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Telehealth Use and Hospital Readmission Rates in Long-term Care Facilities in Southeastern Minnesota During the COVID-19 Pandemic

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Abstract

Objective: To determine whether the length of a telehealth visit predicted the risk of hospital readmission at 30 days in skilled nursing facilities (SNFs) in southeastern Minnesota during the coronavirus disease 2019 pandemic.

Patients and Methods: This was a retrospective cohort study conducted in SNFs located in southeastern Minnesota from March 1, 2020 through July 15, 2020. The primary outcomes included hospitalization within 30 days of a video visit, and the secondary outcome was the number of provider video visits during the stay at an SNF. The primary predictor was the duration of video visits, and we collected the data regarding other known predictors of hospitalization. We used the χ^2 test for categorical variables and multivariate conditional logistic regression.

Results: We included 722 patients (mean age, 82.8 years [SD, 10.8 years]). Of those, 76 SNF residents (10.5%) were rehospitalized within 30 days. The average length of a video visit was 34.0 minutes (SD, 22.7 minutes) in admitted residents compared with 30.0 minutes (SD, 15.9 minutes) in nonadmitted residents. After full adjustment, there was no difference in the video visit duration between admitted and nonadmitted residents (odds ratio, 1.01; 95% CI, 0.99-1.03). The number of subsequent provider video visits was 2.26 (SD, 1.9) in admitted residents vs 1.58 (SD, 1.6), which was significant after adjustment (odds ratio, 1.17; 95% CI, 1.02-1.34).

Conclusion: There was no difference in the length of video visits for hospitalized SNF residents vs those who were not hospitalized within 30 days of a video visit. There were more visits in residents with hospital readmission. This may reflect the acuity of care for patients requiring a hospital stay. More research is needed to determine the ideal use of telehealth during the coronavirus disease 2019 pandemic in the postacute and long-term care environment.

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Telemedicine, defined as the use of real-time video-audio equipment by physicians to provide medical assessments to those in remote areas,[1] has been reported to be an effective means of providing medical care in several different settings,[2-5] including the management of chronic asthma, diabetes mellitus, and Parkinson disease. The use of telehealth in postacute and long-term care (PALTC) settings has also been reported.[6]

During the coronavirus disease 2019 (COVID-19) pandemic, it quickly became apparent that the aged population was at the highest risk of clinical morbidity and mortality due to COVID-19.[7] Multiple factors, such as physical colocation of residents, vulnerability of the resident population, and staffing challenges, make skilled nursing facilities (SNFs) particularly at risk of the rapid spread of infection, particularly those related to droplets

or aerosols; this has been amply reported with the influenza virus and respiratory syncytial virus.[8] Furthermore, owing to the uncertainty on the virulence and fatality of an unknown virus and future demands, there was a need to protect the limited resource of health care workers who work across facilities in this setting.

The use of telemedicine has become a method to reduce the potential spread of COVID-19 from staff to patients, and vice versa, in PALTC. Taking this into consideration, health systems rapidly developed telehealth programs. As many of these telemedicine programs were instituted in the setting of a public health emergency, many questions emerged about the optimal use of telemedicine[9,10] as well as patient privacy,[11] among many others. Before the COVID-19 pandemic, studies had suggested that recurrent medical visits (including emergency department visits)[12] were associated with increased hospital readmission rates, many of which could have been avoided.[13] Given the need to avoid unnecessary hospital admissions during the COVID-19 pandemic, this study sought to evaluate whether the time of telemedicine visit could predict hospital readmission at 30 days. We also considered the number of video visits after the initial visit. The primary aim of this study, therefore, was to determine the association between the duration of the initial video visit with a provider and subsequent 30-day hospitalization in patients admitted to SNF. The secondary aim was to determine the association between subsequent visits after the video visit and 30-day hospitalization in patients admitted to SNF.

PATIENTS AND METHODS

Study Design and Approval
This was a retrospective cohort study. The study was reviewed and approved by the Mayo Clinic Institutional Review Board and the Mayo Clinic COVID-19 access committee. The study was conducted according to the principles of the Declaration of Helsinki.[14]

Population and Setting
The study population included patients who were dismissed from the hospital and admitted for PALTC. All patients in nursing homes from March 2020 until July 2020 were potentially included in the study. We conducted our study in 14 nursing homes in southeastern Minnesota that were followed by senior service providers of the Department of Community Internal Medicine. The population in southeastern Minnesota generally represents the population of the upper Midwest.[15] The exclusion criteria included the lack of an index hospitalization or an index video visit. Residents were also excluded if they refused medical record review.[16]

Nursing Home Practice
The nursing home practice for the Mayo Clinic Rochester practice follows a model of a dedicated senior services division that specializes in the PALTC practice. A total of 23 physicians (including resident physicians) and 17 advanced practice providers conducted the video visits. Before the mandatory shelter-in-place orders, residents were routinely seen within 5 days by a physician and earlier if needed by the advanced practice providers. Residents were evaluated for potentially more aggressive management depending on their illness.[17] The senior services division provides coordination for recommendations on standard practice, protocols, staffing, and guidance for the facilities. Especially, many protocols involve admission orders and infection control.

Intervention
The primary intervention was the use of telemedicine for initial and subsequent provider visits for patients admitted to SNF after the declaration of COVID-19 as a pandemic. During the COVID-19 pandemic, the facilities in southeastern Minnesota adopted best practices to reduce the spread of COVID-19 through telemedicine.[18] The practice used iPads with InTouch software (Teledoc Health), which was the standard platform for the clinical practice. This platform used only video visits, without peripheral devices. The nursing facilities provided telemedicine presenters (often nurses) to facilitate the visit with the resident. All providers were given education on the use of the InTouch software.

Outcomes
The primary outcome was 30-day hospitalization after dismissal from the hospital. The

TABLE 1. Demographic Characteristics and Comorbid Health Conditions in 722 Patients[a]

Predictor	Overall cohort	Residents with readmission (n=76)	Residents without readmission (n=646)	P value
Demographic data	…	…	…	…
Age (y), mean ± SD	82.8±10.8	78.8±11.1	83.2±10.7	<.001 (Wil)
Female sex (%)	472 (65.4%)	26 (34%)	224 (34.7%)	.94 (Pchi)
Married (%)	209 (29.0%)	21 (27.6%)	188 (29.1%)	.78 (Pchi)
Race, non-White (%)	28 (3.9%)	2 (2.7%)	26 (4.0%)	.56 (Pchi)
Ethnicity, Latino (%)	7 (1%)	1 (1.3%)	6 (0.9%)	.74 (Pchi)
Interpreter needed (%)	6 (0.8%)	0 (0%)	6 (0.9%)	.40 (Pchi)
Education	…	…	…	…
Less than high school (%)	80 (11.8%)	4 (5.7%)	76 (12.5%)	.23 (Pchi)
High school graduate (%)	258 (38.1%)	24 (34.3%)	234 (38.6%)	…
College or college graduate (%)	244 (36.0%)	30 (42.9%)	214 (35.3%)	…
More than college (%)	95 (14%)	12 (17.1%)	83 (13.7%)	…
Comorbid health	…	…	…	…
Elder risk assessment, mean ± SD	15.89±5.6	16.5±4.6	15.7±5.7	.20 (Wil)
Number of medications, mean ± SD	15±6.7	17.8 (8.6)	15.2 (6.4)	.03 (Wil)
History of congestive heart failure (%)	300 (41.6%)	39 (51.3%)	261 (40.4%)	.07 (Pchi)
History of diabetes (%)	264 (36.6%)	37 (48.7%)	227 (35.1%)	.02 (Pchi)
History of dementia (%)	300 (41.6%)	19 (25.0%)	281 (43.5%)	.002 (Pchi)

[a]Pchi = Pearson χ^2 test; Wil = Wilcoxon nonparametric test of 2 means.

outcome was determined using hand abstraction from the electronic medical record. We used the dismissal date as the index time for starting the 30-day rehospitalization.

Predictors

Our primary predictor of readmission included the length of the video visit and the number of provider video visits after the initial video visit. We determined the length of the video visit using hand abstraction of the provider-reported time of the visit in the medical record. The recording time was a primary method of billing the encounter for the resident; thus, this was recorded in the clinical note. We determined the number of video visits performed over 30 days after hospital discharge. These were determined using hand abstraction and were based on billed encounters with the resident.

Patient demographic characteristics included age (in years, as the continuous variable), sex (female vs other), marital status (married vs other), race (non-White vs White), and interpreter status (yes or no). We abstracted the education level, which was categorized as less than high school, high school graduate, college or college graduate, and more than college. We also reported elder risk assessment (ERA), which accounts for previous hospitalization, comorbid health issues, and demographic factors.[19] In addition, we reported the presence or absence of medical comorbidities such as diabetes, heart failure, and dementia but did not use all ERA criteria. This information was obtained from the electronic health record. We also reported the number of medications that the nursing home resident was using.

Statistical Analyses

Descriptive statistics were used to define the study cohort of post–short-term SNF residents who received a video visit during the specified time frame. We used the Wilcoxon nonparametric test of 2 means. As a secondary analysis, we compared the number of video visits with a provider in 30 days in the hospitalized group compared with those without hospitalization and used the Wilcoxon test. We analyzed the remaining predictors and reported significance using either the Wilcoxon test if continuous or the Pearson χ^2 test if categorical. After univariate analysis, we used logistic regression to determine the significance of individual predictors and high video visit time use. Those factors with a P value of <.05 were considered significant to be

Predictor	Overall cohort	Residents with readmission (n=76)	Residents without readmission (n=646)	P value
Video visit length (minute), mean ± SD	30.4±16.7	34.0±22.7	30.0±15.9	.30 (Wilcoxon nonparametric test of 2 means)
Video visit length of ≥30 minutes (%)	259 (52.5%)	26 (54%)	233 (52.4%)	.81 (Pearson χ^2 test)
Number of visits after the first video, mean ± SD	1.6±1.6	2.26±1.9	1.58±1.6	.002 (Wilcoxon nonparametric test of 2 means)

TABLE 2. Length and Number of Video Visits in 722 Patients With and Without Hospital Readmission

included in the regression. We created a final model using age, sex, ERA score, and significant factors to determine a fully adjusted model for factors that are important for both the duration of video visits and the number of video visits.

RESULTS

We initially had 1006 patients who had a billed visit for nursing home care after a hospitalization. Of those, 904 had given the authorization to access their medical record for research purposes. Of these 904 patients with authorization, 722 had a video visit. In the overall cohort, the average age of the patients was 82.8 years (SD, 10.8 years). The cohort consisted of 472 (65.4%) women and 694 (96.1%) White patients. Only 6 (0.8%) patients needed an interpreter for the medical visit, and 49.9% of the patients had a high school education or less. In the overall cohort, 76 of the 722 (10.5%) patients had a 30-day hospital readmission. There were no differences between the hospitalized and referent groups regarding sex, marital status, race, ethnicity, interpreter use, or educational level. We noted a statistically significant increase in the number of medications in the patients who were hospitalized (17.8 medications [SD, 8.6]) vs those who were not hospitalized after video visits (15.2 medications [SD, 6.4], P=.03). Residents with diabetes were also significantly more likely to be readmitted to the hospital (48.7%) than those without diabetes (35.1%). Dementia was a protective factor for hospital readmission, with 281 (43.5%) patients within the group without hospitalization compared with 19 (25.0%) patients

within the group with a hospitalization after a video visit (Table 1).

In the unadjusted analysis, we did not find any difference between the video visit length in admitted residents with 34.0 minutes (SD, 22.7 minutes) and those who were not admitted with 30.0 minutes (SD, 15.9 minutes) (P=.30). We found that there were greater number of video visits in the admitted patients at 2.26 (SD, 1.9) vs 1.58 visits in patients who were not admitted (P=.002). We also found that the average age of the patients in the hospitalized cohort was 78.8 years (SD, 11.1 years) compared with 83.2 years (SD, 10.7 years) in the referent group (P=.0006) (Table 2).

After full adjustment, there was still no difference in the length of video visits between hospitalized and nonhospitalized residents, with an odds ratio of 1.01 (95% CI, 0.99-1.03). A fully adjusted number of visits was higher in hospitalized residents than in nonhospitalized ones, with an odds ratio of 1.17 (95% CI, 1.02-1.34) (Table 3).

DISCUSSION

In this study of 722 nursing home residents admitted for post−short-term care, we did not find a difference in the length of video visits between those hospitalized and those in the referent group (without hospitalization) within 30 days. This indicates that the hospitalized group did not have a longer or shorter visit. We are encouraged that the length of the video visits was not shorter in hospitalized patients. In ambulatory patients, the median length of time was 15.7 minutes to cover 6 topics in a study[20]; however, we do not fully

TABLE 3. Unadjusted and Adjusted Odds of Hospitalization			
Predictor	Unadjusted odds ratio	Age, sex, and elder risk assessment—adjusted odds ratio	Fully adjusted odds ratio
Video time length (continuous) (95% CI)	1.01 (1.00-1.03)	1.01 (0.99-1.03)	1.01 (0.99-1.03)
Video visit length of ≥30 minutes (95% CI)	1.08 (0.59-1.95)	1.08 (0.59-2.00)	1.13 (0.61-2.30)
Visits after video visit (95% CI)	1.24 (1.09-1.41)	1.20 (1.05-1.37)	1.17 (1.02-1.34)

know how many topics were covered during our visits. We found that the overall rate of hospital readmissions was lower than the rate we have seen historically in our population. In our previous studies, we had found that the overall hospital readmission rate was 18.2%,[17] whereas readmission in this study was 10.5%. This reduction in hospital readmission likely reflects the changes in the hospital admission practices with COVID-19 compared with the efficacy of the telemedicine visit practice.

For our secondary outcomes, we found an increased number of visits between the hospitalized and referent groups, with an extra half visit a month. We are encouraged that providers used telemedicine to provide care to those residents with complications or residents most at risk of hospitalization. The patients in the hospitalized group were younger, were prescribed more medications, and had a higher rate of diabetes mellitus than those in the referent group. Thus, this group may require more visits and care. Our group had previously studied the ERA index and found that diabetes, along with other comorbid conditions, raised the risk of both nursing home admission and 2-year mortality rate.[19] Additionally, scoring tools, such as the Probability of Repeat Admission questionnaire, consider diabetes as one of the major risks of recurrent hospitalization.[19,21] Therefore, our finding that more of the patients who required hospitalization had diabetes mellitus is consistent with those reported in previous studies. Our findings are also consistent with those of multiple studies that have identified polypharmacy as a risk factor for hospitalization, longer length of hospital stay, and mortality risk in older patients.[22-24] The lower readmission rate of 10.2% overall likely reflects the dramatic change in hospitalization and rehospitalization during the COVID-19 pandemic. The patterns of hospital readmission changed after COVID-19 became an important cause of hospitalization.[25]

We had numerous learning experiences while implementing telemedicine in a short time during the COVID-19 pandemic that are not captured in our study. Commonly identified challenges in video-based telemedicine include issues with connectivity, privacy, use of equipment, payment, and performing the visit itself. We certainly experienced many of those challenges, including getting equipment, connectivity, and tele-presenting the visit. The guarantee of patient privacy and security of information when using video telehealth modalities is an issue of high priority, and we used an iPad with InTouch program that ensured privacy standards and provided an encrypted network for video telehealth visits. Health Insurance Portability and Accountability Act—based standardized privacy protocols for telehealth use have been recommended[26,27] to ensure patient privacy standards, although there are currently no unified, federally mandated guidelines for telehealth use in SNFs, with a considerable state-wide variation. We adhered to the privacy protocols for telehealth to ensure the privacy of protected health information.

There are several important limitations in our study. First, our sample size was smaller than anticipated because of patients either not giving consent for research purposes or because they did not receive a video visit during the specified time frame (eg, those who were evaluated by an in-person provider). The results of this study were determined by hand abstraction; although careful efforts were made to keep the abstraction consistent

(ie, how to indicate missing information, decision to include a video visit if it happened on the last day of data collection, etc), human error is always a possibility. This information was not directly abstracted from EPIC, as billing time was not reviewed in the completed encounter. We relied on provider estimation of time during the encounter, which could present some potential recall issues. In terms of bias, it is possible that information bias played a role in the determination of the results of this study, as there were instances in which there was no indication for the length of a video visit. Selection bias was unlikely to be a important source of bias in this study, as all individuals who met the criteria for inclusion were analyzed. From the perspective of generalizability, this is also a limitation to this study, as the population was overwhelmingly White (96.1%). Although approximately 83% of Minnesota's population is White as per the 2020 census (https://www.census.gov/library/stories/state-by-state/minnesota-population-change-between-census-decade.html), our study consisted of more White individuals than the state average. This may limit generalizability to areas in which there is more diversity in nursing home settings. Other limitations were that we could evaluate only at the duration of the visit and that the scope of this study did not include reviewing the content clinical review and information exchange during the visit as additional quality metrics. Overall, this study demonstrates the ongoing need for further evaluation of the use of telehealth in PALTC to further assess many of these remaining questions.

CONCLUSION

In this study of 722 patients in SNFs, we did not find a difference in the length of video visit for residents who were hospitalized and those who were not hospitalized within 30 days after a video visit, although the residents who were hospitalized overall had more video visits than those who were not hospitalized. More research is needed to determine the ideal means to use telehealth in skilled nursing care, especially during the ongoing COVID-19 pandemic threat.

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