Journal of Psychiatric Research 181 (2025) 570–578

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/jpsychires

Improving the physical health of overweight/obese people suffering from severe mental disorders: What is the role of antipsychotic drugs and of lifestyle psychosocial interventions?

Gaia Sampogna [a,*], Matteo Di Vincenzo [a], Mario Luciano [a], Bianca Della Rocca [a], Enrico D'Ambrosio [b], Antonio Rampino [b], Mario Amore [c], Pietro Calcagno [c], Alessandro Rossi [d], Rodolfo Rossi [d], Liliana Dell'Osso [e], Barbara Carpita [e], Cinzia Niolu [f], Alberto Siracusano [f], LIFESTYLE WORKING GROUP [1], Andrea Fiorillo [a]

[a] Department of Psychiatry, University of Campania "Vanvitelli", Italy
[b] Department of Psychiatry, University of Bari, Italy
[c] Department of Psychiatry, University of Genoa, Italy
[d] Department of Psychiatry, University of L'Aquila, Italy
[e] Department of Psychiatry, University of Pisa, Italy
[f] Department of Psychiatry, University of Rome Tor Vergata, Italy

ARTICLE INFO

Keywords:
Severe mental disorders
Metabolism
Antipsychotics
Lifestyle
Psychosocial intervention

ABSTRACT

People with severe mental disorders experience premature mortality compared with the general population. Several factors contribute to the mortality gap, including the adoption of unhealthy lifestyle behaviours, poor screening for physical illnesses, difficulties in accessing healthcare facilities, specific clinical features of mental disorders and some pharmacological treatment such as antipsychotic medications with serious metabolic side effects.

In the present study, carried out in the framework of the LIFESTYLE trial, a funded nationwide multicentric study, we aimed to assess the impact of different antipsychotics in mediating the effectiveness of psychosocial intervention on healthy lifestyle behaviours. The antipsychotics have been grouped in metabolically more problematic (MMP) vs. metabolically less problematic (MLP). The final sample consists of 401 participants with a mean age of 45.6 ± 11.8 years, mainly female (57.1%), suffering from bipolar disorder (43.4%), schizophrenia spectrum disorders (29.7%) and depressive disorders (26.9%). 36.2% of patients (N = 145) received MMP antipsychotics, 32.2% were treated with MLP antipsychotics and 31.6% did not take any antipsychotic medication, but were treated with antidepressants, mood stabilizers and/or benzodiazepines. At 6-month follow-up, patients receiving the experimental lifestyle intervention and treated with MLP medication reported a significant reduction in BMI ($p < .05$).

Our findings clearly indicate that a multilevel, personalized and individualized therapeutic approach for the treatment of patients with severe mental disorders is needed, with the involvement of different physicians and health providers for an appropriate long-term management of patients with severe mental disorders.

1. Background

Compared to the general population, people with severe mental disorders, including schizophrenia, bipolar disorder and major depressive disorder, have a reduced life expectancy of 15–20 years, defining a significant mortality gap (Thornicroft, 2011; Laursen et al., 2012; Nordentoft et al., 2013; Walker et al., 2015; Siddiqi et al., 2017; Luciano et al., 2022a). The excess mortality is primarily attributed to the higher prevalence in these people of cardiovascular, metabolic, respiratory and infectious comorbidities (De Hert et al., 2011; Reilly et al., 2015; Correll

* Corresponding author.
E-mail address: gaia.sampogna@unicampania.it (G. Sampogna).
[1] The members of LIFESTYLE WORKING GROUP are listed in Appendix at the end of the article.

https://doi.org/10.1016/j.jpsychires.2024.11.029
Received 22 August 2024; Received in revised form 4 November 2024; Accepted 18 November 2024
Available online 22 November 2024

et al., 2017; Nica, 2024; Afzal et al., 2021; Sampogna et al., 2022a). Other factors contributing to this mortality gap include the adoption of unhealthy lifestyle behaviours, such as lack of physical activity, unbalanced diet and smoking (Jacob et al., 2020; Luciano et al., 2021a), poor screening for physical illnesses, unfavorable socioeconomic conditions, difficulties in accessing healthcare facilities, and stigma. Furthermore, other relevant factors include some specific clinical features of mental disorders (e.g., cognitive deficits and delusions) and some pharmacological treatments with serious metabolic side effects (Manu et al., 2015; Burschinski et al., 2023; Correll et al., 2023). Among these, antipsychotic drugs, which can be grouped into first-, second- and third-generation compounds based on their pharmacodynamic mechanisms (Orzelska-Górka et al., 2022; Momen et al., 2024; Dragioti et al., 2023), show different patterns of side-effects and tolerability (Casey and Zorn, 2001; Zimmermann et al., 2003; Patel et al., 2009; Kessing et al., 2010; Zhang et al., 2013; Bak et al., 2014; Grajales et al., 2019; Huhn et al., 2019; Pillinger et al., 2020; Sneller et al., 2021; Wu et al., 2022; Højlund et al., 2022). According to the most recent international clinical guidelines (Yatham et al., 2018; National Institute for Health and Care Excellence, 2022, National Institute for Health and Care Excellence, 2023; Lam et al., 2024), these medications are not only used for the management of patients with schizophrenia spectrum disorders but are very effective also in patients suffering from bipolar disorder or depressive disorders with psychotic features. However, using antipsychotic drugs in patients with different mental disorders requires a personalized approach, which is reflected in the use of different dosage for each specific clinical condition. Recently, Vochoskova et al. (2023) grouped antipsychotics into metabolically more problematic (MMP; including clozapine, olanzapine, sertindole, and quetiapine) and metabolically less problematic (MLP; including flupenthixol, haloperidol, levomepromazine, zuclopenthixol, amisulpride, aripiprazole, cariprazine, lurasidone, melperone, risperidone, and paliperidone), regardless of the classical pharmacodynamic classification.

Although the etiology of metabolic alterations in people with severe mental disorders remains multifactorial, antipsychotic medications and lifestyle behaviors represent key contributors, together with genetic predisposition and socioeconomic status (Fiorillo and Giordano, 2022). The optimization of antipsychotic treatment by treating physicians seems the most amenable to change and can significantly reduce the mortality gap (Cuijpers et al., 2024; Taipale et al., 2024).

Another relevant strategy to challenge the morbidity and mortality in people with severe mental disorders is represented by the adoption of healthy lifestyle through specific psychosocial interventions (Luciano et al., 2021b). Several psychosocial approaches are now available (**Barber and Thornicroft, 2018**), differing in terms of setting, involved professionals, duration and model (e.g., motivational interviews, psychoeducation and/or practice of moderate physical exercise) (De Rosa et al., 2017; Oliveira et al., 2022; Levrat et al., 2024; Gurusamy et al., 2024; Barlati et al., 2024; Hoogervorst et al., 2023; Browne et al., 2024). In the recent years, the field of lifestyle psychiatry (Firth et al., 2020) has been enriched by innovative approaches such as the GILL eHealth intervention led by nurses (Hoogervorst et al., 2023), with a focus on lifestyle promotion and somatic screening, or the PeerFIT approach, consisting of an in-person group lifestyle intervention augmented with mobile health technology (Browne et al., 2024). These are just some examples of recently introduced innovations, which highlights the need for defining appropriate and effective psychosocial interventions targeting lifestyle behaviours in people with severe mental disorders. Lifestyle psychosocial interventions are effective in reducing weight and abdominal circumference, in preventing weight gain over time, and in improving glucose and lipid metabolism (Bradley et al., 2022; Luciano et al., 2024; Davidson et al., 2022).

A recent meta-analysis showed a nonsignificant improvement in managing antipsychotic-induced weight gain in people receiving lifestyle psychosocial interventions (Mohanty et al., 2024). However, the specific impact of antipsychotic drugs on weight gain and their role on modifying the impact of psychosocial interventions has been rarely explored. On these premises, our study aims to: 1) evaluate the metabolic profile in a sample of real-world patients with severe mental disorders receiving a lifestyle psychosocial intervention; 2) explore the impact of various antipsychotic medications on the effectiveness of the psychosocial intervention.

2. Methods

This is a secondary analysis of a large multicentric randomized controlled trial funded by the Italian Ministry of University and Research on the effectiveness of a new psychosocial group intervention aimed at improving lifestyle behaviours in patients suffering from severe mental disorders (Sampogna et al., 2018). The trial has been carried out in six Italian university centers (Bari, Campania "Luigi Vanvitelli", Genoa, L'Aquila, Pisa, and Rome "Tor Vergata"), coordinated by University of Campania "Luigi Vanvitelli" in Naples.

2.1. Participants

Patients were considered eligible if they fulfilled the following inclusion criteria: 1) age between 18 and 65 years; 2) a diagnosis of bipolar disorder, major depression, or schizophrenia spectrum disorder according to the DSM-5 criteria (American Psychiatric Association, 2013) and confirmed by the Structured Clinical Interview for DSM-5 (First et al., 2015); 3) written informed consent; 4) BMI$\geq$25 kg/m^2; 5) in charge at the local mental health center for at least three months. Patients were excluded if they: 1) were not able to perform moderate physical activity (e.g., walking at least 150 min per week, or practicing vigorous physical exercises for 75 min twice a week); 2) were pregnant or in breastfeeding; 3) suffered from intellectual disability or cognitive impairment; and/or 4) experienced a serious clinical worsening or hospital admission in the three months preceding the recruitment period.

The decision to incorporate a BMI$\geq$25 kg/m^2 among inclusion criteria is due to the need to select real-world patients for which the experimental intervention could be beneficial and in order to detect the impact of the intervention on a metabolic easy-to-assess outcome.

Eligible patients obtained detailed information about study's protocol and procedures by researchers involved in the LIFESTYLE trial. Thereafter, eligible patients were asked to provide their informed consent to take part to the study. Recruited patients were subsequently randomly allocated to the experimental or the control group. The randomization has been performed by a statistician working at the Coordinating Centre using a 1:1 approach, based on center, age, gender and level of education.

The whole recruitment procedure is described in detail in Sampogna et al. (2018).

2.2. Assessment

The LIFESTYLE trial included six time point assessments: at baseline (time point zero: T0), after two months (time point one: T1), four months (time point two: T2), six (T3), 12 (T4), and after 24 months (T5). For the aims of the current paper, only data collected at baseline (time point zero - T0) and at six months (time point 3 - T3) are included in the analyses.

Information on sociodemographic characteristics, medical history and pharmacological treatments was collected at baseline. Weight, height, abdominal circumference, blood pressure, heart rate values, blood levels of glucose, insulin, triglycerides, total cholesterol, LDL and HDL cholesterol were collected at both T0 and T3. The HOMA index was calculated based on glycemia and plasma insulin levels in order to estimate insulin resistance (Matthews et al., 1985). Current and 10-year Framingham risk scores were calculated based on age, sex, smoking, total cholesterol, HDL cholesterol, systolic blood pressure, any

anti-hypertensive medications in order to assess cardiovascular risk (Wilson et al., 1998).

Psychopathological status was evaluated by the 24-item Brief Psychiatric Rating Scale (BPRS), a semi-structured interview consisting of 24 items assessing positive, negative, depressive-anxiety and manic-hostility symptoms (Lukoff et al., 1986). Cognitive performance was assessed through the MATRICS Consensus Cognitive Battery, including Trail Making Test, Symbol Coding and Category Fluency – Animal Naming (Kern et al., 2008; Nuechterlein et al., 2008). Quality of life was evaluated by the 17-item Manchester Short Assessment of Quality of Life (Priebe et al., 1999); patients' global functioning was assessed through the 100-point scale Personal and Social Performance Scale (Morosini et al., 2000).

2.3. Interventions

Participants were randomly allocated into two arms in order to compare the efficacy of two different lifestyle interventions.

Participants in the experimental arm received the LIFESTYLE Psychosocial Group Intervention, carried out for five months. Group sessions were delivered every 7–10 days providing participants with information on healthy habits (balanced diet, physical activity, smoking cessation, medication adherence, risky behaviors management, and circadian rhythms), motivational interviews and problem-solving strategies. The intervention also included 20 min of moderate exercise at the end of each session.

Patients allocated to the control group received a brief psychoeducational group intervention for 2 months. Group sessions were delivered weekly focusing on information about healthy lifestyle, early detection of clinical relapses, management of medication side effects, stress management and problem-solving techniques.

Further details of both interventions can be found elsewhere (Sampogna et al., 2018).

Ethical approval

This research was carried out in accordance with the Declaration of Helsinki (World Medical Association, 2013) and local regulations. The study protocol was approved by the Ethics Committee of University of Campania "Luigi Vanvitelli", Naples, in January 2017 (n. 64; trial registration number: 2015C7374S).

2.4. Statistical analyses

Sociodemographic, clinical and metabolic characteristics at T0 were obtained through descriptive statistics. Data were presented as means (M) and standard deviations (SD), or as percentages (%) and frequencies (N), as appropriate.

Patients were categorized in two groups: those receiving clozapine, olanzapine, sertindole, or quetiapine were included in the metabolically more problematic (MMP) group; patients taking flupenthixol, haloperidol, levomepromazine, zuclopenthixol, amisulpride, aripiprazole, cariprazine, lurasidone, melperone, risperidone, or paliperidone were allocated to the metabolically less problematic (MLP) group. This classification is based on the study by Vochoskova et al. (2023), who grouped antipsychotics according to their effects on weight and metabolic markers (Wu et al., 2022; Pillinger et al., 2020; Arango et al., 2014). Using a distinction based on evidence-based ranking of medications can shed light on the impact of different antipsychotics on the metabolic profile of treated patients with severe mental disorders in ordinary clinical practice.

Univariate analyses were used to compare MMP and MLP groups in terms of sociodemographic, clinical and metabolic characteristics at T0. In particular, Student t-test was performed to compare mean values of continuous variables between the subsets, while Chi-square test allowed a comparison in the case of categorical variables.

Once stratified according to type of antipsychotics, patients who had received the LIFESTYLE intervention were compared to controls at T3 in order to test differences in terms of metabolic condition.

Linear regression was performed for assessing the impact of using MMP or MLP antipsychotics and receiving the LIFESTYLE experimental intervention on the variation of BMI at T3, adjusting for several confounding variables, such as mean abdominal circumference, mean systolic pressure, mean diastolic pressure, mean plasmatic levels of glucose, insulin, triglycerides, LDL, HDL and different diagnostic categories.

Logistic regression was performed to identify predictors of using MMP antipsychotics at baseline, including gender, age, mean values of BPRS domains (depressive/anxiety, negative, positive, manic symptoms, and hostility), duration of being in charge to the mental health centre, total duration of the illness, type of diagnostic category, mean plasma levels of glucose, insulin, triglycerides, LDL, and HDL, systolic pressure, diastolic pressure, and presence of metabolic syndrome.

Logistic regression was performed to identify predictors of different levels of obesity at baseline, including gender, age, mean values of BPRS domains (depressive/anxiety, negative, positive, manic symptoms, and hostility), duration of being in charge to the mental health centre, total duration of the illness, type of diagnostic category, mean plasma levels of glucose, insulin, triglycerides, LDL, and HDL, systolic pressure, diastolic pressure, presence of metabolic syndrome, and use of MMP antipsychotics.

Statistical analyses were performed using the IBM Statistical Package for Social Science (SPSS), Version 26. The level of statistical significance was set at $p < .05$.

3. Results

The global sample consisted of 401 participants, with a mean age of 45.6 ± 11.8 years, mainly female (57.1%), single (52.4%) and unemployed (61.8%). Forty-three percent of patients suffered from bipolar disorder, 29.7% from schizophrenia spectrum disorder and 26.9% from depression. Mean duration of illness was 15.6 ± 11.3 years, with a mean number of 2.3 ± 4.3 previous voluntary hospitalizations.

Patients reported mild-moderate symptoms, with a mean score of 7.7 ± 3.1 at the BPRS negative symptom subscale and of 5.4 ± 2.0 at the positive symptom subscale (Table 1), and a poor level of functioning (PSP total score: 65.7 ± 15.2). Sixty percent of patients were receiving atypical antipsychotics, and 21.2% typical antipsychotics. Almost half of the global sample were receiving second-generation antidepressants (46.4%; N = 186) and benzodiazepines (46.6%; N = 187), 54.9% of patients received mood stabilizers. According to the type of antipsychotic compound, 145 patients were treated with MMP, while 129 patients with MLP. No significant differences were found between the MMP or MLP groups in terms of socio-demographic and clinical variables, apart from the Category Fluency – Animal naming of the MATRICS Consensus Cognitive Battery ($p < .01$) (Table 1).

3.1. Anthropometric and metabolic parameters at T0

In the majority of cases, patients were obese (63.2%), with a mean weight of 91.4 ± 17.4 kg, with a mean BMI of 32.5 ± 5.5 kg/m^2, and a mean abdominal circumference of 109.2 ± 14.0 cm. More than half of participants (N = 214) suffered from metabolic syndrome. Mean glycemia was 95.4 ± 27.0 mg/dl, insulin plasma levels were 17.4 ± 18.3 mcU/ml; mean blood levels of triglycerides were 171.2 ± 129.6 mg/dl; mean total cholesterol was 189.9 ± 40.9 mg/dl, and plasmatic LDL and HDL cholesterol levels were 119.2 ± 34.9 mg/dl and 46.0 ± 14.6 mg/dl, respectively. Mean blood pressure was 125.6 ± 13.5 mmHg (systolic) and 80.8 ± 9.0 mmHg (diastolic); heart rate was 77.2 ± 12.2 bpm. Current and 10-year cardiovascular risks were calculated by using Framingham scores, whose mean values were 9.8 ± 4.5 and 9.3 ± 7.5, respectively. No significant differences were found between experimental and control groups.

Table 1
Participants' socio-demographic and clinical characteristics at T0.

	Global sample (N = 401)	Metabolically More Problematic (MMP) Group (N = 145)	Metabolically Less Problematic (MLP) Group (N = 129)
Gender, female, % (N)	57.1 (229)	48.3 (70)	51.9 (67)
Age, M (SD)	45.6 (11.8)	45.0 (10.5)	44.0 (12.0)
Living situation, % (N)			
Single	52.4 (210)	60.0 (87)	62.0 (80)
Married/with partner	28.7 (115)	24.8 (36)	23.3 (30)
Separated/ Divorced	14.0 (56)	11.0 (16)	11.6 (15)
Widowed	5.0 (20)	4.1 (6)	3.1 (4)
Years of education, M (SD)	11.7 (2.9)	12.1 (2.9)	11.6 (2.6)
Employed, yes, % (N)	38.2 (144)	30.2 (42)	35.0 (42)
Diagnosis, % (N)			
Depression	26.9 (108)	9.7 (14)	11.6 (15)
Bipolar disorder	43.4 (174)	47.6 (69)	45.7 (59)
Schizophrenia spectrum disorder	29.7 (119)	42.8 (62)	42.6 (55)
Charge to the mental health service, years, M (SD)	5.9 (6.9)	6.7 (6.8)	7.0 (7.8)
Duration of illness, years, M (SD)	15.6 (11.3)	17.9 (11.0)	17.1 (11.0)
Number of voluntary hospitalizations, M (SD)	2.3 (4.3)	2.8 (3.8)	2.8 (5.1)
Number of compulsory hospitalizations, M (SD)	.5 (1.5)	.7 (1.3)	.7 (2.0)
Number of suicide attempts, M (SD)	1.8 (1.6)	2.09 (2.0)	1.5 (1.0)
Treated with LIFESTYLE intervention, yes, % (N)	51.4 (206)	50.3 (73)	56.6 (73)
BPRS, Positive Symptoms, M (SD)	5.4 (2.0)	5.6 (2.1)	5.8 (2.5)
BPRS, Negative Symptoms, M (SD)	7.7 (3.1)	7.5 (3.1)	7.6 (3.0)
BPRS, Depressive/ anxiety symptoms, M (SD)	8.8. (3.1)	8.8 (3.3)	8.3 (3.2)
BPRS, Manic symptoms, M (SD)	4.7 (1.9)	4.8 (1.8)	4.8 (1.9)
BPRS, Hostility, M (SD)	4.0 (1.9)	4.4 (2.1)	4.4 (2.1)
MANSA, total score, M (SD)	4.1 (1.0)	4.1 (1.1)	4.2 (1.0)
B-MCCB, Symbol coding, M (SD)	34.5 (13.8)	33.4 (12.2)	30.7 (12.2)
B-MCCB, Animal naming, M (SD)	17.9 (5.4)	**18.0 (5.7)**	**16.2 (4.7)**[b]
B-MCCB, Trail making test A, M (SD)	52.4 (28.7)	53.0 (24.3)	59.9 (37.0)
PSP, Total score, M (SD)	65.7 (15.2)	61.7 (16.1)	64.7 (14.3)
Typical antipsychotics, yes, % (N)	21.2 (85)	**25.5 (37)**	**37.2 (48)**[a]
Atypical antipsychotics, yes, % (N)	59.6 (239)	**100 (145)**	**71.3 (92)**[c]
First generation antidepressants, yes, % (N)	5.7 (23)	4.8 (7)	8.5 (11)
Second generation antidepressants, yes, % (N)	46.4 (186)	33.8 (49)	33.3 (43)
Benzodiazepines, yes, % (N)	46.6 (187)	46.2 (67)	47.3 (61)
Mood stabilizers, yes, % (N)	54.9 (220)	60.7 (88)	56.6 (73)

[a] $p < .05$.
[b] $p < .01$.
[c] $p < .0001$.

Compared with the MLP group, participants taking MMP antipsychotics had significantly alteration in metabolic profile, in terms of higher plasma levels of LDL cholesterol, diastolic pressure ($p < .05$), and heart rate ($p < .05$), compared to those patients receiving MLP drugs (Table 2).

Impact of MMP/MLP antipsychotics on metabolic parameters and BMI at the end of the intervention.

At T3, patients treated with MMP reported no significant differences in terms of metabolic parameters compared to T0 both in the experimental and in the control groups (Table 3). On the contrary, patients receiving MLP antipsychotics had a significant reduction in BMI (31.6 ± 4.3) compared to the control group (35.1 ± 6.4; $p < .05$) after receiving the LIFESTYLE intervention (Fig. 1).

Table 2
Participants' metabolic parameters at T0.

	Global sample (N = 401)	MMP Group (N = 145)	MLP Group (N = 129)
Weight (kilograms), M (SD)	91.4 (17.4)	93.8 (18.2)	91.5 (15.3)
Height (meters), M (SD)	1.68 (0.1)	**1.70 (0.1)**	**1.67 (0.1)**[a]
Abdominal circumference, M (SD)	109.2 (14.0)	111.1 (15.7)	110.3 (11.8)
BMI, M (SD)	32.5 (5.5)	32.5 (5.8)	32.7 (5.0)
Overweight/obesity degree, % (N):			
Overweight (BMI: 24.9–29.9 kg/m^2)	35.9 (144)	36.6 (53)	31.0 (40)
Obesity, class 1 (BMI: 30.0–34.9 kg/m^2)	35.2 (141)	33.1 (48)	40.3 (52)
Obesity, class 2 (BMI: 35.0–39.9 kg/m^2)	19 (76)	18.6 (27)	20.9 (27)
Obesity, class 3 (BMI ≥40.0 kg/m^2)	9 (36)	10.3 (15)	7.8 (10)
Metabolic syndrome, yes, % (N)	53.4 (214)	62.1 (90)	51.2 (66)
Glycemia, M (SD)	95.4 (27.0)	94.5 (19.3)	92.0 (20.3)
Insulin plasm. levels, M (SD)	17.4 (18.3)	17.2 (14.6)	18.5 (23.2)
HOMA index, M (SD)	4.9 (11.62)	5.7 (17.4)	4.5 (6.2)
Triglycerides plasm. levels, M (SD)	171.2 (129.6)	185.7 (113.6)	158.9 (118.7)
Total cholesterol plasm. levels, M (SD)	189.9 (40.9)	190.4 (39.8)	181.7 (37.8)
LDL plasm. levels, M (SD)	119.2 (34.9)	**121.6 (33.8)**	**112.9 (32.1)**[a]
HDL plasm. levels, M (SD)	46.0 (14.6)	42.9 (12.4)	45.7 (15.1)
Systolic pressure, (mmHg), M (SD)	125.6 (13.5)	127.1 (13.8)	126.4 (12.5)
Diastolic pressure, (mmHg), M (SD)	80.8 (9.0)	**82.5 (9.9)**	**80.3 (8.3)**[a]
Heart rate (bpm), M (SD)	77.2 (12.2)	**80.4 (13.2)**	**76.9 (11.3)**[a]
Framingham risk score, M (SD)	9.8 (4.5)	9.8 (4.5)	9.6 (4.4)
Framingham risk score 10 years, M (SD)	9.3 (7.5)	10.0 (8.7)	8.9 (6.7)

[a] $p < .05$.

Table 3
Participants' metabolic parameters at the end of intervention, stratified according to MMP or MLP antipsychotics.

	MMP		MLP	
	LIFESTYLE (N = 38)	Controls (N = 36)	LIFESTYLE (N = 30)	Controls (N = 19)
Weight (kilograms), M (SD)	93.3 (16.9)	91.5 (18.4)	88.3 (15.8)	95.1 (15.2)
Abdominal circumference, M (SD)	110.5 (13.8)	108.3 (15.6)	107.6 (13.2)	111.9 (10.4)
BMI, M (SD)	31.8 (4.7)	31.9 (6.3)	**31.9 (4.3)**	**35.1 (6.4)**[a]
Glycemia, M (SD)	98.5 (29.8)	92.1 (13.8)	96.7 (28.0)	91.4 (14.6)
Insulin plasm. levels, M (SD)	18.7 (16.4)	25.5 (32.3)	14.1 (16.1)	18.7 (11.2)
Triglycerides plasm. levels, M (SD)	200.2 (101.1)	164.7 (80.3)	139.1 (73.9)	154.2 (76.5)
Total cholesterol plasm. levels, M (SD)	189.1 (36.9)	192.1 (41.8)	180.9 (29.4)	184.7 (39.4)
LDL plasm. levels, M (SD)	119.5 (40.3)	128.0 (40.0)	143.7 (170.7)	116.0 (34.3)
HDL plasm. levels, M (SD)	43.2 (15.9)	46.7 (19.4)	47.1 (10.6)	46.9 (11.8)
Systolic pressure, (mmHg), M (SD)	124.3 (12.1)	123.9 (10.2)	125.4 (13.6)	127.8 (14.3)
Diastolic pressure, (mmHg), M (SD)	82.1 (7.1)	78.3 (14.1)	77.6 (7.7)	80.6 (9.3)

[a] $p < .05$.

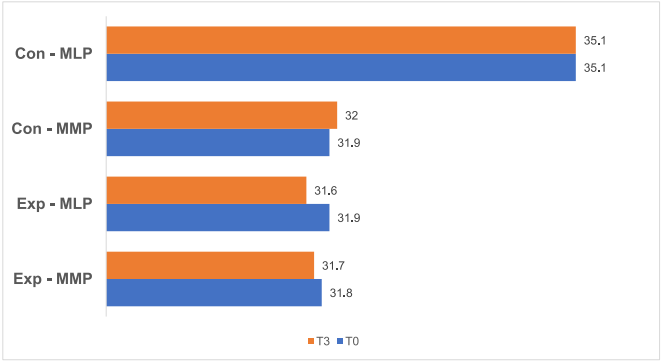

Fig. 1. Variation in BMI between experimental (Exp) and control group (Con), stratified according to MMP or MLP antipsychotics.

HDL cholesterol plasma levels (B: .018; $p < .05$), diastolic blood pressure (B: .032; $p < .05$), use of MLP antipsychotics (B: .570; $p < .05$) and abdominal circumference (B: .293; $p < .000$) predicted a significant reduction of BMI at T3.

Table 4
Predictors of variation in BMI at T3.

Variables	B	Sign.	95% Confidence Interval
MMP antipsychotics	−.115	.426	−.400 – .169
MLP antipsychotics	.016	.908	−.261 – .294
Treated with LIFESTYLE intervention	.306	.127	−.088 – .700
Abdominal circumference	.010	.194	−.005 – .025
Glycemia	.006	.096	−.001 – .014
Plasmatic levels of insulin	.001	.849	−.010 – .012
Plasmatic levels of triglycerides	.000	.886	−.001 – .002
Plasmatic levels of LDL	.000	.969	−.006 – .006
Plasmatic levels of HDL	**.018**	**.015**	**.004–.033**
Systolic pressure	−.005	.589	−.024 – .014
Diastolic pressure	**−.032**	**.034**	**−.061–−.002**

In bold characters, significant values have been highlighted.

Table 5
Predictors of BMI at T3.

Variables	B	Sign.	95% Confidence Interval
MMP antipsychotics	−.001	.997	−.569 – .566
MLP antipsychotics	.570	.044	.016–1.123
Treated with LIFESTYLE intervention	**−.997**	**.001**	**−.784 – .787**
Abdominal circumference	**.293**	**.000**	**.262–.323**
Glycemia	.000	.956	−.015 – .016
Plasmatic levels of insulin	.004	.733	−.018 – .026
Plasmatic levels of triglycerides	.002	.435	−.003 – .006
Plasmatic levels of total cholesterol	−.009	.462	−.034 – .015
Plasmatic levels of LDL	.013	.313	−.012 – .037
Plasmatic levels of HDL	.021	.256	−.015 – .056
Systolic pressure	.026	.171	−.011 – .064
Diastolic pressure	**−.077**	**.011**	**−.135–−.018**

In bold characters, significant values have been highlighted.

Table 6
Predictors of using MMP antipsychotic.

Variables	B	Sign.	95% Confidence Interval
Gender	−.035	.905	.548–1.702
Age	.005	.740	.975–1.036
BPRS, Depressive/anxiety symptoms	.075	.128	.979–1.187
BPRS, Negative Symptoms	−.053	.311	.856–1.051
BPRS, Positive Symptoms	−.064	.417	.804–1.094
BPRS, Manic symptoms	−.024	.788	.821–1.161
BPRS, Hostility	.016	.848	.860–1.202
Duration of charge to the mental health service	.000	.854	.996–1.003
Duration of illness	.005	.749	.975–1.035
Glycemia	.003	.669	.989–1.018
Plasmatic levels of insulin	−.005	.493	.981–1.009
Plasmatic levels of triglycerides	.001	.457	.998–1.004
Plasmatic levels of LDL	.007	.083	.999–1.015
Plasmatic levels of HDL	−.015	.220	.985–1.009
Metabolic Syndrome	.121	.711	.594–2.145
Systolic pressure	−.012	.373	.962–1.015
Diastolic pressure	.032	.086	.995–1.071

There were no significant differences between the experimental and the control group taking MMP medications (Table 4, Table 5, Table 6).

4. Discussion

The mortality gap in patients with severe mental disorders requires urgent actions from an ethical and health perspective (Fiorillo and Sartorius, 2021; Dumas, 2022; Freeman, 2022). The premature mortality in these patients is a complex phenomenon resulting by the interaction of several factors. Among the modifiable risk factors, lifestyle behaviours and types of medications are the most amenable to change following simple actions by treating physicians and patients according to a shared decision-making approach (Puschner et al., 2010; Luciano et al., 2022b). Several studies have highlighted that psychosocial interventions aiming to improve lifestyle are highly effective in reducing physical parameters (such as the BMI and cardiovascular risk), increasing patients' physical activity (Luciano et al., 2022c; Sampogna et al., 2022b) and improving patients' adherence to pharmacological treatments (Sampogna et al., 2023).

Robust evidence shows that people with severe mental disorders are at higher risk compared to the general population to become overweight or obese (Afzal et al., 2021). A recent meta-analysis found that lifestyle interventions are effective in reducing the waist circumference, weight, and BMI in persons with severe mental disorders, as shown from changes of obesity parameters of in the intervention group compared to control group. These findings should be considered in ordinary clinical practice in order to help health care providers to manage obesogenic

environmental and metabolic risk factors among patients with severe mental disorders (Mohanty et al., 2024).

In this study, we have explored the impact of antipsychotic drugs on the achievement of metabolic improvement among real-world patients receiving an innovative psychosocial group intervention compared with patients receiving a brief psychoeducational intervention. Our findings show that patients treated with MMP antipsychotics, such as clozapine, olanzapine, sertindole, and quetiapine (Vochoskova et al., 2023), experience a reduced effectiveness of psychosocial interventions.

Our results are in line with those by Coventry et al. (2019) and Looijmans et al. (2019), who found no significant differences in weight loss, controlling for different categories of antipsychotics based on metabolic side effects. In particular, in the STEPWISE intervention (Holt et al., 2019), patients receiving clozapine and olanzapine did not report any significant improvement in weight reduction.

At baseline, patients receiving MLP drugs reported a BMI significantly higher compared to those in the MMP group. This finding confirms the complexity of the inter-relationship between the metabolic impact of drugs, the individual liability to metabolic side effects and the role of lifestyle behaviours. Other variables, such as dosage of drugs, number of drugs previously taken, presence of familiarity for metabolic disorders, may have a significant role on the metabolic outcomes and on the improvement in lifestyle behaviours. Thus, real-world, long-term, observational studies which take into account such variables may help to better understand this complex interplay.

Metabolic alterations in people with severe mental disorders are multifactorial, and are due to the interaction of genetic predisposition, socioeconomic status, lifestyle behaviors and antipsychotic medications. Although many guidelines discuss the varying risk of weight gain associated with different types of antipsychotics, none of them recommend considering the baseline BMI as a significant predictor of greater weight gain following antipsychotic treatment. Our results, in line with those by Vochoskova et al. (2023), suggest caution when prescribing MMP medications in people with severe mental disorders, in particular for those with a low BMI. Moreover, weight gain should be closely monitored during treatment, given its role as a proxy measure of the metabolic changes.

Looking at other metabolic indexes, such as HDL, LDL and lipid metabolism, no significant differences were observed between patients treated with MMP and MLP groups both in the LIFESTYLE and in the control group. It is well established that second-generation antipsychotics are associated with a greater alteration of lipid metabolism, although the exact mechanism has not been clarified yet. Recently, a key role for gut microbiota and composition of the intestinal microflora has been proposed, but it requires further confirmation (Chen et al., 2023). However, it confirms the complex interplay between genetic, biological psychological and physical factors underlying the metabolic alterations in people with severe mental disorders, according to the biolopsychosocial model of complex diseases (Fiorillo and Giordano, 2022). Further real-world studies are needed to fully understand the role of psychosocial lifestyle interventions and the importance of selecting psychotropic drugs less problematic from a metabolic profile for the recovery of patients with severe mental disorders.

At the regression analyses, when adjusting for the LIFESTYLE treatment, MLP antipsychotics predicted a significant BMI reduction at 6 months. This finding is in line with the hypothesis that antipsychotics with a low metabolic impact, when combined with psychosocial lifestyle interventions, significantly improve patients' physical health. Abdominal circumference resulted to predict BMI, confirming prior robust evidence of correlation (Wilmet et al., 2017; Ross et al., 2020). Furthermore, lower diastolic blood pressure was found associated with reduced BMI, as it was a non-significant trend captured by the univariate analysis in the group of patients receiving LIFESTYLE and taking MLP.

All these findings show that lifestyle interventions, including motivational interviewing, problem-solving strategies, and physical activity, are particularly effective in those patients taking metabolic less problematic antipsychotics. Moreover, the present findings contribute to the increasing evidence in the field of lifestyle psychiatry (Firth et al., 2020), showing that the promotion of healthy lifestyle behaviours can help to prevent the onset of severe mental disorders, as well as to promote the long-term recovery of people already suffering from those disorders. The present findings can be specifically useful for informing clinicians to the need of implementing some physical evaluations, such as measurement of body weight, BMI and other metabolic parameters in their ordinary routine practice. Thus, choosing the right medication for the right patient may lead to the improvement of physical health outcomes, according a personalized and integrated approach (Maj et al., 2020, 2021; Holm et al., 2024; Fowler, 2024; Wasserman et al., 2023b; Galderisi, 2023; Leucht et al., 2023). Moreover, implementing and disseminating lifestyle psychosocial strategies as an add-on treatment is strongly supported by international scientific associations, such as the European Psychiatric Association (Stubbs et al., 2018) and the World Psychiatric Association (Wasserman et al., 2023a; Wasserman, 2023; Sunkel, 2022). After one year from the intervention, improvements in BMI, weight, abdominal circumference and psychopathological domains were still present in the global sample (Luciano et al., 2024). This is why the LIFESTYLE intervention is now being disseminated throughout Italy in order to challenge patients' physical and mental unmet needs (Sampogna et al., 2021).

A relevant innovation of the LIFESTYLE trial is the adoption of a transdiagnostic approach for evaluating the effectiveness of a new psychosocial intervention on lifestyle behaviours in people with severe mental disorders (Davidson and Tondora, 2022). Although people suffering from schizophrenia present specific deficits and difficulties which are different from those reported by people suffering from affective unipolar or bipolar disorders, one common element to these mental disorders is the unacceptable mortality gap compared to the general population, partially due to the adoption of unhealthy lifestyle behaviour. Moreover, our statistical analyses have confirmed the validity of the transdiagnostic approach, since the effect of the experimental intervention has been controlled for the impact of the different diagnostic categories.

The following limitations should be considered. First, the present study is focused only on the impact of antipsychotic medications on patients' metabolic profile. The decision to tailor our analyses on the impact of antipsychotics on the metabolic profile is due to the large evidence on the relationship between antipsychotics and metabolic side effects. However, a systematic review (Sepúlveda-Lizcano et al., 2023) has highlighted that not only drugs such clozapine, olanzapine, and risperidone are linked to weight gain and lipid profile alterations, but also some antidepressants and mood stabilizers. Therefore, it is essential to closely monitor medications' side effects, also considering that the metabolic effects caused by psychopharmacological medications may vary depending on patients' age. The short follow-up period considered, i.e., six months, should be listed among study's limitations. It should be that this time frame did not allow us to detect other metabolic changes in the long term.

Another possible limitation is related to the mild-moderate levels of severity of clinical symptoms as well as to the poor level of patients' personal functioning. It should be that these clinical aspects have limited the effectiveness of the interventions, or that doses of pharmacological drugs have been defined according to the severity of patients' clinical status. However, the inclusion in the study of "clinically stable" patients only, evaluated as proxy measure by the absence of any hospitalization in the previous three months, could have reduced such source of variability. However, further real-world studies, including patients regardless the severity of their clinical conditions, might be useful. Finally, we did not collect data on dosages of antipsychotics (evaluated as chlorpromazine equivalent); future studies might be carried out to identify the impact of the different dosages of the same drug on patients' metabolic profile.

5. Conclusions

Patients suffering from severe mental disorders experience premature mortality and high levels of physical comorbidities in comparison with the general population. Metabolic side effects of antipsychotics contribute to weight gain and glucose and lipid metabolism alterations. Patients receiving an innovative psychosocial intervention focused on healthy lifestyle behaviours reported a significant BMI reduction compared to controls, especially when they were treated with less metabolic problematic antipsychotics.

Our findings clearly indicate that a multilevel, personalized and individualized therapeutic approach is needed, with the involvement of different physicians and health providers for an appropriate long-term management of patients with severe mental disorders (Reed, 2024; Steger, 2022; Bartlett, 2024).

CRediT authorship contribution statement

Gaia Sampogna: Writing – review & editing, Writing – original draft, Conceptualization. **Matteo Di Vincenzo:** Formal analysis, Data curation. **Mario Luciano:** Methodology. **Bianca Della Rocca:** Formal analysis, Data curation. **Enrico D'Ambrosio:** Writing – review & editing. **Antonio Rampino:** Writing – review & editing. **Mario Amore:** Writing – review & editing. **Pietro Calcagno:** Writing – review & editing. **Alessandro Rossi:** Writing – review & editing. **Rodolfo Rossi:** Writing – review & editing. **Liliana Dell'Osso:** Writing – review & editing. **Barbara Carpita:** Writing – review & editing. **Cinzia Niolu:** Writing – review & editing. **Alberto Siracusano:** Writing – review & editing. **Vincenzo Giallonardo:** Writing – review & editing, Writing – original draft, Supervision, Data curation, Conceptualization. **Claudia Toni:** Data collection. **Maria Favia:** Data collection. **Silvia Saltarelli:** Data collection. **Giacomo Marenco:** Data curation. **Alice Trabucco:** Data curation. **Francesca Pacitti:** Data collection. **Ramona di Stefano:** Data collection. **Chiara Bonelli:** Data curation. **Benedetta Nardi:** Data collection. **Giorgio Di Lorenzo:** Data collection. **Michele Ribolsi:** Data curation. **Andrea Fiorillo:** Supervision and final editing.

Authors' statement

All authors approved the final version of the paper and have actively contributed to it.

Declaration of competing interest

All authors have nothing to disclose.

Appendix

[1]LIFESTYLE WORKING GROUP: Vincenzo Giallonardo, Claudia Toni, Department of Psychiatry, University of Campania "Vanvitelli"; Maria Favia, Silvia Saltarelli, Department of Psychiatry, University of Bari; Giacomo Marenco, Alice Trabucco, Department of Psychiatry, University of Genoa; Francesca Pacitti, Ramona di Stefano, Department of Psychiatry, University of L'Aquila; Chiara Bonelli, Benedetta Nardi, Department of Psychiatry, University of Pisa; Giorgio Di Lorenzo, Michele Ribolsi, Department of Psychiatry, University of Rome Tor Vergata.

Data availability

Data will be made available on request.

References

Afzal, M., Siddiqi, N., Ahmad, B., Afsheen, N., Aslam, F., Ali, A., Ayesha, R., Bryant, M., Holt, R., Khalid, H., Ishaq, K., Koly, K.N., Rajan, S., Saba, J., Tirbhowan, N., Zavala, G.A., 2021. Prevalence of overweight and obesity in people with severe mental illness: systematic review and meta-analysis. Front. Endocrinol. 12, 769309. https://doi.org/10.3389/fendo.2021.769309.

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders, fifth ed. https://doi.org/10.1176/appi.books.9780890425596

Arango, C., Giráldez, M., Merchán-Naranjo, J., et al., 2014. Second-generation antipsychotic use in children and adolescents: a six-month prospective cohort study in drug-naïve patients. J. Am. Acad. Child Adolesc. Psychiatry 53 (11), 1179–1190.

Bak, M., Fransen, A., Janssen, J., van Os, J., Drukker, M., 2014. Almost all antipsychotics result in weight gain: a meta-analysis. PLoS One 9 (4), e94112. https://doi.org/10.1371/journal.pone.0094112.

Bartlett, P., 2024 Oct. Ethical challenges in mental health care: moving beyond aspirations. World Psychiatry 23 (3), 387–388. https://doi.org/10.1002/wps.21231. PMID: 39279388; PMCID: PMC11403157.

Barber, S., Thornicroft, G., 2018. Reducing the mortality gap in people with severe mental disorders: the role of lifestyle psychosocial interventions. Front. Psychiatr. 9, 463. https://doi.org/10.3389/fpsyt.2018.00463.

Barlati, S., Nibbio, G., Vita, A., 2024. Evidence-based psychosocial interventions in schizophrenia: a critical review. Curr. Opin. Psychiatr. 37 (3), 131–139. https://doi.org/10.1097/YCO.0000000000000925. Epub 2024 Feb 15. PMID: 38410981; PMCID: PMC10990032.

Bradley, T., Campbell, E., Dray, J., Bartlem, K., Wye, P., Hanly, G., Gibson, L., Fehily, C., Bailey, J., Wynne, O., Colyvas, K., Bowman, J., 2022. Systematic review of lifestyle interventions to improve weight, physical activity and diet among people with a mental health condition. Syst. Rev. 11 (1), 198. https://doi.org/10.1186/s13643-022-02067-3.

Browne, J., Naslund, J.A., Salwen-Deremer, J.K., Sarcione, C., Cabassa, L.J., Aschbrenner, K.A., 2024. Factors influencing engagement in in-person and remotely delivered lifestyle interventions for young adults with serious mental illness: a qualitative study. Early Interv Psychiatry 18 (1), 42–48. https://doi.org/10.1111/eip.13432. Epub 2023 May 23. PMID: 37220910; PMCID: PMC10665543.

Burschinski, A., Schneider-Thoma, J., Chiocchia, V., Schestag, K., Wang, D., Siafis, S., Bighelli, I., Wu, H., Hansen, W.P., Priller, J., Davis, J.M., Salanti, G., Leucht, S., 2023. Metabolic side effects in persons with schizophrenia during mid- to long-term treatment with antipsychotics: a network meta-analysis of randomized controlled trials. World Psychiatry 22 (1), 116–128. https://doi.org/10.1002/wps.21036.

Casey, D.E., Zorn, S.H., 2001. The pharmacology of weight gain with antipsychotics. J. Clin. Psychiatr. 62 (Suppl. 7), 4–10.

Chen, H., Cao, T., Zhang, B., Cai, H., 2023. The regulatory effects of second-generation antipsychotics on lipid metabolism: potential mechanisms mediated by the gut microbiota and therapeutic implications. Front. Pharmacol. 14, 1097284. https://doi.org/10.3389/fphar.2023.1097284.

Correll, C.U., Ng-Mak, D.S., Stafkey-Mailey, D., Farrelly, E., Rajagopalan, K., Loebel, A., 2017. Cardiometabolic comorbidities, readmission, and costs in schizophrenia and bipolar disorder: a real-world analysis. Ann. Gen. Psychiatr. 16, 9. https://doi.org/10.1186/s12991-017-0133-7.

Correll, C.U., Solmi, M., Cortese, S., Fava, M., Højlund, M., Kraemer, H.C., McIntyre, R.S., Pine, D.S., Schneider, L.S., Kane, J.M., 2023. The future of psychopharmacology: a critical appraisal of ongoing phase 2/3 trials, and of some current trends aiming to de-risk trial programmes of novel agents. World Psychiatry 22 (1), 48–74. https://doi.org/10.1002/wps.21056.

Coventry, P., Peckham, E., Taylor, J., 2019. Promoting weight loss in people with schizophrenia: what do we still need to learn before implementing lifestyle interventions? Br. J. Psychiatry 214 (2), 74–75. https://doi.org/10.1192/bjp.2018.252.

Cuijpers, P., Miguel, C., Ciharova, M., Harrer, M., Basic, D., Cristea, I.A., de Ponti, N., Driessen, E., Hamblen, J., Larsen, S.E., Matbouriahi, M., Papola, D., Pauley, D., Plessen, C.Y., Pfund, R.A., Setkowski, K., Schnurr, P.P., van Ballegooijen, W., Wang, Y., Riper, H., van Straten, A., Sijbrandij, M., Furukawa, T.A., Karyotaki, E., 2024 Jun. Absolute and relative outcomes of psychotherapies for eight mental disorders: a systematic review and meta-analysis. World Psychiatry 23 (2), 267–275. https://doi.org/10.1002/wps.21203. PMID: 38727072; PMCID: PMC11083862.

Davidson, L., Tondora, J., 2022. Person-centred care planning as foundational to clinical practice. World Psychiatry 21 (1), 1–2. https://doi.org/10.1002/wps.20922.

De Hert, M., Detraux, J., van Winkel, R., Yu, W., Correll, C.U., 2011. Metabolic and cardiovascular adverse effects associated with antipsychotic drugs. Nat. Rev. Endocrinol. 8 (2), 114–126. https://doi.org/10.1038/nrendo.2011.156.

De Rosa, C., Sampogna, G., Luciano, M., Del Vecchio, V., Pocai, B., Borriello, G., Giallonardo, V., Savorani, M., Pinna, F., Pompili, M., Fiorillo, A., 2017. Improving physical health of patients with severe mental disorders: a critical review of lifestyle psychosocial interventions. Expert Rev. Neurother. 17 (7), 667–681. https://doi.org/10.1080/14737175.2017.1325321.

Dragioti, E., Radua, J., Solmi, M., Gosling, C.J., Oliver, D., Lascialfari, F., Ahmed, M., Cortese, S., Estradé, A., Arrondo, G., Gouva, M., Fornaro, M., Batiridou, A., Dimou, K., Tsartsalis, D., Carvalho, A.F., Shin, J.I., Berk, M., Stringhini, S., Correll, C. U., et al., 2023. Impact of mental disorders on clinical outcomes of physical diseases: an umbrella review assessing population attributable fraction and generalized impact fraction. World Psychiatry 22 (1), 86–104. https://doi.org/10.1002/wps.21068.

Dumas, G., 2022. From inter-brain connectivity to inter-personal psychiatry. World Psychiatry 21 (2), 214–215. https://doi.org/10.1002/wps.20987.

Fiorillo, A., Giordano, A., 2022. The biopsychosocial model of schizophrenia and cancer: unraveling the etiopathogenesis of complex diseases. Eur. Psychiatr. 65 (1), e86. https://doi.org/10.1192/j.eurpsy.2022.2349.

Fiorillo, A., Sartorius, N., 2021. Mortality gap and physical comorbidity of people with severe mental disorders: the public health scandal. Ann. Gen. Psychiatr. 20 (1), 52. https://doi.org/10.1186/s12991-021-00374-y.

First, M.B., Williams, J.B.W., Karg, R.S., Spitzer, R.L., 2015. Structured Clinical Interview for DSM-5—Research Version (SCID-5 for DSM-5, Research Version; SCID-5-RV). American Psychiatric Association, Arlington, VA.

Firth, J., Solmi, M., Wootton, R.E., Vancampfort, D., Schuch, F.B., Hoare, E., Gilbody, S., Torous, J., Teasdale, S.B., Jackson, S.E., Smith, L., Eaton, M., Jacka, F.N., Veronese, N., Marx, W., Ashdown-Franks, G., Siskind, D., Sarris, J., Rosenbaum, S., Carvalho, A.F., Stubbs, B., 2020. A meta-review of "lifestyle psychiatry": the role of exercise, smoking, diet and sleep in the prevention and treatment of mental disorders. World Psychiatry 19 (3), 360–380. https://doi.org/10.1002/wps.20773. PMID: 32931092; PMCID: PMC7491615.

Fowler, D., 2024 Jun. The promise of social recovery therapy in non-affective psychoses. World Psychiatry 23 (2), 289–290. https://doi.org/10.1002/wps.21208. PMID: 38727066; PMCID: PMC11083908.

Freeman, M., 2022. The World Mental Health Report: transforming mental health for all. World Psychiatry 21 (3), 391–392. https://doi.org/10.1002/wps.21018.

Galderisi, S., 2023. Promoting schizophrenia research in europe: the contribution of the European group for research in schizophrenia. World Psychiatry 22 (3), 486–487. https://doi.org/10.1002/wps.21100.

Grajales, D., Ferreira, V., Valverde, Á.M., 2019. Second-generation antipsychotics and dysregulation of glucose metabolism: beyond weight gain. Cells 8 (11), 1336. https://doi.org/10.3390/cells8111336.

Gurusamy, J., Gandhi, S., Damodharan, D., Palaniappan, M., Ganesan, V., 2024. Effect of lifestyle modification intervention (LMI) on metabolic syndrome in schizophrenia in a residential mental health care setting-A mixed method study. Schizophr. Res. 266, 75–84. https://doi.org/10.1016/j.schres.2024.02.002. Epub 2024 Feb 19. PMID: 38377870.

Højlund, M., Andersen, K., Ernst, M.T., Correll, C.U., Hallas, J., 2022. Use of low-dose quetiapine increases the risk of major adverse cardiovascular events: results from a nationwide active comparator-controlled cohort study. World Psychiatry 21 (3), 444–451. https://doi.org/10.1002/wps.21010.

Holm, M., Tanskanen, A., Tiihonen, J., Taipale, H., 2024 Jun. Medication use and sickness absence from work in bipolar disorder: a nationwide register-based study. World Psychiatry 23 (2), 296–298. https://doi.org/10.1002/wps.21213. PMID: 38727041; PMCID: PMC11083958.

Holt, R.I.G., Gossage-Worrall, R., Hind, D., Bradburn, M.J., McCrone, P., Morris, T., Edwardson, C., Barnard, K., Carey, M.E., Davies, M.J., Dickens, C.M., Doherty, Y., Etherington, A., French, P., Gaughran, F., Greenwood, K.E., Kalidindi, S., Khunti, K., Laugharne, R., Pendlebury, J., et al., 2019. Structured lifestyle education for people with schizophrenia, schizoaffective disorder and first-episode psychosis (STEPWISE): randomised controlled trial. Br. J. Psychiatry 214 (2), 63–73. https://doi.org/10.1192/bjp.2018.167.

Hoogervorst, M.M., van Meijel, B., Bruin, E.K., Beekman, A., Boonstra, N., Adriaanse, M., 2023. The nurse-led GILL eHealth intervention for improving physical health and lifestyle behaviours in clients with severe mental illness: design of a cluster-randomised controlled trial. BMC Psychiatr. 23 (1), 672. https://doi.org/10.1186/s12888-023-05024-z. PMID: 37715156; PMCID: PMC10504705.

Huhn, M., Nikolakopoulou, A., Schneider-Thoma, J., Krause, M., Samara, M., Peter, N., Arndt, T., Bäckers, L., Rothe, P., Cipriani, A., Davis, J., Salanti, G., Leucht, S., 2019. Comparative efficacy and tolerability of 32 oral antipsychotics for the acute treatment of adults with multi-episode schizophrenia: a systematic review and network meta-analysis. Lancet 394 (10202), 939–951. https://doi.org/10.1016/S0140-6736(19)31135-3.

Jacob, L., Tully, M.A., Barnett, Y., Lopez-Sanchez, G.F., Butler, L., Schuch, F., López-Bueno, R., McDermott, D., Firth, J., Grabovac, I., Yakkundi, A., Armstrong, N., Young, T., Smith, L., 2020. The relationship between physical activity and mental health in a sample of the UK public: a cross-sectional study during the implementation of COVID-19 social distancing measures. Ment. Health Phys. Act. 19, 100345. https://doi.org/10.1016/j.mhpa.2020.100345.

Kern, R.S., Nuechterlein, K.H., Green, M.F., Baade, L.E., Fenton, W.S., Gold, J.M., Keefe, R.S., Mesholam-Gately, R., Mintz, J., Seidman, L.J., Stover, E., Marder, S.R., 2008. The MATRICS Consensus Cognitive Battery, part 2: co-norming and standardization. Am. J. Psychiatry 165 (2), 214–220. https://doi.org/10.1176/appi.ajp.2007.07010043.

Kessing, L.V., Thomsen, A.F., Mogensen, U.B., Andersen, P.K., 2010. Treatment with antipsychotics and the risk of diabetes in clinical practice. Br. J. Psychiatry 197 (4), 266–271. https://doi.org/10.1192/bjp.bp.109.076935.

Lam, R.W., Kennedy, S.H., Adams, C., Bahji, A., Beaulieu, S., Bhat, V., Blier, P., Blumberger, D.M., Brietzke, E., Chakrabarty, T., Do, A., Frey, B.N., Giacobbe, P., Gratzer, D., Grigoriadis, S., Habert, J., Ishrat Husain, M., Ismail, Z., McGirr, A., McIntyre, R.S., Michalak, E.E., Müller, D.J., Parikh, S.V., Quilty, L.S., Ravindran, A. V., Ravindran, N., Renaud, J., Rosenblat, J.D., Samaan, Z., Saraf, G., Schade, K., Schaffer, A., Sinyor, M., Soares, C.N., Swainson, J., Taylor, V.H., Tourjman, S.V., Uher, R., van Ameringen, M., Vazquez, G., Vigod, S., Voineskos, D., Yatham, L.N., Milev, R.V., 2024. Canadian Network for Mood and Anxiety Treatments (CANMAT) 2023 Update on Clinical Guidelines for Management of Major Depressive Disorder in Adults: Réseau canadien pour les traitements de l'humeur et de l'anxiété (CANMAT) 2023 : Mise à jour des lignes directrices cliniques pour la prise en charge du trouble dépressif majeur chez les adultes. Can J Psychiatry 69 (9), 641–687. https://doi.org/10.1177/07067437241245384.

Laursen, T.M., Munk-Olsen, T., Vestergaard, M., 2012. Life expectancy and cardiovascular mortality in persons with schizophrenia. Curr. Opin. Psychiatr. 25 (2), 83–88. https://doi.org/10.1097/YCO.0b013e32835035ca.

Leucht, S., Schneider-Thoma, J., Burschinski, A., Peter, N., Wang, D., Dong, S., Huhn, M., Nikolakopoulou, A., Salanti, G., Davis, J.M., 2023. Long-term efficacy of antipsychotic drugs in initially acutely ill adults with schizophrenia: systematic review and network meta-analysis. World Psychiatry 22 (2), 315–324. https://doi.org/10.1002/wps.21089.

Levrat, V., Favre, S., Richard-Lepouriel, H., 2024. Current practices of psychoeducation interventions with persons with bipolar disorders: a literature review. Front. Psychiatr. 5 (14), 1320654. https://doi.org/10.3389/fpsyt.2023.1320654.

Looijmans, A., Jörg, F., Bruggeman, R., Schoevers, R.A., Corpeleijn, E., 2019. Multimodal lifestyle intervention using a web-based tool to improve cardiometabolic health in patients with serious mental illness: results of a cluster randomized controlled trial (LION). BMC Psychiatr. 19 (1), 339. https://doi.org/10.1186/s12888-019-2310-5.

Luciano, M., Sampogna, G., Del Vecchio, V., Giallonardo, V., Palummo, C., Andriola, I., Amore, M., Rossi, R., Carmassi, C., Siracusano, A., Fiorillo, A., LIFESTYLE Working Group, 2021a. The impact of clinical and social factors on the physical health of people with severe mental illness: results from an Italian multicentre study. Psychiatr. Res. 303, 114073. https://doi.org/10.1016/j.psychres.2021.114073.

Luciano, M., Sampogna, G., Amore, M., Andriola, I., Calcagno, P., Carmassi, C., Del Vecchio, V., Dell'Osso, L., Di Lorenzo, G., Gelao, B., Giallonardo, V., Rossi, A., Rossi, R., Siracusano, A., Fiorillo, A., LIFESTYLE Working Group, 2021b. How to improve the physical health of people with severe mental illness? A multicentric randomized controlled trial on the efficacy of a lifestyle group intervention. Eur. Psychiatr. 64 (1), e72. https://doi.org/10.1192/j.eurpsy.2021.2253.

Luciano, M., Pompili, M., Sartorius, N., Fiorillo, A., 2022a. Editorial: mortality of people with severe mental illness: causes and ways of its reduction. Front. Psychiatr. 13, 1009772. https://doi.org/10.3389/fpsyt.2022.1009772.

Luciano, M., Fiorillo, A., Brandi, C., Di Vincenzo, M., Egerhazi, A., Hiltensperger, R., Kawhol, W., Kovacs, A.I., Rossler, W., Slade, M., Pushner, B., Sampogna, G., 2022b. Impact of clinical decision-making participation and satisfaction on outcomes in mental health practice: results from the CEDAR European longitudinal study. Int. Rev. Psychiatr. 34 (7–8), 848–860. https://doi.org/10.1080/09540261.2022.2085507.

Luciano, M., Sampogna, G., Amore, M., Bertolino, A., Dell'Osso, L., Rossi, A., Siracusano, A., Calcagno, P., Carmassi, C., Di Lorenzo, G., Di Vincenzo, M., Giallonardo, V., Rampino, A., Rossi, R., Lifestyle Working Group, Fiorillo, A., 2022c. Improving physical activity and diet in patients with severe mental disorders: results from the LIFESTYLE multicentric, real-world randomized controlled trial. Psychiatr. Res. 317, 114818. https://doi.org/10.1016/j.psychres.2022.114818.

Luciano, M., Sampogna, G., D'Ambrosio, E., Rampino, A., Amore, M., Calcagno, P., Rossi, A., Rossi, R., Carmassi, C., Dell'Osso, L., Bianciardi, E., Siracusano, A., Della Rocca, B., Di Vincenzo, M., Lifestyle Working Group, Fiorillo, A., 2024. One-year efficacy of a lifestyle behavioural intervention on physical and mental health in people with severe mental disorders: results from a randomized controlled trial. Eur. Arch. Psychiatr. Clin. Neurosci. 274 (4), 903–915. https://doi.org/10.1007/s00406-023-01684-w.

Lukoff, D., Nuechterlein, K.H., Ventura, J., 1986. Appendix A: manual for the expanded BPRS. Schizophr. Bull. 12 (4), 594–602.

Maj, M., Stein, D.J., Parker, G., Zimmerman, M., Fava, G.A., De Hert, M., Demyttenaere, K., McIntyre, R.S., Widiger, T., Wittchen, H.U., 2020. The clinical characterization of the adult patient with depression aimed at personalization of management. World Psychiatry 19 (3), 269–293. https://doi.org/10.1002/wps.20771.

Maj, M., van Os, J., De Hert, M., Gaebel, W., Galderisi, S., Green, M.F., Guloksuz, S., Harvey, P.D., Jones, P.B., Malaspina, D., McGorry, P., Miettunen, J., Murray, R.M., Nuechterlein, K.H., Peralta, V., Thornicroft, G., van Winkel, R., Ventura, J., 2021. The clinical characterization of the patient with primary psychosis aimed at personalization of management. World Psychiatry 20 (1), 4–33. https://doi.org/10.1002/wps.20809.

Manu, P., Dima, L., Shulman, M., Vancampfort, D., De Hert, M., Correll, C.U., 2015. Weight gain and obesity in schizophrenia: epidemiology, pathobiology, and management. Acta Psychiatr. Scand. 132 (2), 97–108. https://doi.org/10.1111/acps.12445.

Matthews, D.R., Hosker, J.P., Rudenski, A.S., Naylor, B.A., Treacher, D.F., Turner, R.C., 1985. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia 28 (7), 412–419. https://doi.org/10.1007/BF00280883.

Mohanty, K., Gandhi, S., Krishna Prasad, M., John, A.P., Bhaskarapillai, B., Malo, P., Thirthalli, J., 2024. Effectiveness of lifestyle intervention on prevention/management of antipsychotic-induced weight gain among persons with severe mental illness: a systematic review and meta-analysis. J. Health Psychol. 29 (7), 690–706. https://doi.org/10.1177/13591053241227384.

Momen, N.C., Østergaard, S.D., Heide-Jorgensen, U., Sørensen, H.T., McGrath, J.J., Plana-Ripoll, O., 2024. Associations between physical diseases and subsequent mental disorders: a longitudinal study in a population-based cohort. World Psychiatry 23 (3), 421–431.

Morosini, P.L., Magliano, L., Brambilla, L., Ugolini, S., Pioli, R., 2000. Development, reliability and acceptability of a new version of the DSM-IV Social and Occupational Functioning Assessment Scale (SOFAS) to assess routine social functioning. Acta Psychiatr. Scand. 101 (4), 323–329.

National Institute for Health and Care Excellence, 2022. Depression in Adults: Treatment and Management. National Institute for Health and Care Excellence (NICE).

National Institute for Health and Care Excellence, 2023. Bipolar Disorder: Assessment and Management. National Institute for Health and Care Excellence (NICE), London.

Nica, R., 2024 Oct. Improving mechanisms of involvement of people with lived experience in decision-making processes. World Psychiatry 23 (3), 398–399. https://doi.org/10.1002/wps.21239. PMID: 39279391; PMCID: PMC11403162.

Nordentoft, M., Wahlbeck, K., Hällgren, J., Westman, J., Osby, U., Alinaghizadeh, H., Gissler, M., Laursen, T.M., 2013. Excess mortality, causes of death and life expectancy in 270,770 patients with recent onset of mental disorders in Denmark, Finland and Sweden. PLoS One 8 (1), e55176. https://doi.org/10.1371/journal.pone.0055176.

Nuechterlein, K.H., Green, M.F., Kern, R.S., Baade, L.E., Barch, D.M., Cohen, J.D., Essock, S., Fenton, W.S., Frese 3rd, F.J., Gold, J.M., Goldberg, T., Heaton, R.K., Keefe, R.S., Kraemer, H., Mesholam-Gately, R., Seidman, L.J., Stover, E., Weinberger, D.R., Young, A.S., Zalcman, S., et al., 2008. The MATRICS Consensus Cognitive Battery, part 1: test selection, reliability, and validity. Am. J. Psychiatry 165 (2), 203–213. https://doi.org/10.1176/appi.ajp.2007.07010042.

Oliveira, A.C.N., Guariente, S.M.M., Zazula, R., Mesas, A.E., Oliveira, C.E.C., Reiche, E. M.V., Nunes, S.O.V., 2022. Hybrid and remote psychosocial interventions focused on weight and sedentary behavior management among patients with severe mental illnesses: a systematic review. Psychiatr. Q. 93 (3), 813–840. https://doi.org/10.1007/s11126-022-09994-3.

Orzelska-Górka, J., Mikulska, J., Wiszniewska, A., Biała, G., 2022. New atypical antipsychotics in the treatment of schizophrenia and depression. Int. J. Mol. Sci. 23 (18), 10624. https://doi.org/10.3390/ijms231810624.

Patel, J.K., Buckley, P.F., Woolson, S., Hamer, R.M., McEvoy, J.P., Perkins, D.O., Lieberman, J.A., Cafe, Investigators, 2009. Metabolic profiles of second-generation antipsychotics in early psychosis: findings from the CAFE study. Schizophr. Res. 111 (1–3), 9–16. https://doi.org/10.1016/j.schres.2009.03.025.

Pillinger, T., McCutcheon, R.A., Vano, L., Mizuno, Y., Arumuham, A., Hindley, G., Beck, K., Natesan, S., Efthimiou, O., Cipriani, A., Howes, O.D., 2020. Comparative effects of 18 antipsychotics on metabolic function in patients with schizophrenia, predictors of metabolic dysregulation, and association with psychopathology: a systematic review and network meta-analysis. Lancet Psychiatr. 7 (1), 64–77. https://doi.org/10.1016/S2215-0366(19)30416-X.

Priebe, S., Huxley, P., Knight, S., Evans, S., 1999. Application and results of the manchester short assessment of quality of life (MANSA). Int. J. Soc. Psychiatr. 45 (1), 7–12. https://doi.org/10.1177/002076409904500102.

Puschner, B., Steffen, S., Slade, M., Kaliniecka, H., Maj, M., Fiorillo, A., Munk-Jørgensen, P., Larsen, J.I., Egerházi, A., Nemes, Z., Rössler, W., Kawohl, W., Becker, T., 2010. Clinical decision making and outcome in routine care for people with severe mental illness (CEDAR): study protocol. BMC Psychiatr. 10, 90. https://doi.org/10.1186/1471-244X-10-90.

Reed, G.M., 2024 Jun. What's in a name? Mental disorders, mental health conditions and psychosocial disability. World Psychiatry 23 (2), 209–210. https://doi.org/10.1002/wps.21190. PMID: 38727053; PMCID: PMC11083882.

Reilly, S., Olier, I., Planner, C., Doran, T., Reeves, D., Ashcroft, D.M., Gask, L., Kontopantelis, E., 2015. Inequalities in physical comorbidity: a longitudinal comparative cohort study of people with severe mental illness in the UK. BMJ Open 5 (12), e009010. https://doi.org/10.1136/bmjopen-2015-009010.

Ross, R., Neeland, I.J., Yamashita, S., Shai, I., Seidell, J., Magni, P., Santos, R.D., Arsenault, B., Cuevas, A., Hu, F.B., Griffin, B.A., Zambon, A., Barter, P., Fruchart, J. C., Eckel, R.H., Matsuzawa, Y., Després, J.P., 2020. Waist circumference as a vital sign in clinical practice: a Consensus statement from the IAS and ICCR working group on visceral obesity. Nat. Rev. Endocrinol. 16 (3), 177–189. https://doi.org/10.1038/s41574-019-0310-7.

Sampogna, G., Fiorillo, A., Luciano, M., Del Vecchio, V., Steardo Jr., L., Pocai, B., Barone, M., Amore, M., Pacitti, F., Dell'Osso, L., Di Lorenzo, G., Maj, M., LIFESTYLE Working Group, 2018. A randomized controlled trial on the efficacy of a psychosocial behavioral intervention to improve the lifestyle of patients with severe mental disorders: study protocol. Front. Psychiatr. 9, 235. https://doi.org/10.3389/fpsyt.2018.00235.

Sampogna, G., Luciano, M., Del Vecchio, V., Giallonardo, V., Palummo, C., Andriola, I., Sangiuliano, M., Calcagno, P., Zampogna, D., Rossi, R., Stratta, P., Carmassi, C., Dell'Osso, L., Niolu, C., Siracusano, A., Lifestyle Working Group, Fiorillo, A., 2021. Stili di vita nei pazienti con disturbi mentali gravi: quali opportunità per il trattamento? [Lifestyle in patients with severe mental disorders: a new target for psychosocial interventions?]. Riv. Psichiatr. 56 (5), 261–271. https://doi.org/10.1708/3681.36674. Italian.

Sampogna, G., Di Vincenzo, M., Della Rocca, B., Mancuso, E., Volpicelli, A., Perris, F., Del Vecchio, V., Giallonardo, V., Luciano, M., Fiorillo, A., 2022a. Physical comorbidities in patients with severe mental disorders: a brief narrative review on current challenges and practical implications for professionals. Riv. Psichiatr. 57 (6), 251–257. https://doi.org/10.1708/3922.39071.

Sampogna, G., Luciano, M., Di Vincenzo, M., Andriola, I., D'Ambrosio, E., Amore, M., Serafini, G., Rossi, A., Carmassi, C., Dell'Osso, L., Di Lorenzo, G., Siracusano, A., Rossi, R., Fiorillo, A., Working Group LIFESTYLE, 2022b. The complex interplay between physical activity and recovery styles in patients with severe mental disorders in a real-world multicentric study. Front. Psychiatr. 13, 945650. https://doi.org/10.3389/fpsyt.2022.945650.

Sampogna, G., Luciano, M., Di Vincenzo, M., Toni, C., D'Ambrosio, E., Rampino, A., Rossi, A., Rossi, R., Amore, M., Calcagno, P., Siracusano, A., Niolu, C., Dell'Osso, L., Carpita, B., Lifestyle Working Group, Fiorillo, A., 2023. Physical activity influences adherence to pharmacological treatments in patients with severe mental disorders: results from the multicentric, randomized controlled LIFESTYLE trial. Front. Pharmacol. 14, 1285383. https://doi.org/10.3389/fphar.2023.1285383.

Sepúlveda-Lizcano, L., Arenas-Villamizar, V.V., Jaimes-Duarte, E.B., García-Pacheco, H., Paredes, C.S., Bermúdez, V., Rivera-Porras, D., 2023. Metabolic adverse effects of psychotropic drug therapy: a systematic review. Eur. J. Invest. Health. Psychol. Educ. 13 (8), 1505–1520. https://doi.org/10.3390/ejihpe13080110.

Siddiqi, N., Doran, T., Prady, S.L., Taylor, J., 2017. Closing the mortality gap for severe mental illness: are we going in the right direction? Br. J. Psychiatry 211 (3), 130–131. https://doi.org/10.1192/bjp.bp.117.203026.

Sneller, M.H., de Boer, N., Everaars, S., Schuurmans, M., Guloksuz, S., Cahn, W., Luykx, J.J., 2021. Clinical, biochemical and genetic variables associated with metabolic syndrome in patients with schizophrenia spectrum disorders using second-generation antipsychotics: a systematic review. Front. Psychiatr. 12, 625935. https://doi.org/10.3389/fpsyt.2021.625935.

Steger, M.F., 2022. Meaning in life is a fundamental protective factor in the context of psychopathology. World Psychiatry 21 (3), 389–390. https://doi.org/10.1002/wps.20916.

Stubbs, B., Vancampfort, D., Hallgren, M., Firth, J., Veronese, N., Solmi, M., Brand, S., Cordes, J., Malchow, B., Gerber, M., Schmitt, A., Correll, C.U., De Hert, M., Gaughran, F., Schneider, F., Kinnafick, F., Falkai, P., Möller, H.J., Kahl, K.G., 2018. EPA guidance on physical activity as a treatment for severe mental illness: a meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). Eur. Psychiatr. 54, 124–144. https://doi.org/10.1016/j.eurpsy.2018.07.004.

Sunkel, C., 2022. A lived experience perspective on the new World Mental Health Report. World Psychiatry 21 (3), 390–391. https://doi.org/10.1002/wps.21031.

Taipale, H., Lieslehto, J., Lähteenvuo, M., Hamina, A., Tanskanen, A., Mittendorfer-Rutz, E., Paljärvi, T., Solmi, M., Cipriani, A., Correll, C.U., Tiihonen, J., 2024 Jun. Real-world effectiveness of antidepressants, antipsychotics and their combinations in the maintenance treatment of psychotic depression. Evidence from within-subject analyses of two nationwide cohorts. World Psychiatry 23 (2), 276–284. https://doi.org/10.1002/wps.21205. PMID: 38727044; PMCID: PMC11083867.

Thornicroft, G., 2011. Physical health disparities and mental illness: the scandal of premature mortality. Br. J. Psychiatry 199 (6), 441–442. https://doi.org/10.1192/bjp.bp.111.092718.

Vochoskova, K., McWhinney, S.R., Fialova, M., Kolenic, M., Spaniel, F., Svancer, P., Boron, P., Okaji, Y., Trancik, P., Hajek, T., 2023. Weight and metabolic changes in early psychosis-association with daily quantification of medication exposure during the first hospitalization. Acta Psychiatr. Scand. 148 (3), 265–276. https://doi.org/10.1111/acps.13594.

Walker, E.R., McGee, R.E., Druss, B.G., 2015. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. JAMA Psychiatr. 72 (4), 334–341. https://doi.org/10.1001/jamapsychiatry.2014.2502.

Wasserman, D., 2023. Mental health for all: fostering healthy lifestyles. World Psychiatry 22 (2), 343–344. https://doi.org/10.1002/wps.21102.

Wasserman, D., Arango, C., Fiorillo, A., Levin, S., Peters, A., Rao, P., Sanchez-Villanueva, T., Sylla, A., 2023a. Improving mental health through fostering healthy lifestyles in young people: one of the targets in the WPA Action Plan 2023-2026. World Psychiatry 22 (3), 488–489. https://doi.org/10.1002/wps.21146.

Wasserman, D., Arango, C., Fiorillo, A., Levin, S., Peters, A.C., Rao, G.P., Sylla, A., Sanchez-Villanueva, T., 2023 Feb. Pushing forward public mental health agenda and promotion of mental health. World Psychiatry 22 (1), 170–171. https://doi.org/10.1002/wps.21052. PMID: 36640400; PMCID: PMC9840491.

Wilmet, G., Verlinde, R., Vandevoorde, J., Carnol, L., Devroey, D., 2017. Correlation between Body Mass Index and abdominal circumference in Belgian adults: a cross-sectional study. Rom. J. Intern. Med. 55 (1), 28–35. https://doi.org/10.1515/rjim-2016-0050.

Wilson, P.W., D'Agostino, R.B., Levy, D., Belanger, A.M., Silbershatz, H., Kannel, W.B., 1998. Prediction of coronary heart disease using risk factor categories. Circulation 97 (18), 1837–1847. https://doi.org/10.1161/01.cir.97.18.1837.

World Medical Association, 2013. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA 310 (20), 2191–2194. https://doi.org/10.1001/jama.2013.281053.

Wu, H., Siafis, S., Hamza, T., Schneider-Thoma, J., Davis, J.M., Salanti, G., Leucht, S., 2022. Antipsychotic-induced weight gain: dose-response meta-analysis of randomized controlled trials. Schizophr. Bull. 48 (3), 643–654. https://doi.org/10.1093/schbul/sbac001.

Yatham, L.N., Kennedy, S.H., Parikh, S.V., Schaffer, A., Bond, D.J., Frey, B.N., Sharma, V., Goldstein, B.I., Rej, S., Beaulieu, S., Alda, M., MacQueen, G., Milev, R.V., Ravindran, A., O'Donovan, C., McIntosh, D., Lam, R.W., Vazquez, G., Kapczinski, F., McIntyre, R.S., Kozicky, J., Kanba, S., Lafer, B., Suppes, T., Calabrese, J.R., Vieta, E., Malhi, G., Post, R.M., Berk, M., 2018. Canadian network for mood and anxiety treatments (CANMAT) and international society for bipolar disorders (ISBD) 2018 guidelines for the management of patients with bipolar disorder. Bipolar Disord. 20 (2), 97–170. https://doi.org/10.1111/bdi.12609.

Zhang, J.P., Gallego, J.A., Robinson, D.G., Malhotra, A.K., Kane, J.M., Correll, C.U., 2013. Efficacy and safety of individual second-generation vs. first-generation antipsychotics in first-episode psychosis: a systematic review and meta-analysis. Int. J. Neuropsychopharmacol. 16 (6), 1205–1218. https://doi.org/10.1017/S1461145712001277.

Zimmermann, U., Kraus, T., Himmerich, H., Schuld, A., Pollmächer, T., 2003. Epidemiology, implications and mechanisms underlying drug-induced weight gain in psychiatric patients. Journal. Psych. Res. 37 (3), 193–220. https://doi.org/10.1016/s0022-3956(03)00018-9.