Original article

Predicting suicidal behaviour after first episode of non-affective psychosis: The role of neurocognitive functioning

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ABSTRACT

Background: Suicide has been recognised as one of the major causes of premature death in psychosis. However, predicting suicidal behaviour (SB) is still challenging in the clinical setting and the association of neurocognition with SB in psychosis remains poorly understood. This study aimed to investigate the role of neurocognitive performance as predictor of SB. Also, we sought to explore differences in the evolution of clinical and neurocognitive functioning between participants with/without history of suicide attempts (SA) over follow-up period.

Methods: The sample of the study is composed by 517 patients. Sociodemographic, clinical, functional and neurocognitive measures were evaluated at baseline as well as 1-year and 3 years after first episode of psychosis. Bivariate and multivariate analyses explored the influence of these variables as putative baseline predictors of SB. Repeated measures analyses of variance tested differences in clinical and neurocognitive outcomes at 1- and 3-year follow-up.

Results: Global cognitive functioning (GCF) (OR = 1.83, 95% CI = 1.25–2.67) and severe depressive symptoms (OR = 1.17, 95% CI = 1.07–1.28) predicted SB. Longitudinal analyses revealed that patients with SB at follow-up presented with higher levels of remission in terms of positive psychotic symptoms and depression. In addition, those with a history of SB had worse GCF and visual memory than those without such antecedents.

Conclusions: GCF was found to be the most robust predictor of SB along with severe depressive symptomatology. Hence, poorer cognitive performance in FEP appears to emerge as a risk factor for suicidal behaviour from early stages of the illness and a comprehensive neurocognitive assessment may contribute to risk assessment.

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1. Introduction

People with a diagnosis of psychotic spectrum disorder present lower life expectancy than the general population [1] due to a higher mortality both for natural and unnatural causes. It has been estimated that the average life expectancy is reduced by approximately 14.6 years in people diagnosed with schizophrenia [2]. Moreover, in a large sample of first episode psychosis (FEP) patients, suicide was identified as the most common unnatural cause of death, with a 20-fold increase in the risk of death by suicide than their peers [3].

The most relevant suicidal behaviour (SB) risk factors in FEP patients are: i) history of suicide attempts, ii) presence of suicidal ideation, iii) substance use, iv) alcohol use, v) greater insight, vi) younger age of onset at first treatment, as well as vii) longer duration of untreated psychosis (DUP) [4]. In a previous FEP study from our group we also replicated severity of depressive symptoms to be the most robust risk factor of SB in FEP [5], which has been recently subject to a meta-analysis [6].

However, clinicians still struggle to predict SB in patients with psychotic disorders. It has been suggested that other contributing

factors, such as neurocognitive functioning, may be more sensitive in the prediction of SB [7] than the classic risk factors. Indeed, some previous studies suggested that the presence of SB was associated with better neurocognitive performance in domains such as executive functioning [8–10]. In keeping with this, the aforementioned study we found significant differences in processing speed functioning at baseline between patients with SB and those without SB prior to first contact with services [5].

To the best of our knowledge, no previous longitudinal studies have examined the relationships between neuropsychological functioning changes in FEP patients and the presence of SB. Nevertheless, it has been suggested that neuropsychological functioning remains stable over time in FEP patients [11,12]. On the other hand, some prospective studies reported that the presence of severe depressive symptomatology during the follow-up period was related with SB [6,13,14].

The main aim of this study was to explore predictors of SB adjusting the analyses for a set of sociodemographic, clinical and neurocognitive variables. Our secondary purpose was to examine potential long-term differences in clinical measures and neuro-cognitive functioning between patients who made suicidal acts and those who did not over the follow-up period.

We hypothesized that better executive functioning as well as worse processing speed, and severe depressive symptomatology at baseline will be related with SB. Concerning the second aim of the study, we expected that those with history of SB will show i) better executive functioning and worse processing speed throughout the follow-up period; ii) and less improvement in depressive symptoms.

2. Materials and methods

2.1. Participants

Participants were identified and eligible to receive treatment for a first episode of a psychotic disorder under the 'Programa Asistencial de las Fases Iniciales de la Psicosis' (PAFIP), which was a clinical-epidemiological FEP programme over 2001-2014. Patients were recruited from the outpatient and the inpatient unit at the University Hospital Marqués de Valdecilla, Santander, Spain [15]. All participants were initially screened for the presence of psychotic symptoms and all diagnoses were made by an experienced psychiatrist (BC-F) using the Structured Clinical Interview for DSM-IV Axis I Disorders [16] after 6 months of the baseline visit. Participants fulfilled DSM-IV criteria for: schizophrenia (50.1%), brief psychotic disorder (9.5%), not otherwise specified (NOS) psychosis (7.2%), schizophreniform disorder (28.2%), schizoaffective disorder (1.5%), delusional disorder (0.2%). Inclusion criteria were: age between 16–60 years; living in the catchment area; experiencing their first episode of psychosis; no prior treatment with antipsychotic medication or, if previously treated, a life time of adequate antipsychotic treatment of less than 6 weeks while exclusion criteria were: history of neurological disease or head injury were exclusion criteria as well as DSM-IV criteria for drug dependence and mental retardation. Those who took part in the study gave written informed consent. PAFIP obtained ethical approval from the Local Research Ethics Committee.

2.2. Measures

2.2.1. Premorbid and sociodemographic variables

Premorbid and sociodemographic information were collected at the study inception from patients, relatives and medical records. Specifically, we considered: age, sex, years of education, family history of psychosis, hospitalizations, socioeconomic status, living area, living status, relationship status and employment status. Schizophrenia diagnosis was dichotomized into 'schizophrenia' and 'others'. Alcohol and cannabis use were self-reported as 'present/absent'.

2.2.2. Clinical, functional and neurocognitive variables

Clinical, functional, and neurocognitive variables were measured as soon as practicable and were reassessed at 1 and 3 years after the first contact with PAFIP program. The premorbid adjustment was measured by means of Premorbid Assessment Scale (PAS) [17]. The duration of untreated illness (DUI), which was defined as the time from the first unspecific symptoms related to psychosis to initiation adequate antipsychotic drug treatment (for such a symptom to be considered, there should be no return to previous stable level of functioning) and duration of untreated psychosis (DUP), which was defined as the time from the first continuous psychotic symptoms (present most of the time) to initiation of adequate antipsychotic drug treatment, were also recorded. Symptomatology was evaluated by means of the Scale for the Assessment of Positive symptoms (SAPS) [18] and the Scale for the Assessment of Negative symptoms (SANS) [19]. SANS and SAPS scores were used in generating dimensions of positive, disorganized and negative symptoms [20]. Depression was assessed by the Calgary Depression Scale for Schizophrenia (the higher the score, the more depressive symptomatology) (CDSS) [21], while the shortened version of the Scale to Assess Unawareness Mental Disorder (SUMD) [22] was used to evaluate three insight dimensions: awareness of mental illness, awareness of the social consequences and awareness of the need for treatment (the higher the score, the poorer, the insight). Functioning evaluated was by the Disability Assessment Schedule (DAS) [23].

The neuropsychological battery was administered by trained neuropsychologists between week 6 and week 13, a period that seems to be the most appropriate to implement baseline assessment for neurocognitive studies [24] free of biases associated with an acute psychotic mental state. A subset of measures was selected to asses eight cognitive areas: (1) verbal memory was assessed with the Rey Auditory Verbal Learning Test (RAVLT) [25], delayed recall; (2) visual memory was assessed with the Rey Complex Figure (RCF) [26], delayed reproduction; (3) executive functioning was evaluated with the Trail Making Test (TMT) [27] time to complete TMT-B minus TMT-A; (4) working memory was measured by the WAIS-III Backward Digits scale, total subscore [28]; (5) processing speed was assessed with the WAIS-III Digit Symbol subtest, standard total score [28]; (6) motor dexterity was estimated with the Grooved Pegboard Handedness (GP) [29], time to complete with dominant hand; (7) attention was appraised with the Continuous Performance Test (CPT), total number of correct responses; and (8) premorbid IQ was determined using the WAIS-III Vocabulary subtest [30], standard total score. In addition, a composite metric known as GCF was obtained using seven of the cognitive domains evaluated (verbal memory, visual memory, executive functioning, working memory, processing speed, motor dexterity and attention). This index was calculated using the deviation of the patients from the controls in each cognitive domain at baseline, 1-year and 3-years [31]. Higher scores of GCF indicated poorer cognitive functioning.

2.2.3. Suicidal behaviour

Suicidal behaviours, i.e. potentially self-injurious behaviour for which the person intended to kill himself/herself as well as suicide completion [32,33] were taken from medical records. Suicide attempts before first contact with psychiatric services and any further suicidal-related behaviour were registered for this study. The presence of any of them was categorized as SB vs. non-presence of SB for the remaining. A full description of the SB recording was described elsewhere [5].

2.3. Statistical analyses

Statistical analyses were conducted using SPSS, version 24 [34]. The Kolmogorov-Smirnov test examined the normality of variables.

In order to analyse differences in sociodemographic, clinical, and cognitive variables, parametric (t-test) and non-parametric (Mann-Withney U) tests were used for continuous variables as appropriate, while Pearson's chi-square was used for categorical data.

For testing the independent contributions to SB binary logistic models were built up. Significant variables ($p \leq 0.01$) from bivariate analyses were included as trait variables (predictors) in the binary regression model in later blocks (backward: conditional). A repeated analyses of variance (ANOVA) adjusted by gender, age and years of education for cognitive variables and by gender and age for clinical were performed. Sphericity was checked using Mauchy's W (where assumptions of sphericity were violated, a Greenhouse-Geisser adjustment was applied). Effects of time (longitudinal dimension), group (cross-sectional dimension) and time by group (interaction effect) were examined. Pairwise comparisons were conducted to examine between-groups differences at different points in time. All post-hoc comparisons were Bonferroni corrected. The level of significance was set at 1% for all the above analyses.

3. Results

3.1. Sample characteristics

The total sample consisted of 517 patients (297 (57.4%) men, 220 (42.6%) women), aged 15–60 (29.85 ± 9.35). Fifty-one participants (9.9%) made at least one SB. Thirty-six (70.59%) of these behaviours occurred during the first 3 years. Fifteen patients from PAFIP program included is this study died for different causes. Of those, 7

died by suicide which reflects a proportionate suicide mortality of 46.7% (7/15). Regarding completeness of assessments, 371 patients (71.8%) completed clinical measures at baseline, while 46.2% completed cognitive measures at baseline, 1-year and 3-years after FEP. Demographic and baseline clinical characteristics of the sample are presented in Table 1.

3.2. Predictors of SB during 3-year follow-up

At baseline those patients with SB showed significant higher scores in CDSS (U = 8033.50; $p \leq 0.001$) and worse premorbid adjustment (U = 8352; $p \leq 0.01$). Regarding cognitive function, patients with presence of SB over the follow-up period scored significantly worse in motor dexterity (U = 3606.50; $p \leq 0.001$), working memory (U = 4926; $p \leq 0.03$) and GCF (3446.50; $p \leq 0.01$). Finally, participants with SB were more likely to have suicide attempts prior to FEP ($X^2 = 15.87$; $p \leq 0.001$) when compared with those without SB. See Table 1.

In the binary regression model, the dependent variable was the presence of SB versus absence of SB. The independent variables included were those significant in the univariate analyses. The model was significant ($X^2 = 21.05$; $p \leq 0.01$) and it explained 13.5% (Nagelkerke R square) of the variance on the outcome. Variance Inflation Factor (VIF) was calculated and there were no VIF's values over 1.29, thus the assumption of multicollinearity was not violated. GCF (OR = 1.83; 95% CI = 1.25–2.67) and CDSS (OR = 1.17; 95% CI = 1.07–1.28) were the significant predictors of SB after FEP. The presence/absence of SB were predicted with 91% accuracy and

Table 1
Differences between participants with history of suicidal behaviour and non-history of suicidal behaviours.

	Mean	Non-SB	Mean	SB	Mean	p-value	Effect size
Age, years, mean ± SD	29.80± (9.32)	466	29.98± (9.35)	51	28.13± (8.92)	0.15	0.20
Gender (male), n (%)	297 (57.4)	466	264 (56.7%)	51	33 (64.7)	0.27	
Education (years), mean ± SD	10.06± (3.27)	463	10.13± (3.29)	51	9.43± (2.97)	0.17	0.22
Family history of psychosis, n (%)	122 (23.6)	465	106 (22.8)	50	16 (32)	0.15	
Hospitalization, n (%)	356 (68.9)	465	321 (69.03)	51	35 (68.6)	0.95	
Low socioeconomic status, n (%)	269 (52.95)	457	238 (52.1)	51	31 (60.8)	0.24	
Urban area, n (%)	366 (70.8)	461	326 (70.7)	51	40 (78.4)	0.25	
Living with parents/family, n (%)	369 (71.4)	461	331 (71.8)	51	38 (74.5)	0.68	
Unmarried, n (%)	380 (73.5)	463	338 (73.1)	51	42 (82.4)	0.15	
Unemployed, n (%)	223 (43.1)	461	199 (43.2)	51	24 (47.1)	0.60	
Schizophrenia diagnosis, n (%)	259 (50.1)	450	230 (51.1)	50	29 (58)	0.36	
Cannabis, n (%)	226 (43.7)	466	200 (42.9)	51	26 (50.9)	0.27	
Alcohol, n (%)	269 (52)	463	242 (52.3)	51	27 (52.9)	0.93	
Premorbid adjustment, mean ± SD	2.17± (1.34)	408	2.76± (1.35)	42	2.76± (1.22)	<0.01	0.46
DUI, (months), mean ± SD	22.26± (37.25)	441	22.02± (36.83)	49	24.36± (41.19)	0.51	0.06
DUP (months), mean ± SD	12.55± (28.25)	461	12.62± (27.56)	50	11.91± (34.13)	0.62	0.02
SAPS total, mean ± SD	13.69± (4.39)	466	13.73± (4.45)	50	13.3± (3.82)	0.50	0.10
SANS total, mean ± SD	6.68± (6.17)	465	6.61± (6.13)	49	7.33± (6.55)	0.51	0.11
Positive symptoms, mean ± SD	7.42± (2.44)	466	7.45± (2.44)	50	7.1± (2.43)	0.39	0.14
Negative symptoms, mean ± SD	4.85± (5.64)	466	4.77± (5.63)	50	5.54± (5.75)	0.25	0.14
Disorganized symptoms, mean ± SD	6.27± (3.49)	466	6.28± (3.52)	50	6.2± (3.24)	0.93	0.02
CDSS, mean ± SD	2.27± (3.25)	462	2.07± (3.08)	50	4.04± (4.15)	<0.001	0.54
SUMD: mental illness, mean ± SD	2.76± (1.70)	423	2.77± (1.70)	41	2.66± (1.73)	0.69	0.06
SUMD: need treatment, mean ± SD	2.15± (1.50)	423	2.16± (1.50)	41	2.07± (1.49)	0.70	0.06
SUMD: social consequences, mean ± SD	1.89± (1.38)	423	1.9± (1.39)	41	1.73± (1.23)	0.61	0.13
DAS, mean ± SD	1.38± (1.51)	422	1.39± (1.50)	44	1.32± (1.57)	0.67	0.02
Attention, mean ± SD	−2.69± (4.43)	338	−2.58± (4.27)	33	−3.80± (5.78)	0.26	0.24
Verbal memory, mean ± SD	−2.38± (1.37)	362	−2.35± (1.36)	34	−2.63± (1.46)	0.27	0.20
Visual memory, mean ± SD	−0.62± (1.01)	358	−0.59± (0.99)	34	−0.94± (1.13)	0.08	0.33
Processing speed, mean ± SD	−1.47± (1.08)	361	−1.44± (1.08)	35	−1.82± (1.06)	0.03	0.35
Working memory, mean ± SD	−0.52± (0.89)	362	−0.52± (0.89)	35	−0.59± (0.88)	0.82	0.09
Executive function, mean ± SD	−1.37± (2.19)	348	−1.32± (2.16)	34	−1.94± (2.45)	0.23	0.27
Motor dexterity, mean ± SD	−1.23± (2.38)	351	−1.13± (2.36)	33	−2.29± (2.30)	<0.001	0.50
GCF, mean ± SD	1.45± (0.95)	317	1.40± (0.92)	32	1.99± (1.10)	<0.01	0.58
Estimated premorbid IQ, mean ± SD	9.11± (2.75)	354	9.19± (2.68)	32	8.22± (3.27)	0.08	0.32
Previous suicide attempts, n (%)	32 (6.2)	466	23 (4.9)	45	9 (20)	<0.001	

SB: Suicidal Behaviour; DUI: Duration Untreated Illness; DUP: Duration Untreated Psychosis; SAPS: Scales for the Assessment of Positive Symptoms; SANS: Scales for Assessments of Negative Symptoms; CDSS: Calgary Depression Scale for Schizophrenia; SUMD: Scale of Unawareness for Mental Disorder; DAS: Disability Assessment Scale; GFC: Global Cognitive Functioning; IQ: Intelligence Quotient.

correctly classified 99.7% of patients without SB and 6.7% of patients with SB during follow-up period.

3.3. Long-term clinical and neurocognitive functional differences between patients with and without SB during follow-up

The groups differed significantly in CDSS (F(1,374) = 9.95; $p \leq 0.001$), visual memory (F(1,186) = 8.16; $p \leq 0.01$) and GCF (F(1,134) = 7.10; $p \leq 0.01$). Bonferroni post-hoc analyses revealed that at baseline those with SB presented significantly higher scores on CDSS (F(1,374) = 10.26; $p \leq 0.001$) than non-SB subjects. Continued differences at 1 and 3 years were found in SAPS-total (1 year (F(1,371) = 7.85; $p \leq 0.01$); 3 years (F(1,371) = 12.96; $p \leq 0.001$)) and in disorganized symptoms (1 year (F(1,374) = 13.13; $p \leq 0.001$; 3 years (F(1,374) = 12.76; $p \leq 0.001$)) while in positive symptomatology the differences were significant at 3 years after FEP (F(1,374) = 7.51; $p \leq 0.01$). Regarding cognitive variables, at 1-year follow-up there was significant differences between the groups in GCF (1 years (F(1,134) = 8.82; $p \leq 0.01$)) and those with SB presented significant worse visual memory at 3-year follow-up (3 years (F (1,186) = 7.27; $p \leq 0.01$)). Finally, significant time x group interactions were observed in SAPS total (F(2,742) = 5.87; $p \leq 0.01$) as well as CDSS (F(2,748) = 10.26; $p \leq 0.001$). See Table 2.

4. Discussion

Three main findings were revealed by our results. First, worse GCF at baseline appeared to be the most prominent predictor of SB together with severe depressive symptomatology. Second, those patients with history of SB over the follow-up period experienced significantly enhanced in depressive symptomatology and positive psychotic symptoms. Finally, GCF and visual memory resulted to be significantly worse over the follow-up period in patients with SB.

4.1. Baseline predictors of SB

Our results revealed that the most important baseline predictor of lifetime suicidality was worse GCF. To the best of our knowledge, this is the first study testing GCF as a putative risk factor of SB in FEP. Nevertheless, in patients diagnosed with major depressive disorder, worse global neuropsychological functioning was related to SB [35]. It has been postulated that the presence of neuro-cognitive deficits may lead to an inadequate evaluation of one's life circumstances, which may result in a poorer decision-making process [36]. Moreover, worse cognitive functioning has also been associated with higher risk of suicide in non-psychotic population [37].

On the other hand, we failed to find significant relationships between better executive functioning and worse processing speed with SB. The role of executive functioning in SB remains unclear [38] and, although some studies have suggested a relationship between SB and better executive functioning in FEP patients [9], others supported an association between executive deficits and suicidality [39]. Kim et al. found that patients with history of SB outperformed those without history of SB in psychomotor speed, attention, working memory, verbal fluency, verbal memory and executive functioning, being this relationship mediated by hopelessness [40]. On the other hand, a fMRI study reported that suicide attempters presented with reduced neural activity during goal-representation, which can lead to failures to attain goals [41]. These results did not fully confirm Nangle and colleagues hypothesis that better goal-directed behaviour is be related with

Table 2
Changes in clinical and neurocognitive variables over time.

	Presence of SB	Baseline	1 year	3 years	Time	Group	Time x Group	Post-hoc analyses
SAPS total	No	13.66 (4.45)	1.17 (2.53)	1.46 (3.19)	F = 68.77 **	F = 5.52	F = 5.87 *	1 year *;3 years **
	Yes	13.06 (3.77)	2.68 (3.70)	3.88 (5.23)				
SANS total	No	6.60 (6.06)	4.55 (5.45)	3.86 (5.40)	F = 8.73 **	F = 1.66	F = 0.34	
	Yes	7.42 (6.37)	6.18 (5.85)	5.06 (5.05)				
Positive symptoms	No	7.36 (2.43)	0.84 (1.82)	0.92 (2.06)	F = 67.90 **	F = 3.10	F=3.46	3 years *
	Yes	7.24 (2.51)	1.56 (2.33)	2.12 (2.77)				
Negative symptoms	No	4.67 (5.52)	4.19 (5.06)	3.43 (4.86)	F = 5.39 *	F = 0.80	F = 0.17	
	Yes	5.53 (5.40)	5.32 (5.19)	4.09 (4.76)				
Disorganized symptoms	No	6.29 (3.51)	0.33 (1.04)	0.53 (1.61)	F = 29.26 **	F = 3.49	F=4.12	1 year **; 3 years **
	Yes	5.82 (2.77)	1.12 (1.89)	1.76 (3.21)				
CDSS	No	2.16 (3.18)	0.84 (2.13)	0.62 (1.70)	F = 10.15 **	F = 9.95 **	F = 10.26 **	Baseline *
	Yes	4.67 (4.45)	1.06 (1.80)	0.58 (0.97)				
DAS	No	1.36 (1.49)	1.45 (1.45)	1.16 (1.41)	F = 2.58	F = 2.89	F = 1.78	
	Yes	1.39 (1.50)	1.90 (1.25)	1.81 (1.28)				
Attention	No	−2.56 (4.21)	−1.88 (4.21)	−2.35 (4.52)	F = 1.59	F = 0.79	F = 0.25	
	Yes	−3.39 (5.13)	−2.13 (3.57)	−3.32 (6.70)				
Verbal memory	No	−2.31 (1.37)	−1.03 (1.20)	−1.32 (1.33)	F = 9.99 **	F = 3.08	F = 1.18	
	Yes	−2.63 (1.12)	−1.74 (1.25)	−1.89 (1.35)				
Visual memory	No	−0.55 (1.04)	−0.44 (1.02)	−0.97 (1.23)	F = 4.09	F = 8.16 *	F=0.68	3 years *
	Yes	−1.02 (0.77)	−1.03 (1.03)	−1.78 (1.26)				
Working memory	No	−0.45 (0.96)	−0.56 (0.79)	−0.48 (0.89)	F = 0.09	F = 0.07	F = 0.07	
	Yes	−0.56 (0.91)	−0.60 (1.01)	−0.62 (1.10)				
Executive function	No	−1.21 (1.98)	−1.75 (3.10)	−1.18 (2.24)	F = 1.26	F = 3.63	F = 1.51	
	Yes	−1.58 (1.71)	−2.80 (4.50)	−2.71 (5.07)				
Motor dexterity	No	−1.36 (2.97)	−1.74 (3.37)	−1.41 (1.93)	F = 1.29	F = 0.71	F = 0.47	
	Yes	−2.44 (2.06)	−2.26 (2.26)	−1.41 (3.28)				
Processing speed	No	−1.42 (1.13)	−1.81 (1.55)	−1.46 (1.27)	F = 4.53 *	F = 3.35	F = 1.79	
	Yes	−2.01 (0.95)	−1.81 (1.56)	−1.46 (1.59)				
GCF	No	1.38 (0.97)	1.19 (0.99)	1.21 (0.99)	F = 0.25	F = 7.10 *	F=0.73	1 year *
	Yes	2.06 (1.11)	2.08 (1.25)	1.87 (1.22)				

SB: Suicidal behaviour; SAPS: Scales for the Assessment of Positive Symptoms; SANS: Scales for Assessments of Negative Symptoms; CDSS: Calgary Depression Scale for Depression; DAS: Disability Assessment Scale; GCF: Global Cognitive Functioning.
* $p \leq 0.01$.
** $p < 0.001$.

the presence of lifetime SB [8]. Finally, according to previous literature, we replicated the association of more severe baseline depressive symptomatology with SB [4,42], which is in line with our previous study [5].

4.2. Long-term clinical and neurocognitive functional differences

Those participants who made SB over the follow-up period improved significantly more in positive psychotic symptoms than those without the presence of SB. Post-hoc analyses showed that those patients with SB scored significantly lower at 1- and 3-years follow-up assessments than non-SB subjects. In relation to depressive symptomatology, patients with SB during the follow-up presented with significantly higher depressive symptomatology at baseline than participants without SB, but these associations were not replicated at 1 and 3-year follow-up. We tested if antidepressant medication may explain this; however no significant differences were found between suicidal and non-suicidal patients, which is consistent with a study in elderly people [43], although to our knowledge this has not been investigated in FEP yet. One possible reason for the improvement in positive and depressive symptomatology may be related to the better engagement of patients with SB with PAFIP programme. In keeping with this, patients with history of SB presented with higher assistance demands and were more likely to be hospitalised than non-SB individuals (data available upon request). It could be speculated that this better engagement may have resulted in better treatment compliance, thus leading to clinical remission [44].

The higher proportion of SBs occurred during the first 12 months after the onset of the psychotic disorder (40.9%), which is consistent with previous studies [45,46]. In addition, repeated measures analyses revealed significant differences between suicidal and non-suicidal in GCF performing at follow-up. Moreover, post-hoc analyses revealed that suicidal patients scored significantly lower than non-suicidal subjects at 1-year follow-up period, which was preceded by the highest rate of SB. The worse GCF demonstrated by patients with SB as well as post-hoc results may suggest that GCF has both trait- and state-like properties, which had already been proposed in elderly people with history of SB [47].

On the other hand, patients with SB after FEP performed significantly worse in visual memory than non-SB subjects at follow-up assessments. Previous publications reported that visual memory deterioration may reflect a brain dysfunction, which is also linked with relapses [48]. Moreover, as alluded to above, groups differed significantly in number of relapses, which is a proxy for illness progression [49], which might explain the above differences.

4.3. Strengths and limitations

We recruited a large sample of FEP patients from the PAFIP programme detailed above, which is therefore likely to be representative of our population. In addition, we examine multiple relationships between clinical, functional and cognitive measures prospectively over a prolonged follow-up period. However, some limitations should be taken into account when interpreting the results of this study. Firstly, the possible effect that the attrition may have had on the study, which concerns most longitudinal studies. Secondly, the use of retrospective historical medical records to register suicide-related behaviours, which may have resulted in underestimating the number of suicidal events, thus resulting in lower power to detect some between-groups differences. However, this method allows the inclusion of the entire sample. Finally, it is worth noting that the prediction accuracy was very low for the SB group.

Conclusion

GCF was found to be the most robust predictor of SB along with severe depressive symptomatology, which was consistent with the longitudinal analyses. Hence, poorer cognitive performance in FEP appears to emerge as a risk factor for suicidal behaviour from early stages of the illness and a comprehensive neurocognitive assessment may contribute to risk assessment if these results were replicated. As mentioned above, it has been recognised the possible importance of neurocognitive functioning as a predictor factor of SB [7]. In the light of our findings it seems that FEP patients may benefit from early intervention programmes which include cognitive remediation interventions. Further follow-up studies are required to investigate the possible benefits from specific procedures focused in basic cognitive processes in the prevention of suicidal behaviour.

Author's contributions

All the authors have participated and have made substantial contributor for this paper.

Conflict of interest

The authors have no conflicts of interest concerning the subject of the study.

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