Use of Commercial Direct-to-Consumer Telemedicine by Children

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The authors have no conflicts of interest to disclose.
Presented in part at the Pediatric Academic Societies annual meeting, May 6, 2018, Toronto, Ontario.
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Received for publication August 9, 2018; accepted November 3, 2018.

ABSTRACT

OBJECTIVE: In commercial direct-to-consumer (DTC) telemedicine, physicians outside of the medical home treat common, acute complaints through real-time, audio-visual conferencing using telephones and personal computers. There has been little examination of the use of DTC telemedicine by children. We describe trends in DTC telemedicine use and DTC telemedicine visit characteristics.

METHODS: Using 2011−2016 claims from a large national health plan, we identified pediatric acute visits to DTC telemedicine and to primary care providers (PCPs). We examined DTC telemedicine visit trends and compared DTC telemedicine and acute PCP visit diagnoses and patient characteristics.

RESULTS: From 2011 through 2016, pediatric DTC telemedicine visits increased from 38 to 24,409 visits annually. In 2015 and 2016, the most common primary diagnoses for DTC telemedicine visits (n = 42,072) were infections of the nose/sinuses (24%), mouth/throat (16%), and ear (9%), which were also the most common diagnoses for acute PCP visits (n = 6,917,976). Odds of DTC telemedicine use were higher for children in non-metropolitan communities (odds ratio [OR], 1.45; 95% confidence interval [CI], 1.40−1.51) and children without preventive visits (OR, 1.08; 95% CI, 1.06−1.11). Compared to children receiving acute PCP care, children with DTC telemedicine visits were also more likely to have had urgent care (17% vs 10%; $P < .001$) and emergency department visits (21% vs 19%; $P < .001$) during the study period.

CONCLUSIONS: The use of commercial DTC telemedicine visits for children is growing rapidly, primarily for acute respiratory infections. Compared to children who did not use DTC telemedicine for acute care, children using DTC telemedicine were also more likely to use other venues for acute care outside of the medical home.

KEYWORDS: direct to consumer; pediatric; telehealth; telemedicine; utilization

ACADEMIC PEDIATRICS 2019;19:665−669

WHAT'S NEW

Pediatric direct-to-consumer (DTC) telemedicine use is growing rapidly, primarily for acute respiratory infections. Compared to children not using commercial DTC telemedicine for acute care, children using DTC telemedicine were more likely to also use emergency departments and urgent care facilities.

IN THE COMMERCIAL direct-to-consumer (DTC) telemedicine model of many national companies, physicians outside of the medical home treat common, acute complaints on-demand through audio-only or audio-video conferencing via personal devices.[1] Although some primary care practices have integrated acute care telemedicine within the medical home,[2−4] national commercial DTC telemedicine companies (eg, Doctor on Demand, Amwell, Teladoc) currently provide the majority of telemedicine visits for acute primary care complaints, either directly or through platforms rebranded by hospitals or health plans as their own.[5]

The American Academy of Pediatrics has cautioned against the use of DTC telemedicine outside of the medical home,[6] given concerns about fragmentation and quality of care. Specifically, DTC telemedicine outside of the medical home may decrease informational continuity, relational continuity, and management continuity.[7] Quality concerns include the limited exam that can be performed via smartphone and personal computer, as well as the potential inconsistency of camera and connection quality.[6,8] Despite such concerns, 96% of large employers now provide coverage through their health plans for telemedicine services for employees and dependents,[9] thus providing millions of children with access to DTC telemedicine.

While access to DTC telemedicine expands, data on pediatric DTC telemedicine are limited. One health system recently described their first 1000 DTC telemedicine visits for children and reported high parent satisfaction; two-thirds of parents stated that the DTC telemedicine visit allowed them to avoid an urgent care, a retail-based clinic, or an emergency visit.[10] Studies on commercial DTC telemedicine quality outcomes are limited to adults. These studies report that DTC telemedicine can increase access to care,[1,11,12] but that visit quality may be lower for specific quality measures[11,13] and the ease of accessing DTC telemedicine may generate increased utilization and spending.[1]

To fill the knowledge gap on pediatric DTC telemedicine use, we analyzed claims from a large national health plan. We examined trends in DTC telemedicine use over time and compared DTC telemedicine and acute PCP visit diagnoses, patient characteristics, and patient health care use.

METHODS

We used 2011−2016 claims for children ≤17 years old from a national commercial health plan that contracts with a large national DTC telemedicine vendor and covers approximately 4 million children enrolled per year across all 9 census divisions of the United States. All professional, pharmaceutical, and facility claims were available.

Based on previously published methods,[14] we identified DTC telemedicine, emergency department, and urgent care visits using a combination of Current Procedural Terminology (CPT) codes, place of service codes, national provider identifiers, and tax identification numbers. We identified PCP visits using CPT codes and provider specialty codes. We defined acute PCP visits as PCP visits where the billing or primary diagnosis code did not indicate a health supervision or immunization visit.

In visit-level analyses, we examined the volume of DTC telemedicine visits from 2011 to 2016, including absolute number of visits as well as number of visits per pediatric member-year nationally and within census regions. Focusing on 2015−2016 DTC telemedicine visits to assess the most recent use patterns, we then compared primary diagnosis subgroups and diagnosis severity determined using a published diagnosis grouping system designed for categorizing pediatric acute care visits.[15] This diagnosis grouping system identifies 21 major groups (eg, respiratory diseases, neurologic disease, trauma) and 77 subgroups of diagnoses (eg, asthma, headache, strains and sprains). This diagnosis grouping system also categorizes visit diagnoses into 5 severity levels, from least severe (1) to most severe (5). We compared visit diagnosis subgroups and diagnosis severity for DTC telemedicine versus acute PCP visits using chi-square tests. After examining diagnoses in most recent years, we examined trends in DTC telemedicine visit diagnosis subgroups across all years (2011−2016).

In patient-level analyses, we assessed patient characteristics among children with ≥1 DTC telemedicine visits from 2015 through 2016 ("DTC telemedicine users"). We compared these children to children with no DTC telemedicine visits but ≥1 acute PCP visit from 2015 through 2016 ("DTC telemedicine non-users"). Patients with no use of either DTC telemedicine or acute PCP visits were excluded from analysis. Patients with missing state or gender were also excluded from analysis (n = 36 DTC telemedicine users [0.1%] and n = 5321 telemedicine non-users [0.2%]).

Additional patient-level variables that we examined include child age, gender, chronic medical complexity, rural-urban status, ZIP Code median income, receipt of preventive care, and high-deductible health plan status. The level of chronic illness was determined by applying the Pediatric Medical Complexity Algorithm to patient data for 2014−2016 claims, to be consistent with prior algorithm use.[16] Rural-urban status was determined by using the US Department of Agriculture Rural-Urban Commuting Area (RUCA) codes.[17] ZIP Code median income was determined by using 2015 US Census data, categorized by the 2015 federal poverty level for a family of 4. Preventive care receipt was determined by identifying any preventive care CPT codes (99381−99387, 99391−99397, 99401−99412, 99429) from 2015 through 2016.

To understand patient factors associated with the use of DTC telemedicine, we compared patient characteristics for DTC telemedicine users and non-users first using chi-square tests and then in adjusted analysis using logistic regression. In the logistic regression model, we included patient characteristics with significance of $P < .1$ for the unadjusted analysis, and the final model included patient age, gender, medical complexity, RUCA code, ZIP Code median income, high-deductible health plan status, and receipt of preventive care. Finally, to understand whether the use of DTC telemedicine is associated with the use of other venues of acute care, we used chi-square tests to compare the use of urgent care and emergency care from 2015 through 2016 among DTC telemedicine users and non-users.

This analysis was reviewed by the Harvard Medical School Institutional Review Board and determined to be exempt. Analyses were conducted in SAS 9.4 (SAS Institute; Cary, NC).

RESULTS

From 2011 to 2016, total pediatric DTC telemedicine visits per year increased from 38 to 24,409 visits. DTC telemedicine use in 2016 was highest among children in the South, with 1231 visits per 100,000 member-years (Fig. 1). Growth in DTC telemedicine use in the most recent interval was highest in the Midwest (79% increase from 2015 to 2016), followed by the Northeast (66% increase from 2015 to 2016). Overall, in 2016, there were 7 DTC telemedicine visits for every 1000 acute PCP visits (n = 3,403,930).

From 2015 through 2016, the 3 most common diagnosis subgroups for both DTC telemedicine and acute PCP visits were infections of nose/sinuses, mouth/throat, and ears (Fig. 2). Compared to acute PCP visits, proportionately more DTC telemedicine visits addressed eye complaints (6% DTC telemedicine vs 2% acute PCP; $P < .001$), and

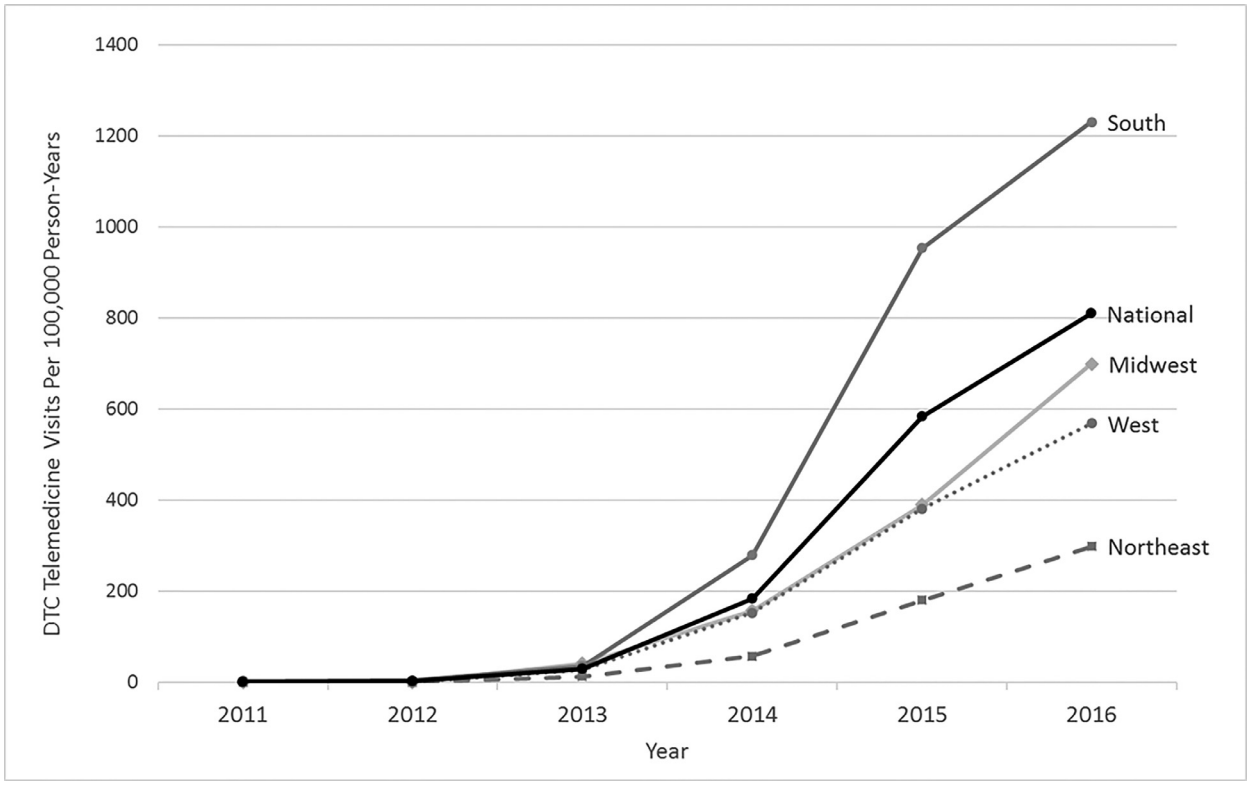

Figure 1. *Pediatric direct-to-consumer (DTC) telemedicine visits nationally and by region from 2011 to 2016. Figures shows the number of DTC telemedicine visits per 100,000 pediatric member-years within each census region within a large commercial health plan from 2011 to 2016.*

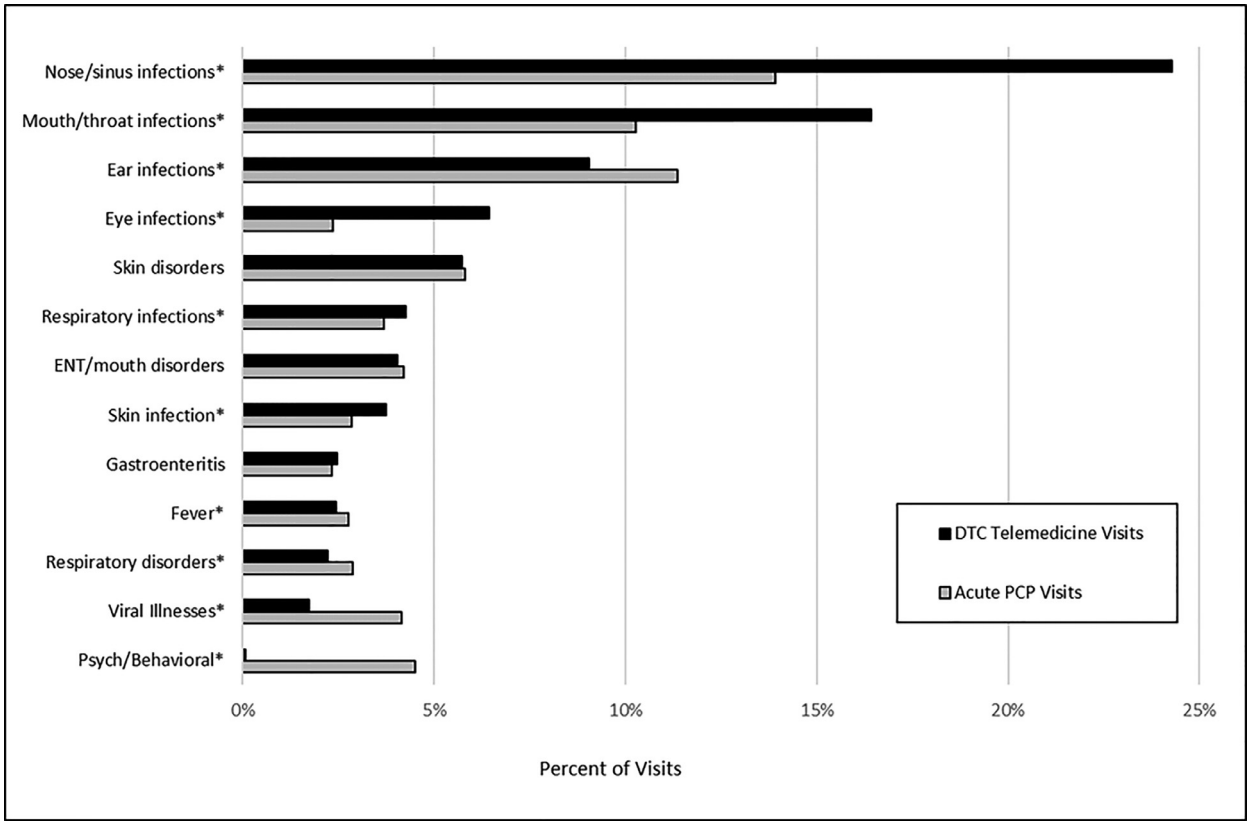

Figure 2. *Primary diagnosis subgroups for direct-to-consumer (DTC) telemedicine (n = 42,072) versus acute primary care provider (PCP) visits (n = 6,917,976) from 2015 through 2016. Diagnosis subgroups were determined through the use of a published diagnosis grouping system designed for categorization of acute pediatric visits[15] which was applied to the primary diagnosis for each visit. The diagnosis grouping system identifies 21 major groups and 77 subgroups. The 10 most common diagnosis subgroups (out of 77 total subgroups) for either DTC telemedicine or acute PCP visits are listed (totaling 13 diagnosis subgroups, due to overlap). ENT indicates ear, nose, and throat. *P < .001.*

Table. Characteristics of Children Using DTC Telemedicine, 2015–2016

Characteristics	Children, No. (%)				
	DTC Telemedicine Users	DTC Telemedicine Non-Users	*P*	Odds Ratio	95% Confidence Interval
Overall	30,171	2,316,611	...	...	...
Age (y)			<.001		
0–1	1751 (6)	285,119 (12)		1.00	Ref
2–5	7801 (26)	560,852 (24)		2.27	2.16–2.40
6–11	10,665 (35)	735,605 (32)		2.37	2.25–2.49
12–17	9954 (33)	735,035 (32)		2.23	2.12–2.35
Gender			<.001		
Female	15,399 (51)	1,137,160 (49)		1.07	1.04–1.09
Male	14,772 (49)	1,179,451 (51)		1.00	Ref
Chronic medical complexity			<.001		
No chronic disease	21,649 (72)	1,607,713 (69)		1.00	Ref
Non-complex chronic disease	5998 (20)	464,121 (20)		0.92	0.89–0.94
Complex chronic disease	2524 (8)	244,777 (11)		0.74	0.71–0.78
Metropolitan/non-metropolitan			<.001		
Metropolitan	26,388 (87)	2,118,881 (91)		1.00	Ref
Non-metropolitan	3541 (12)	173,292 (7)		1.45	1.40–1.51
Missing	242 (1)	24,438 (1)		0.74	0.65–0.84
ZIP Code median income			<.001		
0%–200% FPL	6578 (22)	438,544 (19)		1.52	1.46–1.58
201%–300% FPL	11,368 (38)	786,394 (34)		1.57	1.51–1.62
301%–400% FPL	7871 (26)	602,915 (26)		1.46	1.41–1.52
401%+ FPL	4354 (14)	488,758 (21)		1.00	Ref
Preventive PCP visits			<.001		
0 visits	9763 (32)	639,173 (28)		1.08	1.06–1.11
1+ visits	20,408 (68)	1,677,438 (72)		1.00	Ref
High-deductible health plan			.030		
Yes	2877 (10)	212,477 (9)		1.00	0.96–1.04
No	27,294 (90)	2,104,134 (91)		1.00	Ref

DTC indicates direct to consumer; FPL, federal poverty level; and PCP, primary care provider.

Table shows unadjusted and adjusted analyses comparing DTC telemedicine users (pediatric patients with ≥1 DTC telemedicine visit, with or without associated acute PCP visits) versus DTC telemedicine non-users (pediatric patients with ≥1 acute PCP visits but no DTC telemedicine visits) from 2015 to 2016. We compared patient characteristics among telemedicine users and non-users first using chi-square tests and then in adjusted analysis using logistic regression, adjusting for patient age, gender, medical complexity, Rural-Urban Commuting Area code, ZIP Code median income, high-deductible health plan status, and receipt of preventive care.

proportionately fewer received a diagnosis of an unspecified viral illness (1.7% DTC telemedicine vs 4.1% acute PCP; $P < .001$). Compared to acute PCP visits, a smaller proportion of DTC telemedicine visits addressed psychiatric/behavioral concerns (0.1% vs 4.5%; $P < .001$). The diagnoses detailed in Figure 2 accounted for 83% of DTC telemedicine visits and 71% of acute PCP visits.

Diagnosis severity was statistically different but clinically similar across settings. Compared to PCP visits, the fraction of DTC telemedicine visits categorized as least severe differed by 1 percentage point (5% of DTC telemedicine visits vs 6% of acute PCP visits; $P < .001$), as did the fraction categorized in the 2 highest severity categories (0.3% of DTC telemedicine visits vs 1.3% of acute PCP visits; $P < .001$).

Across all 6 years, nose/sinus infections, ear infections, and mouth/throat infections were the 3 most common diagnosis subgroups for DTC telemedicine visits, together comprising from 46% to 61% of visits within each year. However, over time, the proportion of DTC telemedicine visits receiving a diagnosis of nose/sinus infection has increased from 5% to 23%, while the percent receiving a diagnosis of mouth/throat infection decreased from 37% to 17%, and the percent receiving a diagnosis of ear infection decreased from 18% to 10%.

From 2015 through 2016, the odds of DTC telemedicine use were higher for older children, children in non-metropolitan and lower median income communities, and children without preventive visits (Table). The odds of DTC telemedicine use were lower for children with complex chronic diseases.

Most DTC telemedicine users also visited a PCP for acute concerns (70%) at least once during the 2-year study period. DTC telemedicine users were more likely than non-users to have had any urgent care visit (17% vs 10% of non-users; $P < .001$) and any emergency department visits (21% vs 19% of non-users; $P < .001$) during the study period.

Discussion

Commercial DTC telemedicine visits by children grew substantially from 2011 to 2016 but still accounted for only a small percentage of acute pediatric care. Although some variation was observed, the most common diagnoses and diagnosis severity were relatively similar for DTC telemedicine and acute PCP visits. This is surprising because the care in DTC telemedicine is delivered via personal devices that are not equipped with peripheral exam devices (eg, tele-otoscopy),[18] such that there may be

limited ability to perform specific components of the physical exam. Although commercial DTC telemedicine companies often provide online lists of diagnoses they do or do not treat, our analysis suggests that families are seeking care through DTC telemedicine for a wide spectrum of pediatric acute care needs.

Pediatric DTC telemedicine use appears to be driven by relative convenience rather than absolute lack of availability. Although children from non-metropolitan and lower income areas had modestly increased odds of DTC telemedicine use, the vast majority of DTC telemedicine users lived in metropolitan areas. Over two-thirds of DTC telemedicine users also had preventive and acute PCP visits, suggesting that these children are connected with alternative options for in-person care.

DTC telemedicine users were also more likely than DTC telemedicine non-users to have urgent care and emergency department visits, suggesting a cohort turning to multiple venues for acute care outside of the medical home. This could occur if these children have PCPs who do not have appointment options that fit parents' expectations during acute illness. Alternatively, these children may have higher real or perceived need for acute medical care, resulting in increased use of multiple acute care venues.

Among DTC telemedicine users, 6% were less than 2 years old, despite the American Telemedicine Association advice that children less than 2 should not use commercial DTC telemedicine outside of the medical home.[8] Additionally, 8% of DTC telemedicine users were identified as having complex chronic conditions (ie, chronic disease involving multiple body systems, progressive disease with decreased life expectancy, malignancy, technology dependence).[16] Although children with this level of chronic medical complexity may realize benefits from the use of telemedicine (eg, reduced travel burden, reduced exposure to infections),[19] the lack of informational continuity and care management continuity in DTC telemedicine may be of particular concern for this population, warranting focused evaluation on the risks and benefits among children with medical complexity.

Key limitations of this claims analysis are that we cannot account for patient preferences or details of plan product coverage. We also focused in this analysis on examining DTC telemedicine use and did not examine quality of care or clinical outcomes. Additionally, this analysis focuses on commercial DTC telemedicine use by children within a single national health plan and may not generalize to other populations.

In conclusion, our findings highlight increasing use of commercial DTC telemedicine by children, predominantly for acute respiratory infections, and primarily by children who also had PCP visits. Given this rapid increase in use, there is a need to examine the quality of pediatric care at DTC telemedicine visits, to assess the impact of DTC telemedicine on child health outcomes and utilization, and to consider strategies to integrate acute telemedicine into the medical home.

ACKNOWLEDGMENTS

This work was supported in part by grants from the National Institute of Child Health and Human Development (K23HD088642, K.N.R.) and gifts from Melvin Hall. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

REFERENCES

1. Ashwood JS, Mehrotra A, Cowling D, et al. Direct-to-consumer telehealth may increase access to care but does not decrease spending. *Health Aff (Millwood)*. 2017;36:485–491.
2. McConnochie KM, Wood NE, Herendeen NE, et al. Acute illness care patterns change with use of telemedicine. *Pediatrics*. 2009;123:e989–e995.
3. Pearl RM. Engaging physicians in telehealth. *NEJM Catalyst*. July 10, 2017. Available at: https://catalyst.nejm.org/engaging-physicians-in-telehealth/. Accessed August 7, 2018.
4. North SW, McElligot J, Douglas G, et al. Improving access to care through the patient-centered medical home. *Pediatr Ann*. 2014;43:e33–e38.
5. Raja P, Mehrotra A. The nuts and bolts of convenient care partnerships. *NEJM Catalyst*. October 24, 2016. Available at: https://catalyst.nejm.org/the-nuts-and-bolts-of-convenient-care-partnerships/. Accessed August 9, 2018.
6. Conners GP, Kressly SJ, Perrin JM, et al. Nonemergency acute care: when it's not the medical home. *Pediatrics*. 2017;139:1–10.
7. Haggerty JL, Reid RJ, Freeman GK, et al. Continuity of care: a multidisciplinary review. *BMJ*. 2003;327:1219–1221.
8. McSwain SD, Bernard J, Burke Jr BL, et al. American Telemedicine Association operating procedures for pediatric telehealth. *Telemed J E Health*. 2017;23:699–706.
9. National Business Group on Health. Large US employers project health care benefit costs to surpass $14000 per employee in 2018, National Business Group on Health survey finds [press release]. August 8, 2017. Available at: https://www.businessgrouphealth.org/news/nbgh-news/press-releases/press-release-details/?ID=334. Accessed January 15, 2019.
10. Vyas S, Murren-Boezem J, Solo-Josephson P. Analysis of a pediatric telemedicine program. *Telemed J E Health*. 2018;24:993–997.
11. Uscher-Pines L, Mulcahy A, Cowling D, et al. Access and quality of care in direct-to-consumer telemedicine. *Telemed J E Health*. 2016;22:282–287.
12. 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;33:258–264.
13. Uscher-Pines L, Mulcahy A, Cowling D, et al. Antibiotic prescribing for acute respiratory infections in direct-to-consumer telemedicine visits. *JAMA Intern Med*. 2015;175:1234–1235.
14. Poon SJ, Schuur JD, Mehrotra A. Trends in low-acuity visits to acute care venues in the United States from 2008 to 2015. *JAMA Intern Med*. 2018;178:1342–1349.
15. Alessandrini EA, Alpern ER, Chamberlain JM, et al. A new diagnosis grouping system for child emergency department visits. *Acad Emerg Med*. 2010;17:204–213.
16. Simon TD, Cawthon ML, Popalisky J, et al. Development and validation of the Pediatric Medical Complexity Algorithm (PMCA) Version 2.0. *Hosp Pediatr*. 2017;7:373–377.
17. US Department of Agriculture. Rural-Urban Commuting Area Codes. Available at: https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/. Accessed January 15, 2019.
18. Weinstein RS, Krupinski EA, Doarn CR. Clinical examination component of telemedicine, Telehealth, mHealth, and connected health medical practices. *Med Clin North Am*. 2018;102:533–544.
19. Ray KN, Ashcraft LE, Mehrotra A, et al. Family perspectives on telemedicine for pediatric subspecialty care. *Telemed J E Health*. 2017;23:852–862.