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## Telehealth and Diabetes

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Telehealth and Diabetes

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## PERMISSION

Title Telehealth and Diabetes

Department Nursing

Degree Master of Science

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Date: 04/29/2020

### Abstract

Diabetes is a leading cause of death in many developed countries. Complications from this disease can be prevented by lowering glycosylated hemoglobin levels. In order to have control over these levels, close disease follow-up is needed. There are many barriers to receiving adequate follow-up, and the case that is presented is an example of the multiple complications that can occur because of this lack of care. Telehealth is a way to overcome some of these barriers by bringing the follow-up care to patients in rural areas who have a hard time getting to appointments in larger cities because of cost, transportation, and other barriers. Telehealth is a concept that has recently been developed, and research is constantly evolving regarding its effectiveness in helping to lower glycosylated hemoglobin in patients with diabetes. This literature review presents mostly positive results from the systematic reviews, randomized controlled trials, qualitative studies, and chart reviews that were reviewed, and endorses the use of telehealth in practice where it is available.

## Background

In most developed countries, diabetes is the fourth leading cause of death. It causes many complications including retinopathy, neuropathy, coronary artery disease, peripheral vascular and cerebrovascular disease. Often one complication can lead to another causing severe disease (Heydarabadi, Mehr, & Nouhjah, 2017). Many patients struggle with multiple complications, including the patient who will be presented in this case report. She struggles with uncontrolled hypertension and uncontrolled type two diabetes which lead to peripheral neuropathy and the development of a skin ulcer. This ulcer becomes infected, and she quickly becomes septic. There are many points of interest in the case, however one that stands out is the uncontrolled diabetes which ultimately causes the complications the patient experiences. There are multiple interventions available to help patients with uncontrolled diabetes, and one of these interventions that has recently become more popular and more advanced, especially in rural areas, is telehealth visits.

Telehealth is a way for rural patients to overcome some of the common barriers associated with receiving regular diabetes follow up and education. Some of these barriers include environmental factors, transportation problems and bad weather, time constraints, and a lack of providers (Heydarabadi et al., 2017). Telehealth can be defined as the delivery and coordination of health care services that integrate electronic information and technologies to increase access, improve outcomes, and reduce costs of health care (Schramm, 2019). By having a specialist conduct appointments via computer in rural communities, barriers become easier to overcome, and patients have easier access to the care they need. When this care is readily available there is the potential for patients to have better control of their chronic disease by lowering their glycosylated hemoglobin level. This is extremely important because with every

one percent reduction in glycosylated hemoglobin it is estimated that microvascular complications will decrease by thirty-five percent and diabetes related mortality will decrease by twenty-five percent (Threatt & Ward, 2017). This case report will address if rural patients with diabetes that utilize telehealth services have lower glycosylated hemoglobin than those rural patients that do not utilize telehealth.

### **Case Report**

This case is a fifty-eight-year-old Caucasian woman who presents to the clinic with fever, chills, confusion, and forgetfulness for one day. The patient arrives with her sister because she was unwilling to go to the clinic of her own accord. She lives alone and has a known self-care deficit due to not being able to afford her medications. She has a past medical history of type two diabetes, hypertension, and hyperlipidemia. She is on the following medications for these problems: ezetimibe (ZETIA) 5mg daily, Lopressor 50mg twice daily, lisinopril 10mg daily, metformin 1000mg daily, fish oil 100mg daily, Zocor 80mg daily, and aspirin 325mg daily. She has no allergies. Review of symptoms is positive only for fever and chills, confusion, and fatigue. Pertinent negatives include skin problems or rashes, shortness of breath, chest pain, and urinary symptoms including dysuria and frequency. Her physical exam is largely unremarkable; her neurological exam reveals that she is oriented to person, place, time, and situation, and her cranial nerves are intact with normal strength and sensation bilaterally with no facial droop or other stroke-like symptoms to explain her confusion. Her lungs sound clear bilaterally, respirations are regular and unlabored, and heart sounds are tachycardic but regular. Her skin exam, however, reveals a large two-centimeter, red, warm area on her left lower shin. Her vital signs are abnormal with a blood pressure of 194/83, heart rate 119, respirations 14, oxygen saturation 93% on room air, and temperature of 104.7. Because of these abnormalities, she is

likely in septic shock from cellulitis, and she was sent immediately to the nearest emergency department for lab work and intravenous antibiotics.

Lab work at the emergency department revealed a white blood cell count of 12.5, c-reactive protein of 144.4, glucose of 266, lactic acid of 4.4, and an erythrocyte sedimentation rate of 57 which confirms a diagnosis of sepsis. A glycosylated hemoglobin level was not drawn on this patient as it is not part of an acute care work-up, however given her high blood glucose and history of not having access to her medications the level is probably above average, which puts her at risk for complications like ulcers and sepsis. The patient was admitted to the hospital for broad spectrum intravenous antibiotics to cover common skin infections including methicillin resistant staphylococcus aureus, and her fever and confusion improved after a couple of days. After her hospitalization, close follow-up in the clinic is needed to ensure that she continues taking her oral antibiotics and other medications and checking her blood sugar regularly at home. Since she lives alone, she has no one to drive her to appointments, and she lives in a rural community, so she also has a long drive into the city for her appointments. Overcoming these barriers will be important to assure that she does not experience more complications from her chronic disease.

### **Literature Review**

The first database that was used for this literature search was PubMed because it contains citations and abstracts from the fields of biomedicine and health covering portions of the life sciences, behavioral sciences, and chemical sciences. An advanced search was utilized with the key words “telehealth,” “diabetes,” and “glycosylated hemoglobin.” Articles were limited to those published within the past five years. Even though telehealth is a relatively new concept, a total of seventy-eight articles were found, however priority was given to the highest levels of

evidence. A search of CINAHL and Clinical Key revealed similar results and a total of eleven articles were chosen for review from these databases based on relevance to the PICO question.

### **Forms of Telehealth**

Telehealth is a broad term and there are many different forms. One way to use telehealth would be for patients to use a website to log blood glucose levels. Then a medical team can log on at set intervals and analyze the patients' information and give advice over the telephone or leave a message on the website. The set time interval can vary from logging on every few days, every week, or every two weeks. The method of feedback can also vary from leaving messages to speaking with patients on the phone, which is the more personal option. Appointments can also be conducted via telehealth. Most commonly these appointments are with specialists like endocrinologists, however they may also be with diabetes educators, who have an important role in keeping patients with diabetes on track with managing their disease. These face-to-face appointments over the computer provide a more personal touch than a phone call, and providers can physically see how the patients are progressing, which may be better than the more impersonal option of using a website.

The type of telehealth that seems to have the greatest effect on the reduction of glycosylated hemoglobin is appointments with diabetes educators through telehealth (Threatt & Ward, 2017). The interaction between diabetes educators and patients is an important component in diabetes care, and many patients do not get the opportunity to meet with a diabetes educator regularly. Meeting with the educator can increase patient activation and can help motivate patients to self-manage their disease. Twelve patients participated in telehealth appointments with diabetic educators and, the reduction in glycosylated hemoglobin levels was statistically significant (Threatt & Ward, 2017). However, the glycosylated hemoglobin levels of the control

group receiving face to face visits with a diabetes educator were lowered more than the telehealth group (Threatt & Ward, 2017). Limitations of the study include the glycosylated hemoglobin levels of the face to face group were higher at the start of the trial, and the participants in the face to face group were mandated to attend sessions by the clinic as a condition to continue to use free clinic pharmacy services (Threatt & Ward, 2017). Another limitation is that the telehealth participants were incentivized to complete the study (Threatt & Ward, 2017). Other important points to take away from this study include the patient's comments about the telehealth services. The only negative comments were about internet connectivity and clinic staff member training, so these are things that can be improved upon for future interventions (Threatt & Ward, 2017).

Glycosylated hemoglobin levels also gradually decreased in a study in which the telehealth intervention was patients using a website to log blood glucose levels. The medical team logged in every two weeks to monitor the patients and either gave advice over the telephone or left a message on the website. At three months the intervention group and the control group's glycosylated hemoglobin levels were significantly lower, however the mean change in the levels was greater in the intervention group (Wang et al., 2017). There was no significant difference between levels at the three- and six-month follow-ups, however levels in the intervention group gradually decreased and an upward trend was observed in the control group (Wang et al., 2017). This study could have been improved by healthcare providers logging on more frequently to give advice or using more varied communication methods.

The type and frequency of follow up from the medical team also contributes to the success of telehealth. An Asian population that had a small sample size showed a large and statistically significant reduction in glycosylated hemoglobin (Huang, Tao, Meng, & Jing, 2015).

In this sample the medical team made more frequent calls to the patients than any other study, and the team personally spoke with the patients. The authors of the study interpreted this as more frequent and human calls may have had a positive impact on the glycosylated hemoglobin levels of patients in the study (Huang, Tao, Meng, & Jing, 2015). These frequent calls were easier to make because of the small sample size of the study, and so time and cost effectiveness would need to be analyzed in larger populations.

### **Effectiveness of Telehealth**

Overall, telehealth is beneficial in reducing glycosylated hemoglobin (Faruque et al., 2017). A large and comprehensive systematic review examined one hundred eleven articles and came to the conclusion that telehealth lowered glycosylated hemoglobin by about half of a percent at the three and four month follow-ups, however the benefit was less significant long term perhaps because of reduced adherence to the intervention (Faruque et al., 2017). One article did not find any significant reduction in glycosylated hemoglobin, however this article analyzed psychology, telecare, education, and psychoeducation. These other interventions may have taken away from the effectiveness of telecare even though a multitude of factors affect patients with diabetes. (Viana, Gomes, Zajdenverg, Pavin, & Azevedo, 2016).

A theme that emerged from the literature was that patients with a glycosylated hemoglobin of eight percent or greater had the greatest improvement in glycemic control with telehealth (Lee et al., 2018). This is supported by a systematic review that found a significant reduction in glycosylated hemoglobin was associated with patients who had a glycosylated hemoglobin level greater than eight or nine percent, but also in Asian populations and studies with small sample sizes (Huang, Tao, Meng, & Jing, 2015). Patients with higher glycosylated hemoglobin levels could have a better response to telehealth because they have poorer self-care

including healthy eating, exercise, medication administration. Telehealth can offer regular reminders for self-care to people who live in remote areas and thus lower glycosylated hemoglobin levels (Wu et al., 2018).

A systematic review defined telehealth as remote patient monitoring and included four articles in their study. The scopes of these articles were varied in that some focused on remote patient monitoring, some on using wireless devices only, and some only focused on type two diabetes (Lee, Greenfield, & Pappas, 2018). Since the studies reviewed were only of low to moderate quality, the conclusion was made that more, high quality randomized controlled trials with longer monitoring periods are needed, and more systematic reviews of these studies are also necessary (Lee et al., 2018). This conclusion seems to be a theme throughout the literature, and with the potential that is described in various articles the future research is promising. Because of the low to moderate quality of the studies, other recommendations were not made (Lee et al., 2018).

### **Telehealth in Rural Populations**

Although other populations may benefit from telehealth, rural patients might have the most benefit due to the added barriers of travel time because specialists are not likely to be located in rural clinics. Chart reviews of patients participating in telehealth in rural Veterans Affairs (VA) hospitals add data supporting the use of telehealth in rural populations (Xu, Pujara, Sutton, and Rhee, 2018). One study using retrospective chart reviews involved seventy-one patients and the other involved thirty-two. Both found that patients had a decrease in glycosylated hemoglobin over the time that they were enrolled in telehealth, but the change was not significant (Xu et al., 2018). One of the chart reviews also examined travel time, costs and patient adherence, which are common barriers to health care. The decrease in these barriers was

perhaps more significant than the decrease in glycosylated hemoglobin (Xu et al., 2018). Patients saved an average of seventy-eight minutes of travel time, and the VA saved about seventy dollars in travel reimbursements per patient (Xu et al., 2018). All patients in the study would recommend telehealth to other veterans, and they adhered to appointments eighty-eight percent of the time (Xu et al., 2018). A limitation of self-selection may have affected these results, but they are promising for the future of telehealth (Xu et al., 2018). If rural patients or clinics are hesitant to try telehealth, educating them about the elimination of these barriers might change their opinion. These barriers are large reasons why patients do not seek care, and it is important for providers to address them.

These chart reviews are not the only evidence that telehealth breaks the barriers that rural patients might experience. Other randomized controlled trials from Wyoming and Montana found improvement in glycosylated hemoglobin in the rural setting and demonstrated that results between telehealth and in-person visits were similar (Wood et al., 2016). However, more follow-up visits took place with telehealth (Wood et al., 2016). Diabetes is a disease that requires multiple follow-up appointments, and telehealth will be important to ensure that these appointments take place.

Although the focus is the effect of telehealth on glycosylated hemoglobin levels, other aspects of patients' health were mentioned in the literature such as body mass index and blood pressure, and telehealth had no significant effects on these aspects in either study (Lee et al., 2018). In both studies, telehealth had a statistically significant impact on glycosylated hemoglobin. This reinforces that in future studies glycosylated hemoglobin should be measured to show the effects of telehealth, and less reliable statistics such as body mass index and blood pressure should not be the focus.

### **Patients' Attitudes about Telehealth**

As previously presented, telehealth is integral in overcoming barriers to accessing care, however if the patients using the services are not satisfied and are not willing to continue to use them, they will not be effective. One qualitative study interviewed fourteen patients, six health care workers, three doctors, and three family members simply to identify their point of view as to why patients are not able to take an active role in their healthcare related to diabetes (Heydarabadi et al., 2017). Five themes were derived from the data collected: personal barriers, economic and social barriers, environmental barriers, organizational barriers, and barriers related to healthcare workers including staff being absent or lack of follow-up (Heydarabadi et al., 2017). In another qualitative study eighteen patients were interviewed. The purpose of this study was to examine older adults' acceptance and perceived benefits of telehealth (Chang, Lee, & Mills, 2017). The four main themes that emerged from this study were initial trial encouragement from healthcare staff and financial incentives, enhanced self-management capability, ambivalent feelings regarding dependence on others for problem solving, and consideration for continual technology use for an uncertain future (Chang et al., 2017). Although these studies had contrasting sample populations, a common theme of encouragement from providers was found. Patients may be reluctant to initially engage in telehealth, but encouragement from healthcare professionals is an incentive to join. Most patients trust their primary provider. When this provider educates patients about how frequently monitoring is needed for this complicated disease and helps them understand the magnitude of their condition, they are less likely to feel uninvolved in their care and more likely to want to join telehealth services. The relationship with healthcare providers can also be a barrier to seeking care if the relationship is a negative one (Chang et al., 2017). Staff may be unmotivated or absent which does not encourage patients to

manage their diabetes and follow up as appropriate. Telehealth may eliminate these barriers, as well as other barriers identified in the study including low earnings and high healthcare costs, lack of family support, transportation problems, time constraints, and physical disability (Heydarabadi et al., 2017).

One benefit that was identified by patients was enhanced self-management capability (Chang, Lee, & Mills, 2017). After participating in telehealth, they learned about disease control, proper eating habits, and symptom management. There was some concern that if patients had a family member who could operate the telehealth system, they would not learn how to use the technology. There was also concern that the equipment was not portable. However, most patients looked forward to continuing the telehealth program and would be willing to pay for the equipment (Chang et al., 2017). Even though there were limitations of these studies including small sample size and they took place outside the United States, they still present valuable information about patient attitudes and perceived benefits and barriers.

### **Conclusion and Learning Points**

Rural patients with diabetes that utilize telehealth services have lower glycosylated hemoglobin than those rural patients that do not utilize telehealth. Many forms of telehealth were reviewed, and the form that seems most promising for patients is sessions online with a diabetic educator. These sessions give the patients access to counseling that can improve the daily management of their disease. This case report and literature review presents three learning points that can be applied to today's practice of telehealth. First, patients that have a high glycosylated hemoglobin of eight percent or greater may have a greater benefit from telehealth. The reason for this remains unclear, but perhaps patients that have higher levels have poorer self-care, and when they receive reminders for better self-care such as diet and exercise

through telehealth, they may be more likely to partake in those activities. Second, there are many barriers that have been addressed about receiving traditional follow-up care for diabetes, but it is encouraging that at least some of those barriers including transportation time and cost may be overcome with telehealth. Third, telehealth is beneficial in lowering glycosylated hemoglobin levels, and patients generally have a positive attitude towards telehealth. Based on these conclusions it would be acceptable to utilize telehealth in practice where it is available.

Telehealth is available in many different forms, and telehealth in any form is better than no follow-up care at all for patients with diabetes. With more positive studies hopefully telehealth will become more widely used and accepted by both patients and physicians for greater secondary prevention of diabetes complications as a result of high glycosylated hemoglobin.

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