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Feasibility and Effectiveness of a Comprehensive Care Program for People Living with Obesity: A Real-World Experience in a Public Hospital in Mexico

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Comprehensive care program · Mexico · Obesity · Public hospital · Treatment

Abstract
Introduction: Existing evidence indicates that the best treatment model for obesity leading to successful weight loss consists of a so-called comprehensive lifestyle intervention program, but the offer, implementation, and coverage of these kinds of programs for the diagnosis, management, and follow-up of people living with obesity are limited. So, the aim of this study was an evaluation of the feasibility and effectiveness of a comprehensive care program for obesity in a public tertiary hospital in Mexico. ***Methods:*** An observational, longitudinal, and retrospective study evaluated a six-month long medium-intensity comprehensive care program (seven visits focused on medical, nutritional, psychological, and psychiatric diagnosis and treatment). A total of 1,017 people living with obesity were recruited for the program. Logistic regression models were used to predict the factors associated with attendance and weight loss. ***Results:*** Of the 1,017 participants, 661 completed the program (65% retention rate) and attended 4.9 ± 1.9 visits each, with 40.1% losing ≥5% of their starting weight ($X = 4.3 \pm 4.4\%$). From visit 1 to visit 7, the participants that completed the program had weight decreases of $\Delta = -4.8$ kg and body mass index (BMI) -2.3 kg/m^2; $p < 0.01$. Each additional visit increased the likelihood of a 5% weight loss [OR 1.90, 95% CI: 1.51–2.38, $p < 0.001$] and 10% [OR 2.45, 95% CI: 1.49–4.02, $p < 0.001$], becoming statistically significant after attending more than four visits. Each additional year of age increased the likelihood of losing ≥5% body weight [OR 1.01, 95% CI: 1.00–1.03, $p < 0.05$] and increased the likelihood of completing the program [OR 1.02, 95% CI: 1.00–1.03, $p < 0.01$] after controlling for sex, weight, BMI, and psychiatric and weight loss medications. ***Discussion/Conclusion:*** This study demonstrates the feasibility and effectiveness of a six-month comprehensive program for obesity in a public hospital in Mexico.

Introduction

Obesity is a progressive chronic disease which is associated with other chronic diseases such as type 2 diabetes mellitus, cardiovascular disease, and coronavirus (COVID-19) [1, 2]. In Mexico, three out of ten adults aged over 20 years have obesity. As such, obesity represents a complex public health challenge in Mexico given its impact on overall health [3].

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Research evidence on intervention effectiveness has evolved over the years, and current evidence indicates that the best treatment model for obesity leading to successful weight loss consists of a so-called comprehensive lifestyle intervention program. These include three key components: a moderately calorie-reduced diet, increased physical activity, and the use of behavioral strategies to help patients achieve and maintain healthier body weight. These programs are intensively taught in at least 16 sessions during the first 6 months, either individually or in groups [4–6]. The Canadian guidelines for the treatment of obesity in adults recommend patient-centered conversations about weight and the use of the 5A model approach, a holistic approach to health behavior which addresses the root causes of weight gain, with care taken to avoid stigmatizing and overly simplistic narratives like "eat less and move more" [7].

The need for inclusion among people living with obesity has been shown in efficacy studies such as the Diabetes Prevention Program (DPP) and the Action for Health in Diabetes (Look AHEAD) [6, 8–10]. There has been substantial evidence shown in translational and effectiveness studies that the translation and adaptation of DPP findings into "real-world" settings are the gold standard for the treatment of diabetes and obesity and lead to weight loss in different public settings [11–15].

In Mexico, the offer, implementation, and coverage of comprehensive evidence-based programs for the diagnosis, management, and follow-up of people living with obesity are limited. However, short-term studies have reported that comprehensive programs could prove effective [14–18].

National-level data revealed that only 8% of individuals living with obesity had received treatment by a health care provider [19]. The interventions offered in the Mexican clinical care delivery system usually consist of conventional sporadic appointments with recommendations on diet and exercise given by primary care doctors or nutritionists without a structured protocol [20, 21]. These encounters typically do not consider the delays inherent in seeking care within the Mexican population living with obesity and how reluctant physicians may be to start a conversation about the disease with their patients [22].

Conducting complex comprehensive programs that utilize available resources has been a challenge in daily clinical practice. Despite this, expert obesity treatment groups have concluded that there is currently no better alternative than to implement this intervention model as much as possible [4]. Comprehensive programs have shown that obesity can be successfully managed and that the more frequent contacts or consultations are between patients and their care provider team, the greater the weight loss [4, 23–27]. The programs have also demonstrated that a 5–15% weight loss over 6 months has led to improvements in risk factors (glucose, systolic and diastolic blood pressure, HDL cholesterol, and triglycerides) or incidence of disease in populations "at risk" due to their obesity, and that this level of weight loss is a realistic goal [4, 6, 28]. Therefore, the aim of this study was to describe the feasibility and effectiveness of a six-month comprehensive care program designed to reduce weight among people living with obesity in a public tertiary care hospital in Mexico.

Materials and Methods

Setting

This was an observational, longitudinal, and retrospective study conducted at the National Institute of Medical Sciences and Nutrition Salvador Zubirán (Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, INCMNSZ), a public tertiary care hospital in Mexico City. The Obesity and Eating Disorders Clinic operates within the INCMNSZ and provides care to people living with obesity who have been referred from primary and secondary care facilities throughout Mexico where they lack human resources or multidisciplinary treatment options. In July 2019, the Obesity and Eating Disorders Clinic was certified as the first "Collaborating Center for Obesity Management" in the Americas by the European Association for the Study of Obesity (EASO) and was accredited in accordance with accepted European and academic guidelines, thus ensuring a high-quality and well-structured center.

Participants

Preconsultation assessments were conducted to identify patients who met the following inclusion criteria for receiving the intervention: 18–70 years of age, literate, body mass index (BMI) ≥30 kg/m^2, with recent, mild, or moderate comorbidities related to obesity under medical treatment or willing to start it (type 2 diabetes mellitus, hypertension, dyslipidemias, osteoarthritis, hypothyroidism, etc.), and absence of unstable psychiatric condition at the time of admission. Exclusion criteria included pregnancy, breastfeeding within the last 6 months, bariatric surgery, patients with significant target organ damage related to obesity (e.g., recent myocardial infarction, unstable or advanced heart failure, severe complications of diabetes, disabling osteoarthritis, Child B and C liver cirrhosis, and abnormal kidney function), schizophrenia, severe psychotic or suicidal depression, bipolar disorder, obsessive-compulsive disorder, addictions in partial remission, dementia, moderate or profound intellectual disability, and serious functional limitations. Once patients were accepted and had been assigned to a file by the INCMNSZ, it took between three and 6 months to begin the program. This was due to the high demand for the service and was limited by the number of patients that could be seen daily. During this time, patients did not receive treatment and remained on a waiting list. Of course, there was no ability to control patients'

weight changes during this period. Since February 2003, a total of 4,124 patients participated in the program, but the program was updated in July 2015 in accordance with advances in the treatment of obesity. Therefore, the data from consecutive patients enrolled between July 2015 and October 2019 and who had finished the program are presented in this paper.

Intervention

The clinic offered a program called "comprehensive care program for patients with obesity" ("Programa de Atención para el Paciente con Obesidad," PAPO). It was approved by the INCMNSZ Committee following the International Ethical Guidelines for Biomedical Research Involving Human Subjects. It was fundamentally a program for patient management and focused on the needs of each patient in a real-world context. All service costs were paid by the patient, with the total intervention cost ranging from 17 to 490 USD, depending on the patient's socioeconomic level as assigned by an INCMNSZ social worker. It is important to emphasize that public reimbursement in Mexico partially covers the cost of medical care according to the patient's income but does not cover medications. Most patients who attended the clinic were low- to medium-low income, and some were significantly limited in their ability to purchase diet components or medications.

The program was a medium intensity, comprehensive six-month program focused on medical, nutritional, psychological, and psychiatric diagnosis and treatment. Intervention consisted of seven visits, with five individual visits (with alternate contact with a medical doctor, nutritionist, psychologist, and psychiatrist) and two psychoeducational group sessions designed by the research group and based on behavioral interventions (provided by psychologists, nutritionists, and physicians) for the patients and their families and social support networks (Fig. 1).

Program introduction (visit 1): this involved a psychologist who presented the program to the patients and their families during a psychoeducational group session focused on obesity, its causes and treatment, and outlined the program features (online suppl. material; see www.karger.com/doi/10.1159/000527024 for all online suppl. material). All patients signed an informed consent form before completing questionnaires evaluating eating behavior (Three-Factor Eating Questionnaire) [29, 30], anxiety and depression symptoms (Hospital Anxiety and Depression Scale [HAD]) [31, 32], quality of life (Impact of Weight on Quality of Life) [33, 34], and motivation and behavioral goals (semistructured questions). These questionnaires were previously validated with Mexican patient samples. Body weight, height, BMI, and body composition (body fat and lean mass, total body water, extracellular water, intracellular water, and skeletal muscle mass) were assessed using a Medical Body Composition Analyzer (Seca mBCA 514; Seca GmbH & Co. KG, Hamburg, Germany). For these measurements,

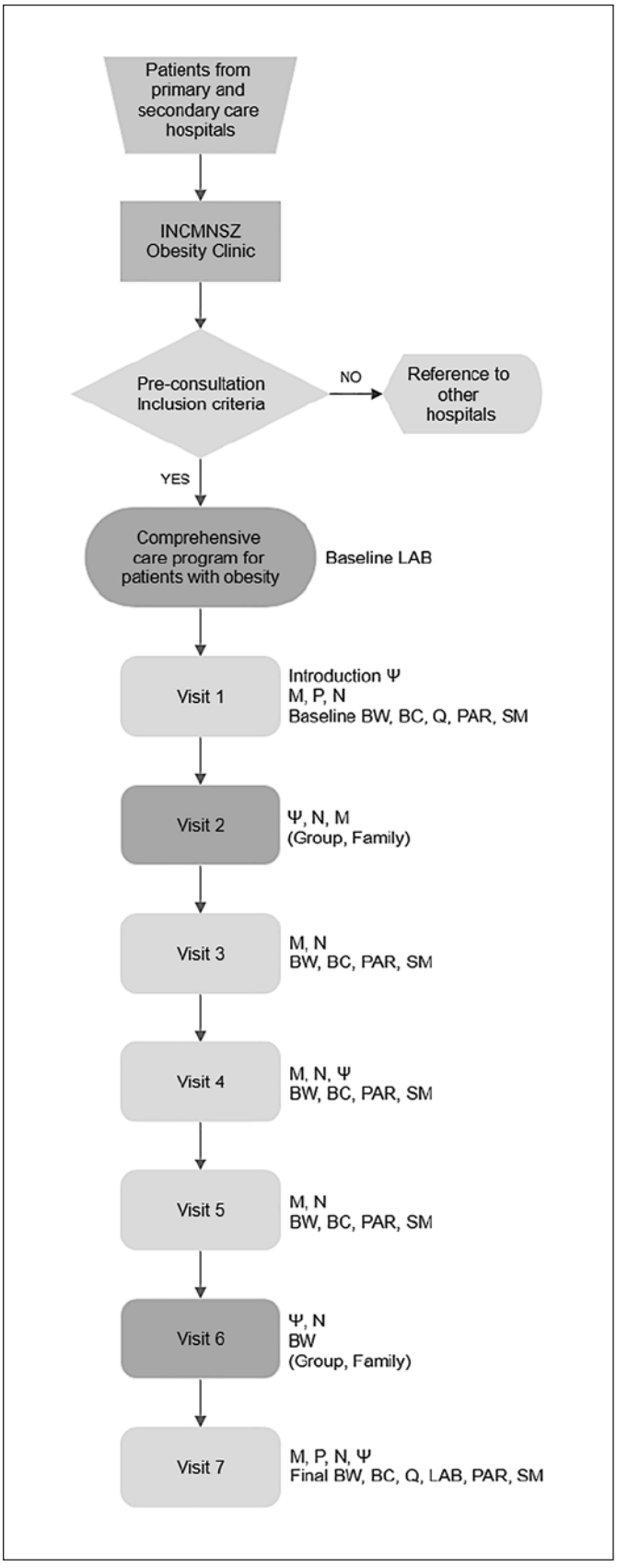

Fig. 1. Model of the comprehensive care program for patients with obesity. INCMNSZ: Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán; M, medical intervention; P, psychiatric intervention; Ψ, psychological intervention; N, nutrition intervention; LAB, laboratory tests; BW, body weight; BC, body composition; Q, questionnaires; PAR, physical activity recommendations; SM, self-monitoring. Visit 2 and visit 6 (dark gray) are the psychoeducational group sessions (for patients and their families and social support networks).

patients should have been in light clothing and bare feet and had ideally fasted and had empty bladders. This intervention lasted 90 min. The patients were then assigned to a specific team including a physician, nutritionist, psychiatrist, and psychologist who attended them throughout the program. Because INCMNSZ is an academic hospital, residents and social service nutritionists could interact with the patient while under the supervision of the Obesity Clinic staff.

Medical intervention (visits 1, 3–5, and 7): the physician (internist or endocrinologist, with training in obesity) directed a complete obesity-centered initial assessment which included a medical history, a thorough clinical evaluation, laboratory studies (fasting glucose, fasting lipid panel, liver function studies, thyroid function tests, and vitamin D test), and the Edmonton Obesity Staging System (EOSS) [35]. Patients were advised to increase their physical activity according to individualized plans based on comorbid conditions, preferences, and capabilities (eventually doing 30–45 min of activity most days of the week, with a goal of reaching 150 min per week at the end of the program). Physical activity was self-monitored by the patients. Some patients had additional conditions related to obesity (T2DM, dyslipidemia, hypertension, etc.), so their physicians provided prescriptions for treatment of these comorbidities which were adjusted according to clinical changes and patient characteristics within the Obesity Clinic. If additional intervention was needed, the patient was referred to other specialists within the INCMNSZ, but according to the inclusion criteria, patients with very serious diseases were not included in the program or were admitted once stabilized. Obesity treatment medications (orlistat and liraglutide are the only drugs approved in Mexico for long-term use) were prescribed as needed, dependent on patient characteristics and possibilities. During all consultations, patient adherence to medications, including psychopharmacological treatment, was assessed based on the patient's own reports. Every patient received a "visit 1 handout" with their individualized diagnosis and treatment. This included a record of weight, behavior, and adherence (see online suppl. material). Body weight, body composition, self-care behaviors for health, and barriers were discussed during all visits to track changes. A physician established a clinically significant weight loss of ≥5% of initial body weight during the program. Visits 1 and 7 had durations of 60 min each, and visits 3–5 were each 30 min in duration.

Nutritional intervention (visits 1, 3–5, and 7): the nutritionist provided an individualized meal plan based on medical comorbidities and patient preferences. The meal plans ranged from 1,200 to 1,500 kcal/day for women and 1,500–1,800 kcal/day for men [4]. All patients were encouraged to self-monitor (eating behavior, physical activity, and sleep patterns) throughout the program in order to assess adherence and to tailor the intervention on a monthly basis. This also helped the patients overcome barriers to maintaining their meal plans. Visit 1 had a duration of 60 min, visits 3–5 and 7 were 30 min in duration.

Psychiatric intervention (visit 1 and 7): the psychiatrist performed a semistructured interview to investigate if there was a psychiatric condition that required psychopharmacological treatment and/or psychotherapy and specified the EOSS mental condition [35]. At each medical intervention, the doctor measured adherence to medications based on the patient's self-report. Both visits 1 and 7 had durations of 60 min each.

Psychological intervention (visit 4 and 7): the psychologist interpreted the questionnaire results and provided support to promote adherence to treatment using strategies from cognitive-behavioral therapy and motivational interviewing. The psychologist established SMART goals (Specific, Measurable, Achievable, Relevant, Timely), provided psychoeducation, problem solving, cognitive restructuring, and the patient's relapse prevention plan. Family members were included if needed. The duration for visits 4 and 7 were 40 min each.

Psychoeducational group sessions (visit 2 and 6): patients and their families or social support network are involved in two sessions conducted by a psychologist, nutritionist, and a physician. The group sessions were designed by the research group and based on behavioral interventions. They raised awareness of obesity as a chronic and multifactorial disease and included reviews of the benefits of physical activity, food groups, and portions and the importance of self-monitoring, stimulus control, family and social support, cognitive restructuring, decisional balance, benefits of weight loss, and physiological changes associated with weight loss and weight regain. Visit 2 was 3 h in length, and visit 6 was 2 h in length.

Final visit (visit 7): patients underwent a clinical evaluation which included an assessment of body composition, laboratory studies, and EOSS stage and the completion of questionnaires. Patients, along with physicians, psychiatry staff, nutritionists, and psychologists, separately discussed the next steps in the patient's treatment depending on the results during the program up to that point (e.g., patients who achieved any weight loss, had complied with the use of medications, attended ≥4 visits continued for another 6 months to complete a 12-month comprehensive care program [extended], or continued in a bariatric surgery program or physician-only consultations, as needed).

Endpoints

Feasibility was defined as the number of patients who attended the program visits and provided a final percentage of attendance at the final visit (visit 7). Effectiveness was determined as the effect of receiving the intervention over the achievement of clinically significant weight loss of ≥5% and ≥10% during the six-month intervention.

Statistical Analysis

Consecutive patients were included in the analysis. Categorical variables were presented as frequency (%), and continuous variables were reported as means and SDs. The number of patients who attended each program visit and the final visit (visit 7) attendance rate was determined as frequencies. Nonparametric tests were used because weight, BMI, and weight loss were not normally distributed as shown by the Skewness-Kurtosis test for normality ($p < 0.001$) and the Shapiro-Wilk test ($p < 0.001$).

A Wilcoxon signed rank test for paired samples was performed to determine whether the weight and BMI reductions seen in visits 1–7 were statistically significant. A Mann-Whitney U test for unpaired samples was conducted to compare weight loss differences by percentage from visit 1 to visit 7 between patients with BMI ≥40 kg/m^2 and patients with BMI <40 kg/m^2 and between patients taking psychiatric and weight loss medications and those who were not. A Kruskal-Wallis test was conducted to compare weight loss between patients according to the number of visits attended; attendance to all seven visits (100% of attendance), 4–6 visits (>60% of attendance), and 2–3 visits (<40% of attendance).

To determine the program's effectiveness, two logistic regression analyses were conducted, for which, both outcome variables

were coded as dichotomous, assigning the number 1 to those patients who reached either goal (≥5% and ≥10%) and 0 to those who did not reach the established goals. To evaluate the treatment integrity, we analyzed the total number of visits patients attended, given that this indicator was more suitable in contrast to only measuring who attended the final session. Thus, each patient could have attended between 1 and 7 sessions, allowing the possibility of attending nonconsecutive sessions. Those who completed seven sessions received the full treatment.

In both logistic regression analyses, the effects of the number of sessions attended were controlled by sex (men and women), age (years), initial weight (kg), and BMI, as well as psychiatric and weight loss medications. Predicted probabilities were determined for each of the seven visits completed and, in the case of achieving ≥5% of the goal, for age.

Two additional regressions were carried out to determine which factors better predicted how many treatment sessions patients would complete. The first model considered attendance of at least four visits and was computed as 1, while attending one to three sessions was considered as noncompletion and was computed as 0. In the second logistic regression analysis, completion was defined as attendance of all seven treatment sessions. Both models considered age, sex, initial body weight, and BMI, as well as psychiatric and weight loss medications, as predictor variables. The two-sided level of significance was set at ≤0.05 as a criterion of statistical significance. The analyses were carried out with the Stata Statistical Software (version 14.1; StataCorp LP, College Station, TX, USA).

Table 1. Patient characteristics

Variable	Total
Female, *n* (%)	689 (67.7)
Age, years	43.3±12.3 (18–70)
Age group, *n* (%)	
18–30 years	186 (18.3)
31–40 years	216 (21.2)
41–50 years	281 (27.6)
51–60 years	257 (25.3)
61–70 years	77 (7.6)
Initial weight, kg	112.9±26.7 (62.4–280.4)
Height, m	1.62±0.09 (1.38–1.91)
Initial BMI, kg/m^2	42.7±8.3 (30.2–86.5)
BMI classification, *n* (%)	
Class 1, BMI 30-34.9	141 (13.9)
Class 2, BMI 35–39.9	305 (30)
Class 3, BMI ≥40	571 (56.1)
Hypertension, %	45.8
Type 2 diabetes, %	25.1
Dyslipidemia, %	69.6
Osteoarthritis, %	37.0
Any psychiatric disorder, %	71.9

Values are percentage or mean±*SD* (min–max). BMI, body mass index.

Results

A total of 1,017 consecutive patients were included in the study. The baseline characteristics of the patients are shown in Table 1. Most patients were women (*n* = 689, 67.7%), the mean age was 43 years (women 44 ± 12, men 41 ± 12 years), more than 60% of the sample were older than 41 years, 60% had either some (i.e., incomplete) high school or higher levels of education, and 78% belonged to low or medium socioeconomic levels (established by the Social Work Department of the INCMNSZ). Initial weight was 112.9 kg (women 104.8 ± 20.4, men 129.9 ± 30.2), and the initial BMI was 42.7 kg/m^2 (women 42.2 ± 7.6, men 43.7 ± 9.7). A total of 56.1% of the patients who attended the program had BMI ≥40 kg/m^2. Most patients had at least one metabolic disease: 69.6% dyslipidemia, 45.8% hypertension, 37% osteoarthritis, and 25.1% type 2 diabetes. The majority had a psychiatric disorder (71.9%), of which, 39% had mood disorders, 35% had an eating disorder (binge eating disorder or nocturnal eating syndrome), and 26% had an anxiety disorder; the remainder had mixed disorders or other disorders (ADHD, substance abuse, personality disorders, mild intellectual disability, etc.).

During the program, only 16 patients (1.6%) received a prescription for an obesity drug (6 patients received orlistat, 5 received liraglutide 3.0 mg, and 5 received liraglutide 1.2–2.4 mg); of these, four did not complete the program, two suspended their drug, and 10 continued the treatment until visit 7 (0.7%), with a weight loss of 6.7%. We kept these patients in the total analysis of the sample because there was no statistically significant difference between these patients and the patients who did not use an obesity drug (6.7 ± 4.4 vs. 4.2 ± 4.4%, $p = 0.07$) and to show the real-world context.

A total of 436 patients (42.9%) received a prescription for a psychopharmacological treatment during visit 1 (sertraline [25.7%], fluoxetine [24.3%], escitalopram [16.3%], venlafaxine [8.2%], topiramate [6.6%], citalopram [6%], bupropion [3.4%], and others [9.5%]). A total of 243 patients maintained the use of their medication until the end of the program. These prescriptions were not intended to reduce weight but treated psychiatric illnesses with psychotropic drugs that have a neutral or favorable effect on weight and avoided drugs that promote weight gain. Patients who received psychotropic treatment lost a similar amount of weight as those who did not receive these types of medication (4.0 ± 4.4 vs. 4.4 ± 4.5,

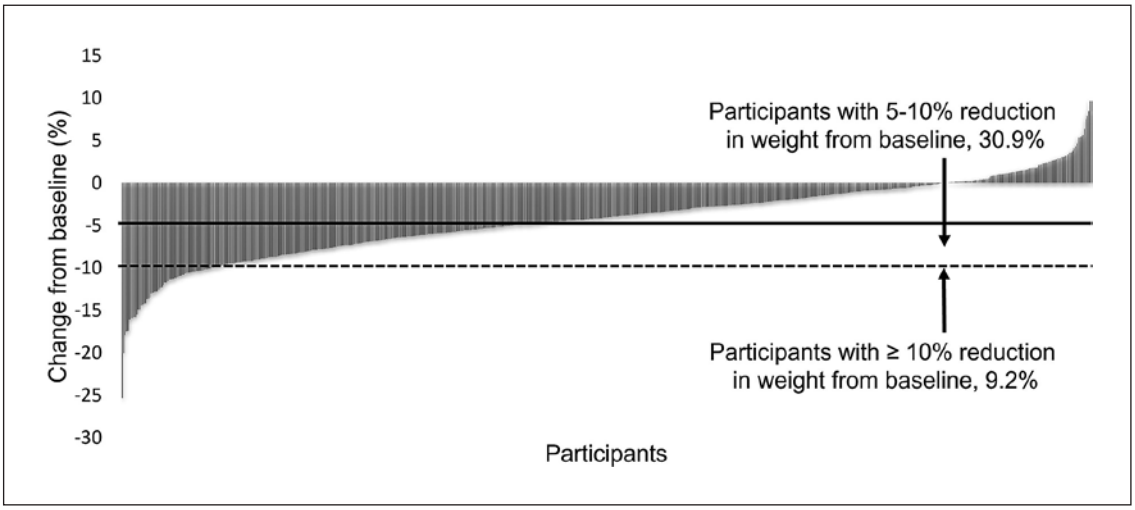

Fig. 2. Weight results of patients during the program. Data are shown in a waterfall plot of the observed percentage change in weight at the final program visit. The solid line indicates the cut-off point for patients who achieved ≥5% weight loss, and the dotted line indicates the cut-off point for patients who lost ≥10%.

$p = 0.382$). The percentage of patients with BMI ≥40 kg/m^2 and taking psychotropic drugs was 45% compared with 39% of patients with BMI <40 kg/m^2 ($p = 0.09$).

Feasibility

The attendance rate for the final visit of the program was 65% ($n = 661$); of these patients, 41.7% attended all seven visits ($n = 276$), 33.9% attended six visits ($n = 224$), 16.8% attended five visits ($n = 111$), 5.9% attended four visits ($n = 39$), 1.5% attended three visits ($n = 10$), and 0.1% attended two visits ($n = 1$). The mean number of program visits attended was 4.9 ± 1.9 (71% of total visits). The dropout rate was 35% ($n = 356$). Only 8.7% attended visit 1 and no other visits ($n = 88$).

Effectiveness

The weight loss results were derived from program completers ($n = 661$). The weight of completers decreased significantly from visit 1 (114.8 ± 28.5) to visit 7 (110.01 ± 28.4) (Δ = −4.8 kg, $p < 0.001$). For BMI, a statistically significant decrease was observed from visit 1 to visit 7 (43.4 ± 8.8 vs. 41.1 ± 8.8) (Δ= −2.3 kg/m^2; $p < 0.011$). When comparing weight loss percentage differences from visit 1 to visit 7 between patients with BMI ≥40 kg/m^2 and patients with BMI <40 kg/m^2, no significant differences were observed (4.2 ± 4.6 vs. 4.3 ± 4.1, $p = 0.55$), but patients with BMI ≥40 kg/m^2 attended more program visits (5.1 ± 1.9 vs. 4.7 ± 1.9, $p < 0.001$). Among the patients who lost ≥5% of their initial weight, no difference between these two groups was identified (39% vs. 42%, $p = 0.462$).

The mean weight loss percentage was 4.3 ± 4.4%. The maximum observed weight loss during the program was 25.3% (25.2 kg) (Fig. 2). A total of 84.6% of patients ($n = 559$) lost some weight during the program; 40.1% lost ≥5% ($n = 265$) (from these, 30.9% lost between 5% and 10% [$n = 204$], 9.2% lost more than 10% [$n = 61$]), and 44.5% lost <5% ($n = 294$). Of the remaining patients, 0.7% maintained their weight ($n = 5$) and 14.7% gained weight ($n = 97$).

Patients were divided according to the number of visits attended to analyze differences in weight loss: attendance of all seven visits ($n = 276$), 4–6 visits ($n = 374$), and 2–3 visits ($n = 11$). The three groups differed by age (45.2 ± 12.5, 42.8 ± 12.4, and 41.7 ± 12.2, respectively; $p < 0.001$), initial BMI (44.1 ± 8.4, 42.7 ± 8.7, and 41.2 ± 7.3, respectively; $p < 0.002$), and weight loss: patients who attended all seven visits lost more weight than the other two groups (5.8 ± 4.5%, 3.2 ± 3.9%, and 1.8 ± 3.8%, respectively; $p < 0.001$). A total of 55% of patients attending all visits lost ≥5% of their weight, compared to 30% of patients who attended 4–6 visits and 9% who attended 2–3 visits. Patients who gained weight, maintained weight, or lost less than 5% during the program had fewer visits in the program and were younger than the other two groups who lost 5–10% and those who lost >10% (weight 5.4 ± 1,

6 ± 0.9, 6.3 ± 0.9, and 6.6 ± 0.5, $p < 0.001$; age 38 ± 13, 44 ± 12, 46 ± 11, and 45 ± 11, $p < 0.001$) (data not shown).

The logistic regression model showed that for each additional visit to the program, there was an increased likelihood of losing ≥5% body weight [OR 1.90, 95% CI: 1.51–2.38, $p < 0.001$] and 10% body weight [OR 2.45, 95% CI: 1.49–4.02, $p < 0.001$], when controlling for sex, age, initial weight, BMI, and psychiatric and weight loss medications (Table 2). When calculating the predicted probabilities of achieving a weight loss of ≥5%, attending four or more visits increased the likelihood, and attending all seven visits of the program was associated with a greater probability of achieving this result. Data show that there was no impact associated with attending one to three visits (Table 3; Fig. 3a). The probability of achieving a weight loss of ≥10% was rather low; however, the probability of obtaining this result increased significantly after attending five to seven visits (Table 3; Fig. 3b). Additionally, each additional year of age increased the likelihood of losing ≥5% body weight [OR 1.01, 95% CI: 1–1.03, $p = 0.02$], when controlling for sex, age, initial weight, BMI, and psychiatric and weight loss medications (Table 2). Because completing the seven visits of the program significantly predicted the odds of achieving weight loss of ≥5% or ≥10%, one additional logistic regression was performed to determine which factors helped predict attendance (Table 4). Each additional year of age increased the probability of attending the entire program [OR 1.02, 95% CI: 1–1.03] after controlling for sex, weight, BMI, and psychiatric and weight loss medications (Table 4).

Figure 4 shows the predicted probabilities of age relative to the probabilities of reducing the initial weight by ≥5% (panel A) and of completing the entire program (panel B). Patients who were 56 years old (predicted odds 0.437, SE = 0.033, 95% CI [0.3706, 0.5039]) had significantly higher odds of reducing their initial weight by ≥5% than their 18 years old counterparts (predicted odds 0.275, SE = 0.048, 95% CI [0.1815, 0.3702]) (Fig. 4a), and patients aged 47 years (predicted odds 0.75, SE = 0.01, 95% CI [0.724, 0.789]) had higher odds of completing treatment in comparison with younger patients (predicted odds 0.63, SE = 0.04, 95% CI [0.555, 0.722]) (Fig. 4b).

Table 2. Binary logistic regression for achieving weight loss of ≥5% and ≥10%

Factors	OR		SE		*p* value		95% CI		Pseudo R^2		$p\ \chi^2$		*N*
	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	
Visits, *n*	1.90	2.45	0.21	0.61	**<0.001**	**<0.001**	[1.51, 2.38]	[1.49, 4.02]	0.072	0.075	**<0.001**	**<0.001**	488
Sex													
Male	0.89	1.59	0.22	0.64	0.64	0.25	[0.54, 1.45]	[0.71, 3.53]					
Age, years	1.01	0.98	0.008	0.01	**0.02**	0.34	[1.00, 1.03]	[0.96, 1.01]					
Initial weight, kg	1.00	0.99	0.005	0.009	0.32	0.56	[0.99, 1.01]	[0.97, 1.01]					
BMI													
35–39.9	0.97	0.65	0.33	0.36	0.95	0.44	[0.50, 1.90]	[0.21, 1.95]					
>40	0.65	0.85	0.24	0.51	0.26	0.79	[0.31, 1.37]	[0.25, 2.80]					
Psychiatric medications	1.07	0.79	0.21	0.27	0.72	0.49	[0.72, 1.5]	[0.40, 1.54]					
Weight loss medications	1.63	2.02	1.03	1.68	0.43	0.39	[0.00, 0.02]	[0.39, 10.3]					

Discussion/Conclusion

This program provided a novel model of how obesity could be managed by a multidisciplinary team within the Mexican public tertiary health care system, with similar results observed in other programs. It should be empha-

Table 3. Predicted probabilities of achieving a weight loss of ≥5% and ≥10% for the number of program visits attended

Visits	Predicted probabilities		SE		95% CI	
	5%	10%	5%	10%	5%	10%
1	0.02	0.000	0.01	0.001	[−0.003, 0.05]	[−0.001, 0.002]
2	0.04	0.001	0.02	0.002	[0.002, 0.08]	[−0.002, 0.006]
3	0.07	0.004	0.02	0.004	[0.02, 0.13]	[−0.003, 0.012]
4	0.14	0.01	0.03	0.007	[0.07, 0.20]	[−0.003, 0.025]
5	0.23	0.02	0.03	0.01	[0.17, 0.29]	[0.004, 0.048]
6	0.37	0.06	0.02	0.01	[0.32, 0.41]	[0.036, 0.088]
7	0.52	0.13	0.03	0.02	[0.46, 0.59]	[0.093, 0.186]

SE, standard error; CI, coefficient intervals.

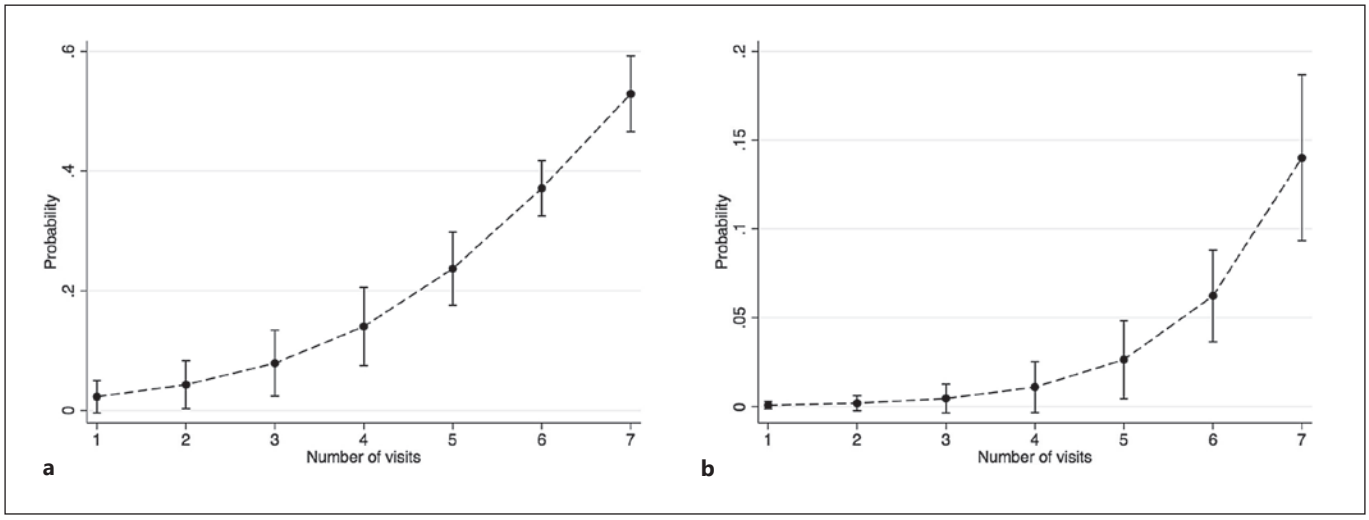

Fig. 3. Probabilities of achieving a weight loss of ≥5% (**a**) and ≥10% (**b**) according to the number of visits attended.

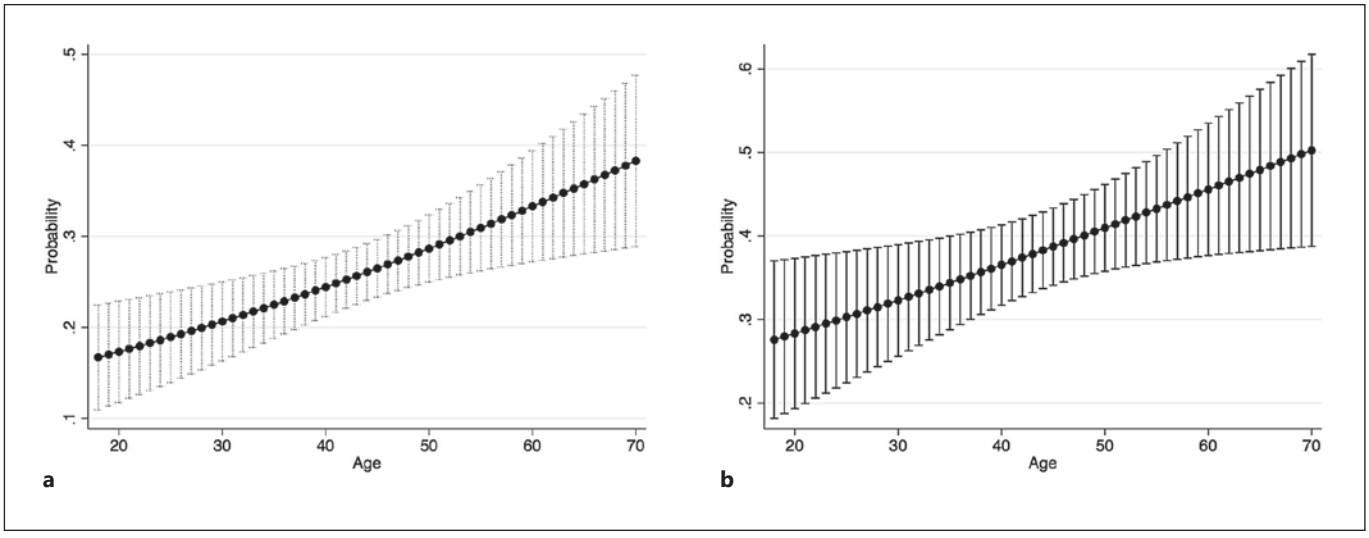

Fig. 4. Probabilities of achieving a weight loss of ≥5% (**a**) and completing the seven visits of program (**b**) according to age.

Table 4. Binary logistic regression for completing the seven visits of the program

Factors	OR	SE	*p* value	95% CI	Pseudo R^2	*p* χ^2	*N*
Age, years	1.02	0.007	**<0.01**	[1.00, 1.03]	0.03	**<0.001**	785
Sex							
Male	1.01	0.21	0.93	[0.67, 1.54]			
Initial weight, kg	1.00	0.004	0.33	[0.99, 1.01]			
BMI							
35–39.9	0.64	0.19	0.14	[0.36, 1.15]			
>40	1.19	0.37	0.57	[0.64. 2.20]			
Psychiatric medications	1.28	0.22	0.14	[0.91, 1.79]			
Weight loss medications	2.29	1.20	0.11	[0.82, 6.4]			

sized that this program was not a controlled study, but a real-world intervention, and therefore, any comparison with controlled studies has limitations. Despite this, the results of the program are relevant because these patients did not receive financial incentives such as free medical care, medications, or food replacements.

Design of the Program

The program was designed following international standards for the treatment of patients living with obesity and represents an effort to create a simplified but complete compilation of multidisciplinary strategies adapted to Mexican patients. The obesity guidelines of the USA, Canada, and Europe have proposed advising individuals with obesity to participate for more than 6 months in a comprehensive lifestyle program which assists participants in adhering to a lower caloric diet and increasing physical activity using behavioral strategies [4, 7, 36].

The challenge remains in standardizing the program and adapting it to the care models of other hospitals or clinics in Mexico that provide obesity treatment and to educate the population to look for treatment that has proven safe and effective. A total of 62.2% of people with obesity have reported taking steps to lose weight, but unfortunately, most of the strategies used were isolated and not within the context of a program: exercise (79%), dieting (78%), or consulting a specialist (44%), with only 32% reporting participation in a weight management program [37].

Results of the Program

The program retention rate was 65%, higher than other comprehensive programs for obesity in Mexico (40–58%) [15–17]. In this study, 98% of completers attended four or more visits (76%, including noncompleters). Attrition can be frequent among patients with obesity (10–80%) [15–17, 38], but in this program, only 9% dropped out during the first visit, compared to the 20% seen soon after the first visit by Dalle Grave et al. [39]. These results can reflect the feasibility of the program.

Visit attendance was found to be linked to weight loss, similar to results in other studies [23–27]. Katzmarzyk et al. [40] found that after a high-intensity lifestyle-based program, during the first 6 months (weekly sessions), low-income patients who attended at least 80% of sessions had lost 7% at 24 months, compared with 1.9% among those who attended less than 80% of the sessions. At 6 months, we found a weight loss of 5.8% in those who attended all visits, 3.2% in those who attended >60% of visits, and 1.8% in those who attended <40% of the visits. Additionally, we concluded that those that attended a minimum of four of the seven visits during the program had their probability of achieving a weight loss of ≥5% increase progressively.

It is known that high-intensity interventions and greater participant contact conducted in primary care settings can result in greater weight loss [27, 41]. According to obesity guidelines and several trials, a model of obesity care that allows frequent contact could improve treatment outcomes [4, 18, 41–44].

In Mexico, the implementation of a DPP adapted intensive program for obesity treatment at different points of healthcare was effective when applied by staff who typically provided care to patients in real-world clinical practice, at least in the short term, with significant weight loss observed (3.2–8.6%) [15]. In a Mexican primary care clinic, 62% of the patients lost ≥5%, and lost 5.3% of their weight after 3 months, following a brief intensive lifestyle intervention (12 weekly consultations by a nutritionist and meal replacement) [42]. Although our analysis only

included those who completed a medium-intensity program, we conclude that a shorter and less intense program has benefits when it is not possible to carry out real-world treatment programs with greater contact with the participants and when funded by research grants. If the ideal setting of weekly contact is not feasible within a hospital, a medium-intensive program setting (monthly visits) appears to produce good outcomes. It is important to generate conditions which allow patients to attend appointments more frequently with a patient-centered interdisciplinary team who can offer a comprehensive program (including behavioral treatment, pharmacological management, and surgery) to establish common objectives, improve weight loss, and ensure patient satisfaction with treatment outcomes [45, 46].

Concerning weight loss, 40% of patients who completed the program were able to attain a clinically significant weight loss in the short term (≥5% within 6 months). This is a meaningful result since it falls within the range of 28.5–48% obtained in other clinics in Mexico but with treatment protocols based on the DPP and with financial support [15, 16, 42]. In our program, patients paid for their treatment (including medical consultations and medication), and nonsalaried employees, who are numerous in Mexico, do not receive income when they come to their medical appointments. These unfavorable conditions constitute powerful socioeconomic determinants that create barriers to initiating or maintaining treatment. For example, in our study, prescription of an obesity drug, along with acceptance and continuity, was very rare (less than 2% of patients), so the small sample size is likely the reason why we did not find differences in weight loss. The limitation of prescriptions was associated with the socioeconomic level of the patients. The only report of the use of an approved obesity drug in Mexico revealed that orlistat was the most common treatment used by those taking steps to lose weight (19% over-the-counter orlistat [60 mg] and 61% in the correct dose [120 mg]). Unfortunately, in this report, the use of medication not approved for long-term use was high (8–34%) [37]. It is a challenge for health professionals to begin drug treatment for obesity because many do not consider it as a chronic disease, and patients may have difficulty with the cost. If obesity medications were publicly funded, along with behavioral interventions and bariatric surgery, perhaps the situation would improve.

Finally, older age was associated with our program completion and weight loss, as many other studies have shown [23, 24, 47, 48]. Patients who were ≥47 years old were more likely to complete the entire program than younger patients, and patients 56–70 years old had significantly higher odds of reducing their initial weight by ≥5% than their younger counterparts. There are misconceptions about the ability of older patients to comply effectively with a structured weight loss program, especially when frailty, physical and mental impairments, and other comorbidities also exist. But precisely, declining health may motivate older patients to increase their awareness of their health status, and they might have greater family support, a more empathetic medical attitude, and reinforcement by other specialists who emphasize to the patient the benefits of losing weight in order to improve their quality of life and health [49, 50]. This seems to have a positive effect on adherence and weight loss. Younger patients have a higher risk of attrition because they may not be able to attend appointments as frequently as older patients, and they may have less financial stability, may not be able to take time off work, or may be less motivated to improve their health [24, 51].

Adaptation of the Program to Other Scenarios

Although the program was designed and developed in a tertiary health care center, it is feasible to adapt the program interventions to clinical practice within first contact healthcare units. Obesity is a great challenge Mexico is facing. According to data from the 2006 Mexican National Health and Nutrition Survey, only 20% of people with obesity have been diagnosed with it, 8% had started formal treatment, and 5.6% had lost weight intentionally (≥5%), although they do not specify how they lost it [19].

Even though the Official Mexican Standard NOM-008-SSA3-2017, "For the Comprehensive Treatment of Overweight and Obesity," recommends a multidisciplinary approach, it does not specify which structured behavior change protocol should be followed [20]. Unfortunately, some public primary care clinics do not have medical personnel trained in the field of obesity [18]. In Mexico, and throughout the world, there is limited training in the diagnosis and treatment of obesity in medical educational programs, insufficient time, limited services, inadequate obesity management infrastructure, long consultation waiting times, resistance among HCPs to initiate a conversation about weight with their patients, stigmatizing attitudes, and the misperception that patients with obesity are not motivated to lose weight [22, 52–57].

An organizational restructuring of obesity care delivery must be a priority in Mexico. Improving education and training in the science and clinical management of obesity (effective advice on diet, physical activity, behavioral change, and medical and surgical therapy) among

whole practice teams; use of multidisciplinary approaches; treatment of obesity as a chronic disease (challenging the misperception that obesity is self-inflicted); education regarding the harms of weight stigma; promotion of the initiation of helpful weight loss conversations earlier; and increased frequency of diagnosis, follow-up appointments, and referrals for effective evidence-based treatment may also help secure better funding streams for treatment services [6, 7, 20, 56–58].

Strengths and Limitations

To our knowledge, this is the first study in Mexico that describes the results of implementing a multidisciplinary program according to what it is now considered "best clinical practices." This program provides structure and medium-intensity support with good weight loss results, similar to intensive interventions, and is adequately balanced in addressing the metabolic, functional, and psychological aspects of patients. Additionally, it is the first study that includes a diagnostic approach using the EOSS system which uses a psychoeducational approach and ad hoc therapeutic proposals for each patient, with documented benefits associated with the program. The results obtained should encourage inclusion in obesity management for older and low- to medium-low-income patients, even when the purchase of diet components or medications is the responsibility of the patient.

It should also be emphasized that different healthcare professionals participated in this program, including resident doctors and nutritionists in training. These results show that reproducibility and continuity are feasible.

Attrition rates were acceptable, considering they occurred in a real-world context. The program was feasible and can justify Mexican government investment in creating specialized clinics for the treatment of obesity which offer comprehensive care to the millions of adults living with this disease.

Limitations include the short-term results and no sample size calculation or randomized assignment process within the program since the institute is a referral-based center of third-level care. These factors may make the findings nongeneralizable to the greater Mexican healthcare sector or population. Additionally, the patients who attended might have been more aware and concerned about their health than typical, weight loss prior to admission into the program was not controlled, and no "last observation carried forward" analysis was conducted. Changes in biochemical data, body composition, obesity-associated comorbidities, EOSS, and quality of life and psychological questionnaires were not included in this paper but will be published shortly. The effectiveness of this program beyond 6 months will be examined in future research.

Conclusion

This paper describes a novel and feasible model for an effective, comprehensive, obesity care program within the Mexican public healthcare system. An approach involving frequent patient contact and patient education can result in a weight loss of ≥5% in a substantial number of patients. Similar care within the Mexican healthcare system might enhance the appropriate management of obesity.

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Statement of Ethics

The intervention was approved by the Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán (INCMNSZ) Committee following the International Ethical Guidelines for Biomedical Research Involving Human Subjects (Reference 1354/DIA-124-03/24-3). Participation in this study was completely voluntary and all the patients signed an informed consent form.

Conflict of Interest Statement

Verónica Vázquez-Velázquez and Eduardo García García report personal fees, grants, and nonfinancial support from Novo Nordisk, not related to this manuscript. Verónica Vázquez-Velázquez is the head of Obesidades, a nonprofit community of people living with obesity and health professionals interested in changing the narrative of obesity and its treatment in Mexico.

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Author Contributions

Verónica Vázquez-Velázquez and Eduardo García García designed and implemented the original comprehensive care program and contributed equally to writing the manuscript and study design. Verónica Vázquez-Velázquez conducted the data collection, analysis, and interpretation; Verónica Vázquez-Velázquez and Eduardo García García revised it critically, conducted the literature search, and approved the submitted and final versions. Verónica Vázquez-Velázquez drafted the paper.

Data Availability Statement

The data that support the findings of this study are available from the Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán (INCMNSZ), but restrictions apply to the availability of these data, which were used under license, and are therefore not publicly available. Data are, however, available from the authors upon reasonable request and with permission of the INCMNSZ.

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