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# A comparative analysis of outpatient nutrition clinic scheduling outcomes based on in-person and telehealth patient care delivery modalities<sup>☆</sup>

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## ABSTRACT

During the start of the global COVID-19 pandemic in March 2020, patient care modalities changed from in-person to telehealth to comply with physical distancing guidelines. Our study uniquely examines operations data from three distinct periods: before the transition to telehealth, early transition from in-person care to telehealth, and the eventual adoption of telehealth. We present a comparative analysis of outpatient nutrition clinic scheduling outcomes based on care delivery modality. We used descriptive statistics to report means and variance and frequencies. We used inferential statistics to make comparisons: categorical data were compared using chi-square analysis with post-hoc comparisons using a z-test with alpha at 0.05. Means of continuous variables were compared using ANOVA with Tukey HSD post-hoc analysis. We found patient demographics remained widely unchanged across the three distinct periods as the demand for telehealth visits increased, with a notable rise in return patient visits, signaling both adaptability across the patient population and acceptance of the telehealth modality. These analyses along with evidence from the included literature review point to many the benefits of telehealth, thus telehealth as a healthcare delivery modality is here to stay. Our work serves as a foundation for future studies in this field, provides information for decision-makers in telehealth-related strategic planning, and can be utilized in advocacy for the extension of telehealth coverage.

## 1. Introduction

In 2020, the outbreak of coronavirus disease-19 (COVID-19) suddenly became a global emergency causing health care facilities, specifically outpatient clinics, to switch over to telehealth care modality [1]. The reason for this immediate switch in patient care delivery was ultimately to help reduce the spread of COVID-19 and continue to provide care safely. Telehealth has improved care safety during the pandemic by complying with social distancing protocols recommended by the Centers for Disease Control and Prevention (CDC) agency [2]. With this change in patient care modality, patients and providers had to quickly learn how to adapt to virtual care appointments. Once health care facilities had more established telehealth infrastructure, patients and clinicians soon discovered the benefits associated with telehealth compared to in-person patient care modality. As healthcare moves forward navigating the logistics of our post-pandemic world, many leaders, practitioners, and policy-makers require operations data and research to help make informed decisions about how best to utilize telehealth.

Our study examining historical operations data aims to report findings that can be used by leadership teams to make decisions regarding

operational strategic planning. Not only did we compare scheduling outcomes immediately after the transition from in-person care modality to telehealth, but we also present findings after telehealth became mainstream. This more thorough analysis has not been demonstrated in current published studies comparing healthcare delivery modalities. In addition, our work provides information for policymakers in making decisions related to healthcare since the results of this study can be used by professional societies such as the Academy of Nutrition and Dietetics to continue to advocate for the extension of telehealth coverage.

Since 2020, there has been an increase in publications examining virtual versus in-person health care delivery modalities. The literature review presented here suggests that the pros of virtual care outweigh the cons. Our work adds to this narrative and serves as a foundation for future studies in this field.

### 1.1. Increase in healthcare demand

As a result of the pandemic, there was an increase in the demand for care and telehealth care delivery modality helped support this sudden

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change [3,4]. Previous studies comparing pre-and post-pandemic operations data found that the number of telehealth ambulatory encounters increased significantly [5–8]. Because telehealth allows providers to quickly adapt to the increase in demand, one study predicts that there will be a continued increase in demand for telehealth services after COVID-19 [6].

### 1.2. Positive provider and patient perspectives

The perspectives from both healthcare providers and patients about the use of telehealth care modality is overall positive. After the initial adjustment period, the majority of healthcare providers reported being comfortable using telehealth for patient care [9,10]. Studies have shown that physicians felt they were able to diagnose acute conditions and provide efficient educational sessions during clinical consultations using telehealth [11]. Also, physicians report telehealth helps reduce documentation time and overall increases the number of appointments compared to in-person appointments [11]. The majority of providers claimed no difference in the overall quality of care and reported higher efficiency via telehealth when compared to in-person care modality [12,13].

Studies have also shown patients' attitudes about telehealth care modality to be generally favorable with high satisfaction rates [13–15]. Patients' comfort and trust in their providers are likely correlated with higher patient satisfaction with telehealth visits. An overwhelming majority of patients believe their clinician provided adequate face-to-face time via telehealth [12,14,16]. Other studies showed patients felt telehealth appointments were just as effective compared to in-person visits [12,17]. Most patients have stated they received great care through telehealth and acknowledged they would recommend remote visits to their friends and families [12,17–19]. Patients stated they were interested in continuing to use telehealth in the future [9].

### 1.3. Advantages of telehealth

A common advantage of telehealth appointments is convenience, which includes flexibility with time, travel, and scheduling [20]. Telehealth appointments increase patients' access to care by eliminating the need to travel, find parking, or sit in waiting rooms [21–23]. When it comes to waiting times for visits, most patients reported they saw their clinicians relatively on time [12]. Patients believe the time they waited for their clinician was shorter in the telehealth care modality compared to in-person visits. Therefore, telehealth care modality provides opportunities for patients to be seen by a clinician sooner with fewer wait times, resulting in earlier care [17,20]. In addition, remote appointments have allowed providers to continue to treat a full caseload of patients in outpatient clinics [21]. Telehealth helps promote patients' safety by continuing to deliver care while preventing the spread of COVID-19 [22]. Telehealth has allowed for continuous communication between providers and patients without the need of leaving their homes or work during the pandemic [21,23,24]. Another advantage of telehealth is it allows clinicians more insight into their patients' home life if the patient is attending the telehealth visit in their homes [25,26]. For example, with the use of telehealth, registered dietitians can observe their patients' typically eaten foods, pantry items, and kitchen access, and thus better assess nutritional status and structure more appropriate nutrition recommendations based on the patient's living situation [25]. Telehealth also allows family members, caretakers, and friends to conveniently be included in patient appointments if needed without the need of travel [25]. A recently published study showed patients who had an initial telehealth visit were more likely to receive follow up care when needed compared to patients who had an initial in-person visit, thus further highlighting the advantage of telehealth [5].

### 1.4. Telehealth operations data

Common obstacles to providing ambulatory care deal with the management of scheduling issues such as appointment cancellations and no-shows. A cancellation is when a patient communicates to the clinic ahead of time that they will not attend the appointment. A missed appointment, also called a “no-show”, is when a patient is absent from their appointment and fails to notify the clinic ahead of time. Compared to in-person care modality, telehealth results in fewer cancellation rates [27–30]. Concurrent with fewer canceled telehealth appointments, the no-show rates of telehealth visits are also decreasing compared to in-person visits [27,31]. A scheduled appointment with no patient present is a missed opportunity for another patient to come in sooner [31]. Some reasons why patients do not show up to their in-person appointments include complications associated with transportation, long clinic wait times, scheduling, work, and personal health issues; however, telehealth has helped alleviate these barriers [32]. One study saw a significant decrease in no-show rates when comparing operations data pre-and post-pandemic [33]. Other studies have also seen similar trends of clinic no-show rates decreasing from pre-pandemic to when telehealth became the primary patient care modality during the pandemic [10]. Telehealth decreases the number of cancellations and no-show rates; this ultimately provides a positive impact on clinic workflows, patient outcomes, and quality of care [32]. Identifying reasons why patients cancel or do not show up to their appointments can help clinic administrators implement new interventions to improve these rates. Furthermore, studies extracting historical data to examine operations outcome with the transition to telehealth are needed to better inform healthcare decision makers.

### 1.5. Objectives of our study

The primary objective of our descriptive study is to provide a comparative analysis of operations data and report findings that can be considered by healthcare leadership in making informed decisions about how best to utilize telehealth moving forward. In addition, results from this study can also be used to advocate for telehealth payment policies such to increase patients' access to care. We hope our work can serve as a foundation for future research.

## 2. Methods

With permission from Clinical Nutrition leadership and the Office of Compliance at our urban teaching hospital, we obtained data from the facility's Digital Health team. We analyzed data from outpatient clinical nutrition clinics. The data was retrieved by using an encrypted hospital-issued device to access the de-identified data. The data extracted from the electronic medical record included information about patient demographics (age, gender, race/ethnicity, language group, need for an interpreter, and insurance type) and clinic scheduling outcomes (visit modality, visit type, appointment status, and average days from scheduled to appointment).

The total number of encounters was then split into three groups based on the date of the appointment and care delivery modality. The three groups consisted of (1) March 1, 2019 to February 29, 2020 in-person visits, (2) March 1, 2020 to February 28, 2021 telehealth visits, and (3) March 1, 2021 to February 28, 2022 telehealth visits. These three specific time periods were selected to capture the transition from in-person to telehealth care modalities pre-COVID-19, during COVID-19, and one year later when telehealth became normalized. As our primary study interest was to compare care delivery modalities, telehealth visits were excluded from our analyses during the in-person modality time frame, and in-person visits were removed during the two telehealth modality time frames. From March 2019–February 2020, any telehealth appointments were removed from the group, focusing only on in-person appointments. For March 2020–February 2021 and March

**Table 1**  
Demographics of patient encounters.

Characteristic	In-Person n = 13,457	Telehealth Year 1 n = 14,265	Telehealth Year 2 n = 19,116	p-value	
Average age $\pm$ standard deviation, years	52.0 $\pm$ 16.4	52.2 $\pm$ 16.8	52.7 $\pm$ 16.6	<0.001	
Gender, frequency (%)					
Female	8902 (66.2%)	8995 (63.1%)	12,257 (64.1%)	<0.001	
Male	4555 (33.8%)	5270 (36.9%)	6858 (35.9%)		
Unknown	0 (0.0%)	0 (0.0%)	1 (<0.1%)		
Race/Ethnicity, frequency (%)					
American Indian or Alaska native	1 (<0.1%)	0 (0.0%)	7 (<0.1%)	<0.001	
Asian	2290 (17.0%)	2403 (16.8%)	3337 (17.5%)		
Black	878 (6.5%)	885 (6.2%)	1168 (6.1%)		
Hispanic, All races	2673 (19.9%)	3122 (21.9%)	4478 (23.4%)		
Non-Hispanic white	5798 (43.1%)	5933 (41.6%)	7,757 (40.6%)		
Other	1409 (10.5%)	1440 (10.1%)	1800 (9.4%)		
Patient declined to state	183 (1.4%)	222 (1.46)	241 (1.3%)		
Missing data	225 (1.7%)	260 (1.8%)	328 (1.7%)		
Language group, frequency (%)					
English	12,248 (91.0%)	13,065 (91.6%)	17,463 (91.4%)		<0.001
Limited English proficiency	1202 (8.9%)	1186 (8.3%)	1608 (8.4%)		
Missing data	7 (0.1%)	14 (0.1%)	45 (0.2%)		
Needed Interpreter, frequency (%)	978 (7.3%)	1058 (7.4%)	1392 (7.3%)	0.181	
Insurance type, frequency (%)					
Medicaid	2025 (15.0%)	2235 (15.7%)	3197 (16.7%)	<0.001	
Medicare	4454 (33.1%)	4680 (32.8%)	6146 (32.2%)		
Other insurance	671 (5.0%)	581 (4.1%)	558 (2.9%)		
Private	6370 (46.9%)	6769 (47.5%)	9215 (48.2%)		

2021–February 2022 timeframes, any in-person appointments were excluded from the data, focusing only on telehealth (phone or video) appointments. All data analyses were conducted using the IBM Statistical Package for Social Sciences software version 26 (IBM, Armonk, NY, USA). Categorical data were compared using chi-square analysis with post-hoc comparisons using a z-test with alpha at 0.05. Means of continuous variables were compared using ANOVA with Tukey HSD post-hoc analysis.

### 3. Results

The study data inclusion criteria are shown in Fig. 1. During the study timeframe, data for 49,204 outpatient nutrition clinic encounters were obtained. The in-person modality group (time frame March 1, 2019 through February 29, 2020) included 13,457 visits, the telehealth modality year 1 group (time frame March 1, 2020 through February 28, 2021) included 2798 phone visits and 11,467 video visits, and the telehealth modality year 2 group (time frame March 1, 2021 through February 2022) included 1628 phone visits and 17,488 video visits. While there were statistically significant differences in the demographics data among the three groups, the trends within each group remain similar; the majority of the patients seen in the clinics were older adults (average age ~52 years old), were female, were non-Hispanic white, had English proficiency, did not require interpreters for their visits, and had private insurance (Table 1).

As indicated in Table 2, there were dramatic shifts in the number of visits based on care delivery modality over the three years time period. In-person visits decreased 78-fold while video visits increased 186-fold; telephone visits increased 6-fold from year 1 to 2, but then decreased in year 3 to be about 3.5-fold more than year 1 (Fig. 2). Patient visits were scheduled as either a new patient visit (for first time patients) or a return patient visit (for patients previously seen at the clinic). There was an increase in the number and percentage of return patient visits scheduled over the three years ( $n = 6251$  vs.  $n = 7639$  vs.  $n = 11779$ ,  $p < 0.001$ ) concurrently with a decrease in the percentage of new patient visits scheduled ( $n = 7206$  vs.  $n = 6626$  vs.  $n = 7337$ ,  $p < 0.001$ ) (Table 2 and Fig. 3). Results indicated there were fewer canceled appointments with telehealth compared to in-person appointments (23.4% and 28.7% vs. 39.4%, respectively,  $p < 0.001$ ) (Table 2 and Fig. 4). However, the frequency of no-show rates

was similar between telehealth and in-person appointments (10.3% and 10.9% vs. 10.4%, respectively,  $p > 0.05$ ) (Table 2 and Fig. 4; post-hoc analysis data not shown in table but indicated on figure). In addition, the average number of days from scheduled to appointment initially decreased with the switch to remote care delivery modality, but then increased back to “baseline” as telehealth became the norm (51.1 vs. 35.2 days,  $p < 0.001$ ; 51.1 vs. 51.8 days,  $p = 0.326$ ) (Table 2; post-hoc analysis data not shown in table but reported here).

### 4. Discussion

#### 4.1. Telehealth is here to stay

The findings from our study suggest telehealth as a care modality will continue as we move forward post-pandemic. The supporting evidence that can be inferred from our study include (1) patients have been able to adapt to telehealth, (2) demand for telehealth appointments continues to increase, and (3) more patients are accessing care, especially returning for follow-up visits in the telehealth modality compared to in-person. All patient populations in our study were able to adapt to telehealth as evidenced by no significant changes in demographic trends such as race/ethnicity, language group, and insurance trends over the study period. Other studies have also shown similar outcomes with minimal changes regarding patient demographics with the transition from in-person to telehealth, implying no specific patient population being unable to adapt to the virtual care modality [34]. Also similar to other studies that compared in-person versus telehealth care modalities, our study showed a significant increase in the number of telehealth appointments over time [6,35]. This indicates telehealth care modality was able to support the rapid surge of patient care demand during the pandemic. The increased appointment completion rates along with the decrease in cancellation rates via telehealth care modality seen in our study further supports improved patient access to healthcare. It can be inferred that more patients are attending their appointments due to the overall convenience that telehealth offers; telehealth eliminates barriers such as travel, time, and scheduling conflicts associated with in-person visits [5]. Finally, our study findings regarding an increase in the number of returned patient visits scheduled over the study period infers that patients were satisfied with telehealth and more likely to seek follow up care in the virtual care modality.

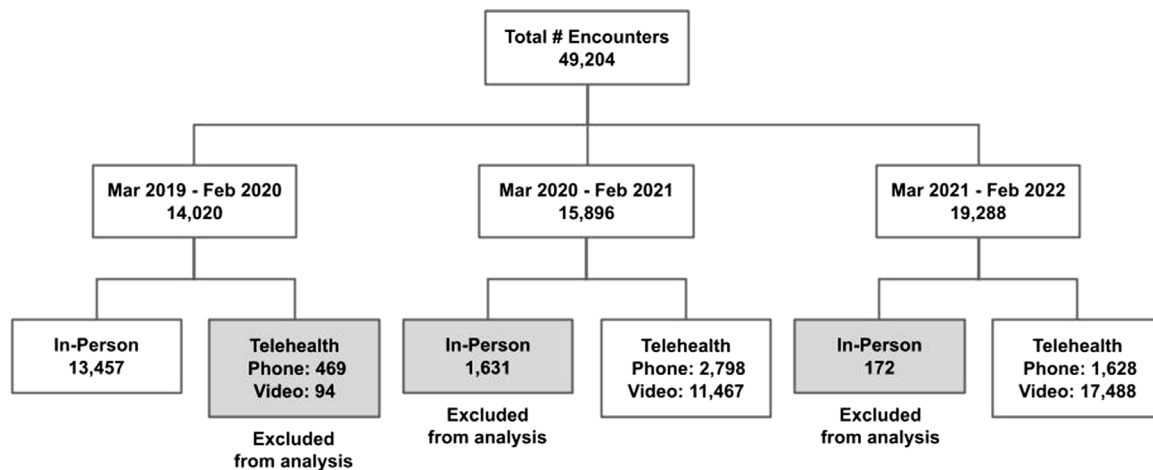


Fig. 1. Study data inclusion criteria.

Table 2

Clinic scheduling outcomes.

Clinic scheduling outcome	In-Person n = 13,457	Telehealth Year 1 n = 14,265	Telehealth Year 2 n = 19,116	p-value
Visit mode, frequency (%)	n = 14,020	n = 15,896	n = 19,288	
In-person	13,457 (96.0%)	1631 (10.3%)	172 (0.9%)	<0.001
Phone	469 (3.3%)	2798 (17.6%)	1628 (8.4%)	
Video	94 (0.7%)	11,467 (72.1%)	17,488 (90.7%)	
Visit type, frequency (%)				
New patient visit	7206 (53.5%)	6626 (46.4%)	7337 (38.4%)	<0.001 <sup>a</sup>
Return patient visit	6251 (46.5%)	7639 (53.6%)	11,779 (61.6%)	
Appointment status, frequency (%)				
Canceled	5297 (39.4%)	3342 (23.4%)	5489 (28.7%)	<0.001 <sup>a</sup>
Completed	6755 (50.2%)	9421 (66.0%)	11,519 (60.3%)	
Left without seen	10 (0.1%)	35 (0.2%)	33 (0.2%)	
No show	1395 (10.4%)	1467 (10.3%)	2075 (10.9%)	
Average days from scheduled to appointment ± standard deviation, days	51.1 ± 49.5	35.2 ± 36.2	51.8 ± 47.0	<0.001 <sup>a</sup>

<sup>a</sup>Post-hoc analysis p-values reported in text and/or indicated on figures. Categorical data were compared using chi square analysis with post-hoc comparisons using a z-test with alpha at 0.05. Means of continuous variables were compared using ANOVA with Tukey HSD post-hoc analysis.

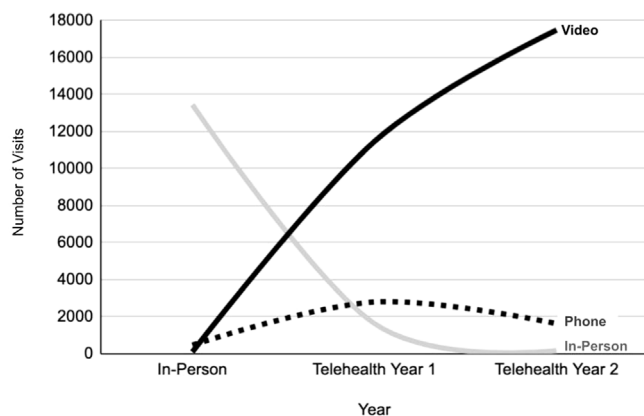
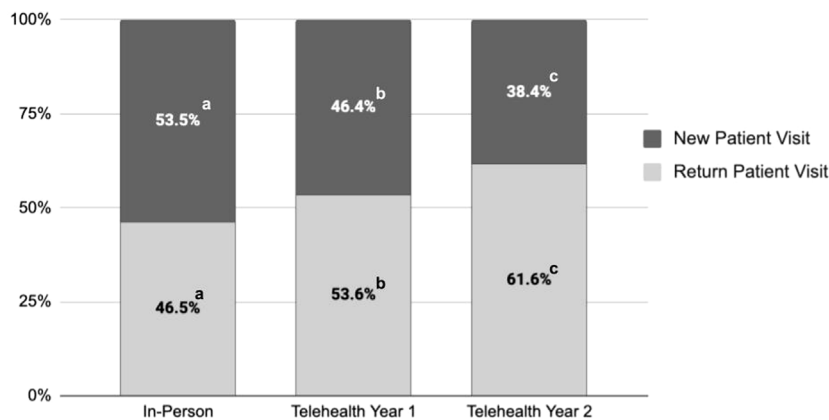


Fig. 2. Number of visits based on care delivery modality over time.

While our study did not analyze patient satisfaction directly, other studies have found that returning patients are more likely to recommend telehealth to their peers because they felt telehealth appointments were easier to access and were overall easy to navigate [18]. Thus it is not surprising that our study showed an increase in the number of returned patient visits, likely with patient satisfaction being a strong influence. Our study along with emerging research in this field suggests telehealth is here to stay.

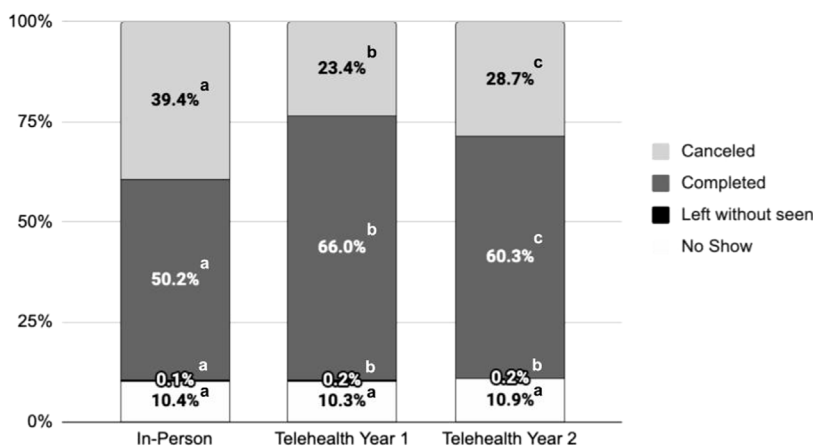
#### 4.2. There are telehealth challenges that need to be considered

Although telehealth has positively influenced clinical scheduling outcomes in the outpatient setting, there are still some challenges associated with delivering care virtually. Some studies suggest telehealth lacks the personal human connection that is seen within in-person appointments [22]. Patients have mentioned it is easier to establish trust during face-to-face appointments [20]. Some patients do not feel comfortable sharing personal information via telehealth with their healthcare provider. Other challenges include communication between providers and clinical support staff, privacy/confidentiality, and lack of telehealth training [16,36]. Along with the technology equipment required for telehealth, patients and clinicians must also have access to a reliable network [26]. Previous studies have noted that racial minorities, rural residents, and older adults are less likely to have access to technology [3,23,30,37,38]. A past study mentioned patients living in a lower-socioeconomic neighborhood were significantly less likely to choose virtual visits [39]. Also, patients who are 65 years and older tend to have a harder time understanding how to use telehealth but are in great need of medical services [40]. However, Batsis et al. suggest with the proper resources and guidance to build their confidence, older adults are capable of using telehealth [41]. Having additional resources and training for patients who need more education on how to navigate telehealth appointments can ultimately help increase patients' acceptance of telehealth. Improvements in increasing access to technology devices for individuals who cannot afford it also need to be addressed for telehealth services to be more inclusive.



<sup>a, b, c</sup> Different superscript letters denote when an analysis differs significantly from each other at p-value <0.05

Fig. 3. Comparison of visit type (new patient visit vs. return patient visit) based on care delivery modality over time.



<sup>a, b, c</sup> Different superscript letters denote when an analysis differs significantly from each other at p-value <0.05

Fig. 4. Comparison of appointment status based on care delivery modality over time.

From a practitioner’s perspective, the telehealth care modality limits providers from facilitating physical examinations including collecting vital signs, specimens, and other clinical data [42]. For example, accurate nutritional screening is an important first step in identifying patients who are at risk for malnutrition [43]. One review about performing nutrition-focused physical exams via telehealth notes the difficulty with studying fine details during a virtual exam [25]. Due to the challenges associated with telehealth, not all aspects of healthcare services can be implemented successfully. As a result, the interdisciplinary team will need to consider whether each patient case is appropriate for virtual care.

4.3. Limitations of our study

One limitation of our study is that it evaluates only one healthcare facility and thus the results may not be generalizable; however our study results are similar to those found in published literature. Another limitation is that the data reported for the demographics of patient encounters does not account for individual patients; instead, each encounter is considered a unique demographics data point. Future studies should track individual patient experiences and gather patient satisfaction data. Finally, our data was unable to evaluate staffing changes, scheduling nuances, and changes to workflows that occurred during the timeframes examined. However, our study is the only study that we know of that has done a comparative analysis of scheduling

outcomes immediately after the transition to telehealth and one year later after telehealth became the norm. Additional strengths of our study include the large data sample size and the timeframe of our study was long-term, over a three-year period. Our study provides relevant and insightful findings that can be considered by leadership and interdisciplinary teams in making decisions regarding future telehealth use.

4.4. Future areas of research

In conjunction with the expansion of telehealth use during the pandemic, patients are also engaging more in asynchronous online messaging systems to communicate with their providers. Asynchronous messages is another virtual communication system for patients and clinicians to discuss non-urgent related topics such as scheduling appointments, test results, and questions about medications [44]. More patients are utilizing online messaging systems due to its convenient nature, improving patient satisfaction [45]. Studies have acknowledged clinicians agree asynchronous messaging systems are effective and have increased their efficiency; however, it has also greatly increased their workloads. Future studies should assess asynchronous messaging and implement new strategies to help manage providers’ workloads while continuing to deliver patient care in the outpatient setting [46].

Moreover, it is likely the demand for patient care will continue to increase as we move towards post-COVID-19 pandemic, accepting

telehealth as the new norm. Studies have already mentioned clinicians are experiencing clinical burnout as their caseloads continue to rise [47, 48]. In our study, there was a decrease in the average wait time for an appointment with the initial switch from in-person to telehealth, but as telehealth became the norm, the average wait time for appointments returned to baseline. This is likely due to the increase in demand for patient care.

To alleviate this issue, health care facilities should be proactive and create an improvement committee that is responsible for implementing changes that will help face the growing volumes of patient care including hiring more full-time staff and establishing proper workflows [47, 49,50]. Therefore, future studies should further analyze outpatient clinic operations and address ways potential challenges associated with clinical burnout can be avoided. There are steps the healthcare system can take to ensure clinicians are not being overworked and able to provide quality care to their patients.

## 5. Conclusion

The novelty of our study is that we examined operations data not only immediately after the transition from in-person care modality to telehealth, but we also included data from a timeframe when telehealth became more established. By comparing historical operations scheduling data, we have provided evidence to support the continued use of telehealth. Healthcare and policy decision makers can consider our findings in strategic planning for the future of telehealth. Our study also provides a foundation for future research.

## Declaration of competing interest

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

## Data availability

The authors do not have permission to share data.

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