Fall 12-4-2022

Implementing a Medication App for Transplant Recipients

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NURS 5382: Capstone

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12/4/2022

Executive Summary

Lack of medication adherence is a significant issue in solid organ transplantation that can have detrimental effects on patients. Immunosuppressive medications are vital to preventing rejection of the transplanted organ. Transplant nurses spend much of their time counseling patients and families on the importance of their medications and it can feel frustrating when nonadherence occurs anyway. If solutions to improve medication compliance post-transplant are identified, the burden of poor transplant outcomes on numerous healthcare resources such a nurse staffing, medical supplies, and inpatient admissions will be reduced.

As technology becomes more integrated in to everyday life, it could provide some assistance to medication adherence for these patients. Medication apps on mobile devices are increasingly being introduced to assist patients with medication adherence. Perx Health has created an app that targets medication adherence by increasing patient engagement. Once installed, the app provides patients with medication reminders, assists patients with tracking when medication is taken, and rewards patients for taking their medications (Perx Health, n.d). In addition, Perx allows providers to see patient data related to medications so that providers can address any potential hurdles with patients. Perx is HIPPA compliant and provides its own implementation team that assists patients with the enrollment process.

In a retrospective study, a facility where the Perx app was implemented found that medication adherence was over 95% for patients on one or more medication for 6, 9, and 12 months (Wicek et al., 2020). The second portion of this same study found that the Perx app could save between $1,200 and $5,000 AUD per patient depending on the patient's diagnosed condition (Wicek et al., 2020). This data shows that the Perx app could be utilized to increase patient engagement and adherence, while reducing healthcare costs. The Perx app could be

implemented within the transplant population at Texas Children's Hospital to increase medication adherence, reduce rejection rates and adverse outcomes, and save hospital resources including money.

Rationale

Many transplant patients wait weeks and months for a life-saving transplant, yet nearly half of late acute rejection episodes in post-transplant adults are attributed to immunosuppression non-adherence (Serper et al., 2015). In addition, Shemesh et al. (2017) found that 53% of patients with a Medication Level Variability Index >2 had rejection by the end of the second year of their prospective study. According to the OPTN/SRTR 2018 Annual Data Report: Liver (Kwong et al., 2020), 563 pediatric liver transplants were performed in 2018 in the United States, but 715 new pediatric candidates were added to the waitlist that year. 9.2% of pediatric liver transplant candidates listed in 2018 were listed as a re-transplant (Kwong et al., 2020). Chronic rejection due to medication noncompliance seems to be a preventable post-transplant complication simply with better medication adherence.

At Texas Children's Hospital, 27 liver transplant recipients had biopsies with confirmed rejection in 2021 alone. While this is only approximately 6% of the total liver transplant population, only 12 months of data was reviewed. Texas Children's performs heart, lung, liver, and kidney transplants for patients. If each of these organ groups is experiencing rejection in approximately 6% of patients per year, that would mean about 24% of total transplant patients experience rejection per year. Although not all rejection can be attributed to immunosuppressive medication adherence, it is an easy variable to control in the prevention of rejection.

Goals of Project

The following PICOT question was created to address medication adherence: In post-transplant patients (P), how does a medication adherence app (I) compared to no medication adherence app (C) affect transplant rejection rates (O) within one year of implementation (T)? This project is currently still in the planning phase, where patients have been identified but have not been enrolled in the app as of yet. The primary goal of this project is to reduce rejection rates in post-transplant recipients at a pediatric hospital. This will hopefully reduce admission rates, improve transplant outcomes, and reduce strain on necessary hospital resources. An additional goal is to implement an app that patients find helpful and are willing to use for medication adherence. If successful within transplant services, this app could be utilized for patients with other chronic conditions to improve adherence.

Review of Literature

Based on the research done, mobile devices can be a useful tool to improve adherence for post-transplant patients via either text messaging or apps. Jones et al. (2014) completed a meta-review of 11 systematic reviews that showed that text message reminders improved adherence to appointments, medications, and improved behavioral outcomes. The systematic reviews analyzed were completed between 2009-2012, and cell phone use has only continued to grow since this time. Although text messaging was shown to improve adherence, there was little data on the cost of using text messages and how those costs would be covered.

Han et al. (2019) completed a randomized controlled trial of immunosuppression adherence for renal transplant recipients using a mobile phone app. The findings were that the Adhere 4U app showed no improvement in medication adherence when compared with patients not using the app. This finding was likely due to a high attrition rate and was contradictory to other studies that did show improvement in adherence for patients using mobile phone apps. In

contrast, Miloh et al. (2009) found that text message reminders for medications decreased mean tacrolimus standard deviations and acute cellular rejection episodes. Foster et al. (2018) also found better medication taking adherence amongst their study participants who received multicomponent intervention including text message, email, or visual cue reminders.

The Han et al. (2019) study found that the attrition rate significantly altered their expected outcome. This brings forth questions, such as, do patients understand the importance of adherence? Do patients want to use a mobile app to improve their medication adherence? Israni et al. (2016) completed a qualitative study with a small sample of 16 renal transplant patients from a single transplant center. Researchers conducted semi-structured interviews either at participants' homes or work. The researchers found that based on participants' responses, patients do understand the importance of medication adherence and are interested in using a mobile phone app to improve adherence. Shellmer et al. (2016) also found that adolescent renal transplant recipients reported that a different app, called Teen Pocket PATH ®, was useful, and were interested in using the app in the future. However, the participants in the Israni et al. (2016) study did bring up some important barriers to using a mobile phone app such as the lack of cell phone service or turning the phone off. These barriers will be important to overcome in future studies regarding the use of mobile phones to improve adherence for transplant recipients.

Stakeholders

Identification of stakeholders and their preferences is an important consideration when implementing change. Key stakeholders for this project include: patients, patient families, nurse coordinators, clinical pharmacists, physicians, and hospital administrators. All stakeholders would like to see improved medication adherence for patients, as it has an effect on patient outcomes.

Patients and patient families will have to utilize the Perx app for this project to be successful. As demonstrated in the previously mentioned Israni et al. (2016) and Shellmar et al. (2016) studies, patients are interested and willing to utilize a mobile app for medication adherence. The app should be convenient for patients to use and require minimal set up from the patients themselves. In addition, patients should not have to pay for the app and should feel that there is value gained by using it.

Transplant coordinators, pharmacists, and physicians would all like to see improved medication adherence for our patients. It can be very frustrating to see patients with poor adherence to necessary medications despite education. There is a significant amount of time expended by each of these team members when medication non-adherence is identified. There is even more time invested when transplant rejection is diagnosed. The implemented app for medication adherence should not require significant set up from any of these team members. These team members should also not be expected to be able to do anything beyond basic troubleshooting once patients begin using the app.

Hospital administrators, who will have to approve this project, would like to see fewer patient readmissions and improved post-transplant outcomes. Patient readmissions are quite costly from a variety of aspects. Readmissions utilize valuable resources, such as hospital beds and staff, that could be allocated to other patients. Post-transplant outcomes are made available publicly and poor published outcomes could affect patient referrals. From the viewpoint of hospital administrators, the implemented medication adherence app should be effective at increasing medication adherence while remaining at relatively low cost to the organization.

Overview of Change Project Process

Planning

To implement this change, a team was assembled to assist with the project. This team consists of a coordinator from each organ group, the transplant services educator, and the transplant services director. Coordinators and the department educator have presented project to transplant services director and received approval for project implementation. This implementation team will be vital as this project moves forward to collecting project data and providing information to other stakeholders related to the project.

The medication adherence app that has been selected is called Perx Health. The pediatric transplant program where this project is to be implemented consists of heart, lung, liver, and kidney transplant. This program is overall the largest volume pediatric transplant program in the country. In order to implement the use of a medication app at this institution, data has been collected related to rejection rates in previous years and the medication level variability index for these patients in the year of the biopsy.

The first step to planning implementation was to create eligibility criteria to select patients who will be enrolled in the Perx app. Eligible patients were at least 12 years old and greater than 1-year post-transplant. The rationale for selecting patients greater than 1-year post-transplant was that we expect medication level variations in the first year due to frequent dosage changes. Patients needed to be able to take medications on their own without parental administration and have access to a cell phone or tablet. Eligible patients were divided in to low-risk and high-risk groups. The patients identified as being high-risk were patients that have had rejection with unexpected drug levels at the time of rejection, or had three or more unexpected drug levels within a 2-year timeframe. Low-risk patients did not have a history of rejection with unexpected drug levels or variable drug levels over a 2-year timeframe. Patients were identified from lung, heart, liver, and kidney transplant.

The next step will be for coordinators, coordinator assistants, clinical pharmacists, and physicians to receive simple education about the Perx app and how it will be utilized. An implementation proposal will be provided to these team members via email from the project implementation team. Coordinators and physicians will ultimately have access to patient data collected through Perx app but will receive education about how to access data from the Perx enrollment experts at a later date. The project implementation team will allow these stakeholders to provide feedback on proposed Perx app implementation.

Implementation

Once the planning phase is complete, implementation of the Perx app will occur. The first step in implementation will be providing the Perx enrollment team with a list of patients that will be eligible to be enrolled. Then, a time will be established for the Perx enrollment team to provide education to coordinators and physicians regarding how to access the patient data once patients are enrolled. This education will be provided in a brief 1 to 2 hour information session. Next, the Perx enrollment team will begin enrolling identified patients. The Perx Health team will obtain consent for patient participation in the app. The goal will be to have all eligible patients enrolled within two months of beginning the enrollment process. Once enrollment begins, the project has officially gone live and patients can begin using the app. Patients will utilize the app for medication reminders and to track medication adherence. Patients earn rewards for taking their medications. The project implementation team will collect data on a monthly basis for 1 year related to the patient usage of the app and medication adherence. In addition, project implementation team will track any episodes of rejection for enrolled patients. At the end of one year, data will be reviewed and analyzed for success. Future patients can be identified by transplant coordinators for Perx app eligibility and enrollment.

Timeline

The process of identifying patients took the implementation team about 1 month to complete. We are currently at a standstill with this project, but the following timeline will be utilized once implementation continues. In the first week, an email will be sent to all transplant services team members with information about Perx app. The implementation team will request feedback be received within one week of sending the email. A second week will be taken to allow the implementation team to address any feedback received from other team members. Ideally, the Perx enrollment team would be able to provide staff education about how to access patient data in the third week and begin enrolling eligible patients. Overall, all eligible patients should be enrolled within two months of beginning the enrollment process. Once patients are enrolled, they should begin using the app immediately. The implementation team should begin collecting patient data monthly and will track this data for 1 year for all patients. At the end of the 1-year period, the implementation team should assess the collected data and provide feedback to all stakeholders regarding outcomes of project implementation. This should be completed within one month of the completion of data collection. A flowchart demonstrating this timeline is available in appendix A.

Data Collection Methods

Preliminary data that will be used for comparison was collected from patient historical drug levels and rejection episodes. Coordinators, physicians, and the project implementation team will have access to the patient data provided by the Perx app. The project implementation team will look at the medication adherence data provided by the Perx app monthly to identify trends. In addition, medication level variability indexes will be calculated based on trough levels of medications from patients who are enrolled in the Perx app. Episodes of rejection will be

tracked for enrolled patients and compared to historical data related to rates of rejection from previous years. Finally, patients who are enrolled in the Perx app will be surveyed every 3 months for the entire year post-implementation to get an idea of patient perspectives on using Perx app (see Appendix B).

Costs and Benefits

In an effort to prevent patients from absorbing the costs, the Perx app will come at a cost for the hospital. The app costs $29 per month per patient (Perx Health, n.d.). This is without any type of commercial purchase discount. Based on the patient eligibility criteria, the plan is to enroll 250 patients in total for the initial 12-month implementation period. This comes to a total cost of $87,000. However, the cost would likely be worth the improved patient outcomes, and hopefully the decreased cost associated with rejection admissions. As a rough example, when a patient has suspected liver transplant rejection, they are sent to interventional radiology for a liver biopsy and immediately admitted to the hospital following the biopsy for rejection treatment once rejection has been confirmed by biopsy. Per the institution's website, the cost for the biopsy itself, excluding anesthesia and other procedure related-costs, is over $900 The patient is admitted to an acute care patient floor post-biopsy, which has a cash pay cost of $4257 per day (Texas Children's Hospital, 2022). If rejection is confirmed the minimum inpatient stay is 3 days, bringing the inpatient cost to $12,771 per patient before the cost of meds, etc. If adding the inpatient cost with the cost of the actual biopsy, the total is $13,671 per patient. A reduction of just 7 biopsies per year just based on these two numbers would cover the costs of the Perx app for the entire year for all 250 patients.

There are additional cost savings to consider when evaluating the costs and benefits of implementing the Perx app. Patients who are admitted for a biopsy are utilizing a hospital bed

that could potentially be needed by another patient. Texas Children's Hospital is frequently on census alert and beds are a valuable resource. Patient caregivers may experience lost wages while admitted with their child for a biopsy. Finally, transplant patient outcomes are available publicly and there could result in detrimental losses of referrals if outcomes are not acceptable.

Discussion/Results

This project is still in the early phases and has not officially been implemented. However, the data collected has been compelling enough to gain the support of the transplant services director and educator. The transplant director has approved of project implementation and is actively participating in assisting to get executive approval of the project. The patient selection criteria creation went well amongst team members and small modifications were made to the original selection criteria. The identified patients have been sorted in to high-risk and low-risk categories. However, momentum has stalled on this project for now. The implementation team is planning to re-approach the progress of this project at the beginning of the new year.

Recommendations

Mobile device apps have been shown to improve medication adherence for transplant recipients. Using the Perx app, a multi-faceted adherence app may be implemented in our transplant services department to prevent rejection and improve outcomes post-transplant. Currently, there are no tools being offered to assist patients with medication adherence other than continued patient education from coordinators and clinical pharmacists. Although this may work for some patients, it is not a tangible tool for patients to use at home. The Perx app provides patients with medication reminders, documented adherence, and rewards for using the app to document adherence. Improved medication adherence could prevent future episodes of transplant rejection and the need for re-transplant in some cases. If successful, the data collected from this

project could be shared with other departments and hospitals to improve medication adherence for other patients as well.

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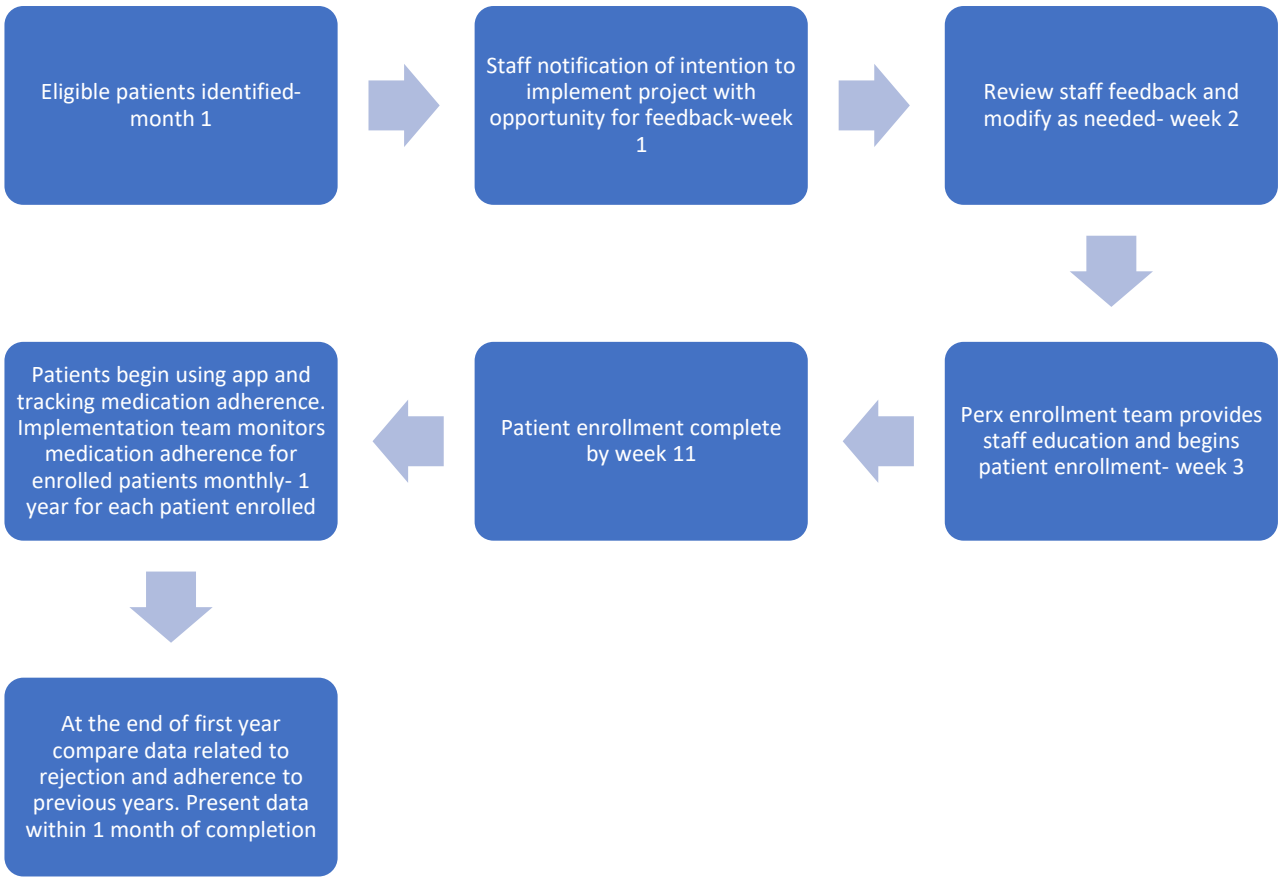
Appendix A


Eligible patients identified- month 1
Staff notification of intention to implement project with opportunity for feedback-week 1
Review staff feedback and modify as needed- week 2
Perx enrollment team provides staff education and begins patient enrollment- week 3
Patient enrollment complete by week 11
Patients begin using app and tracking medication adherence. Implementation team monitors medication adherence for enrolled patients monthly- 1 year for each patient enrolled
At the end of first year compare data related to rejection and adherence to previous years. Present data within 1 month of completion

Appendix B

Patient Survey

1. I find the Perx app easy to use.

   Yes

   No

2. I feel as though my medication adherence has improved since I have started using the Perx app.

   Yes

   No

3. I believe that the Perx app has been helpful to me.

   Yes

   No

4. I would like to continue using the Perx app to help with my medications.

   Yes

   No