescription within 3 days of the visit. A higher score indicates better performance as antibiotics are *not* recommended for this population of patients. The use of imaging studies for low back pain captures the percentage of adults 18–50 years of age with a primary diagnosis of low back pain who did not have an imaging study (plain x-ray, magnetic resonance imaging, computed tomography scan) within 28 days of the diagnosis. A higher score indicates better performance as diagnostic testing in this case is *not* recommended because low back pain is typically a self-limited condition that resolves within 30 days. Appropriate testing for pharyngitis captures the percentage of *children* who were diagnosed with only pharyngitis, dispensed an antibiotic, and received a Group A *Streptococcus* (strep) test for the episode. We modified this measure for use in adults and applied it to adults 18–64 years of age. There is some controversy on whether clinical signs alone are sufficient in adults to diagnose streptococcal pharyngitis; current Infectious Disease Society of America guidelines recommend routine testing of all adults for streptococcal pharyngitis before treatment.[14] For this measure, diagnostic testing *is* indicated, and as above, a higher score indicates better performance. Pharyngitis is the only common condition among upper respiratory infections where diagnosis is frequently be made via testing. It may serve as an important indicator of appropriate antibiotic use among all respiratory tract infections.

We used National Committee for Quality Assurance documentation to define these measures (e.g., identify exclusions and applicable episodes) and compared performance by Teladoc and physician offices using chi-squared tests.[12] All analyses were performed using SAS version 9.3 software (SAS Institute, Cary, NC), and values of $p < 0.05$ were considered significant.

Results

From April 2012 through October 2013, 3,043 adults used Teladoc for a total of 4,657 visits (1.5 visits per user). Compared with patients who used other sites for care, Teladoc users were more likely to be younger than 51 years of age (66% versus 58%, $p < 0.01$) and to be female (63% versus 56%, $p < 0.01$) (*Table 1*).

ACCESS FOR UNDERSERVED POPULATIONS

In unadjusted analyses, Teladoc users were slightly more likely to be located in a rural area (6.0% versus 5.8%, $p = 0.65$) and in a HPSA (22.2% versus 20.0%, $p < 0.01$) compared with Teladoc nonusers with some healthcare utilization (*Table 2*). When adjusting for age, sex, and other factors as described above, location within an HPSA (odds ratio = 1.12, $p = 0.10$) and rural location (odds ratio = 1.0, $p = 0.98$) were not significantly associated with Teladoc use.

In unadjusted analyses, there we no differences with respect to drive time to the nearest PCP (approximately 3 min for all

Table 1. Characteristics of Adult Teladoc Users and Nonusers, April 2012–October 2014

	TELADOC (*N*=3,043)	NON-TELADOC (*N*=214,944)	*P* VALUE
Sex			
Male	1,121 (36.8)	94,530 (44.0)	<0.01
Female	1,922 (63.2)	120,414 (56.0)	
Age (years)			
18–30	476 (15.6)	38,777 (18.0)	<0.01
31–50	1,544 (50.7)	86,379 (40.2)	
51+	1,023 (33.6)	89,788 (41.8)	
Chronic illness			
0	1,544 (50.7)	109,152 (50.8)	0.96
1+	1,499 (49.3)	105,792 (49.2)	

Data are number (%). Teladoc nonusers were limited to those with at least one visit to any site for care during the study period.

groups) or ED (approximately 10 min for all groups) across Teladoc users and nonusers (*Table 2*). However, Teladoc users were located further from an urgent care center than nonusers (15.5 versus 12.8 min, $p<0.01$). In adjusted analyses, differences in travel time to the nearest PCP and ED remained insignificant. However, each additional minute of travel time to an urgent care center was associated with a 0.3% increase in the odds of being a Teladoc user ($p<0.01$).

Table 2. Location Characteristics and Travel Time of Teladoc Users and Nonusers

	TELADOC USER (*N*=2,744)	TELADOC NONUSERS		*P* VALUE[a]
		WITH 1+ VISITS (*N*=189,055)	NO UTILIZATION (*N*=19,382)	
Location characteristics				
HPSA (%)	610 (22.2)	37,923 (20.0)	4,139 (21.4)	<0.01
Rural (%)	166 (6.0)	11,055 (5.8)	1,026 (8.4)	0.64
Travel time (mean in min) to nearest				
PCP	3.2	3.1	3.0	0.45
Hospital	10.6	10.3	10.1	0.10
Urgent care	15.5	12.8	12.5	<0.01

[a]*p* value compares Teladoc users and nonusers with 1+ visits.

HPSA, medical care (health) professional shortage area; PCP, primary care provider.

PERFORMANCE ON HEDIS MEASURES

Physician offices performed notably better than Teladoc on appropriate testing for pharyngitis. Of applicable pharyngitis encounters, there was an associated strep test in 50% of physician encounters and 3.4% of Teladoc encounters ($p<0.01$). In contrast, Teladoc performed better than physician offices on the use of imaging studies for low back pain, although differences were not significant as there were relatively few applicable low back pain episodes at Teladoc. Of applicable low back pain encounters, there was no imaging study within 28 days in 78.5% of physician office encounters and 87.9% of Teladoc encounters. Physician offices also performed significantly better than Teladoc on avoidance of antibiotics for acute bronchitis. Of applicable bronchitis encounters, antibiotics were not prescribed in 27.9% of physician office encounters compared with 16.7% of Teladoc encounters ($p<0.01$) (*Table 3*).

Discussion

Our results indicated that Teladoc users are not preferentially located in underserved communities. Teladoc visits are associated with less diagnostic testing and poorer performance on appropriate antibiotic prescribing for acute bronchitis compared with physician offices.

A major goal of telemedicine programs is to increase access to care to underserved populations. However, it appears that Teladoc is primarily serving those in urban areas in close proximity to a range of alternatives for acute care. This is in contrast to the Veterans Health Administration and Medicare, which have been successful in targeting telemedicine services to the underserved. Simply offering DTC telemedicine may not be sufficient because patients must be somewhat technologically savvy and willing to experiment with a new model of delivery, typically without direct support or encouragement from their regular providers. As such, DTC telemedicine companies may need to take additional steps such as aggressive marketing and education within patients' medical homes to overcome the digital divide and increase use among the patients that could most benefit from its services. Although the goal may to be preferentially treat those in underserved communities, we recognize that many patients in urban areas may have barriers to timely and accessible care, including difficulty obtaining a suitable appointment. The patients who regularly use Teladoc may confront such challenges.

Teladoc visits were associated with less diagnostic testing compared with physician offices. This has different implications for quality depending on the condition, as diagnostic testing is recommended for streptococcal pharyngitis but

Table 3. Performance on Healthcare Effectiveness Data and Information Set Measures Comparing Teladoc and Physician Offices

	POPULATION APPLICATION (AGE IN YEARS)	TELADOC		PHYSICIAN OFFICE		*P* VALUE
		APPLICABLE EPISODES	PASS RATE (%)	APPLICABLE EPISODES	PASS RATE (%)	
Appropriate testing for pharyngitis[a]	18–64	113	3.4	4,641	49.5	<0.01
Use of imaging studies for low back pain[b]	18–50	33	87.9	17,790	78.8	0.20
Avoidance of antibiotics in adults with acute bronchitis[c]	18–64	168	16.7	7,342	27.9	<0.01

[a]The percentage of adults 18–64 years of age who were diagnosed with only pharyngitis, dispensed an antibiotic, and received a Group A *Streptococcus* (strep) test for the episode. (This is based on a Healthcare Effectiveness Data and Information Set measure for children.)

[b]Percentage of adults 18–50 years of age with a primary diagnosis of low back pain who did not have an imaging study (plain x-ray, magnetic resonance imaging, computed tomography) within 28 days of the diagnosis.

[c]The percentage of adults 18–64 years of age with a diagnosis of uncomplicated acute bronchitis who were not dispensed an antibiotic prescription.

discouraged for lower back pain. Teladoc is relatively unique in concerns about undertesting because outpatient settings are typically criticized for overtesting, which can be costly and pose a risk to patients.[15] Because of lack of on-site testing, Teladoc physicians tell patients to seek testing via their primary care physician or an emergency department. Our results highlight that patients infrequently do so, and therefore treatment of conditions where testing is necessary may be inappropriate for DTC telemedicine at this time. To address this limitation, Teladoc is developing protocols for its physicians to order testing directly. In addition, the greater use of rapid home testing could address this quality concern.[16]

Finally, Teladoc had higher rates of antibiotic prescribing for acute bronchitis. In an earlier study, we found that Teladoc and physician offices had similar antibiotic prescribing rates for acute respiratory infections overall[8]; however, our findings here highlight significant differences in antibiotic prescribing patterns for bronchitis. Bronchitis is of particular interest because it is classified as a diagnosis for which antibiotics are never appropriate, and, as such, many initiatives focus specifically on decreasing antibiotic use in adults with this condition. Focused provider education and training could be directed to those conditions where antibiotic prescribing rates at Teladoc are higher than desired.

Our study had several limitations. First, we only described the CalPERS experience with Teladoc, so our results may not generalize to entities outside of California, to different types of patient populations (e.g., with less comprehensive insurance or a higher proportion of rural residents), or to telemedicine companies with different features. Second, we only had the zip codes of patients rather than their full postal addresses, and as a result our analyses related to access lacked some precision. Finally, the pharyngitis testing measure that we applied to adults was designed for use in children.

DTC telemedicine is growing at a rapid rate despite lack of evidence-based research on whether it is offering care of comparable quality or fulfilling its promise to reach the patients who need it most. The Texas Medical Board has worked to restrict the operation of Teladoc and similar DTC telemedicine companies in Texas, citing concerns about quality and lack of accountability to patients.[17] Although additional work is needed to fully explore the impact of DTC telemedicine on access and the extent to which different features of DTC telemedicine services impact quality (e.g., telephone visits versus video visits), our research suggests that focused attention is needed on the use of antibiotics and on facilitating diagnostic testing. Studies such as this should help DTC telemedicine companies improve their services and inform ongoing policy debates in the United States on the appropriateness of different models of telemedicine for acute care.

Acknowledgments

Support for this work comes from a grant from the California Health Care Foundation. A.M. was also supported by grant R21 AI097759-01 from the National Institutes of Health.

Disclosure Statement

No competing financial interests exist.

REFERENCES

1. Dougherty C. Am I sick? Google has a doctor waiting on video. **2014.** Available at http://bits.blogs.nytimes.com/2014/10/13/am-i-sick-google-has-a-doctor-waiting-on-video/?_php=true&_type=blogs&_php=true&_type=blogs&_php=true&_type=blogs&emc=edit_tu_20141014&nl=technology&nlid=31581203&_r=4 (last accessed January 10, 2015).

2. Federation of State Medical Boards. Model policy for the appropriate use of telemedicine technologies in the practice of medicine. **2014.** Available at https://www.fsmb.org/Media/Default/PDF/FSMB/Advocacy/FSMB_Telemedicine_Policy.pdf (last accessed October 3, 2015).
3. American Medical Association. Telemedicine: Is prescription writing allowed? Available at www.ama-assn.org/ama/pub/physician-resources/legal-topics/telemedicine.page (last accessed January 5, 2015).
4. DeJong C, Santa J, Dudley R. Websites that offer care over the Internet: Is there an access quality tradeoff? *JAMA* **2014;**311:1287–1288.
5. Mehrotra A, Paone S, Martich D, Albert S, Shevchik G. A comparison of care at e-visits and physician office visits for sinusitis and urinary tract infection. *JAMA Intern Med* **2013;**173:72–74.
6. North F, Crane S, Stroebel R, Cha S, Edell E, Tulledge-Scheitel S. Patient-generated secure messages and eVisits on a patient portal: Are patients at risk? *J Am Med Inform Assoc* **2013;**20:1143–1149.
7. Courneya P, Palattao K, Gallagher J. HealthPartners' online clinic for simple donditions delivers savings of $88 per episode and high patient approval. *Health Aff (Millwood)* **2013;**32:385–392.
8. Uscher-Pines L, Mulcahy A, Hunter C, Burns R, Mehrotra A. Antibiotic prescribing for acute respiratory infections in direct-to-consumer telemedicine visits. *JAMA Intern Med* **2015;**175:1234–1235.
9. Independent Health Foundation and Teladoc join efforts to provide medical relief for all Western New Yorkers. **2014.** Available at www.teladoc.com/news/2014/11/21/independent-health-foundation-and-teladoc-join-efforts-to-provide-medical-relief-for-all-western-new-yorkers/ (last accessed January 3, 2015).
10. U.S. Department of Health and Human Services. HPSA by state & county 2015. Available at http://hpsafind.hrsa.gov/ (last accessed April 10, 2015).
11. U.S. Department of Agriculture. Rural-urban commuting area codes. **2015.** Available at www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx (last accessed April 10, 2015).
12. National Committee for Quality Assurance. HEDIS measures. **2015.** Available at www.ncqa.org/HEDISQualityMeasurement/HEDISMeasures.aspx (last accessed January 2, 2015).
13. National Committee for Quality Assurance. HEDIS®1 2014 Volume 2: Technical update. **2013.** Available at www.ncqa.org/Portals/0/HEDISQM/HEDIS2014/HEDIS_2014_Volume_2_Technical_Update_FINAL_9.30.13.pdf (last accessed January 2, 2015).
14. Shulman S, Bisno A, Clegg H, et al. Clinical practice guideline for the diagnosis and management of Group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin Infect Dis* **2012;**55:e86–e102.
15. Qaseem A, Alguire P, Dallas P, et al. Appropriate use of screening and diagnostic tests to foster high-value, cost-conscious care. *Ann Intern Med* **2012;**156:147–149.
16. Robinson A. Home health tests: The rise in DIY diagnosis. **2013.** Available at www.theguardian.com/lifeandstyle/2013/nov/17/home-health-tests-diy-diagnosis-cancer-cholesterol-cannabis (last accessed January 6, 2015).
17. Wicklund E. Texas board curbs telemedicine. mHealthNews. **2015.** Available at www.mhealthnews.com/news/texas-board-curbs-telemedicine-prompts-lawsuit?page=0 (last accessed January 24, 2015).

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Received: May 1, 2015
Revised: July 9, 2015
Accepted: July 10, 2015