

Association between cognitive flexibility and flourishing in patients with chronic non-communicable illnesses and healthy individuals

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ABSTRACT:

Background: Previously, cognitive flexibility (CF) which indicates ability to adapt and change course of action was associated with better health related quality of life. Flourishing is a wider index of positive health than quality of life. The study aimed to determine (i) the association between CF and flourishing and (ii) compare flourishing and CF between chronically ill patients and healthy persons.

Materials and Methods: Sixty participants of both genders (thirty patients with chronic non communicable illnesses and thirty healthy individuals) aged between 20 to 45 years were assessed for CF using (i) Cognitive Flexibility Scale and (ii) Trail Making Test B (TMT-B) whereas flourishing was determined using the Flourishing Scale. Data were analysed using (i) linear regression analyses (to obtain association between cognitive flexibility and flourishing) and (ii) independent t-test (to compare CF and flourishing scores of patients and healthy individuals).

Results: In multiple linear regression analyses, cognitive flexibility scores alone were a significant predictor for flourishing scores ($R^2 = .142$, $df = 58$, $p < 0.01$) in both, the group of patients and healthy individuals and in patients alone ($R^2 = .211$, $df = 28$, $p < 0.05$).

Conclusion: Cognitive flexibility determined by a self-report measure relevant to daily life positively predicts flourishing in patients with chronic illness, but not in healthy persons, possibly relative to accommodative coping in patients related to their illness. Also, patients with chronic non communicable illnesses do not differ from healthy persons with respect to cognitive flexibility or flourishing.

Keywords: Cognitive flexibility, flourishing, patients, healthy individuals.

INTRODUCTION:

Cognitive flexibility alludes to a person's cognizance of the availability of alternatives and achievable options in diverse situations which influences their ability to adapt to various circumstances.¹ Being cognitively flexible empowers an individual to function effectively to detach from a previous activity, recompose a new response set, and execute the new response set as required for the next activity.² Greater cognitive flexibility is associated with favorable outcomes at all ages including greater ability to read in childhood,³ better coping and resilience to stress and adverse life events as an adult,⁴ superior creativity in adulthood,⁵ and better quality of life in adults¹ and in older persons.⁶ Quality of life is a divergent concept comprising numerous factors often listed in the context of health, with good quality of life entailing being able to perform daily activities, work, having entertainment, social relationships, free time utilization, resources and positive experiences.⁷ However not all contributors to wellbeing are captured under health related quality of life, whereas the construct of flourishing includes additional domains related to life purpose and meaning, which are known to significantly contribute to overall wellbeing and that are not included in instruments measuring health related quality of life.⁸ Flourishing is considered the highest level of health, and people with high scores for flourishing have greater work productivity, lower healthcare costs, and longer life expectancy compared to non-flourishers.⁸ With this background, the present study aimed to determine the association between cognitive flexibility and flourishing.

However, a considerable volume of research has indicated a significant association between greater cognitive flexibility and improved well-being indices for mental health in patients with diverse

chronic medical conditions.⁹⁻¹² Hence a secondary aim of the study was to determine whether the association (if any) between cognitive flexibility and flourishing would be the same (and comparable) in healthy persons as compared to patients with chronic non-communicable illnesses. Finally, in research and clinical practice cognitive flexibility is determined with self-report scales and neuropsychological assessments, though the two approaches provide independent information.¹³ Hence the overall aims of the study were (i) to determine if an association exists between cognitive flexibility and flourishing, (ii) to determine whether any association found is the same/different in persons of normal health compared to those with chronic non-communicable illness and (iii) whether the method used to assess cognitive flexibility (i.e., a self-report scale versus a neuropsychological test performance) would influence any association found.

METHODS:

Participants:

Sixty participants of both sexes with ages between 20 and 45 years were recruited. Of these, thirty were patients with chronic non-communicable illness (male: female= 15: 15; group average age \pm standard deviation (mean \pm SD): 32.47 \pm 8.17 years) recruited from the outpatient department of a hospital, whereas another thirty participants (male: female= 15: 15; group average age \pm standard deviation (mean \pm SD): 26.07 \pm 3.3 years) were healthy individuals studying in a state university. Patients with chronic (over three months duration) non-communicable illnesses i.e., endocrine, nutritional or metabolic diseases, skin diseases, diseases of digestive system, etc. were included whereas following an interaction and on the basis of the ability to understand and

respond to simple commands and answer appropriately, patients with mental health problems, cognitive impairment, and problem in executive functions were excluded from the study (none were excluded for these reasons). A semi-structured interview was filled in by healthy participants to confirm their health status and include them in the study. Written informed consent was taken prior to data collection. The study was approved by the Institutional Ethics Committee (approval number: PRF/YRD/022/005).

Study design and procedure: This cross-sectional comparative trial was carried out between September to November 2022. Eligible patients were recruited from new admissions to a wellness centre whereas healthy participants were recruited from a state university in north India. The recruitments were done by oral announcements and flyers in the centres. There was no incentive to take part in the study. Assessments were carried out during working hours for 6 days/week. The timings were based on the availability of research personnel to administer the questionnaires hence this was based on convenience. Participants were assessed individually in a side room with no disturbance during a forty minutes session. Questions were read aloud to each participant and were explained further if required. The following questionnaires were then given to the participants, who completed them on their own with help if needed: (i) Socio-demographic information (age, gender and years of education), (ii) the Flourishing Scale,¹⁴ (iii) Cognitive flexibility scale¹⁵ and (iv) Trail Making Test B.¹⁶

Assessments:

The questionnaires used in the present study were translated into Hindi in three steps: (i) one independent translator translated the English version of each questionnaire to Hindi, (ii) one independent translator back-translated the Hindi version of the questionnaires to

English to determine if there were any discrepancies (iii) any discrepancy was resolved with mutual discussion.

Participants were assessed using (i) the Flourishing Scale, (ii) the Cognitive flexibility scale and (iii) the Trail Making Test B when they were seated at ease.

(i) **The Flourishing Scale** - The Flourishing Scale consists of 8 items, assesses self-perceived success in relationships, self-esteem, purpose in life, and optimism. The participants were asked to respond on a 7-point Likert scale, ranging from 1 (Strongly disagree) to 7 (strongly agree) with total possible scores ranging between 8 and 56.¹⁴

(ii) **Cognitive Flexibility Scale** -The Cognitive Flexibility scale consists of 12 items, determines awareness of communication alternatives, willingness to adapt to challenging situations, and self-efficacy in being flexible. Participants were asked to rate each item on a 6-point scale ranging from 1 (strongly disagree) to 6 (strongly agree) with total possible scores ranging from 12 to 72.¹⁵

(iii) **Trail Making Test B**-Trail Making Test B is indicative of executive function, executive control or the ability to flexibly shift the course of an ongoing activity. Firstly the participant was instructed individually to connect numbers (from 1 to 13) and letters (from A to L) alternately in consecutive order (1-A, 2-B, 3-C...) as quickly as possible without lifting the pen from the paper and a sample part was used to see how much they understood. After this the actual test was performed.¹⁶ The time taken to complete the test was noted using a stopwatch which had the accuracy of 10 milliseconds.

DATA ANALYSIS:

Comparative analysis

With SPSS version 24.0, independent t-test was performed to compare cognitive flexibility and flourishing between patients

with chronic non-communicable illnesses and healthy individuals. Pearson correlation coefficient and linear regression analyses were performed to examine the association between the scores of (i) Cognitive Flexibility Scale with the Flourishing Scale and (ii) the Trail making test B with the Flourishing Scale.

Linear regression analyses were carried out for the variables which showed significant correlations based on the Pearson correlation test. The forced entry method of linear regression analysis was selected. Based on the results of Pearson correlation test, there was a single model with Flourishing scale scores as a dependent variable while cognitive flexibility scores were the independent variable in both (a) group of patients and healthy persons combined and in (b) the patients alone.

RESULTS: Sixty participants (thirty patients and thirty healthy persons) completed the study satisfactorily. **The three most common illness categories among patients based on ICD 11 were (i) endocrine, nutritional or metabolic diseases (26.67%), (ii) skin diseases (13.33%) and (iii) diseases of digestive system (10.00%).** The baseline characteristics of the participants are given in Table 1. The group mean \pm SD values for (i) the Cognitive flexibility scale (ii) the Flourishing Scale and (iii) time taken to complete the Trail Making Test (TMT) B are given in Table 2.

The Pearson correlation test showed a significant positive association between the scores of Cognitive Flexibility Scale and the Flourishing Scale ($r=.38$, $df= 58$, $p<0.01$) in the patients and healthy persons combined and in the patients alone ($r = 0.46$; $df= 28$, $p <0.05$). In the linear regression analyses, cognitive flexibility scale scores acted as a significant predictor for the Flourishing Scale scores (R^2 coefficient for the model = 0.142, $df= 58$, $p<0.01$) in group of patients and healthy

persons combined and in the patients alone (R^2 coefficient for the model = 0.211, $df= 28$, $p<0.05$). The regression coefficients, standard errors and p-values for group of patients and healthy persons combined and for the patients alone are presented in Table 3 and Table 4 respectively. Regression coefficient and standard error are presented in Figure 1 (a scatter plot) showing the relation between the scores of Cognitive Flexibility Scale and the Flourishing Scale. Also, patients with chronic non communicable illnesses do not differ from healthy persons with respect to cognitive flexibility or flourishing.

DISCUSSION:

Cognitive flexibility scale scores positively predicted flourishing accounting for 14.2 percent of variance for the group of patients and healthy persons combined, with 21.1 percent variance accounted for patients alone. Here, the patients included non-communicable illnesses i.e., especially endocrine, nutritional or metabolic diseases, skin diseases, diseases of digestive system. There was no association between cognitive flexibility scores and flourishing in healthy persons alone, or between TMT B time required (an index of cognitive flexibility) and flourishing in all persons studied.

The results can be considered comparable to a previous report of cognitive flexibility predicting higher health related quality of life in older persons.⁶ Flourishing includes the dimensions of functioning included under health-related quality of life, with flourishing additionally including having a purpose in life and goals.⁸ Goals represent states a person aims to achieve by their actions.¹⁷ It is recognized that being engaged with specific need-satisfying goals increases a person's subjective wellbeing.¹⁸ Cognitive flexibility is considered to help a person to be cognitively receptive to alter these goals if required, allowing for an accommodative adaptive response with a flexible

modification of goals based on available resources.¹⁹

In the present study in patients with non-communicable illnesses cognitive flexibility positively predicts flourishing, which was not seen in healthy persons. This difference may be related to specific aspects of functioning which are changed in patients with chronic illness. Events such as a chronic illness or the gradual decline of capacities because of aging may be detrimental to achieving goals.²⁰ If people continue to strive to attain goals which can longer be attained, their wellbeing is negatively impacted.²¹ The dual process model of Brandtstädter & Rothermund (2002) describes how coping strategies may differ; while assimilative coping strategies lead to an unchanging pursuit of goals, in contrast accommodative coping strategies are associated with flexible goal adjustment.²² ²³ When people with chronic illness are confronted with sustained failure to fulfil their premorbid goals despite additional effort, some persons may be receptive to alter their goals, setting the stage for an accommodative adaptive response. Central to this accommodative mode of functioning is cognitive flexibility.²⁴ Hence the positive association between cognitive flexibility and flourishing in patients with chronic illness seen here may be related to the patients' ability to make changes in their goals (and other required changes) based on their illness. Since such adaptations may not be as frequent or necessary in healthy persons, flourishing in normal health may not depend to the same degree on being cognitively flexible as in patients with chronic illness.

The present results show that self-report scores of cognitive flexibility based on a standard scale¹⁵ predicted flourishing whereas the TMT B time scores did not. The TMT B measures cognitive flexibility

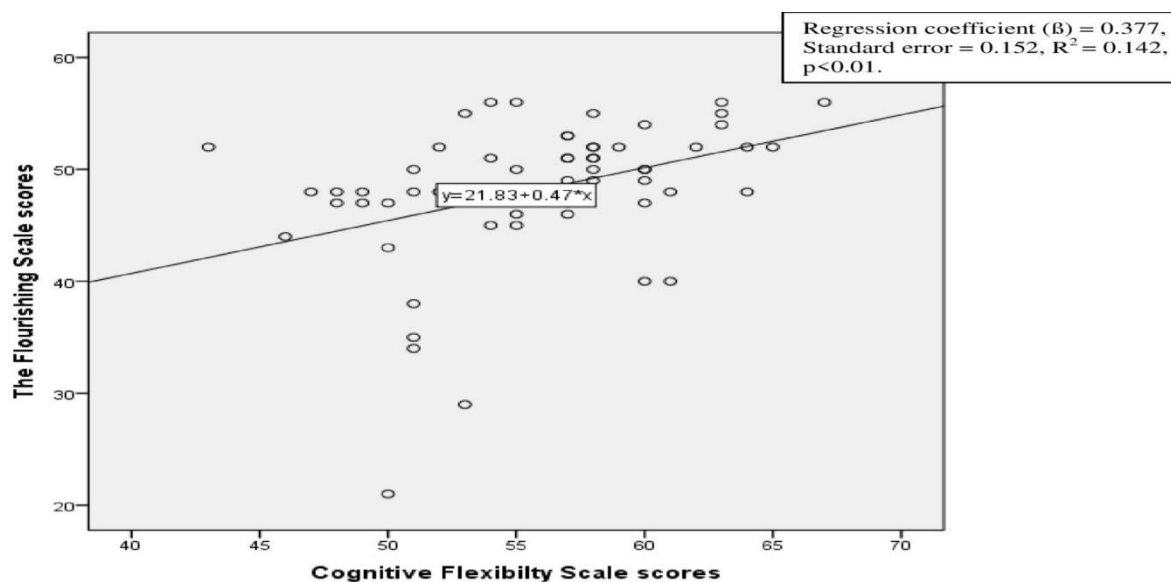
based on the time taken by the participant to complete the task requiring shifting between sets of numbers and letters.²⁵ This method reduces subjective biases (participant responding to conform to social norms can influence self-report scores) using a laboratory based task.²⁶ These tasks can be influenced by other aspects of cognition and by practice effects.²⁶ In contrast, self-report measures assess cognitive flexibility as applied to situations in daily life, outside the laboratory with higher validity and generalizability in social situations.²⁷ However, these scales are more subjective and participants may modify their responses to fit in with accepted societal norms.²⁷ The present results suggest that cognitive flexibility assessed with self-report scales, indicating cognitive flexibility in daily life settings, positively predicted flourishing. In contrast time taken to complete TMT B did not predict flourishing, suggesting that cognitive flexibility as relevant to shifting cognitively between structured sets of information may be less relevant to overall flourishing in patients. Carrying out testing the association of self-report measures and neuropsychological tasks with flourishing in a larger sample size would add value to this finding which can be considered exploratory. The findings hence are limited by the sample sizes of patients and healthy persons. Also, it would have been desirable to study aspects of functioning directly related to the association between cognitive flexibility-flourishing, such as accommodative capacity in the drive to achieve goals.

CONCLUSION: In summary the present results indicate that cognitive flexibility determined by a self-report measure relevant to daily life positively predicts flourishing in patients with chronic illness.

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Legend for figure 1.

Scatter plot of linear regression analysis with Cognitive Flexibility Scale scores predicting The Flouring Scale scores (n=60).

Table 1: Baseline characteristics of participants

Characteristics	n = 30 (patients with non-communicable illnesses)	n = 30 (healthy individuals)
Age (years)		
Age range	20- 45	22-38
Group mean age \pm SD	32.47 \pm 8.17	26.07 \pm 3.3
Gender		
Male: Female		
Actual values	15:15	15:15
Percentage values	50:50	50:50
Diagnosed disease according to ICD-11	Percentage values	
Endocrine, nutritional or metabolic diseases	26.67	NIL
Diseases of circulatory system	10	
Diseases of digestive system	10	
Diseases of skin	13.33	
Diseases of musculoskeletal system or connective tissue	6.67	
Diseases of genitourinary system	6.67	
Other non-communicable diseases	26.67	

Table 2: Values of flourishing, cognitive flexibility and TMT B

Variables	Values (Mean \pm SD)	
	Patients with chronic non-communicable illnesses	Healthy individuals
Flourishing (scores)	47.70 \pm 5.41	48.70 \pm 7.45
Cognitive Flexibility (scores)	56.03 \pm 4.11	55.67 \pm 6.13
Time taken to complete TMT B (in seconds)	80.97 \pm 27.01	71.90 \pm 18.56

Table 3: Regression coefficient, standard error, variance inflation factor and p-value for regression analysis with cognitive flexibility scores as predictor of flourishing in patients and healthy individuals (n=60).

Dependent variable	Predictor variables	Regression coefficient (β)	Standard error	Tolerance	Variance inflation factors	p-value
Flourishing	Cognitive Flexibility (scores)	0.377	0.152	1	1	<0.01

Table 4: Regression coefficient, standard error, variance inflation factor and p-value for regression analysis with cognitive flexibility scores as predictor of flourishing in patients with chronic non-communicable diseases (n=30).

Dependent variable	Predictor variables	Regression coefficient (B)	Standard error	Tolerance	Variance inflation factors	p-value
Flourishing	Cognitive Flexibility (scores)	0.460	0.221	1	1	<0.05