EVALUATING THE EFFICACY OF TELEMEDICINE FOR DIABETES CARE

By

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A THESIS

Presented to the Department of Medical Informatics and Epidemiology

And the Oregon Health & Science University

School of Medicine

in partial fulfillment of

the requirements for the degree of

Master of Science

June 2021

School of Medicine

Oregon Health & Science University

CERTIFICATE OF APPROVAL

This is to certify that the Master's Capstone Project of

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"Evaluating the efficacy of telemedicine for diabetes care"

Has been approved

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Acknowledgements

This work would not have been possible without the help of those in the clinical informatics program. I received mentorship and guidance from Drs. Eilis Boudreau and Vishnu Mohan, without whom this research would not be possible.

I had support from the Portland VA Medical Center Department of Diabetes and Endocrinology, especially Drs. Robert Klein and Barbara Hettinger. They not only allowed me to review data from their clinic, but were supportive of the findings and eager to use them to make changes going forward.

Finally, I would like to acknowledge my wife who is very glad this project is over and has not yet realized it might just be the beginning.

Abstract

During the period of SARS-CoV-19 global pandemic there was a significant shift in the number of telehealth visits performed at the Portland VA. The Portland VA Diabetes clinic conducted visits in person as well as via telemedicine technology. Telemedicine visits had been minimally implemented prior to this time period, and as such there are limited data around the efficacy of seeing patients in this manner. It is anticipated that after the pandemic there will continue to be an increase in telehealth visits, and to safely and appropriately do so, more data are needed on the efficacy of such visits. A QI project was conducted to review the cohort of all patients seen in the VA Diabetes Fellows clinic from 12/1/2019 – 2/29/2020. The cohort was then followed longitudinally and 36 of the 71 patients were seen during the expected interval one year later during the pandemic, between 12/1/2020 – 2/28/2021. Of the patients seen during the pandemic, 2/3rds (24 of 36) were seen via telehealth visit. Patients seen via telehealth were less likely to have their hemoglobin A1c, creatinine, cholesterol or blood pressure checked in a timely fashion relative to their visit. Next steps will be to find ways to schedule blood work and vitals checks relative to appointments to ensure that patients seen via telehealth still receive the recommended appropriate level of care.

Chapter 1: Introduction

Diabetes effects approximately 25% of all veterans(1). People with diabetes are at increased risk for severe infection with COVID-19(2). At the beginning of the pandemic, in efforts to protect both patients and providers, a significant percentage of visits were converted to telehealth visits. The Veterans Administration (VA) went from approximately 10,000 telehealth visits per week to 120,000 telehealth visits weekly between February and May of 2020(3). Given the increased risk of severe COVID-19 to patients with diabetes, there was a higher risk reduction by using telehealth for medical their visits. However, the efficacy of telemedicine to treat patients with diabetes has not been established. As the risk from in person visits decreases with vaccines and lower rates of COVID-19 infections, and the efficacy for telemedicine visits should be evaluated before telemedicine becomes the standard of care.

There was a dramatic increase in the implementation and utilization of telemedicine during the COVID-19 pandemic. A study looking at data from the Research and Development Survey (RANDS) showed that patients with diabetes utilized telemedicine more than patients with other chronic diseases, noting "More than 40 % of respondents who had diabetes reported at least one appointment through telemedicine, while 30% of patients with other chronic diseases had an online session"(4). While we have the data showing that telemedicine is being used to see patients with diabetes, the data for the efficacy of seeing patients with diabetes via telemedicine are sparse. There are data to show that general diabetes education can be done well via telemedicine(5), however there are not specific markers to show quality of care that patients are receiving via telemedicine for diabetes. There are data about the numbers of patients who were seen via telehealth during the pandemic and speculation about the advantages telemedicine would provide for the distribution of care going forward(6), and it is generally agreed that people

will not return to pre-pandemic levels of telemedicine. However without data on the quality of care offered via telemedicine, it is hard to assess whether patients with diabetes should be encouraged to have a specific means of physician visit.

The increase in telemedicine at the onset of the COVID-19 global pandemic occurred with the impetus of the increased risk of infectious disease exposure from face to face medical visits. A paradigm shift occurred which resulted in patients and providers widely considering telemedicine a viable alternative to in person visits. However there were limited data on the efficacy of such visits. There were many variables during the COVID-19 pandemic that likely affected patients' ability to treat their diabetes, however the recommended standards of care did not change.

There are markers we can use to evaluate if patients received the care recommended by the American Diabetes Association (ADA). Many people experienced changes in the diet and activity level during the pandemic that might impact the stability of their hemoglobin HbA1c (A1c) and weight. The ADA recommended guidelines include routine measurements of blood pressure, weight, HbA1c, urinary microalbumin to creatinine ratio (MAb), creatinine, cholesterol and other blood work(7). While external factors likely impacted the values of the labs themselves, one marker for quality of care is adherence to guidelines. If telemedicine offered the same quality of care as face to face consultations, then the consistency with which labs were checked should have been the same for people seen face to face during the pandemic as for those seen via telehealth during the pandemic.

The primary objective of this study was to determine whether patients seen in the Portland VA Diabetes Clinic received standard diabetes care as recommended by the American Diabetes Association independently of the means by which they were seen. This care includes routine checks

of hemoglobin HbA1c (A1c), urinary micro albumin to creatinine ratios (MAb), cholesterol and blood pressure measurements at defined recommended intervals. We hypothesize that appropriate lab work was completed from 12/1/2020-3/1/2021 to monitor patients with diabetes independently of modality of their visit (i.e. in person vs via telehealth). However, we hypothesize that screening exams beyond basic lab work surveillance, such as blood pressure monitoring, was not completed during telehealth visits at the same rate as it was with in person visits.

Chapter 2: Background

Both diabetes and COVID-19 are diseases associated with significant racial disparities. It is well established that there is a significantly higher prevalence of diabetes in the Black community(8). Disparities are also seen in the rates and severity of complications from diabetes in the Black community when compared with the white community. However, those differences are dramatically reduced when racially integrated communities with similar socioeconomic backgrounds are compared(9), implicating the cultural, societal and structural disparities associated with race rather than race itself as the cause for the increased prevalence and worsened complications.

The treatment modalities used for people with diabetes is also subject to bias. For example, while there are significant data showing that continuous glucose monitoring can improve diabetes outcomes in younger people, it is clear that diabetes technology is not used equally across patients with different socioeconomic backgrounds. There are significant racial-ethnic disparities in access to disease treating technologies that exist independent of the socioeconomic background of the patients(10). Knowing that these disparities exist in the treatment of diabetes, providers must be cognizant of their biases and proactive to provide the same quality of care for all of their patients independent of race. Providers must be proactive to establish justice in the types of treatment that patients receive.

The disparities in the prevalence and treatment of people with diabetes were mirrored in the impact of COVID-19. "COVID-19 (has) disproportionately harmed Black, Indigenous, and People of Color (BIPOC) and poor people, reflecting higher baseline comorbidity from diseases caused by health disparities, worse access to high-quality care, and higher exposure to COVID-19 from jobs as essential workers and crowded housing"(11). These disparities raise ethical questions around the justice with which we offer care to this community. In order to offer more just care, we cannot simply say that telemedicine is available to all patients. We must ensure that the infrastructure such as high-speed internet and appropriate technological devices are available equally for access to the care.

While there were benefits to telemedicine specific to the increased infectious disease risks during the pandemic that contributed to the dramatic increase in telemedicine usage, there are other benefits to telemedicine that lead people to believe it will continue to be used over time. Studies have shown that access to care is directly related to diabetes outcomes for patients with diabetes(12) and telemedicine has been proposed as a means to improving access for patients with diabetes. For example, telemedicine can expand the reach of specialists to more easily reach patients in rural areas. It can also reduce the time that patients need to take off from work for an appointment by eliminating travel time and expenses.

Historically, overall care for diabetes using telemedicine has not been considered cost effective for providers(13), however that math changed when the reimbursement structure changed for telemedicine visits. There are good data that show that diabetes education can be done via telemedicine with the same improvement in markers of disease as with those who undergo in person training(5). Unfortunately, these data focus on diabetes education and not on other aspects of the clinical visit. There is still a shortage of data around the efficacy of physician-patient visits for diabetes care. But there is a clear role for other providers via telemedicine, and diabetes care is often administered by an interdisciplinary team to meet all the patient needs.

Diabetes is a disease that develops and progresses over time. As such, it is more prevalent in older groups. When video conferencing technology became far more common during the pandemic, there were

dramatic changes in the patient demographics accessing the technology. While pre-pandemic data showed very few users over the age of 65, reviews of the telemedicine access during the pandemic showed that those over the age of 65 were actually the patients most likely to access care via telemedicine(4). This review further showed that Black patients were most likely to access care via telemedicine. This is encouraging that what was once believed to be a technological age challenge for accessing care is no longer a significant hurdle for older patients to access care and that patients with diabetes should be able to access care by whatever means is offered.

Telemedicine is also lauded for its ability to reduce commute times and often significant fees for parking. Interestingly, this review of telemedicine during the pandemic found that those living in urban areas were the most likely to use telemedicine(4). This is likely a reflection on pandemic circumstances, but might also reflect users' baseline comfort with technology. While it is generally accepted that telemedicine will persist in the future at much higher levels than before the pandemic, it is not clear that the utilization will be similar to what was seen during the pandemic. It is likely that increased access to subspecialists for rural patients will drive more rural telemedicine participation, but not guaranteed. There is a shortage of both primary care physicians and endocrinologists in rural areas which can be ameliorated by the use of telemedicine so that patients from underserved communities can access experts without overwhelming travel burden.

Despite all the benefits of telemedicine, there are no data to show if telemedicine visits provide equivalent care to patients as face to face visits. Even if patients with diabetes do have telemedicine visits with video, there are significant parts of the exam that cannot be completed without additional tools. For example, there is no means of taking a patient weight or measuring blood pressure without additional supplies. The American Diabetes Association (ADA) recommends that these measures be taken at every visit for a patient with diabetes(7). No telemedicine visit can do a sufficient diabetic foot exam which the ADA recommends at least annually for every patient with diabetes. Even parts of the exam where tools have been developed to complete them remotely, such as the recent expansion of diabetic teleretinal

exams, the data only support these as screening exams and do not support that they are equivalent to in person retinal exams, and thus traditional retinal exams are still recommended annually(7,14).

Patients with diabetes require routine bloodwork. For patients without optimal care, the ADA recommend checking a hemoglobin HbA1c (A1c) every three months, and then other bloodwork such as lipids and other labs associated with renal function at least once a year(7). While these do not need to be synchronized with a visit, many patients get blood work done around the time of a visit to review with clinicians. If patients are being seen exclusively through telemedicine, there still must be an in person contact for bloodwork. This can likely be done at labs close to a patient's home depending on insurance and coverage, and might still be easier for the patient, but cannot be synchronized as is often done with face to face visits.

Beyond the traditional medical concerns about the quality of care offered, there are concerns about the technology requirements and patient safety. Significant concerns about patient privacy have been raised in the era of "zoom bombing" when uninvited guests have been known to show up to Zoom meetings whether providers can adequately provide privacy for patients(15). Furthermore, many patients are seen at home where there might be other individuals around witnessing the medical visit whom a patient would not want to be present. Especially with visits for diabetes, sensitive issues often come up around a patients mental health, weight and eating habits that they may not want to share with other individuals in their home, but they may not have the infrastructure to have privacy. Furthermore, there are significant patients with houselessness for whom this would be unlikely to be an option.

This study aims to evaluate whether current telemedicine implementations are offering equivalent care to that of face to face encounters. The study evaluates the adherence to ADA recommendations as standard of care for patients seen face to face and via telemedicine. Because the patients evaluated in this population are at high risk for health disparities, it is imperative the quality of care be evaluated. These are outcomes that can be addressed and improved upon in the future, but only if we know where the shortcomings are currently.

Chapter 3: Materials and Methods:

A comprehensive chart review was completed through the VA Computerized Patient Record System (CPRS). All patients seen in the Portland VA Fellows Diabetes Clinic between 12/1/2019 – 2/29/2020 were reviewed. The dates and values for their most recent HbA1c, cholesterol, MAb, creatinine and blood pressure were all recorded by a single reviewer. Patients were then evaluated to see if they had been seen in the clinic again within the next year, and if they were seen specifically in the anticipated period of 12/1/2020 – 2/28/2021. The second visit which occurred during the COVID-19 global health pandemic was recorded as either telemedicine or face to face visit. Data were also collected for all ADA recommended lab work and physical exam data including blood pressure and body weight. Data were recorded as on time if they were within the recommended time frame before the visit or one month after the visit. For blood pressure, they were recorded as one time if they were within one month before or after the visit as the ADA recommends blood pressure be recorded at every visit. All data were recorded and stored on a secure VA server.

The Portland Veterans Administration (VA) is a 160-bed acute care medical facility in Portland, Oregon. The Endocrinology Fellows Diabetes Clinic is a subspecialty clinic that operates once a week out of the Portland VA hospital. Patients from across the state of Oregon historically travel to Portland to seek specialty care. The providers are first and second year endocrinology fellows from Oregon Health & Science University who see patients with attending supervision from academic endocrinologists employed by the VA.

A retrospective cohort analysis was done to evaluate all patients seen in the Portland VA Diabetes fellows' clinic from 12/1/2019 – 2/29/2020. Patients were then evaluated to see if they

were seen during that same time period a year later between 12/1/2020 – 2/28/2021. The initial interval was selected as the last three months before the global pandemic (pre-pandemic) when all visits were still in person. The one year interval was selected because it allowed for annual blood work to be evaluated. It also allowed for as much time as possible for telemedicine techniques to be established, thereby making them as reflective as possible for current telemedicine methods. By following the same patients longitudinally the patients were matched to themselves, controlling for variables such as age and sex. The groups split into lost to follow up, face to face follow up and telemedicine follow up. Those groups were self-selected without any intervention or randomization.

The primary outcome was the difference in on time lab work for patients seen in person compared to patients seen via telehealth. Blood work was considered on time if it was completed within the ADA recommend period before the visit or within one month after the visit was completed. For hemoglobin HbA1c, a three month window before the visit was used. All other blood work was analyzed with a window of one year prior to the visit or one month after the visit. For blood pressure, which is recommended to be checked at every visit, it was considered on time if it was within one month before or after the visit. The cohort consisted of all patients seen in the Portland VA Fellows Clinic from 12/1/2019 – 2/28/2020. This time frame was selected as the last three months before the pandemic when almost all patients' visits were face to face. Statistical analysis was completed using RStudio with tidyverse and plotly packages. Statistical comparisons were done with chi-squared analysis. Graphical analysis was completed with GraphPad Prism 9.0.

All patient data were deidentified and stored on a secure server. The long term benefit of understanding potential short comings for telemedicine visits outweighed any risk to patients from the retrospective chart review.

Chapter 4: Results

A total of 71 patients were seen in the clinic between 12/1/2019 – 2/29/2020 (pre-pandemic). All of the pre-pandemic visits were done in person. Of those patients, 36 were seen one year later between the time window of 12/1/2020 – 2/28/2021 (mid-pandemic). There were no significant differences between age, sex, type of diabetes or diabetic control as indicated by baseline HbA1c for the groups that did or did not have follow up visits within the expected time window (table 1).

	Follow Up Timed Appropriately	No Follow Up Visit in Expected Window	P-value
Total number	36	35	
Age (years)	65.7	59.9	0.08
Male (percent of total)	94.4	94.3	0.98
T1DM (percent of total)	44.4	45.7	0.92
Average HbA1c (%)	8.38	8.36	0.71

Table 1: Overall demographics of the patients

Of the 36 patients seen during the pandemic time window, 12 of them were seen in-person (cohort 1) and 24 were seen via phone visit (cohort 2). There was no difference in age, sex, type of diabetes or HbA1c at baseline between the two cohorts of patients (table 2).

	F2F Follow up (Cohort 1)	Phone Follow up (Cohort 2)	P-value
Total number	12	24	
Age (years)	67.2	64.9	0.56
Male (percent of total)	91.7	95.8	0.66
T1DM (percent of total)	58.3	37.5	0.26
HbA1c at baseline	7.83	8.72	0.10

Table 2: Demographics of patients seen during the pandemic

In the pre-pandemic period when all patients were seen face-to-face, there was no statistical difference between the two cohorts for having all of their blood work completed on time (A1c $X^2 = 1.42$, p=0.23, MAb $X^2 = 0.26$, p=0.61, Cholesterol $X^2 = 0.32$, p=0.57, Cr $X^2 = 0.51$, p=0.47). However, during the mid-pandemic visit patients who were seen via phone call (cohort 2) were significantly less likely to have on time blood work completed for their HbA1c, creatinine and cholesterol (Table 3) when comparted to patients seen face-to-face (Figure 1). There was a trend towards MAb also being less likely to be on time, however it was not statistically significant (Table 3). All patients had a blood pressure check on the day of their pre-pandemic clinic visit.

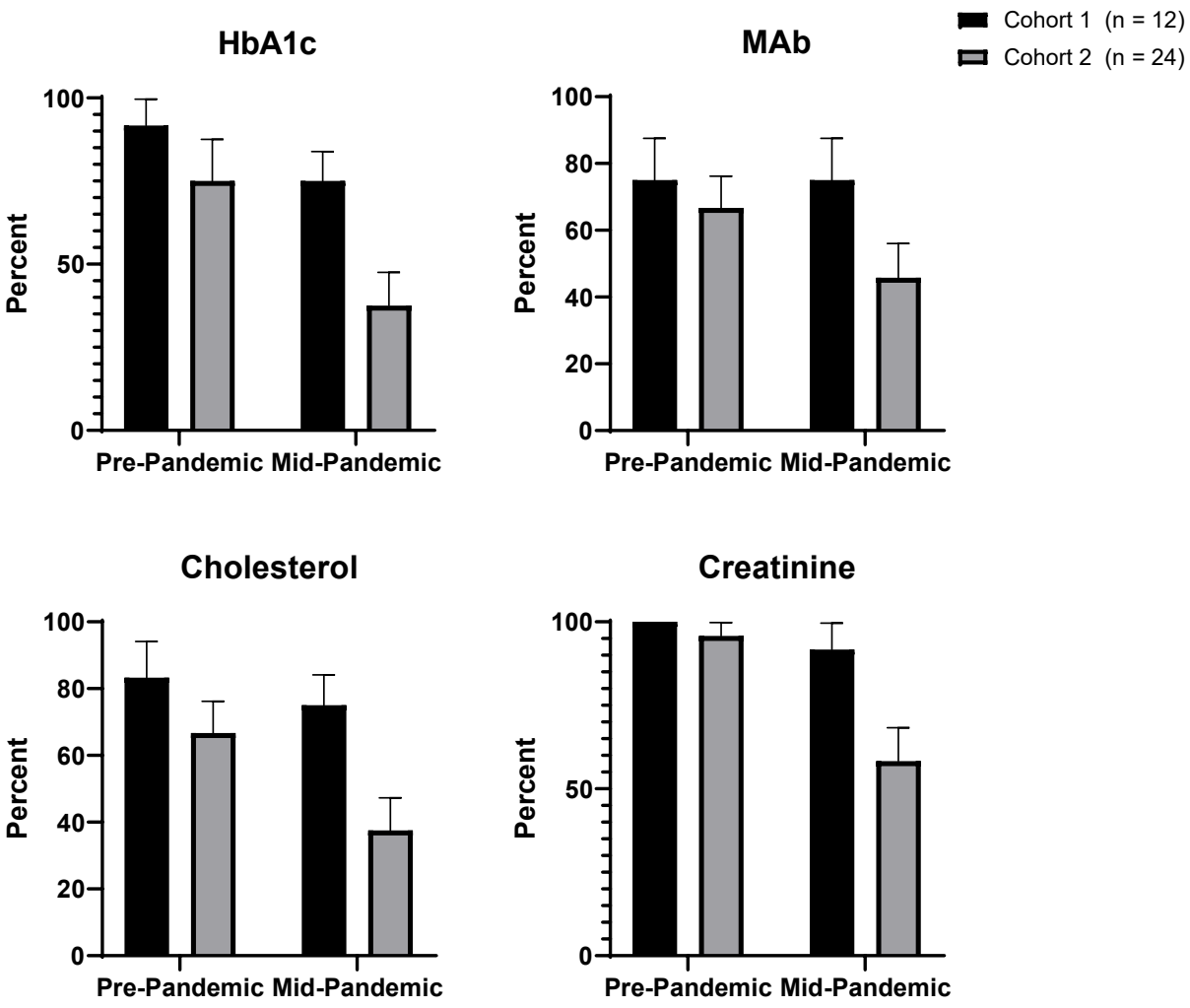

Figure 1: Percent of patients with lab work on time, by date and type of visit. Pre-pandemic visits occurred 12/1/2019-2/29/2020 and were all done face-to-face. Mid-pandemic visits were completed 12/1/2020 – 2/28/2021. For the mid-pandemic visits, cohort 1 was seen face-to-face while cohort 2 was seen with a telehealth visits.

	Cohort 1 Mid Pandemic (face to face follow up visits) N (%)	Cohort 2 Mid Pandemic (phone follow up visits) N (%)	X^2
Total number of visits	12	24	
HbA1c On time	9 (75.0)	9 (37.5)	4.5 ($p = 0.03$)
MAB On time	9 (75.0)	11 (45.8)	2.8 ($p = 0.10$)
Cr on time	11 (91.7)	14 (58.3)	4.2 ($p = 0.04$)
Cholesterol On Time	8 (66.7)	9 (37.5)	2.7 ($p = 0.09$)
BP on time	11 (91.7)	4 (16.7)	18.5 ($p < 0.01$)

Table 3: Timeliness of lab work for patients seen during the pandemic divided by type of visit.

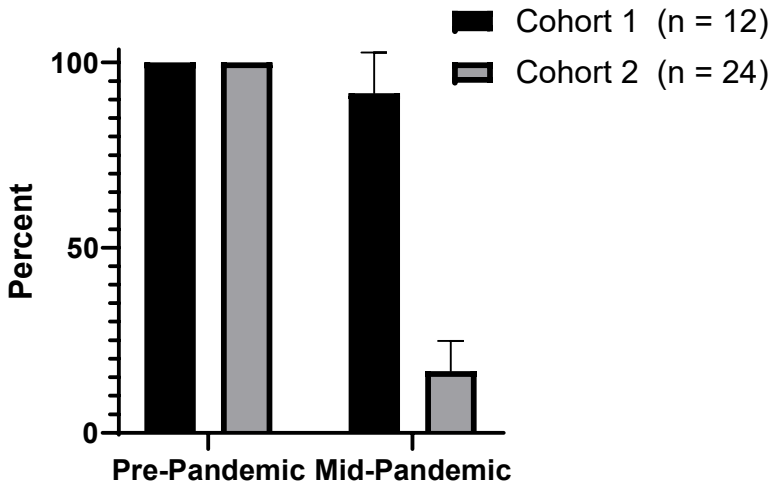

Figure 2: Percent of patients with blood pressure measurement within a month before or after their visit date, by date and type of visit. Pre-pandemic visits occurred 12/1/2019-2/29/2020 and were all done face-to-face. Mid-pandemic visits were completed 12/1/2020 – 2/28/2021. For the mid-pandemic visits, cohort 1 was seen face-to-face while cohort 2 was seen with a telehealth visit.

Chapter 5: Discussion

Almost half of the patients seen in the diabetes clinic were not seen in follow up in the expected time window a year later. Most patients in the diabetes clinic are seen every 2-3 months and that is an unusually high rate of loss. Though it is possible that patients consolidated their care and had primary care physicians manage their diabetes for the year or took their care to outside providers, that is not usual. It is reasonable to consider that other factors during the pandemic likely impacted that attrition rates at the clinic. It is possible that patients not seen in person had blood work and vital signs done elsewhere that was not in the computer in the expected location. Especially in the VA system, there has been an expansion of systems other than CPRS that may make blood work that was done elsewhere not visible during the review.

There does not seem to be any difference in the patients who were lost to follow up based on age, sex, type of diabetes or HbA1c before the pandemic started. Further studies looking at whether patients have appropriate return to care rates in other clinics would further clarify if this was particular to this clinic, a more broad problem during the pandemic, or an unforeseen consequence of telemedicine.

Before the pandemic when all patients were seen face-to-face, there were no significant differences in the groups. However, the patients who were seen face-to-face during the pandemic were more likely to have their blood work done on time and more likely to have a blood pressure checked in a timely window than those patients seen over the phone. The follow up visits were reviewed nine months or longer into the pandemic, and many providers had found means to schedule blood work with patients doing telephone visits. However even with these adaptations, the HbA1c, Cr, cholesterol and the blood pressure measures were done as consistently as when patients were seen in person. While the MAb checks were not statistically different, it is notable that it was the least consistently checked lab before the pandemic, not that it was done more often than other checks during the pandemic. Overall, annual labwork was not more likely to be completed on time than every 3 month HbA1c checks.

These particular markers are easy to improve upon with modifications. The most dramatic decline in adherence was in blood pressure monitoring. It is simple to have patients check blood pressure with a home cuff or check at a supermarket. Blood pressure measurements could be taken with routine blood work to ensure that vitals are being followed appropriately. Lab work can be scheduled when visits are scheduled and done asynchronously from visits, either before or after appointments as deemed appropriate by providers. This still provides the

time benefits for patients and more flexibility in timing, so does not lose the advantages of telemedicine but provides a higher level of care.

Just as socioeconomic status affects other aspects of medicine, it appears to impact what type of telemedicine is used as well. A study of telelmedicine out of Columbia University looking at over 80,000 telemedicine encounters during 2020 found that Black and Brown patients were 20% less likely than white patients to have an audio and video telemedicine visit as opposed to a telephone only appointment(16). This brings up the ethical concern of equity and justice. There are clear benefits to having a video portion of the exam such as allowing a physician to see changes in physical appearance such as significant weight gain or loss, difficulty in breathing or ambulating and the ability to perform visual aspects of the physical exam such as looking for rashes, bruises or other skin wounds. Since diabetes disproportionally impacts the BIPOC communities, expansions in telemedicine should be done with caution if the telemedicine offered is not the same to all patients. While many patients have phones and even smartphones are very common(17), there is a higher technological requirement for patients in order to have a video visit including sufficient internet speed and a device such as a smart phone or computer that can use the video technology.

Chapter 6: Summary and Conclusions

Routine lab work and blood pressure checks were not done as consistently for patients seen via telehealth visits during the pandemic as they were for patients seen in person at the Portland VA medical center. Patients with diabetes are at significant risk for health disparities. Health disparities in other aspects of care for patients with diabetes has been shown to negatively impact health outcomes, and should be considered carefully when choosing a means of

treatment. In order to adhere to the recommended guidelines, providers offering telemedicine visits need to be proactive in making sure that patients are still receiving appropriate lab work at appropriate intervals and having vital checks. The markers selected in this paper were done so because they are easy to measure, and similarly easy to improve upon. By recognizing that there is a problem, proactive steps such as scheduling lab work to be done around visits can be taken.

There were some significant limitations to this study. This was a small review of a single clinic during a short period of time. It is not clear whether these data can be extrapolated to other clinics. The demographics of patients at the VA is not reflective of the general population, with the vast majority of patients seen in this cohort being men. A more robust review of similar markers at other clinics would be appropriate to see if these data are consistent with other telemedicine implementations. Further it will be interesting to see if these shortcomings persist after the global pandemic when the barriers to having blood work done are lowered with the reduced risk of face-to-face contact.

There are clearly many confounding factors going on during the pandemic which may or may not be reflective of how telemedicine will be used going forward. It is not clear how post-pandemic the demographics of those who use telemedicine will change. However after the pandemic it will likely mean that the desire to avoid all face-to-face contact will not be the main driver of telemedicine, and thus a face-to-face interaction for a blood draw will not be contraindicated or have the risk that existed during the pandemic. These data indicate that patients who were seen via phone visits during the pandemic were less likely to be on time with recommended lab work and blood pressure screening. As telemedicine visits continue in the future, proactive measures should be taken to ensure that patients seen outside of the clinic setting still have routine monitoring of things that cannot be done over the phone.

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