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Telemedicine utilization and incorporation of asynchronous testing in a pediatric allergy clinic during the COVID-19 pandemic

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Clinical Implications

Telemedicine encounters in a pediatric allergy clinic can increase accessibility for allergy care. For patients who required in-person testing, this can be successfully completed in a subsequent visit, including for time-sensitive management of early food introduction in infants.

When the COVID-19 pandemic imposed the reduction of face-to-face encounters, many practices quickly adapted to use of telemedicine more broadly.[1,2] Patient response to telemedicine has been favorable, so use beyond the COVID-19 pandemic continues to provide a convenient alternative for patients.[3-5] However, the use of telemedicine for allergy evaluation restricts the ability to perform synchronous in-clinic testing. From our institution's experience of conducting only telemedicine visits during clinic closures in spring 2020, we report the patterns of telemedicine use and allergy testing at an academic pediatric allergy clinic to evaluate the viability of telemedicine and asynchronous testing for management of allergic diseases beyond a pandemic setting.

All telemedicine encounters scheduled April 1 to 30, 2020 at the Children's Hospital Colorado Pediatric Allergy Clinic were retrospectively reviewed in the telemedicine cohort. A similar number of in-person encounters from April 2019 were also reviewed in the in-person cohort for pre-pandemic baseline comparison. Telemedicine encounters were conducted via synchronous videoconferencing using the Vidyo application (Hackensack, NJ). Interpreter services were available only in Spanish during part of the study period. If testing (skin prick testing [SPT], spirometry, or laboratory testing) was required, an asynchronous testing approach was employed. Patients were scheduled for a separate in-person visit for testing starting May 11, 2020. Future SPT by clinic nurses and spirometry was performed by respiratory therapists through nursing-only encounters. Laboratory tests were completed in the walk-in outpatient laboratory.

Retrospective chart review data for each encounter were collected using Research Electronic Data Capture electronic data capture tools[6,7] for analysis, including patient demographics, type of visit, primary visit diagnosis, testing and challenges ordered and completed, and follow-up patterns. We employed χ^2 or Fisher exact test for categorical data and independent samples t test for continuous data to test statistical differences between groups.

Over the 30-day period in 2020, 365 patients were scheduled and 315 telemedicine encounters were completed (86.3%). These results were compared with 377 scheduled and 260 completed in-person encounters (69.0%) in 2019. Better show rates for telemedicine visits ($P < .001$) indicate that telemedicine for outpatient encounters may be more accessible for certain patients. Comparison of patient demographics and visit characteristics are listed in Table E1 (in this article's Online Repository at www.jaci-inpractice.org). Significantly fewer patients identified as Hispanic or Latino (24.4% vs 32.4%; $P = .019$) and reported a primary language other than English (3.9% vs 10.4%; $P = .036$) in the telemedicine cohort. With limited availability of interpreter services during the telemedicine cohort study period, there was significantly less interpreter use (0.6% vs 10.4%; $P < .001$). This highlights the need for robust interpreter services to facilitate telemedicine for non—English speaking patients. Also, greatly fewer publicly insured patients were seen via telemedicine (38.1% vs 45.9%; $P = .005$). These additional discrepancies indicate the presence of other barriers for telemedicine among certain populations, which require further exploration.

Although the distribution of primary visit diagnoses was not significantly different between groups, there were differences in testing patterns (Table I). In-person testing was recommended in 152 of telemedicine visits (48.3%), which decreased from the in-person rate of 79.6% ($P < .001$). Less testing was required for follow-up visits and for the diagnoses of drug allergy and urticaria in both cohorts (Table I). When stratified by primary diagnosis, less testing was ordered in the telemedicine cohort for food allergy or other adverse food reaction (61.5% vs 92.1%; $P < .001$), eosinophilic gastrointestinal disease (28.0% vs 92.3%; $P < .001$), and asthma or other respiratory disorders (47.3% vs 86.5%; $P < .001$). These differences were more pronounced in follow-up visits (Table I) and may reflect less urgent testing that was more often performed during in-person visits for ongoing monitoring of these diseases. In new patient visits for atopic dermatitis or other rash, there was also significantly less testing ordered (43.5% vs 75%; $P = .037$). Similarly, testing for the management of dermatologic problems may not be as urgent.

Of the recommended tests, 66.8% were completed in the telemedicine cohort and 95.6% in the in-person cohort ($P < .001$). There were lower rates of testing ordered and completed for SPT, spirometry, and laboratory values (Table II). Without the convenience of synchronous testing during the same visit encounter, allergy providers may be more judicious with testing recommendations, and the need for an additional encounter for patients to complete testing would reduce rates of completion. This may be magnified owing to hesitancy for in-person encounters during the COVID-19 pandemic. Although proportions of food challenges ordered were not significantly different (10.5% vs 15.4%; $P = .078$), fewer food challenges were completed in the telemedicine cohort (63.6% vs 87.5%; $P = .016$). Because food challenges are scheduled as a separate visit in both cohorts, decreased completion in the telemedicine cohort is also likely primarily a consequence of the COVID-19 pandemic. In contrast, for drug challenges, for which there may be less of a perceived urgency for completion even in the pre-pandemic period, order and completion rates were similar in both cohorts.

Evaluation and management of possible food allergies in the infant population are often considered more time-sensitive owing to the possible ramifications of the delayed introduction of

TABLE I. Testing orders by primary diagnosis

	In-person testing ordered, n (%)								
	New patient			Follow-up			Total		
Primary encounter diagnosis	COVID telemedicine	Pre-COVID in-person	*P*	COVID telemedicine	Pre-COVID in-person	*P*	COVID telemedicine	Pre-COVID in-person	*P*
Atopic dermatitis or other rash	10 (43.5)	15 (75)	**.037**	4 (50.0)	6 (46.2)	1.000	14 (45.2)	21 (63.6)	.138
Food allergy or other adverse food reaction	49 (76.6)	46 (88.5)	.098	15 (37.5)	35 (97.2)	**<.001**	64 (61.5)	81 (92.1)	**<.001**
Eosinophilic gastrointestinal disease	1 (25.0)	2 (100.0)	.217	6 (28.6)	10 (90.9)	**.001**	7 (28.0)	12 (92.3)	**<.001**
Asthma or other respiratory disorders	9 (81.8)	15 (93.8)	.549	17 (38.6)	30 (83.3)	**<.001**	26 (47.3)	45 (86.5)	**<.001**
Rhinitis	15 (79.0)	21 (95.5)	.164	7 (30.4)	6 (33.3)	.843	22 (52.4)	27 (67.5)	.163
Drug allergy	2 (22.2)	3 (42.9)	.596	2 (100.0)	1 (100.0)	1.000	4 (36.4)	4 (50.0)	.658
Urticaria	7 (36.8)	10 (62.5)	.130	2 (22.2)	1 (33.3)	1.000	9 (32.1)	11 (57.9)	.080
Mast cell disorder/idiopathic anaphylaxis	2 (66.6)	2 (100.0)	1.000	1 (100.0)	0	1.000	2 (50.0)	2 (100.0)	.467
Concern for allergic disorder with none found	3 (25.0)	4 (80.0)	.105	1 (100.0)	0	1.000	3 (23.1)	4 (80.0)	.055
Total	98 (59.0)	118 (83.10)	**<.001**	53 (35.6)	89 (75.40)	**<.001**	152 (48.3)	207 (79.6)	**<.001**

Bolded values indicate $P < .05$.

TABLE II. Testing order and completion rates

	In-person testing ordered, n (%)					
Testing type	COVID telemedicine	Pre-COVID in-person	*P*	COVID telemedicine	Pre-COVID in-person	*P*
All patients						
Skin prick testing	113 (35.9)	143 (55.0)	**<.001**	87 (77.7)	143 (100.0)	**<.001**
Spirometry	31 (9.8)	76 (29.2)	**<.001**	13 (41.9)	73 (96.1)	**<.001**
Laboratory values	40 (12.7)	76 (29.2)	**<.001**	29 (72.5)	71 (93.4)	**.004**
Food challenge	33 (10.5)	40 (15.4)	.078	21 (63.6)	35 (87.5)	**.016**
Drug challenge	15 (4.8)	9 (3.5)	.438	5 (33.3)	7 (77.8)	.089
Total	171 (54.3)	213 (81.9)	**<.001**	155 (66.8)	329 (95.6)	**<.001**
Patients aged <1 y						
Skin prick testing	26 (61.9)	12 (48.0)	.267	24 (92.3)	12 (100.0)	.324
Laboratory values	9 (21.4)	2 (8.0)	.151	8 (88.9)	2 (100.0)	.621
Food challenge	14 (33.3)	7 (28.0)	.649	11 (78.6)	7 (100.0)	.186
Total	32 (78.1)	15 (79.0)	1.000	43 (87.8)	21 (100.0)	.168

Bolded values indicate $P < .05$.

allergenic foods. To evaluate the possible effect of increased urgency for management on completion rates of additional testing and challenges, we specifically analyzed this subgroup of infants aged less than 1 year. The telemedicine cohort consisted of more infants (11.5% vs 6.6%; $P = .021$). Analysis of infants aged less than 1 year had similar rates of SPT, laboratory tests, and food challenges ordered and completed between the cohorts (Table II). These findings suggest that within a group of patients for whom timely testing and challenges are emphasized, completion rates were comparable even in a pandemic setting.

With the increasing demand for telemedicine, we must devise strategies to adapt to its wider use. Because of higher rates of telemedicine encounter completion, continuing to offer telemedicine encounters may improve accessibility for allergy care among certain patients. There was notable underrepresentation among Hispanic, non—English speaking, and publicly insured patients; thus, additional barriers for access need to be addressed, including the availability of interpreter services.

About half of patients in the telemedicine cohort (51.7%) did not require additional in-person testing; this would be the preferred group of patients to target for telemedicine management. Patients who required less testing included follow-up patients and those who presented for drug allergy or urticaria. Because the need for testing cannot be anticipated in all scenarios before the visit encounter, we sought to evaluate patterns of asynchronous testing. Although there were decreased rates of testing completion with an asynchronous model, significant differences were not seen in more time-sensitive cases of infants who may benefit from early food introduction.

A primary study limitation was the effects of the COVID-19 pandemic on testing orders and completion. There was hesitancy among allergy providers to conduct in-person testing because of concern about the increased risk for virus exposure.[8] Similar concerns were likely shared among patients. This may have reduced both testing order and completion rates, which could improve after resolution of the COVID-19 pandemic. Some

testing might also have been deferred if test results would not have changed management significantly. This may be seen in cases such as follow-up for longstanding IgE-mediated food allergy or well-controlled asthma, although our study was unable to identify and account for these possible scenarios. Subset analysis of infants aged less than 1 year revealed that when the risks of delaying management might have outweighed the risks of increased health care encounters during a pandemic, testing patterns were comparable to those of in-person management. These results may be more reflective of practices outside a pandemic. Additional studies will need to be completed to evaluate asynchronous testing patterns with telemedicine after the COVID-19 pandemic.

In addition, these results cannot be generalized to all telemedicine programs. With the resources available at our institution, patients seen by telemedicine were able to receive care similar to that given in-person, including access to ancillary services and in-person testing and challenges. This may not be feasible at institutions that lack staffing to provide these services, particularly the availability of nursing-only visits for in-person testing. The ability to return for in-person evaluation may be more difficult for patients who live farther from the clinic location, so our findings cannot be readily applied to the expansion of telemedicine to more remote locations. Because we had focused on a pediatric population, there may also be different challenges in caring for an adult population that we did not identify. Thomas et al[9] described a cohort of patients seen during the COVID-19 pandemic via telemedicine in an adult allergy clinic, some of whom needed an additional in-person visit for further testing. Similar to findings in this study, more than half of patients did not require additional in-person testing (55%), but the rates of test completion were not reported to determine outcomes of a similar approach in an adult clinic. Additional studies to address these scenarios are needed.

Continuing to offer telemedicine in a pediatric allergy clinic can increase patient accessibility. Approximately half of patients can be managed completely by telemedicine, especially follow-up patients. For patients who require testing, testing-only appointments can be employed with adequate completion rates, particularly for cases that require more timely management.

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ONLINE REPOSITORY

TABLE E1. Patient demographics and clinical characteristics

Characteristic	COVID telemedicine (n = 365)		Pre-COVID in-person (n = 377)		*P*
Age, y					
Mean (SD)	7.22	(5.32)	6.90	(4.97)	.562
Median [minimum, maximum]	7	[0, 21]	6	[0, 19]	
<1 y	42	(11.5)	25	(6.6)	**.021**
Sex					
Female	139	(38.3)	146	(38.7)	.903
Male	224	(61.7)	231	(61.3)	
Race					
American Indian/Alaska Native	4	(1.1)	3	(0.8)	.107
Asian or Pacific Islander	8	(2.2)	8	(2.1)	
Black	24	(6.6)	29	(7.7)	
White	243	(66.5)	215	(57.0)	
>1 race	28	(7.7)	43	(11.4)	
Unknown or not reported	23	(6.3)	26	(6.9)	
Other[a]	35	(9.6)	53	(14.1)	
Ethnicity					
Hispanic or Latino	89	(24.4)	122	(32.4)	**.019**
Not Hispanic or Latino	245	(67.1)	227	(60.2)	
Unknown or not reported	31	(8.5)	28	(7.4)	
Primary language					
English	351	(96.1)	338	(89.7)	**.002**
Spanish	12	(3.3)	30	(8.0)	
Other[b]	2	(0.6)	9	(2.4)	
Health insurance					
Private	177	(48.5)	157	(41.6)	**.005**
Public	139	(38.1)	173	(45.9)	
Uninsured	4	(1.1)	1	(0.3)	
Type of visit					
New	200	(54.8)	214	(56.8)	.589
Follow-up	165	(45.2)	163	(43.2)	
Outcome of visit					
Completed	315	(86.3)	260	(69.0)	**<.001**
Cancelled	36	(9.9)	96	(25.5)	
No show	13	(3.8)	21	(5.6)	
Primary visit diagnosis					
Atopic dermatitis or other rash	31	(9.9)	33	(12.7)	.548
Food allergy or other adverse food reaction	104	(33.2)	88	(33.9)	
Eosinophilic gastrointestinal disease	25	(8.0)	13	(5.0)	
Asthma or other cough	55	(17.6)	52	(20.0)	
Rhinitis	42	(13.4)	40	(15.4)	
Drug allergy	11	(3.5)	8	(3.1)	
Urticaria	28	(9.0)	19	(7.3)	
Mast cell disorder or idiopathic anaphylaxis	4	(1.3)	2	(0.8)	
Concern for allergic disorder with none found	13	(4.2)	5	(1.9)	
Interpreter services used					
Yes	2	(0.6)	27	(10.4)	**<.001**
In-person testing					
Yes	152	(48.3)	207	(79.6)	**<.001**
Deferred	14	(4.4)	0	(0.0)	
No	149	(47.3)	5	(20.38)	

(continued)

TABLE E1. *(Continued)*

Characteristic	COVID telemedicine (n = 365)		Pre-COVID in-person (n = 377)		*P*
Follow-up required					
Yes	196	(62.2)	158	(60.8)	.893
No	50	(15.9)	45	(17.3)	
Not specified	69	(21.9)	57	(21.9)	
Type of follow-up completed					
In-person	34	(17.3)	51	(32.3)	.371
Telehealth	23	(11.7)	0	(0.0)	
Not completed	72	(36.7)	64	(40.5)	
Not yet required	67	(34.2)	43	(27.2)	

Bolded values indicate $P < .05$.
[a]Includes all patients who have self-selected the option "Other" for race.
[b]Includes all patients who did not indicate either English or Spanish as their primary language.