Longitudinal Care Management for Improved Chronic Disease Outcomes

Corewell Health

Primary Contact Information:
- Jane Gietzen, director, digital services, applications and platforms
- jane.gietzen@corewellhealth.org
- 616.460.0479

Clinical Project Lead:
- Erica Auger, senior director, ambulatory, transitions, and behavioral care coordination
- erica.auger@corewellhealth.org
- 616.486.6744 X66744

IT Project Lead:
- Holly Schewe, manager, digital services, population health
- holly.schewe@corewellhealth.org
- 269.930.3752

Executive Summary

Chronic disease management is a key opportunity for all health care systems interested in value-based care success. Patients with uncontrolled diabetes are at increased risk of poor clinical outcomes, which are compounded when other chronic conditions, such as hypertension, also exist. Many of these patients are unequipped to self-manage and have trouble establishing health behavior goals that may help bring their diabetes under better control. Care managers embedded in primary care settings have a unique opportunity to partner with patients to create space for an honest dialogue about the barriers and challenges impeding their ability to achieve optimal health.

Adopting the Scaled Agile Framework for Enterprises (SAFe®), Corewell Health developed cross-functional teams comprised of individuals from operations and digital services that quickly adapted to changes, new insights and information, embodying transparency, alignment, respect for people and continuous improvement. These teams aligned around a common purpose, vision and understanding focused on the problem first, and then allowed the best solution to emerge through iterative end-user feedback and person-centric development. With this new collaborative

agile approach, the teams were able to maintain continuous delivery of viable, desirable, feasible and sustainable innovative solutions to address these health opportunities.

In January 2020, the Corewell Health care management team started to redesign a longitudinal care management (LCM) program with a plan to identify, engage, and support patients with chronic diseases more effectively, starting with diabetes management. Evaluating learnings from over 10 years of care management experience, the design team mapped a pathway focused on a structured connection of interventions. Full implementation of the redesigned LCM model occurred in January 2022.

Central to our longitudinal care model's design is the ability to identify patients who can benefit from enhanced self-management skills and a patient-centered program design, matching interventions to the patient's stage of change. Care managers taking a whole-person approach to patient care help patients set realistic goals and build on their initial successes in behavior change. Over time, this momentum can have a significant impact on clinical outcomes, while respecting a patient's autonomy to determine what works best in the context of their own health care journey.

Identifying a focused patient population is a good first step to matching that population with an intervention tailored to their needs. Personalizing an approach creates systemic design that fosters effective LCM models. Risk stratification can also be a helpful tool to identify patients at risk for poor outcomes or utilization of high-cost care. Corewell Health defined their initial focused patient population as patients of internal primary care providers (PCPs) with risk contracts. A flag, called the "Blue R" was established within the electronic health record to delineate these patients. Additional builds provided proactive patient lists to identify patients with the Blue R and a Hemoglobin A1c (HgbA1c) of 8 and greater. Once the LCM intervention and workflows were established, customized Epic Compass Rose tools were built to facilitate longitudinal documentation by the care management team.

Implementing this disease management effort has yielded positive clinical and financial outcomes. Patients have achieved better control of their diabetes and reduction of A1c and systolic blood pressure can be observed. These clinical improvements bode well for patients' long-term health and health care resource utilization.

Define the Clinical Problem and Pre-Implementation Performance

The total direct and indirect cost of diabetes in the United States was estimated at $412.9 billion in 2022[1]. Helping patients manage their diabetes mitigates the risk of complications and long-term health problems such as retinopathy, nerve damage, kidney problems, heart attack and stroke[2]. Atherosclerotic cardiovascular disease (ASCVD), defined as coronary heart disease (CHD), cerebrovascular disease, or peripheral arterial disease presumed to be of atherosclerotic origin, is the leading cause of morbidity and mortality for individuals with diabetes and results in an

estimated $37.3 billion in cardiovascular-related spending per year associated with diabetes[3]. According to the American Diabetes Association 2023 Standards of Care in Diabetes:

- Sustaining an A1c reduction for 12 months will avoid $5,124 in health care costs per patient.
- Sustaining an A1c reduction for an additional 12 months would avoid an additional $3,624 per patient[4].

Addressing common sources of chronic disease leads to improved patient health and a scalable target for improving value-based care outcomes. Although the American Diabetes Association defines patients with an A1c of 7% or higher as uncontrolled, Medicare defines it at 9% and the Corewell Health team targets patients with an A1c of 8% or higher[5].
Corewell Health's journey to value-based care drove focused interest in a more sophisticated model of allied health team support. By positioning nurse care managers to deliver a refined model of longitudinal care management, chronic disease control improved. Diabetes and hypertension management was the initial focus used to test the principles of longitudinal care management. Achieving success in control of these chronic diseases can have a cumulative effect on patient motivation, building confidence toward managing other clinical conditions and health-related needs.

Early publicly-funded programs focused on process metrics — individual outreaches to all members and total population utilization of unplanned acute care, like emergency visits and inpatient care. As Corewell Health considered entry into full-risk contract arrangements, we zoomed out to a more strategic level, considering the possibilities of applying different levels of teaching and support to patients who were more complex and could benefit from short bursts of personalized support at clinical inflection points that were most impactful to their total cost of care. Corewell Health used this pivot into more intense value-based risk contracts as an opportunity to advance a more focused program design that was driven by clinical and utilization outcomes, rather than process measures. Instead of focusing resources on patients who were low risk for needing or returning to acute care, or patients who were already being cared for by another care navigation team, we could look upstream and focus on longitudinal care management for patients with uncontrolled diabetes.

Corewell Health's value-based risk contracts include arrangements with two commercial payers and traditional Medicare. As a result, caseloads include patients with commercial products, Medicare advantage plans, Medicaid and traditional Medicare. The precise payer mix varies for each care manager based on attribution in each practice.

Prior to the workflow redesign that began in 2020, care managers worked with considerable personal latitude to identify patients and provide assessments, care plans, self-management and goal setting conversations, guided by their individual clinical acumen. This caused unwarranted variation in the cadence and quality of encounters, proportion of face-to-face and phone interactions and length of episodes. Variation made it difficult to articulate to patients and providers the services they were being offered. Even after many years of having embedded team members in their practice, providers often said they didn't understand the care manager's role.

Potential lack of endorsement from their primary care provider can negatively impact patient engagement. This gap in clarity and understanding concerned operational leaders and team members at the clinical interface.

A lack of consistent encounter cadence was not the only problem the design team needed to solve. We needed to clarify instructions to personalize conflicting care goals, encourage patients toward confident health literacy and disease compliance, and graduate patients more quickly from our longitudinal support so we could engage a new set of patients. The team often kept patient cases open long after self-management had been achieved, concerned that patients might regress. We needed to embolden team members to graduate patients and trust that patients would reach out to us if their situation changed.

The initial ambulatory care management design, with no targeted intervention, took place from January 2020 to December 2021. It included 2,744 patient care management episodes in Corewell Health primary care offices with an A1c of 8 or higher, and with 1,708 of these patients with A1c of 9 or higher (see Table 1 for pre- and post-intervention mean A1cs.) Little data was collected on sustainment of A1c reduction but 443 patients with an A1c of 8 or higher were also diagnosed with hypertension.

Table 1

Initial Design (no targeted intervention)	January 2020-December 2021	Patients with Pre-Encounter A1c of 8+					Patients with Pre-Encounter A1c of 9+				
		# of episodes	Mean A1c Pre-intervention	Mean A1c Post-intervention	Pre/Post Delta	p-value	# of episodes	Mean A1c Pre-intervention	Mean A1c Post-intervention	Pre/Post Delta	p-value
		2744	9.91	8.77	**-1.14**	<0.001	1708	10.83	9.25	**-1.58**	<0.001

Initial Design (no targeted intervention)	January 2020-December 2021	Patients with Pre-Encounter Systolic BP ≥140 and A1c of 8+							
		# of episodes	Mean Systolic BP Pre-encounter	Mean Systolic BP Post-encounter	Pre/Post Delta	Pre/Post p-value	Mean Systolic BP 90-days Post-encounter	Pre/90-days post Delta	Post / 90-days Post p-value
		443	151.22	140.34	**-10.88**	<0.001	136.33	**-14.89**	<0.001

Initial Design (no targeted intervention)	January 2020-December 2021	Patients with Pre-Encounter Systolic BP ≥140 and A1c of 9+							
		# of episodes	Mean Systolic BP Pre-encounter	Mean Systolic BP Post-encounter	Pre/Post Change	Pre/Post p-value	Mean Systolic BP 90-days Post-encounter	Pre/90-days post Change	Post / 90-days Post p-value
		279	151.32	**139.53**	-11.79	<0.001	136.87	**-14.45**	0.005905

The numerator for this case study is all patients with a Corewell Health primary care provider, in a value-based contract and with an A1c of 8 or greater who participated in the targeted longitudinal care management intervention. The denominator is all patients with a Corewell Health primary care provider and diagnosed with diabetes.

Design and Implementation Model Practices and Governance

Corewell Health envisions health care that is simple, affordable, equitable and exceptional. When done well, chronic disease management aligns to that vision. Improving self-management skills and quality of life for patients are key goals of chronic disease management. Mitigating high-cost utilization and slowing disease progression creates mutual success for patients and health care systems. Reaching out to patients who may not have the health literacy or agency to ask for what they need ensures that all patients in our population are offered access to the care they deserve.

Value-based contracting allows us to think beyond a traditional health care mindset and highlight teaming opportunities that support effective clinical approaches to disease management.

Much has been said about the total cost of care created by the top 5% of highest-cost patients in the United States. If an integrated delivery system intends to invest in long term, sustainable success of value-based care delivery for their community, it is worth considering impactful clinical improvement on the second 5% of patients in the population. Often these patients have a clinical disease burden that is more biologically amenable to behavioral and clinical intervention. Like the effect of more aggressive statin lowering of low-density lipoprotein (LDL) 20 years ago, improved control of hypertension and diabetes yields results for years beyond the real-time clinical improvement[6]. Improving control of hypertension and diabetes reduces costs of care and raises the confidence of patients and families that integrated delivery systems would like to retain in value-based arrangements. It demonstrates health system investment in the agenda important to each patient — achieving the highest number of healthy days of high function each year. It is ideal to find those who need help with chronic disease control before health outcomes devolve into a state that requires unplanned, acute care. Extending the time a person spends in lesser intensity disease states pays dividends to patients and value-based health systems[7,8]. Once these goals have been identified, a framework is helpful to guide team efforts to design operational and technical improvements in system design.

The Multidisciplinary Approach to Disease Over Time (MADOT) framework (Figure 1) took shape as Corewell Health teams designed solutions for key complex health journeys. It builds upon the classic recommendation to use multidisciplinary care teams in clinical settings[9] by being more specific about how those teams should find patients, determine goals of care and ensure improvement in personal health management. As care coordination attention shifted to people managing multiple disease conditions, a patient persona became apparent. For many people who find themselves diagnosed with a growing number of chronic diseases, inter-related challenges to daily management can lead to frustration, disengagement and "non-compliance." This framework provides guidance for complex health care systems to make room for the care needed by a minority of complex patients, without disturbing the complicated processes that move non-complex patients through a high-production environment operating the business model of Fee-For-Service (FFS) medicine. The MADOT framework also reframes conversations often characterized as a problem of "non-compliance" into a space of broader understanding and potential for cooperative agenda between complex patients and the health care teams desiring to create a space for optimal health[10]. This framework was originally applied to readmission reduction with success, giving the team confidence to utilize it in other settings[11].

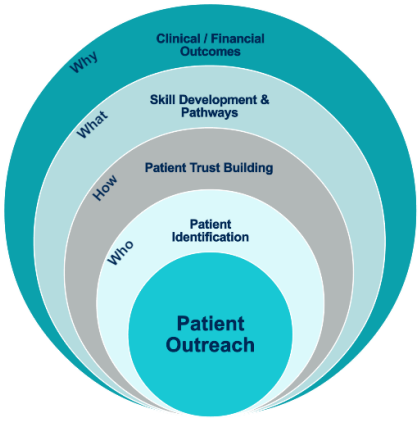


Figure 1: The MADOT Framework

The MADOT framework details incremental steps needed to design a clinical intervention that supports strategic value-based care work and match the right patients to the designed intervention. By identifying patients who are ready to respond to relationship-focused outreaches and applying additional team member competencies that encourage patient development of self-management skills, complex patients are more likely to stay engaged in clinical programs to completion. Successful program graduations lead to increased aggregate improvement of population outcomes.

In the MADOT framework, the intersectionality of patient identification, trust building and specialized skill development prevent the deficiencies seen by using only a pair of these three considerations. Wrapping these three design elements with feedback from clinical outcomes gives rise to continuous improvement. Inclusion of financial outcomes calls attention to sustainability of these programs in a robust portfolio of health care strategies. Key concepts of the MADOT framework revolve around putting patients at the center of the healing journey, including:

- Focus on patient agendas rather than health care provider agendas.
- Attempting to solve problems with an aligned timeframe to the patient's and family's sense of urgency.
- Using predictive analytics and electronic health record (EHR) flags to aid identification of the most complex patients, with particular intent to include:
    - Those who are vulnerable, due to lack of a support system.
- Those with an emerging temporary health-related social need, like lack of fresh food, due to a hospital stay of two to three weeks.
    - Those who may not understand what they need or have the agency necessary to articulate that need.
    - Those with an emerging depression or anxiety, accompanying a surprising new clinical diagnosis, like advanced cancer or serious heart condition.
    - Those with suboptimal access to internet service, particularly services robust enough to allow video visits and remote patient monitoring.

Care coordination leadership posited that patients with well-developed self-management skills could achieve and sustain improved clinical outcomes, lowering their total cost of care and requiring less utilization of acute care. The program was redesigned with consistent workflows and structure to support specific chronic disease management and whole person care through LCM. Patients targeted for the redesigned interventions show objective signs of uncontrolled chronic disease and manage multiple chronic conditions. Patients managing multiple medical issues often see several office-based teams for care. Multiple care teams were not always aware of the interdependent and conflicting instructions provided to a single patient, nor the struggle created for patients who needed to interpret these instructions. For a person with several detailed clinical plans, optimizing a disease state while balancing multiple complicated sets of instructions can cause frustration[12]. The LCM intervention starts with trust building and identification of opportunities to personalize clinical management plans that could be confusing to one person receiving advice from multiple care teams. Patients are actively engaged in setting the goals and care plans, leading to increased satisfaction and confidence in their health care journey.

With a clearly defined beginning, middle and end to the program, the team was able to track interventions to determine what was most impactful in the care design and to monitor productivity for team members working in multiple care locations. The new design was an intentional shift to top of license practice. Monitoring productivity allowed leaders to focus team members on optimizing the amount of time spent on the highest use of their clinical skills.

When space is created for allied health team members to practice at the top of their license, they can effectively focus on building health literacy with complex patients and facilitate patient-centered goal setting to foster realistic and achievable progress that engages each patient. The care manager serves as a collaborative resource between patients and providers, working to meet an individual's health goals of self-management, increasing opportunities to achieve behavior change and disease control. To achieve these objectives, care managers conduct a whole-person assessment, facilitate care plans, provide education and care coordination and serve as patient advocates. Success for each graduate is the improved understanding of their complex personal medical needs and increased confidence in their own ability to advocate for their health needs. Care managers affirm understanding by monitoring the patient's ability to teach back disease-specific information and advocacy through effective communication during encounters with providers and other members of the care team. Confidence, combined with enhanced self-management abilities, are the key to patients meeting their goals and sustaining (or improving) their progress.

Ticia Baird, M.D., was leading care coordination across Corewell Health inpatient and ambulatory. Dr. Baird knew that the existing Epic system could be optimized, leveraging the information contained in the system to better support the work her teams needed to accomplish. In early 2020, utilizing the Scaled Agile Framework (SAFe) methodology (Figure 2), the clinical care coordination and digital services teams partnered to improve patient outcomes using a new approach that allowed for close collaboration between operations and development to build capabilities in Epic that would best support the care managers.

The new approach required a new process for breaking down the work into smaller incremental valuable components that could be continuously integrated into the larger working solution by a dedicated network of cross-functional, value-aligned teams. The care coordination clinical team, including registered nurse care managers (NCM), master's prepared social workers (MSW) and community health workers (CHW), were the key subject matter experts involved in the design and implementation to ensure planning and development followed a people-centric approach. CHWs often have life experience and provide credibility that sometimes our licensed team members cannot represent, making CHW's instrumental in bridging trust between the patients and the care teams.

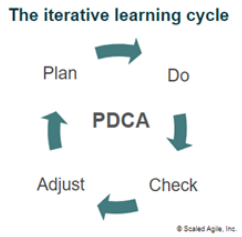


Figure 2

Additionally, this approach improved workflow efficiency and effectiveness to free care managers' capacity to work on the most critical elements of their jobs. The increments of value-delivering work were prioritized using an economical approach to ensure the highest valued items with the least effort were prioritized first to maximize the early value delivery of the integrated solution. The team completed live demonstrations of the integrated working solution routinely at close intervals to ensure early feedback from stakeholders, end-users and the internal application oversight committee was incorporated into the build for continuous optimization of the solution.

Clinical Transformation enabled through Information and Technology

As illustrated in Figure 3, the care manager team partnered with primary care providers across 41 offices to provide intervention for patients with a hemoglobin A1c of 8 or higher that met intervention criteria. The model was initiated with a phased approach, beginning in five pilot locations with a team of early adopters. The remaining locations began adopting the model after six months of refinement in the early adopter practices. It took an additional six months before our operational leaders observed consistent model adherence in chart audits. Along with diabetes, care managers applied a similar redesign to other chronic conditions. These operational changes occurred concurrently to meet the full range of longitudinal care management needs in each location.

Care managers continue to provide other forms of on-demand care coordination and short-term education. In a typical year, 46 care managers spend 50% of their time performing intensive LCM, generating 800 patients engaged in LCM for diabetes annually, with 60% of patients graduating the program successfully. The known supply of over 5,000 diabetes patients in primary care practices with embedded care managers provides an ample supply of LCM patients for future

work. The success of LCM is dependent upon engaging patients who are in a state of readiness to change, or available team members seek out patients who are signaling an optimal readiness for disease improvement. This creates balance in the supply of nurses and demand of patients available for LCM.

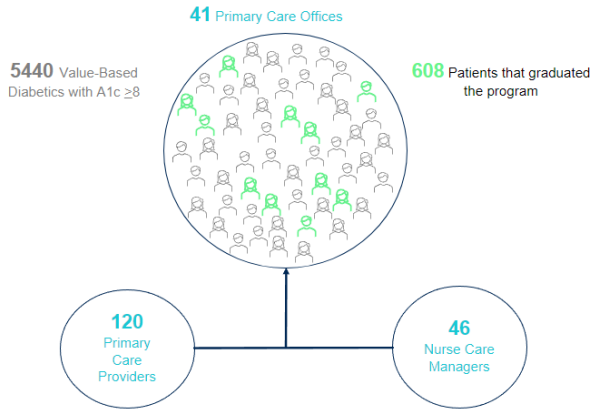


Figure 3: Ecosystem of Longitudinal Diabetes Management

Total eligible pool in value-based contracts vs patients captured in the most first 18 months of program, completing full intervention. This does not include the 40% of disenrolled patients who also saw significant clinical benefit. Eligibility for program enrollment: valued patients with a diagnosis of diabetes type 2 and a hemoglobin A1c of 8 or higher.

The execution of the LCM initiative illustrates the three key aspects of MADOT framework:

- Identifying patients ready to engage in behavior change.
- Deploying a meaningful intervention that would help patients develop self-management skills.
- Specialized skill development for care managers to optimize each encounter during the intervention.

Timely and Actionable Patient Identification

Patient identification improvements focus on identifying patients who might benefit from self-management skills and leverage those skills to improve health-related behaviors. In the past, our team members relied solely on targeting lists generated from payers, which often listed hundreds of patients per primary care location with no information to indicate why the patient might benefit from care management services. Furthermore, payer lists were often generated based on patient cost information from claims that were several months old.

Chart reviews and proactive outreach often demonstrated patients were not appropriate for care management for one of many reasons – patients had experienced significant disease progression and were engaged with hospice or palliative care, the patient was engaged in another similar program and making progress, or the patient had moved to another health system. This method required "cold calling" patients, which did not always produce a positive outcome.

Team feedback indicated the desire for a timely way to effectively identify patients who would most benefit from a longitudinal care management intervention. The design team developed a targeting list to identify patients scheduled for a provider visit in the next seven business days who met the criteria for engagement with the care manager (Type 2 diabetes diagnosis, in a value-based contract, with A1c > 8).

Care managers also engaged patients referred by providers or others identified in care team huddles by the allied health team, as well as location-specific initiatives targeting high-risk populations. Varying our patient identification strategies has improved care manager satisfaction, reduced the amount of time spent in chart review and untargeted outreach, and leverages face-to-face opportunities with patients for first-time engagement with care management services.

Corewell Health care managers use a custom Compass Rose Ambulatory Care Management dashboard (Figure 4). This dashboard leverages Epic's Reporting Workbench functionality to create a Targeting List that generates a list of patients, based on each program's specific criteria. Patients are enrolled in a Compass Rose program from these lists and care managers use additional reports on the dashboard to manage their current caseloads and tasks due.

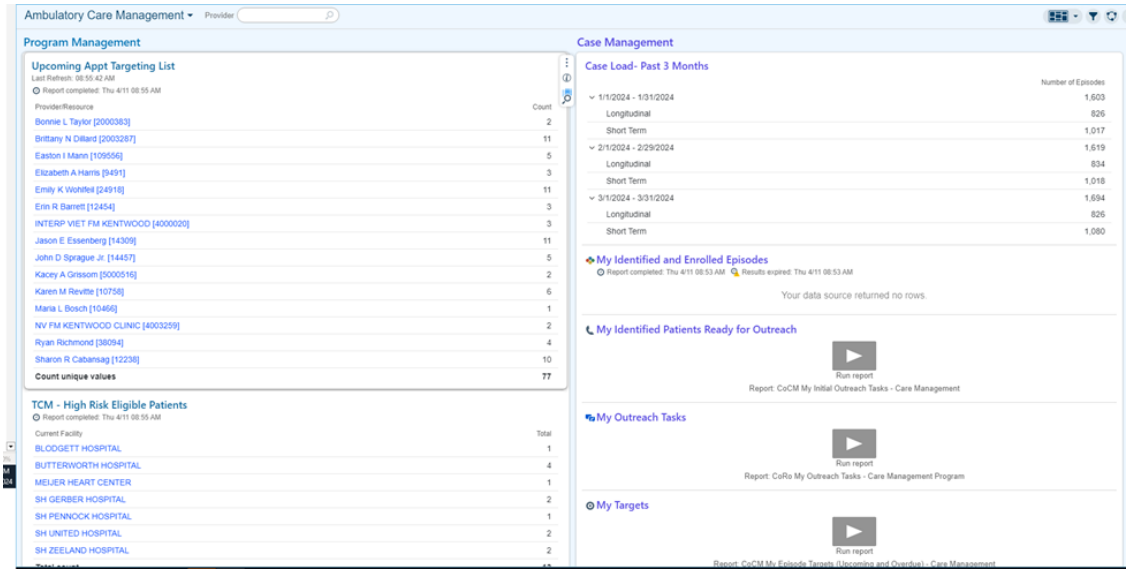


Figure 4

The Upcoming Appt Targeting List Criteria tab finds appointments within the next seven days of patients who (Figure 5):

- Are on the Congestive Heart Failure Registry or Chronic Obstructive Pulmonary Disease Registry.
- *Or* patients with a last A1c of greater than or equal to 8.
- *Or* a last systolic blood pressure (SBP) of greater than or equal to 150.
- *And* are a member of the Blue R program (risk contract) with a John Hopkins ACG risk of moderate, high, or very high.

- *And* who have not declined working with a care manager in the last three months.

If a patient already has an existing care management program, they will not display in this report as they are already part of the caseload for that care manager.

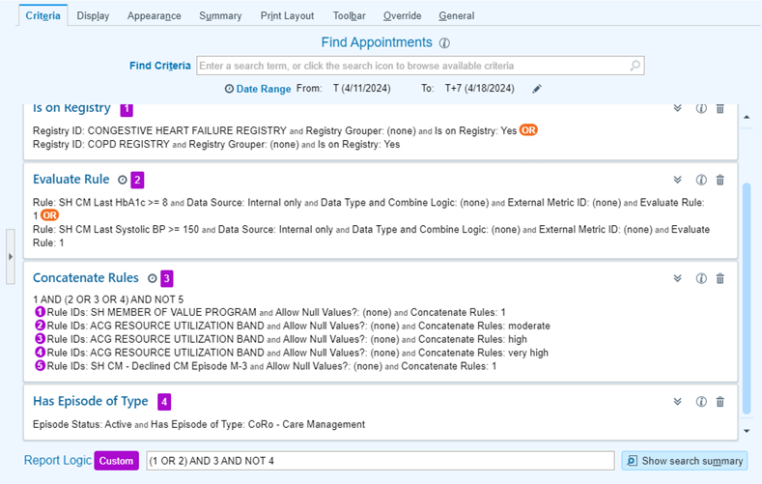


Figure 5

Compass Rose uses program data stored in an episode structure (Figure 6) for coordinated care management. This allows us to add discrete documentation at the episode level for better managing and tracking of our patient populations.

- Case Types assist us in placing a tag on the program for disease tracking.
- The Support and Services section helps drive our clinical workflows for tasks/targets/outreaches. Our care management program has three Support/Service types: Longitudinal, Short Term, and Transitions of Care.

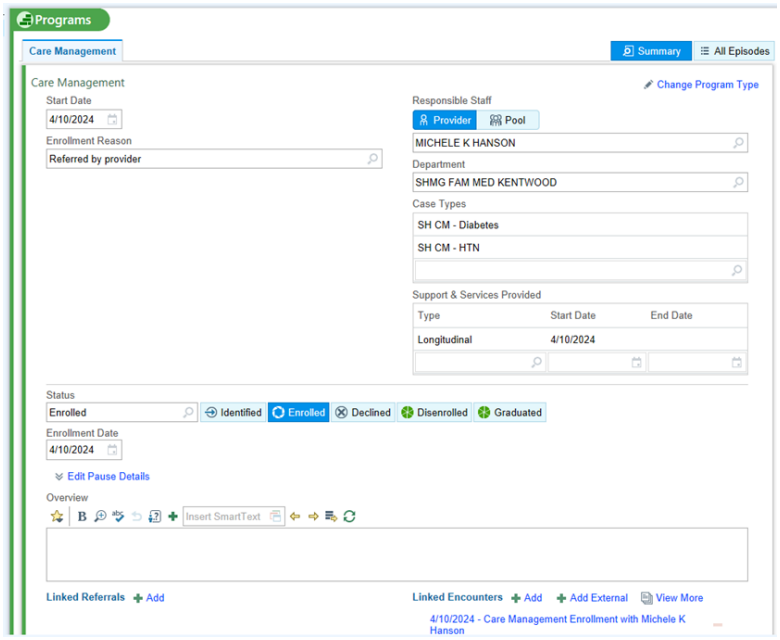


Figure 6

Compass Rose allows us to provide a standardized care model for following patients utilizing the following Epic tools:

- Custom Targets (Figure 7) for each program help us track key performance indicators and program-level milestones.

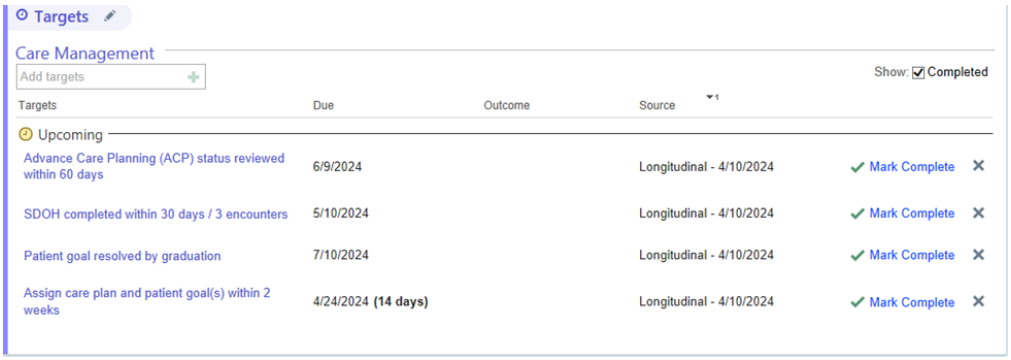


Figure 7

- We designed disease specific custom care plans (Figure 8) focusing on long- and short-term patient centered goals to track and evaluate progress with a patient's overall health.

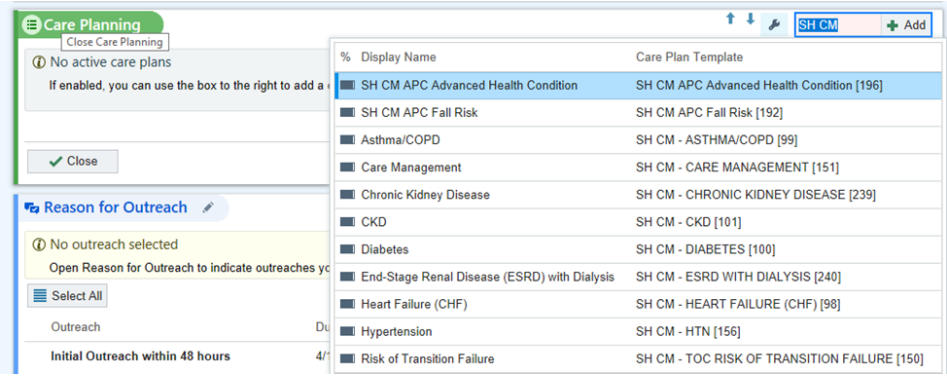


Figure 8

- Outreach tasks (Figure 9) are generated to ensure we provide timely outreach to patients, and assist in prioritizing patients, based on due dates for tasks. For example, we provide an initial outreach within 48 hours of identification for the care management program.

Figure 9

- Checklist Tasks (Figure 10) are auto generated to track and manage day-to-day interventions related to the patient's care.

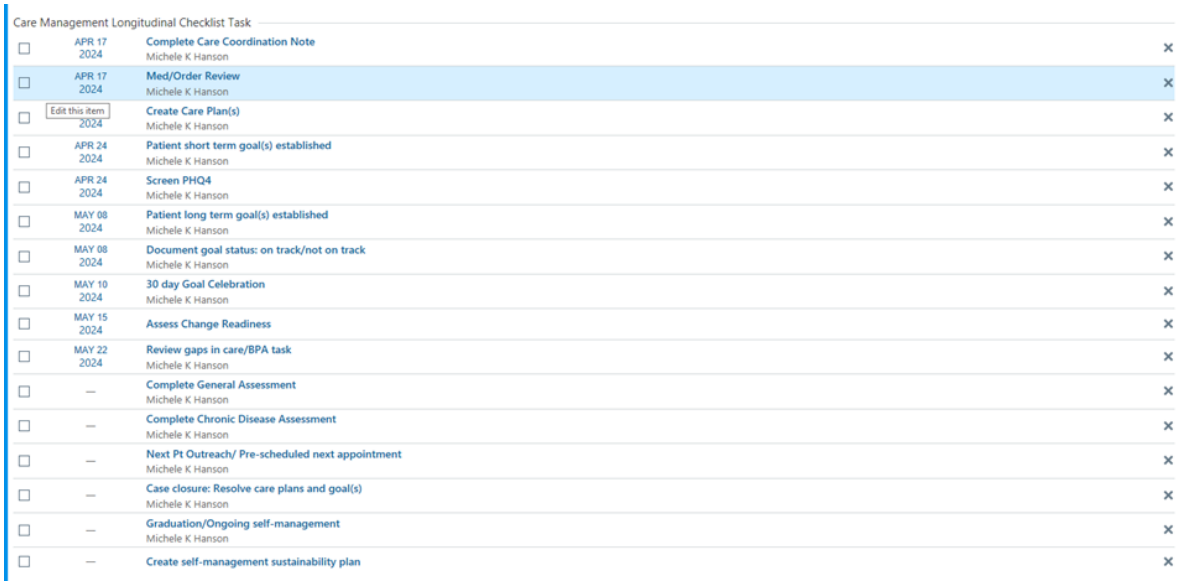


Figure 10

- Multiple custom SmartForms are embedded in the care manager visit navigator (Figure 11) to allow for standardized documentation by our care managers. Using SmartForms allows us to import this documentation to a standardized Note Template that is completed during each encounter.

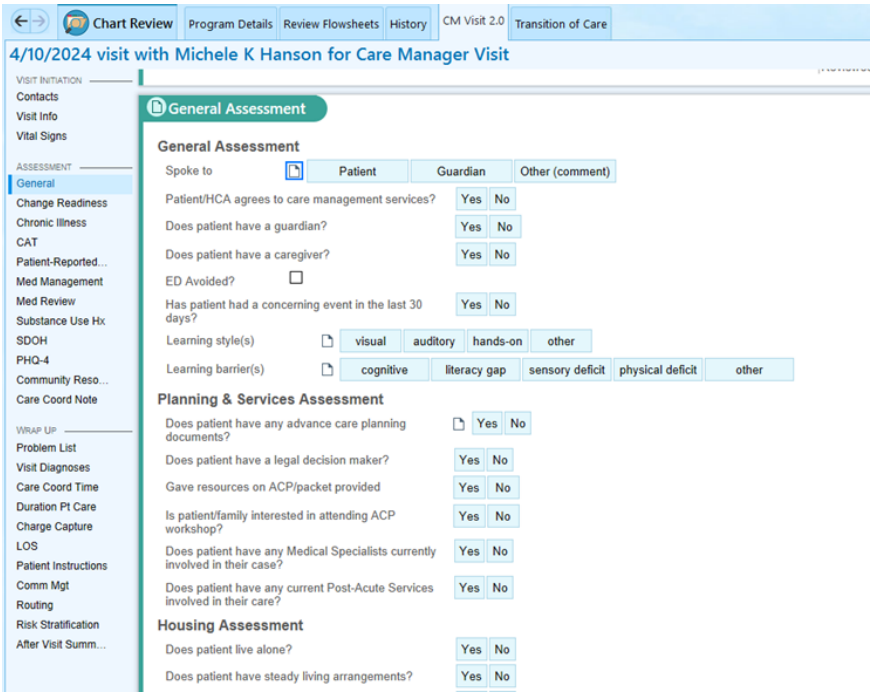


Figure 11

Intervention Design

Patients who agree to longitudinal care management receive a whole-person assessment that encompasses clinical, social and behavioral health (Figure 12). Care managers partner with each patient to assess readiness to change, establish self-management goals and navigate barriers. Engagement with the patient occurs weekly for the first four weeks of an episode and then at least every two weeks until goals are achieved, defined as patient demonstration of successful self-management of daily health behaviors (Figure 13). Episode lengths average around 20 weeks. Reassessment occurs every 30 days to adjust the care plan and goals, based on the patient's progress and wishes. Upon graduation, each patient is supplied a self-management plan that provides strategies to maintain their progress. When reviewing patient data 180 days after graduation, the aggregate population has either maintained or improved their A1c since completing the intervention.

Figure 12: Whole Person Care

Whole-person care at Corewell Health is defined as the aggregate perspective gained by considering each individual's clinical health + behavioral health + social determinants of health.

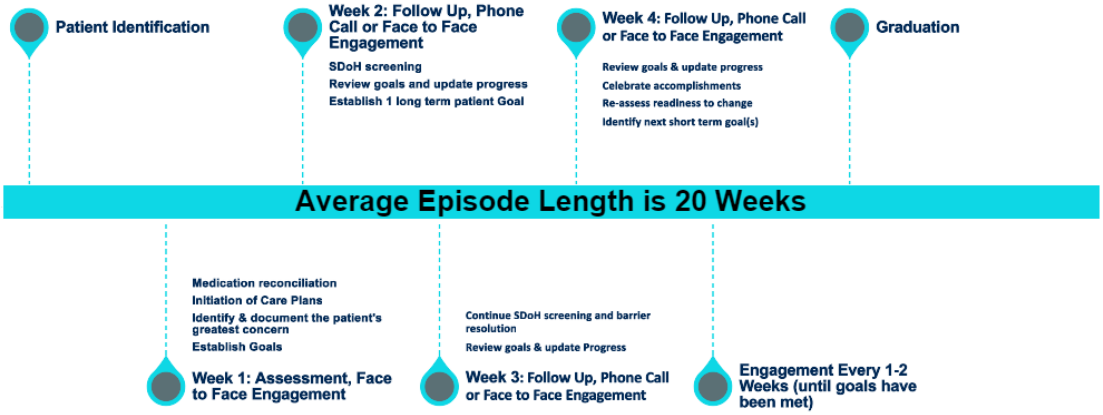


Figure 13: Intervention Timeline

Longitudinal Care Management uses defined outreaches and tasks on a timeline queued from the electronic health record to the care manager. Additional follow-up and outreaches can be initiated by care managers or patients involved in the intervention.

Care managers interact with patients in person and by telephone. Whenever possible, care managers conduct two face-to-face encounters in the first four weeks with phone calls on alternate weeks to optimize trust building and partnership with patients. Face-to-face interaction occurs at least one time per month after the first four weeks. We encourage care managers to pre-schedule all encounters with patients. Formalizing each encounter by scheduling an appointment communicates to patients that this is not merely a friendly check, but rather an intentional clinical intervention. If patients experience a barrier or express a preference for virtual or telephonic visits, care managers will support barrier resolution and/or accommodate preferences.

This intervention is driven by continually placing patient goals at the forefront. Patients identify goals that are SMART: specific, measurable, achievable and time bound. Helping patients navigate barriers, identify strengths, and build self-management skills are keys to a successful

intervention. At least 50% of premature mortality is a result of health behaviors such as smoking, poor diet and physical inactivity[13]. Assessing a patient's readiness to change and providing stage matched support as they move through change stages is vital. Other interventions include depression and anxiety screening, problem solving health related social needs, care coordination with specialty offices or community-based organizations and patient education. The American Diabetes Association Standards of Care in Diabetes recommends a collaboration among a multidisciplinary team as an effective method to maintain momentum toward patient goals[14]. Our care managers regularly facilitate care conferences with primary care providers and other allied health team members to align care plans and leverage the unique skill set of the entire health care team. Near graduation, care managers, in collaboration with the patients, develop a sustainability plan to maintain progress after the intervention. Patients can re-enroll in the program any time if they decompensate, receive a new diagnosis or experience an acute event.

Specialized Skill Development

From the first encounter, establishing a quick rapport is crucial to trust-building. Establishing trust leads to honest conversations about health behaviors, barriers and fears, which makes for more effective care not only with the care managers, but the entire health care team. It's this ability to build rapport and trust that has facilitated a 92% enrollment rate and 63% graduation rate in the longitudinal care management intervention. Reasons for patients who do not graduate from the program include changing providers, transitioning to a new level of care, or declining continued engagement. Since the start of the program, we have observed a steady increase of patients enrolled, as care managers have fully adopted the model. The number of enrollments and graduates doubled between 2002 and 2023. Although a full intervention is optimal, patients who receive a partial intervention do benefit from improved hemoglobin A1c (see disenrolled patients, Table 2 in the "Improving patient outcomes" section).

To ensure a successful program, our care managers need the tools and skills to support patients in achieving their optimal health. This goes beyond disease-specific training, so we enhanced our onboarding process for new team members, spending additional time on screening processes, SMART goals, diabetes education, team-based care, patient engagement and motivational interviewing (MI). Developed by specialists in the field of addictions, MI can be an effective tool in the health care setting, as a strategy to support patients engaging in health-related behavior change, but specific training in MI skills, such as asking open-ended questions, reflective listening and summarizing patient statements is essential[15]. As new training courses are developed, established team members have opportunities to attend, to enhance and refresh their skills. We also employ a dedicated educator to develop training content, assist with on-boarding and help team members maintain clinical competencies.

The Corewell Health LCM team in West Michigan is comprised of 46 nurse care managers across 41 primary care offices. Each care manager has multiple responsibilities, such as longitudinal care management, short-term care management and team interactions via meetings and huddles. The average longitudinal care management caseload per care manager is 25-30 patients at a time, with the intensive intervention timeline of 12-18 weeks described above.

Improving Adherence to the Standard of Care

Supervisors and managers use the Case Analysis and Productivity dashboard to track program-related metrics. Several different reporting modalities are used to track trending metrics over time, with an emphasis on Epic's SlicerDicer toolkit. Custom structured query language (SQL) code is leveraged to create SlicerDicer data models, filters and reports that populate the dashboard. Users can view the sessions by a variety of summary levels: individual case manager, patient PCP department, and support & service types.

The clinical outcomes dashboard is used to track clinical indicators for longitudinal patients with a case type of "Diabetes" or "SH CM – Diabetes." These metrics use a patient's episode as an anchor event. The data produced by these SlicerDicer sessions is derived from a custom data mart in Caboodle developed to track care management episode outcomes. Each session only returns episodes for patients who have a recorded "pre-engagement" and "post-engagement" value in the data mart, resulting in the varying number of episodes included in each metric. Pre-engaged values are defined as the closest recorded value to a patient's episode start date. Post-engaged values are defined as the closest recorded value to a patient's episode end date. 90d values are defined as the closest recorded value to 90 days-post episode end date for a patient.

Although the longitudinal care management model is focused on patients with uncontrolled diabetes, the multidisciplinary team is also assessing patients for depression, anxiety, and social determinants of health. This whole person approach helps care managers identify the social and behavioral health barriers that might inhibit a patient's ability to self-manage. Social workers and community health workers can contribute to the clinical plan of care to clear barriers and improve patient outcomes.

The American Diabetes Association defines uncontrolled diabetes of an A1c of 7% or greater. Due to resource constraints, the Corewell Health longitudinal care management program actively targets patients with an A1c of 8% or higher. Our proactive targeting list identifies patients with an A1c of 8+ but care managers may prioritize patients with an A1c of 9 or greater due to increased disease burden and potential for the risk of long-term diabetes complications.

Improving Patient Outcomes

Since completing the redesign in early 2022, success of the longitudinal care management model has been demonstrated in patients with uncontrolled diabetes (A1c above 8.0). The team implemented targeted interventions with over 1,000 patients since January 2022, with 608 patients graduating with full completion and has demonstrated an average 2.24-point A1c reduction (Figure 14). Of those 608 patients, 364 had a pre-intervention A1c of 9.0 or higher and achieved a 3.02-point A1c reduction (Figure 15). This is a notable indication of better disease management and can be quantified in cost avoidance using industry standard annual costs of care for uncontrolled diabetes. In addition, patients who experienced co-occurring hypertension experienced an average 16.33-point improvement in systolic blood pressure. Those same patients

achieved a further reduction in systolic blood pressure 90-days after successfully graduating from the intervention.

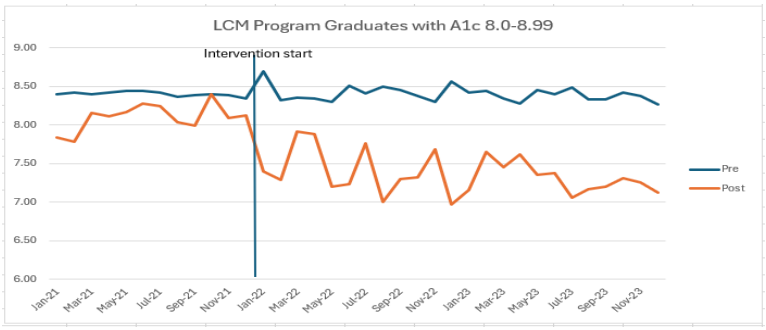


Figure 14

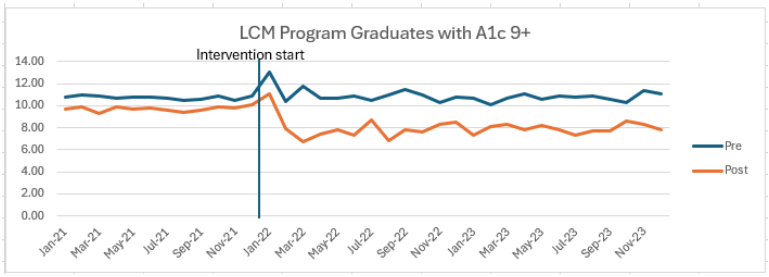


Figure 15

Patients who graduate longitudinal care management with full intervention have achieved the goals outlined in their care plan. Patients identified as disenrolled have received a partial intervention but disengaged before completion of goals and/or a self-management plan. Declined patients received no intervention from the care manager. The A1c of graduated patients is monitored for 180-days after graduation. Aggregate data demonstrates patients maintain or improve A1c at six months.

Table 2 demonstrates A1c improvement for patients who graduated, disenrolled, and declined a longitudinal care management episode. Patients who graduated and received a full intervention achieved A1c almost three times greater than patients who disenrolled and nearly four times greater than patients receiving no intervention. Patients who decline are often in the pre-contemplative stage of change while patients who disenroll saw some benefit, but the same factors that led them to leave the intervention without closing the loop caused them to leave other disease management loops unclosed in their lives, leading to poor compliance. The graduates had an ideal overlap of uncontrolled disease, willingness to change and a trust-building, face-to-face invitation to see their change efforts supported. They took the invitation and met it with their own ongoing commitment to change. From diabetes drug trials, we know that any HgbA1c reduction of 1 point or more is clinically significant and represents notable clinical effect. For patients with A1c over 9 or10, it is not realistic to expect that all A1c values will drop below 7 on the first program time period. As noted below, 90- and 180-day data continues to reflect

clinical improvement toward A1c less than 7. It takes time for the body to fully reach a new set point.

Table 3 demonstrates changes in systolic blood pressure for patients who graduated, disenrolled or declined the A1c intervention. Similar to changes in A1c, patients who graduated with a full intervention saw the greatest improvement in systolic blood pressure than patients who disenrolled or declined.

Table 2: LCM A1c Reduction

Initial Design (no targeted intervention)	January 2020-December 2021	Patients with Pre-Encounter A1c of 8+					Patients with Pre-Encounter A1c of 9+				
		# of episodes	Mean A1c Pre-intervention	Mean A1c Post-intervention	Pre/Post Delta	p-value	# of episodes	Mean A1c Pre-intervention	Mean A1c Post-intervention	Pre/Post Delta	p-value
		2744	9.91	8.77	**-1.14**	<0.001	1708	10.83	9.25	**-1.58**	<0.001
Re-Design Intervention Group	January 2022 - October 2023	Patients with Pre-Intervention A1c of 8+					Patients with Pre-Intervention A1c of 9+				
		# of episodes	Mean A1c Pre-intervention	Mean A1c Post-intervention	Delta	p-value	# of episodes	Mean A1c Pre-intervention	Mean A1c Post-intervention	Delta	p-value
	Graduated	608	9.82	**7.58**	**-2.24**	<0.001	364	10.77	**7.75**	**-3.02**	<0.001
	Disenrolled	401	10.18	9.3	**-0.88**	<0.001	286	10.88	9.76	**-1.12**	<0.001
	Declined	70	9.94	9.3	**-0.64**	<0.001	49	10.58	9.73	**-0.85**	<0.001
	All Patients	1,079	9.98	8.73	-1.25	<0.001	699	10.74	9.08	**-1.66**	<0.001

This table shows the number of episodes patients participated in pre-intervention A1c, post-intervention A1c, and the delta for three groups of patients (those that graduated the program, those that started the program but did not continue to completion, and those that declined to participate). There is a statistically significant difference between the Pre and Post values for all three intervention groups. There is a statistically significant difference between the change from Pre and Post between group for both the A1c of 8+ and 9+ groups.

Table 3: LCM Systolic Blood Pressure (SBP) Reduction

Initial Design (no targeted intervention)	January 2020-December 2021	Patients with Pre-Encounter Systolic BP ≥140 and A1c of 8+							
		# of episodes	Mean Systolic BP Pre-encounter	Mean Systolic BP Post-encounter	Pre/Post Delta	Pre/Post p-value	Mean Systolic BP 90-days Post-encounter	Pre/90-days post Delta	Post / 90-days Post p-value
		443	151.22	140.34	**-10.88**	<0.001	136.33	**-14.89**	<0.001
Re-Design Intervention Group	January 2022 - October 2023	Patients with Pre-Intervention Systolic BP ≥140 and A1c of 8+							
		# of episodes	Mean Systolic BP Pre-encounter	Mean Systolic BP Post-encounter	Pre/Post Delta	Pre/Post p-value	Mean Systolic BP 90-days Post-encounter	Pre/90-days post Delta	Post / 90-days Post p-value
	Graduated	103	151.51	135.18	**-16.33**	<0.001	131.64	**-19.87**	0.025
	Disenrolled	88	151.4	137.31	-14.09	<0.001	136.17	**-15.23**	0.452
	Declined	11	149.55	136	-13.55	0.02739	140.09	**-9.46**	0.800
	Patient Total	202							
Initial Design (no targeted intervention)	January 2020-December 2021	Patients with Pre-Encounter Systolic BP ≥140 and A1c of 9+							
		# of episodes	Mean Systolic BP Pre-encounter	Mean Systolic BP Post-encounter	Pre/Post Change	Pre/Post p-value	Mean Systolic BP 90-days Post-encounter	Pre/90-days post Change	Post / 90-days Post p-value
		279	151.32	**139.53**	-11.79	<0.001	136.87	**-14.45**	0.005905
Re-Design Intervention Group	January 2022 - October 2023	Patients with Pre-Intervention Systolic BP ≥140 and A1c of 9+							
		# of episodes	Mean Systolic BP Pre-encounter	Mean Systolic BP Post-encounter	Pre/Post Change	Pre/Post p-value	Mean Systolic BP 90-days Post-encounter	Pre/90-days post Change	Post / 90-days Post p-value
	Graduated	56	152.39	136.7	**-15.69**	<0.001	**131.36**	**-21.03**	0.022
	Disenrolled	64	149.62	138.23	-11.39	<0.001	137.23	**-12.39**	0.689
	Declined	8	150.38	136.75	-13.63	0.05493	142.38	**-8**	0.611
	Patient Total	128							

There is a statistically significant difference between the Pre and Post values for all three groups. There is a statistically significant difference between Post and 90 day values for only the Graduated group. There is no statistically significant difference between all three groups for either the change from Pre to Post or Post to 90 days.

Accountability and Driving Resilient Care Redesign

Our philosophy is to give patients tools to change behaviors and self-manage. The benefit of these tools extends beyond our engagement and measurement because meeting goals takes time. 90-day and 180-day outcomes demonstrate sustained and often continued improvement.

Supervisors and managers use the Case Analysis and Productivity dashboard (Figure 16) to track program-related metrics. Several different reporting modalities are used to track trending metrics over time, with an emphasis on Epic's SlicerDicer toolkit. Custom SQL code is leveraged to create SlicerDicer data models, filters and reports that populate the dashboard. Users can view the sessions by a variety of summary levels: individual case manager, patient PCP department and support & service types.

As the program gains momentum, we continue to have conversations with private insurance, federal and state payers, and research groups. We are convinced these interventions are effective in helping patients achieve management of their chronic disease and we will continue to seek partnerships to expand our services. Using technology to help identify the right patients and track interventions has positioned us well to share the success of the program as we seek additional collaborators.

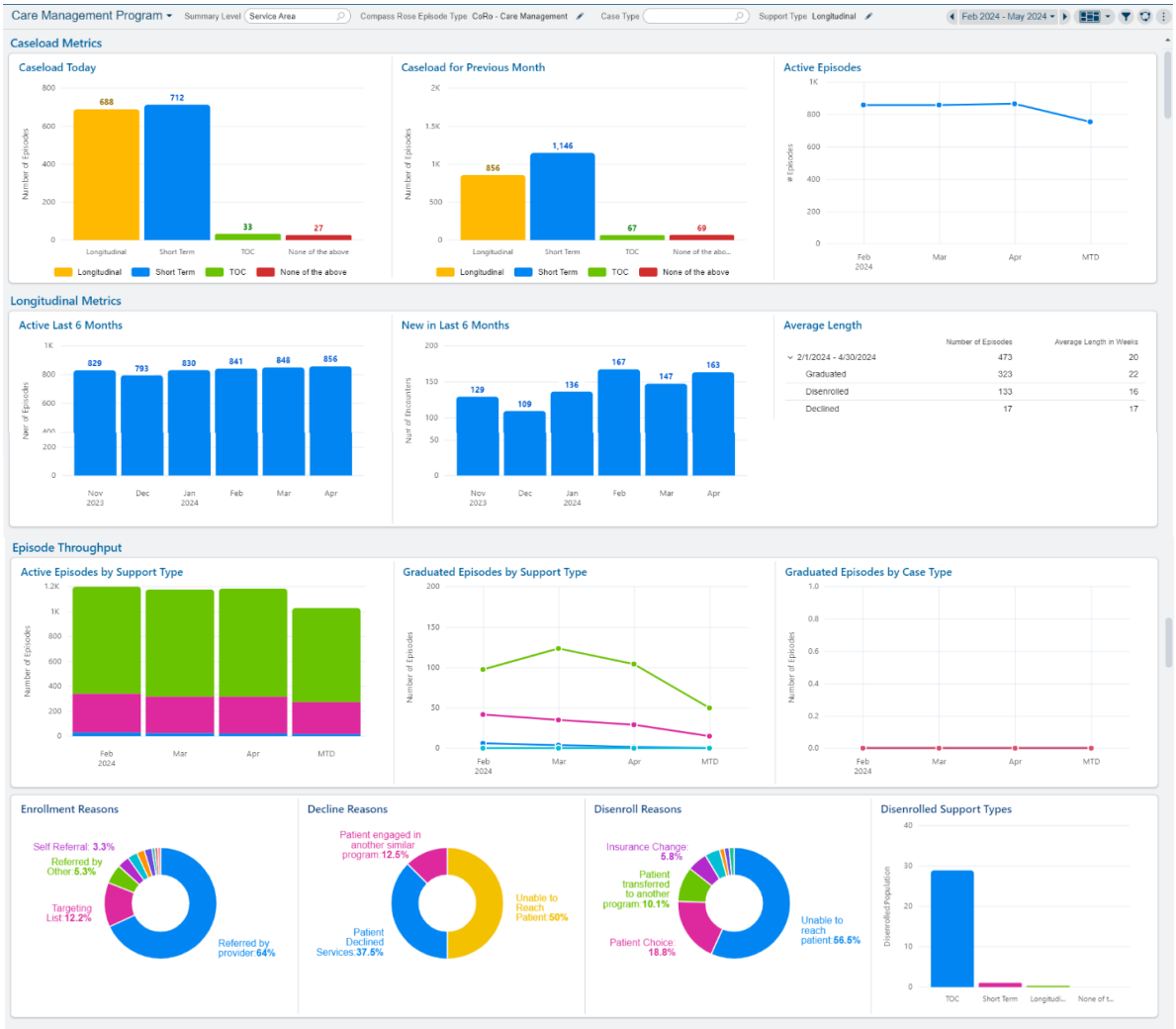
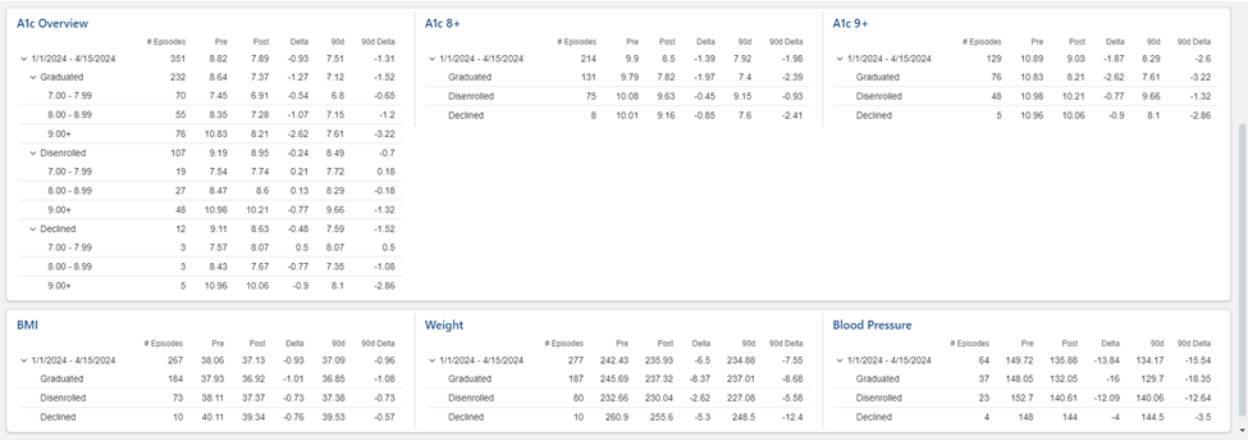


Figure 16

The clinical outcomes dashboard (Figure 17) is used to track clinical indicators for longitudinal patients with a case type of "Diabetes" or "SH CM – Diabetes." These metrics use a patient's episode as an anchor event. The data produced by these SlicerDicer sessions is derived from a custom data mart in Caboodle developed to track care management episode outcomes. Each session only returns episodes for patients who have a recorded "pre-engagement" and "post-engagement" value in the data mart, hence the varying number of episodes included in each metric. Pre-engaged values are defined as the closest recorded value to a patient's episode start date. Post-engaged values are defined as the closest recorded value to a patient's episode end date. 90d values are defined as the closest recorded value to 90 days-post episode end date for a patient.



A1c Overview

	# Episodes	Pre	Post	Delta	90d	90d Delta
1/1/2024 - 4/15/2024	351	8.82	7.89	-0.93	7.51	-1.31
Graduated	232	8.64	7.37	-1.27	7.12	-1.52
7.00 - 7.99	70	7.45	6.91	-0.54	6.8	-0.65
8.00 - 8.99	55	8.35	7.28	-1.07	7.15	-1.2
9.00+	76	10.83	8.21	-2.62	7.61	-3.22
Disenrolled	107	9.19	8.95	-0.24	8.49	-0.7
7.00 - 7.99	19	7.54	7.74	0.21	7.72	0.18
8.00 - 8.99	27	8.47	8.6	0.13	8.29	-0.18
9.00+	48	10.98	10.21	-0.77	9.66	-1.32
Declined	12	9.11	8.63	-0.48	7.59	-1.52
7.00 - 7.99	3	7.57	8.07	0.5	8.07	0.5
8.00 - 8.99	3	8.43	7.67	-0.77	7.35	-1.08
9.00+	5	10.96	10.06	-0.9	8.1	-2.86

A1c 8+

	# Episodes	Pre	Post	Delta	90d	90d Delta
1/1/2024 - 4/15/2024	214	9.9	8.5	-1.39	7.92	-1.98
Graduated	131	9.79	7.82	-1.97	7.4	-2.39
Disenrolled	75	10.08	9.63	-0.45	9.15	-0.93
Declined	8	10.01	9.16	-0.85	7.6	-2.41

A1c 9+

	# Episodes	Pre	Post	Delta	90d	90d Delta
1/1/2024 - 4/15/2024	129	10.89	9.03	-1.87	8.29	-2.6
Graduated	76	10.83	8.21	-2.62	7.61	-3.22
Disenrolled	48	10.98	10.21	-0.77	9.66	-1.32
Declined	5	10.96	10.06	-0.9	8.1	-2.86

BMI

	# Episodes	Pre	Post	Delta	90d	90d Delta
1/1/2024 - 4/15/2024	267	38.06	37.13	-0.93	37.09	-0.96
Graduated	184	37.93	36.92	-1.01	36.85	-1.08
Disenrolled	73	38.11	37.37	-0.73	37.38	-0.73
Declined	10	40.11	39.34	-0.76	39.53	-0.57

Weight

	# Episodes	Pre	Post	Delta	90d	90d Delta
1/1/2024 - 4/15/2024	277	242.43	235.93	-6.5	234.88	-7.55
Graduated	187	245.69	237.32	-8.37	237.01	-8.68
Disenrolled	80	232.66	230.04	-2.62	227.08	-5.58
Declined	10	260.9	255.6	-5.3	248.5	-12.4

Blood Pressure

	# Episodes	Pre	Post	Delta	90d	90d Delta
1/1/2024 - 4/15/2024	64	149.72	135.88	-13.84	134.17	-15.54
Graduated	37	148.05	132.05	-16	129.7	-18.35
Disenrolled	23	152.7	140.61	-12.09	140.06	-12.64
Declined	4	148	144	-4	144.5	-3.5

Figure 17

HIMSS Global Conference Audience Guidance (This will not be published)

Topic Guidance: Check three which apply to this case study

Clinical Informatics and Clinician Engagement

Clinically Integrated Supply Chain

Consumer/Patient Engagement and Digital/Connected Health

Consumerization of Health

Culture of Care and Care Coordination

Data Science/Analytics/Clinical and Business Intelligence

Disruptive Care Models

Grand Societal Challenges

Health Informatics Education

Health Information Exchange

Interoperability

Data Integration, and Standards

Healthcare Applications and Technologies Enabling Care Delivery

Healthy Aging and Technology

Improving Quality Outcomes

Innovation, Entrepreneurship, and Venture Investment

Leadership, Governance, and Strategic Planning

Population Health Management and Public Health

Precision Medicine and Genomics

Process Improvement, Workflow, and Change Management

Social, and Behavioral Determinants of Health

Telehealth

User Experience (UX)

Usability

User-Centered Design

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