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Rapid Growth Of Remote Patient Monitoring Is Driven By A Small Number Of Primary Care Providers

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ABSTRACT **Growing enthusiasm for remote patient monitoring has been motivated by the hope that it can improve care for patients with poorly controlled chronic illness. In a national commercially insured population in the US, we found that billing for remote patient monitoring increased more than fourfold during the first year of the COVID-19 pandemic. Most of this growth was driven by a small number of primary care providers. Among the patients of these providers with a high volume of remote patient monitoring, we did not observe substantial targeting of remote patient monitoring to people with greater disease burden or worse disease control. Further research is needed to identify which patients benefit from remote patient monitoring, to inform evidence-based use and coverage decisions. In the meantime, payers and policy makers should closely monitor remote patient monitoring use and spending.**

Remote patient monitoring is the automated collection of patient physiological measurements (such as blood pressure, weight, or blood glucose levels) outside of traditional health care settings. It has been heralded as the "future of health care"[1–3] for its potential to improve chronic disease management by allowing for frequent adjustment of medications and early detection of complications, particularly for patients whose disease control is poor, patients with greater disease burden and higher risk for complications, and patients who face significant barriers to in-person care (for example, travel, financial, or disability-related challenges).

Until recently, the use of remote patient monitoring was modest and largely focused on narrower applications for specific patient populations, such as continuous glucose monitoring. However, in recent years coverage of remote monitoring for common chronic conditions has expanded meaningfully. In 2019 the Centers for Medicare and Medicaid Services (CMS) implemented new billing codes for a broad range of applications that cover the remote monitoring of physiological data of any kind.[4] These coverage expansions have been echoed by most major commercial payers.[5,6] Early in the COVID-19 public health emergency that began in the US in 2020, both Medicare and commercial payers made further changes to encourage the use of remote patient monitoring, including waiving cost sharing and relaxing requirements for billing, such as minimum measurement days and the need for established patient-provider relationships.[7]

How health care providers have responded to these changes and which types of patients are more likely to receive remote patient monitoring services have not been quantified. To fill this gap in knowledge, we describe recent trends in remote patient monitoring use—namely, how volumes have grown, which providers are adopting it, and the characteristics of patients receiving it. Our hope is that these results can illuminate how remote patient monitoring is used and inform how policy makers regulate and determine reimbursement coverage for it.

Study Data And Methods

DATA SOURCES We used deidentified claims data from January 1, 2019, to March 31, 2021, from the OptumLabs Data Warehouse, which includes medical claims for approximately twenty million commercially insured and Medicare Advantage enrollees annually.[8] For each claim, we collected information on the date of service, associated procedure codes, motivating diagnoses, and a deidentified provider ID.

MONTHLY CLAIMS VOLUME We first calculated trends in monthly volume of general remote patient monitoring claims. These claims were identified via the new Current Procedural Terminology (CPT) codes introduced by CMS in 2019 for this purpose. The codes cover a one-time device setup and patient onboarding service (CPT code 99453), monthly costs associated with device provision and data collection and interpretation (99454), and twenty minutes of clinician time per month for care management (99457). We also included code 99458, which was added in 2020 for additional twenty-minute increments of clinician time per month, and code 99091, which served a similar role to code 99457 before 2019. Monthly volumes of general remote patient monitoring claims were compared with those for continuous glucose monitoring—a form of monitoring used only for diabetes, with its own dedicated set of previously established CPT codes (see online appendix exhibit 1).[9] Monthly claims volumes for general remote patient monitoring and continuous glucose monitoring were indexed to their February 2020 levels, which served as a baseline for prepandemic volumes.

CLAIMS PERSISTENCE After being onboarded onto remote patient monitoring, patients can continue receiving the services indefinitely. We therefore documented general remote patient monitoring claims persistence throughout 2020 to understand how long the average onboarded patient received general remote patient monitoring services.

We restricted this analysis to patients who had received a general remote patient monitoring onboarding service (CPT code 99453) in 2020 and were continuously enrolled in a health plan through all of 2020. Patients were assigned to one of twelve "onboarding groups" based on the first calendar month in which they were onboarded. For each onboarding group, a persistence curve was calculated to reflect the proportion of patients who had at least one general remote patient monitoring claim in each month after their initial onboarding. An overall persistence curve was generated by taking the simple average across all groups (that is, weighting each onboarding group equally). To quantify average remote patient monitoring service costs in the first year after initiation, we summed average costs per month across all general remote patient monitoring CPT codes.

CLAIMS CONCENTRATION AMONG PROVIDERS To understand provider-level concentration of general remote patient monitoring claims in 2020, we focused on primary care providers because they were the most common providers listed on these claims in 2020 (about 50 percent of claims; appendix exhibit 2).[9] We limited our analysis to providers who billed for services with at least ten unique patients in 2020. Among these providers, we calculated the fraction of all 2020 general remote patient monitoring claims from the top 0.1 percent, 0.1–0.5 percent, 0.5–1.0 percent, and remaining 99 percent of providers by remote patient monitoring claims volume and labeled the top 0.1 percent of providers "high-volume primary care providers." For comparison, we calculated analogous fractions for outpatient telemedicine claims.

We identified the top ten markets in which high-volume primary care providers provided remote patient monitoring services. For each high-volume provider, we identified the county in which they had the most general remote patient monitoring claims (based on patient residence) and then aggregated county-level counts of high-volume providers up to the Metropolitan Statistical Area (MSA) level.

USE RATES AMONG PATIENTS OF HIGH-VOLUME PROVIDERS To understand which patients eligible for remote patient monitoring actually received these services, we focused on already established patients of high-volume primary care providers. We focused on the patients of these providers because they accounted for the majority of remote patient monitoring use. Patients were considered to have established care with a high-volume provider if they had at least one claim with that provider in 2019. In addition, we restricted our analysis to patients who were continuously enrolled in a health plan from 2019 through 2020 and had diagnoses of hypertension or diabetes (from the Elixhauser Comorbidity Index,[10] based on 2019 claims). We selected these two conditions because they were the most common primary diagnoses on general remote patient monitoring claims in 2020 (about 60 percent of claims; appendix exhibit 3)[9] and because patients with hypertension or diabetes could be readily identified in our data using the Elixhauser Comorbidity Index.

The use rate for a given patient group was calculated as the percentage of patients with at least one general remote patient monitoring claim in 2020. Patient groups were defined on the basis of condition type, patient age, and num-

ber of chronic conditions. For a subset of patients who conducted testing with contracted vendors, hemoglobin A1c (HbA1c) results were available. For these patients, we used their most recent 2019 HbA1c test result to categorize them as having had good (less than 7 percent) or poor (7 percent or higher) diabetes control.

LIMITATIONS Our study had several limitations. First, because of limitations in the data available, we were unable to examine clinic structure or whether providers were part of a larger health system, both of which may be informative in understanding the nature of remote patient monitoring adoption. Second, the data available did not allow us to observe the specific remote patient monitoring device used, whether the device was used properly, the physiological measure or measures recorded, or the amount paid to the provider. Laboratory results were also available for only a subset of laboratories.

Third, another potential gap was our inability to observe remote patient monitoring use that was not billed to the insurer. In some cases, clinicians may offer remote patient monitoring but not bill—either by choice or because the service does not meet current billing requirements (for example, the minimum sixteen days of measurement). Fourth, some remote patient monitoring services may be provided within the context of a chronic disease management program (for example, Omada Health) or through a consumer electronic product (for example, an Apple Watch or Fitbit), which might or might not be part of an employer-sponsored health program; none of these cases were captured in our claims data.

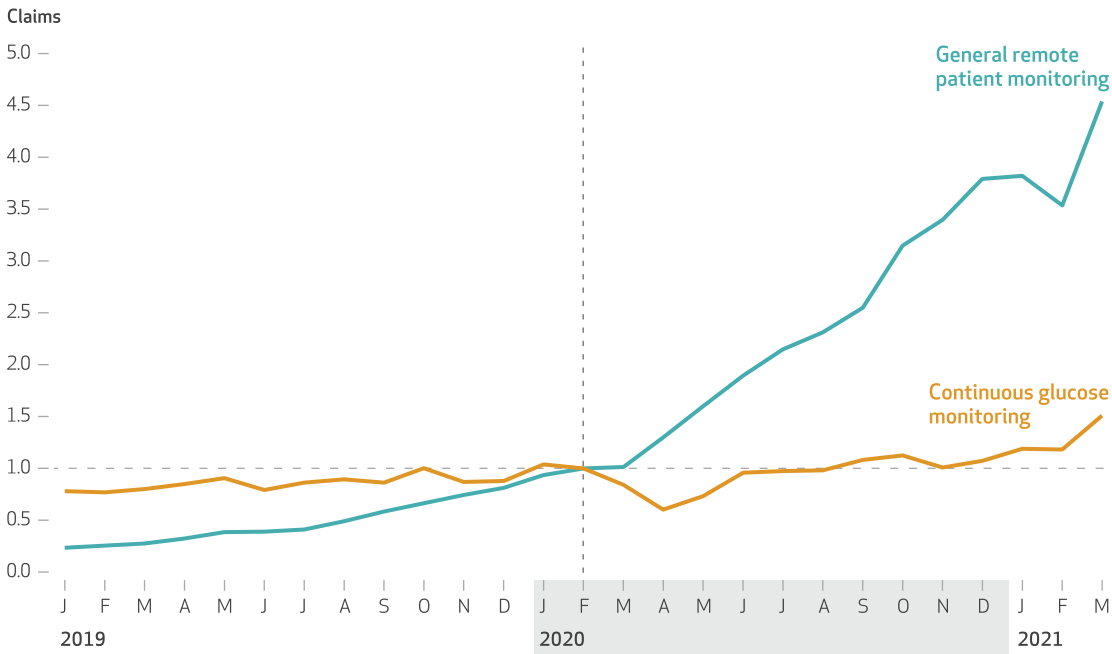
Fifth and last, our analysis was limited to the commercial and Medicare Advantage enrollees included in the data set. As such, our findings might not generalize to other patient populations, such as those insured by Medicare fee-for-service or state Medicaid programs.

Study Results

MONTHLY CLAIMS VOLUME From March 2020 onward, the volume of general remote patient monitoring claims increased rapidly, reaching more than four times its prepandemic level by March 2021. Exhibit 1 illustrates this trend, with claim volumes indexed to February 2020 (1.0). Similar trends were observed when we tracked the number of patients and number of providers with claims (appendix exhibits 4 and 5).[9] There

EXHIBIT 1

Volume of health insurance claims for general remote patient monitoring and continuous glucose monitoring, indexed to prepandemic levels, January 1, 2019–March 31, 2021



SOURCE Authors' analysis of data from the OptumLabs Data Warehouse. **NOTES** Claims are assigned to general remote patient monitoring or continuous glucose monitoring if any Current Procedural Terminology code associated with that monitoring group was billed for in a given claim; claims can be assigned to both monitoring groups (although this is rare). Volumes are aggregated by month and indexed to February 2020 (1.0), as indicated by the vertical dashed line. The 2021 values extend through the end of March 2021.

were 19,762 general remote patient monitoring claims across 15,682 unique patients in March 2021, up from 4,355 claims across 3,653 unique patients in February 2020 (appendix exhibit 6).[9] In contrast, continuous glucose monitoring showed a more modest increase of 51 percent during the same period, reaching 15,408 claims across 14,410 unique patients in March 2021 compared with 10,218 claims across 9,459 unique patients in February 2020. Although continuous glucose monitoring started the pandemic with more than twice the claims volume of general remote patient monitoring and nearly three times the patient volume, by March 2021 general remote patient monitoring had surpassed continuous glucose monitoring on both dimensions.

CLAIMS PERSISTENCE Among patients onboarded onto general remote patient monitoring in 2020, 51 percent continued to use these services six months after initial onboarding (appendix exhibit 7).[9] The steepest drop-off occurred in the first month after onboarding, after which time long-term use, defined here as use for six months or longer, was common. We did not have data on remote patient monitoring payments to providers; however, using the national average 2020 Medicare nonfacility reimbursement rate for remote patient monitoring services,[11] we estimated an average of $706 in remote patient monitoring charges per patient in the first year of use (appendix exhibit 8).[9]

CLAIMS CONCENTRATION AMONG PROVIDERS General remote patient monitoring claims in 2020 were highly concentrated among a small number of primary care providers (exhibit 2). Only 0.75 percent of providers (2,515 providers) had any general remote patient monitoring claims, and the 0.1 percent of providers in our high-volume provider group (342 providers) accounted for 69.0 percent of all general remote patient monitoring claims observed. In contrast, the top 0.1 percent of primary care providers by outpatient telemedicine claims volume accounted for only 6.1 percent of telemedicine claims.

High-volume primary care providers were also geographically concentrated (appendix exhibit 9).[9] The top ten MSAs by number of high-volume providers had 40 percent of all high-volume providers (136 providers). Six of these ten MSAs were located in the southern United States.[12]

USE RATES AMONG PATIENTS OF HIGH-VOLUME PROVIDERS Among the 8,481 patients with diabetes or hypertension who saw a high-volume primary care provider in 2019, 21.5 percent had a general remote patient monitoring claim in 2020 (exhibit 3).

There were modest or no differences in remote patient monitoring use based on condition complexity, number of chronic conditions, and disease control. Patients with an uncomplicated hypertension diagnosis had a use rate of 21.7 percent versus 23.8 percent for those with a complicated hypertension diagnosis. Patients with an uncomplicated diabetes diagnosis had a use rate of 20.7 percent versus 24.4 percent for those with a complicated diabetes diagnosis. Patients with a single chronic condition had a use rate of 16.5 percent, versus 24.1 percent for those with five or more chronic conditions. Those with good diabetes control had a use rate of 22.1 percent versus 21.9 percent for those with poor diabetes control.

EXHIBIT 2

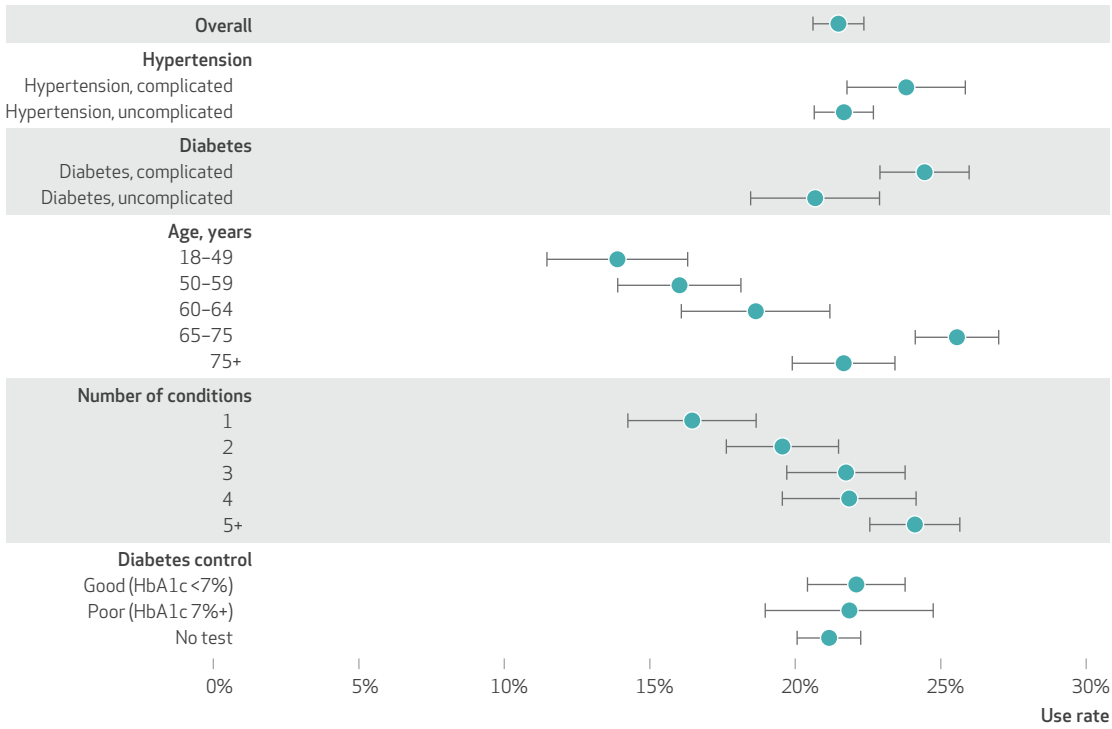
Concentration of health insurance claims for general remote patient monitoring and for outpatient telemedicine across primary care providers, 2020

	2020 general remote patient monitoring			2020 outpatient telemedicine		
Provider group	No. of providers	No. of claims	Percent of claims	No. of providers	No. of claims	Percent of claims
Top 0.1%	342	34,406	69.0	342	335,130	6.1
Top 0.1%–0.5%	1,338	14,257	28.6	1,338	427,946	7.8
Top 0.5%–1.0%	1,681	1,236	2.5	1,681	335,861	6.1
Other	332,752	0	0.0	332,752	4,412,668	80.1
Total	336,113	49,899	100.0	336,113	5,511,605	100.0

SOURCE Authors' analysis of data from the OptumLabs Data Warehouse. **NOTES** Restricted to primary care providers who billed for at least 10 unique patients in 2020. Multiple providers were tied at the top 0.1 percent threshold. All were included in our top 0.1 percent group, which is why the group size shown slightly exceeds 0.1 percent of the eligible provider sample. Claims are considered general remote patient monitoring claims if any Current Procedural Terminology (CPT) code for this service is billed for in the claim. Claims are considered outpatient telemedicine visits if they include a CPT or Healthcare Common Procedure Coding System (HCPCS) code with a telemedicine modifier, have a 02 place-of-service code for telemedicine, or include a dedicated telemedicine CPT or HCPCS code.

EXHIBIT 3

Use rates of general remote patient monitoring among patients with hypertension or diabetes treated by high-volume primary care providers, by patient characteristics, 2020



SOURCE Authors' analysis of data from the OptumLabs Data Warehouse. **NOTES** Use rate refers to the percent of patients in a given segment that had at least one general remote patient monitoring claim in 2020. Error bars reflect 95% confidence intervals. Patients were included in the analysis if they maintained continuous health coverage through all of 2019 and 2020, had at least one claim with a high-volume primary care provider (top 0.1 percent of providers based on 2020 general remote patient monitoring claims volume) in 2019, and had a diagnosis of hypertension or diabetes in 2019. The number of conditions and condition type are determined using the Elixhauser Comorbidity Index, as described in the text. Diabetes control is based on patients' most recent HbA1c test from 2019. HbA1c test results were available for only a subset of patients.

Discussion

Within a large, national, commercially insured population in the US, the use of general remote patient monitoring increased more than fourfold during the COVID-19 pandemic. The majority of use was driven by a small fraction of primary care providers. Among patients onboarded onto general remote patient monitoring, most used it for at least six months, and the average onboarded patient is estimated to have received $706 in general remote patient monitoring services in their first year. Assuming that an average primary care provider has a panel of 2,300 patients,[13] 50 percent of whom have one or more chronic conditions (consistent with the overall rate in our sample), and assuming 21.5 percent remote patient monitoring uptake among those patients (consistent with use rates among diabetes and hypertension patients of high-volume-providers), general remote patient monitoring reimbursement would prospectively total approximately $175,000 per primary care provider per year.

At present, general remote patient monitoring use and spending are still relatively small; however, the growth rates and persistence patterns observed in our analysis indicate that total spending on remote patient monitoring could quickly escalate. Others have already noted the potential financial burden that this monitoring could represent to CMS and other payers.[14] Further, the fraction of patients eligible for remote patient monitoring is large, as under current policies it can be used for any chronic illness and any physiological measurement.

Establishing a remote patient monitoring program requires substantial up-front investments by providers, including not only costs for procuring monitoring devices and other necessary technology infrastructure but also more subtle organizational costs, such as those tied to educating providers, modifying established care workflows, and developing systems for ensuring that concerning physiological data (for example,

a low glucose reading) sent to the provider can be addressed in a timely manner. However, once such initial investments are made, the marginal resources needed to add additional patients to a remote patient monitoring program are quite low. Providers have significant latitude in determining how remote patient monitoring is used, and in a fee-for-service reimbursement environment there may be strong incentives to maximize uptake, in particular when remote patient monitoring is a complement to other care provision. The growing presence of third-party remote patient monitoring vendors, which provide monitoring devices to clinicians and conduct various services such as patient onboarding or technical support on their behalf, further reduces provider costs for scaling and may further encourage uptake.[15]

If an increase in spending for remote patient monitoring results in improved chronic illness management or substantial improvements in access or convenience for patients, this uptake could constitute high-value spending. However, evidence for the benefits of this service is still sparse. Results to date have been mixed overall, in part as a result of substantial heterogeneity in study designs.[16] Targeted use cases for specific patient groups appear to show more promise—for example, remote monitoring of congestive heart failure using data from implanted devices.[17] General remote patient monitoring services are more likely to be high value if they target the patients who will benefit from them most. Many expect that these patients will include those with greater disease burden, worse disease control, or significant barriers to in-person care. The first two of these dimensions were measurable to some degree in our analysis. Although we did observe higher use rates among patients with more chronic conditions or more complicated disease, the differences were relatively small. In addition, patients with good disease control had use rates that were roughly equal to those of patients with poor disease control.

Policy Implications

Further research, including both prospective randomized controlled trials and observational studies leveraging real-world data, will be critical to determine which remote patient monitoring applications are most beneficial and for which patients. In addition to clinical outcomes, future work should also investigate patients' use of, spending for, and access to care and the convenience of that access (for example, reduced travel time). These nonclinical measures can help us understand the substitutability of remote patient monitoring for in-person care, net impacts on spending, and potential access benefits, all of which could be vital components of the value proposition for remote patient monitoring. Related research can also help identify and disseminate best practices for how remote patient monitoring data can be efficiently incorporated into care delivery. This may include new process innovations that support shifting remote patient monitoring–related responsibilities away from physicians and advanced practice providers, thus improving its cost-effectiveness and scalability. For example, one could imagine centralized remote patient monitoring teams and protocolized pharmacist- or nurse-delivered interventions triggered by worsening physiological measurements.

Ultimately, instead of the current broad coverage offered by Medicare and other payers, more targeted remote patient monitoring reimbursement policies may be needed in the long term. Although our analysis highlighted the rapidly growing use of remote patient monitoring and some key characteristics of that use, it did not allow us to say where the boundaries of coverage should be drawn. Additional research will be imperative for guiding these important policy decisions.

In the near term, payers and policy makers should closely monitor the use of remote patient monitoring and be prepared to adjust coverage policies based on patterns of spending and use. This could include introducing restrictions on eligibility criteria for patients, covered conditions, physiological measures by condition, eligible devices, or use duration. Similar eligibility criteria have been necessary for home treatments such as sleep apnea devices[18] or home oxygen.[19] However, such restrictions could also stymie valuable remote patient monitoring use because of the substantial administrative burden placed on providers in keeping up to date with requirements and documenting services in a manner that conforms to them.[20]

Concerns about remote patient monitoring overuse are largely driven by the currently dominant fee-for-service system. Under capitated payment or other value-based payment models in which providers are responsible for both the quality and the total cost of care, providers would be more likely to ensure that remote patient monitoring is leveraged in a cost-effective manner. However even in these cases, evidence on its effectiveness for various types of patients and conditions, as well as best practices for incorporating remote patient monitoring data into care delivery, will be important to guide adoption and use in practice.

Conclusion

Although remote patient monitoring has promise as a clinical management tool, there are many uncertainties as to how it should be used most effectively. Despite this, reimbursement policies are already in place. General remote patient monitoring has grown rapidly since the outset of the COVID-19 pandemic, and it could theoretically expand by orders of magnitude if adopted by additional providers beyond the narrow subset who use it today. The observed degree of claims persistence among remote patient monitoring users suggests that use is often long-term, and the associated costs are therefore substantial. More research is needed to identify which patients and use cases benefit most from remote patient monitoring. In the meantime, payers and policy makers should closely monitor its use and be prepared to establish appropriate controls as informed by new evidence. ■

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