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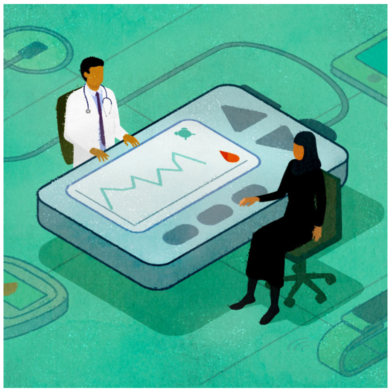

A Hybrid Care Model to Manage Diabetes Mellitus in the United Arab Emirates

Ihsan Almarzooqi, PhD, Hala Zakaria, MSc, Ali Hashemi, MBA

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The GluCare.Health hybrid care model represents a potentially groundbreaking approach to diabetes management that integrates on-site and remote components. With the global burden of diabetes projected to affect 783 million people by 2045, this model addresses the shortcomings of both traditional care and virtual care as stand-alone modalities, emphasizing patient engagement. Hybrid care combines the strengths of both in-person visits and digital health technologies to provide a continuous-engagement care model. Under the GluCare.Health hybrid model, the physical clinic, aligned with American Diabetes Association standards, offers personalized consultations and an intuitive layout. The virtual component employs remote continuous data monitoring and utilizes wearables such as the Oura ring for real-time tracking and mobile apps for remote monitoring and engagement, primarily around habits and behaviors across specific parameters that affect metabolic health. Implementation was effective in October 2022 when the model went live. Within just 3 months, significant improvements in certain health parameters were observed, and data at 12 months show similar results. Challenges for this model include scalability, talent recruitment, the physician adoption of continuous care models, reimbursement issues, resistance from older patients, and ethical considerations. The model's success hinges on proactive policy advocacy, community engagement, and iterative refinement to navigate evolving health care landscapes. In essence, GluCare.Health's hybrid model has the potential to become a transformative, patient-centric solution to the escalating global diabetes burden, driving innovation in chronic disease management.

Patients with chronic conditions make daily decisions that impact their illnesses, with the quality of outcomes driven significantly by the patient's own behavior and self-management, arguably more than by the provider's interventions in many cases. Within the chronic disease realm, diabetes management is perhaps most highly influenced by the patient's proactive engagement in their self-management, complemented by periodic advice and counsel from physicians and allied health professionals.[1] Against the backdrop of a largely failing traditional episodic care model, a new model of care, termed *hybrid care*, is emerging. Definitions can vary but, typically, a hybrid model is understood as a combination of in-person visits, telemedicine, and/or remote monitoring, which we do offer. However, we may consider expanding the definition of hybrid care to encompass our unique integration of continuous real-time data collection with immediate feedback loops involving not just health care professionals, but a multidisciplinary team (including sports scientists and health coaches). This real-time approach is a critical part of our hybrid care model and goes beyond the simple use of telemedicine for consultations.

The GluCare.Health hybrid care model is designed so that the provider care team becomes part of a continuous management process alongside the patient, with discrete and focused engagement linked to continuous data received remotely from a range of wearables and medical devices. A central concept in remote continuous data monitoring (RCDM) is for the provider team to use personalized information received from patients (both passively and manually transmitted), often in real time, to provide actionable insights with the goal of achieving sustainable behavioral change. The central tenet of our hybrid care model is that chronic conditions, which are themselves continuously burdensome in patients' lives, must be mirrored by a similarly continuous care model to be managed effectively. The lifestyle modification components provided in all clinical guidelines for metabolic health management — such as exercise, stress management, sleep, dietary choices, etc. — are largely superficially delivered in a typically one-way educational or advisory context today by traditional care providers. Hybrid care allows providers to effectively monitor and manage these lifestyle parameters alongside patients as part of their standard care, but also facilitates two-way communication between the patient and care team to evolve and enhance the educational/awareness aspect of care.

By 2045, among adults aged 20–79 years, the global burden of diabetes is projected to affect 783.2 million people worldwide, an increase from 536.6 million in 2021.[2] The economic cost of the care of diabetes is rising; in the United States, it increased from an estimated US$132 billion annual cost in 2002 (combined direct medical costs and indirect expenditures)[3] to an estimated US$412.9 billion in 2022 (US$306.6 billion in direct medical costs and US$106.3 billion in indirect costs attributable to diabetes).[4] In the United Arab Emirates (UAE), costs amounted to an estimated US$4.16 billion in 2018, representing 23.25% of the UAE's total health expenditure;[5] moreover, a 2004–2005 study of UAE patients found that the average annual management cost per patient with diabetes without complications is estimated at 70% less than that for those with diabetes mellitus complications (US$1,605 vs. US$5,645).[6] Studies have demonstrated that improved care for people with diabetes, including better glycemic and blood pressure control, lipid management, and eye care, can greatly reduce the complications and costs of diabetes over the long term.[7–10] Despite this, medical management provided for people with diabetes is often suboptimal.[11,12]

In the UAE, the 2021 domestic general government health expenditure as a percentage of general government expenditure was 13%; in comparison, the world average share was 11% and the U.S. share was 21% for the same year, according to the World Health Organization.[13] Furthermore, the use of expensive glucagon-like peptide receptor agonists (GLP-1 RAs) as first-line pharmacotherapy in diabetes is expected to create immense pressure on payers, leading to higher costs for governments and payers.

> *"The central tenet of our hybrid care model is that chronic conditions, which are themselves continuously burdensome in patients' lives, must be mirrored by a similarly continuous care model to be managed effectively."*

In the UAE, more than 75% of patients with diabetes have poorly controlled diabetes;[14] at one diabetes care facility in Abu Dhabi, the Imperial College London Diabetes Centre, providers reported an average hemoglobin A1c (HbA1c) of 7.4% for the follow-up visits among the 42,306 patients treated in 2019.[15] Further, in a cross-sectional study, only 80 out of 200 (40%) patients with type 2 diabetes mellitus randomly selected from outpatient clinics in the northern emirates of the UAE reported being adherent; contributing factors included follow-up visit inconsistency, lack of self-motivation, undereducation, and noncompliance.[16] Implementing hybrid care in managing chronic conditions tackles many of these basic adherence factors. Virtual-only care models face challenges in addressing these issues effectively due to limitations in continuous monitoring and personalized patient engagement, according to an evaluation of digital diabetes management solutions.[17]

In contrast, hybrid care integrates remote monitoring technologies and virtual engagements with in-person visits, aiming to overcome these challenges by providing more continuous and personalized support. By integrating these technologies, hybrid care aims to improve clinical outcomes, increase patient satisfaction, and reduce health care costs through better disease management and early intervention. This paper describes the implementation in October 2022 of a hybrid care model pioneered in the UAE by GluCare.Health, including the components of its physical and virtual model, and the challenges and barriers faced when bringing this care model to the market, along with early results.

Current Challenges of the Physical-Only Traditional Care Model

Fragmentation of Care and Disconnected Touchpoints

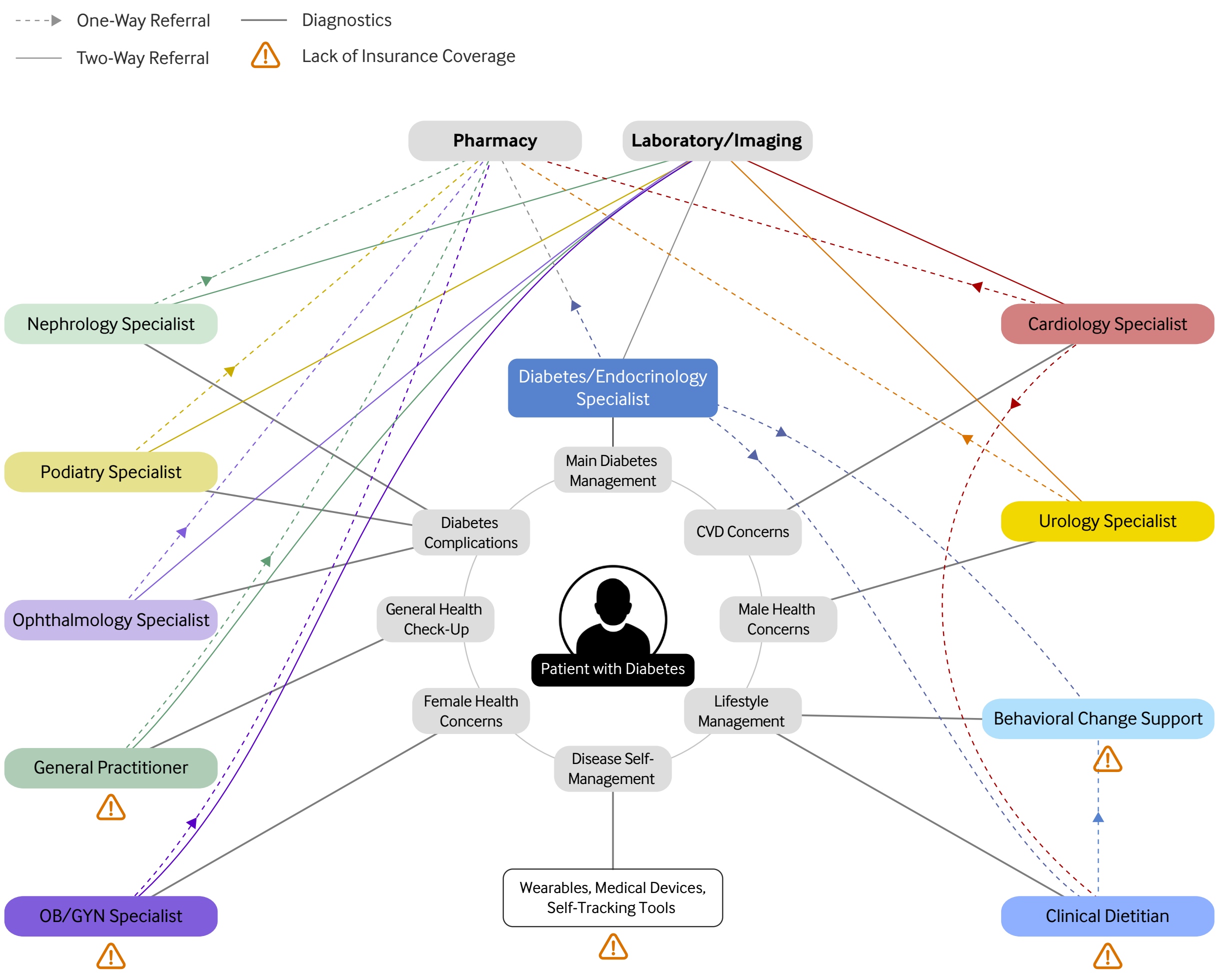
In traditional diabetes care models, patients face complex and disorganized care pathways with various disconnected points of contact (Figure 1), largely due to the many comorbidities associated with diabetes that all require follow-up.

The diagram highlights the challenges posed by insurance limitations, as well as the numerous one-way and two-way referral pathways that are part of this physical-only traditional care model.

FIGURE 1

The Traditional Care Model for a Patient with Diabetes

The illustration conveys the complex nature of the interactions among and between the various clinicians (outer ring) and the patient (center) who navigates a complex web of care and referrals (inner ring).



CVD = cardiovascular disease, OB/GYN = obstetrics and gynecology.
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An additional preliminary diagnostic layer complicates matters further, as blood draws and subsequent lab tests are often asynchronous with the physician visit and require separate visits. Or, in cases where the blood draw is simultaneous with the physician visit, results are postliminary and therefore not useful in informing the contemporaneous conversation with the patient.

These touchpoints, including interactions with different health care providers and services, often operate independently and lack effective communication, integration, and feedback loops. The result is a fragmented and inefficient system that fails to provide cohesive and comprehensive care for patients with diabetes, with the focus, instead, primarily being on billable services. This outdated approach has been proven to fall short in addressing the evolving needs of individuals with diabetes — notably the root contributory behavioral issues — leading to suboptimal health outcomes and an increased burden on the patients themselves. Studies have reported that, despite all efforts, resources, and money spent in the traditional health care system, for high proportions of patients with diabetes, their diabetes remains poorly controlled.[15,18–21]

The Data Explosion

In recent years, the quality and quantity of real-time data from various sources (wearable devices, continuous glucose monitors, connected weight scales, etc.) have improved. Devices have become more accessible and accurate, providing patients with data regarding their sleep stages, glycemic levels, stress levels, heart rate variability, and other relevant biomarkers. Various stand-alone apps and platforms have emerged to help patients dive into this new world of real-time data, but these tools are largely disconnected from the care provision layer managing the patient. The data are also nearly impossible for the physician to synthesize as part of an interaction with the patient — the data are simply too voluminous and too siloed, and correlations between them have not been drawn to form actionable insights. Care providers, when challenged by patients to incorporate and account for new forms of data in their therapeutic journeys, are bound by the limitations in their own understanding of how to best use the data, how to derive useful and actionable insights, and, most critically, how to get reimbursed for the time spent exploring the intersection of remote patient data and clinical care. Consequently, very few diabetes practices today fully leverage the wealth of data that their patients are capable of producing and sharing daily.

> *“Location-wise, considering the quarterly cadence of patients with diabetes visiting their providers, such facilities are better suited to be located in communities than in the outpatient wings of large hospitals.”*

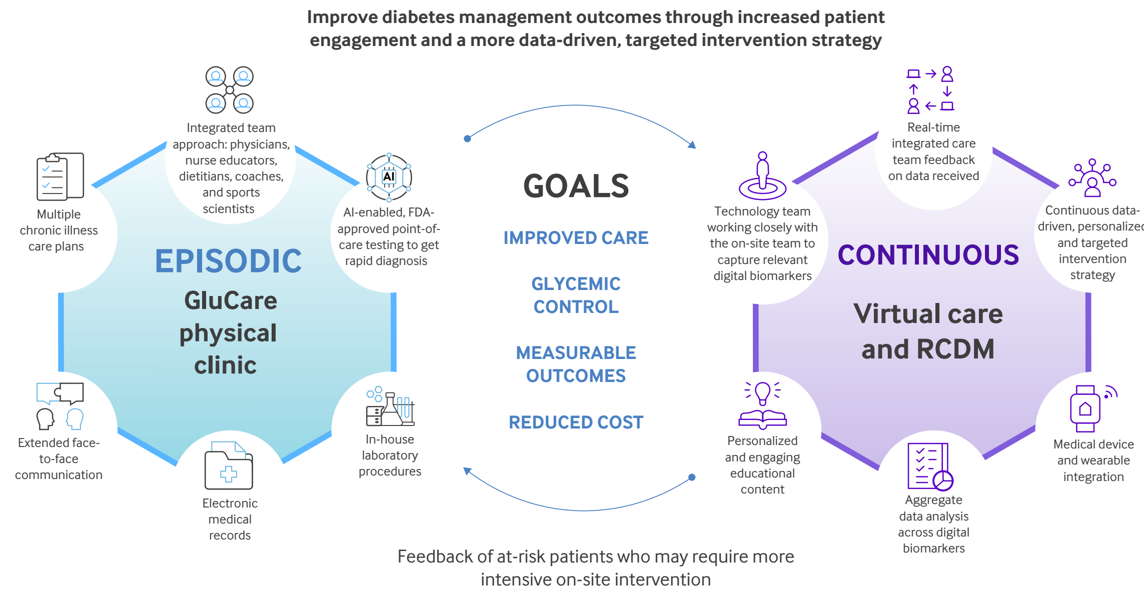
Overview of the GluCare.Health Hybrid Model

There is a pressing need for a transformative shift toward a more integrated, collaborative, and patient-centric model — including the appropriate utilization of remotely collected patient data — to improve the overall effectiveness and quality of diabetes care. In a hybrid model, both physical and virtual data-driven components work hand in glove. The physical clinic serves primarily as a setting for human-to-human communication and the regular blood testing/diagnostics that can only occur in person. Seeds of engagement and trust-building between the physician and the patient are also planted here. Between physical visits, a *virtual clinic* comprising the same core clinical team from the physical visit spends time with the patient *in the cloud*, both unlocking the ability to deliver real-time diabetes management, including behavioral modification, while also providing enhanced patient engagement and a more data-driven set of targeted interventions.

FIGURE 2

GluCare.Health Hybrid Model of Care

This illustration depicts the integration of physical and virtual care in the GluCare.Health Hybrid Model of Care for diabetes disease management.



FDA = U.S. Food and Drug Administration, RCDM = remote continuous data monitoring.
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The GluCare.Health hybrid care model has been implemented in the UAE, a region experiencing a high prevalence of diabetes. Globally, the estimated prevalence of diabetes in adults aged 20–79 years has increased from 151 million (4.6% of the global population at the time) to 537 million (10.5%) in 2021.[22] In the UAE, the 2021 prevalence of diabetes in adults aged 20–79 years was 12.3%, with an age-adjusted comparative diabetes prevalence of 16.4%.[22] The UAE's health care infrastructure and patient demographics present challenges and opportunities that this model is designed to address. Figure 2 demonstrates the integration of the physical and virtual aspects of the GluCare.Health hybrid model. Note the integration of the in-person component for episodic care and the virtual component for continuous care to target four key goals: improving care, achieving glycemic control, defining and meeting measurable outcomes, and reducing the cost of care.

Components of the Physical Clinic

Following the American Diabetes Association's standards of care, the physical component provides personalized consultations with an assigned health care team, including physicians, dietitians, diabetes nurse educators, health coaches, and sports scientists. Care providers lead the development, adoption, and ongoing modification of practice guidelines for patients of different risk levels for their diabetes management and other related comorbidities. Because of the expertise of each of the providers and their familiarity with their patient population, they are able to adapt general guidelines to the specific setting in which they are providing care. Providers also play a critical role in encouraging the active engagement of the patient to participate in the disease management program.

In addition to the comprehensive team composition, the physical clinic is also distinctive in its architecture and functions. The layout of the facility is entirely built around the flow of the patient's journey, and is architecturally designed to be intuitive, to balance public and private spaces, and to be aesthetically distinctive from typical sick-care settings. In addition, the facility includes an on-site laboratory, immediate imaging modalities, and an on-site pharmacy, which enables it to both run real-time labs and scans and fulfill prescriptions, thereby saving patients an extra trip for those specific interactions, thus reducing friction that may impede adherence and leading to an enhancement of patient satisfaction. Numerous U.S. Food and Drug Administration–approved hardware–software pairings have been incorporated into the workflows to allow for point-of-care testing without the need to refer to further specialists; for example, artificial intelligence retinopathy screening avoids the need to refer a patient to an ophthalmologist unless required. Location-wise, considering the quarterly cadence of patients with diabetes visiting their providers, such facilities are better suited to be located in communities than in the outpatient wings of large hospitals.

Components of Virtual Care and RCDM

Virtual care and RCDM complement activities in the physical clinic with real-time, continuous tracking and analysis of various diabetes-related parameters and biomarkers, such as glucose levels (via continuous glucose monitors), stress (derived from heart rate variability), detailed sleep staging, physical activity, food logs, and body weight measurements. As part of its partnership with Oura, the makers of the Oura ring, GluCare.Health's physicians provide the rings (at no additional cost to the patient) in order to capture this information, which includes the ability to view new digital biomarkers, such as cardiovascular age, and even perform a remote cardio capacity test.

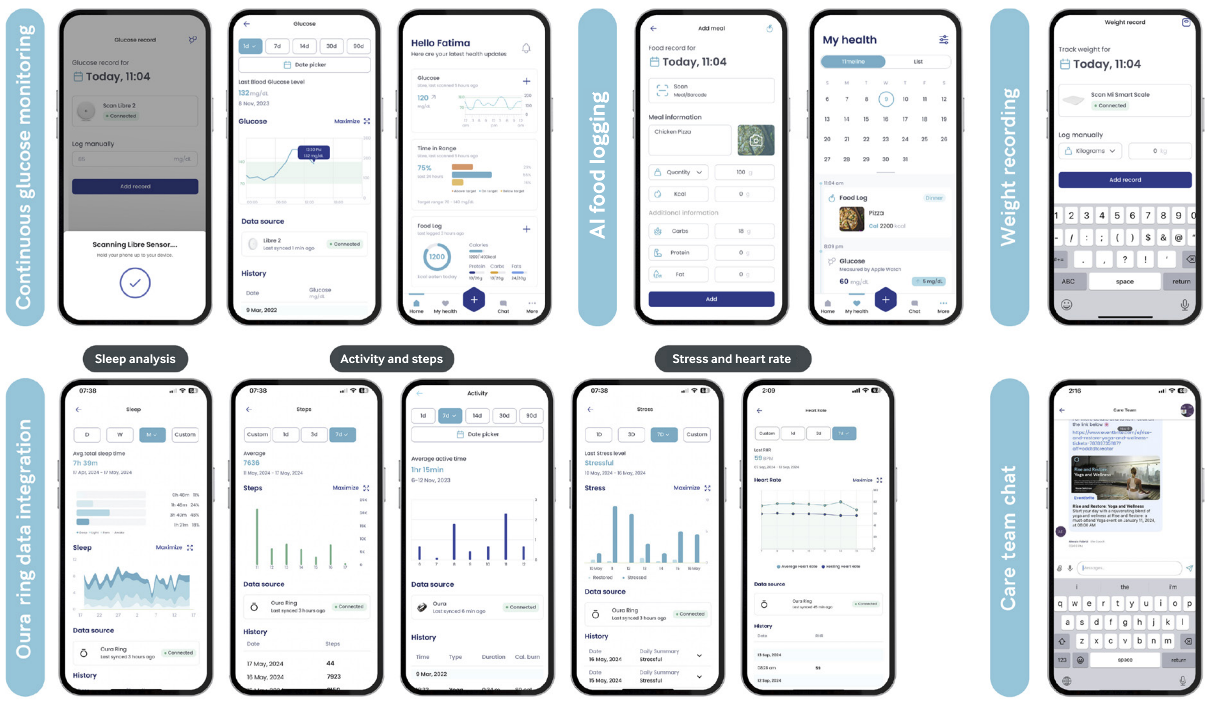
> *"Participation in the virtual component of the care model is engrained in the job descriptions and responsibilities of every relevant staff member, and key performance indicators are measured and tracked."*

Remote pharmacotherapy titrations based on real-time digital biomarkers and patient-reported side effects — particularly concerning multidose medications such as GLP-1 RAs and insulin — are also standard practice. This digital component involves a combination of mobile app technology, remote personalized coaching from health coaches, consultations with diabetic educators/dietitians, personalized resistance training plans from sports scientists, and consultations from board-certified endocrinologists for medication management. The technology was developed to allow for enough customization to support the clinical workflows required in metabolic health management. Snapshots of the mobile application are presented in Figure 3.

FIGURE 3

Snapshots of the GluCare.Health App Featuring Integration of Digital Wearables

This figure illustrates key features of GluCare.Health's hybrid care model, integrating advanced technology with personalized care. It highlights continuous glucose monitoring (top left); AI-driven food logging (top center); weight tracking (top right); and Oura ring data for monitoring heart rate, stress, activity, and sleep patterns (bottom left). These metrics, combined with direct patient-provider communication through the Care Team Chat (bottom right), create a seamless and data-driven approach to managing diabetes effectively.



Source: The authors

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Across the care team, engagement was primarily focused on changing behavior using personalized data received from patients, with key digital biomarkers assigned to certain team members as their primary engagement points. Participation in the virtual component of the care model is engrained in the job descriptions and responsibilities of every relevant staff member, and key performance indicators are measured and tracked. Details on each parameter tracked by each care team member are highlighted in Table 1.

Current cohort estimates sit at 70 patients per coach in a human-only scenario, which could potentially double when automated messaging and machine learning tools are embedded into patient engagement. Additionally, findings from our recently published study highlight that 58 patients who had 11 or more interactions with the care team over 90 days showed significant improvements in HbA1c levels (−2.38) and weight reduction outcomes (−6.00 kg) regardless of initial levels.[23] In contrast, outcomes among 34 patients with four or fewer interactions showed

Table 1. Care Team Members and Parameters Tracked in the Hybrid Care Model

Care Team Member	Parameter Tracked	Description	Engagement KPIs
Life Coach	Stress, sleep, activity, overall engagement	Life coaches use real-time data from the Oura ring to monitor patient stress, sleep, and activity levels. Regular engagement with the patient through the chat tool is critical for providing immediate feedback, encouraging adherence, and ensuring the patient remains motivated.	11–15 interactions across all parameters with an average time spent of 120 minutes per quarter
Diabetes Educator	Insulin dosing, glucose levels, insulin pump data	Diabetes educators track real-time glucose data from CGMs, ensuring patients stay within their TIR. Regular insulin dose adjustments and monitoring are performed remotely through the chat tool, providing flexibility and quick feedback. By analyzing glucose patterns and insulin use, the educator can help prevent glucose excursions and optimize insulin therapy, even from a distance.	
Clinical Dietitian	Food logs, glucose levels, body composition data	Dietitians analyze food logs submitted through the app and correlate them with CGM data to assess the effect of diet on glucose control. Using the chat tool, dietitians provide feedback on meal choices, suggest modifications, increase protein intake, and work closely with the patient to ensure sustainable eating habits that improve glycemic control.	
Sports Scientist	Activity, RHR, body composition data	Sports scientists utilize Oura ring data to monitor the patient's physical activity and RHR. Adjustments to the patient's exercise plan can be made remotely via the chat tool to ensure that physical activity remains within safe and effective parameters. Recovery metrics such as RHR help gauge how well the patient is responding to exercise, and adjustments are made to optimize fitness goals while managing diabetes.	
Endocrinologist/ Primary Care Physician	Medication enquiries, glucose, HR, RHR, symptom tracking, body composition data	Endocrinologists leverage both CGM and Oura ring data to track real-time glucose levels and cardiovascular metrics. Medication adjustments, patient inquiries, lab results, and health updates are communicated through the chat tool, allowing continuous care without the need for frequent in-person visits.	
Cardiology Specialist	Cardiovascular age, HRV, HR, sleep, RHR, blood pressure	Cardiologists monitor comprehensive cardiovascular metrics through the Oura ring and communicate with patients via the chat tool. By tracking HRV, HR, and RHR, the cardiologist can detect changes in cardiovascular health early and intervene remotely when necessary. Monitoring cardiovascular age helps in tailoring personalized treatment plans targeted at reducing the patient's risk of heart disease. Continuous data flow from wearables ensures that cardiovascular care is proactive rather than reactive.	

KPI = key performance indicator, CGM = continuous glucose monitor, TIR = time in range, RHR = resting heart rate, HR = heart rate, HRV = heart rate variability. Source: The authors

less improvement in HbA1c levels (−0.69) and weight reduction (−3.65 kg) over the 90-day period. This reinforces the importance of regular touchpoints in achieving meaningful clinical results, and hence needs to be embedded into the protocols of hybrid care providers.

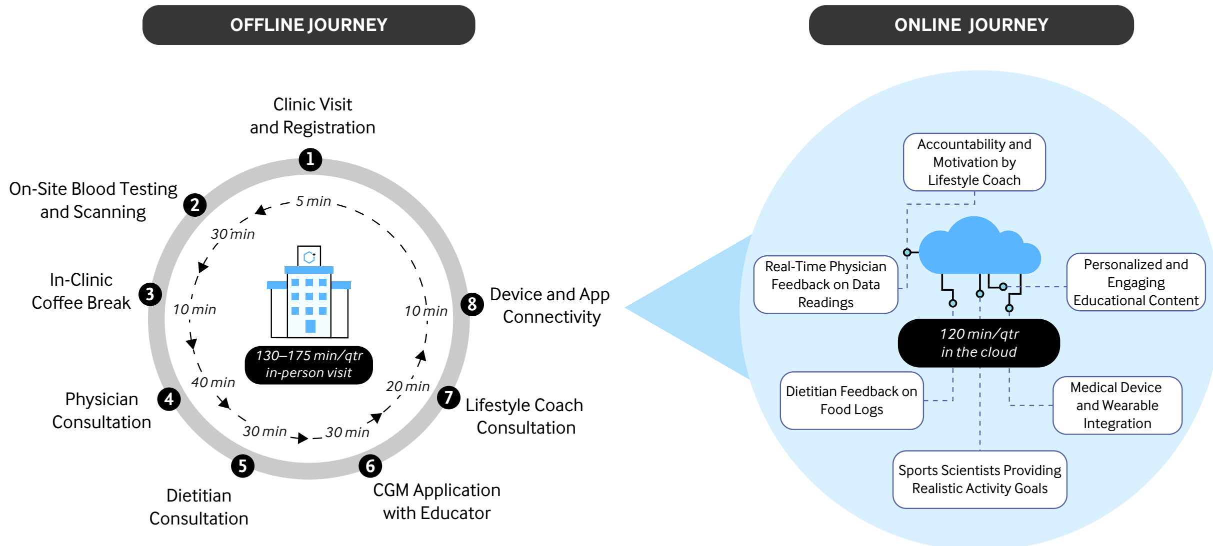
> *"Fifty-eight patients who had 11 or more interactions with the care team over 90 days showed significant improvements in HbA1c levels (−2.38) and weight reduction outcomes (−6.00 kg) regardless of initial levels."*

The integration of the patient's offline and online journeys through the GluCare.Health hybrid model is depicted in Figure 4, starting with the initial offline, on-site visit and then the follow-up in-

FIGURE 4

Overview of the Patient Journey in the GluCare.Health Hybrid Model

This figure depicts the patient's journey, starting, at left, with the initial offline, on-site visit as well as follow-up in-person visits over a 3-month period. The journey also includes the online component, shown at right, for the various virtual care elements.



CGM = continuous glucose monitor.
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person visits over a 3-month period, and the online component for the various virtual care elements. The 120 minutes in the cloud per quarter represents an estimation of the patient's engagement in the virtual care aspect, averaging around 40 minutes per month. This time includes both direct interactions with care team members (such as lifestyle coaches or physicians) and patient-driven activities like reviewing wearable device data. For the offline journey, the 130 minutes reflects an average total time spent during in-person visits per quarter. While the individual time elements for events 1 through 8 add up to 175 minutes, this total accounts for variability in patient needs, meaning not every step is required at each visit. The time estimate focuses on core activities that most patients complete.

Effect on Health Outcome Measures

In May 2024, we published a retrospective case–control real-world observational study that included a total of 162 patients with type 2 diabetes under the hybrid model and a total of 100 patients with type 2 diabetes under the physical-only episodic care model control group (who had a minimum of two in-clinic visits without any virtual engagement on the app).[23] Data was collected for patients attending the clinic who had their 3-month follow-up in the period from January 2021 to August 2023. The demographic breakdown of the study population was 76.7% male and 23.3% female, with a mean age of 50.4±33.4 years. At baseline, the average HbA1c level was 8.78±2.00,

Table 2. Outcomes of the Hybrid Model Intervention at 3 Months

Variable	Hybrid Model at Baseline (n=162)	Hybrid Model at 3 Months (n=162)	Mean Difference±SD	*P*-Value*	Control Group at Baseline (n=100)	Control Group at 3 Months (n=100)	Mean Difference±SD	*P*-Value
HbA1c (%)	8.78±2.0	6.58±0.92	−2.19±1.79	<0.001	7.53±1.6	7.44±1.8	−0.10±1.05	0.368
Weight (kg)	87.84±18.9	82.79±18.1	−5.05±6.52	<0.001	83.37±17.4	80.22±18.5	−3.15±0.17	<0.001
BMI (kg/m^2)	31.28±9.1	29.29±7.6	−1.99±4.72	<0.001	30.27±9.5	28.27±4.8	−1.86±8.54	0.033
LDL (mg/dL)	120.9±40.3	95.60±41.7	−25.3±42.4	<0.001	112.99±42.0	101.36±38.1	−11.63±42.04	0.008
Cholesterol (mg/dL)	186.34±48.0	154.53±44.6	−31.82±50.98	<0.001	172.11±50.4	162.3±48.2	−9.81±43.85	0.032
Triglycerides (mg/dL)	249.47±291.2	222.37±886.9	−27.1±715.6	0.638	195.07±136.8	206.54±189.4	+11.47±157.97	0.483
CVD Risk	15.83±17.4	9.33±12.8	−6.50±12.54	<0.001	14.2±14.3	12.45±12.7	−1.75±8.18	0.042
eGFR	112.56±31.5	109.92±30.4	−2.64±15.34	0.032	109.02±28.8	104.06±33.5	−4.96±23.81	0.046
Urine Albumin–Creatinine Ratio	71.52±285.8	44.36±224.23	−27.16±117.27	0.007	143.28±501.6	101.43±371.3	−41.86±259.46	0.143

SD = standard deviation, HbA1c = hemoglobin A1c, BMI = body mass index, LDL = low-density lipoprotein, CVD = cardiovascular disease, eGFR = estimated glomerular filtration rate. *The *P*-values <0.05 indicate statistical significance by paired sample t-test. Source: Zakaria H, Said Y, Aleabova S, et al. Measuring the effectiveness of hybrid diabetes care over 90 days through continuous data monitoring in type 2 diabetic patients. Front Endocrinol (Lausanne) 2024;15:1355792 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11106412/. https://doi.org/10.3389/fendo.2024.1355792

indicating that all participants had poorly controlled diabetes at baseline. Data in Table 2 illustrates the outcomes of the GluCare.Health hybrid model intervention on various health parameters for 162 individuals at baseline and after 3 months.[23]

Virtual engagement had an average of 15.28 interactions during the 3-month period of observation. Significant improvements were observed in several key metrics, notably HbA1c (–2.19%, $P<0.001$); weight (–5.05 kg, $P<0.001$); body mass index (BMI) (–1.99 kg/m^2, $P<0.001$); low-density lipoprotein cholesterol (–25.3 mg/dL, $P<0.001$); total cholesterol (–31.82 mg/dL, $P<0.001$); cardiovascular disease risk (–6.50, $P<0.001$); and urine albumin–creatinine ratio (–27.16, $P=0.007$). These results suggest that interventions delivered within a hybrid model of care had a positive impact on glycemic control, lipid profile, cardiovascular risk, and renal health in individuals with type 2 diabetes over the 3-month period. Control groups that excluded the virtual component of the care model showed much smaller improvements across the range of biomarkers measured.

Similar results were seen over a longer period. In a 12-month retrospective observational study of the GluCare.Health hybrid model's outcomes,[24] significant improvements were observed in various health parameters. Among the 89 patients (which included 45 adherent and 44 nonadherent patients), participants experienced a considerable reduction in weight (–4.0 kg), BMI (–1.32 kg/m^2), and waist circumference (–4.74 cm), indicating improvements in their body composition.[24] (Patients were considered adherent if they met two out of three behavioral criteria: communication with the care team, regular body weight readings, and consistent glucose monitoring.) Additionally, in the 12-month study, among adherent patients there was a significant decrease in HbA1c levels (–1.54, to 6.94 from 8.48), compared with a 0.1 reduction (to 6.98 from 7.08) among nonadherents, which underscores the potential for better and sustained blood glucose management.[24] Blood pressure metrics for the 89 patients also improved, with systolic blood pressure decreasing by 3.1 mm Hg and diastolic blood pressure decreasing by

3.4 mm Hg. Mental health also improved among the 89 participants: World Health Organization–Five Well-Being Index scores, reflecting quality of life, increased significantly (to 24.60 from 23.56), while emotional distress measured by Problem Areas in Diabetes Questionnaire and Patient Health Questionnaire–9 scores decreased, to 12.65 from 17.46 and to 1.18 from 1.67, respectively. Adherence to diet, exercise, blood glucose monitoring, and medication showed substantial enhancements, with significant increases in adherence scores across these domains. These improvements highlight the holistic benefits of the hybrid care model in managing type 2 diabetes.[24]

> *"In the 12-month study, among adherent patients there was a significant decrease in HbA1c levels (–1.54, to 6.94 from 8.48), compared with a 0.1 reduction (to 6.98 from 7.08) among nonadherents, which underscores the potential for better and sustained blood glucose management."*

Challenges and Barriers to Achieving Scale

There are several challenges in implementing a hybrid care model. While it holds great promise for enhancing accessibility, flexibility, and overall patient care, navigating through certain obstacles is crucial for its successful integration into broader health care ecosystems at scale. GluCare.Health is a for-profit company and, despite the resource-intensive aspects of our hybrid model, it is sustainable. Once the initial investment in the platform and the design of the purpose-built clinic is made, the GluCare.Health hybrid model will become scalable and can be used for a large number of centers.

The cost considerations for adopting a hybrid care model like GluCare.Health's are multifaceted. In terms of staffing, the additional clinical staff such as coaches, dieticians, and sports scientists contribute approximately 13%–15% of the total clinical staff costs. While we are not currently reimbursed for value-based care outcomes, we are aligning ourselves with the eventual shift to this model, as payers globally are increasingly struggling to manage costs under the traditional fee-for-service framework.

Moreover, even in the absence of value-based care reimbursement, the high margins in laboratory and imaging services allow for the cross-subsidization of hybrid care components. This ensures that the model remains fiscally sound in a fee-for-service environment, providing sustainability while we anticipate the adoption of value-based reimbursement models in the near future.

Scalability of the Physical Component

It generally takes more time to scale the GluCare.Health hybrid model, relative to a digital-only platform, as the physical component ideally needs to be purpose-built and integrated. Retrofitting existing diabetes practices to incorporate all the elements of the patient experience is often impractical due to structural and architectural constraints, and is also potentially more timeconsuming and costly. This complexity arises because existing facilities are typically designed for conventional care workflows, which may not accommodate the technological and spatial requirements of a hybrid model. For instance, integrating advanced telehealth capabilities, data analytics systems, and patient monitoring technologies necessitates significant modifications to the physical infrastructure. These changes might include enhanced Internet connectivity, specialized rooms for virtual consultations, and additional space for new equipment.

Moreover, operational workflows for clinicians must also be adapted to achieve optimal clinical outcomes. Traditional practices often have established routines that do not account for the seamless integration of digital health tools. Clinicians may need training to effectively use new technologies, and workflows must be restructured to ensure that digital and physical care components complement each other rather than operate in silos. This could involve changes in appointment scheduling, data management practices, and patient follow-up procedures. As a result, a hybrid model demands a more holistic redesign of both the physical environment and operational processes, making it significantly more complex than simply adding a virtual *bolt-on* solution to an existing practice. Both the initial and incremental costs to develop the platform, which are not common in typical health care capital costs, can be a barrier for widespread adoption, especially in health care settings with limited resources.

Scalability of Talent

As far as the humans who work inside of the clinic, it can be a challenge to recruit clinical team members who are both open to the adoption of cutting-edge technology into their clinical practice and fluent in its effective use. Care team members need to become familiar with analyzing new digital biomarkers such as stress and sleep and use these metrics in daily practice.

> *“Even in the absence of value-based care reimbursement, the high margins in laboratory and imaging services allow for the cross-subsidization of hybrid care components. This ensures that the model remains fiscally sound in a fee-for-service environment, providing sustainability while we anticipate the adoption of value-based reimbursement models in the near future.”*

Challenges for Reimbursement and Lack of Transparency in Outcome Reporting

As the majority of GluCare.Health’s engagement happens online, many aspects of the care model are not currently reimbursed under traditional fee-for-service frameworks, as adequate codes for activities related to driving behavioral change simply do not exist in the UAE, nor in the majority of markets worldwide. In addition, the long-term ROI of such models are lost on payers that are focused on annual medical loss ratios and quarterly financial reporting. These shortsighted payers typically negotiate new contract terms based on historic expenditures, which is a fundamentally flawed approach given that the historic underinvestment in care itself begets suboptimal outcomes. With the advent of value-based reimbursement (through reporting mechanisms such as the International Consortium for Health Outcomes Measurement standard sets), hybrid care models will be able to lead the next wave in innovation in payer contracting. Traditional providers do not currently report a standard set of outcomes and hence a shift in the transparency of such providers is needed to prove out the efficacy of new care models and build that into ROI calculations and actuarial models.

Considering Patient Digital Access and Literacy

Engaging patients with diabetes in the context of hybrid models can present challenges associated with digital literacy, communication preferences, and access to technology. The reliance on electronic systems may encounter resistance from those less familiar with digital technologies, those with a preference for face-to-face communication, or those who lack access to personal digital tools or reliable Internet access. For such patients, a balanced approach to incorporating both digital and in-person interactions may be required.

Increased Workforce and Hardware Costs

Yes, workforce costs are increased relative to baseline standard care. Put simply, individual care team members are spending more time with each patient, driving engagement both physically and virtually. This increase in time spent levels off over time — peaking at 15–20 engagements per quarter and leveling off at around 1 or 2 engagements per month remotely — to become commensurate with traditional episodic care models as patients' diabetes is brought under control, and they themselves take on the agency of their own management.[25] In addition, although the steady-state allocation of time in the hybrid outpatient setting will always likely remain higher than in traditional outpatient care, it will likely be offset by a significant reduction in both redundant services and billable events within the acute care setting (ER visits, acute events, etc.).

Further confounding the issue is the unfortunate fact that the comprehensive hybrid care model calls for additional new categories of staff to evolve from a traditional care model. New functions such as engineers, data scientists, health coaches, and sports scientists do not get covered by existing reimbursement structures. In the UAE, even regulated services from dieticians and diabetes educators are not consistently reimbursed. Furthermore, the hardware required in the form of wearables and other connected devices represents costs that have never before been considered reimbursable expenses. As mentioned earlier, value-based contracting could solve current payer issues around such services.

Looking Ahead

The shift to value-based care presents significant opportunities for hybrid care models by emphasizing outcomes over service volume. Value-based care models align well with the objectives of hybrid care, which focus on improving patient engagement and health outcomes through continuous monitoring and personalized interventions. Our studies showed that the hybrid model significantly improves HbA1c, weight, BMI, and cholesterol levels, highlighting its potential to be cost-effective and reduce diabetes-related complications.[23,24] Additionally, value-based care encourages the adoption of innovative patient engagement strategies, such as wearables and mobile health applications. These technologies facilitate continuous data collection and real-time feedback, supporting sustained behavioral changes essential for managing chronic diseases.

Hybrid models, such as the GluCare.Health hybrid model, not only respond to the immediate challenges presented by the rising global burden of diabetes, but also herald a paradigm shift in health care delivery. Bridging the gap between traditional on-site models and innovative remote monitoring, this model places patients at the center, emphasizing personalized care and leveraging technology for optimal outcomes.

Ihsan Almarzooqi, PhD
Cofounder and Managing Director, GluCare Integrated Diabetes Center, Dubai, United Arab Emirates

Hala Zakaria, MSc
Research Coordinator, GluCare Integrated Diabetes Center, Dubai, United Arab Emirates

Ali Hashemi, MBA
Cofounder and Chairman, GluCare Integrated Diabetes Center, Dubai, United Arab Emirates

Ms. Zakaria can be contacted at hala@glucare.health.

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