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Lifestyle Interventions in Weight Loss Programs for Community-Based Patients with Severe Mental Disorders: A Scoping Review

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Keywords: Nutritional intervention; obesity; psychiatric disease; severe mental disorder; weight loss
Parole chiave: Intervento nutrizionale; obesità; malattia psichiatrica; grave disturbo mentale; perdita di peso

Abstract

Background. *Patients with psychiatric disorders face exacerbated physical health issues and reduced life expectancy, primarily due to premature cardiovascular diseases. The intricate relationship between lifestyle factors, illness, and psychotropic medications contributes to this phenomenon. The focus of this research is to evaluate weight management interventions for individuals with Severe Mental Disorders through a comprehensive scoping review, investigating the characteristics, types, modalities and topics of interventions to provide a useful tool for professionals who want to promote lifestyle interventions for people with Severe Mental Disorders.*

Methods*. Eligible articles were peer-reviewed studies that reported an intervention targeted to patients with Severe Mental Disorders and aimed at promoting health through nonpharmacological interventions (including but not limited to nutritional education, physical activity and exercise interventions).*

Results*. A total of 20 studies with a total of 3,886 participants were evaluated.The studies included patients with a weighted mean age of 44.37 (SD=4.72) and a mean Body Mass Index of 34.7 kg/m^2 (SD=3.56). Varied interventions, mostly conducted in the US, showed promising weight reduction and cardiovascular risk management results among patients with psychiatric disorders. However, disparate methods used in the studies hindered the evaluation of outcomes. The studies, which yielded the most interesting results, included parallel cluster randomized controlled trials, which showed improvements in HDL cholesterol and metabolic indicators, (HR 0.085; 95% CI:0.007-0.16) using IMPACT therapy, and a pragmatic randomized controlled trial which reported that with the InShape intervention 51% of participants achieved clinically significant reduction in overall cardiovascular risk.*

Conclusion*. Such a synthesis of findings provides valuable insights for future research, emphasizing the need for standardized outcome measures and more extended, comprehensive interventions.*

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Introduction

Patients with psychiatric disorders face a higher prevalence of severe physical conditions and a reduced life expectancy, primarily due to premature cardiovascular diseases (CVD) (1). Various factors contribute to the increased mortality of individuals with Severe Mental Disorders (SMDs). There is a well-established multilevel model highlighting risk factors for excess mortality in persons with SMDs at the individual, health system and socio-environmental levels, including positive correlations between mental disorders and other non-communicable diseases such as cardiovascular and respiratory diseases, diabetes and cancers (2). This intricate relationship is influenced by lifestyle factors, disease-related issues, and the effects of psychotropic medications. People with SMDs are more exposed to risk factors associated with non-communicable diseases such as smoking, excessive alcohol consumption, sedentary behavior, as well as adverse effects of medications and inequitable access to healthcare services.

While unnatural causes such as accidents, homicide, and suicide contribute to higher mortality rates among individuals with SMDs compared to the general population, a significant number of deaths are due to physical health conditions, both non-communicable and communicable (2). Notably, cardiovascular disease presents a ten-fold higher risk of death compared to suicide among those with SMDs (3). Overall, individuals with SMDs face a 1.5-3 times higher risk of cardiovascular morbidity and mortality compared to the general population (4). Moreover, they exhibit high rates of diabetes mellitus, with a reported 2-3 fold higher prevalence (5).

Psychotropic medications, especially second-generation antipsychotics, are associated with metabolic side effects like weight gain, glucose intolerance, and dyslipidemia (6). These medications, along with mood stabilizers and antidepressants, contribute to weight gain, affecting the overall health and well-being of individuals undergoing such treatments (7). The initiation of antipsychotic treatment in drug-naïve patients often leads to substantial weight gain within a few weeks, associated with changes in appetite and eating preferences. The appetite increases and eating preferences changes, such as the choice for high fat/high sugar diets, are possibly related to olanzapine-induced plasma glucagonlike peptide-1 (GLP-1) decrease (8,9) which plays a role in satiation signals and modulation of taste sensitivity. A mesolimbic hyperdopaminergic state may render a motivational/incentive reward system insensitive to low salience/palatability food. This, together with poor cognitive control from the hypofunctional prefrontal cortex and enhanced hedonic impact of food, owing to exaggerated opioidergic drive (clinically manifested as pain insensitivity), may underlie unhealthy eating habits in patients with schizophrenia (10). Many antidepressants and mood stabilizers are associated with weight gain, further complicating the issue. Despite implicated causes such as fast food consumption and specific pharmacotherapies, the exact pathophysiology of the link between SMDs and obesity remains unclear (10).

This scoping review is especially relevant because weight reduction among overweight and obese individuals is crucial for improving cardiovascular health. Even a modest 5% weight loss is considered clinically significant as it has been shown to improve cholesterol levels, glycemic control, and blood pressure (11,12). Lifestyle interventions, including nutrition, education and increased physical activity, have shown promising results for achieving weight loss in the general patient population.

The emerging field of 'Nutritional Psychiatry' holds promise in addressing the significant disease burden associated with mental disorders. There's consistent evidence suggesting that an individual's diet quality is linked to the risk of common mental disorders. New studies are focusing on understanding the biological pathways connecting diet, nutrition, and mental health, emphasizing the importance of the immune system, oxidative biology, brain plasticity, and the microbiome-gut-brain axis for potential nutritional interventions (13). The aim of this review is to analyze the methods and approaches of non-pharmacological interventions for health promotion and weight control in patients with SMDs.

Although other systematic reviews and metanalysis have been done on this topic, it appears that in the last 5 years there has been no formal gathering of new data. In addition, this scoping review focuses on the characteristics, types, modalities and topics of interventions to provide a useful tool for professionals who want to promote lifestyle interventions for people with SMDs.

Materials and methods

1. Search Strategy

Searches were conducted in PubMed (from 2013), Scopus (from 2013), EBSCO (from 2013), from

PsychNet (from 2013), and Web of Science (from 2013) until March 31st, 2023.

The following search terms were used: Mental disorders (Mesh) OR Mental illness OR Psychiatric illness OR Psychiatric disease OR Psychiatric disorder OR Severe mental disorder AND health promotion OR Wellness program OR Health campaign AND Weight loss OR Weight reduction. Reference lists were manually searched for eligible articles.

2. Eligibility Criteria

Eligible articles were peer-reviewed studies that reported an intervention targeted to patients with SMDs and aimed at promoting health through nonpharmacological interventions (including but not limited to nutritional education, physical activity and exercise interventions). All relevant studies were included in the review regardless of methodological quality and design. All identified articles were assessed for adherence to the inclusion criteria by reading titles and abstracts. If abstracts were unavailable or did not provide enough detail to assess study relevance, the full text of the article was obtained and reviewed. Full-text reports were independently reviewed by 2 team members. Disagreements between reviewers were resolved by consensus or by the decision of a third independent reviewer. All eligible studies passing this screening stage were included in the review.

3. Inclusion criteria

In accordance with the PRISMA statement, we used the participants, interventions, comparisons, outcomes and study design (PICOS) criteria to assess study eligibility.

Participants - Adults (aged over 18 years, no upper limit) with serious mental disease defined according to the Diagnostic and Statistical manual of Mental disorders - V (DSM-V) or the International Classification of Diseases-11 (ICD-11) criteria (including but not limited to schizophrenia/psychosis spectrum disorder, bipolar disorder spectrum and major depressive disorder).

Interventions - Any lifestyle intervention for weight management and health promotion. These included promotion of behavioral and dietary changes, self-monitoring interventions, nutrition education and physical activity. Interventions involving pharmacological agents, nutritional supplements or surgical procedures were excluded.

Comparators - All types of comparison conditions were considered eligible. This included usual care, minimal interventions, or other lifestyle interventions.

Outcomes - The primary outcome of interest was a change in body weight at follow-up. The outcome could be measured as a change in weight (kgs or lbs) or BMI (kg/m^2). The other outcomes which were evaluated in the reviewed studies included: the 6 minute walking test (6MWT), blood lipids, blood pressure, waist circumference, Short Form-36, fasting glucose, physical activity habits, body fat percentage, cardiovascular risk reduction, completion and adherence to the program and step count. We also included studies that reported the proportion of participants who achieved >5% weight loss at follow-up. This outcome was collected because >5% weight loss is associated with a reduction in cardiovascular risk among the overweights and obese individuals (14-17), and a 5% to 10% goal for medically supervised weight loss was recommended by the American College of Cardiology/American Task Force guidelines in 2013 for managing overweight and obesity (11,12).

Study design - All studies reporting quantitative outcomes at follow-up, published in English, French and Italian, from January 2013 to August 2023 .

4. Exclusion criteria

The exclusion criteria for this study include individuals below the age of 18, those with self-diagnosed psychiatric disorders, individuals diagnosed with an eating disorder, and veterans with Post Traumatic Stress Disorder (PTSD). Additionally, studies conducted before 2013 will be excluded from consideration. Moreover, participants with outcomes that are not quantitatively measured will be excluded from the study. Furthermore, articles not in English, Italian, or French language will be excluded,

5. Data Extraction and Analysis

Two researchers (GP and CD) screened titles for relevant studies, and independently extracted data from eligible articles using Rayyan, a predefined data extraction tool that identified the lead author, year of publication, country of origin, and study design. The reviewers worked independently with blind results and were not masked to study authorship, discussion, and consensus-resolved differences. Disagreements between reviewers were resolved by consensus or by the decision of a third independent reviewer. No statistical analysis or meta-analysis was conducted due to heterogeneity among identified studies regarding study interventions and outcomes. Thus, the existing comments in the reviewed articles were reported in a scoping format. In accordance with reporting

guidelines, the Preferred Reporting Items for Systemic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist was used to guide the reporting of this review.

Results

1. Study selection

Our search across 5 databases retrieved 112 articles, among which 43 were duplicates. Following this step, 40 records were excluded based on the title or abstract and 6 because they did not meet the inclusion criteria, which left us with 20 articles (Figure 1).

2. Study characteristics

The selected studies were conducted in the following countries: USA (70%), UK, Italy, Japan, Canada and South Africa. The study designs were 5 RCT (19-23), 5 pre-post designs (24-28), 3 pilot studies (29-31), 1 mixed method (32), 2 quasi-experimental (33,34), 1 exploratory study (35), 1 prospective (36), 1 real-world controlled pragmatic outpatient trial (37) and 1 NRCT (38). In only 20 studies, 9 different study designs were present. Only 5 of these were RCT and 1 NRCT, whilst in the other 17 a control group was not present. The modalities of intervention were also ranging from only educational sessions, or in combination with supervised physical activity, or with the addition of mobile health (mHealth) devices which result in a wider range of inputs.

3. Participants' characteristics

The total number of participants included in the 20 studies evaluated was 3,886, with sample sizes ranging from 10 to 1,348 participants. All trials included samples of all genders, with 2,100 females, 1,133 males and 3 transgender people, 3 studies did not report participants' gender. The studies included only patients over 18 years of age, with a

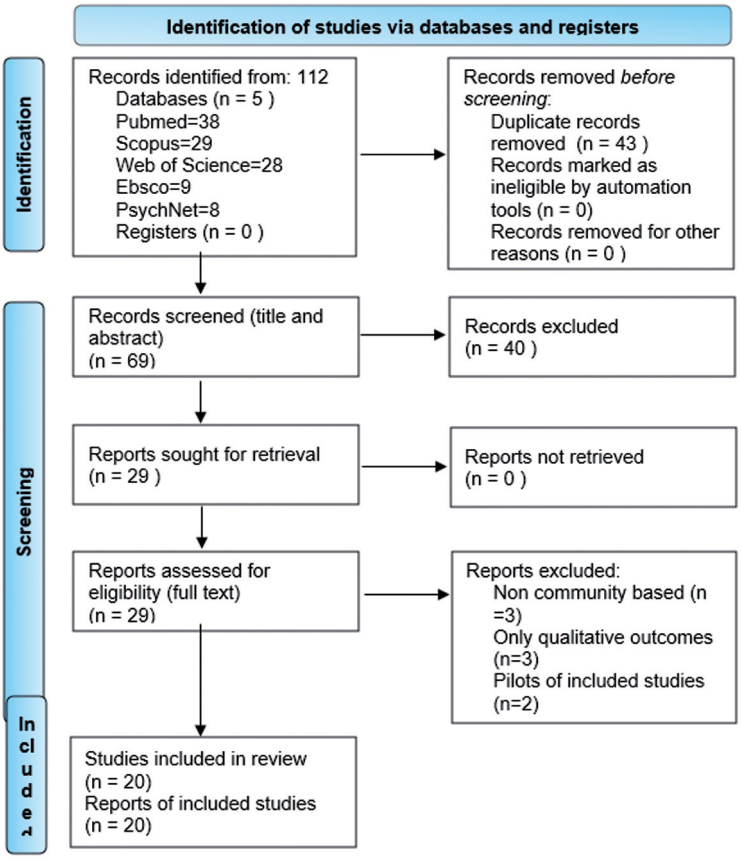

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Figure 1 - Flow of selected articles

weighted mean age of included participants of 44.37 (SD=4.72) and a mean BMI of 34.7 kg/m^2 (SD=3.56). Most patients were recruited through referrals from general practitioners, private psychiatrists, weight loss programs and outpatient clinics. All the studies were conducted in community settings, and the patients involved were diagnosed with a psychiatric disorder according to the Diagnostic and Statistical manual of Mental disorders- V (DSM-V) or the International Classification of Diseases-11 (ICD-11) criteria (including but not limited to schizophrenia/psychosis spectrum disorder, bipolar disorder spectrum and major depressive disorder).

4. Lifestyle intervention characteristics

All the studies were conducted through community and outpatient mental health settings, which is essential considering that people with serious mental illness receive most of their care through these settings (39). The main objectives of the interventions were weight loss and management, a healthy lifestyle and diet, an increase in physical activity, and in some cases also intervention on smoking and alcohol habits were provided. The major characteristics are reported in Table 1.

A varying range of topics was covered in the 20 different interventions. Several essential design elements and topics were consistent across the lifestyle interventions. The most frequently encountered topics were rules for healthy eating, enforcement of physical activity, weight loss maintenance, lifestyle modifications, meal planning, portion control, and budget food shopping. Only a few studies also focused on psychiatric medication effect on weight control, the impact of mood on health behaviors, and strategies for overcoming barriers to change for people with SMDs. The mean duration was 7.45 months, ranging from 2 to 13 months. The delivery modes were group sessions in 9 studies (45%), individual encounters in 1 (5%), a combination of individual and group sessions in 4 (20%), group sessions and text messages in 1 (5%) and only telephonically administered in 1 (5%), and not specified in 4 (20%). The mean frequency was 1.38 times per week, ranging between 0.5 to 3 times. Each educational session lasted 15 to 120 minutes, averaging 63.4 minutes. Supervised physical activity was included in 12 (60%) of the studies, while 6 (30%) offered a free gym membership, 5 (25%) made use of mHealth devices, and 3 (15%) were conducted with peer pairs.

In order of frequency, the professional figures involved were fitness trainers, lifestyle coaches, health counsellors, nurses, occupational therapists, dieticians, physiotherapists, pharmacists, psychologists, biokineticists, community health workers and peers. The studies included various providers with differing training and expertise. However, Giusti et al (37), demonstrated that the group that received support from an interdisciplinary team which delivered diet protocol, monitoring of regular aerobic activity and metacognitive training lost more weight than the control group in which only diet suggestions were provided. Out of the considered studies, different primary outcomes were given attention; weight modifications were measured 19 times, BMI 17, 6MWT 12, blood pressure 5, cardiovascular risk reduction 6, waist circumference 6 and blood lipids 4. The difference in outcomes represents a difficulty when trying to compare the effectiveness.

Based on the available data, there isn't a clear and direct association between study duration and positive outcomes. More than half of the studies are of short duration (60%) lasting 6 months or less. Between both shorter and longer durations some have reported positive outcomes. This suggests that the effectiveness of interventions doesn't solely depend on the duration but, more than that, on the nature of the intervention, its intensity, and the comprehensiveness of the approach. Not all studies that include physical activity reported statistically significant weight loss among their participants. While physical activity was a component in many of the interventions, the degree of weight loss and its statistical significance varied across the studies. The relationship between weight loss and the use of mHealth technology devices appears to be mixed across the studies. Some studies involving mHealth tech devices reported weight loss, but the relationship between the use of these devices and the amount of weight loss is not consistently highlighted in all cases. The study by Giusti et al (37) revealed a significant difference in weight loss among intervention groups using technology, demonstrating a greater decrease in weight compared to the control group without these specific tech interventions. On the other hand, despite the use of mHealth devices, Mangurian et al (33) describes that no significant differences between the two intervention groups in mean weight or BMI was observed.

The studies which yielded more interesting results included a) Gaughran et al, 2017 (21) who showed improvements in HDL cholesterol and metabolic indicators, b) Giusti et al, 2022 (37) who revealed statistically significant weight loss and improvement in blood lipids among participants, c) Bartels et al, 2015 (23) who reported that 51% of participants

Table 1. Table of included articles

Author, Year, Country	Study design, setting, modality	Intensity, frequentation, duration	Sample characteristics case/control	Topics	Professionals involved	Measurements	Results
Aschbrenner K, et al (2015) (32) United States	intervention mixed methods study design In SHAPE community Whole Health Action Management (WHAM) training	1 hour 1 x week 8-10 sessions with personal trainer training sessions for peers 6 months 25$ gift card per interview participation	N =10 mean age: 46.6, SD 8.7 mean BMI: 42.3 SD 15.3 90% white 90% women	Fitness Club Membership Personalized fitness training Peer health coaching Motivational texting Physical activity sensors for monitoring Exercise and healthy eating	Fitness trainer Peers mHealth: FitBIt or Nike FuelBand	Clinically significant weight loss >5% 6MWT	no overall significant change in mean weight; however, over half (56%) of participants lost weight by the end of the intervention with mean weight loss 2.7±2.1kg.
Aschbrenner K, et al (2016)(24) United States	prepost pilot community Diabetes Prevention Program Group Lifestyle Balance + peer support and mHealth tech	90 mins + 2x 1 hr 3 x week mHealth tech and social media 24 weeks	N= 13 Mean age: 48.8 SD 10.6 mean BMI: 41.5 kg/m^2 SD 11.5 91% white 73% female	Healthy eating Physical activity Impact of mood on health behaviors Group exercise sessions Strategies on overcoming change for people with SMI	Lifestyle coaches: mental health counseling graduates Wellness peer Fitness trainer Dietician mHealth: Fitbit Zip + Facebook group	Weight 6MWT	There were no overall significant changes in mean weight or fitness. (36%) of participants met the criteria for clinically significant cardiovascular risk reduction
Aschbrenner K, et al (2016)(24) United States	Pilot study community	1 hr + 2 x 1 hr 3 x week mHealth tech and social media 24 weeks	N = 32 mean age: 48.8 SD 11.9 mean BMI: 37.7 kg/m^2 SD 7.9 97% white	Healthy eating and exercise Group discussion, team building activities Group exercise sessions	Lifestyle coaches Fitness trainer mHealth: Fitbit Zip + Facebook group + text messages	Weight (lb) BMI(kg/cm^2) 6MWT adapted 10-item Social Provisions Scale	28% clinically significant weight loss (mean±SD weight loss of 7.76±12.4 pounds) weight loss was significantly associated with perceived peer-group support (r(24) =0.59, p = 002).
Aschbrenner K, et al (2017)(30) United States	Pilot study prepost community Fit Together (augmented In SHAPE)	1 hours 1 x week 12 weeks	N = 36 18 / 18 mean age: 39.6 SD 12.5 mean BMI: 43.1 kg/m^2 SD 10.3	Healthy eating, exercise, weight loss Challenges to health behavior changes for SMI patients Pair communicational skills Gym membership	couple: participant partner pairs: 33% friends, 27% parents, 23% significant others Psychologist mHealth: Fitbit Zips	Weight (lb) BMI(kg/cm^2) 6MWT Short- form International Physical Activity Questionnaire (IPAQ)	changes in weight and BMI from baseline to post-intervention were not statistically significant However, 27% of participants achieved clinically significant weight loss(≥5%), and 40% of participants who lost any weight achieved clinically significant weight lost (≥5%).

Bartels S, et al (2013)(19) United States	RCT In SHAPE vs fitness club membership + education community	45-60 mins 1x week 1 year	N = 133 67/66 mean age: 43.8 SD 11.5 mean BMI: 37.6 kg/m^2 SD 8.2 82% female 92% white	Fitness training Gym membership	Fitness trainer	6MWT weight BMI short form International Physical Activity Questionnaire (IPAQ) Weight Loss Behavior Stage of Change Scale (WLB-SOC)	49% (N=22 of 45) of In SHAPE participants experienced reduced cardiovascular risk by achieving either clinically significant improved fitness or weight loss and 24% (N=11 of 45) had both an increase on the 6MWT of at least 50 m and a 5% or greater reduction in body weight (χ2=10.42, p=.003).
Bartels S, et al (2015)(23) United States	pragmatic RCT In SHAPE	45-60 mins 1 year	N = 210 104/106 mean age: 43.9 SD 11.2 mean BMI: 36.8 kg/m^2 SD 8.2 46% non white 80% high school graduates	Gym membership	Mental health case managers with fitness training or Fitness trainers Clinical psychologist Dietician	Weight (lb) 6MWT triglicerides HDL LDL	51% of In SHAPE participants achieved clinically significant reduction in overall cardiovascular risk
Bartels S, et al (2018)(34) United States	quasi experimental observational design In SHAPE	60 mins 1x week 12 months	N = 122 63/59 mean age: 46 SD 11.04 mean BMI: 38.4 kg/m^2 SD: 8.8	Gym membership Fitness training Healthy eating Celebrations	Fitness trainer	Weight Clinically significant weight loss BMI 6MWT	Nearly half of In SHAPE participants (49%, N=25) achieved clinically significant cardiovascular risk reduction at six months, and over half (60%, N=28) achieved clinically significant cardiovascular risk reduction at 12 months
Brown C, et al (2015)(20) United States	Randomized control trial Nutrition and Exercise for Wellness and Recovery (NEW-R)	2 hours 1 x week 8 weeks $10 grocery bag reimbursement	N = 113 55/58 mean age: 47.1 mean BMI: / 89% female	Being intentional Healthy eating: labels, portion control Physical activity	Occupational therapist Occupational therapy student	Weight BMI	Average weight loss of 10 pounds from baseline. This difference was statistically significant (t=2.39, p=0.03). The average percentage of total body weight loss was 3.6% with 6 participants who had a weight loss 5%.
Gaughran F, et al (2017)(21) UK	Parallel cluster RCT IMPaCT Therapy	50 mins average 8.44 sessions 12 or 15 months	N = 406 213/ 196 mean age: 43.76 SD 10.09 mean BMI: 30.6 kg/m^2 SD 7.52	Physical health Substance use Running groups Motivational interviewing	Care coordinators	Short Form-36 BMI waist (cm) HDL LDL Cholesterol Triglycerides Hba1c	HDL Cholesterol improved Treatment effect 0.085; 95% CI: 0.007 to 0.16; *p* = 0.034

Giusti L, et al (2022)(37) Italy	real world controlled pragmatic outpatient trial An Apple a Day + modified OMNIHeart dietary protocol	12 months	N = 51 34/17 mean age: 42.4 SD 14.6 mean BMI: 31.5 kg/m^2	Diet protocol Physical activity: Metabolic Equivalent of Task (MET) Changing beliefs and self esteem	Clinical nutritionist Psychologist Psychiatric rehabilitation technician	weight blood lipids weight circumference BMI SF-36 blood pressure fasting glucose	intervention groups G1 and G3 revealed a statistically significant difference in the proportion of participants who lost 5% (59.3%) or 10%(25.4%) both intervention groups showed a more marked mean decrease in weight at −6.7 kg (SD: 3.57) than the TAU groups at −0.32 kg (SD: 1.96)
Ito H, et al (2021)(38) Japan	Prospective non randomized control trial Solution for Wellness	1 hour 8 sessions 1 x 10-12 days 24 weeks	N = 82 34/ 48 mean age: 44.2 SD 11.75 mean BMI: 28.1 kg/m^2 SD 4.2	Nutrition, Wellness and Healthy Lifestyle for Life Fitness and Exercise	Nurses Occupational therapists Dieticians	Weight (kg) BMI(kg/cm^2) Exercise habits (times x week) Body fat percentage	the biological males in the Intervention group showed a further decreased in weight (Intervention = −1.20 kg, Control = 0.62 kg; 95% confidence interval [CI], −3.500 to −0.130, p = .035) as well as BMI (Intervention = −0.50 kg/m^2, Controls = 0.23 kg/m^2; 95% confidence interval [CI], −1.349 to −0.109, p = .22). In contrast, the biological females in the Intervention group showed no statistically significant differences in body weight or BMI at 12 or 24 weeks.
Knight M, et al (2015)(31) United States	pilot study	2 x week 5 visits 18 weeks	N = 38 mean age: 40.4 SD 10 mean BMI: /	Healthy living groups Life's simple 7s	Nurse practitioner Nurse researcher	weight waist blood pressure lipid panel My Progress Toward Goal semantic differential scale	28.9% completed the study Improvements in mean weight, waist circumference, systolic blood pressure, fasting blood glucose and triglycerides, yet the sample was too small to attribute any relationship to the intervention.
Magni LR, et al (2017)(36) Italy	prospective multicenter design Superwellness Program	1 hour 2 x week 32 encounters 16 weeks	N = 85 59/ 26 mean age: 43.1 SD 9 mean BMI: 32.6 kg/m^2 SD 5.3	Psychoeducation on nutrition Displacement of dysfunctional beliefs Increase self observation Development of alternative behavioral skills	Psychologist Nutritionist / Nurse	Weight BMI Blood lipids	The mean change in BMI after 16 weeks was-1.9% for the intervention group (decreasing from 32.6 to 32)and +0.6% for the control group (increasing from 35 to 35.2).

Mangurian C, et al (2013)(33) United States	quasi experimental pilot study	Extended intervention: 60 mins 20 classes 14 weeks Brief: 1 x 45 min class	N= 80 mean age: 60.5 SD 13.3 mean BMI: 33.6 kg/m^2 SD 5.9 85% Latino	Instructional phase Individual review Exercise 15 mins	Dietician	Body weight	No significant differences between the two intervention groups in mean weight or BMI weights Although not statistically significant, 24% (7/29) lost 5% of their body weight
Naslund JA, et al (2016)(35) United States	Exploratory study based on DPP	1 x week 3-5 texts x week	N = 34 mean age: 50.2 SD 11 mean BMI: 38.5 kg/m^2 SD 9.3 100% non hispanic white	FitBit use	Lifestyle coach mHealth: FitBit Zip	Step count Weight 6MWT	There was a significant association between participants' average daily step count and weight loss. If participants average daily step count increased by 1000 steps, it corresponded to an increase of 18.79 feet on the 6-Minute Walk Test (F = 1.92; df = 1, 31; p = 0.176).
Naslund JA, et al, (2017)(25) United States	Prepost Community setting In- SHAPE Individual sessions	1 hour 1 x week 12 months	N = 194 mean age: 44 SD 11.1 mean BMI: 37.1 kg/m^2 SD 8	Gym membership Nutrition education: balanced diet, portion control, budget	Fitness trainer	Weight (lb) 6 MWT BMI (kg/cm2) short form International Physical Activity Questionnaire Blood pressure + Lipids	the overall sample showed significant mean±SD weight loss of 4.37±19.20 pounds (p=.002 for pre-post change) and significant improvement in fitness, as reflected by an increase on the 6-MWT of 59.89±228.98 feet (p=.002 for pre-post change).
Niv N, et al (2014)(26) United States	Pre-post non RCT Enhancing QUality of care in Psychosis (EQUIP) Individual + group sessions	1 x week 16 weeks	N = 109 55/54 mean age: 50.2 SD 9.7 mean BMI: 31.5 kg/m^2 SD 5.4 93% male	Healthful weight management techniques Light physical exercise Handouts + quizzes	Nurse care coordinator	Weight (lb) BMI (kg/cm^2)	Participation in the wellness program resulted in an average weight loss of 2.4 (SD = 10.6) pounds and an average BMI decrease of 0.3 (SD = 1.5). Paired t-tests indicated that neither of these changes were significant (t = 1.6, p = .12 and t = 1.5, p = .13 respectively) The wellness group lost an average of 2.3 (SD = 18.0) pounds, and the control group lost an average of 2.2 (SD = 11.9) pounds
Pratt S, et al (2019)(22) United States	RCT Effect of cash incentives to motivation in weight loss	1 x week 45-60min 12 months	N = 1348 mean age: 42.9 SD 12.35 mean BMI: 37.6	Nutritional education Food journalling	Health mentors Group leaders	weight 6MWT	Within the Weight Watchers group, 25 % and 38 % of participants achieved clinically significant weight loss at 6 and 12 months

	Gym/ InSHAPE / InSHAPE + Weight Watchers /Weight Watchers		kg/m² SD 8.77 69.2% female				respectively. Within the InSHAPE + Weight Watchers group, 16 % and 25 % achieved clinically significant weight loss at 6 and 12 months. Within the Gym group, 11 % and 23 % achieved clinically significant weight loss at 6 and 12 months, and finally, only 12 % and 3 % of InSHAPE participants achieved clinically significant weight loss at 6 and 12 months
Provencher MD, et al (2016)(27) Canada	Prepost 'Wellness' program Individual + group sessions	2-3 x week 12 weeks	N = 47 31/16 mean age: / mean BMI: 32.7	Physical conditions Nutrition Meal cooking Psychoeducation Walking sessions			the experimental group recorded a greater weight loss (−1.63 kg; −1.81%) than the control group (−0.38 kg; −0.40%), this difference is not statistically significant [F (1, 38) =1.90, p=0.18].
Temmingh H, et al (2013)(28) South Africa	Prepost	telephonically delivered 1x week or 1 x month 5-30 mins 12 months	N = 761 mean age: mean BMI: 31.2	Diet, exercise, smoking, alcohol Exercise and meal plan	Lifestyle coaches Dieticians Biokineticists	Weight (kg) Waist (cm) Blood pressure	The mean body weight loss for the completer group at the end of the study was -4.8 kg (95% CI,-5.67 to -3.82), with 46% of the participants losing 5% or more of their baseline weight. The mean reduction in waist circumference was -6.8 cm (95% CI, -8.49 to -5.19)

achieved clinically significant reduction in overall cardiovascular risk, d) Bartels et al, 2018 (34) who showed that nearly half of the participants achieved clinically significant cardiovascular risk reduction at six months, and over half achieved this reduction at 12 months and e) Brown et al, 2015 (20) who demonstrated statistically significant average weight loss among participants.

Discussion

The synthesis of the gathered information highlights the critical need for effective non-pharmacological interventions targeting individuals with severe mental disorders to address the heightened risk of cardiovascular diseases and associated conditions. The scoping review meticulously outlines the intricate relationship between SMDs, lifestyle factors, psychotropic medications, and physical health conditions, emphasizing the multifaceted challenges faced by this population. The prevalence of obesity, metabolic disturbances, and cardiovascular risk factors among those with SMDs underscores the urgency of interventions promoting health and weight control.

The variability of outcomes across studies reflects the multifaceted nature of lifestyle interventions and underscores the complexity of addressing physical

health in individuals with SMDs. Health interventions involving people with SMDs have been incredibly varied in their approaches, measurements, and outcomes. A range of outcomes were considered in these interventions, providing a comprehensive assessment of the impact on overall health. The outcomes considered in the reviewed studies include: weight loss, BMI, 6MWT, blood lipids, blood pressure, waist circumference, Short Form-36, fasting glucose, physical activity habits, body fat percentage, cardiovascular risk reduction, completion and adherence to the program and step count. The variability in outcomes can be attributed to the diverse objectives of the interventions. While some primarily targeted weight loss, others aimed at improving overall cardiovascular health, physical fitness, or quality of life. The variability in outcomes can be attributed to the diverse objectives of the interventions. While some primarily targeted weight loss, others aimed at improving overall cardiovascular health, physical fitness, or quality of life. The studies encompass a range of designs, settings, modalities, intensities, and durations, reflecting the multifaceted nature of interventions aimed at improving the physical health of this population. The topics covered were classified in macro areas: 1. Nutrition and Healthy Eating (Examples: "Healthy living groups," "Labels and Portion Control," "Psychoeducation on nutrition," "Nutrition, Wellness and Healthy Lifestyle"), 2. Physical Activity and Exercise (Examples: "Physical activity sensors for monitoring," "Group exercise sessions," "Running groups," "Fitness and Exercise."), 3. Psychosocial and Behavioral Factors (Examples: "Impact of mood on health behaviors," "Challenges to health behavior changes for SMI patients," "Strategies on overcoming barriers to change," "Food Journaling", "Development of alternative behavioral skills."), 4. Technology and Monitoring (Examples: "Motivational texting," "mHealth: FitBit or Nike FuelBand," "Fitbit Zip + Facebook group + text messages."), 5. Social Support and Peer Involvement (Examples: "Peer health coaching," "Pair communicational skills,").

The integration of mHealth technology showed mixed results across studies, indicating that while some interventions using technology reported positive outcomes, others did not consistently demonstrate significant effects on weight loss. Peer support and involvement of peers or support persons emerged as impactful factors in some studies, with perceived peer-group support correlating with significant weight loss. The diverse needs of individuals with serious mental disorders necessitate tailored, individualized approaches. Future interventions should consider the unique challenges and preferences of this population.

The existing data primarily stem from high-income countries, where health literacy is higher, services are more accessible, and institutions maintain better oversight with regular physical health check-ups for individuals with SMDs. However, the situation may be considerably worse in low-middle income countries, where resources are limited and access to quality mental and physical healthcare is restricted (3). In addition, the concurrence of causes could be different in low-middle income countries, where diagnosis and access to treatment is less, therefore the association between psychotropic drugs and metabolic disorders is less relevant. All studies were conducted in high-income countries, except for one, leading to non-generalizable results as non-representative of the differences in diets and approaches of public health interventions for SMDs in other countries. In addition, 66.7% of the studies were conducted in the United States, which is the country with the highest increase rate of obesity between 1980 and 2019 (+23.3%) (40) independent of the presence of psychiatric disorders. This underlines the relationship between the cultural lack of health education and an increase in weight. This could suggest that countries which are focusing more on obesity have studied this aspect more in the population with psychiatric disorders as well.

None of the studies indicated the presence of diabetes, and only one considered hypertension, suggesting that the patients are metabolically altered but do not present any metabolic-related disease. The variety of endpoints makes comparisons almost impossible. Given that the interventions used multiple combinations of different or overlapping professionals (60%), it was not possible to specifically isolate which features were effective or necessary in contributing to weight loss. Nevertheless, this gives reason to think that the health of patients with psychiatric disorders should not only be the task of their psychiatrists but also of community-offered services, which can intervene with everyday lifestyle modifications and support. Most of the studies do not define an initial endpoint which needs to be achieved; therefore, the clinical meaning of the results achieved is debatable. Notably, the review highlights the potential impact of mHealth devices, peer support, and supervised physical activity in enhancing the effectiveness of interventions. However, the varying outcomes and the lack of a consistent relationship between study duration and positive results suggest that the nature,

intensity, and comprehensiveness of interventions play pivotal roles. The identified studies, such as those by Giusti et al (37), Gaughran et al (21), and Bartels et al (23,34), showcase promising outcomes in terms of weight loss, improvements in blood lipids, and cardiovascular risk reduction (21,33,34,37). These findings offer glimpses into the potential success of non-pharmacological interventions in mitigating the health disparities faced by individuals with SMDs. The discussion also underscores the challenges in comparing study outcomes due to differences in measured parameters and the absence of a uniform standard for assessing intervention effectiveness. The systematic review on the economic burden of obesity by Tremmel et al (41), shows that obesity is responsible for a large fraction of costs, both for the healthcare systems and for the society. Obesity and its related diseases reduce life expectancy by 0.9 years to 4.2 years, depending on the country. It is projected that by 2050 there will be around 92 million premature deaths from obesity-related diseases in OECD, G20 and EU28 countries. OECD countries spend about 8.4% of their total health budget on treating obesity-related diseases. This is equivalent to about US$ Purchase Power Parity (an economic theory and method used to compare the relative value of currencies in terms of their ability to purchase the same basket of goods and services in two different countries), of 311 billion per year (or US$ PPP 209 per capita per year) (42). More specifically in the study on the economic burden of obesity in Italy (43) it is indicated that the total costs attributable to obesity in this Country amounted to €13.34 billion in 2020 (95% CI: €8.99 billion< μ<€17.80 billion). Direct costs were €7.89 billion, with cardiovascular diseases (CVDs) having the highest impact (€6.66 billion), followed by diabetes (€0.65 billion), cancer (€0.33 billion), and bariatric surgery (€0.24 billion). Indirect costs amounted to €5.45 billion, with almost equal contribution of absenteeism (€2.62 billion) and presenteeism (€2.83 billion).

We must better direct future efforts to identify effective health promotion interventions for people with SMDs, considering that additional health professionals other than psychiatrists should be included. Nutritional protocols, like the ones for other categories of patients aiming for weight loss, must be defined with fixed assessment dates. There is growing evidence supporting the likely cost effectiveness of dietary intervention in a range of health conditions, such as diabetes and cancer (44). Despite the heterogeneity of the studies and their results, they demonstrate that lifestyle interventions are useful and should be part of the usual management of patients with psychiatric disorders.

Limitations and future research

Several limitations warrant consideration. First, we were unable to determine whether weight loss was sustained over time among people with SMDs. The findings were mixed among the few studies reporting long-term weight loss outcomes. Second, participants' mean age across most included studies exceeded 40 years, suggesting that our findings likely do not generalize to younger individuals with SMDs and/or treatment-naive. This is a significant concern because young adults with SMDs are at risk of substantial weight gain due to mental illness onset and its consequences on functioning and motivation, and due to the initiation of antipsychotic treatment (45). In addition, 6 articles reported the use of mHealth devices such as FitBits, yet, no one noted any difficulties associated with their use. It would be helpful if the authors documented the barriers associated with the use of mHealth devices. In future research the anthropometric and metabolic measurements need to be more robust and include biochemical investigations and clinical variables that can affect weight gain and motivation to participate in lifestyle programs. In addition, studies must consider samples from more diverse socioeconomic and ethnic backgrounds.

Conclusions

Lifestyle interventions can help manage the physical and mental health symptoms of people affected by psychiatric disorders (24,46). In conclusion, the scoping review sets the stage for a deeper understanding of the methodologies and approaches employed in non-pharmacological interventions for health promotion and weight control in severe mental disorders. Although the discussed topic is highly relevant, the approach to identifying possible strategies is disparate and conducted by several categories of specialists. This leads to a lack of a replicable protocol, and from the literature, it is impossible to compare the different results and reach a unanimous conclusion. The synthesis of findings provides valuable insights for future research, emphasizing the need for standardized outcome measures and more extended, comprehensive interventions. Due to the significant

health burden, the costs for the lives of the patients and the state medical health expense, it is warranted to identify a protocol and proceed through established steps to reduce the health burden due to obesity in the population affected by psychiatric disorders. In the future we hope to see collaboration between different health and non-health professionals, to structure a multidimensional approach combining healthy nutrition, physical exercise, and emotional support at community and outpatient level. Regarding future research, despite the lack of association between study duration and outcomes, the authors believe it being mainly related to the content and modality of the intervention, therefore it is crucial to focus on long term interventions (>12 months) and outcomes years after the intervention has concluded, measured as improvement in chronic diseases, decrease in weight, lack of cardiovascular disease, decreased morbidity and mortality, to verify the long-term effect of nutritional education in time.

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Riassunto

Interventi sullo Stile di Vita nei Programmi di Perdita di Peso per Pazienti con Disturbi Mentali Gravi: Una Scoping Review

Premesse. I pazienti con disturbi psichiatrici affrontano problematiche di salute fisica aggravate e una ridotta aspettativa di vita, principalmente a causa di malattie cardiovascolari premature. La complessa interazione tra fattori legati allo stile di vita, la malattia e i farmaci psicotropi contribuisce a questo fenomeno. L'obiettivo di questa ricerca è valutare gli interventi per la gestione del peso nei soggetti con Disturbi Mentali Gravi attraverso una revisione scoping, analizzando le caratteristiche, le tipologie, le modalità e gli argomenti degli interventi, fornendo uno strumento utile per i professionisti che desiderano promuovere interventi sullo stile di vita per persone con Disturbi Mentali Gravi.

Metodi. Gli articoli selezionati sono studi peer-reviewed che riportavano interventi mirati a pazienti con Disturbi Mentali Gravi e finalizzati a promuovere la salute attraverso interventi non farmacologici (inclusi, ma non limitati a, educazione nutrizionale, attività fisica e interventi di esercizio fisico).

Risultati. Il numero totale di partecipanti inclusi nei 20 studi valutati era di 3.886. Gli studi comprendevano pazienti con un'età media ponderata di 44,37 anni (DS=4,72) e un BMI medio di 34,7 kg/m² (DS=3,56). Vari interventi, condotti per lo più negli Stati Uniti, hanno mostrato risultati promettenti nella riduzione del peso e nella gestione del rischio cardiovascolare tra i pazienti con disturbi psichiatrici. Tuttavia, i metodi disparati utilizzati negli studi hanno ostacolato la valutazione dei risultati. Gli studi che hanno prodotto risultati più interessanti includono un trial randomizzato a coorti parallele, che ha evidenziato miglioramenti nel colesterolo HDL e negli indicatori metabolici (HR 0,085; IC 95%: 0,007-0,16) utilizzando il metodo IMPACT, e un trial randomizzato pragmatico che ha riportato che con l'intervento InShape il 51% dei partecipanti ha raggiunto una riduzione clinicamente significativa del rischio cardiovascolare complessivo.

Conclusioni. La sintesi dei risultati fornisce preziose indicazioni per future ricerche, sottolineando la necessità di misure standardizzate degli esiti e interventi più prolungati e completi.

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