



# The impact of clinical and social factors on the physical health of people with severe mental illness: Results from an Italian multicentre study

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## ABSTRACT

Our manuscript aims to: 1) assess physical health in a sample of patients with severe mental disorders; and 2) identify the psychopathological and psychosocial characteristics associated with an increased likelihood of having a poor physical health. The study, funded by the Italian Ministry of Education, has been carried out in psychiatric outpatient units of six Italian University sites. All recruited patients have been assessed through standardized assessment instruments. Moreover, anthropometric parameters have been obtained at recruitment and a blood samples have been collected to assess cardiometabolic parameters.

Four-hundred and two patients with a primary diagnosis of bipolar disorder (43.3%), schizophrenia or other psychotic disorder (29.9%), or major depression (26.9%) were recruited. Internalized stigma, psychosocial functioning, quality of life, psychiatric hospitalizations, depressive/anxiety and manic symptoms and cognition were those domains more strongly associated with poor metabolic parameters, including high body mass index, HOMA and Framingham indexes and waist circumference. There were no statistically significant differences among the three diagnostic groups.

Our findings highlight the importance of perceived stigma and quality of life on patients' physical health. This should be taken into account when developing plans for reducing the mortality rate in patients with severe mental disorders.

## 1. Introduction

People with severe mental illness (SMI) have a higher incidence of physical disorders and a higher mortality rate, with a life expectancy reduced by 10 to 20 years compared to the general population (Plana-Ripoll et al., 2020; World Health Organization, 2018; Thornicroft, 2011). Only a minority of premature deaths is attributable to unnatural

causes, such as suicide, homicide, or accidents (De Rosa et al., 2017). In fact, premature deaths in patients with SMI are mainly due to the co-occurrence of physical diseases (Hoang et al., 2013), such as cardiovascular (van Os et al., 2019) and metabolic ones (Global Burden of Diseases, 2016).

The association between physical and mental disorders is due to a complex interplay of factors, which are attributable to the patients

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themselves, to the illness, and to psychotropic medications. Patients with SMI receive fewer physical health check-ups and screenings compared to patients without SMI, and are less likely to receive a timely diagnosis of any physical illness, including cardiovascular diseases and cancer (Lawrence et al., 2003). The premature mortality in patients with SMI is also influenced by the adoption of unhealthy lifestyle behaviours, such as low physical activity, high rates of tobacco use and poor diet (Vancampfort et al., 2019; Firth et al., 2019). As far as illness-related factors are concerned, these include several psychopathological domains, such as cognitive impairment, depressive and negative symptoms, and some psychosocial factors, including social isolation and self-stigma, which hamper patients' help-seeking for physical illnesses (Kimhy et al., 2014; Mucheru et al., 2020). Finally, the risk of developing physical illnesses is increased by several psychotropic medications, including second-generation antipsychotics, mood stabilizers and tricyclic antidepressants (Schneider et al., 2020; Solmi et al., 2020; Taipale et al., 2020).

The presence of physical health problems in patients with SMI has traditionally been explored according to their main psychiatric diagnosis, while only a minority of studies assessed the relationship between psychopathological dimensions and poor physical health, in order to clinically characterize those patients with SMI with a higher risk to develop physical diseases, independently from diagnostic categories. In fact, it has recently been proposed that poor physical health may not be related to a specific diagnostic category (i.e., schizophrenia or major depression) but it could be associated with specific clusters of symptoms (i.e., having depressed mood vs. cognitive deficits) (Mansell, 2019). Moreover, physical health in patients with SMI may also be influenced by their overall levels of functioning and insight, the quality of their social network and the presence of adaptive coping strategies (World Health Organization, 2018; Firth et al., 2020), which are transdiagnostic and are impaired in most patients with SMI.

This paper, based on the LIFESTYLE randomized controlled study (Sampogna et al., 2018), aims to: 1) assess physical health in a sample of patients with severe mental disorders; and 2) identify which psychopathological and psychosocial characteristics increase the likelihood of poor physical health.

## 2. Materials and methods

The LIFESTYLE trial is a multicentre randomized controlled trial with blinded outcome assessments. The project was carried out at six Italian university sites (Universities of Campania "L. Vanvitelli", Bari, Genova, L'Aquila, Pisa and Roma Tor Vergata) and funded by the Italian Ministry of Education, Universities and Research.

Patients attending the outpatient units of participating centres were consecutively recruited from September 2017 to May 2018. Inclusion criteria were the following: 1) a diagnosis of schizophrenia or other psychotic disorder, bipolar disorder or depressive disorder, according to the DSM-5 criteria; 2) age between 18 and 65 years; 3) body mass index (BMI)  $\geq 25$ ; 4) ability to provide written informed consent. Exclusion criteria were: 1) inability to perform moderate physical activity (i.e., walking at least 150 min per week, or 75 min of vigorous exercise twice a week, according to the guidelines of the Italian Ministry of Health); 2) pregnancy or breast feeding; 3) severe cognitive impairment or intellectual disability; 4) a worsening of their clinical status or hospital admission in the previous 3 months.

After the baseline assessments, recruited patients were randomly assigned to receive an experimental psychosocial intervention to improve their physical health and promote lifestyle behaviours or to a control group. The full study protocol has been described in detail previously (Sampogna et al., 2018).

This study was conducted in accordance with globally accepted standards of good practice, in agreement with the Declaration of Helsinki and with local regulations. A formal ethical approval for conducting the trial was obtained by the Coordinating Center's Ethics

Committee, which approved the whole study protocol on January 2017 (approval number: prot. 64). All recruited patients gave written informed consent to participate in the study.

### 2.1. Measures

All patients were assessed at baseline and after 2, 4, 6, 12 and 24 months. The data collected at T0 are used for the analyses of this paper.

The patients' physical health was assessed using the following instruments: a) the Cumulative Illness Rating Scale (CIRS) (Linn et al., 1968), a 14-item questionnaire exploring the presence and severity of physical comorbidities; b) an anthropometric schedule with information on weight, height, BMI, waist circumference, blood pressure, resting heart rate, high-density lipoprotein (HDL), low-density lipoprotein (LDL) and overall levels of cholesterol, blood glucose, triglycerides, blood insulin; c) the homeostasis model assessment of insulin resistance (HOMA-IR), calculated as follows:  $\text{fasting insulin (mg/dL)} \times \text{fasting glucose (mmol/L)} / 405$ ; d) the Framingham 10-year risk score (FRS) for the evaluation of cardiovascular risk.

The patients' psychiatric symptoms and psychosocial functioning were assessed by: a) the Structured Clinical Interview for DSM-5, a semi-structured interview guide for DSM-5 diagnoses. (American Psychiatric association (APA), 2013)) the Brief Psychiatric Rating Scale (BPRS), a semi-structured 18-items interview on psychopathological status. Each item is rated on a Likert scale ranging from 0 to 7. Items are grouped in four subscales: positive symptoms (range 0–28), negative symptoms (range 0–28), depressive-anxiety symptoms (0–28), and manic-hostility symptoms (range 0–21) (Lukoff et al., 1986); c) the Personal and Social Performance Scale (PSP) (Morosini et al., 2000), a 100-point single-item rating scale, subdivided into 10 equal intervals. The ratings are based on the assessment of patient's functioning in four main areas (socially useful activities, personal and social relationships, self-care, disturbing and aggressive behaviours). Higher PSP total score indicate a better functioning; d) the 17-item Manchester Short Assessment of Quality of Life (MANSA), a 17-item questionnaire assessing quality of life focusing on satisfaction with life as a whole and with life domains (Pribe et al., 1999). Each item is rated on a 7-point Likert scale from 1 (could not be worse) to 7 (could not be better); e) the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive Battery (MCCB), brief version, including the MATRICS Consensus Trail Making Test—part A, Brief Assessment of Cognition in Schizophrenia: Symbol Coding and Category Fluency-Animal Naming (Kern et al., 2008) the Internalized Stigma of Mental Illness (ISMI), a 29-item questionnaire for evaluating the experience of stigma and internalized self-rejection. Each item is rated on a 4-level Likert scale, where higher scores indicate greater levels of internalized stigma (Ritsher et al., 2003); f) The Morisky Medication Adherence Scale (MMAS), a 4-items questionnaire on adherence to pharmacological treatments, with a total score ranging from 0 to 4. A Higher total score indicates a better adherence to pharmacological treatments (Morisky et al., 1986); g) the Pattern of Care Schedule (PCS), is a 40-item questionnaire on pharmacological and non-pharmacological treatments as well as on health care treatments received by the patient (Fiorillo et al., 2015).

The inter-rater reliability of participating researchers has been tested through Cohen's kappa coefficient (29), which was satisfactory for both the PSP ( $k$  value=0.918) and the BPRS ( $k$  value ranging from 0.835 to 0.972). A 100% agreement rate was found for the SCID-5 diagnoses.

### 2.2. Statistical analyses

Descriptive statistics were calculated for socio-demographic, clinical and metabolic variables. Data are presented as means and standard deviations (SD) or frequencies and percentages (%), as appropriate. The Kolmogorov-Smirnov test was used to check the normality of distribution of the sample.

Differences in the three diagnostic categories (i.e., schizophrenia and other psychotic disorders, major depression, and bipolar disorder) with respect to cardio-metabolic parameters were assessed with the ANOVA test with Bonferroni correction. Linear regression analyses were performed using cardio-metabolic and anthropometric variables as dependent variables (i.e., waist circumference, CIRS severity and comorbidity indexes, FRS total point, HOMA index and BMI). Independent variables were Number of hospitalizations, MANSA total score, ISMI total score, PSP total score, B-MCCB symbol coding; B-MCCB Trial making test A, BPRS depressive/anxiety subscale, BPRS positive symptoms subscale; BPRS manic symptoms subscale; BPRS negative symptoms subscale; MMAS negative symptoms subscale. All regression models were adjusted for age, gender, diagnosis, pharmacological treatments, duration of illness and educational level. Pharmacological treatments and psychiatric diagnoses were included in the regression models as dummy variables (i.e., mood stabilizers, tricyclic antidepressants, new-generation antidepressants, first- and second-generation antipsychotics, depressive disorder, bipolar disorders, psychosis).

Statistical analyses were performed with the Statistical Package for Social Sciences version 21. The level of statistical significance was set at  $p < .05$ .

### 3. Results

#### 3.1. Socio-demographic and clinical characteristics

Four hundred and two patients with a primary diagnosis of bipolar disorder (43.3%), schizophrenia or other psychotic disorder (29.9%), or

major depression (26.9%) were recruited. All socio-demographic and clinical characteristics of recruited patients are reported in Table 1.

The only metabolic differences among the three diagnostic groups were significantly higher levels of systolic and diastolic blood pressure in patients with schizophrenia or other psychotic disorder vs. those with major depression ( $p < .05$ ), and higher heart rates in patients with schizophrenia or other psychotic disorder and bipolar disorder vs. patients with major depression ( $p < .01$  and  $p < .05$ , respectively) (Table 2).

#### 3.2. Multivariate analyses

The multivariate analyses have been performed controlling for age, gender, duration of illness, level of education, diagnosis and pharmacological treatments.

Higher number of hospitalizations ( $B = 0.95$ ;  $p < .000$ ), higher levels of internalized stigma ( $B = 0.30$ ;  $p < .000$ ), higher scores for depressive/anxiety symptoms ( $B = 0.19$ ;  $p < .000$ ), poor quality of life ( $B = -0.34$ ,  $p < .000$ ) and reduced psychosocial functioning ( $B = -0.32$ ;  $p < .05$ ) were associated with higher BMI.

Lower quality of life ( $B = -0.27$ ;  $p < .000$ ), higher levels of internalized stigma ( $B = 0.27$ ;  $p < .000$ ), higher scores for depressive/anxiety ( $B = 0.11$ ;  $p < .000$ ) and manic symptoms ( $B = 0.05$ ;  $p < .05$ ) and a higher number of psychiatric hospitalizations ( $B = 0.02$ ;  $p < .01$ ) were associated with higher waist circumference. On the other hand, a lower waist circumference was associated with a higher score on the B-MCCB symbol coding ( $B = 0.03$ ;  $p < .000$ ).

Higher levels of self-stigma ( $B = 0.61$ ;  $p < .000$ ), and a reduced

**Table 1**  
Socio-demographic and Clinical Characteristics of the sample ( $N = 402$ ).

|                                                      |              |
|------------------------------------------------------|--------------|
| Gender, female, % (N)                                | 57 (227)     |
| Age, M (sd)                                          | 45.8 (11.8)  |
| Living situation, % (N)                              | 71.4 (287)   |
| Alone                                                | 28.6 (115)   |
| Married                                              |              |
| Years of education, M (SD)                           | 11.69 (2.9)  |
| Employed, yes, % (N)                                 | 35.7 (143)   |
| Diagnosis, % (N)                                     |              |
| Bipolar disorder                                     | 43.3 (174)   |
| Schizophrenia and other psychotic disorders          | 29.6 (120)   |
| Major depression                                     | 27.1 (108)   |
| Years in charge to the mental health service, M (SD) | 5.9 (6.9)    |
| Duration of illness, M (SD)                          | 15.6 (11.3)  |
| Number of hospitalization, M (SD)                    | 2.8 (5.1)    |
| Suicide attempts, M (SD)                             | 1.8 (1.6)    |
| BPRS, positive symptoms subscale, M (SD)             | 5.4 (2.1)    |
| BPRS, negative symptoms subscale, M (SD)             | 7.7 (3.1)    |
| BPRS, depressive/anxiety symptoms subscale, M (SD)   | 8.8 (3.1)    |
| BPRS, manic/hostility symptoms subscale, M (SD)      | 4.7 (1.9)    |
| MANSA, total score, M (SD)                           | 4.1 (1.0)    |
| ISMI, alienation subscale, M (SD)                    | 2.3 (0.6)    |
| ISMI, stereotype endorsement subscale, M (SD)        | 2.0 (0.5)    |
| ISMI, perceived discrimination subscale, M (SD)      | 2.1 (0.6)    |
| ISMI, social withdrawal subscale, M (SD)             | 2.1 (0.6)    |
| ISMI, stigma resistance subscale, M (SD)             | 2.4 (0.4)    |
| ISMI, total score, M (SD)                            | 10.9 (2.1)   |
| MMAS, total score, M (SD)                            | 1.06 (1.1)   |
| B-MCCB, symbol coding, M (SD)                        | 36.9 (50.3)  |
| B-MCCB, animal naming, M (SD)                        | 20.3 (49.3)  |
| B-MCCB trial making test A, M (SD)                   | 69.1 (127.9) |
| PSP, total score, M (SD)                             | 65.5 (15.1)  |
| Typical antipsychotics, yes % (N)                    | 22.5 (90)    |
| Atypical antipsychotics, yes % (N)                   | 59 (236)     |
| Antidepressants, yes % (N)                           | 51.5 (205)   |
| Benzodiazepine, yes % (N)                            | 47.1 (189)   |
| Mood stabilizers, yes % (N)                          | 65.8 (264)   |

MANSA: Manchester Short Assessment of Quality of Life; ISMI: Internalized Stigma of Mental Illness scale, MMAS: Morisky Medication Adherence Scale; B-MCCB: Brief MATRICS Consensus Cognitive Battery; PSPS: Personal and Social Performance Scale; BPRS: Brief Psychiatric Rating Scale.

**Table 2**  
Metabolic parameters of the total sample and differences according to the diagnostic groups.

|                                            | Total sample | Schizophrenia and other psychotic disorders | Major depression           | Bipolar disorder |
|--------------------------------------------|--------------|---------------------------------------------|----------------------------|------------------|
| BMI, kg/m <sup>2</sup> , M (SD)            | 32.5 (5.5)   | 32.4 (5.6)                                  | 33.1 (6.6)                 | 32.2 (4.7)       |
| Waist circumference, cm, M (SD)            | 109.3 (14.2) | 106.0 (12.9)                                | 106.8 (13.5)               | 113.2 (14.8)     |
| Systolic blood pressure, mm Hg, M (SD)     | 125.6 (13.5) | 128.1 (14.0) <sup>a</sup>                   | 123.1 (13.7) <sup>a</sup>  | 125.2 (12.7)     |
| Diastolic blood pressure, mm Hg, M (SD)    | 80.7 (9.0)   | 82.0 (8.6) <sup>a</sup>                     | 79.0 (9.0) <sup>a</sup>    | 80.9 (9.2)       |
| Heart rate, bpm, M (SD)                    | 77.2 (12.2)  | 79.2 (13.0) <sup>a,b</sup>                  | 74.0 (11.5) <sup>a,b</sup> | 77.9 (11.7)      |
| Blood glucose, mg/dL, M (SD)               | 95.5 (28.0)  | 92.8 (20.6)                                 | 99.4 (34.0)                | 95.0 (28.3)      |
| Total cholesterol, mg/dL, M (SD)           | 189.9 (42.5) | 184.6 (40.3)                                | 194.8 (47.3)               | 190.5 (40.7)     |
| LDL cholesterol, mg/dL, M (SD)             | 121.6 (58.6) | 115.7 (33.3)                                | 120.3 (37.2)               | 126.4 (79.0)     |
| HDL cholesterol, mg/dL, M (SD)             | 48.5 (51.7)  | 42.8 (13.4)                                 | 47.7 (13.9)                | 53.0 (76.9)      |
| Serum triglycerides, mg/dL, M (SD)         | 163.4 (98.0) | 167.5 (92.2)                                | 145.8 (80.1)               | 171.4 (110.5)    |
| Framingham Risk Score, total score, M (SD) | 9.8 (4.5)    | 9.6 (4.9)                                   | 10.2 (4.0)                 | 9.8 (4.6)        |
| HOMA index, M (SD)                         | 4.9 (11.6)   | 4.4 (4.2)                                   | 5.8 (9.1)                  | 4.8 (15.7)       |
| CIRS, severity index, M (SD)               | 0.3 (0.3)    | 0.2 (0.3)                                   | 0.4 (0.4)                  | 0.3 (0.3)        |
| CIRS, comorbidity index, M (SD)            | 0.3 (1.4)    | 0.4 (2.0)                                   | 0.45 (1.6)                 | 0.1 (0.5)        |

BMI: Body Mass Index; CIRS: Cumulative Illness Rating Scale; HOMA: Homeostatic Model Assessment of Insulin Resistance; bpm: beats per minute.

<sup>a</sup>  $p < 0.05$ .

<sup>b</sup>  $p < 0.001$ ;

<sup>c</sup>  $p < 0.05$ .

number of psychiatric hospitalizations ( $B = -0.27$ ;  $p < .05$ ) were associated with higher HOMA index. Moreover, a higher Framingham Risk Score (FRS) was associated with higher levels of internalized stigma ( $B = 0.16$ ;  $p < .05$ ) and higher B-MCCB trail making test mean scores ( $B = 0.05$ ;  $p < .05$ ), while the FRS was reduced in patients with a better quality of life ( $B = -0.27$ ;  $p < .000$ ) and with higher B-MCCB symbol coding mean scores ( $B = 0.04$ ;  $p < .05$ ).

Patients with a reduced quality of life ( $B = -0.43$ ;  $p < .000$ ), reduced psychosocial functioning ( $B = -0.25$ ;  $p < .000$ ), and a higher score on the BPRS manic symptoms subscale ( $B = 0.85$ ;  $p < .000$ ) were more likely to present higher means at CIRS severity index.

Finally, higher levels of the CIRS comorbidity score were associated with a reduced quality of life ( $B = -0.73$ ;  $p < .000$ ), reduced social functioning ( $B = -1.01$ ;  $p < .000$ ), poor adherence to pharmacological treatments ( $B = -0.09$ ;  $p < .05$ ), higher levels of internalized stigma ( $B = 0.43$ ;  $p < .01$ ) and a higher score on the BPRS manic symptoms subscale ( $B = 0.58$ ;  $p < .05$ ). The multivariable models are reported in Table 3.

#### 4. Discussion

The present study provides additional insight into the complex relationship between the mental and physical health of patients with severe mental disorders. In particular, we found that several domains of patients' mental health, including internalized stigma, psychosocial functioning, quality of life, psychiatric hospitalizations and depressive/anxiety and manic symptoms were strongly associated to poor metabolic parameters.

The most important finding of our study is the fact that internalized stigma, which is the subjective perception of devaluation, marginalization, secrecy, shame, and withdrawal (Boyd et al., 2014), correlates with basically all the physical health dimensions analysed. It has been reported that SMI patients perceive stigmatizing attitudes in their health care providers, and thus are reluctant to seek medical help (Thornicroft, 2011). Moreover, internalized stigma causes social withdrawal which, in turn, may lead to reduced check-up visits for physical health (Mazzi et al., 2018), with a consequent increase of incidence of cardiovascular diseases (Valtorta et al., 2018) and excess mortality (Holt-Lunstad et al.,

2015; Thornicroft et al., 2019). Finally, the physical health of patients with severe mental illness is very often neglected by health care providers due to negative stereotypes and diagnostic overshadowing (Correll et al., 2020; Hassan et al., 2020; Magliano et al., 2004).

A poor quality of life is the other most important factor significantly associated with poor physical health, being associated with BMI, waist circumference, CIRS comorbidity and severity indexes and cardiovascular risk score. These findings are in line with the available literature (Bressington et al., 2016), which reports a significant association between BMI, waist circumference and quality of life of people with SMI. Obesity is also associated with a significant worsening of patients' quality of life, independently from the diagnosis of any mental disorder (Paniganti et al., 2020). Moreover, studies have showed that even moderate reductions in BMI levels are associated with a significant improvement in patients' quality of life (Jahromi et al., 2020). Of course, the relationship between BMI and quality of life may be bidirectional, meaning that poor physical health may influence quality of life, and therefore only longitudinal studies can help to better understand the directionality of this relationship.

Poor psychosocial functioning was associated in our sample to BMI, CIRS severity and comorbidity indexes. The association between social functioning and physical health has only been explored in a few studies, reporting that patients with reduced social functioning have a greater risk of developing physical illnesses due to poor skills in help seeking and in taking care of themselves (Harvey et al., 2019), and to low levels of physical and daily activities (Falkai et al., 2019).

Patients with a higher number of psychiatric hospitalizations were more likely to have a greater BMI and waist circumference. This result is of particular relevance, since psychiatric hospitalizations are considered a proxy of global severity and of higher economic health costs (Sprah et al., 2017; Knapp et al., 2020). Available evidence shows that the risk of psychiatric hospitalization of patients with bipolar disorder and schizophrenia or other psychotic disorder is higher if they have co-occurring physical disorders (Sprah et al., 2017; Knapp et al., 2020; Leucht et al., 2007; Chwastiak et al., 2014), and it may be that the presence of physical illnesses could contribute to the "revolving door" phenomenon in mental health (Sprah et al., 2017). However, the

**Table 3**  
Regression analyses.

|                                            | Waist Circumference (cm) | CIRS severity index       | CIRS comorbidity index    | FRS total point          | HOMA index             | BMI                       |
|--------------------------------------------|--------------------------|---------------------------|---------------------------|--------------------------|------------------------|---------------------------|
|                                            | B (95% CI)               | B (95% CI)                | B (95% CI)                | B (95% CI)               | B (95% CI)             | B (95% CI)                |
| Number of hospitalizations                 | .02 (0.12 to 0.80)**     | –                         | –                         | –                        | –0.27 (–0.60 to 0.02)* | .95 (0.13 to 0.39)***     |
| MANSA, total score                         | –0.27 (–8.49 to 5.60)*** | –0.43 (–8.45 to –2.77)*** | –0.76 (–0.31 to –0.17)*** | –0.27 (–0.94 to 0.44)*** | –                      | –0.34 (–3.22 to –2.08)*** |
| ISMI, total score                          | .27 (2.00 to 3.32)****   | –                         | .43 (–0.09 to 0.02)**     | .16 (–0.27 to 0.034)*    | .61 (0.38 to 1.04)**** | .30 (0.64 to 1.11)***     |
| PSP, total score                           | –                        | –0.25 (–0.06 to 0.20)***  | –1.01 (–0.02 to –0.01)*** | –                        | –                      | –0.32 (–3.64 to –0.65)**  |
| B-MCCB symbol coding                       | –0.03 (–0.71 to 0.00)*** | –                         | –                         | –0.041 (–0.013 to 0.00)* | –                      | –                         |
| B-MCCB trial making test A                 | –                        | –                         | –                         | .05 (0.00 to 0.01)*      | –                      | –                         |
| BPRS, depressive/anxiety symptoms subscale | .11 (0.73 to 1.99)****   | –                         | –                         | –                        | –                      | .19 (0.48 to 0.88)***     |
| BPRS, positive symptoms subscale           | –                        | –                         | –                         | –                        | –                      | –                         |
| BPRS, manic symptoms subscale              | .049 (0.10 to 2.04)*     | .85 (5.99 to 11.47)****   | .58 (0.10 to 0.21)*       | –                        | –                      | –                         |
| BPRS, negative symptoms subscale           | –                        | –                         | 0.34 (0.020–0.09)***      | –                        | –                      | –                         |
| MMAS, total score                          | –                        | –                         | –0.09 (–0.16 to 0.01)*    | –0.04 (–0.51 to 0.00)    | –                      | –                         |

CIRS: Cumulative Illness Rating Scale; HOMA: Homeostatic Model Assessment of Insulin Resistance; MANSA: Manchester Short Assessment of Quality of Life; ISMI: Internalized Stigma of Mental Illness scale, MMAS: Morinsky Medication Adherence Scale; B-MCCB: Brief MATRICS Consensus Cognitive Battery; PSP: Personal and Social Performance; BPRS: Brief Psychiatric Rating Scale. All regression analyses have been adjusted for age, gender, diagnosis, pharmacological treatments, duration of illness and years of education.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; \*\*\*\* $p < .0001$ .



relationship between physical health and psychiatric hospitalizations should be further investigated, and studies should focus particularly on the identification of which health domains are most frequently associated with multiple admissions to psychiatric wards.

As far as psychiatric symptoms are concerned, we found that the symptoms most strongly associated with poor physical health were the depressive/anxiety and manic ones. Anxiety patients frequently adopt unhealthy lifestyle behaviours (Allgulander, 2016), which can influence their physical health. The presence of depressive symptoms is frequently associated with a worse physical health, since these patients may be less motivated to attend physical health consultations (Adams et al., 2006; Maj et al., 2020) and show poor adherence to pharmacological treatments both for physical and mental illnesses. Furthermore, patients with depressive symptoms also have unhealthy lifestyle behaviours, including low physical activity and poor diet (Jacob et al., 2020; Fiorillo et al., 2019).

It is noteworthy that we did not find any clinically relevant difference in physical health between patients with major depression, schizophrenia or other psychotic disorder and bipolar disorder. This finding may be explained by the fact that physical health in patients with SMI is not influenced by any specific psychiatric diagnostic category but by certain psychopathological dimensions, supporting the importance of a transdiagnostic approach to mental health care (Reininghaus et al., 2019; Fusar-Poli et al., 2019; McGorry and Nelson, 2019; Mansell, 2019).

Lastly, in our sample, poor cognitive performance was associated with increased waist circumference and cardiovascular risk score. The relationship between cognitive performance and physical health of people with SMI has been mainly investigated in patients with schizophrenia, and the relationship between cognitive impairment and metabolic diseases has been documented (Foguet-Boreu et al., 2020). In particular, patients with schizophrenia with higher BMI have a worse performance on recall, verbal and working memory (Foguet-Boreu et al., 2020; Green et al., 2019). However, only a few studies have assessed the impact of cognitive performance on the physical health of patients with affective disorders. Foguet-Boreu et al. (2020) reported a significantly higher risk for cardiovascular diseases in a sample of SMI patients with cognitive impairment compared to patients without this impairment. It is possible that cognitive deficits impair patients' ability to understand their need for health check-ups and healthy lifestyle behaviours. Moreover, patients with reduced cognitive and social functioning may be less motivated to participate and to be actively involved in interventions for the promotion of physical health (Bar Deucher et al., 2016). Contrary to what we expected, the impact of cognitive deficits on physical health was evident not only on patients with schizophrenia, but also on patients with major depression and in those with bipolar disorder. Therefore, the presence of cognitive deficits should be explored in all patients with SMI, since they can influence the long-term outcome. A transdiagnostic approach would be advisable in order to deepen our knowledge about the relationship between physical health and cognitive performance in people with SMI.

The present study has some limitations, such as the recruitment of patients with a BMI  $\geq 25$ , which may reduce the generalizability of our findings, and the cross-sectional design of the study, with patients being assessed only once, so that it was not possible to explore the direction of the causality between physical and mental health domains. Another possible limitation of the study is that we did not assess the longitudinal exposure to medications, which could contribute to increase BMI and worsen metabolic parameters of patients.

In conclusion, the results of our study provide additional support to the notion that poor physical health is influenced more by certain clinical and psychosocial factors, such as internalized stigma, quality of life, and psychosocial and cognitive functioning, rather than by specific psychiatric diagnoses. In order to reduce the mortality rate in patients with SMI, supportive interventions should include the improvement of patients' cognitive and social functioning and quality of life, as well as

addressing and overcoming patients' self-stigma and discrimination.

## Author statement

Data published in this paper are available at the corresponding author upon request.

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## Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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