

Perceived Stress and its Epidemiological and Behavioral Correlates in an Urban Area of Delhi, India: A Community-Based Cross-Sectional Study

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ABSTRACT

Background: Increasing stress has been recognized as a major public health problem in the developing world accelerated by an ongoing demographic, economic, and sociocultural transition. Our study objectives were to validate a Hindi version of the 10-item Perceived Stress Scale (PSS-10) and to also assess the extent of perceived stress and its correlates among an adult population in an urban area of Delhi. **Methodology:** A community-based cross-sectional study was conducted in an urban resettlement colony of Delhi among 480 adult subjects aged 25–65 years, during the period from January to December 2015. The PSS-10 was translated into Hindi and validated in the study population. Data was analyzed using IBM SPSS Version 25. **Results:** A total of 243 (50.6%) men and 237 (49.4%) women were enrolled. The scale had an acceptable level of internal consistency (Cronbach's alpha = 0.731). A principal component analysis was run on the PSS-10 data, based on which a three-component structure was accepted, which explained 61% of the total variance. The mean PSS score was 19.25 (SD = 4.50) years. Perceived stress was highest in the 35–50 age group. On multivariate analysis, low socioeconomic status and a white-collar occupation were found to be associated with increased perceived stress ($P < 0.001$). **Conclusion:** A high burden of perceived stress exists in residents of a low-income urban population in India.

Key words: Hindi, India, PSS-10, stress

Key messages: The Hindi version of the PSS-10 is a valid and reliable instrument for measuring perceived stress in the community.


Growing stress in the developing world is indicative of unresolved physical and emotional tensions accentuated by the fast-changing demographic, economic, and sociocultural landscape. Chronic stress negatively influences health and well-being in relation to mental health, cardiovascular disease, diabetes, obesity, etc.^[1-5]

Stress is a dynamic concept influenced by the relationship between the environment and the individual and its effect upon the individual varies

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How to cite this article: Pangtey R, Basu S, Meena GS, Banerjee B. Perceived stress and its epidemiological and behavioral correlates in an Urban Area of Delhi, India: A community-based cross-sectional study. *Indian J Psychol Med* 2020;42:80-6.

Access this article online	
Website: www.ijpm.info	Quick Response Code 
DOI: 10.4103/IJPSYM.IJPSYM_528_18	

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Received: 23rd December, 2018, **Revision:** 24th January, 2019, **Accepted:** 28th July, 2019, **Publication:** 06th January, 2020.

with his or her ability in coping with it.^[6] Perceived stress is a measure of the degree to which situations in one's life are appraised as stressful and is comprised of sociocultural context dependent on medical, physical, psychological, and psychosocial aspects.^[7] The appraisal of this perceived stress is considered to supersede the assessment of stressful life events.^[8]

Previous studies have shown that sociodemographic factors (like educational level, socioeconomic status, neighborhood profile, and gender) and behavioral risk factors (like smoking and alcohol consumption) are also associated with perceived stress.^[9-14] However, most Indian studies on perceived stress have been conducted within specific population subgroups, but there is a lack of data regarding perceived stress and associated factors in the general population.^[15-18] Understanding the factors associated with stress in Indian populations can enhance the development of community-based interventions for stress reduction. Furthermore, early identification of individuals and subgroups with an accumulation of stress-related risk factors may provide opportunities for early strategic intervention for prevention of adverse behavioral and health outcomes.^[11]

Perceived Stress Scale (PSS), developed by Sheldon Cohen, is used as a self-appraisal measure for individuals to assess the extent of the perceived stressfulness of their various life situations.^[19] Various studies in India have used the scale, but to our knowledge, it has not been previously validated in a predominantly Hindi speaking population.

Our study objectives were to validate a Hindi version of the PSS and to also assess the extent of perceived stress and its correlates among an adult population in an urban area of Delhi.

METHODOLOGY

A community-based cross-sectional study was conducted in an urban resettlement colony in the Gokalpuri area located in the North-East district of Delhi, India during the period from January to December 2015. The population of the area was approximately 23,187 (December 2013). The study site was chosen as it is the field practice area of the Department of Community Medicine of a premier medical college in Delhi. The study area is a resettlement colony of an urban slum and comprises a densely populated, low-income population.

Adult individuals aged from 25 to 65 years who were residing in the area for a minimum period of 6 months and could understand and converse in Hindi were included in the study. Those who, at the time of the interview, were suffering or recuperating from serious

illnesses which had required hospitalization were excluded.

We conducted a secondary analysis of data collected originally for a study ascertaining the burden of behavioral risk factors related to select non-communicable diseases in 480 subjects.^[20]

The sampling unit for the present study was a household. Systematic random sampling was applied for selection of houses. Every ninth house was selected. If the selected house was found to be locked, it was visited three more times. In the eventuality that data could not be collected from the same house or no eligible individual was available in the household, the next house was selected. From each familial household, a maximum of two individuals, each of the opposite sex, were enrolled in the study. If multiple eligible individuals were available in the same household, the study subjects were selected randomly by a draw of lots. A maximum of 10 individuals were enrolled in a day.

Data were collected from the subjects using a semi-structured patient interview schedule. The perceived stress was measured using PSS.^[19] The scale was linguistically validated into the local language Hindi. The translation process included: (1) Forward translation of the original PSS into Hindi was done by a native speaker, (2) the back-translation into English was done by another native speaker, (3) this forward and back-translation process was continued until the back-translated version matched with the original English version of the scale, (d) the translated version was pretested in 10 adults who were not included in the study [Supplement 1]. The PSS was verbally administered to those subjects who were illiterate or lacked functional literacy or on their request.

The PSS has been widely used and psychometrically validated as a reliable measure of psychological stress estimated over the previous 4 weeks.^[19] It comprises of 10 items measured on a five-point Likert scale (0: never, 1: almost never 2: sometimes 3: fairly often 4: very often). The PSS construct demonstrates a two-factor structure; the first being "general stressors" and the second being "the ability to cope."^[21] The PSS score is obtained by summing the scores of all the items, with reverse coding for items 4, 5, 7, and 8 as they are positively stated. The PSS score ranges from 0 to 40, with the 40 point score representing the highest perceived stress level. The PSS does not have any diagnostic cutoff to differentiate between the stressed and not stressed individuals.

The socioeconomic status of the subjects was assessed using the modified Kuppaswamy classification updated

for 2014 income criteria.^[22] Current daily smokers were defined as those who were currently smoking cigarettes, bidis, or hookah daily in the previous 7 days. Current daily smokeless tobacco users were defined as those who were currently using chewable tobacco products like gutka, naswar, khaini, or zarda paan daily in the previous 7 days. Heavy drinking was defined as a quantity of alcohol consumption that exceeds an established threshold value which in the present study was set at more than 14 drinks per week for men (or >4 drinks per occasion) and more than seven drinks per week for women (or >3 drinks per occasion).^[23] Weight and height of the subjects were also recorded to calculate the body mass index (BMI). The Asia-Pacific classification of BMI, which has a lower cutoff for overweight and obesity, was accepted for this study.^[24]

Ethics: Ethical clearance was obtained from the Institutional Ethics Committee of the medical college. All subjects gave their written and informed consent before their enrolment in the study.

Statistical analysis: The data was analyzed using IBM SPSS Version 25.

A principal component analysis (PCA) was run on the 10-item PSS to ascertain its construct validity. The present dataset satisfied the PCA requirements regarding the linear relationship between variables and adequacy of sample size. The Cronbach alpha and the Spearman-Brown split-half reliability coefficient were calculated to establish the reliability of the PSS.

Categorical variables were expressed as frequency and proportion, while continuous variables were expressed as mean and standard deviation. The Mann-Whitney U test and the Kruskal-Wallis H test were used to determine if there was a statistically significant median difference in perceived stress levels between two or more groups, respectively. A multiple regression analysis was run to predict the PSS score (dependent variable) from the independent variables that showed statistically significant association with higher PSS scores on bivariate analysis. There was linearity as assessed by partial regression plots and a plot of studentized residuals against the predicted values. There was homoscedasticity as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. The assumption of normality was met, as assessed by a Q-Q Plot.

Due to the multiple comparisons involved, the Bonferroni correction was applied (0.05/11) and a *P* value <0.004 was considered as statistically significant.

RESULTS

The mean (\pm SD) age of the subjects was 37.9 (11) and ranged from 25 to 64 years. A total of 243 (50.6%) men and 237 (49.4%) women were enrolled. The socioeconomic class of the subjects was lower in a majority (62) of the subjects, with 113 (23.5%) belonging to the lower middle class and 279 (58.1%) to the upper lower class [Table 1].

The mean PSS score was 19.25 (SD = 4.5) years. The scale had an acceptable level of internal consistency, as determined by a Cronbach's alpha of 0.731. The Spearman-Brown split-half reliability coefficient was also adequate (0.71). The translated Hindi version of PSS is provided as online supplementary material.

PCA of the PSS-10 was conducted. The suitability of PCA was assessed before analysis. Inspection of the correlation matrix showed that all variables had at least one correlation coefficient greater than 0.3. The overall Kaiser-Meyer-Olkin (KMO) measure was 0.633, classifications of "mediocre" according to Kaiser, while the individual KMO values for all the items were greater than 0.4, which suggested retaining all the items of the

Table 1: Sociodemographic characteristics of study sample (n=480)

Variable	n (%)
Age	
18-34	225 (47)
35-50	156 (32.4)
>50	99 (20.6)
Sex (Gender)	
Men	243 (50.6)
Women	237 (49.4)
Marital status	
Married	346 (72.1)
Unmarried	123 (25.6)
Divorced	11 (2.3)
Family type	
Nuclear	288 (60)
Joint	192 (40)
Educational status	
No schooling	101 (21)
<10 years	159 (33.2)
≥10 years	220 (45.8)
Occupation	
Professional	45 (9.4)
Semi-Professional	23 (4.8)
Clerical/shop owner	54 (11.3)
Skilled worker	42 (8.8)
Semi-skilled	54 (11.3)
Unskilled	142 (29.6)
Housewife	120 (25)
Socioeconomic Status	
Upper	22 (4.6)
Upper middle	47 (9.8)
Lower middle	113 (23.5)
Upper Lower	279 (58.1)
Lower	19 (4)

PSS-10. Bartlett’s Test of Sphericity was statistically significant ($\chi^2 = 1526.04$, $df = 45$, $P < 0.001$), indicating that the data was likely factorizable.

PCA revealed three components that had eigenvalues greater than one, which explained 34.2%, 16.6%, and 10.1% of the total variance, respectively. Component loadings of the rotated solution are shown in Table 2. Visual inspection of the scree plot with a cutoff of an eigenvalue ≥ 1 also indicated that the three components should be retained [Figure 1]. Strong loadings of items relating to “perceived helplessness” were present in component 1 (items 1, 2, 6), “perceived distress” in component 2 (items 9, 10), and “self-efficacy for coping” in component 3 (items 5, 7, 8).

On bivariate analysis, subjects of lower education level (less than 10 years), of lower socioeconomic status, who were married, or having diabetes were observed to show significantly higher median PSS scores ($P < 0.004$). A Kruskal-Wallis H test was conducted to determine if the PSS score in the subjects differed by age and BMI [Table 3]. A post-hoc analysis using the Mann-Whitney U test revealed that the increase in the median PSS scores from 0--34 to 35--50

age group was statistically significant ($P < 0.001$). Furthermore, the increase in the median PSS score from underweight to overweight ($P = 0.001$) and the decrease from normal to obese ($P = 0.001$) were also statistically significant.

The multiple regression model statistically significantly predicted PSS, $F(8, 471) = 13.8$, $P < 0.0005$, adjusted $R^2 = 0.18$. The variables socioeconomic status (coded high/middle = 1, lower = 0), employment type (coded 1 = white collar, 0 = non-white collar), and marital status (coded 1 = married, 0 = unmarried) added statistically significantly to the prediction ($P < 0.004$). The regression coefficients and standard errors are reported in Table 4.

Self-rated health status was reported as *excellent* by 66 (13.8%), *very good* by 112 (23.3%), *good* by 180 (37.5%), *fair* by 93 (19.4%), and *poor* by 29 (6%) subjects. Furthermore, adherence to healthy lifestyle habits was reported as *excellent* by 48 (10%), *very good* by 143 (29.8%), *good* by 164 (34.2%), *fair* by 113 (23.5%), and *poor* by 12 (2.5%) subjects.

DISCUSSION

The present study assessed the reliability and factor structure of the PSS-10 in a general population in an urban area in Delhi. The study findings of the Hindi PSS-10 revealed a three-component structure which is in variance with previous studies which had supported a two-component structure comprising of “perceived helplessness” and “perceived self-efficacy for coping.”^[25,26] The three-component structure in our study additionally indicates the presence of “distress.”

The amount of total variance explained by the two-component structure was 51%, which is consistent with previously published studies on PSS-10.^[25-26] Furthermore, the three-component structure of our study explained 61% of the total variance.

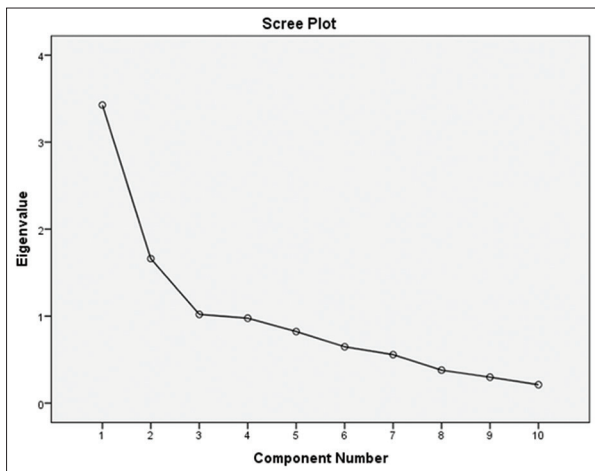


Figure 1: Scree Plot of the Perceived Stress Scale-10

Table 2: Rotated Structure Matrix for PCA with Varimax rotation of a three component (PSS-10) questionnaire*

	Component		
	1	2	3
PSS 1 felt upset because of something that happened unexpectedly?	0.792	0.112	0.040
PSS 2 felt unable to control the important things in your life?	0.668	0.320	0.007
PSS 3 felt nervous and “stressed”?	0.737	0.282	0.166
PSS 4 felt confident about your ability to handle your personal problems?	-0.627	0.326	-0.033
PSS 5 things were going your way?	0.083	-0.121	0.907
PSS 6 felt could not cope with all the things that you had to do?	0.61	0.515	0.030
PSS 7 felt able to control irritations in your life?	0.23	0.340	0.632
PSS 8 felt you were on top of things?	-0.17	0.478	0.629
PSS 9 angered because of things that were outside of your control?	0.078	0.710	0.109
PSS 10 felt difficulties were piling up so high that you could not overcome them?	0.342	0.636	0.152

*Varimax rotation with Kaiser Normalization. PCA - Principal component analysis, PSS - Perceived stress scale

Table 3: Association between perceived stress score and sociodemographic variables (n=480)

Variable	Mean (SD)	n (%)	PSS median score (IQR)	P
Age				
18-34	37.9±	225 (47)	19 (5)	<0.001*
35-50	11.0	156 (32.4)	21 (5)	
>50		99 (20.6)	19 (5)	
Sex (Gender)				
Men	-	243 (50.6)	19 (6)	0.02**
Women		237 (49.4)	20 (4)	
Education (years)				
<10	8.0±5.2	260 (54.2)	20 (4)	<0.001**
≥10		220 (45.8)	18 (5)	
SES				
Upper/Middle	-	182 (38)	17 (5)	<0.001**
Lower		298 (62)	20.5 (5)	
Marital status				
Married	-	346 (72.1)	20 (5)	<0.001**
Unmarried		134 (27.9)	18 (6)	
Family type				
Nuclear	-	288 (60)	20 (5)	0.02**
Joint		192 (40)	19.5 (5)	
Employment type				
White collar	-	122 (25.4)	20 (5)	0.37**
Others		346 (72)	20 (5)	
Daily tobacco smoking				
Present	-	53 (11)	20 (8)	0.42**
Absent		427 (89)	19 (5)	
Daily smokeless tobacco use				
Present	-	60 (12.5)	20 (5)	0.02**
Absent		420 (87.5)	19 (6)	
Heavy drinking				
Present	-	113 (23.5)	20 (4)	0.14**
Absent		367 (76.5)	20 (6)	
BMI				
Normal	21.3±4.8	150 (31.3)	20 (6)	<0.001*
Underweight		154 (32.1)	18 (6)	
Overweight		134 (27.9)	21 (3)	
Obese		42 (8.8)	17 (5)	
Diabetes				
Present	-	42 (8.8)	21 (4)	0.004**
Absent		438 (91.3)	19 (6)	
Hypertension				
Present	-	91 (19)	20 (4)	0.11**
Absent		389 (81)	20 (6)	

*Kruskal-Wallis H Test, **Mann-Whitney U Test. SES - Socioeconomic status, BMI - Body mass index

Table 4: Summary of Multiple Regression Analysis

Variable	B	95% CI	P
Intercept	16.73		< 0.001
Age (Years)	0.02	-0.02 - 0.06	0.26
Male sex	0.72	-0.18 - 1.16	0.11
≥10 years education ⁺	1.65	0.59 - 2.7	0.002
Married ⁺	1.98	0.94 - 3.0	< 0.001*
Nuclear family ⁺	0.28	-1.09 - 0.53	0.50
White collar occupation ⁺	3.34	2.16 - 4.53	< 0.001*
Upper SES ⁺	-5.5	-6.85 - (-4.1)	< 0.001*
BMI	-0.02	-0.10 - 0.06	0.62

*P<0.001; B=unstandardized regression coefficient; ⁺Sex (1=male, 0=female), education (1 = ≥ 10 years, 0 = < 10 years), marital status (1=married, 0=unmarried), employment type (1=white collar, 0=others), SES (high/middle=1, lower=0). SES - Socioeconomic status, BMI - Body mass index

Our study found that mean perceived stress level measured by the PSS-10 was 18.69 in men and 19.75 in women. The mean PSS score was also lower in young people aged below 35 years. Large population-based studies conducted in the general population of the developed world had also found higher mean PSS scores among women compared with men, but the mean PSS scores were found to be much lower. A cross-sectional study in Denmark reported mean PSS scores of 11.7 in 5,346 women respondents and 10.2 in 4,676 men respondents.^[11] Three national-level surveys in the United States (US) also found higher mean PSS scores among women than men, but in contrast to the present study, reported an increase in the PSS scores with decreasing age.^[10] The US surveys also showed that mean PSS scores increased in men from 12.07 to 15.52 from 1983 to 2009 and in women from 13.68 to 16.14 during the same period. Mean PSS scores in a five-country Western European study in the elderly population was 17.6.^[27] Developed countries with much higher human development indices, overall material prosperity, and relative lack of economic insecurity are expected to show lower stress levels in their populations compared with populations in the developing world. Nevertheless, the perceived stress levels in our study are only slightly higher compared with those in the US study. This could be due to the phenomenon of relative deprivation in which, despite the lack of absolute deprivation, the perceptions of inequality could translate into stress.^[28]

Low educational level was not found to be a significant predictor of increased stress in the present study. Although a high educational level can also act as a stressor, it has been suggested that the ability to cope with stress improves with education.^[11] Furthermore, similar to previous studies, we also found higher PSS scores in subjects belonging to the lower socioeconomic classes.^[9-11]

Unemployment or the lack of a means of employment in those who desire to work has been previously reported to be associated with increased perceived stress due to the likelihood of lack of financial autonomy.^[10] However, in our study, those with a white-collar job reported higher perceived stress. This could be due to the large number of homemakers in our sample whose perceived stress levels differed from those of the unemployed.

In the present study, married participants reported increased levels of perceived stress compared with those who were unmarried, although marriage is usually considered to lower perceived stress levels.^[29] However, it is also known that factors related to economic

deprivation can contribute towards stress spillover in marriages.^[30]

The strengths of the present study are that it is one of the first studies from India that validated the PSS-10 scale and assessed the perceived stress in the general population from a low-income community. However, there are certain limitations to our study. First, it is a cross-sectional study due to which temporal relationship between perceived stress and the various stressor variables cannot be determined. Second, the study did not take into account several factors like social isolation and neighborhood profile, which can influence perceived stress levels among individuals in a community.^[11,14,29] Third, our study did not include elderly subjects (aged ≥ 65 years) who are known to experience greater perceived stress.^[31] Finally, the study was conducted in a single community in Delhi, which limits its external validity.

In conclusion, perceived stress in a low-income urban Indian population was high, with low socioeconomic status and lack of white-collar employment being its covariates. Future studies should assess the role of social networks in the Indian context for coping with perceived stress.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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