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Virtual Visits Partially Replaced In-Person Visits In An ACO-Based Medical Specialty Practice

ABSTRACT Specialty care contributes significantly to total medical expenditures, for which accountable care organizations (ACOs) are responsible. ACOs have sought to replace costly in-person visits with lower-cost alternatives such as virtual visits (videoconferencing with physicians). In fee-for-service environments, virtual visits appear to add to in-person visits instead of replacing them. While this may be less of a problem within ACOs, whether virtual visits reduce in-person visits in an ACO is not known. Using data from over 35,000 patients in the period 2014–17 within a Massachusetts-based ACO, we found that the use of virtual visits reduced in-person visits by 33 percent but increased total visits (virtual plus in-person visits) by 80 percent over 1.5 years. While the use of virtual visits reduced in-person visits soon after registering with the program, the effect did not endure beyond a year. Whether and how virtual visits can substitute for in-person care in the long term are open questions.

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Telemedicine-enabled virtual visit programs in which patients access physicians via videoconference are touted as a tool that can both increase access to and lower the cost of specialty care.[1] Virtual visits have proven useful in increasing access in rural areas and in providing timely care for acutely ill patients.[2–4] Because virtual visits are less costly to provide than in-person visits, substituting virtual for in-person visits may decrease the total cost of care. The prospect of virtual visits as a novel alternative to traditional in-person care has attracted the attention of accountable care organizations (ACOs), which bear the risk of increasing utilization and therefore seek to reduce their overall spending on specialty care while maintaining access, quality, and the patient experience.

Hopes of an innovative, lower-cost alternative to in-person specialty care have been tempered by early analyses suggesting that virtual visit programs may decrease in-person visits but also increase total health care utilization.[5–7] These analyses examined programs in fee-for-service environments where there is a weak financial incentive to decrease utilization. By contrast, ACOs have a strong financial incentive to limit low-value utilization. While it has been theorized that virtual visit programs within ACOs would be better at using virtual visits to replace in-person visits and limiting overuse, there is little experience or evidence to inform this proposition.[8]

To address this gap, we examined a virtual visit program in a medical specialty practice within an ACO to determine whether such a program affects the use of in-person specialty care. Specifically, our primary aim was to answer the following question: Does the use of virtual visits lead to decreased use of in-person care?

Background

The Massachusetts General Physicians Organization (MGPO), a regional service organization

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within Partners Healthcare, an integrated delivery system in Boston, implemented a virtual visit program in 2013. At that time, Partners was participating in the Medicare Pioneer ACO program as well as commercial risk-based contracts, each of which created the opportunity to share in savings generated through delivery innovation. The strategy adopted by the MGPO was to pioneer alternatives to traditional in-person specialty care with the goals of preserving access, quality, and patient experience while reducing the overall cost of care.[9] The virtual visit program was one tactic employed to meet these objectives. Structured electronic consults (e-consults), in which referring physicians request an electronic consultation rather than an in-person visit, was another program designed to meet the strategic goal.[10]

The Massachusetts General Hospital Center for TeleHealth implemented the virtual visit program using a commercial vendor for the technology services and established in-house program development and service support teams. Medical practices within the MGPO voluntarily participated in the virtual visit program; physicians within these practices also volunteered to participate. Physicians and support staff received brief in-person training, and their offices were outfitted with the equipment needed to conduct secure virtual visits. Once trained, physicians could refer patients for registration with the virtual visit program. Patients had to complete one in-person visit before being referred to the program. Once a patient was referred to the program, the TeleHealth team would register the patient through a process that included a test call—a trial video visit that helped prepare patients for their upcoming virtual visit. Program managers tracked the date of registration and all completed virtual visits.

The MGPO billed payers that provided reimbursement for virtual visits. When payers did not reimburse or only partly reimbursed virtual visits, the MGPO internally reimbursed practices at a rate equivalent to that for a customary in-person visit. Patients paid a standard copayment if their insurance covered virtual visits and a $25 fee if their insurance did not.

Throughout, the mode of care—in-person, virtual, or otherwise—occurred at the discretion of the patient and physician. While the goal of the program was to optimize access for patients and decrease costs, physicians were not asked to justify the use of a virtual visit.

Study Data And Methods

DATA We used virtual visit registration and administrative data for 35,854 patients cared for at the Massachusetts General Hospital Department of Neurology ambulatory clinics in the period October 15, 2014—May 31, 2017. We focused the study on the clinics because this practice completed the most virtual visits of all the medical specialty practices. We measured baseline sociodemographic characteristics and outpatient utilization using administrative data.

STUDY COHORTS First, we compared patients who registered with the virtual visit program to those who did not. We then divided the group that registered into patients who completed at least one virtual visit and those who did not.

To create a control group, we exploited the fact that only half of the patients who registered for the program completed a virtual visit in the study period. Specifically, we created a matched set of registered users (the treatment group) and registered nonusers (the control group) of virtual visits using observable characteristics to minimize bias generated by nonrandom intention to participate in the program. The characteristics used for matching included age, sex, race, primary language, insurer, date of registration in the program, preregistration visit frequency, distance to the clinic based on patients' home ZIP codes, subspecialty clinic type, and prior appointment no-shows. We used a propensity score matching algorithm to perform a 1:1 match of similar registered nonusers to registered users.[11–13] The propensity score matching algorithm resulted in 519 registered users matched with 519 registered nonusers. (Additional details on matching are available in the online appendix.)[14]

IMPACT ON IN-PERSON VISITS The study was designed to determine whether the use of the virtual visit program resulted in fewer in-person visits. First, we determined the period over which patients were active with the specialty practice. We defined this period as the interval between the first and last completed appointment. (Additional details and the results of sensitivity analyses are available in the appendix.)[14] Using the date of registration as time 0, we determined how many times each patient completed an in-person visit during each quarter they were active with the practice. For each patient, we examined in-person visit frequency for up to six quarters (1.5 years) before and six quarters after registration with the virtual visit program.

STATISTICAL ANALYSES To determine whether patient baseline characteristics varied in the unmatched groups, we used chi-square tests for categorical variables and *t*-tests for continuous variables. We estimated whether the use of virtual visits was associated with decreased in-person visits by comparing in-person visit rates between users and the matched control group of non-

users, in every quarter before and after the patient registered with the virtual visit program. Since patients' registration with the program almost always coincided with an in-person visit, we did not include in-person visits that occurred fifteen days before or after registration.

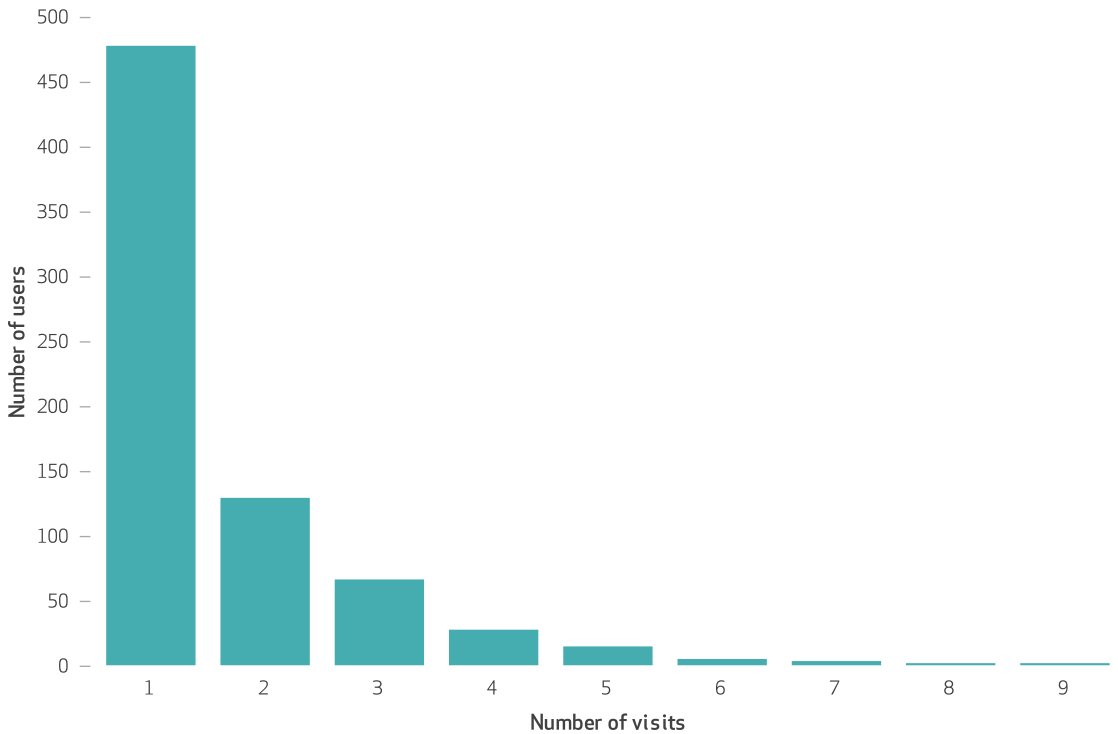
We performed an interrupted time-series analysis in which propensity score matched registered nonusers served as the control for matched registered users.[15] In this analysis the date each patient registered with the virtual visit program—which differed across patients—served as the start of the intervention (that is, time 0). This approach reduced the risk that other contemporaneous changes to clinical operations influenced our measurement of the effect of virtual visit use. We calculated the overall in-person visit rate in the control and intervention groups, the difference between the two rates, and the virtual visit rate in the 1.5 years following registration with the virtual visit program. The censoring period sensitivity analyses, the specification of the time-series model, and details of the bootstrapping methodology are in the appendix.[14] We used SAS, version 9.4, and Stata, version 15.1, for the analyses.

LIMITATIONS Our study had several limitations. First, while we attempted to minimize bias from nonrandom participation by matching users and nonusers from among a group of people who had registered with the program, this procedure does not guarantee that the groups did not differ on unobserved characteristics. We mitigated the risk of unobserved confounding by comparing pre-intervention trends. Differential trends would indicate residual bias. However, we found similar trends during the pre-intervention period, which increased confidence that the matched control group was appropriate.

Second, physicians and patients had complete latitude regarding the indication for a virtual visit (that is, what constituted appropriate use). While the population health goal of the virtual visit program was to replace in-person visits, this might not have been the intention of physicians when they opted to use virtual visits. Such misaligned use of virtual visits would bias the analysis toward finding no relationship between the use of virtual visits and subsequent in-person visits. Also, lacking data on physicians' rationale for virtual visits, we were unable to determine the drivers of the temporal trend of increasing in-person visits among patients who used virtual visits.

EXHIBIT 1

Numbers of virtual visits completed by users of the virtual visit program, by how many visits users had



SOURCE Authors' analysis of neurology clinic administrative data from Massachusetts General Hospital and the Massachusetts General Physicians Organization for the period 2014–17.

Third, the analyses presented here result from the experience of a specialty practice in a single center and therefore might not be generalizable to other settings. However, the more than 1,400 virtual visit registrations and the 750 active users constitute one of the largest published cohorts of virtual visit users in a medical specialty practice. The study findings may be more readily generalizable to tertiary medical specialty practices, and caution should be used when generalizing them to procedural or surgical practices and practices without the infrastructure to support a virtual visit program.

Study Results

PATIENTS WHO REGISTERED WITH AND USED THE VIRTUAL VISIT PROGRAM In the period October 2014–February 2017, 1,431 patients registered with the virtual visit program in the neurology ambulatory clinic (4 percent of all of the clinic's patients) (appendix exhibit 1).[14] Patients who registered were more likely to be younger, white, English speaking, and commercially insured and to live farther from the clinic, compared to those who did not register. Among the 1,431 patients who registered with the virtual visit program, 730 (51 percent) completed at least one virtual visit.

There were few differences between registered patients who ultimately did (registered users) and those who did not use (registered nonusers) the virtual visit program, but those differences were important. Registered users were more likely to identify themselves as white and to live further from the clinic. Before registration with the virtual visit program, those who ultimately used the program had the same in-person visit frequency as those who did not use the program. After matching, there were no observable differences between registered users and registered nonusers (appendix exhibit 1).[14]

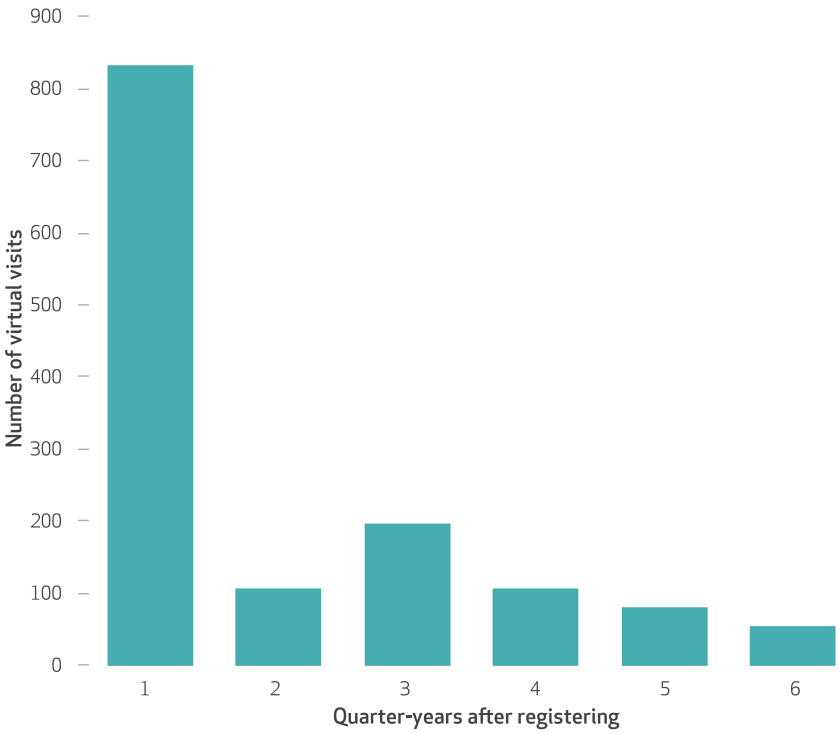
TIMING AND USE OF VIRTUAL VISITS AMONG REGISTERED USERS Among the 730 users of the virtual visit program, 478 (65 percent) completed a single virtual visit, and 252 (35 percent) completed two or more (exhibit 1). These 730 users completed a total of 1,416 virtual visits. Of these visits, 831 (59 percent) occurred within the first quarter-year after registration, and 1,242 (88 percent) occurred within the first year after registration (exhibit 2).

QUARTERLY TRENDS IN IN-PERSON VISIT RATES Using the matched cohort of 519 registered users and 519 registered nonusers, we estimated the effect of virtual visit use on the subsequent in-person visits. Immediately after registration with the virtual visit program, virtual visit use was associated with a decrease of 1.1 in-person visits per person-year in the in-person visit rate (exhibit 3). Following the initial decrease in in-person visits, virtual visit use was associated with an increase of 0.2 in-person visits per person-year in the in-person visit rate each quarter. After four quarters, the in-person visit rate among virtual visit users was equivalent to that among virtual visit nonusers.

CHANGES IN UTILIZATION AND VISIT SUBSTITUTION In the 1.5 years following registration, matched users had 2.4 virtual visits per person-year (exhibit 4). By definition, matched nonusers did not complete any virtual visits. In the 1.5 years following registration, matched users of virtual visits had 1.4 in-person visits per person-year, whereas matched nonusers of virtual visits had 2.1 in-person visits per person-year. Based on these observations, we estimated the following three results: First, the use of virtual visits was associated with a 33 percent decline in the number of in-person visits. Second, the use of virtual visits was associated with an 80 percent increase in combined visits (in-person and virtual). Third, at a population level, for every 3.5 virtual visits performed, an in-person visit was averted.

EXHIBIT 2

Numbers of virtual visits completed by users of the virtual visit program, by quarter-years after registering



SOURCE Authors' analysis of neurology clinic administrative data from Massachusetts General Hospital and the Massachusetts General Physicians Organization for the period 2014–17.

Discussion

Within a medical specialty practice of an accountable care organization over a year and a half, the use of virtual visits resulted in 33 percent fewer in-person visits but an 80 percent increase in total visits (virtual and in-person). Furthermore, for every 3.5 virtual visits performed, one fewer in-person visit was performed. In the first quarter-year following patients' registration with the virtual visit program, in-person care decreased significantly, coinciding with the peak use of virtual visits. Following the initial decline in the first quarter, among virtual visit users, there was steady growth in in-person visits and a concurrent decline in the use of virtual visits.

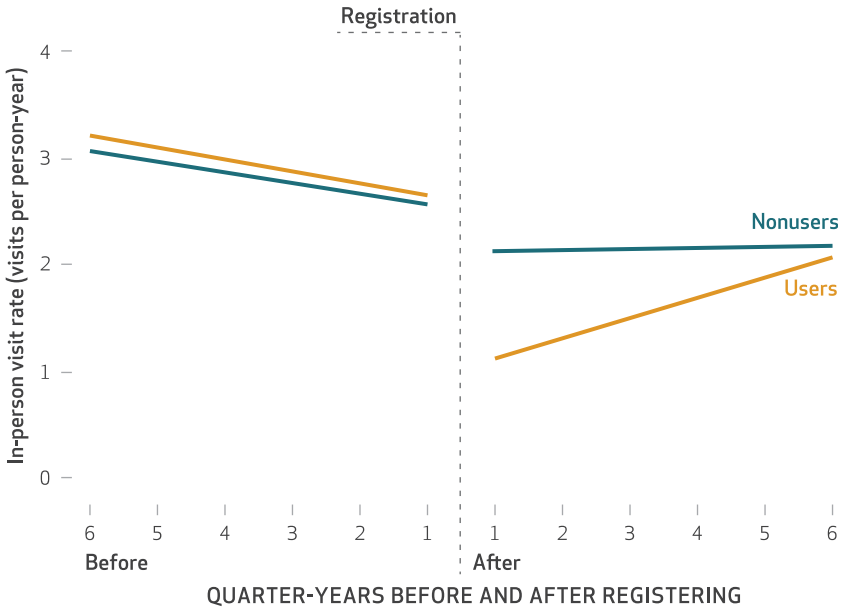
Notably, after one year the rate of in-person care among users of the virtual visit program returned to baseline. This observation should be interpreted in the context that two-thirds of patients who used virtual visits were active with the practice for a year or less.[16] For most patients, care was delivered in the first year, and during this period there was a clear reduction in the use of in-person care among users of the virtual visits. Among the one-third of patients who were active with the practice for more than a year, the results indicate that the initial use of virtual visits was not sustained, and the reduction in in-person visits was transient.

The study results speak to the effect of virtual visits on ambulatory care use and may inform future implementation efforts. For ACOs, these findings provide an estimate of the virtual visit volume required to yield a return on an ambulatory care–focused virtual visit program. At a minimum, ACOs bear the administrative and technical costs of establishing virtual visit programs and also the costs of reimbursing clinicians when insurers do not. This study provides ACO administrators with an estimate of the potential gains attainable through shared savings from reduced in-person visit billing that could offset the necessary investment. However, the diminishing effectiveness over time observed in this study cautions against assuming a long-lasting reduction in in-person visits, absent a change in program design.

These findings also inform the evolving conversation about the role of virtual visit programs

EXHIBIT 3

Quarterly trends in the in-person visit rates of matched virtual visit nonusers and users, before and after registering for the virtual visit program



SOURCE Authors' analysis of neurology clinic administrative data from Massachusetts General Hospital and the Massachusetts General Physicians Organization for the period 2014–17. **NOTES** The in-person visit rate is the number of such visits divided by the person-year, or the number of people included in the years they were observed. The lines are the product of an interrupted time-series regression model.

EXHIBIT 4

Virtual, in-person, and combined visit rates in the 1.5 years after registering for the virtual visit program, 2014–17

	Matched nonusers	Matched users	Absolute difference	Percent difference
Virtual visits per person-year[a]	0	2.4	2.4***	—[b]
In-person visits per person-year[a]	2.1	1.4	−0.7***	−33***
Combined visits per person-year[a]	2.1	3.9	1.7***	80***
	Matched nonusers	**Matched users**	**Number**	**Percent**
Estimated virtual visits needed to replace one in-person visit[c]	—[b]	—[b]	3.5***	—[b]

SOURCE Authors' analysis of neurology clinic administrative data from Massachusetts General Hospital and the Massachusetts General Physicians Organization for the period 2014–17. **NOTES** "Nonusers" refers to people who did not use the program. Significance was calculated using 1,000 bootstrapped samples with replacement. A version of this table with confidence limits is in the appendix (see note 14 in text). [a]Observed rate. [b]Not applicable. [c]Estimated by dividing the number of virtual visits per person-year (explained in the notes to exhibit 3) by the change in in-person visits per person-year. ***$p < 0.01$

in increasing access and the associated risk of overutilization. The use of virtual visits in traditional fee-for-service environments increased rural patients' use of mental health and dermatologic care, both of which are traditionally access-constrained specialties.[2,5] These cases demonstrate increased use of care that simultaneously raises hopes of fulfilling an unmet need and concerns of overutilization. J. Scott Ashwood and coauthors examined the potential for supply-induced demand when patients used virtual visits in a direct-to-consumer urgent care model. They found no significant improvement in access and estimated that 88 percent of virtual visits represented new utilization, raising concerns about overutilization.[7]

Theoretically, a virtual visit program implemented in an ACO could increase access while limiting excess utilization. This study supports this premise. First, we found that the use of virtual visits resulted in 33 percent fewer in-person visits over 1.5 years (exhibit 4). Unused in-person appointments could be used by waiting patients, thus increasing access. Second, we used the Ashwood measure to quantify the percentage of virtual visits that could be considered new utilization. We found that 29 percent of virtual visits replaced in-person visits; the remaining 71 percent of virtual visits represented new utilization.

Notably, the increase in access was time limited: One year after initiation of use, there was no measurable reduction in in-person visits. However, in this implementation of virtual visits, there was no explicit effort to guide patient selection or constrain virtual visit use. With a different design and incentives, virtual visits could be a viable way to increase access over the long term. To achieve this goal, qualitative and survey analyses that explore clinicians' use of virtual visits as well as patients' experiences and outcomes might be particularly useful.

The results of this study point to three areas of focus for population health administrators and researchers as virtual visit programs are implemented and evaluated: using a comprehensive measure of utilization, demonstrating value, and ensuring equity.

First, future ACO-based virtual visit programs should be designed to affect total medical expenditures and measured against this goal. This study found a limited and transient effect on ambulatory care use. Measuring the effect on acute care, postacute care, diagnostic, and therapeutic costs would allow population health administrators to design future virtual visit programs to address these high-cost areas. Also, virtual visit programs should measure their effect on clinician effort—for example, by measuring the effect on the total number of touch points (such as phone calls, chart messages, and in-person visits) or the total time spent in the care of a patient. Such measures may have greater traction as ACOs move away from relative value unit–based compensation models and toward a comprehensive valuation of clinician effort.

Second, demonstrating the value of virtual visit programs must be a priority. While access and utilization have been the focus of many virtual visit program evaluations, researchers and administrators have not been as productive with the more challenging half of the value equation: ascertaining the impact on patient outcomes. The acute care[4,17] and nursing home[3] virtual visit models have demonstrated value, but there is a dearth of data about the value of virtual visit programs in the ambulatory care setting.[18–22] While utilization is an important measure, it must be weighed in the context of improvement in patient outcomes. This aim may be best achieved by evaluating the integration of virtual visits into the clinical workflow related to specific conditions. As organizations that deliver clinical care, ACOs are well positioned to explore, refine, and disseminate virtual visit use cases that improve value.

Third, sponsors of virtual visit programs must monitor their potential to propagate disparities.[23] Virtual visit programs have meaningfully addressed the inequities faced by rural patients. However, in this study we found that younger, white, and commercially insured patients were overrepresented among those who registered with the virtual visit program and overrepresented further among those who chose to use the service. Historically, new health interventions favor the well resourced, thereby widening socioeconomic disparities.[24] As virtual visit programs mature, special attention should be paid to promoting their use among traditionally marginalized patients such as members of racial and ethnic minority groups, the homebound, people with limited English proficiency, and those living in poverty.

Conclusion

Virtual visit programs that deliver synchronous video-based clinical care have gained the attention of accountable care organizations seeking to find alternatives to traditional, high-cost specialty care while preserving access, quality, and the patient experience. In an ACO-based medical specialty practice, we found that the use of a virtual visit program resulted in one-third fewer in-person visits but a greater number of total visits (in-person and virtual visits). However, the effect was transient: Beyond a year, virtual

visits did not replace in-person visits. Virtual visit programs may eventually become a viable tool for ACOs to address the use of ambulatory specialty care, but additional work is needed to ascertain whether and how virtual visits can substitute for in-person care in the long term. ■

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NOTES

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