

## Correlation of Cognitive Resilience, Cognitive Flexibility and Impulsivity in Attempted Suicide

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### ABSTRACT

**Context:** Impaired cognitive flexibility and resilience and increased impulsivity are presumed to underlie an attempt of suicide. There is, however, a paucity of research examining their relationship in those who attempted suicide. **Aims:** To know the correlation of cognitive flexibility and resilience and impulsivity in attempted suicide. **Materials and Methods:** Two hundred seventy subjects with suicide attempt (s) were assessed with sociodemographic and clinical proforma, cognitive flexibility scale (CFS), cognitive resilience scale (CRS), and Barratt impulsiveness scale (BIS-15). **Statistical Analysis Used:** Descriptive statistics, linear regression model. **Results:** Mean scores on CFS, CRS, and BIS-15 were 44.93 (SD ± 2.50), 4.49 (SD ± 0.25), and 36.13(SD ± 2.13), respectively. On linear regression analysis, BIS-15 nonplanning had statistically significant negative correlation with CFS and CRS scores, and BIS-15 attention had a positive correlation with CFS and CRS scores. CFS and CRS scores were positively correlated. **Conclusions:** In attempted suicide, cognitive flexibility and resilience are interrelated positively and inversely associated with impulsivity (nonplanning and inattention).


**Key words:** *Attempted suicide, cognitive flexibility, cognitive resilience, impulsivity*

**Key messages:** *High levels of cognitive flexibility, cognitive resilience and impulsivity are present in attempted suicide. Cognitive flexibility and resilience are not protective in the presence of high impulsivity.*

Resilience is a trajectory that starts from the presence of significant risk or adversity to the achievement of positive adaptation or outcomes<sup>[1]</sup> or demonstration of a relatively good outcome, given exposure to adverse circumstances.<sup>[2]</sup> Research on resilience has received increased interest over the years, particularly among those involved with policy and practice in relation to its potential impact on health, well-being, and quality of life. This inclination is because of moving away from “deficit” models of illness to understanding healthy

development, despite the risk and focusing on strengths rather than weaknesses.<sup>[3]</sup> Literature reveals that about 25-84% of the general population is reasonably resilient.<sup>[4]</sup>

Cognitive resilience is the capacity to overcome the negative effects of setbacks and associated stress on cognitive function or performance.<sup>[5]</sup> Recently, this

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has been a topic of interest for psychological research. Previous studies have used this term in reference to aging and related disorders, cognitive functions,<sup>[6]</sup> or genetic risk.<sup>[7]</sup> So far, no study has examined cognitive resilience in attempted suicide, although, resilience, in general, seems to play a mitigating role in the ideation of suicide in depressive and anxious individuals.<sup>[8]</sup> Indirect evidence suggests impaired cognitive resilience in attempted suicide.<sup>[9]</sup>

Cognitive flexibility is the ability to adapt the cognitive processing strategies to face new and unexpected conditions in the environment.<sup>[10]</sup> It is the awareness of other alternatives and options in a situation, willingness to be flexible and to adapt to a situation, and the belief that one has the ability to be flexible.<sup>[11]</sup> In other words, cognitive flexibility is the ability to switch cognitive sets to adapt to changing environmental stimuli. Cognitive flexibility is positively correlated with problem-solving skills, coping with problem-solving oriented stress, and decision-making;<sup>[12]</sup> these are impaired in patients with suicidality.<sup>[13,14]</sup> Cognitive inflexibility enhances vulnerability to suicidal thinking by mediating greater brooding rumination and hopelessness.<sup>[15,16]</sup> Indirect evidence suggests a lower level of cognitive flexibility among nonwestern population.<sup>[17]</sup>

Impulsivity comprises of a wide range of actions that are poorly conceived, prematurely expressed, unduly risky, or inappropriate to the situation and those that often result in undesirable outcomes,<sup>[18]</sup> such as swift action without forethought or conscious judgment, behavior without adequate thought, and the tendency to act with less forethought than most individuals of equal ability and knowledge.<sup>[19]</sup> The ability to control our impulses is fundamental to day-to-day social functioning, and impairment predisposes to untoward events.<sup>[20]</sup> A significant proportion of suicides and attempted suicides are committed impulsively.<sup>[21,22]</sup> Elevated impulsivity facilitates the transition from suicidal thoughts to suicidal behavior<sup>[23]</sup> and interventions aimed to address impulsivity may reduce further attempts of suicide.<sup>[24]</sup> There is a paucity of research on impulsivity in suicide in India. Only one research by Menon *et al*, revealed a positive association of impulsivity and severity of intent in attempted suicide.<sup>[25]</sup> However, the study included subjects with parasuicide, diluting the accuracy of inferences to be made out of the findings.

The relationship between impulsivity, cognitive flexibility, and resilience is unknown. Impulsivity affects executive functions and hence may influence cognitive flexibility.<sup>[26]</sup> Indirect evidence suggests a positive association of low impulsivity (attentional performance) and cognitive flexibility,<sup>[27,28]</sup> whereas inflexibility may enhance impulsivity.<sup>[12,15,16,29]</sup> A similar trend seems to

be true for cognitive resilience as well.<sup>[9,30-32]</sup> However, resilience appears to have a reciprocal relationship with flexibility.<sup>[12,33]</sup> There is a dearth of research and a knowledge gap as to how these variables are related. This understanding may help to formulate management and preventive interventions and aid further research, especially as suicide is a global concern.

Keeping in view of the paucity of research in this area, and with the above background, this study was conducted to know the correlation between impulsivity, cognitive flexibility, and resilience among patients with attempted suicide, with the hypothesis that cognitive resilience and cognitive flexibility are positively interrelated and negatively related to impulsivity.

## MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted at the outpatient department of psychiatry in Jagadguru Sri Shivarathreeswara Medical College Hospital after approval from the institutional ethics committee. The department conducts a suicide prevention program, and patients are referred from medical and surgical departments for intervention after recovery from an attempted suicide. Participants were recruited while attending department of psychiatry, by purposive sampling method, after obtaining informed consent. Out of 311 patients screened, 270 met selection criteria. Inclusion criteria were a history of suicide attempt within 1 month, aged 18-65 years, of either gender. A suicide attempt was defined for our study as “self-inflicted, potentially injurious behavior with a nonfatal outcome for which there is evidence of intent to die”.<sup>[34]</sup> Participants were excluded if they were unable to provide the required information; had intellectual disability, terminal illness, or dementia; or if psychotic symptoms were present. All participants underwent psychiatric and medical evaluations by a psychiatrist and a physician, respectively. The participants were further evaluated with the assessment tools in the following order:

1. Sociodemographic and clinical proforma- This proforma covered age, gender, marital status, occupation, religion, socioeconomic status, residence, the method of suicide attempt, and family history of suicide
2. Cognitive flexibility scale (CFS)- The scale was developed by Martin and Rubin in 1995 to assess cognitive flexibility.<sup>[11]</sup> The CFS is a 12-item self-report scale that measures aspects of cognitive flexibility considered relevant for effective interactions and communication on a 6-point Likert scale (strongly disagree to strongly agree). Each item on the scale consists of a statement dealing with beliefs and feelings about behavior. The CFS

had high-internal consistency ( $\alpha = 0.76-0.77$ ), good concurrent and construct validity, and high-test-retest reliability ( $r = 0.83$ ) over 2 weeks.<sup>[11]</sup> The scale has been used in the Indian population previously.<sup>[35]</sup> Kannada translated and validated version of the scale was used for this study

3. Cognitive resilience scale (CRS)- This scale was developed by Smith MA in 2015.<sup>[36,37]</sup> Items of the scale are statements dealing with beliefs and feelings about behavior. This 10-item scale has five possible response ranging from strongly disagree = 1 to strongly agree = 5. To avoid a response bias, reverse scoring is done for item 2, 4, 5, 6, and 8. The score is obtained by adding up all 10 item scores, divided by 10. A higher score indicates better resilience. This scale predicts optimism about the future, life-goal tracking, satisfaction with productivity and effectiveness, and living according to core values. This self-administered scale can be administered in less than 10 min and has acceptable reliability and validity. In this study, Kannada translated and validated version of the scale was used
4. Barratt impulsiveness scale (BIS-15) - The BIS-15 was first developed by Spinella (2007) and is available in many languages, including Indian languages.<sup>[38]</sup> Items are scored on a 4-point scale from rarely/never, occasionally, often, and always/almost always. Some of the items are reverse scored to avoid response bias. The BIS-15 items score ranges from 1-4. Item numbers 1, 4,5,7, 8, and 15 are scored reverse. The scale can be administered in 10 min. The scale has three domains namely attention, motor, and nonplanning. Internal consistency was 0.793, and test-retest reliability was 0.80. This scale has been used in Indian population.<sup>[39,40]</sup> For this particular study, Kannada translated and validated version of the scale was used.

Data was analyzed using SPSS version 22. Descriptive statistics was used to describe sociodemographic and clinical characteristics. Assessment of the association of impulsivity with cognitive flexibility and cognitive resilience was done using linear regression model. Statistical significance for all tests was  $P = 0.05$ .

## RESULTS

The majority were male, married, educated (nongraduate), Hindus, of low socioeconomic status, from a rural background, and without a family history of suicide or current psychiatric diagnosis [Table 1]. Mean of age, CFS score, CRS Score, and BIS-15 score were 41, 44.93, 4.49, and 36, respectively [Table 1].

On multiple linear regression analysis ( $R^2 = 0.102$ ,  $df = 3$ ,  $F = 10.120$ ,  $P = 0.001$ ), when CRS score

**Table 1: Sociodemographic and clinical feature**

Variables	Frequency	Percent
Gender		
Male	187	69.3
Female	83	30.7
Marital status		
Single	77	28.5
Married	193	71.5
Education		
Uneducated	69	25.4
Primary	57	21.1
Middle	43	16.0
High school	59	21.9
Higher secondary	28	10.4
Graduate	14	5.2
Occupation		
Skilled	16	5.9
Semiskilled	108	40.0
Non-skilled	122	45.2
Unemployed	24	8.9
Religion		
Hindu	242	89.6
Non-Hindu	28	10.4
Residence		
Rural	217	80.4
Urban	53	19.6
Socioeconomic status		
Low	235	87.0
Middle	35	13.0
Method		
Organophosphorous compound	181	67.0
Aluminium phosphide	37	13.7
Potassium nitrate	14	5.2
Hanging	16	5.9
Phenyl	2	0.7
Medication overdose	20	7.4
Family History of suicide		
No	240	88.9
Yes	30	11.1
Psychiatric diagnosis		
No	253	93.7
Yes	17	6.3
	<b>Mean</b>	<b>Std. Deviation</b>
Age	41.41	16.70
CFS <sup>1</sup> score	44.93	2.50
CRS <sup>2</sup> score	4.49	0.25
BIS <sup>3</sup> score	36.13	2.13
BIS- non-planning	12.75	0.96
BIS- motor	10.82	0.69
BIS- attention	12.55	1.10

1 – Cognitive Flexibility Scale, 2 – Cognitive Resilience Scale, 3 – Barratt Impulsiveness Scale

was the dependent variable and subscales of BIS were the independent variables, 10% of the variance in the score of CRS was accounted for by subscales of BIS, with regression parameters to be 10. CRS score had a statistically significant association

with BIS-15-nonplanning ( $\beta = -0.23, t = -3.61, P = 009$ ) and BIS-15-attention ( $\beta = 0.30, t = 4.36, P = 001$ ) [Table 2].

On multiple linear regression analysis ( $R^2 = 0.102, df = 3, F = 10.120, P = 0.001$ ), when CFS score was the dependent variable and subscales of BIS were the independent variables, 10% of the variance in the score of CRS was accounted for by subscales of BIS, with regression parameters to be 10. CFS score had a statistically significant association with BIS-15-nonplanning ( $\beta = -0.23, t = -3.61, P = 001$ ) and BIS-15-attention ( $\beta = 0.30, t = 4.36, P = 001$ ) [Table 3].

In linear regression analysis ( $R^2 = 1.000, df = 1, F = 5.029, P = 001$ ), the score on CRS was entered as the dependent variable and CFS score was the independent variable. The variance (10%) in the score of CRS was accounted for by CFS score, with all regression parameters to be 5. There was a statistically significant positive association between CRS and CFS scores ( $\beta = 1.000, t = 2.24, P = 001$ ) [Table 4].

## DISCUSSION

This study aimed to examine the correlation between cognitive resilience, flexibility, and impulsivity. Elevated impulsivity and impaired cognitive function have been reported in attempted suicide.<sup>[13,15,16,41]</sup> Although positive association of impaired cognitive flexibility and severity of illness has been reported in gambling and obsessive compulsive disorder, there is hardly any literature on the relationship of impulsivity with cognitive flexibility and cognitive resilience among those with attempted suicide, and to the best of our knowledge, this is the first study to examine the relationships between these variables.<sup>[42,43]</sup>

In this study, the nonplanning domain of impulsivity was negatively, and attention was positively, associated with cognitive flexibility. This was statistically significant. There appears to be a close but negative association between cognitive inflexibility and impulsivity. Impulsivity may directly or indirectly hamper executive functions that determine cognitive flexibility.<sup>[26]</sup> Moore and Malinowski reported a positive association of attentional performance and cognitive flexibility in the general population.<sup>[27]</sup> Loyo *et al.* found a problem in inhibitory control in social contexts, together with subtle alterations in executive functions, in patients with suicidal tendency.<sup>[28]</sup> Presence of cognitive inflexibility may mediate suicidal ideation, increased brooding rumination, and hopelessness.<sup>[15,16]</sup> This may further enhance impulsivity.<sup>[29]</sup> Similarly, impaired cognitive flexibility may adversely affect problem-solving skills,

**Table 2: Relationships of BI and CR**

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.09	0.26		15.31	0.001
BIS -nonplanning	-0.06	0.017	-0.23	-3.61	0.001
BIS-motor	0.02	0.023	0.08	1.25	0.211
BIS-attention	0.06	0.016	0.30	4.36	0.001

Dependent Variable: CRS score;  $R^2=0.102, df=3, F=10.120, P=0.001$  (BIS – Barratt Impulsiveness Scale), BI – Barratt impulsiveness; CR – Cognitive resilience

**Table 3: Relationships of BI and CFS**

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	40.91	2.67		15.31	0.001
BIS -nonplanning	-0.60	0.16	-0.23	-3.61	0.001
BIS-motor	0.29	0.23	0.08	1.25	0.211
BIS-attention	0.68	0.15	0.30	4.36	0.001

Dependent Variable: CFS score;  $R^2=0.102, df=3, F=10.120, P=0.001$  (BIS–Barratt Impulsiveness Scale, CF–Cognitive Flexibility), BI – Barratt impulsiveness

**Table 4: Relationships between cognitive flexibility and cognitive resilience**

	Unstandardized Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.15	0		0	1.000
CFS Score	0.100	0	1.000	2.24	0.001

Dependent Variable: CRS score;  $R^2=1.000, df=1, F=5.029, P=0.001$  (CFS–Cognitive Flexibility Scale)

coping with stress, and decision-making, and may augment impulsivity.<sup>[12]</sup>

Another finding of this study was a statistically significant negative association of impulsivity with cognitive resilience. Impulsivity is reported to be inversely relate with resilience in general population.<sup>[30]</sup> Similarly, attention impulsivity and nonplanning impulsivity have been reported with low levels of resilience in bipolar disorder,<sup>[31]</sup> but no literature is available comparing these variables in attempted suicide. Indirect evidence suggests an impaired cognitive resilience in attempted suicide.<sup>[9,32]</sup> Since impulsivity adversely affects the factors contributing to resilience such as cognitive appraisal, locus of control, perception of predictability, and control, it can be stipulated that resilience is directly or indirectly impeded by impulsivity.<sup>[5]</sup>

We found an absolute correlation between cognitive flexibility and cognitive resilience. There appears to be a reciprocal relationship between these variables. Cognitive flexibility positively mediates nonaggressiveness



and tolerance, belief in social self-efficacy and problem-solving skills, coping with problem-solving oriented stress, and decision-making, and hence strengthens cognitive resilience.<sup>[12]</sup> On the other hand, resilient individuals are able to spontaneously generate new strategies in-action that support response to regular disturbances and potentiate cognitive flexibility.<sup>[33]</sup> We observed high scores on CFS (mean =  $44.93 \pm 2.54$ ) and CRS (mean =  $4.49 \pm 0.25$ ). Absolute correlation between variables is uncommon. It suggests that an increase of one standard deviation in the corresponding independent variable entails an increase of one or more than one standard deviation in the dependent variable. It can occur legitimately (though it poses a problem in interpretation) if there is a very high  $R^2$  or very low standard error, particularly when predictor variable is single and is highly interdependent or correlated.<sup>[44]</sup>

It is of interest that in attempted suicide (as observed in this study), high resilience and flexibility appear to be nonprotective. It may be likely that impulsivity (as observed in this study, BIS-15 mean score =  $36.13 \pm 2.13$ ) may have played a bigger role. There is an indication that impulsivity adversely affects resilience and flexibility (e.g., self-regulatory deficits, decision-making impairments).<sup>[30,45]</sup> On the other hand, there is indirect evidence that lack of flexibility (e.g., premeditation) and resilience (e.g., negative urgency, cognitive appraisal) are potential risk factors for suicidal behavior.<sup>[16,46]</sup> Thus, impulsivity may take a leading role and nullify the protective effects of resilience and flexibility.

It may be concluded that in attempted suicide, cognitive flexibility and resilience are positively interrelated and inversely associated with impulsivity (nonplanning and inattention). The findings imply that cognitive resilience, flexibility, and impulsivity should be assessed in attempted suicide and addressed appropriately. The findings of this study should be cautiously interpreted as study population were hospital- patients, and the study had a cross-sectional design and had no control group. Further research is needed to address these limitations to make the findings applicable to the general population.

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#### Conflicts of interest

There are no conflicts of interest.

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