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DEPRESSIVE SYMPTOMS, COGNITIVE IMPAIRMENT AND FUNCTIONAL IMPAIRMENT IN A RURAL ELDERLY POPULATION IN INDIA: A HINDI VERSION OF THE GERIATRIC DEPRESSION SCALE (GDS-H)

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ABSTRACT

Objective. To measure depressive symptomatology in a largely illiterate elderly population in India, using a new Hindi version of the Geriatric Depression Scale (GDS-H), and to examine its distribution and associations with age, gender, literacy, cognitive impairment and functional impairment.

Design. A Hindi version of the Geriatric Depression Scale was developed and administered to participants along with measures of demographic characteristics, cognitive functioning and functional ability.

Setting. The rural community of Ballabgarh in northern India.

Participants. A community sample of 1554 mostly illiterate Hindi-speaking residents of Ballabgarh aged 55+.

Measures. The Hindi version of the Geriatric Depression Scale (GDS-H); the Hindi Mental State Exam (HMSE); the Everyday Abilities Scale for India (EASI); age, gender and literacy.

Results. The GDS-H had high internal consistency and a factor structure comparable to the original English language version. The overall distribution of scores was higher than reported from other populations. Greater numbers of depressive symptoms, as measured by higher scores on the GDS-H, were associated with older age and illiteracy. Among the illiterate, there was no gender difference while among the literate, higher GDS-H scores were found among women. Cognitive impairment and functional disability were independently associated with higher scores on the GDS-H after adjustment for age, gender and literacy.

Conclusion. A reliable and valid Hindi version of the GDS has been developed. Depressive symptoms as measured by the GDS-H were prominent in this elderly illiterate northern Indian population and strongly associated with both cognitive and functional impairment. Copyright © 1999 John Wiley & Sons, Ltd.

KEY WORDS—Hindi Mental State Exam (HMSE); Everyday Abilities Scale for India (EASI); developing countries; epidemiology; ageing; community studies; activities of daily living (ADL)

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As the world's population ages, there is growing interest in the prevalence and significance of depressive symptoms and disorders in the elderly. The excess disability, morbidity and mortality associated with late life depression has been well established (Alexopoulos *et al.*, 1996; Bruce *et al.*, 1994; Carney *et al.*, 1995; Frasure-Smith *et al.*, 1995; Lindesay, 1989; Mossy *et al.*, 1990; Rabins *et al.*, 1985; Zubenko *et al.*, 1997). Most of the research on this topic has been carried out in industrialized societies; however, the majority of the world's elderly reside in developing countries (US Bureau of the Census, 1992). From a global public health perspective, it is clearly important to document the distribution and characteristics of depressive symptomatology in older populations in developing countries.

During 1991–1999, we conducted the Indo-US Cross-National Dementia Epidemiology Study, which included an epidemiological study of the total population aged 55 and older in the rural area of Ballabgarh in northern India. The primary focus of the study was on the prevalence and incidence of dementia and cognitive impairment, and on factors associated with these conditions (Chandra *et al.*, 1998a,b). In this study, therefore, depressive symptoms were primarily of interest as potential risk or comorbid factors or confounders in the study of dementia. We developed a Hindi version of the widely used Geriatric Depression Scale (GDS) (Yesavage *et al.*, 1983; Sheikh *et al.*, 1991) to screen our study cohort for depressive symptoms. In this article, our objective is to report first on the development of the scale, and then on the distribution of depressive symptomatology, and its associations with age, gender, literacy, cognitive impairment and functional impairment, in a largely illiterate elderly population of over 1500 individuals in Ballabgarh, India.

METHODS

Background

Details of the background and rationale of the Indo-US Study, the population of Ballabgarh, sampling and recruitment, and assessment methodology have been described previously (Ganguli *et al.*, 1995b, 1996; Chandra *et al.*, 1998a,b; Fillenbaum *et al.*, 1999). Briefly, this project was funded in 1991 by the National Institute on Aging (NIA) of the US Public Health Service. Participating institutions were the University of Pittsburgh in Pittsburgh, Pennsylvania (USA) and the Center for Ageing Research, India (CARI) in New Delhi, India. The primary goals of the study were the determination of prevalence, incidence and risk factors for Alzheimer's and other dementias in the rural northern Indian population of Ballabgarh and to compare these data with those obtained from a reference US population.

Sampling, recruitment, and phases of data collection

The 28 villages in the Ballabgarh area which participated in this study represented the Field Practice Site of the Centre for Community Medicine of the All-India Institute of Medical Sciences in New Delhi. A census of the entire population of these villages was conducted approximately three decades ago and has been updated monthly to reflect births, deaths and in- and out-migration. For our study, the elderly Ballabgarh cohort was first identified from this census database. Given the relatively short life expectancy of this population, inclusion in our study was based on a minimum age of 55 years. Each individual identified in the census database as aged at least 55 on July 1, 1995 was visited by project field workers, who confirmed his/her identity, age, address and next of kin, and invited him/her to participate in the study. Informed consent was obtained according to procedures approved by both the University of Pittsburgh Institutional Review Board and the Human Volunteers Protection Committee of CARI. Further details of subject recruitment have been reported previously (Ganguli *et al.*, 1995a, 1996; Chandra *et al.*, 1998a,b).

Phase I of the study was devoted to the development of cognitive and functional screening and diagnostic instruments for dementia; it consisted of multiple iterations of testing and modification on volunteer and random subgroups of individuals aged 55 + (Ganguli *et al.*, 1995b, 1996). Phase II consisted of a prevalence survey of the entire age 55 + cohort during which the primary focus was identification of cognitively/functionally impaired and demented subjects (Chandra *et al.*, 1998b). Phase III consisted of follow-up of the entire surviving cohort to identify cases of cognitive decline and incident dementia, and to identify potential risk factors for these outcomes. The work reported here was conducted during Phase III.

Instrument development

We have previously reported the development of, and norms for (1) a functional ability (activities of daily living, ADL) scale (Fillenbaum *et al*., 1999) which we entitled the Everyday Abilities Scale for India (EASI); and (2) a cognitive screening battery (Ganguli *et al*., 1996) including the Hindi Mental State Exam (HMSE) (Ganguli *et al*., 1995b), a Hindi version of the well-known Mini-Mental State Exam (Folstein *et al*., 1975).

A review of the Indian literature, as well as consultation with clinical experts in India, failed to reveal any depression screening scales which were specifically suitable for elderly subjects and which could be reliably administered to large populations by lay workers without clinical experience. We therefore selected the Geriatric Depression Scale (GDS) (Yesavage *et al*., 1983; Sheikh *et al*., 1991), which was developed specifically to use with older populations, has been successfully translated into many languages (Chinese, Dutch, French, German, Hebrew, Italian, Japanese, Portuguese, Rumanian, Russian, Spanish and Yiddish), used in several countries around the world, and extensively validated in many types of elderly populations and settings (Sheikh *et al*., 1991; Montorio and Izal, 1996). This 30-item scale was translated into Hindi by bilingual clinicians (MG, RP, VN) from CARI and the University of Pittsburgh. Minimal modifications were made to the content, to enhance cultural appropriateness. For example, the item asking whether the subject found life to be exciting was altered so as to substitute 'very enjoyable' for 'exciting' because the concept of older people feeling excited for no particular reason would be considered alien or unseemly in rural Indian society.

The scale was named the Geriatric Depression Scale—Hindi version (GDS-H). It was pilot-tested on a sample of Ballabgarh elderly by the project's medical officer (RP) and field workers, making necessary modifications into the local Haryanvi dialect of Hindi. To enhance validity, the Hindi version was then back-translated into English by a fourth bilingual clinician (SD) at the University of Pittsburgh. Further field-testing was then carried out to train and establish interrater reliability among the field workers who would be administering the depression screen to the population. We were sensitive to the total illiteracy of the majority of our subjects, their lack of familiarity with pencil-and-paper forms and questionnaires, and the high frequency of visual impairment in this population. Therefore, we developed the GDS-H as an interviewer-administered questionnaire, with trained field workers reaching each question aloud to the subjects and recording their oral responses. We thus retained the essential subjective self-report quality of the responses while ensuring that the subjects understood the questions and left no responses blank and that the screening did not take an excessive length of time. Regrettably, we lacked the resources to conduct independent psychiatric evaluations of study subjects. Thus, we were unable to use standard nosological classifications to make diagnoses of depressive syndromes/disorders which could have served as external validity criteria within our study population. However, the GDS has previously demonstrated reliability and validity in elderly populations and has been shown to be both sensitive and specific for depressive disorders. We therefore assumed that the GDS-H would serve our purpose of assessing depressive symptomatology among the elderly of Ballabgarh.

The GDS-H was administered for the first time during Phase III and took approximately 6–7 minutes to administer to most subjects, longer if the subject had hearing impairment. All participating subjects responded to the GDS-H with no missing data. At the same interview, subjects also provided responses to the cognitive screening battery including the HMSE, while their next-of-kin were questioned about the subjects' ability to perform activities of daily living according to the EASI.

Demographic variables. Subjects aged 55+ years according to the census database were approached for consent and then asked to confirm their age. Literacy was defined as the ability to read the local newspaper and write a sentence. Further details have been reported previously (Chandra *et al*., 1998a).

Statistical analysis

Depressive symptoms. On the GDS-H, there are 30 depressive symptoms each of which is scored as 1 if present and 0 if absent. Items which reflect the absence rather than the presence of depression are subject to reverse coding. A higher score therefore reflects a greater number of symptoms; a perfectly 'non-depressed' score should be 0. Summing the item scores for a total score of 30, we examined

the distribution of total scores in all subjects, separately within 10-year age intervals, among men and women, and also among those who could read and write and those who were totally illiterate.

The distribution of GDS-H total scores was extremely skewed in this community population (see Results) and did not lend itself to normalizing transformation. We therefore analysed it as a categorical rather than a continuous variable. Since scores were considerably higher than have been reported on the GDS from other populations (see Discussion), it was decided that the conventional cutpoint of 11 (Yesavage *et al*., 1983; Sheikh *et al*., 1991) was too low to categorize the Ballabgarh population as depressed and non-depressed (or less depressed). Instead, we set the operational cutpoint at the 90th percentile of the Ballabgarh population's scores, ie the score which identified the 'most depressed' tenth of the population. We have used and validated this percentile-based approach to population screening, in both our Indian and US studies, for cognitive function (Ganguli *et al*., 1993; Chandra *et al*., 1998a) as well as for depressive symptoms (Ganguli *et al*., 1995a).

We also measured the internal consistency of the GDS-H, using Cronbach's alpha, and explored the factor structure of the GDS-H. For exploratory factor analysis, since the GDS-H is scored dichotomously, we employed tetrachoric correlations, with unweighted least-squares estimates. We examined both varimax and promax rotations.

Cognitive performance. On the HMSE (Ganguli *et al*., 1995b), scores also range from 0 to 30; a perfect score is 30 and lower scores indicate a poorer degree of cognitive functioning. We therefore used the lowest 10th percentile of scores as the operational cutpoint for cognitive impairment, thus identifying the most severely cognitively impaired tenth of the population, as previously reported (Chandra *et al*., 1998a). The HMSE 10th percentile cutpoint was a score of 20.

Functional impairment. On the EASI (Fillenbaum *et al*., 1999), there are 11 ADL items, each scored as 0 if able and 1 if unable to perform independently. A perfect score is 0, and higher scores indicate worse levels of functional impairment. The 90th percentile (demarcating the most disabled tenth of the population) fell in between scores of 2 and 3 on the EASI. Being unable to perform two or more of the ADLs was reported by 16.5% of the population, while inabilty to perform three or more ADLs were reported by only 4.4% of the sample. We selected a cutpoint of 2 on the EASI for the current analyses.

Unadjusted analyses. We examined bivariate relationships between a higher number of depressive symptoms (high GDS-H score, ie score $\geqslant 22$ vs 0–21) and age (10-year intervals), gender, literacy, cognitive performance (HMSE score 0–20 vs 21–30) and functional ability (EASI score $\geqslant 2$ vs 0–1). Associations are reported using odds ratios (ORs) and 95% confidence intervals (CI).

Adjusted analyses. Next, we used logistic regression to model the multivariate associations between a high GDS-H score (dependent/outcome variable) and age, gender and literacy (independent/predictor variables). Because there was a statistical interaction between literacy and gender (women less likely to be literate), we then modelled the multivariate associations between high GDS-H score (dependent variable) and age and gender (independent variables) separately for literate and illiterate subjects.

Finally, we used multivariate logistic regression to look for associations between high GDS-H score as the dependent variable and cognitive performance (HMSE score) and functional impairment (EASI score) as the independent variables. We report the results of two models. The first model includes HMSE and EASI scores as predictor variables, with adjustment for age, gender and literacy as additional independent variables. For the second model, we used stepwise logistic regression to identify independent variables that were associated with high GDS-H score at a significance level as low as 0.1. Two variables were selected by this process: HMSE score $\leqslant 20$ and EASI score $\geqslant 2$. All logistic models satisfied the Hosmer and Lemeshow goodness of fit test (Hosmer and Lemeshow, 1989). Associations are reported using ORs and their 95% CIs.

RESULTS

The first 1554 subjects (all subjects in the first 10 villages) to complete the GDS-H during Phase III were included in this sample. The mean (SD) age of this group was 67.3 (6.9) years with a median of 66 and a range of 57–95 years (since Phase III began 2 years after the 55 + cohort was recruited for Phase II). The group was 49.0% female ($N = 762$)

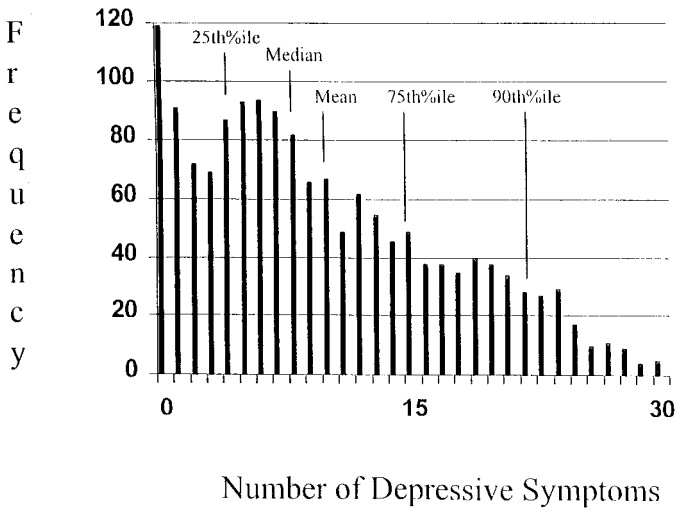

Fig. 1. Distribution of GDS-H scores in the Ballabgarh elderly population

and 68.9% ($N = 1071$) illiterate. Classifying the cohort by years of education rather than literacy, 15.3% ($N = 236$) had more than 5 years of school, 14.8% ($N = 228$) had 1–5 years of 'primary school' and 70.6% ($N = 1090$) had no formal education; however, the latter group included 19 individuals who could read and write a little. We have therefore literacy rather than education in the analyses reported here and in previous publications.

Fig. 1 is a histogram of total GDS-H scores, showing their skewed distribution in the study sample.

Table 1 lists individual GDS-H items rank-ordered with respect to frequency and percentage of subjects reporting that symptom in the total sample. The most commonly endorsed symptom (76.2% of all subjects) was a negative response to the question 'Is your mind as clear as it used to be?'. This was also the most common symptom among all gender and literacy subgroups: men (67.0%), women (85.7%), illiterate subjects (83.7%) and subjects who could read and write (59.6%). The second most commonly endorsed symptom, a positive response to the question 'Have you dropped many interests and hobbies' (57.2% of all subjects), was also the second most common symptom among all subgroups: men (52.4%), women (62.2%), illiterate subjects (62.1%) and subjects who could read and write (46.4%).

Table 2 summarizes the distribution of total GDS-H scores in the entire sample as well as for subgroups defined by age, sex and literacy. The range of total GDS-H scores in the overall sample (aged 57+) was from 0 to 30, with a mean (SD) of 9.8 (7.4) and a median of 8. The 90th percentile score was 22. For comparisons with other studies, among those aged 65 + , the range of scores was 0–30, with a mean (SD) of 10.9 (7.5), a median of 10 and a 90th percentile score of 22.

Table 3 presents bivariate associations between total GDS-H score $\geqslant 22$ and other characteristics, including demographics, cognitive (HMSE) score and functional (EASI) score. Scoring 22 or higher on the GDS-H was significantly associated with older age, illiteracy, lower (more impaired) HMSE score and higher (more disabled) EASI score. In the overall sample, there was no association of high GDS-H score with gender.

We then fit multiple regression models separately for literate and illiterate subjects to look for associations of gender with GDS-H score $\geqslant 22$ after adjusting for age (not shown in tables). Among literate subjects, female gender was significantly associated with the higher GDS-H score, with an age-adjusted odds ratio of 2.77 (95% CI 1.03–7.45). However, among illiterate subjects, there was no association with gender (OR = 0.90, CI 0.60–1.36).

Table 4 presents the results of multiple logistic regression where the outcome variable was scoring at or above 22 on the GDS-H and the predictor variables were female gender (compared to male), literacy (compared to illiteracy), age (10-year intervals), lower (<20) HMSE score (compared to scoring between 21 and 30) and higher (difficulty with two or more ADLs) score on the EASI.

Table 1. Frequency of GDS-H items in the Ballabgarh sample ($N = 1544$), rank-ordered

Depressive symptoms (GDS-H items)	*N*	%
30. Mind not as clear as it used to be	1184	76.2
2. Dropped many interests and hobbies	889	57.2
14. Have more memory problems than most	727	46.8
4. Often get bored	725	46.7
17. Feel pretty worthless the way you are now	694	44.7
20. Hard for you to start new projects	691	44.5
23. Think most people are better off than you	595	38.3
12. Prefer to stay at home rather than go out and do new things	594	38.2
24. Frequently get upset over little things	581	37.4
6. Bothered by thoughts you can't get out of your head	575	37.0
15 (Do not) think it is wonderful to be alive now	574	36.9
10. Often feel helpless	564	36.3
26. Have trouble concentrating	545	35.1
11. Often get restless and fidgety	540	34.7
18. Worry a lot about the past	517	33.3
21. (Do not) feel full of energy	511	32.9
13. Frequently worry about the future	509	32.8
3. Feel that life is empty	508	32.7
29. (Not) easy to make decisions	504	32.4
5. (Not) hopeful about the future	498	32.0
22. Feel that your situation is hopeless	481	31.0
16. Often feel downhearted and blue	467	30.1
25. Frequently feel like crying	385	24.8
28. Prefer to avoid social gatherings	344	22.1
19. (Do not) find life exciting/enjoyable	312	20.1
7. (Not) in good spirits most of the time	191	12.3
1. (Not) basically satisfied with life	181	11.6
8. Afraid something bad will happen to you	163	10.5
9. (Do not) feel happy most of the time	136	8.8
27. (Do not) enjoy getting up in the morning	112	7.2

Table 2. Total GDS-H score in the overall sample and in subgroups defined by age, sex and literacy

	N	Mean	SD	Range	25th percentile	Median	75th percentile
Total sample	1544	9.8	7.4	0–30	4	8	15
*Age**							
57–64 yr	605	8.1	7.0	0–28	2	6	13
65–74 yr	699	10.3	7.4	0–30	5	9	15
75 + yr	250	12.6	7.5	0–30	7	12	18
Gender†							
Men	792	8.9	7.5	0–30	3	7	14
Women	762	10.8	7.2	0–30	5	10	16
Literacy‡							
Literate	483	7.7	7.0	0–30	2	6	12
Illiterate	1071	10.8	7.4	0–30	5	10	16

* $p = 0.0001$ for difference in number of symptoms across age group (Kruskal-Wallis test with 2 degrees of freedom).
† $p = 0.0001$ for difference in number of symptoms between men and women (Wilcoxon two-sample rank sum test).
‡ $p = 0.0001$ for difference in number of symptoms between literate and illiterate subjects (Wilcoxon two-sample rank sum test).

Table 3. Unadjusted odds ratios (ORs) for scoring at or above the 90th percentile ($\geqslant 22$) on the GDS-H (bivariate analyses)

	Unadjusted OR	95% confidence interval
Aged (compared to 57–64 yr)		
65–74 yr	1.65	1.08–2.51
75 or more yr	2.83	1.75–4.59
Women vs men	1.26	0.89–1.79
Literate vs illiterate	0.48	0.31–0.74
HMSE score 0–20 vs 21–30	5.37	3.53–8.18
Difficulty with $\leqslant 2$ ADLs vs difficulty with 0–1 ADL	6.79	4.71–9.79

Table 4. Odds ratio for scoring at or above the 90th percentile ($\geqslant 22$) on the GDS-H (multivariate analysis)

	Odds ratio	95% confidence level
Model 1		
Difficulty with $\geqslant 2$ ADLS vs difficulty with 0–1 ADL	4.92	3.23–7.48
HMSE score 0–20 vs 21–30	2.82	1.77–4.50
Age (compared to 57–64 yr)		
65–74 yr	1.16	0.74–1.82
75 + yr	1.27	0.73–2.21
Literate vs illiterate	0.66	0.39–1.10
Women vs men	0.76	0.50–1.16
Model 2		
Difficulty with $\geqslant 2$ ADLs vs difficulty with 0–1 ADL	5.28	3.59–7.78
HMSE score 0–20 vs 21–30	2.94	1.85–4.67

In the first multiple regression model, which included all predictor variables, both low HMSE score and high EASI score were associated with high GDS-H score at a significance level of 0.05. Neither gender, literacy nor age were significantly associated with high total GDS-H score when HMSE and EASI scores were included in the model. The second model, with the same outcome variable, used stepwise logistic regression to select predictor variables associated with GDS-H score $\geqslant 22$ at a significance level as low as 0.10. Only HMSE and EASI scores were selected for this model.

Table 5 shows the factor structure of the GDS-H in our sample. We have chosen to retain and report the four factors with eigenvalues greater than 1. The resulting factor structure explained 63.6% of the variance after varimax rotation. We also examined promax rotation, which allows factors to be correlated with one another, and obtained identical factor loading patterns. For simplicity, we report the results of varimax rotation.

Thirteen items loaded on factor 1. This factor might be considered as representing the core symptoms of depressed and anxious mood and is fairly similar to the first factor in the original GDS factor structure described by Sheikh *et al.* (1991). Factor 1 explained 24.1% of the total variance in our sample.

Eight items loaded on factor 2. This factor seems to represent the 'cognitive' and motivational symptoms of late life depression, appears similar to the second factor in the original scale (Sheikh *et al.*, 1991) and explained 16.8% of the variance.

Four items loaded on factor 3. This factor clearly represents the reverse-scored positive mood/absence of depressed mood, is very similar to the third factor in the original GDS (Sheikh *et al.*, 1991) and explained 13.0% of the variance.

Five items loaded on factor 4. This factor appears to represent social withdrawal and low self-esteem, but also includes the element of rumination ('Are you bothered by thoughts that you can't get out of your head?'). On the whole, it appears to combine elements of both fourth and fifth factors in the original GDS (Sheikh *et al.*, 1991) and explained 9.7% of the variance.

The above factor structure is conceptually valid and remarkably similar to that reported on the original GDS. Internal consistency of the GDS-H was excellent as measured by a Cronbach's alpha of 0.92.

DISCUSSION

From a large population-based cohort drawn from a stable rural community in northern India, we have reported the prevalence and some associated features of potentially depressive symptoms in the elderly. Previous Indian community-based data are limited and widely disparate, most likely reflecting non-uniform methodology. Ramchandran *et al.* (1979) reported a prevalence of 23.6% for 'depression' in subjects aged 50 + in a small town in southern India, while Venkoba Rao and

Table 5. Factor loadings on the Geriatric Depression Scale—Hindi version (GDS-H)*

	Factor 1	Factor 2	Factor 3	Factor 4
Eigenvalue	7.22	5.05	3.89	2.91
% variance explained	24.1	16.8	13.0	9.7
GDS item				
18. Worry about the past	*0.77*	0.24	0.18	0.18
24. Upset over little things	*0.75*	0.39	0.23	0.10
13. Worry about the future	*0.73*	0.25	0.14	0.22
11. Get restless and fidgety	*0.72*	0.36	0.24	0.17
15. Feel like crying	*0.72*	0.32	0.30	0.15
16. Feel downhearted and blue	*0.69*	0.41	0.37	0.10
8. Afraid something bad will happen	*0.63*	0.10	0.31	0.16
22. Feel situation is hopeless	*0.63*	0.42	0.31	0.28
3. Feel life is empty	*0.60*	0.29	0.34	0.30
10. Feel helpless	*0.58*	0.49	0.27	0.18
19. (Not) find life exciting/enjoyable	*0.57*	0.31	0.53	0.22
15. (Not) wonderful to be alive	*0.53*	0.27	0.47	0.30
1. Basically satisfied with life	*0.52*	0.33	0.41	0.26
20. Hard to start new projects	0.37	*0.72*	0.15	0.19
26. Trouble concentrating	0.43	*0.69*	0.22	0.09
29. (Not) easy to make decisions	0.18	*0.69*	0.23	−0.02
30. Mind (not) as clear as before	0.20	*0.66*	0.09	0.16
4. Often bored	0.38	*0.58*	0.18	0.31
21. (Not) full of energy	0.24	*0.58*	0.42	0.17
14. Problems with memory	0.52	*0.56*	0.16	0.22
2. Dropped activities and hobbies	0.33	*0.48*	0.16	0.24
9. Happy most of the time	0.46	0.21	*0.78*	0.10
27. Enjoy getting up in the morning	0.29	0.28	*0.73*	−0.02
7. Good spirits most of the time	0.46	0.20	*0.70*	0.09
5. Hopeful about the future	0.22	0.26	*0.48*	0.45
12. Prefer staying at home	0.23	0.02	0.04	*0.70*
6. Bothered by thoughts	0.28	0.20	0.23	*0.64*
17. Feel worthless	0.04	0.40	−0.04	*0.61*
28. Prefer to avoid social gatherings	0.03	−0.12	0.38	*0.58*
23. Most other people better off	0.15	0.21	−0.06	*0.44*

* Items in italics are regarded as loading on that factor.

Madhavan (1982) found an approximately 6% prevalence of 'depressive illness' in a semi-urban southern Indian community population aged 60+. A more substantial previous Indian literature describes symptoms among clinically diagnosed depressed patients, including several reports comparing depressive symptoms among patients in different regions of India, and among depressed patients in India and other countries (Bagadia *et al.*, 1973; Gada, 1982; Gupta *et al.*, 1991; Raguram *et al.*, 1996; Sen and Williams, 1987; Teja *et al.*, 1991). To our knowledge, ours is the first report from India of depressive symptomatology in adults of any age in the community at large. Thus, we are restricted in our ability to compare our findings with previous data from India.

Overall high scores in this community

The original GDS (Yesavage *et al.*, 1983) was specifically developed for use in the elderly, and was translated as faithfully as possible into Hindi for use with our Indian study population. The Hindi version had excellent internal consistency; its factor structure was comparable to that of the original English language version (Sheikh *et al.*, 1991) and explained almost two-thirds of the variance. The reference US population studied by the original authors of the GDS (Sheikh *et al.*, 1991) had a mean age of 71 (SD = 4.4) and a mean GDS score of 7.1 (SD = 5.3). That study's criterion for depression, which was a GDS score $\geqslant 11$, was fulfilled by 23% of that

population. Similarly, in a study of elderly Chinese immigrants in the US (Mui 1996), the mean age was 75.1 (SD = 6.5), the mean GDS score was 7.2 (SD = 5.6) and 18% of the population had scores $\geqslant 11$. By contrast, in the Ballabgarh population, which had a mean age of 67.3 (SD = 6.9) years, the mean GDS-H score was 9.8 (SD = 7.4) and 40.2% received scores $\geqslant 11$. Clearly, the distribution of scores on this scale in the Ballabgarh population was much higher than that reported from US and other populations. While it is conceivable that this community has more depression than any others previously studied, a more plausible explanation might be that the scale has identified some responses which may have alternative implications in this population.

'Normal' or socially desirable sentiments associated with ageing in India

Formal anthropological and social research on 'normal' ageing expectations across cultures is still in its infancy; thus, a normative base does not currently exist for the construction of universally valid depression rating scales. Our findings using the GDS-H should therefore first be considered in the context of traditional Indian attitudes towards ageing. According to Hindu scriptures, the last phase of a human being's life should be characterized by disengagement. Older adults are expected to gradually divest themselves of worldly economic, social and domestic responsibilities, and adopt a more spiritual focus (Venkoba Rao, 1993). Thus, feelings such as contentment or peacefulness might be considered more desirable in this stage of life than excitement ('life very exciting') or enthusiasm ('wonderful to be alive'); reflection might be regarded as a more appropriate mental activity than novelty-seeking ('going out and doing new things', 'starting new projects'). Meanwhile, adult children are enjoined with the sacred duty of caring for their ageing parents. Both traditions are diminishing in the face of rapid social and technological change, which may have differential effects on, eg, illiterate rural elderly and on educated urban individuals of the same age with different experiences, opportunities and lifestyles. However, the underlying beliefs still persist in much of Indian society. Thus, a socially desirable or sanctioned stance of disengagement (eg avoidance of social gatherings) by the elderly could potentially lead to false positive responses on a standard depression scale, thus inflating scores and making the scale less specific for depressive illness. Similarly, Mui (1996), in her report of a Chinese version of the GDS, points out that many of the original items may appear normal or desirable, rather than pathological, to Chinese elderly; for example, such individuals may consider it a virtue to prefer staying at home. Alternatively, the stereotype of disengagement and fatalism in the elderly Asian could prevent the recognition and treatment of clinically significant depression; clinical experience suggests that this is often the case.

The most frequently endorsed GDS-H items in our population were diminished clarity of thinking (in three-fourths of the sample) and dropping of many previous interests and activities (in over half of the sample). Slightly less than half of the sample also reported memory problems, feelings of worthlessness, boredom and difficulty starting new projects. These items could potentially be considered aspects of normal ageing by this rural community. Other individuals here typically live with their children, who are expected to treat them with respect and provide for their material needs. Physical limitations (eg from cataracts and degenerative joint disease) reduce their opportunities for participation in household or agricultural activities; it is not expected that they initiate any 'projects'. Having less to contribute to family or community activities may be concretely interpreted as having diminished 'worth', but in a normative rather than pathological or demeaning sense. Becoming forgetful and/or bored may be accepted as the price to be paid for living a long life. Independent recreation and 'hobbies; are not part of these older persons' normal expectations. Events outside the village are of minimal interest, and illiteracy impedes many older individuals from, eg, reading newspapers. Thus, there is often little besides the family to engage the older person's interest. Anecdotally, many of the individuals who endorsed GDS-H items related to sadness and hopelessness attributed these feelings to changes and dynamics within the family (eg poor relationship with a daughter-in-law, death of a son or spouse, change of status due to widowhood).

Relevance for the diagnosis of depressive disorders

The GDS has, in American and other populations, been shown to have high sensitivity and specificity for depressive illness. As noted, we lacked

the resources to obtain independent diagnostic information as to the presence or absence of definable depressive syndromes. We are therefore unable to calculate the external validity, or sensitivity and specificity, of the GDS-H for, eg, major depression in the Ballabgarh population, or to compare these properties with those of the original GDS in US or other populations. Further, our data cannot be used to draw conclusions about the prevalence of depressive syndromes or disorders in our population.

The GDS taps primarily the affective and motivational/cognitive components of depression in the elderly. It deliberately forgoes examining the neurovegetative and somatic components which could result from a variety of non-psychiatric medical conditions in older persons and thus create false positive responses (Sheikh *et al*., 1991). Thus, it excludes symptoms such as disturbances in sleep, appetite and weight, even though these symptoms are essential to the diagnosis of major depression. Clinical experience in India, as well as previous literature (Gada, 1982; Derasari and Shah, 1988; Raguram *et al*., 1996; Teja *et al*., 1971; Sethi, 1986), has shown that depressed Indian patients report a relatively high prevalence of somatic symptoms (eg pain and fatigue) as compared to depressed western patients. Raguram *et al*. (1996) demonstrated that, while both somatic and depressed symptoms were present and distressing in Indian patients with depression, depressive symptoms were perceived as stigmatizing while somatic symptoms were not. Thus, we had anticipated that the absence of somatic items on the GDS might in fact lead this population to under-report depression and thereby to have low overall scores. In fact, if such items had been added to the GDS-H, the distribution of scores in our study population might have been even higher. Alternatively, somatic symptoms may be more prominent in individuals with depressive disorders in medical samples than in the popuation at large.

Among the symptoms that are tapped by the GDS, the observed factor structure of the GDS-H appears conceptually sound. Notably, the classic symptoms of depressed and anxious mood loaded together on the same factor. This finding is consistent with previous observations that depression in Indian patients is manifested by prominent anxiety and agitation rather than psychomotor retardation or guilt (Teja *et al*., 1971; Derasari and Shah, 1988; Sethi, 1986; Venkoba Rao, 1993).

Demographic characteristics of subjects with the highest depression symptom scores

Our primary interest was in measuring depressive symptoms, whether or not they fulfilled diagnostic criteria for specific clinical syndromes. Given previous literature attesting to the validity of the GDS (Sheikh *et al*., 1991; Mui, 1996; Montorio and Izal, 1996), we assumed that individuals with the highest scores (ie the greatest number of symptoms) were the most likely to be depressed. As described, we established our own cutpoint of 22, based on scores received by the 10% of the sample with the highest scores. For convenience, in the rest of this article we will refer to subjects with scores of or above 22 as having 'depression' or being 'depressed', although we fully acknowledge that symptom scores are not diagnostic of depression in and of themselves.

The 'depressed' subgroup was older and less likely to be literate than the rest of the elderly population of Ballabgarh. While there were no overall gender differences between the depressed and non-depressed (or less depressed) groups, we took account of the fact that women were substantially less likely to be literate than men. Among the literate, women were significantly more likely to be depressed than men; however, among the illiterate, there was no gender difference in depression.

Most of the world's literature suggests that depressive symptoms and disorders are more common in women. However, Jorm (1987) has hypothesized that gender differences in depression are reduced with increasing age, and Venkoba Rao (1993) has reported evidence of a male preponderance among older depressed patients in the state of Tamilnadu in South India. With regard to literacy, the previous observation (Sethi, 1986) that 'the manifestations of Indian depressives resembled the ones observed in preliterate societies' may be relevant; however, caution should be exercised in comparing illiterate individuals in a given community with entire preliterate societies. Notably, among the literate members of the Ballabgarh population, the mean GDS-H score was 7.7 (SD = 7.0) and the conventional cutpoint score of 11 was obtained by 28.6% of the literate population, very similar to the GDS distribution seen in the US reference population of Sheikh *et al*. (1991). This finding is remarkable, considering the very minimal standard we defined for 'literacy' in the Ballabgarh study. By way of interpretation, we offer the following cautious speculation. To the

extent that literacy is a marker of modernization and social change, perhaps it renders the literate segment of a society more like the rest of the world, in which women are more likely than men to experience and/or report depressive symptoms. Perhaps a similar female preponderance would have been noted among the illiterate if more somatic manifestations had been included in the screening scale. Further, men in illiterate or preliterate societies may be less inhibited about expressing depressive symptoms. It should be noted that the oldest group of both men and women in Ballabgarh are the least likely to have had educational opportunities. Thus, their experiences and attitudes manifested here as 'depression' might represent cohort effects rather than true effects of either age or literacy *per se*.

Association of depressive symptoms with cognitive and functional impairment

Among Ballabgarh elderly, higher depressive symptom scores were independently and significantly associated both with lower cognitive function scores and with greater levels of reported functional impairment. These findings are fully consistent with those of previous clinical and epidemiological studies (Ganguli *et al*., 1995a; Launer *et al*., 1993; Bruce *et al*., 1994; Alexopoulos *et al*., 1996). However, since ours are cross-sectional data, we can only hypothesize about the direction of the association.

To the extent that scores on the GDS-H truly represent depressive symptoms in this population, poor scores on cognitive tests in depressed individuals may represent some form of 'depressive pseudodementia'. In other words, depressed individuals with poor motivation and attention may perform poorly on standardized tests of cognitive functioning. It has also been suggested that depressed mood may be a risk factor for Alzheimer's disease (Devanand *et al*., 1996). For example, in depressed individuals, prolonged hypercortisolemia associated with depression could have a negative impact on memory through hippocampal damage (O'Brien *et al*., 1996; Jacobson and Sapolsky, 1991).

Alternatively, it is possible that cognitively impaired individuals who also exhibit signs of depression are in prodromal or incipient stages of dementia (Chen *et al*., 1999). Both biological and psychological explanations have previously been invoked to explain the high prevalence of depression in individuals with early or incipient dementia. For example, depressive symptoms could be manifestations of the degeneration of noradrenergic neurons in Alzheimer's disease (Forstl *et al*., 1994). They could also represent the individual's emotional response to self-awareness of failing abilities and autonomy, since demented persons who deny their memory loss are less likely to be depressed (Sevush and Leve, 1993; Tobiansky *et al*., 1995). There is potential overlap between some of the symptoms of depression and dementia; the commonly reported GDS-H items indicating diminished memory and clarity of thinking might well have represented dementia more than depression. However, Sheikh and Yesavage (1986) have shown that the GDS is a valid measure of depression in individuals with mild to moderate dementia; they themselves caution that individuals with severe dementia may be unable to comprehend and accurately respond to self-report questions. Any distortion of subjects' responses by overt dementia would have been minimal in our study, as we have previously reported on the extremely low prevalence of dementia in the Ballabgarh cohort (Chandra *et al*., 1998b).

Similarly, being depressed can lead an older person to have decreased functional ability (Bruce *et al*., 1994; Alexopoulos *et al*., 1996; Parikh *et al*., 1990); alternatively, being functionally disabled and dependent can lead an individual to become depressed (Oxman *et al*., 1992; Harlow *et al*., 1991). Functional impairment can also be due to sensory impairment (particularly visual, in this population), motor impairment (particularly from severe arthritis), other physical illnesses, or be a result of cognitive impairment. It is important to note that we found functional impairment was independently associated with depression even after controlling for cognitive impairment.

Regardless of the explanation(s), it is clear from our data that depressive symptoms, cognitive impairment and functional impairment occurred together in this elderly rural Indian population more than they would by chance alone. We urge caution in interpreting these results, because of the cross-sectional nature of our data and the absence of further data addressing their diagnostic significance. From a clinical perspective, it is reasonable to recommend screening for depression in subjects with either cognitive or functional impairment. Individuals who screen positive for depression deserve a more detailed clinical evaluation for depressive illness. If the three conditions

coexist, a depressive illness would be the most amenable to treatment; and possibly, successful treatment of depression may also improve cognitive and ADL functioning.

Recommendations for further research

We have developed a Hindi version of the GDS which appears to be reliable and internally consistent, and can be efficiently administered to elderly individuals by trained lay workers with no loss of data. Replication of our study in other elderly populations of developing countries, using the GDS in Hindi and other languages, would establish the generalizability of our findings. The external validity of the GDS as a measure of depressive illness, and its utility as a screening tool for depressive disorders, would be enhanced by the inclusion of standardized psychiatric diagnostic procedures and criteria in future studies. Studies might explore the utility of the GDS-H in clinical (psychiatric as well as other medical) settings to identify Hindi-speaking individuals who might benefit from antidepressant treatment and to monitor their response to treatment. The experimental addition of selected somatic items would help to determine whether or not such items would improve sensitivity and specificity for depressive disorders in the populations of developing countries. Follow-up of individuals previously screened with the GDS-H would help to determine the extent to which symptom scores predict different clinically relevant outcomes, and establish the importance of screening for depression.

Conclusion

Although in the year 2000 there will be over 60 million individuals aged 65 + in India, they will only constitute 6–7% of that nation's population (US Bureau of the Census, 1992) and thus perhaps not have high priority for access to scarce resources. Over 80% of India's elderly live in rural areas with limited access to mental health services (Venkoba Rao, 1993). In these populations, depressive symptoms are likely to be dismissed as 'understandable' or 'normal' by older persons, their family members and even their health care providers; or to go unreported because of potential stigma. Given the relative ease with which depressive illness can be diagnosed and treated, there is enormous potential for alleviating this largely neglected public health burden among the elderly in India and other developing countries. The systematic screening of older adults for depression may be a useful first step.

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