ELMER PRESS

Check for updates

Original Article

J Endocrinol Metab. 2024;14(5):221-225

The Cardiometabolic Clinic: Bridging Gaps in Care

Jacob Gabbay[a, d], Amanda G. Kennedy[b], Juvena Hitt[b], Matthew Gilbert[c], Kaitlyn Barrett[c]

Abstract

Background: While cardiometabolic disease is an increasingly common occurrence, there is evidence to suggest that many of these patients are not receiving optimal, evidence-based care. We set out to determine the effects of an integrated cardiometabolic clinic on the treatment of patients with cardiometabolic disease.

Methods: This retrospective cohort study compared the University of Vermont Cardiometabolic Clinic with four primary care clinics in the same network. Major outcomes included adherence to goal-directed medication regimens, and control of hemoglobin A1c, body mass index (BMI) and low-density lipoprotein (LDL).

Results: Our study found that over 6 to 18 months, the cardiometabolic clinic group had statistically significant improvement in medication regimens, with GLP1s started in 63% vs. 24.6% ($P < 0.001$), and SGLT2 inhibitors started in 47.7% vs. 10.8% ($P < 0.001$). The cardiometabolic clinic showed BMI reduction of -2.8 kg/m^2 vs. -0.5 kg/m^2 ($P < 0.001$), and an A1c reduction of -0.9% vs. -0.4% ($P = 0.016$).

Conclusions: This study added to the literature showing cardiometabolic clinics could play an important role in treatment of this high-risk group.

Keywords: Cardiometabolic; Multidisciplinary; Pharmacology; Diabetes; Obesity; Heart failure

Introduction

Cardiometabolic diseases are the leading cause of death in the United States and are associated with a significantly lower quality of life [1]. Cardiometabolic diseases are a collection of pathologies that include cardiovascular disease, insulin resistance, central adiposity, hypertension, and hyperlipidemia. New evidence suggests that kidney function is intimately involved in this disease spectrum as well [2]. These patients are at a very high risk for myocardial infarction, stroke, and overall mortality [3]. Although there are strong, evidence-based treatment protocols for the constellation of conditions, many of these patients still are not on optimal medication regimens [4].

One reason for suboptimal medication regimens is the increasing degree of specialization within medicine resulting in care silos. These silos cause gaps where care is frequently missed [5]. The concept of a multidisciplinary cardiometabolic clinic was created for better subspecialty integration and to fill these gaps [5]. Cardiometabolic clinics can be variable in composition, but typically consist of cardiometabolic experts (typically an endocrinologist, cardiologist, or primary care provider), nurse specialists, behavioral psychologists, nutritionists, education specialists, and pharmacists [5]. Several research studies have shown success, with one retrospective study showing improved adherence to goal-directed medical therapy by 17-fold [6], and another showing a 10.8% reduction in A1c and a 2.7% reduction in body mass index (BMI) [7].

Our academic medical center's Division of Endocrinology, Diabetes, and Osteoporosis established a cardiometabolic clinic in September 2021 in collaboration with the Division of Cardiology. The cardiometabolic clinic consisted of an endocrinologist and a specialty pharmacist focused on addressing cardiometabolic disease with an emphasis on medication optimization. Patients in the cardiometabolic clinic were primarily referred from cardiology. This study's purpose was to describe the cardiometabolic clinic's impact on medication regimens and health outcomes including BMI, hemoglobin A1c, blood pressure, and low-density lipoprotein (LDL).

Materials and Methods

This retrospective study of electronic health record data (Epic) was conducted at the University of Vermont Medical Center (UVMMC). UVMMC, located in Burlington, Vermont, serves over 1 million patients annually in Vermont and northern New York. All patients who attended the cardiometabolic clinic were included if they had at least two visits 6 - 18 months apart between September 1, 2021, and January 1, 2024. A control group was selected from four UVMMC Primary Care Clinics in the same county as the endocrinology clinic. Eligible controls in-

Manuscript submitted July 24, 2024, accepted August 31, 2024
Published online October 31, 2024

[a]Department of Medicine, The University of Vermont Medical Center, Burlington, VT 05401, USA
[b]Department of Medicine Quality Program, Larner College of Medicine, The University of Vermont, Burlington, VT 05405, USA
[c]Division of Endocrinology and Diabetes, The University of Vermont Medical Center, South Burlington, VT 05403, USA
[d]Corresponding Author: Jacob Gabbay, Department of Medicine, The University of Vermont Medical Center, Burlington, VT 05401, USA.
Email: Jacob.Gabbay@uvmhealth.org

doi: https://doi.org/10.14740/jem1018

cluded a diagnosis of diabetes, diagnosis of heart failure and/or coronary artery disease, and attendance at two primary care visits 6 - 18 months apart between September 1, 2021, and January 1, 2024. Control patients were matched in age and gender.

Baseline and initial visit data included date-of-birth, sex, race, ethnicity, insurance, smoking history, weight, height, BMI, and severity of heart failure and chronic kidney disease (CKD). Laboratory values included A1c, estimated glomerular filtration rate (eGFR), total cholesterol, triglycerides, LDL, and urine microalbumin. Systolic and diastolic blood pressure were also recorded. Medications for diabetes, cholesterol, and blood pressure were noted. The medical record was searched for medication changes or interventions that occurred at the initial visit. Data at the follow-up visit included the same information as baseline in addition to changes in medical history. Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Vermont [8]. This study was approved as exempt research by the University of Vermont Committees on Human Research (STUDY00002901) and was conducted in compliance with the ethical standards of the responsible institution on human subjects as well as with the Helsinki Declaration.

The analysis of this study was primarily descriptive and included cardiometabolic medication regimen optimization measured by adherence to the American Diabetes Association (ADA) 2021 guidelines, and control of metabolic markers (BMI, A1c, LDL) on follow-up 6 - 18 months later. Additionally, comparisons between cardiometabolic clinic patients and controls were analyzed. Categorical variables were analyzed using Fisher's exact test or Chi-square, and continuous variables were analyzed using Wilcoxon rank sum. Data were analyzed using Stata 18 (Stata Corporation, College Station, TX). $P < 0.05$ was required for statistical significance. As this retrospective project was largely exploratory, we did not correct for multiple comparisons.

Results

A total of 65 patients attended the cardiometabolic clinic with at least two visits during our study timeframe. Matched controls were similar to cardiometabolic patients at baseline with notable differences between the groups for CKD history (cardiometabolic: 38% vs. control: 17%, $P = 0.01$) and mean diastolic blood pressure (cardiometabolic: 67.5 mm Hg vs. control: 72.2 mm Hg, $P = 0.01$) (Table 1).

At the initial cardiometabolic clinic visit, there were a high number of changes to medication regimens, with 51 patients (78.5%) started on a new medication and 24 patients (40%) who had medications discontinued (Table 2). Thirty-three patients (51%) were started on glucagon-like peptide-1 (GLP-1) medications, and 16 patients (24.6%) were started on sodium-glucose cotransporter-2 (SGLT2) inhibitors (Table 3). Follow-up visit 6 - 18 months later showed significantly different medication regimens between the two groups, with more patients prescribed GLP1 medications in the cardiometabolic clinic versus controls (63% vs. 24.6%, $P < 0.001$), and more SGLT2 inhibitor prescriptions in the cardiometabolic clinic versus controls (47.7% vs. 10.8%, $P < 0.001$) (Table 4). Notably there were no statistically significant differences in prescriptions of other cardiometabolic medications, including statins, angiotensin-converting-enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARB), or angiotensin receptor/neprilysin inhibitor (ARNI).

At the follow-up visit, there was a larger reduction in BMI of the cardiometabolic clinic patients compared to controls (-2.8 kg/m^2 vs. -0.5 kg/m^2, $P < 0.001$), and a larger reduction in A1c in cardiometabolic clinic patients compared to controls (-0.9% vs. -0.4%, $P = 0.0155$) (Table 5). There were no statistically significant differences in eGFR, LDL, or blood pressure between groups.

Discussion

Cardiometabolic syndrome is common in the United States, and data suggest most of these patients are undertreated [4]. In our study, the cardiometabolic clinic was associated with statistically significant improvement in goal-directed medication prescriptions, especially GLP-1s and SGLT2 inhibitors. In addition to showing increased rates of prescriptions for these newer evidence-based agents, the study also showed a significant number of medication discontinuations in the cardiometabolic group, which represented a reduction of potentially harmful older medications, including insulin, sulfonylureas, and thiazolidinediones. The study also showed improved weight loss and A1c compared to primary care controls over 6 months. This finding cannot be explained by severity of disease in the cardiometabolic patients, as controls had equivalent disease burden, and the same medications were indicated. Notably, the changes in other goal-directed medical treatments (statins, ACE/ARB/ARNI), as well as LDL, eGFR, and blood pressure were not statistically significant.

The outcomes from poorly treated disease can be devastating, and the low prescription rates of medications known to reduce these risks underscore the need for urgent intervention. There are many reasons why patients are not on these medicines, including insurance coverage, access, lack of provider knowledge, and competing priorities in visits. While policies and prescribing rationales will largely be the same for providers regardless of clinic type, a focused cardiometabolic clinic creates the best possible circumstances for successful interventions. This is in part due to the specific expertise of cardiometabolic providers and dedicated ancillary staff in optimizing their documentation to increase the speed and rates of insurance reimbursement. Our data show the striking changes that can be made to medications in a brief time including initiation, discontinuation, and dose changes. Our study adds to the current body of evidence supporting cardiometabolic clinics. Other studies have shown similar results with improvement in both goal-directed medication regimens, as well as metabolic control [4, 7, 9-11]. Our clinic is similar with a multidisciplinary approach, with isolated focus on cardiometabolic disease and an emphasis on goal-directed medical therapy. The study differs because our team is smaller with only an endocrinologist and pharmacist working with the cardiology department.

There are limitations to the study. Given that it was a retrospective chart review, it was vulnerable to inaccuracies in

Table 1. Baseline Patient Characteristics in the Cardiometabolic Clinic Patients and Controls

Characteristic	Cardiometabolic clinic patients	Primary care controls	P
	N (%)	N (%)	
Total	65 (100)	65 (100)	
Mean age[a], years	66.3 (9.6)	64.3 (9.8)	0.18
Sex, female	21 (32.3)	21 (32.3)	0.57
Race, White	59 (90.1)	63 (96.9)	0.24
Non-Hispanic	63 (96.9)	62 (95.4)	1.00
Insurance			
Medicare	29 (44.6)	31 (47.7)	0.73
Commercial	29 (44.6)	25 (38.5)	0.48
Medicaid	4 (6.2)	4 (6.2)	1.00
None	1 (1.5)	3 (4.6)	0.62
Other	3 (4.6)	0 (0)	0.24
Smoking			
Current	5 (7.7)	13 (20)	0.11
Former	37 (56.9)	29 (44.6)	
Never	23 (35.4)	23 (35.4)	
Heart failure			
None	24 (36.9)	37 (56.9)	0.09
Heart failure reduced ejection fraction (HFrEF)	19 (29.2)	14 (21.5)	
Heart failure mid-range ejection fraction (HFmEF)	7 (10.8)	2 (3.1)	
Heart failure preserved ejection fraction (HFpEF)	15 (23.1)	12 (18.5)	
Coronary artery disease history	51 (78.5)	56 (86.2)	0.18
Chronic kidney disease history	25 (38.5)	11 (16.9)	0.01
Body mass index (BMI)[a], mean kg/m^2	37.1 (13.0)	35.3 (11.1)	0.35
Hemoglobin A1c[a], mean %	7.8 (1.6)	7.7 (2.0)	0.24
Estimated glomerular filtration rate (eGFR)[a], mean mL/min/1.73 m^2	73.3 (27.5)	75.8 (26.3)	0.59
Low-density lipoprotein (LDL)[a], mean mg/dL	72.2 (32.2)	79.3 (30.1)	0.15
Systolic blood pressure[a], mean mm Hg	133.2 (17.5)	129.7 (20.9)	0.22
Diastolic blood pressure[a], mean mm Hg	67.5 (8.8)	72.2 (10.3)	0.01

[a]Numbers in percent column represent standard deviation.

Table 2. Overall Medication Changes at an Initial Visit to the Cardiometabolic Clinic (N = 65)[a]

Characteristic	Cardiometabolic clinic patients
	N (%)
No medication changes at visit	4 (6.2)
Discontinue	24 (40.0)
Dose increase	18 (27.7)
Dose decrease	15 (23.1)
Start a new medication	51 (78.5)

[a]Patients often had more than one medication intervention.

charting information. Additionally, patients in the intervention group were not randomized, and most came directly from cardiology, which introduces biases. This population may have more severe diseases not managed by primary care, potentially more medical contact, and may have better resources to attend subspecialty appointments. The studies per protocol analysis can lead to an optimistic assessment of the clinic's effectiveness. Lastly, there are limitations to the external validity of the study, as the population was from one health system, was primarily White and had a better A1c compared to the national average. Both a strength and weakness of the study is the degree of similarity between the two study groups. Both groups had statistically similar general demographic information and

Table 3. Specific Medication Changes at an Initial Visit to the Cardiometabolic Clinic (N = 65)[a]

	Start a new medication	Discontinue	Dose increase	Dose decrease
Glucagon-like peptide-1 (GLP-1)	33	2	7	0
Sodium-glucose cotransporter-2 (SGLT2) inhibitor	16	5	1	0
Gastric inhibitory polypeptide (GIP) and glucagon-like peptide-1 (GLP-1)	4	0	0	0
Insulins-basal	3	4	4	9
Metformin	2	0	6	0
Insulins-bolus	1	6	1	2
Sulfonylureas	1	3	0	4
Dipeptidyl peptidase-4 (DPP-4) inhibitors/incretin enhancer	0	7	1	0

[a]Patients often had more than one medication intervention.

Table 4. Follow-Up Diabetes Medication Regimens (N = 65 per Group)

Medication	Cardiometabolic clinic patients	Primary care controls	P
	N (%)	N (%)	
Glucagon-like peptide-1 (GLP-1)	41 (63.1)	16 (24.6)	0.000
Sodium-glucose cotransporter-2 (SGLT2) inhibitor	31 (47.7)	7 (10.8)	0.000
Insulins-basal	27 (41.5)	25 (38.5)	0.720
Metformin	26 (40.0)	29 (44.6)	0.594
Insulins-bolus	11 (16.9)	20 (30.8)	0.099
Sulfonylureas	10 (15.4)	8 (12.3)	0.612
Gastric inhibitory polypeptide (GIP) and glucagon-like peptide-1 (GLP-1)	3 (4.6)	0 (0.0)	0.244
Dipeptidyl peptidase-4 (DPP-4) inhibitors/incretin enhancer	2 (3.1)	6 (9.2)	0.273
Thiazolidinediones (TZD)	0 (0.0)	2 (3.1)	0.496

baseline medications regimens; however, the cardiometabolic group notably had a significantly higher degree of renal dysfunction. This could serve as a limitation to the study as these patients have greater disease burden possibly prompting initiation of more aggressive treatment (although notably there was no FLOW trial data available at the time of the study). Other strengths of the study include relatively rapid changes in BMI; we anticipate even stronger results at 12 months. Additional areas for study in the future could include differences in prescribing patterns (speed of up titration of GLP1s, recognition of true side effects, etc.), as well as counseling regarding medications and potential adverse effects.

Conclusions

This study's intention is to describe the impact of a cardiometabolic clinic on health outcomes and adherence to goal-direct-

Table 5. Follow-Up Visit Diabetes Medication Regimen (N = 65 per Group)

Characteristic	Cardiometabolic clinic patients		Primary care controls		P
	Mean	SD	Mean	SD	
Body mass index (BMI), kg/m^2	-2.8	5.2	-0.5	2.0	0.0001
Hemoglobin A1c, %	-0.9	1.8	-0.4	1.9	0.0155
Estimated glomerular filtration rate (eGFR), mL/min/1.73 m^2	-1.95	12.9	0.51	16.0	0.22
Low-density lipoprotein (LDL), mg/dL	-4.8	23.8	-9.4	29.5	0.61
Systolic blood pressure, mm Hg	-5.4	19.4	-0.8	26.9	0.25
Diastolic blood pressure, mm Hg	2.4	12.1	-1	12.5	0.15

SD: standard deviation.

ed care for patients with cardiometabolic syndrome. We found that patients had rapid improvement in medication regimens, as well as A1c and BMI. This study suggests that cardiometabolic clinics could play an important role in the treatment of this high-risk group.

Acknowledgments

Kayla Davis is a pharmacist who contributed to planning and execution of the cardiometabolic clinic.

Financial Disclosure

This research did not receive any specific grant from any funding agency in the public, commercial or not-for-profit sector.

Conflict of Interest

No disclosures are necessary from Jacob Gabbay, Kaitlyn Barrett, Juvena Hitt, or Amanda Kennedy. Dr. Gilbert works as a consultant for Novo Nordisk.

Informed Consent

This study was approved as exempt research by the University of Vermont Committees on Human Research (STUD Y00002901).

Author Contributions

Jacob Gabbay contributed to study design, data collection, data analysis, and manuscript production. Amanda G. Kennedy, Juvena Hitt, Matthew Gilbert and Katilin Barrett helped with study design, data analysis and manuscript production. Kaitlin Barrett was the lead faculty mentor.

Data Availability

Some or all datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author upon reasonable request.

Abbreviations

BMI: body mass index; LDL: low-density lipoprotein; GLP: glucagon like peptide; SGLT2: sodium glucose cotransporter; UVMMC: University of Vermont Medical Center; CKD: chronic kidney disease; eGFR: estimated glomerular filtration rate; ADA: American Diabetes Association; ACE: angiotensin-converting-enzyme; ARB: angiotensin II receptor blockers; ARNI: angiotensin receptor/neprilysin inhibitor; SD: standard deviation; HFrEF: heart failure with reduced ejection fraction; HFmEF: heart failure with mid-range ejection fraction; HFpEF: heart failure with preserved ejection

References

1. Cao X, Zhang L, Wang X, Chen Z, Zheng C, Chen L, Zhou H, et al. Cardiovascular disease and all-cause mortality associated with individual and combined cardiometabolic risk factors. BMC Public Health. 2023;23(1):1725. doi pubmed pmc
2. Ndumele CE, Rangaswami J, Chow SL, Neeland IJ, Tuttle KR, Khan SS, Coresh J, et al. Cardiovascular-kidney-metabolic health: a presidential advisory from the American Heart Association. Circulation. 2023;148(20):1606-1635. doi pubmed
3. Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration. Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: a comparative risk assessment. Lancet Diabetes Endocrinol. 2014;2(8):634-647. doi pubmed pmc
4. Arnold SV, de Lemos JA, Rosenson RS, Ballantyne CM, Liu Y, Mues KE, Alam S, et al. Use of guideline-recommended risk reduction strategies among patients with diabetes and atherosclerotic cardiovascular disease. Circulation. 2019;140(7):618-620. doi pubmed
5. Reiter-Brennan C, Dzaye O, Davis D, Blaha M, Eckel RH. Comprehensive care models for cardiometabolic disease. Curr Cardiol Rep. 2021;23(3):22. doi pubmed pmc
6. Thomas M, Magwire M, Gosch K, Sammour Y, Mehta R, O'Keefe J, Nassif ME, et al. Cardiometabolic center of excellence: a novel care delivery model for secondary prevention of cardiovascular disease in type 2 diabetes. Circ Cardiovasc Qual Outcomes. 2021;14(10):e007682. doi pubmed pmc
7. Neeland IJ, Al-Kindi SG, Tashtish N, Eaton E, Friswold J, Rahmani S, White-Solaru KT, et al. Lessons learned from a patient-centered, team-based intervention for patients with type 2 diabetes at high cardiovascular risk: year 1 results from the CINEMA program. J Am Heart Assoc. 2022;11(15):e024482. doi pubmed pmc
8. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-381. doi pubmed pmc
9. Modarressi T, Fox JM, Ghusson MS, Patel JK. Establishing a cardiometabolic clinic: interventions for the first 400 patients. Journal of the American College of Cardiology. 2023;81(8_Supplement):1870. doi
10. Narain R, Bijman L, Chen M. 128 Progress and early outcomes of a cardiometabolic clinic in a UK tertiary cardiology centre. Heart. 2022;108(Suppl 1):A96-A97. doi
11. Daniel E, Beth A. Prioritizing prevention and closing care gaps: development of a canadian cardiometabolic prevention clinic. American Journal of Preventive Cardiology. 2023;13:100410. doi