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The Future of Type 2 Diabetes Management and The Changing Roles 0f Healthcare Professionals

A study of how a team of physicians and pharmacists at St. Elizabeth Healthcare in Kentucky uses artificial intelligence to improve treatment, adherence, and cost savings for both Medicaid and Americans, and to get the patient to goal in a shorter period.

Innovative artificial intelligence (AI) Tool Optimizes Care for T2D Patients

A new clinical software using artificial intelligence is being used for those with Type 2 diabetes in Kentucky. It is showing promising results in improving the Quality of Life for its residents and lowering the cost of treatment.

Using "GlucosePATH" artificial intelligence software to lower cost and improve the quality of life for patients with type 2 diabetes.

Part 1. Adherence-related issues are hemorrhaging the costs of diabetes-related treatment in America. To offset this tragedy, GlucosePATH is utilized by a team of healthcare professionals dedicated to improving the quality of life while decreasing avoidable costs.

Part 2. An examination of the project architecture and the research methods are reported with the results in support of GlucosePATH's positive impact on patient outcomes, which ultimately decreases total costs.

Part 3. User testimonials will summarize their experience on the user side. Interesting findings will be addressed on the importance of patient engagement. Personal Further findings and discussions will be a more in-depth examination of the future benefits of applying decision-support software.

Part 3 also will provide you the opportunity to use the software at no expense.

Part 1: Innovative artificial intelligence (AI) Tool Optimizes Care for T2D Patients

Over one-in-three Americans are promised to be diagnosed with diabetes by 2050, according to the Centers for Disease Control [1]. The 2019 Kentucky Diabetes Report reveals daunting numbers of adults with diabetes more than doubled between 2000 and 2017, to 442,480 [2]. Kentucky's Medicaid program spends over $117 million on diabetes-related treatments, making it the third-most-expensive chronic disease behind the cerebrovascular disease and chronic obstructive pulmonary disease.

Meeting compliance with Kentucky's health challenges, the state runs a State-University Partnership program (SUP), which pairs the government agencies with in-state university research departments. For the quality improvement project reviewed here, Kentucky's Department of Medicaid Services (DMS) partnered with Northern Kentucky University (NKU), and the hospital and physicians of Saint Elizabeth Healthcare in Covington, Kentucky. The healthcare team at St. Elizabeth is known for its holistic approach to assisting patients through multilevel collaboration.

Kentucky's two-year project, which ended June 30th, 2020, focused on adult Medicaid patients with an A1C level of 8 or higher. Outcomes measured included the change in patient hemoglobin A1C, patient and system medication cost, and hospitalization claims for unplanned hospitalization visits. The project goals included improving medication adherence by involving patients in the decision-making process, reducing clinical inertial, aiding physicians in clinical decision-making, and, ultimately, reducing the cost of treating diabetes.

Cost is an essential factor when it comes to managing diabetes. It is vital to reduce the cost to patients so that patients will take their medications. An increase in adherence should ultimately lead to a decrease in hospitalization visits due to uncontrolled diabetes. It is also important to ask patients about their medication preferences, such as for oral agents, since patients with injection phobia may be reluctant to take their medicine.

A drug regimen's success depends heavily on the patient's adherence to the treatment. There is a consensus among pharmacists that the two primary obstacles to patients' treatment adherence are preference and cost. Kentucky's project began by having pharmacists speak by telephone with individual patients about their diabetes treatment concerns before an initial office visit. The extra care to reach out to their patients led to more communication and shared decision-making between physicians, pharmacists, and patients. The pharmacists entered the patients' responses into the computer software, which used that information along with the patient's insurance formulary, to identify promising treatment regimens. While the patient's physician made the final decision regarding the patient's treatment regimen, the project empowered pharmacists and patients to identify promising options using the software, before presenting those options to the physician.

Because neither the software nor the pharmacist had made the previous treatment recommendation, it might also have helped avoid clinical inertia - approximately 94 of the 156 patients enrolled in the project changed regimens to include all or some of the software's recommendation. The A1C of these patients was reduced by approximately 2.15 points (about 20%), a statistically significant difference versus the project's control group. Taken together, the benefits of team-based care may be the future for managing life-long illnesses such as diabetes.

Besides incorporating patient preferences, healthcare providers are faced with the constant introduction of new medicines and dosages. More than 160 combinations of diabetes medications and doses are available, with different levels of efficacy, side effects, and cost. With that many individual choices, there are millions of ways to build multi-drug regimens to treat diabetes. Because of this, it often takes years to reach therapeutic goals, while toxic sugar levels in the blood are degenerating the patient's micro-and-macro vascular system.

The pharmacists in Kentucky's project used the GlucosePATH AI software to avoid these obstacles.

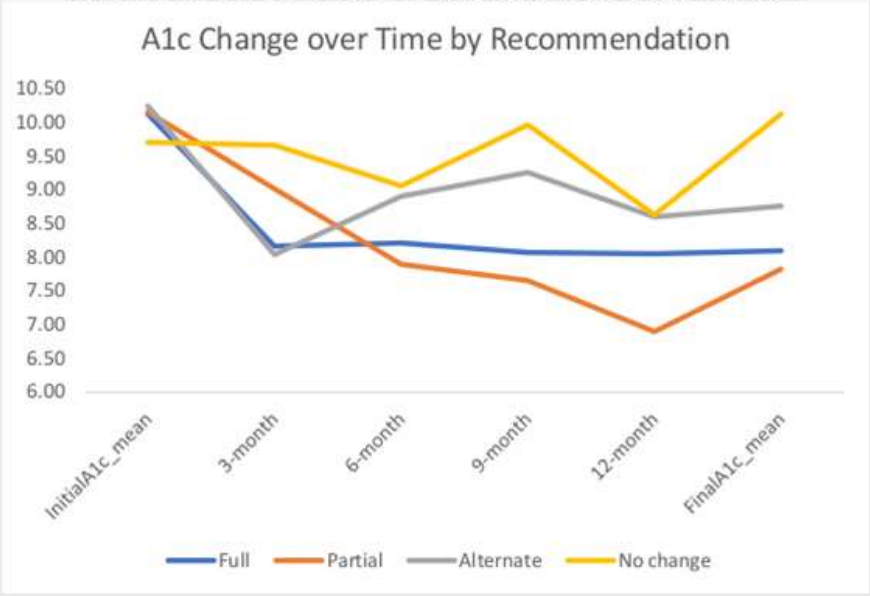
The software goes through every possible combination of medicines that could be prescribed. For each combination, the software uses current treatment standards to evaluate efficacy and safety. It also identifies barriers to treatment compliance and generates personalized strategies to facilitate treatment compliance. For example,

GlucosePATH provides medication costs and pre-authorization information to mitigate potential cost problems. This transparency may build patient trust and improve health outcomes.

The software suggested up to ten regimen options for helping the patient reach therapeutic goals. This AI technology expands on the physician's typical prescribing habits and provides better alternatives that can be implemented in the patient treatment plan to control the A1C levels. Physicians who participated in the project concluded that AI is an excellent tool for expanding their knowledge of treatment options. Additionally, more than 80% of physicians found that the AI improved their patient outcomes in their practice setting [3].

GlucosePATH is designed to reach therapeutic goals within three months. In the Kentucky project, patients who wholly followed the regimen proposed by the software (and agreed to by the patient, pharmacist, and provider) saw an average A1c decrease of approximately two points (about 20%) in 90 days. Also, those patients' A1c did not substantially increase for the duration of the project. The chart below, from the project report, shows the A1c change.

Figure 4: Outcome Measures for Quarterly Follow-Up Appointments



("Full" indicates patients who followed the full regimen recommendation of the pharmacist/patient/provider/software; "Partial" represents patients who followed some of the regimen recommendations; "Alternate" represents patients who followed a regimen different than their current regimen, and one not recommended by the team or software; and "No change" are the patients who didn't change their regimen.)

By experiencing dramatic positive change, patients may be more motivated to stay committed to improving their lifestyle with exercise and diet.

Artificial intelligence is the key to healthcare breakthroughs. AI tools assist rather than replace healthcare professionals by providing shared decision making and improving personalized, patient-centered care. GlucosePATH equips physicians to provide various treatment options for patients with type 2 diabetes by curating the patient's particular needs and integrating the cost of medication into the treatment decision-making process. This project demonstrates how to reach therapeutic goals by integrating GlucosePATH software into your practice. An opportunity to act will be provided at the end.

Part 2: Collaborative Analysis Concludes that the AI Tool Improves Outcomes for Type 2 Diabetes Patients

The project was designed to address through clinical intervention the issues experienced by patients with diabetes, such as high A1c levels. Through team-based care, clinical software support, and patient engagement, the intervention was projected to help control HbA1c and potentially lower treatment costs.

The project design consisted of using an electronic tool (GlucosePATH) to facilitate and recommend treatments to patients based on cost and social factors. The project was designed to have pharmacists use that decision tool to make recommendations for alternatives regimens. The use of pharmacists rather than the patients' current physician was designed to address two potential issues:

- Cost - Pharmacists typically bill at a lower rate than physicians
- Clinical inertia - The pharmacists didn't recommend the patient's current regimen, so they would be more open to changing that regimen if it wasn't working.

Another goal of the project was to determine which regimen would be the most cost-effective for both the patient and the insurer.

Approximately 43 providers and 126 patients from St. Elizabeth Healthcare participated in the test group. The patients included were adults (age 18+) from Kentucky Medicaid, had Type 2 Diabetes, an A1C higher than 8%, and had previously completed an appointment with a Saint Elizabeth's primary care physician (PCP). Other patients that did not meet these criteria were not able to participate.

Pharmacists and patients used the electronic tool to identify treatment regimens (including diet and exercise, which were modeled as if they were medicines) consisting of 1 to 5 drugs. After agreeing on a course of action, the pharmacist sent the regimen to the patient's provider for final review.

The study allowed for the possibility that the patient or provider would accept all, some, or none of the medicines in the selected regimen. Patients were grouped into four main categories based on how much they followed the selected regimen. The following table shows those categories and the number of patients in them.

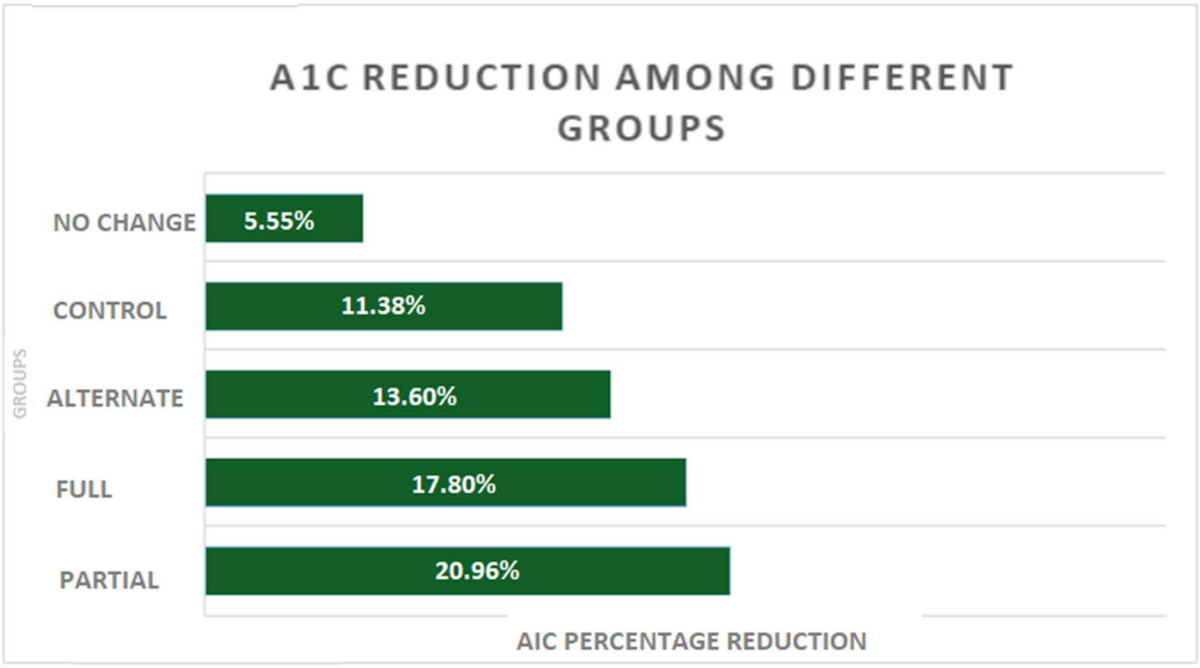
Recommendation	Frequency	Percent
Full - the patient took exactly the medicines in the selected regimen identified by the tool	72	57.10%
Alternate - the patient followed a regimen that was different from their pre-intervention regimen and that did not include medicines recommended by the tool	22	17.50%
Partial - the patient took at least one (but not all) of the medicines in the selected regimen created by the tool	18	14.30%
No changes - The patient's regimen remained the same after intervention as before.	12	9.50
Alternate initially, full after nine months	1	0.80%
No changes, full after six months	1	0.80%

Table 1: Clinical Decision by the Provider

GlucosePath software used an algorithm that would focus on A1C control, body weight, adherence, cost, and side effects. The main goal and outcome consisted of clinical data and team-based decision support. For the clinical data, a longitudinal analysis was used to measure the patient's changes over time, comparing the test group with the control group.

As shown in the above table, providers used the GlucosePath software to obtain recommendations that would suit each patient. Based on the A1C measure's changes, most of the providers used the full recommendation for 72 patients. For 22 patients, the alternate recommendation was used. Then, for 18 patients, they used a partial recommendation, and for 12 patients, they did not use the recommendation. The last two patients did not follow the recommendation immediately, but they did after a few months.

Graph 1: Recommendations Used Among Groups



The providers that used these recommendations for their patients noticed a statistically significant improvement in the A1C. Surprisingly, the partial recommendation showed the highest decrease in A1C, about 20.96%. Patients who had used the full recommendation from their providers had an A1C decrease of 17.80%, and the patients

who used the alternate recommendation only showed a 13.60% decrease. The control group, 11.38%, only showed an improvement compared to the no-change group but not compared to the other groups.

A T-test was also used to compare the full and partially test group's differences versus the control group. The collaborative test group showed a statistically significant improvement decline in the A1C with a P-value of 0.04. This improvement could be the effect of the increase in sample size by combining the two groups.

The project also asked pharmacists and providers a series of questions about the use of the clinical tool for patient outcomes.

Question: How significant is the CDS tool for improving patient outcomes?		
Response	**Frequency**	**Percent**
Strongly Disagree	1	2.56%
Disagree	6	15.38%
Agree	16	41.03%
Strongly Agree	16	41.03%

Table 2: Responses from providers regarding the CDS tool

Most providers mentioned that they were not aware of the CDS tool that would recommend these regimens for their patients. Most of their knowledge about the tool was introduced during the experiment. Approximately 82% of the providers mentioned

that they agreed that the CDS tool would improve patient outcomes. Only 18% disagreed that this tool would not improve patient outcomes.

They were also asked if they felt comfortable with the regimen that their patients' decision support tool chose. More than 85% agreed that they felt comfortable with those regimens. About 53% of the providers agree that this tool can be handy and will use it in their current practice.

Providers had also mentioned that medication costs were one of their main concerns because every patient wants to save money and, at the same time, get the best diabetes regimen. The CDS tool would display up to ten regimen options. It is the provider's and pharmacist's duty to notify any drug interactions that would interfere with the patient's current medications. In the test, they also compared costs for diabetes medications between the test and control group. It was concluded that with the CDS tool, the mean cost for the test group was $712, while the mean cost for the control group was $2,419. An exciting discovery about the most commonly used diabetes medications in each regimen was Biguanide, followed by insulin (basal) and GLP1s, respectively. Pharmacists mentioned that the best part of GlucosePath is finding these types of regimen recommendations with the best costs available and lowering the A1C by 20%.

Part 3: Optimize Clinical Diabetes Management with AI Technology

User testimonials about the experience and exciting findings using the software. A more in-depth examination of the benefits of applying decision-support software in clinical practice.

GlucosePATH is a software that can provide aid to the prescriber when developing patient treatment plans and decrease the amount of time it takes for the patient to achieve their goals. It is essential for the patient to be a part of the decision-making process and, more importantly, be informed when considering their ability to pay for a treatment option. At least 60 different types of medication therapies available for patients with diabetes, and not all are viable options for all patients. It is crucial to personalize medication regimen so that prescribers can optimize therapeutic outcomes for their patients. GlucosePATH is an AI that recognizes the importance of using specific standard therapies while also shedding light on almost 6 million different ways to choose from a list of the 60 regime options. This software will save physicians time while determining the ideal regimen for a specific patient case.

The software is user-friendly, collecting a wide range of data and compiling it into a summarized recommendation list highlighting the most critical outputs that need to be considered to make an informed decision. Patient information data include age, sex, A1c level, and current regimen. The treatment is then tailored based on inputted information, such physician preference on what drug that the treatment should contain, what drug interventions to exclude, patients' susceptibility to side effects, and patients' comorbidities. The AI uses a Medicare cost formula to generate the medication's average cost using the patient's insurance information. It allows the user to set a maximum solution cost that the patient can specify to the prescriber based on their financial capabilities, but this will not affect how the medication ranking process works. The AI system will also consider treatment options based on how the patient's answers to adherence questions. While all input responses are considered in the ultimate recommendation results, the AI is wired to produce the best-ranked link per both the information inputted and the clinical patient data.

The AI software makes it easy for the user to factor in cost when computing recommendations for drugs, which is unique to this tool. It bases its recommendations on various financial variables inputted into the software, including the maximum solution cost, the patient's insurance, any coupons available, cost sensitivity, and free medications available. Based on this information, the operating system creates an estimated figure of what the drug will cost per month. Of the different variables used to get this result, cost sensitivity is the most exciting and valuable factor that many prescribers cannot take into account for each patient. The cost sensitivity refers to the financial burden the patient will face if the entire dollar amount in the maximum field is spent on the scale ranging from 0-10. From a user perspective, it is comforting that the software not only intends to make the treatment success for the patient medically but also provides a financially sound option.

Also, AI users can choose different demo scenarios designed to show how the software makes recommendations under these conditions. These scenarios help to individualize other medication therapy selection based on what the physician selects as a condition to consider. To further clarify, demo-GERD is selected by physicians for patients with high LDL, hypertension, hypertriglyceridemia, and susceptibility to gastroesophageal reflux disease, while the demo-BMI factor in the patient's weight treatment options recommendation. The demo options resist and take into account the insulin resistance and insulin secretion factors, depending on what they select. The patient's insulin

resistance score (HOMA-IR), endogenous insulin production score (HOMA-B), and eGFR must be considered from a user's perspective to tailor the medication therapy based on those critical factors. The AI is set to provide the user with a default of 5 recommended options, so it is not limited to just one intervention – allowing the prescriber and the patient to then determine which intervention option they will ultimately apply. Special optional features are also available to personalize further this process, such as allowing prescribers to track the inventory of medicines available to patients once an option is chosen. This feature gives the user a space to keep a record of not only the quantity of the medication chosen but also replacement costs and alternate doses that might be available so that any changes from standard dosing can be tracked.

Applying decision support software like GlucosePATH will help patients get to their goals sooner, in the most effective way. It allows the user to be in control of patient care while expanding the norm of prescribing habits. Patients are a part of the decision-making process, and tailor a medication to their needs to optimize their goals. The system does the complicated analytical computing for the provider while also considering patient factors and even finances. This will change the future of prescribing and bring a fresh new outlook on patient care using AI technology that can improve a patients' quality of life in a shorter amount of time and eliminate the frustrations of trying to pick the right medication. GlucosePATH uses algorithms based upon treatment standards, clinical data inputs, and other variables such as budget to help individualize treatment to fit the patient. While it is important to consider patient input when making treatment decisions, it is equally essential to ensure that the medication chosen is clinically ideal for an individual patient case. The future of diabetes care needs to consider both – a happy medium where patients can be a part of their drug therapy so that they are more inclined to adhere, and an ideal drug regimen that fits their specific patient profile. GlucosePATH is an AI software that can do this on one user-friendly platform while navigating through millions of therapy options and ultimately yielding the top few choices. Prescribers and patients can confidently use this software, knowing that the options they will get to choose from will keep both of their interests in mind: the clinical factors of an ideal therapy for prescribers, and a cost-effective drug that fits the needs of the patient.

Reference:

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[2]Rowley, William. et al. “Diabetes 2030: Insights from Yesterday, Today, and Future Trends.” Population health management vol. 20,1 (2017): 6-12. doi:10.1089/pop.2015.0181

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