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Ten-Year Risk of Cardiovascular Disease in Patients with Bipolar Disorder

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SUMMARY

Objective: Patients with bipolar disorder (BPD) are less likely to seek treatment for cardiovascular diseases (CVD) despite the two fold increased CVD-related death rate in BPD. The aim of this study was to evaluate the relationship between clinical variables, exercise characteristics and 10-year risk of CVD in patients with bipolar I disorder (BPD-I).

Method: The study was carried out with 106 euthymic BPD-I patients who were followed up at the Mood Disorders Centers of Bakırköy Hospital for Mental and Neurological Diseases and Selcuk University Faculty of Medicine. The physical activity status of the patients were evaluated with the Godin Leisure-Time Exercise Questionnaire (GLTEQ) and the prospective 10-year risk of CVD was assessed by the QRISK®2-2017 - CVD risk algorithm.

Results: Mean age of the patients were 39.5±8.6 years. The mean QRISK2 score of the patients was 3.64±0.46 %, which did not differ with respect to the gender. Patients' mean healthy heart age (QAGE) was 8.49±6.46 years ahead of their current age. There was a weak negative correlation between GLTEQ total score and QRISK2 score (r= 0.168), but this was not statistically significant. However, statistically significant positive correlations were determined between the categorical QRISK2 score and the disease age of onset (RR:1.18; 95%CI:1.09-1.28), treatment duration (RR:1.16; 95%CI:1.05-1.29) and the inclusion of atypical antipsychotic agents in the treatment received (RR:5.99; 95%CI:1.12-31.90).

Conclusion: A strong positive correlation was determined in this study between the QRISK2 score and the use of atypical antipsychotic drugs in the treatment of the BPD-I patients. It is important to identify patients diagnosed with bipolar disorder with a high risk of developing CVD to review the psychiatric treatment and to encourage the patients for preventive approaches.

Keywords: Bipolar disorder, cardiovascular diseases, QRISK2, cardiovascular disease risk

INTRODUCTION

Bipolar disorder (BPD) is recognized as a chronic mood disorder with manic-depressive episodes and a lifetime prevalence of approximately 1-3% (Merikangas et al. 2011). Given the frequent comorbidity of cardiovascular disease (CVD), respiratory and endocrine diseases in BPD leads to shortened mean life span and increased risk of mortality. (Roshanaei-Moghaddam and Katon 2009). Life expectancy in patients with BPD was found to be 10 years lower than in individuals with no psychiatric illness (Westman et al. 2013); and CVD was reported to start 17 years earlier in BPD-I patients as compared to the healthy control individuals (Goldstein et al. 2015). In addition, while CVD-related deaths in BPD are two times higher than in the general population, individuals with BPD are less likely to seek treatment for those diseases than the normal population (Westman et al. 2013).

Different definitions have been proposed for metabolic syndrome (MetS), constituting a high risk for most CVDs and showing an increased prevalence the recent years. According to the ATP III guidelines updated in 2005, MetS is diagnosed on the basis of meeting 3 of the criteria including abdominal obesity (waist circumference ≥102 cm in men or ≥88 cm in women), hypertension (blood pressure ≥130/85 mmHg or on hypertensive medication), elevated triglyceride level

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(≥150 mg/dL or under treatment), low HDL cholesterol level (<40 mg/dL in men, <50 mg/dL in women or in treatment), or increased fasting glucose (≥100 mg/dL or under treatment) (Grundy et al. 2005). Individuals with MetS have a 3-6 times increased risk to develop type-2 diabetes (Hanley et al. 2005; De Hert et al. 2011) and a 2-6 times increased risk of mortality from CVD compared to the general population (Hanley et al. 2005). One meta-analysis found a 37.3%, prevalence of MetS in BPD patients as compared to healthy control individuals (Vancampfort et al. 2013). In Turkey, MetS incidences of 32- 56% have been reported in BPD patients (Yumru et al. 2007, Demir and Tuğlu 2020). Higher incidences of MetS in BPD can be expected due to disorders of the endocrine system, dysregulation of the sympathetic nervous system, low level of physical activity and excessive eating behavior (Fagiolini et al. 2008). Furthermore, as compared to healthy control individuals, significantly higher incidences of the MetS criteria of hyperglycaemia and obesity were observed in the first degree relatives without psychiatric disorders of BPD patients (Baptista et al. 2011). It has been suggested that the susceptibility for metabolic disorders in chronic psychiatric diseases may be closely related with common pathways connected with the occurrence of the disease as well as with dietary and exercise habits associated with people's impaired functionality due to the disease load and side effects of drugs used in pharmacotherapy (Penninx and Lange 2018). To date, no single factor to account for this susceptibility has been identified; rather, it is thought to be a multifactorial condition (Fagiolini et al. 2008).

Cardiovascular risk algorithms are commonly used in clinical application to develop basic strategies for a protection from CVDs (Zomer et al. 2017). Studies with chronic psychiatric diseases made in Turkey have mainly assessed MetS and its parameters individually, while no work has been done assessing BPD patients' 10-year CVD risk, using a cardiovascular risk algorithm, in relation with the exercise characteristics of this risk. In the light of this information, we aimed to assess the relation of clinical variables and exercise characteristics with the 10-year CVD risk in BPD-I patients. We expected to find the BPD patients' 10-year CVD risk to be related with duration of illness, duration of treatment, varieties of treatment, and patients' exercise characteristics.

METHOD

Participants

The patients recruited for this study were diagnosed with BPD-I by at least two independent psychiatrists on the basis of the DSM-V criteria (American Psychiatric Association – APA- 2013) and were being followed up at the Raşit Tahsin Mood Disorders Center of Bakırköy Mazhar Osman Training and Research Hospital for Mental Health and Neurological Diseases, and at the Mazhar Osman Mood Disorders Center of Selçuk University Medical Faculty. The patients who were determined to be in remission and accepted to participate were included in the study.

Procedures

This research was approved by the decision no. 2019/248 of the Ethics Committee of Selçuk University Medical Faculty. Informed consent forms were received from all participants of the study. Clinical and sociodemographic data of the participants were acquired from the hospital medical records and during patient interviews. The participant's physical activity level over the previous week was assessed by the Godin Leisure-Time Exercise Questionnaire (Godin and Shephard 1985). The prospective 10-year CVD risk of each participant was calculated using the QRISK®2 algorithm (https://qrisk.org/2017/). As recommended by the QRISK®2 algorithm, participants younger than 25 years or above the age of 84 and with current heart disease or stroke diagnoses were excluded from the study for the correct calculation of the CVD risk. The Young Mania Rating Scale (YMRS) and the Hamilton Depression Rating Scale (HDRS), previously confirmed reliability and validity in the Turkish language (by Karadağ et al. 2002 and Akdemir et al. 1996, respectively), were used to assess the remisioın levels of the participants. Scores of <6 on the YMRS and <8 on the 17-item HDRS for a minimum of 2 months were taken to indicate clinical remission.

Instruments

The QRISK®2-2017 Algorithm: To calculate the risk of developing CVD within the coming 10 years, the QRISK®2-2017 was used as a verified estimator tool (https://qrisk.org/2017/). The risk score (QRISK2) for participants between the ages of 25 and 84 years was calculated by entering the information about their age, gender, smoking status, diabetes diagnosis, kidney failure (stage 4 or 5), history of angina or heart attack in first-degree relatives before the age of 60 years, atrial fibrillation, diagnosis and treatment of hypertension, history of rheumatoid arthritis, the cholesterol/HDL ratio, systolic blood pressure, and height and weight. The same algorithm was used to calculate the healthy heart age (QAge) indicating the age corresponding to the QRISK2 score in a healthy individual of the same gender QRISK2 scores ≥20% were classified as high risk, between 10 and

20% as intermediate risk, and <10% as low risk (Johns et al. 2018). However, in current therapeutic guidelines, scores obtained by estimator tools for 10-year CVD risk were reported to indicate a "borderline" risk for values between 5 and 7.5%, which under certain circumstances may warrant statin therapy. Values between 7.5 and 20% were considered an intermediate risk, and scores >20% a high risk (Lloyd-Jones et al. 2019).

The Godin Leisure-Time Exercise Questionnaire-GLTEQ: Leisure-time exercise is described as a concept comprising physical activities of various intensities that increase heart and breathing rate at different times of the day. The GLTEQ was developed to classify and to determine the level of the physical activities individuals carry out in their free time (Godin and Shephard 1985). The validity and reliability of the GLTEQ in the Turkish language was confirmed by Sarı and Erdoğan (2016). The questionnaire has 3 questions on the frequency of performing light, moderate, and strenuous exercise. The weekly frequencies of light, moderate and strenuous activities are multiplied by 3, 5, and 9, respectively, and the total score is obtained by summing up these multiplication results. For healthy individuals, the scores of ≥24 and ≤23 are considered, respectively, as active and inactive (Amireault and Godin 2015).

Statistical Analyses

Statistical analyses were carried out using the SPSS (Statistical Package for the Social Sciences) version 20.0. Continuous variables were tested for normal distribution by histogram and Kolmogorov-Smirnov test. Descriptive statistics for continuous variables are presented as mean ± standard deviation, while categorical variables are shown as case numbers and percentages. The Pearson correlation test was used to test relationships between continuous or ordinal variables for statistical significance.

All potential factors with a significant predictive power for QRISK2 scores according to univariate statistical analyses were tested in multivariate statistics performing backward stepwise binary logistic regression analysis. For this purpose, all variables and drug categories found to have significant correlations by the Pearson correlation analysis were evaluated as independent variables in regression analysis. Considering the 10-year CVD risk assessment intervals in the current therapeutic guidelines (Lloyd-Jones et al. 2019) and the distribution of QRISK2 scores as dependent variables, those with a score of <5% were coded as "0" and those with scores 5% as "1". Model fit was assessed by the Hosmer-Lemeshow test.

RESULTS

Sociodemographic and Clinical Characteristics of the Participants

Two-thirds of the participants were female (61.3%, n=65). The mean participant age was 39.5±8.6 years. The mean disease onset age was 25.8±8.8 years and the mean disease duration was 13.9±7.6 years. All of the patients were followed with a BPD-I diagnosis, and 76 (71.7%) participants were treated with two or more drugs. Various atypical antipsychotics were used in the treatment of 65.1% of the participants. About one-third of the participants had a medical comorbidity (Table 1). According to the GLTEQ total score, 40.6% (n=43) were physically active. The distribution of sociodemographic and clinical data is shown in Table 1.

Assessment of the Risk of Cardiovascular Disease (CVD) in the Sample

The mean QRISK2 risk of developing CVD in the next 10 years was found to be 3.64% (SD=0.46). In 5.7% (n=6) of the participants, the QRISK2 score was ≥10%, and 1 participant had a score of ≥20%. For 16.04% (n=17) of the participants, the risk of developing CVD in the next 10 years was in the 5-10% interval. A gender-based difference was not found in the QRISK2 score ($t=1.29$, $p>0.05$). The mean QAge score was 47.7±11.1 years. The mean difference between the healthy heart age and the chronological age of the participants was 8.49±6.46 years. The participant QRISK2 and QAge scores on the basis of age and gender categories are shown in Table 2.

Assessment of the Relation of the CVD Risk with the Clinical Parameters and Exercise

Evaluation of the clinical variables not included in the calculation of the CVD risk (QRISK2) and the assessment of QRISK2 demonstrated direct linear correlations with disease duration ($r=0.316$, $p<0.01$), treatment duration $r=0.361$, $p<0.01$) and the disease onset age ($r=0.399$, $p<0.01$) (Table 3). There was a statistically insignificant ($p>0.05$) low negative correlation between the GLTEQ total score and QRISK2 score ($r=-0.168$). The correlations between the parameters included within the scope of the QRISK2 and QAge are presented in Table 3.

Logistic regression analysis using QRISK2 score as the dependent variable and the drugs used (divided into 2 groups as including and not including atypical antipsychotics), disease duration, treatment duration and disease onset age as the independent variables resulted in the 2nd-step

Table 1. Sociodemographic and Clinical Data of the Participants

	n(%) / mean±SD
Sex	
Female	65(61.3%)
Male	41(38.7%)
Age (years)	39.5±8.6
Marital status	
Married	51(48.1%)
Single	35 (33%)
Divorced/Widowed	20(18.9%)
Employment status	
Working/in education	37(34.9%)
Not working	35(33%)
Homemaker	29(27.4%)
Retired	5(4.7%)
Age at illness onset	25.8±8.8
Duration of illness (years)	13.9±7.6
Number of hospitalizations	3±3.77
Duration of treatment (years)	11.2±6.6
Drugs used	
Lithium	9(8.5%)
Lithium+VPA/CBZ/LAM	8 (7.5%)
Lithium + AA	24(22.6%)
VPA/CBZ/LAM	15(14.2%)
VPA/CBZ/LAM + AA	14(13.2%)
AA	1 (0.9%)
Multiple combination	30(28.3%)
No drugs	5 (4.7%)
Drugs used by category	
MS	32(30.2%)
AA or AA+MS	69(65.1%)
Physical disease	
Hypothyroidism	23(21.7%)
Hypertension	2(1.9%)
Diabetes	2(1.9%)
Polymorbidity	6(5.7%)
Cigarette use	
None	54(50.9%)
1-9 per day	10(9.4%)
10-19 per day	13(12.3%)
>19 per day	29(27.4%)
Body Mass Index (kg/m^2)	29.88±6.55
<18.5	0
18.5-24.9	27(25.5%)
25-30	32(30.2%)
30.1-35	35 (33%)
35.1-40	10 (9.4%)
>40	2 (1.9%)
GLTEQ Total score	13.39±16.01

MS: Mood stabilizer (single or multiple); AA: Atypical Antipsychotic; VPA: Valproic acid; CBZ: Carbamazepine; LAM: Lamotrigine; GLTEQ: Godin Leisure-Time Exercise Questionnaire

Table 2. Variation of QRISK2 and QAge Scores According to Age

Age group (years)	QRISK2 (mean±SD)	QAge (mean±SD)
25-34 (n=33)	1.39±0.30	38.03±1.35
35-44 (n=49)	2.99±0.31	48.15±1.10
45-54 (n=15)	4.75±0.78	55.36±1.47
55-64 (n=7)	12.72±4.31	67±3.36
>64 (n=2)	18.75±0.35	73±2
Total (n=106)	3.64±0.46	47.7±1.11
Female (n=65)*	3.13±0.46	47.9±1.46
Male (n=41)*	4.46±0.95	47.24±1.72

* QRISK2 scores did not change on the basis of gender (t=1.29, p=0.200).

Table 4. Logistic Regression Modelling for QRISK2 and Clinical Parameters by the Backward Stepwise Method

	B (S.E)	p	RR	95% Confidence Interval
1st Model				
Disease Duration	0.047(0.135)	0.729	1.048	0.805-1.364
Treatment Duration	0.1(0.155)	0.516	1.106	0.817-1.497
Age at Disease Onset	0.17(0.043)	<0.001	1.185	1.09-1.289
AA included in therapy	1.742(0.869)	0.045	5.71	1.041-31.33
Constant value	-9.08(2.106)			
2nd Model*				
Treatment Duration	0.151(0.052)	0.004	1.164	1.051-1.289
Age at Disease Onset	0.166(0.041)	<0.001	1.180	1.09-1.278
AA included in therapy	1.79(0.853)	0.036	5.99	1.125-31.904
Constant value	-8.938(2.053)			

*Goodness of fit tests for the 2nd model: Hosmer-Lemeshow goodness of fit test χ^2:4.865 (p=0.772), Cox & Snell R^2: 0.245, Nagelkerke R^2: 0.370.
RR: Relative risk; AA: Atypical antipsychotic

model, according to which the disease onset age, treatment duration and the inclusion of atypic antipsychotic agents in the treatment were significantly correlated with QRISK2 (Table 4).

Table 3. Correlation of QRISK2 and QAge Scores with Other Clinical Parameters

	Age at Disease Onset	Disease Duration	Duration of psychiatric treatment	Number of hospitalizations	GLTEQ total score
QRISK2 score	0.399*	0.316*	0.361*	0.008	-0.168
QAge score	0.475*	0.347*	0.429*	0.067	-0.189

* p<0.01; GLTEQ: Godin Leisure-Time Exercise Questionnaire

DISCUSSION

CVD risk is a multifactorial phenomenon and may become further complicated by the risk increasing psychiatric disorders such as schizophrenia and BPD. In order to manage primary CVD prevention strategies, CVD risk algorithms are used in clinical application, especially when starting the use of statin type of lipid regulators (Zomer et al. 2017). Our study assessing the prospective 10-year CVD risk in BPD-I patients with regard to exercise characteristics showed mean QRISK2 score of 3.64±0.46%. The participants with moderate or elevated CVD risk (QRISK2>10) made up 5.7% (n=6).of the group. Studies using the Framingham method found the 10-year CVD risk rates to be 4.7±5.8% (Correll et al. 2008), 7.57±7.4% (Garcia-Portilla et al. 2009), 7.3±7.8%(Montes et al. 2009), 13.7±10% (Slomka et al. 2012), 3.36±5.02% (Grover et al. 2014) and 3.26±6.4%(Damegunta and Gundugurti 2017), respectively. In all of these studies, with the exception of two, the reported 10-year CVD risk was higher than our results. The study reporting the highest CVD risk of 13.7% was conducted with disabled veterans, diagnosed with BPD and carrying at least 1 of the CVD risk factors including hyper- or dyslipidemia, hypertension, diabetes mellitus, BMI >30, and/or a current diagnosis of CVD (Slomka et al. 2012). It is very likely that the high 10-year CVD risk in this study compared to the other studies may be related to the participant selection, as this group also had the highest mean age of 53±9.9 years, while the mean age of the participants in the other studies finding a high 10-year CVD risk ranged from 44.4 to 46.6 years (Correll et al. 2008, Garcia-Portilla et al. 2009, Montes et al. 2009) which was also higher than the mean age of 39.5 years determined in our study. The studies finding a prospective 10-year CVD risk similar to our results also reported similar mean participant ages of 39.68 years (Damegunta and Gundugurti 2017) and 39.55 years (Grover et al. 2014). Thus, the higher mean participant age in the studies reporting a high 10-year CVD risk may be an important explanatory factor for the differences in the results.

On the basis of gender, another factor used in risk calculation, 61.3% of our participants were female patients, as compared to 51.4% in the study by Correll et al. (2008), 50.8% in the work by Garcia-Portilla et al. (2009), 32% in the research by Damegunta and Gundugurti (2017), and 17% in the paper by Slomka et al. (2012). While the gender distribution in those studies varied widely, we did not find any statistically significant difference in the QRISK2 score between the male and female participants in our study. Cigarette smoking, another factor used in the CVD risk calculation, had 49.1% prevalence among our participants, similar to 53.4% and 51.5% reported, respectively, by Correll (2008) and Garcia-Portilla (2009), but higher than 24% and 12.9% reported by, respectively, Damegunta and Gundugurti (2017) and Grover et al. (2014) whose results are based on similar mean participant age as in our study but on higher percentages of male participants, respectively, 68% and 71%, as compared to 38.7% in our study. Considering all age groups, cigarette smoking results in higher CVD risk in males than in females. The contrasts in the distribution of gender and smoking factors among the participants may have given rise to the similarity of CVD risk scores.

Despite assessing the same phenomenon, the Framingham and QRISK2 algorithms are different. In the validity study for the QRISK2, the Framingham 10-year CVD risk calculation was used to measure simultaneous validity; and the percentage of explained variation was found around 5 points higher for QRISK2 (Collins and Altman 2012). This observation needs to be considered when comparing the two scores.

The QAge, expressing the QRISK2 score corresponding age of a healthy person of the same gender not carrying risk factors, was about. 8.5 years higher than the chronological age of our participants. Considering that CVD is the primary cause of mortality related to the general medical state in BPD, our QAge result is consistent with the results of Westman et al. (2013) indicating that the average lifespan in BPD patients was reduced by 10 years. Calculators for CVD risk age such as the QAge are relatively easier to comprehend in showing the potential reduction in life expectancy of a young person with a high relative CVD risk if preventative measures are not taken (Perk et al. 2012).The QAge can be used as a tool to provide CVD risk-related information to especially young BPD and Schizophrenia patients carrying high risk factors in order not to delay changing the unhealthy habits of their lifestyle. However, providing preventive therapy with statins for the CVD risk assessment based on measures like the QAge has not yet been proposed in the guidelines (Catapano et al. 2016).

In our study, the prospective 10-year CVD risk for BPD-I patients assessed in the context of exercise status did not give a significant correlation between the QRISK2 and GLTEQ scores. However, the lack of physical activity is considered a modifiable behavioral risk factor for CVD (Payne 2012). The negative correlation detected between QRISK2 and GLTEQ scores in our study was not statistically significant ($r=-0.168$, $p>0.05$). The validity and reliability study for the Turkish language version of the GLTEQ, used in our study to measure physical activity, was conducted with diabetic patients, yielding a mean total score of 23.73±7.73 (Sarı and Erdoğan 2016), which was considerably higher than the mean score of 13.39±16.01obtained in our study. According to the GLTEQ total score, around 60% of our sample consisted of individuals categorized as physically inactive (<24). Previous studies reported a sedentary lifestyle in 40-64.9% of BPD patients (Melo et al. 2016). We did not find in the literature any study assessing the prospective 10-year CVD

risk in BPD patients in the context of their characteristics including exercise. Most reports have been on MetS and exercise characteristics. However, the correlation between MetS and physical activity is unclear in BPD patients. Thus, Guan et al. (2010) and Salvi et al. (2008) did not find such a correlation. Subsequently, Salvi et al. (2011) showed in a larger sample (n=200) that BPD patients with MetS exercised less. The relatively low numbers of our participants and their predominantly sedentary lifestyle may be reasons for not finding a significant correlation between GLTEQ and QRISK2 scores.

In our study, linear correlations were found between the QRISK2 score and the clinical parameters of disease duration, treatment duration and disease onset age. Logistic regression analysis generated a model with a significant correlation between the QRISK2 score and the disease onset age, treatment duration and the use of atypical antipsychotics in the treatment. In multivariate analysis, the correlation between the QRISK2 score and the disease duration was lost. While treatment duration and disease duration are seen as correlated concepts, in BPD it can take years after the first attack to arrive at the right diagnosis and to start appropriate treatment (Drancourt et al. 2013). Among our participants, the mean disease duration was 2.5 years longer than the treatment duration (Table 1). This may be the reason why disease duration was not included in the model in the multivariate statistics.

Both in the correlation and regression analyses, a positive correlation was found between QRISK2 score and the disease onset age (relative risk: 1.18). Previously, a strong positive correlation had been shown between the disease onset age and the CVD risk score in 50 BPD patients (Damegunta and Gundugurti 2017). Early onset of BPD may correlate with a higher CVD risk both on grounds of the duration of disease burden and the potential side effects of the treatment duration; but in these studies negative correlations were not demonstrated. A possible cause to explain the positive correlation may be the central role of the age factor in calculating the CVD risk (Anderson et al. 1991). Goldstein et al. (2015) found the mean CVD onset age of 42.11±2.43 years in BPD-I patients, which was 17 years earlier than in the control group. This result suggests that age is a more sensitive CVD risk factor in BPD than in the general population. Also, age is associated with increase in general medical illness, and additional diseases may increase behavioral risk factors with a detrimental effect on the CVD risk such as restricting exercise. This result needs to be confirmed through a different study design with larger number of participants.

In logistic regression analysis carried out, QRISK2 score classification, the use of atypical antipsychotics and the treatment duration were found to be related. The ≥5% higher QRISK2 score of patients on atypical antipsychotic agents were equivalent to a relative 6-fold increase as compared to patients not using these agents. Our results were consistent with those of Damegunta and Gundugurti (2017) who found the atypical antipsychotics risperidone, quetiapine, and aripiprazole to be low-to-moderate predictors for the CVD risk. Particularly the relation between atypical antipsychotics and MetS features, including lipid anomalies, obesity, and diabetes, has long been known. The adverse side effects of atypical antipsychotic agents on triglyceride and cholesterol levels and insulin resistance can appear before the start of weight gain (Correll et al. 2015). Insulin resistance facilitates the development of diabetes either directly or through weight gain (Ballon et al. 2014). Also, mood stabilizers such as lithium and valproate are associated with weight gain, and valproate is also involved in the development of insulin resistance (Correll et al. 2015). One patient among the participants of our study was treated with atypical antipsychotic agents only, while the treatment of all the other participants also included at least 1 mood stabilizer, which may explain the high relative risk determined in the study.

Our study has a number of limitations. Our participant number was relatively small, and a control group of participants with other psychiatric disorders and/or healthy individuals were not included, which could have been compensated by the inclusion in QRISK2 of the risk calculated relative to the CVD risk in healthy controls. Including patients regularly followed up at specialized outpatient clinics may limit the generalizing of our results. The majority of participants were on more than one psychiatric drug and information on the different atypical antipsychotics used, detailed duration of use, daily doses, and interruption of use were not evaluated. Finally, the cross-sectional design and the CVD risk scoring used represented the CVD risk calculated at the moment of the investigation, not providing information about likely changes in the CVD risk over time.

Recent studies have consistently reported a CVD risk for patients diagnosed with schizophrenia, BPD or depression. In the management of the principal prevention strategies against CVDs, cardiovascular risk algorithms have been commonly used in clinical application, particularly when starting treatment with lipid regulators such as the statins (Zomer et al. 2017). Guidelines are country-specific for the initiation of statin treatment in clinical practice, proposing the 10-year CVD risk levels of 10% for Europe and 7.5% for the USA (Zomer et al. 2017).

Estimating the risk of developing CVD is highly significant for both the preventive approaches and for the planning of psychiatric treatment. Given that seeking treatment against CVD is less likely among BPD patients, awareness by the mental healthcare clinicians of the CVD risks of these patients is important for recommending the suitable treatment as well as for re-planning of the psychiatric therapy. This study

is the first in Turkey using the 10-year CVD risk algorithm in BPD-I patients and with results that are consistent with the reports from other countries. Further studies with larger groups of participants and taking into account the variety of antipsychotic drugs used, the daily doses and the duration of use are still needed.

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