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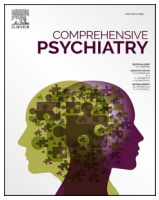

Screening and prevalence of cardiometabolic risk factors in patients with severe mental illness: A multicenter cross-sectional cohort study in the Netherlands

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ABSTRACT

Background: Due to increased cardiometabolic risks and premature mortality in people with severe mental illness (SMI), monitoring cardiometabolic health is considered essential. We aimed to analyse screening rates and prevalences of cardiometabolic risks in routine mental healthcare and its associations with patient and disease characteristics.

Methods: We collected screening data in SMI from three mental healthcare institutions in the Netherlands, using most complete data on the five main metabolic syndrome (MetS) criteria (waist circumference, blood pressure, HDL-cholesterol, triglycerides, fasting blood glucose) within a 30-day timeframe in 2019/2020. We determined screened patients' cardiometabolic risks and analysed associations with patient and disease characteristics using multiple logistic regression.

Results: In 5037 patients, screening rates ranged from 28.8% (waist circumference) to 76.4% (fasting blood glucose) within 2019–2020, and 7.6% had a complete measurement of all five MetS criteria. Older patients, men and patients with psychotic disorders had higher odds of being screened. Without regarding medication use, risk prevalences ranged from 29.6% (fasting blood glucose) to 56.8% (blood pressure), and 48.6% had MetS. Gender and age were particularly associated with odds for individual risk factors. Cardiometabolic risk was present regardless of illness severity and did generally not differ substantially between diagnoses, in−/outpatients and institutions.

Conclusions: Despite increased urgency and guideline development for cardiometabolic health in SMI last decades, screening rates are still low, and the MetS prevalence across screened patients is almost twice that of the general population. More intensive implementation strategies are needed to translate policies into action to improve cardiometabolic health in SMI.

1. Introduction

Approximately 1 % of the worldwide population lives with severe mental illness (SMI), which often includes schizophrenia, bipolar disorder and major depression and is characterised by the substantial impact on a person's daily life for a long period of time [1,2]. Patients with SMI have up to 15 years shorter life expectancy than the general population, largely caused by cardiometabolic diseases, such as cardiovascular diseases and type 2 diabetes [3–7]. The risk factors for these diseases, such as abdominal girth, blood pressure and cholesterol levels, are clustered in the metabolic syndrome (MetS) [8]. A previous large meta-analysis found a prevalence of MetS in patients with SMI of 32.6%

Abbreviations: MetS, Metabolic Syndrome; SMI, Severe Mental Illness; FACT, Flexible Assertive Community Treatment; HoNOS, Health of the Nation Outcomes Scale; SmS, Somatische mini Screen (translation: physical health mini screening); HDL, High-density lipoprotein; Q, Quartile.

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[9]. Specifically, they found that 33.4% of patients with schizophrenia, 31.7% of patients with bipolar disorder and 31.3% of patients with major depressive disorder met the criteria for MetS. The relative risk of having MetS was significantly higher for all these specific diagnoses than in age-matched control groups [9]. More recent cohort studies in the Netherlands even found prevalences of MetS of >50% in patients with a psychotic disorder [10] and 69% in inpatients with SMI [11], which is much higher than the general population (28.8%) [12].

Behind this increased cardiometabolic risk is a variety of factors [7]. Besides genetic and biological vulnerabilities or dysregulations, lifestyle behaviour (i.e., sedentary lifestyle, smoking, an unhealthier diet and sleep) [7,13–15]. Additionally, most patients with SMI use psychotropic medication, which can have negative side effects such as a higher risk of weight gain and metabolic disturbances [9,16]. These factors also interact, such as links between dietary intake, microbiome, inflammation and MetS factors that are increasingly becoming clear and are also associated with worse mental health, in addition to physical health [7]. Physical healthcare is also less accessible for patients with SMI (i.e. caused by difficulties in reporting physical symptoms, overshadowing of physical health by mental disorders) [7], and if they have access to healthcare, they are less often examined or treated for physical complaints [17]. During the COVID-19 pandemic, providing good care for patients with SMI has become even more difficult because measures (e.g., social distancing, telepsychiatry instead of face-to-face) hindered physical examination [18,19]. Moreover, although important, mental health professionals do not always have sufficient skills and protocols for preventing or treating cardiometabolic risk factors in treating patients with SMI [20,21].

Due to the increased cardiometabolic risk in patients with SMI, it has recently often been emphasised that it is important to monitor the physical health of patients with SMI and provide adequate treatment if needed [4,22–24]. According to the multidisciplinary guideline in the Netherlands, every patient with SMI should be screened for physical health problems (including physical examination and blood tests) at least when prescribed antipsychotics and after that annually [25]. However, studies in the past have shown that these guidelines were not followed properly in routine mental healthcare and that cardiometabolic risk factors were underdiagnosed and undertreated in patients with SMI, not only in the Netherlands [10,21,24,26–31]. This is worrying because if (risk factors for) physical diseases are not identified, no appropriate interventions can be provided to prevent or treat health issues, such as switching medication or offering lifestyle interventions [7]. This is stressed by the fact that the life expectancy of patients with SMI has not substantially improved in recent years [4,6,21,23,32]. There is limited recent knowledge on whether screening, detecting and treating cardiometabolic risk factors are sufficiently implemented in routine healthcare of patients with SMI in the Netherlands, including their physical health status. Also, previous studies often focused on patients who use antipsychotic medication (e.g. schizophrenia and related psychotic disorders), while there is evidence that cardiometabolic risk occurs in a range of other diagnoses and psychotropic medications [7]. Therefore, we aimed to analyse the extent to which screening is regularly done in routine mental healthcare, the prevalence of cardiometabolic risk factors and associations with patient and disease characteristics in SMI.

2. Methods

2.1. Study design and population

In this multicenter retrospective cross-sectional study, data were collected from electronic patient records of patients with a mental disorder treated in specialised mental healthcare institutions in the Netherlands. The exact operationalisation of SMI can be inconclusive across countries and studies. Therefore, all patients treated in 2019 and 2020 in non-acute inpatient facilities or Flexible Assertive Community Treatment (FACT) were included, a setting which in the Netherlands mainly includes patients with SMI [33].

2.2. Procedure

Firstly, institutions affiliated with the special interest group' Lifestyle and Physical Health' ($n = 7$) were approached to participate in the study [34]. The data managers of the institutions that participated were asked to collect data (patient, disease and metabolic health characteristics) from the electronic patient records. Although patients should be screened annually [25], we included screenings performed between January 1st, 2019 and December 31st, as the COVID-19 pandemic may have hindered regular screening in 2020. To obtain the most comprehensive and representative data, we used the most complete set of cardiometabolic screening data according to MetS criteria (see the next paragraph) within a 30-day time frame for each patient. The data were anonymised and encrypted by the institutions' data managers. After sending the anonymised data to the researchers, the description key was removed from the institutions' system to guarantee anonymisation. The researchers merged the different institutions' datasets into a combined database. To prevent bias and guarantee no public disclosure of institutions screening performance, institutions were labelled (i.e., 'institution A', 'institution B', etc.), and specified organisation results were available to the relevant organisation upon request. Lastly, the participating institutions completed a self-developed questionnaire to gain insight into institutions' policies regarding monitoring cardiometabolic health. The study was approved by the Medical Ethical Committee of Isala clinics Zwolle, the Netherlands (no. 210609) and the included institutions' responsible scientific research committees.

2.3. Outcomes

2.3.1. Cardiometabolic risk factors

The assessments of the following cardiometabolic risk factors according to the harmonised definition of MetS [8] were provided for each patient if determined: 1) waist circumference ≥ 102/ ≥88 cm (men/women); 2) blood pressure ≥ 130/85 mmHg (systolic/diastolic); 3) HDL-cholesterol <1.0/<1.3 mmol/l (men/women); 4) triglycerides ≥1.7 mmol/l; 5) fasting glucose ≥5.6 mmol/l. Retrieving information about medication use accurately across all settings was not feasible. Therefore, this study focused on the measured values of the five risk factors only. To determine the prevalence of MetS, only the patients of whom all five criteria were available were included. Patients were required to meet ≥3 of the five cardiometabolic risk factors to meet MetS [8]. As potentially a limited number of patients were assessed on all five cardiometabolic risk factors, the assessment of MetS potentially lacks representativeness for this sample. Therefore, we also assessed how many patients with incomplete assessments (i.e. 3 or 4) of cardiometabolic risk factors are 'at risk of developing MetS' indicated by meeting ≥2 criteria.

2.3.2. Patient and disease characteristics

The participating institutions provided the following information for each patient: gender; age; most recent primary diagnosis according to the DSM-5 criteria [35]; treatment duration in months (i.e. first registration date in the institution minus the last possible date of the study period or the most recent date of discharge); divided in short-term (<24 months) and long-term (≥24 months) treatment [36] and treatment setting (i.e. in/outpatient). The disease severity was also provided, assessed via the Health of the Nation Outcomes Scale (HoNOS, or HoNOS-65+ for patients aged ≥65 years). HoNOS is a 12-items validated and reliable questionnaire measuring behavioural problems, impairment, symptoms and social problems. Each item scored from 0 (no problems) to 4 (very severe problems), with a total HoNOS score ranging from 0 to 48 [37,38].

2.3.3. Institutions' policies regarding monitoring cardiometabolic health

The participating institutions completed a self-developed questionnaire to gain insight into the nature and structures of their organisation and metabolic health monitoring (e.g. the population they treat and current policies and procedures regarding physical health monitoring, see supplementary material A for the questionnaire's content). The questionnaire aimed to gain more insight into institutions' application of somatic screening and lifestyle in their daily treatment of people with SMI.

2.4. Data analyses

Data analyses were performed using SPSS version 26.0. Continuous variables were reported using mean and standard deviation (SD) and categorical variables by frequency (n) and percentage (%). The normality of continuous values was examined using frequency histograms and comparing means with medians. In the absence of normal distributions, the medians with interquartile ranges were reported. The linearity of continuous variables was examined by scatter plots and Box-Tidwell tests. If a non-linear distribution of a variable towards the dependent variable was found, the variable was added as quartiles, with the first quartile as reference [39]. Odds ratios (ORs) from multivariable logistic regression analyses were used to assess potential differences in patient and disease characteristics (i.e., gender, age, type of diagnosis, inpatient treatment, severity of disease and type of mental health care institution) between patients who are screened and patients that were not screened. Similarly, if measured, potential differences in patient and disease characteristics and the presence or absence of cardiometabolic risk according to MetS criteria were determined. Correlation coefficients and collinearity statistics (variance inflation factor and tolerance values) were used to test for multicollinearity. Furthermore, subanalyses were performed for patients with SMI, for whom regular screening according to guidelines can at least be expected, defined as patients with psychotic disorders and/or bipolar disorders who have been in treatment for at least two years [25,36,40]. Chi-square analyses were used to analyse potential differences in the degree of screening on all five criteria of MetS between these patients for whom regular screening could be at least expected and other patients.

3. Results

Eventually, three out of the seven institutions could provide data and descriptions of institutions' policies regarding monitoring cardiometabolic health within the study period (labelled as institutions A to C). One institution only provided the policy description. The other institutions could not deliver data due to time constraints and difficulties with recording and retrieving physical health data. The participants were treated within a university medical centre, a large specialised mental healthcare institute or a psychiatric forensic facility.

The data included 5037 eligible patients, whose characteristics are presented in Table 1. The mean age was 48 years (range 15 to 97), and 54.4% were men. The median treatment duration was 102 months (range 0 to 708 months). The largest group of included patients was diagnosed with 'schizophrenia spectrum or other psychotic disorders' (32.8%).

3.1. Screening for cardiometabolic risk factors

As presented in Table 1, there were large variations in the degree to which the five cardiometabolic risk factors of MetS were determined. The most frequently determined risk factor in patients' most complete screening in 2019 or 2020 was fasting blood glucose, with a screening rate of 76.4% ($n = 3847$), and the least frequently determined risk factor was waist circumference, with a screening rate of 28.8% ($n = 1452$).

In total, 381 patients (7.6%) had all five criteria of MetS determined within a 30-day time frame in 2019 or 2020. Patients for whom regular screening could be at least expected according to guidelines (psychotic or bipolar disorder with ≥2 years treatment) were more often screened on all five MetS criteria compared to other patients ($n = 247$ of 1810 (13.6%) vs. $n = 134$ of 3227 (4.2%) respectively) ($x^2(1)$: 149.49 $p < 0.001$). As shown in Table 2, the criteria of MetS were also less often determined in almost all patients with diagnoses other than

Table 1
Patient, disease and mental health characteristics of the included patients ($n = 5037$).[a]

Outcome (scale)	Mean/ n	(SD/ %)	Data available n	(%)
Patient characteristics				
Men, n (%)	2738	(54.4)	5037	(100)
Age, years	48.2	(16.9)	5035	(99.9)
Disease characteristics	3946	(78.3)	5037	(100)
Inpatients, n (%)				
Treatment duration (months), median (25th, 75th percentiles)[b]	102	(20, 216)	4802	(95.3)
Severity of disease (HoNOS (scale 0–48))[c]	14.6	(7.4)	2976	(59.1)
Primary diagnosis, n (%):			5037	(100)
Schizophrenia spectrum and other psychotic disorders	1650	(32.8)		
Substance-related and addictive disorders	992	(19.7)		
Depressive disorders	630	(12.5)		
Bipolar and related disorders	505	(10.0)		
Personality disorders	408	(8.1)		
Neurodevelopmental disorders	231	(4.6)		
Neurocognitive disorders	177	(3.5)		
Trauma- and stressor-related disorders	116	(2.3)		
Anxiety disorders	101	(2.0)		
Obsessive-compulsive and related disorders	56	(1.1)		
Other mental disorders	44	(0.9)		
Dissociative disorders	28	(0.6)		
Physical health symptom and related disorders	30	(0.6)		
Eating disorders	12	(0.2)		
Disruptive, impulse-control and conduct disorder	12	(0.2)		
Other conditions that may be a focus of clinical attention	11	(0.2)		
Psychological disorder due to another medical condition	7	(0.1)		
Patients with Severe Mental Illness[d]	1810	(35.9)	5037	(100)
Metabolic Health:				
Body weight (kg)	79.1	(19.8)	2964	(58.8)
Body Mass Index (BMI) (kg/m^2)	25.9	(6.1)	1253	(24.9)
MetS criteria met:				
Waist circumference (men: ≥102 or women: ≥88 cm)[e], n (%)	660	(45.5)	1452	(28.8)
Blood pressure (systolic: ≥130 and/or diastolic: ≥85 mmHg)[e], n (%)	1960	(56.8)	3453	(68.6)
HDL-cholesterol (men: <1.0 mmol/l or women: <1.3 mmol/l)[e], n (%)	823	(42.3)	1944	(38.6)
Triglycerides (≥1.7 mmol/l)[e], n (%)	715	(36.7)	1949	(38.7)
Fasting blood glucose (≥5.6 mmol/l)[e], n (%)	1489	(29.6)	3847	(76.4)
MetS (≥3 of the 5 criteria met when all 5 determined)[e], n (%)	185	(48.6)	381	(7.6)

HDL: high-density lipoprotein; SD: standard deviation; MetS: metabolic syndrome.

[a] Values are in mean (SD), unless mentioned otherwise.

[b] Treatment duration: the first registration date in the institution minus the last possible date of the study period or the most recent date of discharge.

[c] HoNOS: Health of the Nation Outcomes Scale or HONOS-65+ for patients ≥65 years [37,38].

[d] Patients with psychotic disorders and/or bipolar disorders, who have been in treatment for at least 2 years.

[e] Criteria according to Alberti et al. [8], but relevant medication use was not taken into account for this.

Table 2
Associations between patient or disease characteristics and cardiometabolic risk factors of MetS screened.[a]

Patient and disease characteristics	Waist circumference (N = 1452)		Blood pressure (N = 3453)		HDL-cholesterol (N = 1944)		Triglycerides (N = 1949)		Fasting blood glucose (N = 3847)		All five risk factors screened (N = 381)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Gender (men)	**1.44**	**(1.19–1.75)****	1.00	(0.81–1.24)	**1.38**	**(1.15–1.64)****	**1.38**	**(1.16–1.64)****	1.14	(0.94–1.38)	**1.63**	**(1.23–2.17)****
Age[b, c]												
Q2 (36–48 years)	1.10	(0.85–1.43)	0.99	(0.75–1.31)	**1.39**	**(1.10–1.77)***	**1.38**	**(1.09–1.75)***	1.24	(0.95–1.60)	1.46	(0.99–2.16)
Q3 (49–60 years)	1.24	(0.96–1.61)	1.08	(0.81–1.44)	**1.67**	**(1.31–2.13)****	**1.67**	**(1.31–2.13)****	1.20	(0.92–1.56)	**2.10**	**(1.44–2.06)****
Q4 (61–97 years)	**0.58**	**(0.45–0.76)****	**1.94**	**(1.42–2.64)****	**1.35**	**(1.06–1.73)***	**1.34**	**(1.04–1.72)***	1.12	(0.85–1.46)	1.39	(0.93–2.08)
Diagnosis[d]												
Substance-related/addictive disorders	**6.67**	**(5.21–8.55)****	**5.94**	**(4.04–8.73)****	**0.13**	**(0.10–0.16)****	**0.13**	**(0.10–0.17)****	1.12	(0.85–1.48)	**0.26**	**(0.18–0.37)****
Depressive disorders	**0.36**	**(0.24–0.53)****	1.00	(0.70–1.43)	**0.29**	**(0.21–0.38)****	**0.28**	**(0.21–0.38)****	**0.66**	**(0.48–0.90)***	**0.17**	**(0.08–0.33)****
Bipolar disorders	1.07	(0.79–1.47)	1.33	(0.93–1.90)	**0.66**	**(0.50–0.87)***	**0.65**	**(0.49–0.87)***	1.14	(0.80–1.61)	0.88	(0.58–1.32)
Personality disorders	**0.66**	**(0.45–0.99)***	0.79	(0.54–1.15)	**0.37**	**(0.26–0.51)****	**0.37**	**(0.26–0.51)****	0.73	(0.51–1.03)	**0.25**	**(0.11–0.54)****
Other mental disorders	**0.63**	**(0.47–0.84)***	1.00	(0.74–1.35)	**0.36**	**(0.28–0.46)****	**0.35**	**(0.27–0.45)****	**0.71**	**(0.54–0.93)***	**0.29**	**(0.18–0.47)****
Inpatient treatment	**0.22**	**(0.17–0.30)****	**0.07**	**(0.05–0.09)****	**2.93**	**(2.37–3.64)****	**2.94**	**(2.37–3.64)****	**0.34**	**(0.27–0.42)****	**0.11**	**(0.06–0.20)****
Severity of disease[e,f]	**1.02**	**(1.01–1.03)***	1.01	(1.00–1.03)	1.00	(0.99–1.02)	1.00	(0.99–1.02)	0.99	(0.99–1.01)	1.01	(1.00–1.03)
Mental health institution[g]												
Institution B	**0.03**	**(0.01–0.25)****	$4.2{\cdot}10^{8}$	(0.00 - $>4.2{\cdot}10^{8}$)	**9.09**	**(4.86–17.0)****	**10.1**	**(5.31–19.2)****	0.81	(0.44–1.47)	**0.13**	**(0.02–0.96)***
Institution C	**0.12**	**(0.04–0.36)****	1.42	(0.81–2.49)	**0.24**	**(0.13–0.43)****	**0.24**	**(0.13–0.42)***	**0.09**	**(0.05–0.18)****	0.84	(0.11–6.65)

Note: Significant results ($p < 0.05$) are shown in bold. HDL: high-density lipoprotein; OR: odds ratio; 95% CI: 95% confidence interval; Q = Quartile; MetS: metabolic syndrome.

[a] Criteria according to Alberti et al. [8], but the use relevant medication was not taken into account for this.

[b] Reference group: Q1 (17–35 years).

[c] Missing value: $n = 2$, due to missing information in patient files.

[d] Reference group: 'schizophrenia spectrum disorder'.

[e] Assessed by HoNOS (Health of the Nation Outcomes Scale) or HONOS-65+ for patients older than 65 years [37,38].

[f] Missing values: $n = 2061$, due to missing information in patient files.

[g] Reference group: 'Institution A'.

* $p < 0.05$.

** $p < 0.001$.

Table 3
Associations between patient or disease characteristics and cardiometabolic risk factors above threshold or MetS [a]

Patient and disease characteristics	Waist circumference (N = 1452)		Blood pressure (N = 3453)		HDL-cholesterol (N = 1944)		Triglycerides (N = 1949)		Fasting blood glucose (N = 3847)		MetS (N = 381)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Gender (men)	**0.42**	**(0.32–0.56)****	**1.35**	**(1.12–1.62)***	**0.54**	**(0.42–0.70)****	**1.52**	**(1.17–1.97)***	0.99	(0.82–1.19)	0.92	(0.54–1.60)
Age[b, c]												
Q2 (36–48 years)	**3.13**	**(2.14–4.59)****	1.13	(0.87–1.46)	0.95	(0.68–1.32)	**1.88**	**(1.33–2.66)****	**2.30**	**(1.74–3.04)****	1.82	(0.85–3.88)
Q3 (49–60 years)	**3.44**	**(2.35–5.02)****	**1.48**	**(1.14–1.91)***	0.77	(0.54–1.08)	**1.44**	**(1.01–2.05)***	**4.14**	**(3.13–5.46)****	0.98	(0.47–2.03)
Q4 (61–97 years)	**3.20**	**(2.11–4.84)****	**2.02**	**(1.56–2.61)****	**0.59**	**(0.41–0.86)***	1.17	(0.79–1.74)	**4.59**	**(3.46–6.08)****	1.87	(0.85–4.08)
Diagnosis[d]												
Substance-related/ addictive disorders	**0.44**	**(0.32–0.61)****	1.14	(0.91–1.44)	0.73	(0.45–1.19)	0.67	(0.41–1.10)	**0.76**	**(0.60–0.97)***	0.53	(0.26–1.09)
Depressive disorders	1.18	(0.55–2.53)	1.14	(0.82–1.58)	0.69	(0.44–1.09)	1.07	(0.68–1.69)	**0.65**	**0.47–0.89)***	2.02	(0.48–8.40)
Bipolar disorders	1.37	(0.79–2.37)	1.11	(0.79–1.55)	1.01	(0.69–1.49)	1.26	(0.95–1.87)	**0.60**	**(0.43–0.83)***	0.99	(0.47–2.09)
Personality disorders	0.82	(0.40–1.70)	1.05	(0.69–1.60)	**0.58**	**(0.35–0.97)***	1.47	(0.89–2.43)	0.76	(0.52–1.12)	1.39	(0.39–6.73)
Other mental disorders	**0.47**	**(0.29–0.80)***	1.02	(0.76–1.37)	**0.65**	**0.44–0.95)***	0.75	(0.50–1.11)	**0.71**	**(0.53–0.94)***	**0.34**	**(0.12–0.95)***
Inpatient treatment	1.38	(0.78–2.43)	**1.77**	**(1.19–2.64)***	1.07	(0.80–1.41)	1.19	(0.90–1.59)	1.05	(0.81–1.36)	1.59	(0.43–5.86)
Severity of disease[e,f]	1.01	(0.99–1.03)	1.00	(0.99–1.01)	1.01	(0.99–1.02)	0.99	(0.98–1.01)	1.00	(0.99–1.01)	0.99	(0.96–1.03)
Mental health institution[g]	0.00	(0.00–0.00)	0.72	(0.43–1.21)	0.65	(0.34–1.22)	1.08	(0.58–2.00)	1.28	(0.70–2.34)	0.00	(0.00–0.00)
Institution B	0.38	(0.03–4.25)	0.66	(0.29–1.54)	0.64	(0.23–1.74)	1.33	(0.51–3.44)	3.22	(0.88–11.81)	0.00	(0.00–0.00)
Institution C												

Note: Significant results ($p < 0.05$) are shown in bold. HDL: high-density lipoprotein; OR: odds ratio; 95% CI: 95% confidence interval; Q = Quartile; MetS: metabolic syndrome.

[a] Criteria according to Alberti et al. [8], but the use relevant medication was not taken into account for this.

[b] Reference group: Q1 (17–35 years).

[c] Missing value: n = 2, due to missing information in patient files.

[d] Reference group: 'schizophrenia spectrum disorder'.

[e] Assessed by HoNOS (Health of the Nation Outcomes Scale) or HONOS-65+ for patients older than 65 years [37,38].

[f] Missing values: n = 2061, due to missing information in patient files.

[g] Reference group: 'Institution A'.

* $p < 0.05$.

** $p < 0.001$.

schizophrenia spectrum or other psychotic disorders.

Age was categorised in quartiles as it was not linearly distributed towards the cardiometabolic risk factors. Older patients were more often screened for cardiometabolic risk factors than younger patients, particularly for HDL cholesterol and triglycerides. Furthermore, patients with schizophrenia spectrum disorder were more often screened on the cardiometabolic risk factors than patients with any other mental disorder, except for patients with bipolar disorders, specifically HDL-cholesterol and triglycerides. Thereby, patients within inpatient treatment were less often screened for cardiometabolic risk factors than patients in outpatient treatment, and men were more often screened for the cardiometabolic risk factors than women. Triglyceride and HDL-cholesterol have higher odds of being determined in Institution B than Institutions A and C. Waist circumference has lower odds of being determined in Institutions B and C than in Institution A.

3.2. Prevalence of cardiometabolic risk factors

If measured, cardiometabolic risk factors were above the threshold in 29.6% (fasting blood glucose) to 56.8% (blood pressure) of patients (Table 3). In patients of whom all five criteria of MetS were screened ($N = 381$), 48.6% ($n = 185$) could be diagnosed with MetS without regard to medication use. If we consider the group who have been screened for at least 3 of the risk factors ($n = 2631$, 52,2%, see Fig. 1), we see that 47.9% met ≥2 criteria (20.5% two criteria vs. 27.4% ≥3 criteria).

Age was not linearly distributed towards the cardiometabolic risk factors and was therefore categorised in quartiles. As shown in Table 3, men less often met the criteria for waist circumference or high-density lipoprotein (HDL) cholesterol and more often met the criteria for blood pressure or triglycerides than women. Older patients (Q2-Q4, 36–97 years) were significantly more likely to meet the waist circumference or fasting blood glucose criteria than younger patients (Q1, 17–35 years). There were no significant associations between the severity of the disease and meeting the criteria of the cardiometabolic risk factors. Except for the diagnosis' other mental disorder', the odds for MetS did not significantly differ for diagnostic classifications. Cardiometabolic risks did not differ between mental health institutions. Treatment duration could not be included in the multivariable logistic regression because one institution had no data. However, single variable logistic regression with treatment duration with data from two institutions showed only lower odds of meeting triglycerides criteria for people with a treatment duration ≥24 months (OR: 0.44; 95% CI (0.28–0.68) $p < 0.001$).

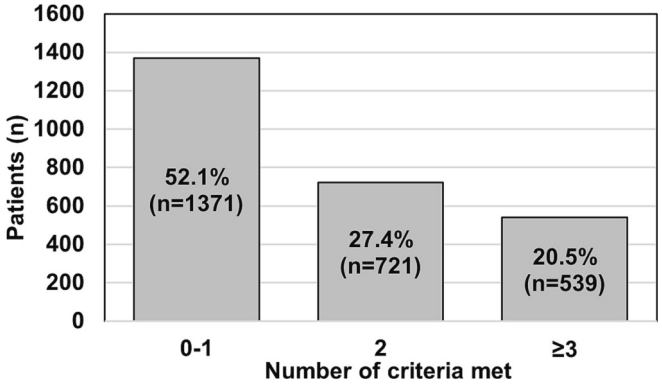

Fig. 1. Number of criteria [a] met when ≥3 criteria were determined (n = 2631; 52.5% of total).

[a.] Criteria according to Alberti et al. [8], but relevant medication use was not taken into account for this.

3.3. Institutions' policies regarding monitoring cardiometabolic health

As can be seen in supplementary material A, there were differences in policies between institutions, such as the components to screen (e.g. lifestyle factors or specific blood tests), the screening protocol used (e.g. somatic mini screen, or 'protocol somatic screening') and the targeted population (e.g. every patient during intake or admission to clinical treatment, or when starting psychotropic medication). Three institutions have a single electronic patient system to record the screening, and one has separate systems. Three institutions indicated that there are reasons not to screen patients, especially when patients feel uncomfortable with certain parts of the screening. All institutions indicated that physical health screening needs to be repeated at least annually and that there are programs for lifestyle improvement.

4. Discussion

To our knowledge, this is one of the first multicenter studies that analysed screening prevalence and severity of cardiometabolic risk in a large group of patients with SMI in everyday mental healthcare within non-acute inpatient or FACT facilities.

We found that patients with SMI are still insufficiently screened these days. In only 7.6% of patients, all five MetS criteria were determined in their most complete screening in a 30-day time frame in 2019 or 2020. Meanwhile, according to the guidelines and protocols of participating institutions (Appendix A), all patients with SMI should be screened for cardiometabolic risk factors at least annually [25,40]. Even considering that the screening rate was almost twice as high (13.6%) in patients for whom screening was at least expected (psychotic or bipolar disorder and ≥ 2 years treatment), this was still relatively low. Similar smaller studies in inpatient settings also found low cardiometabolic screening rates in patients with SMI compared to the guidelines [21,28–31].

Without regarding medication use, risk prevalence ranged from 29.6% (fasting blood glucose) to 56.8% (blood pressure), and 48.6% of participants with complete assessments had MetS. When looking at the group of patients with at least three criteria measured, MetS was already present in 20.5% (i.e., all 3 met MetS criteria), and 27.4% were at high risk to be diagnosed with MetS when completely screened (i.e., already met two criteria). This total (47.9%) is close to the prevalence found in the smaller group with complete assessment, suggesting that this prevalence is relatively representative and not over- or underestimated due to a selective target group with complete assessments. These prevalences are almost twice the prevalence of MetS in the general population in the Netherlands (28.8%, aged 30–70 years) [12], and in recent decades there has been little to no improvement in cardiometabolic risks of people with SMI [41]. Our findings align with previous studies that showed an increased incidence of cardiometabolic risk factors and MetS in people with SMI compared to the average population [9,10,12,13,28,42–44].

Our findings might even be underestimating the severity of the current situation of cardiometabolic screening and risk in mental healthcare. Firstly, according to the definition of MetS, criteria are also met when relevant medication is used. However, we could not include medication use in this study, which most likely resulted in underestimating patients meeting criteria [8]. Secondly, due to the COVID-19 pandemic, we used a 2-year period to control for the potential influence of the decreased number of physical examinations in healthcare settings during the pandemic, while patients should be screened annually according to the guidelines [25,40]. Thirdly, we used the assessments of the 30-day period in which the most complete set of measurements was performed for each patient. However, these assessments were not always jointly performed in structured cardiometabolic screening all at once (i.e., risk factors could have been screened individually for other purposes). This is confirmed by the result that some measurements have been determined substantially more frequently than others (e.g. fasting blood glucose), while in structured screening, they normally would be

measured and reported jointly, leading to treatment advice, according to screening guidelines. In addition, this is a study in the Netherlands, where somatic screening is in most cases paid for by the health insurance when a patient is in treatment, while there are also countries where somatic health care has to be paid for by the patient and the screening numbers may be even lower will be. Lastly, our study found that 45.6% of patients had an elevated waist circumference using the less strict criteria (men: ≥102 cm or women: ≥88 cm) versus 64.9% using the stricter criteria (men: ≥94 cm or women: ≥80 cm) which are already associated with increased cardiometabolic risk [8,45]. Therefore, using the less strict criteria may also have underestimated the prevalence of MetS. For example, a study of 2019 in the Netherlands that also considered medication use and used these lower thresholds for waist circumference found a percentage of MetS of 69% in patients with SMI [11].

On the other hand, prevalences of cardiometabolic risk factors may be biased by clinical judgements by the patient's physician/practitioner, as screening may not have been done because they did not indicate its need based on their observations, despite guidelines. This could have led to an overrepresentation of patients with clear suspected cardiometabolic problems (i.e. being overweight) among screened patients and, thereby, an overestimation of cardiometabolic risk factors for the whole population.

Regarding associations with patient and disease characteristics, there were some differences between institutions and in/outpatients in the screening rate. This may be because some screening elements are more implemented in some institutions. Hospitals may have a more approachable infrastructure and clear agreements to perform some measurements by routine [46]. Even though mental healthcare institutions' screening protocol had no difference in screening for male patients or ages, men and elderly patients were screened more often for most cardiometabolic risk factors. However, men have the same odds for cardiometabolic syndrome and smaller odds for HDL cholesterol and waist circumference than women, suggesting that women should be screened equally often. Elderly patients might be screened more frequently because of having pre-existing cardiovascular diseases because the risk increases with age, for which they need to be screened. In addition, our research showed that cardiometabolic risk factors are present across a wide variety of diagnostic classifications (i.e. psychotic disorders, depressive disorders, anxiety disorders). However, screening prevalence was higher in schizophrenia spectrum disorders and bipolar disorders than in other mental health problems (i.e., substance use disorders, personality disorders, depressive disorders and other mental disorders), whereas the prevalence of cardiometabolic risk factors is equally present after being screened. This corresponds with the fact that people with mental illness all have up to two times higher risk of cardiometabolic health problems than the general population, regardless of diagnosis [7]. Accordingly, it is suggested that all people with SMI should be included in the cardiometabolic screening protocol instead of primarily people diagnosed with a psychotic disorder [25,40].

Furthermore, cardiometabolic risk was independent of treatment institutions and settings, suggesting that improvement is needed in various treatment locations [7]. Lastly, elderly patients were more often at higher cardiometabolic risk. Screening and monitoring should be started at a younger age to reduce this risk in older age, as prevention is better than cure.

4.1. Strength and limitations

Our study provided new findings on the recent situation of cardiometabolic health in patients with SMI, proving that the current implementation of screening and treatment of cardiometabolic risk factors in patients with SMI is insufficient. Our study had many patients from various mental health institutions, and in addition to data, questionnaires were used for an optimal representation of the cardiometabolic health situation.

There were some limitations in our study. Firstly, some factors may underestimate or overestimate the results, as previously mentioned. Thereby, due to the COVID-19 pandemic, findings may not exactly correspond to situations without a pandemic. Furthermore, most institutions did not note surveyed lifestyle factors that may also pose a risk for poorer cardiometabolic health (i.e., smoking, dietary pattern and physical activity); therefore, this data could not be included in this study. In addition, little can be said about how often the individual risk factors were determined because they may be measured apart from the selected 30-day period. Because of the indistinct classification of SMI, only sub-analysis was performed for patients for whom regular screening according to guidelines was at least expected (psychotic or bipolar disorder and ≥ 2 years of treatment). The actual definition of patients with SMI is more extensive; all these patients should be screened annually. Lastly, we mainly analysed relative differences between subgroups, and little can be said about absolute values within subgroups.

4.2. Implications for clinical practice

The relatively low prevalence of cardiometabolic screening in mental health care settings and the relatively high percentage of patients still meeting MetS indicates structural challenges in implementing both cardiometabolic screening and interventions targeting improving physical health and lifestyle within mental health care settings. The low screening rates may indicate that existing guidelines do not align with feasibility and/or clinical judgements in routine mental healthcare. Consequently, this could affect how data is collected and stored and can be used easily in treating patients and improving healthcare on both individual and organisation levels. This is also reflected in the experienced barriers in collecting data in various institutions (4 out of 7) in our study, which hinder mental healthcare professionals and organisations in implementing current guidelines and protocols and treating risk factors in routine mental healthcare. Our study highlights that despite the increased attention paid to cardiometabolic health in recent years, there is still insufficient screening. It emphasises that there is a real need to find effective strategies to enhance implementation success and improve healthcare standards [10]. Further research should focus on whether current guidelines align with what is needed in practice to improve the cardiometabolic health of patients with SMI. One can consider, for example, implementing more accessible screening components or facilities [20,47,48], quality improvement interventions such as introducing standard order sets [21,30,31] or predicting more specific risk profiles to tailor screening components. Also, improvements in patient information systems appear to be an important factor in facilitating standardising physical health monitoring in mental healthcare. Fear of doctor visits or needles should also be discussed with the patient [49].

Furthermore, more research is needed about the effectiveness and implementation of interventions focused on improving the physical health of patients with SMI after meeting thresholds of MetS after cardiometabolic screening. Components based on the *diabetes prevention program* are considered the golden standard for lifestyle interventions, for instance, but studies on this in representative mental healthcare contexts are currently limited [7]. In this context, a greater role in monitoring lifestyle factors is needed, as lifestyle factors are currently being registered insufficiently. Moreover, not only patients with schizophrenia spectrum disorder are at risk for MetS, but various patients with SMI. Therefore, everyone must be screened regularly, regardless of their specific diagnostic classification. Standardisation of monitoring physical health as part of usual care (i.e., not only for cardiometabolic diseases but for the broad spectrum of prevalent physical illnesses in mental healthcare), including referral to adequate treatment if needed, is still necessary to structurally improve the health status of people with SMI [10,41].

4.3. Conclusion

This cross-sectional retrospective study underlines that, despite increased urgency and guidance for cardiometabolic health in SMI last decades, cardiometabolic risk factors are still insufficiently monitored, and almost half of the screened patients with SMI can be diagnosed with MetS. The fact that cardiometabolic risk was present regardless of diagnosis, illness severity and treatment setting highlights the importance of screening and intervening across the SMI spectrum. Further research is needed to explore the screening barriers. After that, more intensive implementation strategies are needed to translate policies into action to improve the cardiometabolic health of people with SMI finally.

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Declaration of Competing Interest

None.

Data availability

Not all the data are freely accessible because no informed consent was given by the participants for open data sharing. However, the corresponding author can be contacted to discuss the possibilities of receiving any data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.comppsych.2023.152406.

References

[1] Brancheorganisatie voor de geestelijke gezondheids- en verslavingszorg. Factsheet Diagnosegroepen: aantallen patiënten en kosten per diagnosegroep. Amersfoort. 2019.
[2] James SL, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the global burden of disease study 2017. Lancet 2018;392:1789–858. https://doi.org/10.1016/S0140-6736(18)32279-7.
[3] Plana-Ripoll O, Musliner KL, Dalsgaard S, Momen NC, Weye N, Christensen MK, et al. Nature and prevalence of combinations of mental disorders and their association with excess mortality in a population-based cohort study. World Psychiatry 2020;19:339–49. https://doi.org/10.1002/wps.20802.
[4] Laursen TM, Plana-Ripoll O, Andersen PK, McGrath JJ, Toender A, Nordentoft M, et al. Cause-specific life years lost among persons diagnosed with schizophrenia: is it getting better or worse? Schizophr Res 2019;206:284–90. https://doi.org/10.1016/j.schres.2018.11.003.
[5] Oakley P, Kisely S, Baxter A, Harris M, Desoe J, Dziouba A, et al. Increased mortality among people with schizophrenia and other non-affective psychotic disorders in the community: a systematic review and meta-analysis. J Psychiatr Res 2018;102:245–53. https://doi.org/10.1016/j.jpsychires.2018.04.019.
[6] Hjorthøj C, Stürup AE, McGrath JJ, Nordentoft M. Years of potential life lost and life expectancy in schizophrenia: a systematic review and meta-analysis. Lancet Psychiatry 2017;4:295–301. https://doi.org/10.1016/S2215-0366(17)30078-0.
[7] Firth J, Siddiqi N, Koyanagi A, Siskind D, Rosenbaum S, Galletly C, et al. The lancet psychiatry commission: a blueprint for protecting physical health in people with mental illness. Lancet Psychiatry 2019;6:675–712. https://doi.org/10.1016/S2215-0366(19)30132-4.
[8] Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; National heart, lung, and blood institute; American heart association; World heart federation; International. Circulation 2009;120:1640–5. https://doi.org/10.1161/CIRCULATIONAHA.109.192644.
[9] Vancampfort D, Stubbs B, Mitchell AJ, De Hert M, Wampers M, Ward PB, et al. Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis. World Psychiatry 2015;14:339–47. https://doi.org/10.1002/wps.20252.
[10] Bruins J, Pijnenborg GHM, van den Heuvel ER, Vissen E, Corpeleijn E, Bartels-Velthuis AA, et al. Persistent low rates of treatment of metabolic risk factors in people with psychotic disorders: a PHAMOUS study. J Clin Psychiatry 2017;78:111–1125. https://doi.org/10.4088/JCP.16m10831.
[11] Deenik J, Tenback DE, Tak ECPM, Rutters F, Hendriksen IJM, van Harten PN. Changes in physical and psychiatric health after a multidisciplinary lifestyle enhancing treatment for inpatients with severe mental illness: the MULTI study I. Schizophr Res 2019;204:360–7. https://doi.org/10.1016/j.schres.2018.07.033.
[12] National Institute for Public Health and the Environment of the Netherlands (institution/organisation). Prevalence of the metabolic syndrome (by age and gender). RIVM (the Natl Inst Environ Hyg Netherlands) 2012. https://www.rivm.nl/metabool-syndroom-naar-leeftijd-en-geslacht.
[13] Morell R, Curtis J, Watkins A, Poole J, Fibbins H, Rossimel E, et al. Cardiometabolic risk in individuals prescribed long-acting injectable antipsychotic medication. Psychiatry Res 2019:281. https://doi.org/10.1016/j.psychres.2019.112606.
[14] Kruisdijk F, Deenik J, Tenback D, Tak E, Beekman AJ, van Harten P. Accelerometer-measured sedentary behaviour and physical activity of inpatients with severe mental illness. Psychiatry Res 2017;254:67–74. https://doi.org/10.1016/j.psychres.2017.04.035.
[15] Stubbs B, Vancampfort D, Hallgren M, Firth J, Veronese N, Solmi M, et al. 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. Eur Psychiatry 2018;54:124–44. https://doi.org/10.1016/j.eurpsy.2018.07.004.
[16] Bak M, Drukker M, Cortenraad S, Vandenberk E, Guloksuz S. Antipsychotics result in more weight gain in antipsychotic naive patients than in patients after antipsychotic switch and weight gain is irrespective of psychiatric diagnosis: a meta-analysis. PloS One 2021;16. https://doi.org/10.1371/journal.pone.0244944.
[17] Van Hasselt FM, Oud MJ, Loonen AJ. Improvement of care for the physical health of patients with severe mental illness: a qualitative study assessing the view of patients and families. BMC Health Serv Res 2013:13. https://doi.org/10.1186/1472-6963-13-426.
[18] O'Brien M, McNicholas F. The use of telepsychiatry during COVID-19 and beyond. Ir J Psychol Med 2020;37:250–5. https://doi.org/10.1017/ipm.2020.54.
[19] Kozloff N, Mulsant BH, Stergiopoulos V, Voineskos AN. The COVID-19 global pandemic: implications for people with schizophrenia and related disorders. Schizophr Bull 2020;46:752–7. https://doi.org/10.1093/schbul/sbaa051.
[20] Ali RA, Jalal Z, Paudyal V. Barriers to monitoring and management of cardiovascular and metabolic health of patients prescribed antipsychotic drugs: a systematic review. BMC Psychiatry 2020:20. https://doi.org/10.1186/s12888-020-02990-6.
[21] Kelly JR, Gounden P, McLoughlin A, Legris Z, O'Carroll T, McCafferty R, et al. Minding metabolism: targeted interventions to improve cardio-metabolic monitoring across early and chronic psychosis. Ir J Med Sci 2021. https://doi.org/10.1007/s11845-021-02576-5.
[22] De Hert M, Correll CU, Bobes J, Cetkovich-Bakmas M, Cohen DAN, Asai I, et al. Physical illness in patients with severe mental disorders. I. Prevalence, impact of medications and disparities in health care. World Psychiatry 2011;10:52–77. https://doi.org/10.1002/j.2051-5545.2011.tb00014.x.
[23] Mitchell AJ, De Hert M. Promotion of physical health in persons with schizophrenia: can we prevent cardiometabolic problems before they begin? Acta Psychiatr Scand 2015;132:83–5. https://doi.org/10.1111/acps.12466.
[24] McGrath JJ. No mental health without physical health - a call to arms. Epidemiol Psychiatr Sci 2016;25:195–6. https://doi.org/10.1017/S2045796015001055.
[25] Trimbos instituut. Multidisciplinaire richtlijn Somatische screening bij patiënten met een ernstige psychische aandoening 2015. 2015.
[26] Stewart R. Mental disorders and mortality: so many publications, so little change. Acta Psychiatr Scand 2015;132:410–1. https://doi.org/10.1111/acps.12476.
[27] Bartels SJ. Can behavioral health organizations change health behaviors? The STRIDE study and lifestyle interventions for obesity in serious mental illness. Am J Psychiatry 2015;172:9–11. https://doi.org/10.1176/appi.ajp.2014.14101246.
[28] Pearsall R, Shaw RJ, McLean G, Connolly M, Hughes KA, Boyle JG, et al. Health screening, cardiometabolic disease and adverse health outcomes in individuals with severe mental illness. BJPsych Open 2019;5:1–7. https://doi.org/10.1192/bjo.2019.76.
[29] O'Brien AJ, Abraham RM. Evaluation of metabolic monitoring practices for mental health consumers in the Southern District Health Board Region of New Zealand. J Psychiatr Ment Health Nurs 2021:1–13. https://doi.org/10.1111/jpm.12729.
[30] Michael S, MacDonald K. Improving rates of metabolic monitoring on an inpatient psychiatric ward. BMJ Open Qual 2020;9:2–7. https://doi.org/10.1136/bmjoq-2019-000748.
[31] Soda T, Richards J, Gaynes BN, Cueva M, Laux J, McClain C, et al. Systematic quality improvement and metabolic monitoring for individuals taking antipsychotic drugs. Psychiatr Serv 2021;72:647–53. https://doi.org/10.1176/appi.ps.202000155.

[32] Plana-Ripoll O, Weye N, Momen NC, Christensen MK, Iburg KM, Laursen TM, et al. Changes over time in the differential mortality gap in individuals with mental disorders. JAMA Psychiatry 2020;77:648–50. https://doi.org/10.1001/jamapsychiatry.2020.0334.
[33] Van Veldhuizen JR. FACT: a Dutch version of ACT. Community Ment Health J 2007;43:421–33. https://doi.org/10.1007/s10597-007-9089-4.
[34] Kenniscentrum Phrenos. Wat is het netwerk leefstijl en somatische gezondheid. https://kenniscentrumphrenos.nl/lerende-netwerken/netwerk-leefstijl-en-somatische-gezondheid/leefstijl-en-somatische-gezondheid/; 2022 (accessed January 7, 2022).
[35] American Psychiatric Association, editor. Diagnostic and statistical manual of mental disorders. 5th ed. American Psychiatric Association; 2013. https://doi.org/10.1176/appi.books.9780890425596.
[36] Delespaul P, Consensusgroep EPA. Consensus over de definitie van mensen met een ernstige psychische aandoening (EPA) en hun aantal in Nederland. Tijdschr Psychiatr 2013;55:427–38.
[37] Mulder CL, Staring ABP, Loos J, Buwalda VJA, Kuijpers D, Sytema S, et al. De Health of the Nation Outcome Scales (HONOS) als instrument voor "routine outcome assessment.". Tijdschr Psychiatr 2004;46:273–84.
[38] Burns A, Beevor A, Lelliott P, Wing J, Blakey A, Orrell M, et al. Health of the nation outcome scales for elderly people (HoNOS 65+). Br J Psychiatry 1999;174:424–7. https://doi.org/10.1192/bjp.174.5.424.
[39] Twisk JWR. Inleiding in de toegepaste biostatistiek. 3th ed. Amsterdam: Reed Business Education; 2014.
[40] De Hert M, Vancampfort D, Correll CU, Mercken V, Peuskens J, Sweers K, et al. Guidelines for screening and monitoring of cardiometabolic risk in schizophrenia: systematic evaluation. Br J Psychiatry 2011;199:99–105. https://doi.org/10.1192/bjp.bp.110.084665.
[41] Rødevand L, Steen NE, Elvsåshagen T, Quintana DS, Reponen EJ, Mørch RH, et al. Cardiovascular risk remains high in schizophrenia with modest improvements in bipolar disorder during past decade. Acta Psychiatr Scand 2019;139:348–60. https://doi.org/10.1111/acps.13008.
[42] Cocoman AM, Gallagher D. A retrospective chart review of screening on the prevalence of metabolic syndrome (MetS) in an Irish community mental health service. Issues Ment Health Nurs 2019;40:895–901. https://doi.org/10.1080/01612840.2019.1609636.
[43] de Louw EJ, Paans NPG, Sonnenberg CM, Konz H, Meesters PD, van Grootheest D, et al. Metabolic syndrome rates in older patients with severe mental illness after five years of follow-up and the association with mortality. Int J Geriatr Psychiatry 2019;34:333–6. https://doi.org/10.1002/gps.5025.
[44] Bartels-Velthuis AA, Visser E, Arends J, Pijnenborg GHM, Wunderink L, Jörg F, et al. Towards a comprehensive routine outcome monitoring program for people with psychotic disorders: the pharmacotherapy monitoring and outcome survey (PHAMOUS). Schizophr Res 2018;197:281–7. https://doi.org/10.1016/j.schres.2018.01.016.
[45] World Health Organisation (WHO). Waist circumference and waist–hip ratio. Report of a WHO expert consultation. 2008. p. 8–11.
[46] Brouwer JMJL, Olde Hengel E, Risselada AJ, van Roon EN, Mulder H. Applicability of somatic monitoring instructions in clinical practice guidelines on antipsychotic drug use. BMC Psychiatry 2021;21:1–8. https://doi.org/10.1186/s12888-021-03162-w.
[47] McCurdy AP, Lamboglia CG, Lindeman C, Mangan A, Wohlers B, Sivak A, et al. The physical activity sector within the treatment of mental illness: a scoping review of the perceptions of healthcare professionals. Ment Health Phys Act 2020;19:100349. https://doi.org/10.1016/j.mhpa.2020.100349.
[48] Deenik J, Tenback DE, Tak ECPM, Blanson Henkemans OA, Rosenbaum S, Hendriksen IJM, et al. Implementation barriers and facilitators of an integrated multidisciplinary lifestyle enhancing treatment for inpatients with severe mental illness: the MULTI study IV. BMC Health Serv Res 2019;19:1–13. https://doi.org/10.1186/s12913-019-4608-x.
[49] Cook LS. Needle phobia. J Infus Nurs 2016;39:273–9. https://doi.org/10.1097/NAN.0000000000000184.