The Impact of Lifedoc Health's Multidisciplinary Team Approach on Cardiometabolic Risk Profile in a Multiracial Cohort of Adults with Obesity: A 1-year Exploratory Pilot Study

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Abstract

Background: Information regarding the effect of a multidisciplinary team (MDT) to improve cardiometabolic risk factors (CMRF) in routine clinical settings is lacking. Methods: In this one-year retrospective chart review (2018), 598 adults (African American 59%, Hispanic 35%, Caucasian 6%) with a mean age of 43.8 ± 14.0 were included. Qualifying patients ([?] 1 CMRF of overweight/obesity, prediabetes/diabetes, or hypertension) who were treated under an MDT protocol were compared to patients who qualified for MDT but were treated solely by a primary care provider (PCP). The MDT protocol included endocrinology-oriented visits, lifestyle counseling, care coordination, and shared medical appointments. Linear and binary regression were performed to identify the factors associated with CMRF changes. Results: Patients treated by MDT had a greater reduction (β, 95% CI) in weight (- 4.29 kg, -7.62, -0.97), BMI (-1.43 kg/m2, -2.68, -0.18), SBP (- 2.18 mmHg, -4.09, -0.26), and DBP (- 1.97 mmHg, -3.34, -0.60). They also had 77% higher odds of reducing [?] 5% their initial weight, 83% higher odds of reducing 1 point of BMI, and 59% higher odds of reducing [?]2 mmHg DBP. No association was observed for MDT intervention and A1c changes. Conclusion: Compared to PCP, MDT-protocolized intervention improves CMRF in a multi-ethnic adult cohort in a routine clinical setting. Patient's activation to access the best care and overcoming barriers from patients (weight perception, social determinants increasing no-shows to visits), providers (obesity stigma, clinical inertia), and health system (time constraints and high paperwork imposed by payers) is a priority.

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ABSTRACT

Background : Information regarding the effect of a multidisciplinary team (MDT) to improve cardiometabolic risk factors (CMRF) in routine clinical settings is lacking.

Methods : In this one-year retrospective chart review (2018), 598 adults (African American 59%, Hispanic 35%, Caucasian 6%) with a mean age of 43.8 ± 14.0 were included. Qualifying patients ([?] 1 CMRF of overweight/obesity, prediabetes/diabetes, or hypertension) who were treated under an MDT protocol were compared to patients who qualified for MDT but were treated solely by a primary care provider (PCP). The MDT protocol included endocrinology-oriented visits, lifestyle counseling, care coordination, and shared medical appointments. Linear and binary regression were performed to identify the factors associated with CMRF changes.

Results : Patients treated by MDT had a greater reduction (β, 95% CI) in weight (- 4.29 kg, -7.62, -0.97), BMI (-1.43 kg/m^2, -2.68, -0.18), SBP (- 2.18 mmHg, -4.09, -0.26), and DBP (- 1.97 mmHg, -3.34, -0.60). They also had 77% higher odds of reducing [?] 5% their initial weight, 83% higher odds of reducing 1 point of BMI, and 59% higher odds of reducing [?]2 mmHg DBP. No association was observed for MDT intervention and A1c changes.

Conclusion: Compared to PCP, MDT-protocolized intervention improves CMRF in a multi-ethnic adult cohort in a routine clinical setting. Patient's activation to access the best care and overcoming barriers from patients (weight perception, social determinants increasing no-shows to visits), providers (obesity stigma, clinical inertia), and health system (time constraints and high paperwork imposed by payers) is a priority.

What's already known about this topic?

1. Detection and management of cardiometabolic chronic disease requires a complex approach as well as the identification of determinants of health affecting patient care/outcomes.

2. Multidisciplinary interventions within the context of clinical trials have been less effective when implemented in routine clinical settings, driving the need to simplify their translation into daily clinical practice.

3. Barriers on patients, providers, and health system alike may limit the patient's activation to a multidisciplinary team (MDT) co-management approach.

What does this article add?

1. In a routine clinical setting, MDT intervention (endocrinology-oriented visits, lifestyle counseling, care coordination) improved cardiometabolic risk profile compared to treatement exclusively via PCP.

2. MDT approach offers more opportunities (i.e. higher number of visits) for effective interventions by integrating regular clinical care, care coordination, and lifestyle counseling into shared medical appointments.

3. Promoting patient activation to access the best care and overcoming barriers is a priority.

INTRODUCTION

Treatment and prevention of cardiometabolic chronic diseases such as high adiposity, hypertension, and dysglycemia require a complex approach as well as identification of determinants of health affecting patient care and outcomes, this is a vital step in the translation of real-world evidence and best practice into the routine clinical setting [1]. Healthcare delivered by a team following a systematically designed set of multidisciplinary protocols can increase the effectiveness of interventions to mitigate cardiometabolic risk. This multidisciplinary team approach (MDT) has demonstrated effectiveness in controlling weight and associated complications within the controlled conditions of clinical trials, but their implementation in routine clinical settings has been limited, with little sustainability and lower efficacy. Other adaptations of lifestyle intervention for diabetes prevention based on the US Diabetes Prevention Program (DPP) and the Finnish Diabetes Prevention Study (DPS) have been implemented, though results suggest these have been significantly less effective [2].

To promote early intervention in patients and enhance sensitivity for detecting subjects affected by excess adiposity, the American Association of Clinical Endocrinology (AACE) proposed that we consider obesity as not only individuals with body mass index (BMI) [?] 30, but also those with BMI [?] 25 and weight-related complications. Furthermore, AACE suggested adopting adiposity-based chronic disease (ABCD) as the new diagnosis term for obesity and dysglycemia-based chronic disease (DBCD) for diabetes [3, 4]. Unlike the model based on BMI, in addition to total fat mass, this complication-centric approach considers the impairment of fat distribution and function as well as other equally crucial factors associated with the obesity-related metabolic derangements (ethnocultural factors, social determinants of health among others). Earlier detection of insulin resistance and/or adequate ß-cell compensation may allow for mechanistic interventions to more efficiently reduce the progression of dysglycemia and cardiometabolic complications [4].

Lifedoc Health (LDH) is a multi-disciplinary and data-driven healthcare organization committed to preventing diabetes and obesity by increasing accessibility to care through an integrated and standardized outcome-oriented model. Its programs have received state and National Committee for Quality Assurance recognition and accreditation. LDH's clinical model combines primary and specialty care, acute and chronic care, as well as care coordination, pharmacy, patient education, and lifestyle counseling into a unified dynamic approach. Providers undergo protocol training and reinforcement, PCPs are coached for the early enrollment of patients with or at risk of cardiometabolic conditions for MDT co-management including obesity, hypertension, elevated A1c, markers of insulin resistance, pre-diabetes, and diabetes.

Several obstacles may limit the effectiveness of MDT co-management in these patients including a) patient and provider perception or stigma of obesity [5, 6], b) time constraints of providers and limited training to

manage obesity and related complications, c) competing priorities for referral of those with multiple chronic conditions, d) the presence of numerous social determinants of health including limited access to preventive care, as well as job, transportation and housing insecurity, and e) patient inertia and/or limited health literacy towards their/their family's health. In order to demonstrate the effectiveness of implementing the Lifedoc model and its accompanying protocols, we aim to evaluate and better understand the evolution of obesity and related comorbidities according to differences in type of care (i.e. PCP vs. PCP with MDT co-management including wellness coach and endocrine team).

METHODS

Study design and population

This is a retrospective chart review pilot study based on a 1-year (2018) analysis of longitudinal structured data collected into the electronic health record (EHR) database of a cohort of patients evaluated at Lifedoc Health in Memphis, Tennessee, USA. Of the 1,113 adult patients seen in 2018, the final sample included 598 subjects (58.9% African American, 35.3%, Hispanic and 5.9% Caucasians) meeting the appropriate inclusion criteria, namely [?] 18 years of age with BMI and blood pressure (BP) measurements recorded in at least Q1 and Q4, and having any of the following risk factors to activate the MDT protocol: (1) overweight (OW)/obesity (OB) (ICD-10 diagnosis or BMI [?] 25), (2) hypertension (HTN) (ICD-10 diagnosis, SBP [?] 140 or DBP [?]90 mmHg), or (3) pre-diabetes (Pre-DM)/diabetes (DM) (ICD-10 diagnoses or glycated hemoglobin A1C (A1C) [?] 5.6% and 6.5%, respectively). Prior to data collection, informed consent was obtained from each patient. All procedures were performed in accordance with the Helsinki Declaration.

Study variables

The primary exposure in this study was type of care (PCP vs MDT). Primary outcomes were 1-year changes in weight and BMI between Q1 and Q4, while secondary outcomes included 1-year changes in systolic blood pressure (SBP), diastolic blood pressure (DBP), numbers of cardiometabolic risk factors (CMRF), and A1c in the same period. Weight was measured with light clothing and without shoes, using a calibrated scale (Health-o-meter Pro Plus(r)). Height was measured using a stadiometer (Seca (r)). Blood pressure (BP) was measured in the right arm, using the appropriate cuff size, in a sitting position, with a validated aneroid sphygmomanometer (McKesson(r)). A1C was measured using both in-house rapid testing (Alere Afinion AS100) and laboratory test by immunoassay in a certified laboratory [7].

Definitions

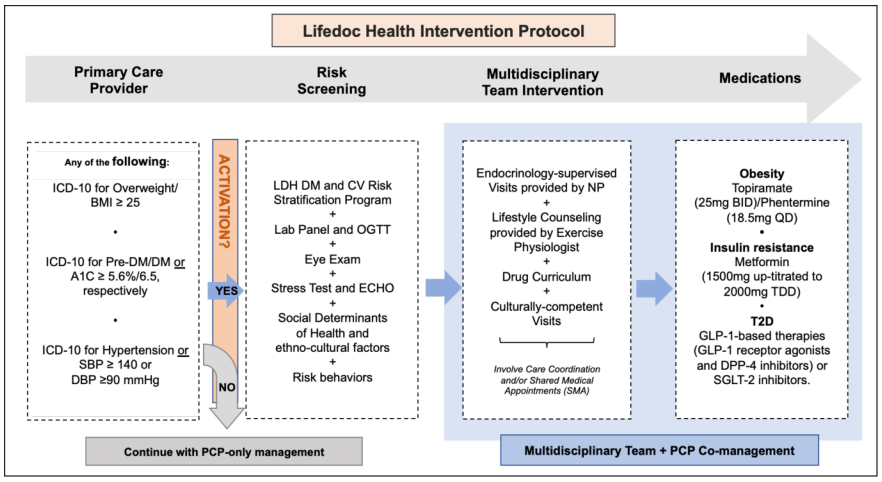
Race was self-reported as either African American (AA), Hispanic (H), or Caucasian (C). Obesity was defined as a BMI [?] 30 kg/m^{2}and overweight as BMI 25–29.9 kg/m^2[8]. HTN was defined as systolic BP [?] 140 mmHg, diastolic BP [?] 90 mmHg or personal history of HTN/use of antihypertensive medication [9]. Pre-DM was defined as either fasting serum blood glucose (FBG) between 100-126 mg/dL, 2-hour post-load serum blood glucose level (2HBG) between 140-199 mg/dL or A1C between 5.6-6.4%. DM was defined as either an FBG [?] 126 mg/dL, 2HBG [?] 200 mg/dL, A1C [?] 6.5% or personal history of DM [10].

Study groups and interventions

Intervention groups were defined as: (1) PCP, including those patients evaluated at least one time by PCP with [?] 1 endocrinology visit and no visits with any lifestyle intervention provider (nutrition, wellness, or education) within the observation period or (2) MDT, including those patients with [?] 2 endocrinology visits and at least 1 visit with the lifestyle provider in the same period. MDT included primarily endocrinology-oriented visits coordinated by an endocrinologist and provided by nurse practitioner, lifestyle counseling provided by an exercise physiologist including physical activity and nutritional counselling, and care coordination. Although cardiac function evaluations and eye exams increased detection of risk factors/complications, these were not considered as grouping variables. The number of cardiometabolic risk factors (CMRF) for DM, HTN, and obesity and time of exposure to LDH interventions were recorded. To account for variability in time of exposure to the intervention, patients were classified as (1) 'established patients', namely those receiving care at LDH between January 01, 2008, and November 15, 2017, and (2)

'new patients', describing attending the center only between November 15, 2017, and March 31, 2018 (end of the first quarter).

Per LDH's outcome-oriented approach (Figure 1), a patient is activated to MDT when [?] 1 cardiometabolic condition (OW/OB, Pre-DM/DM, or HTN, A1c> 5.6) is detected. The present analysis compares the group of patients co-managed by MDT to a group of patients that should have been activated but were not and continued only being cared for by the PCP. Once MDT was activated, blood samples were collected following a [?] 8h overnight fast and 75g oral glucose tolerance test (OGTT) with serum glucose and insulin samples at 0, 30, 60, 90, and 120 minutes was performed [12]. Patients underwent treatment based on a protocolized drug curriculum. Those with OW/OB were treated with topiramate (25 mg, BID) and a low dose of phentermine (18.5 mg, QD) unless contraindicated or otherwise not tolerated. Those with insulin resistance were treated with metformin (1500 mg initial dose and then up titrated to 2000 mg). Patients with type 2 DM were treated with anti-diabetic drugs clinically proven to promote weight loss, primarily metformin and either glucagon-like peptide 1-based (GLP-1) therapies such as GLP-1 receptor agonists and dipeptidyl-peptidase 4 (DPP-4) inhibitors or sodium-glucose cotransporter-2 (SGLT-2) inhibitors. Specific medication was decided according to individual clinical conditions and insurance coverage. Lifestyle recommendations were provided for nutrition, wellness or educational visits and included nutritional counseling with caloric/carbohydrate restriction and physical activity recommendations. In the MDT group, most visits were coordinated and implemented and performed simultaneously between regular medical care and lifestyle counseling. Patients' individual needs were considered in the implementation of follow-up and engagement protocols.



Statistical analysis

Data were analyzed using R (Version 3.6.2). Continuous variables were presented as mean ± SE and baseline differences among two exposure groups were evaluated using a t-test. Frequencies were presented as percentages and 95% confidence intervals (CI) and exposure groups compared using a Z-test. Multiple linear regression analysis was used to investigate the relationship between exposure groups and changes for each outcome between Q4 and Q1 for weight, BMI, SBP, DBP, CMRF, and between last and first measure for A1C measurements. Other confounding variables were included in the model, the confounders were determined based on the 10% rule [11]. To account for the effect modification, a variable was also included if a significant interaction term was observed in a model consisting of that variable and the exposure group. To explore exposure effects on clinically significant changes in cardiometabolic outcomes, a binary logistic regression analysis (reduction of at least vs no reduction of weight [5%], BMI [1 kg/m^2], SBP [2 mmHg], of A1C [0.3%]) was performed. Confounders and effect modifiers were included, following the same rule as the multiple linear regression. A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline subject characteristics

In total, 598 adults (58.9% AA, 35.3% H, and 5.9% C), with a mean age 43.8 ± 14.0 years were included in the analysis. At baseline, subjects co-managed by MDT were older and heavier than those in the PCP group. Between-group distribution of race, SBP, DBP, type of patient, and time exposure to interventions were similar. The mean number of CMRF for the total sample was 1.43 ± 1.0, higher in MDT group (1.76 ± 0.93) compared to PCP group (0.72 ± 0.77). Total sample mean A1C was 6.8 ± 2.0, higher in MDT group (7.0 ± 2.1) than PCP group (5.8 ± 1.4). Total sample average number of visits was 10.5 but was 2 times higher in the MDT group ($x = 12.3$) compared to the PCP group ($x = 6.6$). In MDT, 30.9% of visits were for lifestyle intervention (Table 1).

Changes in CMRF during the intervention

At the end of the period, a significant improvement in CMRF was observed across the total sample with changes in mean weight (- 0.8 Kg, p<0.001), BMI (- 0.3 Kg/m^2, p<0.001), SBP (- 1.4 mmHg, p=0.01), DBP (- 0.9 mmHg, p=0.01), though changes in the number of CMRF were not significant (- 0.04, p=0.16). The positive changes were present in the MDT group, weight (-1.4 Kg, p<0.001), BMI (-0.5 Kg/m2, p<0.001), SBP (-1.5 mmHg, p=0.01), DBP (-1.1 mmHg, p=0.01) with a reduction of the number of CMRF (-0.1, p<0.001). By contrast, no changes were observed in the PCP group other than an increase in the number of CMRF (+0.1, p=0.02) (Table 2). Sixty-one percent of patients (n=364) had a baseline reading for A1c in Q1; among them, 137 (37.6%) had a baseline A1c at or above 6.5%. MDT co-management was activated in 97% of these patients (n=133). Due to the small number of patients in the PCP group meeting this criterion, between-group changes in A1c were not assessed. As compared with baseline A1c, the MDT group experienced sustained and significant reduction in A1c values, (ΔA1c reading 2 & 1 = -0.52 [-0.89, -0.15] p =0.01, n=132; ΔA1c reading 3 & 1 = -0.49 (-0.91, -0.06), p =0.03, n=122). Changes between reading 4 and 1 kept a similar trend, though significance was lost (ΔA1C reading 4 & 1 = - 0.32 (- 0.80, - 0.15), p = 0.18, n=88).

Factors related to changes in cardiometabolic risk

MDT intervention was associated with a higher reduction of adiposity (by weight and BMI) and BP. Compared to the PCP group, MDT intervention, on average (β, 95% CI), was associated to higher reductions of weight (-4.29 Kg, -7.62, -0.97), BMI (-1.43 Kg/m^2, -2.68, -0.18), SBP (-2.18 mmHg, -4.09, -0.26), and DBP (-1.97 mmHg, -3.34, -0.60) (Table 3). Binary analysis shows that those co-managed by MDT had 77% higher odds for reducing 5% or more of the initial weight, 83% higher odds of reducing 1 kg/m^2 of BMI, and 59% higher odds of reducing [?] 2 mmHg DBP compared to the PCP group (Table 4). On average, age was associated (β, 95% CI) with greater reductions in weight (-0.09 Kg, -0.15, -0.03), BMI (-0.03 Kg/m^2, -0.06, -0.01), and no reduction in SBP (+0.07 mmHg, 0.01, 0.13) while male gender associated to a higher increase in SBP (3.46 mmHg, 1.61, 5.31) and 42% lower odds of reducing [?] 2 mmHg than women. Hispanic had a higher reduction in SBP (-2.49 mmHg, -4.09, -0.26) compared to AA. Following the intervention, higher baseline values of weight (only in the continuous outcome analysis), BMI, SBP, DBP, and A1C were associated with a greater reduction of each variable in both continuous and binary outcome analyses.

DISCUSSION

One of the primary challenges in routine clinical settings is the implementation of protocolized interventions, as well as the adequate analysis/reporting of outcomes to continually refine them. At Lifedoc Health, patients having at least one cardiometabolic condition (OW/OB, Pre-DM/DM, elevated A1c, or HTN) should activate the MDT co-management, though this did not occur in 32% of the sample. Enabling patients to access best clinical practice in a health system depends on several factors related to the patient, the providers, and the health system itself.

This study further reinforces the notion that co-management with MDT improved CMRF profile compared to PCP-exclusive patients. MDT was associated with a greater reduction of weight (- 4.29 Kg), BMI (-1.43 Kg/m^2), SBP (- 2.18 mmHg), and DBP (- 1.97 mmHg) as well as the number of CMRF. In addition, MDT

patients having an A1c [?] 6.5% saw and a sustained and significant improvement compared to baseline readings, though adequate comparisons could not be drawn due to limitations in A1c readings [?] 6.5% in PCP group. Higher A1c was a consistent activator of MDT co-management in our clinical setting, with 97% of the patients with an A1c [?] 6.5% being activated to the MDT protocol. However, in this sample composed largely of minority patients with overweight/obesity, increased risk for DBCD, and [?]1 CMRF, the presence of dysglycemia via A1c was evaluated in only 25% of the PCP patients. These findings suggest that early diagnosis of dysglycemia may not be as high a priority in the PCP setting, especially with the presence of competing for acute or chronic conditions at the time of the encounter. MDT co-management, on the other hand, may prove timelier and more effective in monitoring and screening the evolution of dysglycemia in at-risk patients. The notion that DM can be prevented or delayed if dysglycemia is identified in the pre-disease phase [12] should be emphasized and this type of standardized screening protocol should be considered as a strategic tool to overcome these obstacles.

Less weight loss has been reported with lifestyle intervention in AA women (-4.5%) compared to their C and H counterparts (-8.1% and -7.1%, respectively) in the DPP [13] as well as male and female AA patients with DM in the Look AHEAD trial [14]. In this study, no race disparities in weight loss were detected, suggesting a similar benefit among all races. A higher reduction in SBP (-2.49 mmHg) was found in H compared to AA, though this was likely not mediated by weight changes. Number of CMRFs negatively affected SBP and DBP changes and was associated with an increase of 1.66 and 1.04 mmHg, respectively, though the clinical significance of these findings was not supported by the binary model.

At the time of this one-year analysis, we found no between-group difference in mean length-of-care, with a total sample average of 61.8 months (Table 1). Those co-managed with MDT averaged twice as many visits in the same period compared to PCP-exclusive patients (12.3 vs. 6.6 visits/y, $p<0.001$). Our findings support the sustained benefit of a higher number of total visits integrating regular clinical care, care coordination, and lifestyle counseling as in the LDH model. This could explain lower patient attrition and higher levels of engagement, as it presents greater opportunity to reinforce lifestyle education and promote behavioral changes. While benefits of an MDT approach on cardiometabolic risk has been reported within controlled clinical trials, a specialist-based model for patients with severe obesity has been proposed, named Weight Assessment and Management Clinic (WAMC) [15]. High-intensity, lifestyle-based treatment program for obesity delivered in an underserved primary care population produced clinically significant weight loss at 2 years [16]. On the other hand, a review of treatment of obesity in primary care practices in US did not support the exclusive use of low-to-moderate intensity PCP counseling to achieve significant weight loss, though this can be achieved when used in combination with either pharmacotherapy or intensive counseling and meal replacements from dietician/nurse [17]. Implementation of MDT interventions in clinical settings does impose certain challenges. In this study, MDT provided the opportunity for more interaction with providers, intensive pharmacological management, CMRF screening tools and lifestyle counseling. At Lifedoc Health, patients in MDT group were co-managed by PCP and most visits were scheduled simultaneously as shared medical appointments (SMA) where possible to maximize the patient's convenience. SMAs involved several care team members, including personnel trained in delivering patient education (lifestyle provider), facilitating patient interaction (medical assistant), and a prescribing provider (endocrinologist or endocrinologist-directed nurse practitioner), initiating and sustaining a comprehensive care plan [18]. SMAs have been shown to improve A1c and SBP in patients with DM [19], though there is less evidence of its efficacy in other chronic conditions [20].

The detection and management of cardiometabolic diseases in a real-world clinical setting is complex as involves multiple drivers, multi-morbidity, and genetic/environmental interactions [21]. Protocol activation promotes the patient's access to the best health care within the health system and is subject to both patient-imposed and provider-imposed barriers. In this study, some factors may have limited a patient's activation to MDT such as ethnocultural disparities in weight perception, as well as social determinants of health, including a lack of transportation or insurance, lower-income, low health literacy, or work-related constraints for appointments, each of which contributes to the proportion of no-shows. Understandably, both time constraints and multi-morbidity can impose barriers to better outcomes in PCP-driven interventions. This

ultimately causes PCPs frustration in treating obesity, since limited time for simple lifestyle prescription does not lead to sustainable weight loss or improved management of comorbidities for the majority. Payer impact on patient outcomes should also be recognized, as their preferred fee-for-service reimbursement model contributes to the implementation of a volume-driven practices with more restricted visit durations making it extremely difficult to cover all aspects of a patient with multiple competing chronic conditions. In this study, patients undergoing MDT co-management were older and heavier suggesting that weight stigma could also contribute to a lack of provider's activation of younger and overweight patients. Clinical inertia – failure of providers to initiate or intensify treatment when indicated – and diagnosis inertia – unawareness/failure to diagnose a condition when present [22] – can also foster lack of activation. However, contrary to the general idea that providers are chiefly responsible for inertia, all participants in the care delivery experience including patients, pharmacists, nurses, medical assistants, health authorities, payers and policy makers should be considered to play a role. [23]. Rather than an accusatory outlook towards reduced MDT activation or provider inertia, a clear understanding of its multiple causes and determinants should be captured, and development of specific, integrated strategies in clinical practice should be promoted to overcome these barriers.

Some limitations of this study deserve to be mentioned. Because this data is drawn from routine clinical practice, not all are obtained at the same intervals for which the average of measurements from Q1 and Q4 were used. Similarly, laboratory tests were not available for all participants in Q1 and Q4, so it was not possible to analyze the changes in blood glucose and lipid profile and only the A1c readings of those patients with baseline A1c [?] 6.5% were included in DM range, as those tests are payer reimbursable. Patients referred to MDT by PCP were heavier, which may suggest a selection bias, though MDT remained more effective even after adjusting by baseline age and BMI. Outcomes of interventions carried out in routine clinical settings are infrequent [24]. This study has the strength to accurately depict of what occurs in daily clinical practice. Furthermore, a high proportion of patients were underserved, low-income minorities with multiple social barriers, which only further limits the effectiveness of the intervention.

In conclusion, there is a need to simplify the translation of evidence-based interventions into daily clinical practice and to ease healthcare accessibility. Lifedoc's protocolized, integrated, outcome-based clinical model may positively impact the progression of overweight, obesity as well as evolution of blood pressure and A1c and reduced the overall numbers of CMRF in a low-income, minority cohort of adults compared to a PCP-exclusive approach. Results from this analysis can be easily applied to optimize clinical practice, more positively improve health outcomes, and ultimately reduce healthcare system inertia and cost of care in real-world settings. Significant improvement in outcomes of the MDT group suggests that other associated factors should be further investigated and identified to promote strategies for reducing the burden and epidemic progression of cardiometabolic conditions.

Table 1: Baseline demographics, health care, and cardiometabolic risk factors by type of intervention

	Primary care provider	Multidisciplinary team	Total	P
Demographics				
N (%)	192 (32.1)	406 (67.9)	598 (100)	
Age (y)	39.9 ± 14.0	45.6 ± 13.6	43.8 ± 14.0	<0.001
Male (%)	21.4 (15.6 - 27.2)	27.8 (23.5 - 32.2)	25.8 (22.2 - 29.3)	0.112
African American (%)	60.4 (53.5 - 67.3)	58.1 (53.3 - 62.9)	58.9 (54.9 - 62.8)	0.658
Hispanic (%)	35.9 (29.2 - 42.7)	35.0 (30.3 - 39.6)	35.3 (31.5 - 39.1)	0.890
Caucasian (%)	3.7 (1.0 - 6.3)	6.9 (4.4 - 9.4)	5.9 (4.0 - 7.7)	0.163
CMRF				
# CMRF	0.7 ± 0.8	1.8 ± 0.9	1.4 ± 1.0	<0.001
Weight (kg)	84.8 ± 21.5	97.3 ± 26.8	93.3 ± 25.8	<0.001
BMI (kg/m^2)	31.7 ± 7.1	36.13 ± 9.3	34.7 ± 8.9	<0.001
SBP (mmHg)	122.8 ± 14.8	123.64 ± 13.3	123.4 ± 13.8	0.510

DBP (mmHg)	78.16 ± 9.0	77.52 ± 8.3	77.7 ± 8.5	0.387
A1c (%)	5.8 ±1.4	7.0 ± 2.1	6.8± 2.0)	<0.001
Health care indicators				
# visits				
Primary Care Provider	6.4 ± 3.0	3.6 ± 4.3	4.5 ± 4.1	<0.001
Endocrinology	0.2 ± 0.4	4.9 ± 1.7	3.4 ± 2.6	<0.001
Lifestyle	0	3.8 ± 4.9	2.6 ± 4.4	<0.001
Length-of-Care (months)	63.5 ± 40.6	61.0 ± 41.8	61.8 ± 41.4	0.498
Type of patient				
New (%)	9.4 (5.3 - 13.5)	10.3 (7.4 - 13.3)	10.0 (7.6 - 12.4)	0.824
Established (%)	90.6 (86.5 - 94.7)	89.7 (86.7 - 92.6)	90.0 (87.6 - 92.4)	0.824

Frequencies are expressed as percentages and 95% confidence intervals (95% CI) and intervention groups were compared using χ^2 test. Variables with normal distribution are expressed as mean ± se and intervention groups were compared using t test. *Abbreviations* : A1C: glycated hemoglobin, BMI: Body mass index, CMRF: cardiometabolic risk factors (type 2 DM, obesity, HTN), DBP: Diastolic blood pressure, SBP: Systolic blood pressure.

Table 2. Changes in weight, blood pressure, and number of cardiometabolic risk factors between quarter 1 and quarter 4 by type of intervention during 1 y observational period

	Primary care provider Δ Q4-Q1	Primary care provider P	Multidisciplinary team Δ Q4-Q1	Multidisciplinary team P	To Δ
Weight (Kg)	+ 0.6 (-0.3,1.4)	0.19	- 1.4 (-2.0, -0.8)	0.00	- 0
BMI (kg/m^2)	+ 0.2 (-0.1,0.6)	0.15	- 0.5 (-0.8, -0.3)	0.00	- 0
SBP (mmHg)	- 1.2 (-2.9,0.5)	0.17	-1.5 (-2.6, -0.4)	0.01	- 1
DBP (mmHg)	- 0.4 (-1.4,0.7)	0.49	- 1.1 (-1.9, -0.3)	0.01	- 0
Number of CMRF	+ 0.1 (0.0,0.2)	0.02	- 0.1 (-0.2, -0.04)	0.00	- 0

Mean changes and 95% confidence intervals (95% CI) are presented. Mean changes between quarter 1 (Q1) and quarter 4 (Q4) for each variable were compared using paired t test. *Abbreviations* : BMI: Body mass index, CMRF: cardiometabolic risk factors (type 2 DM, obesity, HTN), DBP: Diastolic blood pressure, SBP: Systolic blood pressure.

Table 3. Association between demographics and health care variables and changes in cardiometabolic factors (n= 598)

CMRF	Exposure variable	Linear regression analysis β (CI)	Linear regression analysis β (CI)
Weight		Weight changes (Kg)	P
	Type of intervention (MDT vs PCP)	-4.29 (-7.62, -0.97)	0.011
	Age	-0.09 (-0.15, -0.03)	0.005
	Baseline weight (Q1)	-0.03 (-0.05, -0.00)	0.019
	# CMRF	-0.42 (-1.06, -0.22)	0.200
BMI		BMI changes, Kg/m^2	P
	Age	-0.03 (-0.06, -0.01)	0.007
	Type of intervention (MDT vs PCP)	-1.43 (-2.68, -0.18)	0.025
	Baseline BMI (Q1)	-0.04 (-0.07, -0.02)	<0.001

	# CMRF	-0.08 (-0.32, 0.16)	0.506
SBP		SBP changes, mmHg	P
	Age	0.07 (0.01, 0.13)	0.033
	Gender (Male vs Female)	3.46 (1.61, 5.31)	<0.001
	Type of intervention (MDT vs PCP)	-2.18 (-4.09, -0.26)	0.026
	Race (H vs AA)	-2.49 (-4.25, -0.73)	0.006
	Race (C vs AA)	-0.83 (-4.22, 2.55)	0.628
	Baseline SBP (Q1)	-0.54 (-0.60, -0.47)	<0.001
	# CMRF	1.66 (0.67, 2.66)	0.001
DBP		DBP changes, mmHg	P
	Age	-0.03 (-0.07, 0.02)	0.213
	Type of intervention (MDT vs PCP)	-1.97 (-3.34, -0.60)	0.005
	Baseline DBP (Q1)	-0.48 (-0.55, -0.41)	<0.001
	# CMRF	1.04 (0.34, 1.74)	0.004
A1C changes*		A1C changes, %	P
	Age	0.01 (-0.01, 0.02)	0.271
	Gender (Male vs Female)	-0.28 (-0.65, 0.09)	0.135
	Type of intervention (MDT vs PCP)	0.32 (-0.25, 0.88)	0.271
	Race (H vs AA)	0.03 (-0.33, 0.39)	0.858
	Race (C vs AA)	0.62 (-0.16, 1.39)	0.117
	Baseline A1C (Q1)	-0.24 (-0.32, -0.16)	<0.001
	Type of patient (New vs Established)	-0.26 (-0.78, 0.26)	0.327

Data are β coefficient and 95% confidence intervals (95% CI). Linear regression analysis was applied. *Abbreviations* : A1C: glycated hemoglobin, AA: African American, BMI: Body mass index, C: Caucasian, CMRF: cardiometabolic risk factors (type 2 DM, obesity, HTN), DBP: Diastolic blood pressure, H: Hispanic, MDT: Multidisciplinary team, PCP: Primary Care Provider Q1: First quarter, SBP: Systolic blood pressure.

Table 4. Association between demographics and health care variables and changes in cardiometabolic factors (n= 598)

CMRF	Exposure variable	Binary logistic regression analysis OR (CI)	Binary logistic reg
Weight		Weight loss at least 5% initial weight	P
	Type of intervention (MDT vs PCP)	1.77 (1.09, 2.94)	0.023
	Baseline weight (Q1)	1.00 (1.00, 1.01)	0.232
BMI		BMI change at least 1-point BMI (yes, no)	P
	Type of intervention (MDT vs PCP)	1.83 (1.16, 2.93)	0.010
	Baseline BMI (Q1)	1.05 (1.02, 1.07)	<0.001
	# CMRF	1.03 (0.83, 1.27)	0.772
SBP		SBP change at least 2 mmHg (yes, no)	P
	Age	0.99 (0.98, 1.01)	0.476
	Gender (Male vs Female)	0.58 (0.38, 0.89)	0.013
	Type of intervention (MDT vs PCP)	1.36 (0.87, 2.14)	0.175
	Baseline SBP (Q1)	1.08 (1.07, 1.11)	<0.001
	# CMRF	0.81 (0.64, 1.01)	0.067

	Time exposure to intervention (Months)	1.00 (1.00, 1.00)	0.995
DBP		DBP change at least 2 mmHg (yes, no)	P
	Age	1.01 (0.99, 1.02)	0.248
	Type of intervention (MDT vs PCP)	1.59 (1.01, 2.52)	0.046
	Race (H vs AA)	1.15 (0.76, 1.74)	0.502
	Race (Whites vs AA)	0.67 (0.27, 1.57)	0.375
	Baseline DBP (Q1)	1.14 (1.11, 1.18)	<0.001
	# CMRF	0.87 (0.69, 1.09)	0.233
A1C changes*		A1C change at least 0.3 % (yes, no)	P
	Type of intervention (MDT vs PCP)	1.01 (0.37, 3.23)	0.987
	Baseline A1C (Q1)	1.56 (1.35, 1.81)	<0.001

Data are odd ratio (OR) and 95% confidence intervals (95% CI). Binary logistic regression analysis was applied. *Abbreviations* : A1C: glycated hemoglobin, AA: African American, BMI: Body mass index, C: Caucasian, CMRF: cardiometabolic risk factors (type 2 DM, obesity, HTN), DBP: Diastolic blood pressure, H: Hispanic, MDT: Multidisciplinary team, PCP: Primary Care Provider Q1: First quarter, SBP: Systolic blood pressure.

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