Lifetime Prevalence of Cognitive Impairment by Chinese-Modified NIMH Diagnostic Interview Schedule Among the Elderly in Taiwan Communities

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ABSTRACT

Lifetime prevalence of cognitive impairment by Chinese-Modified NIMH Diagnostic Interview Schedule (DIS-CM) among the community population aged 65 and over in Taipei City, 2 townships and rural villages, are: 2.8%, 12.9% and 12.9% for definitely mild; 1.6%, 9.0% and 5.4% for definitely mild and possibly severe; and 1.3%, 9.6% and 1.8% for definitely severe cases, respectively. The prevalences increase with age in both sexes. In general, prevalence rates are higher in females than males with some inconsistent differences between severity of impairment and age-groups in each of three sites. High rates of errors in and/or refusal of three specific questions in both cases and non-cases are noteworthy. Whether this indicates the limitations of the DIS-CM in case-identification of cognitive impairment in the elderly in Chinese community population deserves further study. The lower rate of severe cognitive impairment among the elderly in urban than that in rural areas as indicated in this study is in accord with the NIMH ECA Studies which adopted the similar case-finding method, and also with two recent studies in Taiwan which used the different case-identification method.

With the increased population of elderly as a result of extended life expectancy, the health care and welfare for this portion of the population have received rapidly growing attention in modern society. Dementia is one of the most serious health

and social problems concerned with the elderly. Estimation of the true figure of dementia, their demographic distribution, risk-factors, natural history and the needs for help etc. in community population have, therefore, become the subjects with increasing interest for study by epidemiologists, public health professionals and gerontologists.

The detection of dementia in community population in its early stage is very important, yet is, as Henderson and Huppert (1984), and Huppert and Tym (1986) pointed out, difficult. The urgent needs in detection of dementia in community population have stimulated efforts to establish case-finding tools which can be easily and reliably applied to reach the accurate clinical diagnosis in recent years. The NIMH Diagnostic Interview Schedule (DIS) was established specifically to satisfy these needs, and has been used as the case-finding tool in the NIMH Epidemiological Catchment Area (ECA) Program, a nation-wide collaborative project involving five university research centers in five study sites and the NIMH (Robins *et al.* 1981). The goal of the NIMH ECA program is to determine rates of incidence and prevalence of specific mental disorders, their risk-factors, demographic distributions, and to find the relationship between psychiatric disorders and the utilization of health and mental health services (Regier *et al.* 1984).

Briefly, the NIMH DIS is a set of highly structured questions with clearly defined criteria designed to reach the DSM-III diagnosis of major mental disorders through computer processing of the data obtained from interview. It elicits the elements of a diagnosis including symptoms, their severity, frequency, distribution over time, and whether or not they can be explained by physical illness, drug or alcohol use or another psychiatric diagnosis. Diagnosis can be generated both currently (last 2 weeks, 1 month, 6 months, 1 year) and over a lifetime. The DIS has been found to be reliably used by non-professionals after a short course of training, and has thus been claimed to be particularly useful as a case-finding method in the study of large population samples (Robins *et al.* 1981). Because of its unique value as a case-finding tool, it has been translated into German, Spanish, Chinese, and more recently in Japanese for application in epidemiological study of mental disorders in community population (Helzer 1985).

In order to obtain the up-to-date findings on incidence and prevalence of mental disorders, and the related data in community population, the Department of Health of the Executive Yuan (Cabinet) initiated a five-year nation-wide research project known as Taiwan Psychiatric Epidemiological Project (TPEP) in 1981 (Yeh and Hwu 1981-6). The Chinese Version of the NIMH DIS was the case-finding tool adopted in the TPEP. This paper reports some preliminary findings on prevalence of cognitive impairment obtained from the TPEP.

METHOD OF STUDY

Sampling Method

The TPEP was designed to study the community population aged 18 years and over covering three different types of community; namely, urban, township and rural village. Taipei City was chosen to represent an urban community for the first segment of the TPEP. For the second segment of the TPEP, Su-lin and Tsau-tung were selected to represent two different subtypes of township in present day Taiwan. Su-lin is a town geographically near to Taipei City and has experienced a higher population mobility associated with industrialization in the past six years, but Tsau-tung is geographically isolated from the large city and has experienced a stable population mobility during the identical period of time. For the third segment of the TPEP, six countries (Hsiang), two each from the northern, central, and southern parts of Taiwan with a total of 90 villages (Tsuang) were drawn to represent three different subtypes of rural village in present day Taiwan, namely; the typical farming, fishing, and mixture of both. The multi-staged stratified sampling method was employed in each of the three study sites to draw the study samples which represented the general population members of the study sites aged 18 years and over. The detailed sampling method has been reported elsewhere (Chang *et al.* 1984). Altogether, 5000 samples drawn from Taipei City and 3000 each from two townships and six countries (Hsiang) were studied in the TPEP during 1982-5.

Case-Identification Method

The Chinese Version II of the NIMH Diagnostic Interview Schedule (DIS-CM-II) was used in the study of Taipei City in 1982, the DIS-CM-III in the study of two townships in 1984, and the DIS-CM-IV in the study of villages in 1985. The development of the Chinese Versions of the NIMH DIS, its *inter rater* reliability, and validity of case-identification have been reported in details elsewhere (Hwu *et al.* 1983, 1984; Hwu *et al.* 1986; Hwu *et al.* 1986).

Interviewing

All interviewing was conducted in the field by trained interviewers. Fifty senior students of medicine, psychology and health education in the first study, and of medicine in the second and third studies, selected from 70-80 applicants, served as interviewers in all three parts of the TPEP after a carefully and comprehensively designed two-week full-time training course. The training program consisted of general orientation to the TPEP, didactic lectures, observation of videotaped interview with the DIS-CM, practice of interview with clinical and community samples, exercise in scoring with mutual analysis, and assigned homework. The

inter rater reliability with the DIS-CM-II in the first study and with the DIS-CM-III in the 2nd study, after the training, were highly satisfactory.

Mini-Mental Status Examination (MMSE)

Mini-Mental Status Examination (MMSE) developed by Folstein *et al.* (1975) was adopted in the NIMH DIS to assess cognitive impairment. The MMSE was developed to provide a short clinical screen for the presence of dementia or related disorders producing impairment of cognitive function. It is a simplified scored form of a cognitive mental status examination which includes 11 questions, and required only 10–15 minutes to administer. It concentrates on cognitive aspects of mental function and excludes questions concerning mood, abnormal mental experiences and for the form of thinking. The questions cover: orientation to time and place; memory; attention and calculation; follow verbal and written command; name shown objects; write a sentence; and copy a pair of pentagons. The total maximal score is 30 correct responses. The criteria for mild and severe cognitive impairment adopted in this study are based on the DIS-III Computer Diagnostic programs for the NIMH DIS Version III as shown in Table 1.

TABLE 1
Diagnostic Programs for Cognitive Impairment in
NIMH Diagnostic Interview Schedule

Version III		
ORBRAIN	OBSTOT	TOTWRNG
1 Absent	0–6	0–6
2 Definitely mild	7–12	7–12
3 Definitely severe	13+	13+
4 Possibly severe, definitely mild	7–12	13+
6 Possibly mild, may be absent	0–6	7–12
7 Could be severe, mild or absent	0–6	13+
Indeterminate	0–4	26+

OBSTOT: The total number of errors in the entire MMSE.

TOTWRNG: The sum of errors plus refusals, not ascertained, and missing in the entire MMSE.

RESULTS

Sociodemographic Findings

The sociodemographic distributions of the study samples in four age-groups, and by educational levels, marital status, domicile of origin, and occupations are significantly different between each of the three study sites as shown in Table 2. This indicates the different sociodemographic composition of the inhabitants in Taipei City, two townships and rural villages in present day Taiwan, and illustrates the necessity of selecting population in each of the three areas in order to have a study sample that is representative of the full range of the Taiwan population. In order to make the prevalence rates comparable between each of the three study sites, the prevalence rates shown in this study are adjusted by sex and age-groups.

Lifetime Prevalence by Sex and Age-groups.

The lifetime prevalence of definitely mild, possibly severe, and definitely severe cognitive impairment in the population aged 65 and older (2.8%, 1.6%, 1.3% in Taipei; 12.9%, 9.0%, 7.6% in township; 12.9%, 5.4%, 1.8% in rural) are all significantly higher than those of the population aged 64 and younger (0.6%, 0.1%, 0.04% in Taipei; 2.6%, 0.7%, 0.4% in township; 2.5%, 0.6%, 0.3% in rural) respectively, as shown in Table 3. The lifetime prevalence of all three categories of cognitive impairment are significantly higher among the females than males in the population aged 64 and younger, while these findings are inconsistent in the population aged 65 and older in each of the three sites. For example, in Taipei City the prevalence of definitely mild and severe cognitive impairment are higher in females than males, the rate of possibly severe impairment are roughly the same between two sexes. In townships and rural villages, the higher female rates of cognitive impairment are observed in definitely mild, and possibly severe groups with roughly the same rates for the definitely severe groups between the two sexes.

Lifetime Prevalence in Elderly Population

As shown in Table 4, the prevalence of cognitive impairment in the population aged 65 and over increases with age, significantly in the groups with definitely severe cognitive impairment for both sexes, respectively, across the three sites. This finding is observed only in Taipei City, and not in the townships and rural villages for the prevalence of mild cognitive impairment. As shown in Table 5, the overall prevalence of cognitive impairment including definitely mild, possibly severe, and definitely severe categories increase with age among both sexes in Taipei and townships, respectively, while in rural villages the corresponding prevalences of cognitive impairment decrease on the contrary in the 75–84 age-group of both sexes, respectively.

TABLE 2
Sociodemographic Data in Three Sites of the TPEP

Sociodemographic Data	Taipei N = 5005		
	Male %	Female %	Total %
Age-group * † ‡			
18-24 years	17.6	21.2	19.4
25-44 years	42.1	49.6	45.8
45-64 years	31.5	22.8	27.1
65+ years	8.8	6.6	7.7
Education * † ‡			
9th grade and lower	40.4	50.7	45.6
10th grade and higher	59.6	49.3	54.2
Marital status †			
Married	68.4	69.9	69.1
Never married	26.6	21.8	24.2
Others	5.0	8.3	6.7
Domicile of Origin * † ‡			
Native Taiwanese	62.3	73.9	68.2
Others	37.7	26.1	31.8
Occupation * † ‡			
I-IV §	52.1	33.1	42.5
V-VII & Others §	32.8	19.3	25.9
House-keeping, students and enlisted	15.1	47.6	31.6

* Taipei vs Townships $p < 0.05$ † Townships vs Rural $p < 0.05$ ‡ Rural vs Taipei $p < 0.05$

§ Professionals, executive of large or medium-sized enterprise, administrator, owner of store, clerical, sales or service worker

§ Skilled worker, semi-skilled worker, non-skilled worker

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Table 2 continued

Township N = 3004			Rural N = 2995		
Male	Female	Total	Male	Female	Total
22.0	24.4	23.1	27.1	29.8	28.3
49.5	46.6	48.1	39.8	38.0	39.0
22.5	20.9	21.8	25.7	24.5	25.2
6.0	8.1	7.0	7.3	7.7	7.5
63.5	73.5	68.1	72.7	82.6	77.2
36.5	26.5	31.9	27.3	17.4	22.8
70.4	72.1	71.2	65.8	69.7	67.5
26.2	18.3	22.4	30.1	20.8	25.9
3.4	9.6	6.4	4.1	9.5	6.5
92.2	94.3	93.2	96.4	97.9	97.1
7.8	5.7	6.8	3.6	2.1	2.9
29.3	18.1	24.0	16.2	10.7	13.7
64.3	42.7	54.1	77.8	45.7	63.3
6.4	39.2	21.9	6.0	43.6	23.0

TABLE 3
Lifetime Prevalence of Cognitive Impairment in General Population
Age ≤ 64 and ≥ 65 in Three Sites of Taiwan Community by Chinese-Modified
NIMH Diagnostic Interview Schedule (Adjusted by Sex and Age)

		Taipei			Size of sample	
		% $\pm$ SE				
		I	II	III	N	%
Male	≤ 64	0.3 $\pm$ 0.1	0	0	2249	91.2
	≥ 65	1.8 $\pm$ 0.9	0.5 $\pm$ 0.5	1.4 $\pm$ 0.8	217	8.8
	Total	0.4 $\pm$ 0.1	0.03 $\pm$ 0.04	0.1 $\pm$ 0.1	2466	100.0
Female	≤ 64	0.9 $\pm$ 0.2	0.1 $\pm$ 0.1	0.3 $\pm$ 0.1	2370	93.3
	≥ 65	4.1 $\pm$ 1.5	2.4 $\pm$ 1.2	1.8 $\pm$ 1.0	169	6.7
	Total	1.2 $\pm$ 0.2	0.3 $\pm$ 0.1	0.4 $\pm$ 0.1	2539	100.0
	≤ 64	0.6 $\pm$ 0.1	0.04 $\pm$ 0.03	0.1 $\pm$ 0.1	4619	92.2
	≥ 65	2.8 $\pm$ 0.8	1.3 $\pm$ 0.6	1.6 $\pm$ 0.6	386	7.8
	Total	0.8 $\pm$ 0.1	0.1 $\pm$ 0.1	0.3 $\pm$ 0.1	5005	100.0

		Township			Size of sample	
		% $\pm$ SE				
		I	II	III	N	%
Male	≤ 64	1.7 $\pm$ 0.3	0.3 $\pm$ 0.1	0.4 $\pm$ 0.2	1484	94.0
	≥ 65	8.4 $\pm$ 2.9	7.4 $\pm$ 2.7	2.1 $\pm$ 1.5	95	6.0
	Total	2.2 $\pm$ 0.4	0.8 $\pm$ 0.2	0.5 $\pm$ 0.2	1579	100.0
Female	≤ 64	3.6 $\pm$ 0.5	0.6 $\pm$ 0.2	1.1 $\pm$ 0.3	1310	91.9
	≥ 65	16.5 $\pm$ 3.5	7.8 $\pm$ 2.5	14.8 $\pm$ 3.3	115	8.1
	Total	4.6 $\pm$ 0.6	1.1 $\pm$ 0.3	2.2 $\pm$ 0.4	1425	100.0
	≤ 64	2.6 $\pm$ 0.3	0.4 $\pm$ 0.1	0.7 $\pm$ 0.2	2794	93.0
	≥ 65	12.0 $\pm$ 2.3	7.6 $\pm$ 1.8	9.0 $\pm$ 2.0	210	7.0
	Total	3.3 $\pm$ 0.3	1.0 $\pm$ 0.2	1.3 $\pm$ 0.2	3004	100.0

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Table 3 continued

		Rural			Size of sample	
		% $\pm$ SE				
		I	II	III	N	%
Male	≤ 64	1.8 $\pm$ 0.3	0.2 $\pm$ 0.1	0.1 $\pm$ 0.1	1523	92.7
	≥ 65	8.3 $\pm$ 2.5	1.7 $\pm$ 1.2	0.8 $\pm$ 0.8	120	7.3
	Total	2.3 $\pm$ 0.4	0.3 $\pm$ 0.1	0.2 $\pm$ 0.1	1643	100.0
Female	≤ 64	3.3 $\pm$ 0.5	0.4 $\pm$ 0.2	1.1 $\pm$ 0.3	1248	92.3
	≥ 65	18.3 $\pm$ 3.8	1.9 $\pm$ 1.4	10.6 $\pm$ 3.0	104	7.7
	Total	4.4 $\pm$ 0.6	0.5 $\pm$ 0.2	1.6 $\pm$ 0.4	1352	100.0
	≤ 64	2.5 $\pm$ 0.3	0.3 $\pm$ 0.1	0.6 $\pm$ 0.1	2771	92.5
	≥ 65	12.9 $\pm$ 2.2	1.8 $\pm$ 0.9	5.4 $\pm$ 1.5	224	7.5
	Total	3.3 $\pm$ 0.3	0.4 $\pm$ 0.1	0.9 $\pm$ 0.2	2995	100.0

I Definitely mild

II Definitely severe

III Definitely mild, possibly severe

Inter-sites Comparison

As shown in Table 6, the overall lifetime prevalence of cognitive impairment including the three categories of severity in population aged 65 and over is highest in township (29.5%), next highest in rural (20.1%), and lowest in Taipei (5.7%) with significant differences among the three sites. The differences between township and rural are, however, not significant when the prevalence of mild cognitive impairment, and the overall prevalence including both mild and severe in each of sex groups are compared.

The prevalence in each category of cognitive impairment between the three sites are, as shown in Table 4, inconsistent. The rates of mild impairment in township and rural are reasonably the same, and both are significantly higher than that of Taipei. The rate of definitely severe impairment is significantly higher in township than in both Taipei and rural, with reasonably the same rates between the latter two sites. The rates for the group with possibly severe impairment is highest in township and lowest in Taipei with rural standing in between.

TABLE 4
Lifetime Prevalence of Cognitive Impairment in Different Age-groups of Population Age ≥ 65
in Three Sites of Taiwan Community by Chinese-Modified NIMH Diagnostic Interview
Schedule (Adjusted by Sex and Age)

	Taipei			Township			Rural		
	I	II (%)	III	I	II (%)	III	I	II (%)	III
Male									
65-74	1.7	0.0	0.6	7.6	4.6	1.5	9.9	0.0	1.1
75-84	2.7	0.0	5.4	7.4	11.1	3.7	3.6	3.6	0.0
≥ 85	0.0	33.3	0.0	50.0	50.0	0.0	0.0	100.0	0.0
Total	1.8 ± 0.9	0.5 ± 0.5	1.4 ± 0.8	8.4 ± 2.9	7.4 ± 2.7	2.1 ± 1.5	8.3 ± 2.5	1.7 ± 1.2	0.8 ± 0.8
Female									
65-74	3.5	1.7	1.7	19.7	4.2	7.0	22.1	0.0	11.7
75-84	6.4	4.3	2.1	13.2	7.9	26.3	8.3	8.3	8.3
≥ 85	0.0	0.0	0.0	0.0	50.0	33.3	0.0	0.0	0.0
Total	4.1 ± 1.5	2.4 ± 1.2	1.8 ± 1.0	16.5 ± 3.5	7.8 ± 2.5	14.8 ± 3.3	18.3 ± 3.8	1.9 ± 1.4	10.6 ± 3.0
65-74	2.4	0.7	1.0	13.9	4.4	4.4	15.5	0.0	6.0
75-84	4.8	2.4	3.6	10.8	9.2	16.9	5.8	5.8	3.9
≥ 85	0.0	11.1	0.0	12.5	50.0	25.0	0.0	25.0	0.0
Total	2.8 ± 0.8	1.3 ± 0.6	1.6 ± 0.6	12.9 ± 2.3	7.6 ± 1.8	9.0 ± 2.0	12.9 ± 2.2	1.8 ± 0.9	5.4 ± 1.5

TABLE 5
Overall Lifetime Prevalence of Cognitive Impairment in Different Age-groups of Population Age ≥ 65 in Three Sites of Taiwan Community by Chinese-Modified NIMH Diagnostic Interview Schedule

	Taipei		Township		Rural	
	I+III	I+II+III	I+III	I+II+III	I+III	I+II+III
Male	65-74	2.3	2.3			
	75-84	8.1	8.1	9.1	13.6	11.0
	≥ 85	0.0	33.3	11.1	22.2	7.1
	Total	3.2±1.2	3.7±1.3	50.0	100.0	100.0
Female	65-74	5.2	6.9	10.5±3.2	17.9±4.0	9.2±2.6
	75-84	8.5	12.8	26.8	31.0	33.8
	≥ 85	0.0	0.0	39.5	47.4	25.0
	Total	5.9±1.8	8.3±2.1	33.3	83.3	0.0
				31.3±4.3	39.1±4.6	28.8±4.5
	65-74	3.4	4.1	18.3	22.6	21.4
	75-84	8.3	10.7	27.7	36.9	9.6
	≥ 85	0.0	11.1	37.3	87.5	0.0
	Total	4.4±1.0	5.7±1.2	21.9±2.9	29.5±3.2	18.3±2.6
						20.1±2.7

TABLE 6
Comparison of Overall Lifetime Prevalence of Cognitive Impairment in Population Age ≥ 65
Between Three Sites of Taiwan Community by Chinese-Modified NIMH
Diagnostic Interview Schedule

	Taipei		Township		Rural	
	% $\pm$ SE		% $\pm$ SE		% $\pm$ SE	
	I+III	I+II+III	I+III	I+II+III	I+III	I+II+III
Male	3.2 $\pm$ 1.2* ‡	3.7 $\pm$ 1.3* ‡	10.5 $\pm$ 3.2*	17.9 $\pm$ 4.0*	9.2 $\pm$ 2.6 ‡	10.8 $\pm$ 2.8 ‡
Female	5.9 $\pm$ 1.8* ‡	8.3 $\pm$ 2.1* ‡	31.3 $\pm$ 4.3*	39.1 $\pm$ 4.6*	28.8 $\pm$ 4.5 ‡	30.8 $\pm$ 4.5 ‡
Total	4.4 $\pm$ 1.0* ‡	5.7 $\pm$ 1.2* ‡	21.9 $\pm$ 2.9*	29.5 $\pm$ 3.2* †	18.3 $\pm$ 2.6 ‡	20.1 $\pm$ 2.7 ‡

* Taipei vs township $p < 0.05$ † Township vs rural $p < 0.05$ ‡ Rural vs Taipei $p < 0.05$

The differences in prevalence of cognitive impairment between males and females in the elderly population in each of the three sites are inconsistent as shown in Table 4. In Taipei and rural, the rates for the groups with definitely mild and severe are higher in 65–74 and 75–84 age-groups of females than males, while these findings are observed only in two mildly impaired groups (I and III) and not in a definitely severe group. On the contrary, the rates with definitely severe impairment in the aged 85 and over group are higher in males than females in Taipei and rural, but the rates are the same between the two sexes in townships. The rates for the group with definitely mild and possibly severe impairment are higher in all three age-groups of females in township and rural, while these findings are observed only in the 65–74 age group in Taipei where the rates are higher among the males for the 75–84 age group.

Symptom Profile

As shown in Tables 7 and 8, the mean number of errors and refusals in the questions regarding “orientation to time and place,” “memory,” “attention and calculation,” and “follow verbal command” and “name shown objects” among the cases do not show significant differences between each of the three sites, except the higher rates of refusal in township than rural for the question regarding “orientation to time,” while the rates of errors in the other three questions regarding “follow written command,” “write a sentence” and “copy a pair of pentagons” show consistent and significant differences in cases between each of the three sites. The cases both in Taipei and township show higher impairment rates in “follow written command,” “write a sentence” and “copy a pair of pentagons” than those in rural with no significant difference between the former two sites. While the rates of errors among the non-cases show some significant but inconsistent differences between the three sites. The elderly non-cases in township show more impaired “orientation to time and to place,” and “memory” than those in Taipei and rural, and in “copy a pair of pentagons” than those in Taipei, while those in rural show more impairment in “attention and calculation,” “follow verbal command” and “name shown objects” than those in Taipei and township, and more impaired function in “copy a pair of pentagons” than those in Taipei.

The attitudes of the elderly towards the MMSE as indicated by the mean number and/or proportion of refusals to respective questions is highly interesting. The elderly in rural refuse more often the questions regarding “orientation to time and place,” “memory,” “attention and calculation” and “copy a pair of pentagons” than those in Taipei and township, while those in Taipei show significantly more refusal rates to the questions regarding “follow written command” and “write a sentence” than those in township and rural; and to the question “copy a pair of pentagons”

TABLE 7
Mean Number of Symptoms in Cases with Cognitive Impairment and
Non-cases in Population Age ≥ 65 in Three Sites of Taipei Community
by Chinese-Modified NIMH Diagnostic Interview Schedule

	Taipei (M $\pm$ SD)			
	Case		Non-case	
	Error	Refusal	Error	Refusal
Orientation to time	2.5 $\pm$ 1.8	0.2 $\pm$ 1.1	0.3 $\pm$ 0.7*	0.5 $\pm$ 1.4
Orientation to place	1.4 $\pm$ 1.9	0.1 $\pm$ 0.3	0.1 $\pm$ 0.4*	0.2 $\pm$ 0.9
Memory	4.9 $\pm$ 2.4	0.4 $\pm$ 0.5	1.3 $\pm$ 1.6*	0.8 $\pm$ 1.4
Calculation	1.0 $\pm$ 1.5	2.5 $\pm$ 2.3	0.3 $\pm$ 0.7*	1.4 $\pm$ 2.1
Follow verbal command	0.4 $\pm$ 1.0	0	0.1 $\pm$ 0.1	0.1 $\pm$ 0.6
	Township (M $\pm$ SD)			
	Case		Non-case	
	Error	Refusal	Error	Refusal
Orientation to time	2.8 $\pm$ 1.7	0.1 $\pm$ 0.6†	0.5 $\pm$ 0.9	0.4 $\pm$ 1.3†
Orientation to place	2.1 $\pm$ 1.8	0.1 $\pm$ 0.6	0.2 $\pm$ 0.4†	0.3 $\pm$ 1.0†
Memory	4.9 $\pm$ 3.2	0.6 $\pm$ 0.9	1.9 $\pm$ 1.8†	0.7 $\pm$ 1.1†
Calculation	0.6 $\pm$ 1.4	3.3 $\pm$ 2.2	0.5 $\pm$ 1.0	1.7 $\pm$ 2.2
Follow verbal command	0.7 $\pm$ 1.1	0.0 $\pm$ 0.4	0.1 $\pm$ 0.4†	0.1 $\pm$ 0.5
	Rural (M $\pm$ SD)			
	Case		Non-case	
	Error	Refusal	Error	Refusal
Orientation to time	2.6 $\pm$ 1.5	0.5 $\pm$ 1.4	0.5 $\pm$ 0.9‡	1.2 $\pm$ 1.8‡
Orientation to place	1.5 $\pm$ 1.8	0.2 $\pm$ 0.8	0.1 $\pm$ 0.4	0.7 $\pm$ 1.3‡
Memory	4.5 $\pm$ 3.1	0.7 $\pm$ 0.9	1.5 $\pm$ 1.8	1.2 $\pm$ 1.6‡
Calculation	1.0 $\pm$ 1.8	3.4 $\pm$ 2.3	0.7 $\pm$ 1.1‡	2.2 $\pm$ 2.4‡
Follow verbal command	0.6 $\pm$ 0.9	0	0.3 $\pm$ 0.6‡	0.1 $\pm$ 0.6

* Taipei vs township $p < 0.05$ † Township vs rural $p < 0.05$ ‡ Rural vs Taipei $p < 0.05$

than those in township. Generally, the refusal rates are lowest both among the cases and non-cases in township. The unusually high refusal rates in questions regarding "follow written command" and "write a sentence" among the cases and non-cases in Taipei, and in the questions "copy a pair of pentagons" among the cases and non-cases in Taipei and rural, are noteworthy. These findings seem to suggest the limitation of the MMSE as a case-finding tool in study of cognitive impairment among the elderly in community population, and may in part explain the lower overall rates of cognitive impairment in Taipei than would be expected comparing with those in township and rural villages.

DISCUSSION

In any given current period of time, dementia among the elderly is perhaps the only disorder with higher prevalence rate which increases with age than that of the younger population.

The reported results of studies on prevalence of dementia in community population have yielded a rather consistent rate of around 5% for the moderate and severe dementia (Henderson 1983) while the rates reported on mild dementia have varied from 2.6% (Bergman *et al.* 1971) to 21.9% (Parsons 1965). Kaneko (1969, 1975) even reported an unusually high rate of 52.7% in a community sample of 531 persons aged 65 and over in Japan. Studies with rates between these extremes have been reported by Essen-Möller (1956), Nielson (1962), Kay *et al.* (1964), Williamson (1964) and Helgason (1964). The results of these studies have indicated the importance and urgent needs in development of a set(s) of diagnostic schedule which can be easily and reliably used even by non-professionals after a short-term training in the study of large community population across cultures.

Though DSM-III is an important break-through in psychiatric diagnosis, the criteria for dementia have been criticized (Jorm and Handerson 1985) for treating dementia categorically rather than dimensionally, ignoring the problems of placing appropriate cut-off and being too broad, thus, encouraging diagnostic unreliability. The MMSE was integrated in the NIMH DIS in an effort to supplement the criteria for severity of impairment in DSM-III dementia. In a recent Australian study, Kay *et al.* (1985), however, found the MMES ineffective in detecting mild dementia and recommended the Pfeiffer (1981) Mental Function Index (MFI) which is the addition of the Smith Symbol Digit Design Test and the Raven's Matrices Subtest B to the MMES.

This is the very first study of cognitive impairment using the MMES on a large community population in Taiwan. Though the *inter rater* reliability of the interviewers were found to be satisfactorily high before field work in each segment of the TPEP, there was no way of testing the reliability of the inter-site interview data. The

TABLE 8
Percentage of Symptoms in Cases with Cognitive Impairment and Non-cases in
Population Age over ≥ 65 in Three Sites of Taiwan Community
by Chinese NIMH Diagnostic Interview Schedule

	Taipei (%)			
	Case		Non-case	
	Error	Refusal	Error	Refusal
Name shown object (1)	4.6	0	0.3	2.5
Name shown object (2)	4.6	0	0	2.2
Follow written command	31.8	40.9*	3.5	27.5*
Write a sentence	50.0	31.8*	6.3	34.1*
Copy a pair of pentagons	59.1	18.2*	7.4*	22.6*

	Township (%)			
	Case		Non-case	
	Error	Refusal	Error	Refusal
Name shown object (1)	9.7	0	0.7	2.0
Name shown object (2)	9.7	0	0.7	2.0
Follow written command	29.0†	0	6.1†	3.4
Write a sentence	37.1†	0	10.1†	7.4
Copy a pair of pentagons	56.5†	4.8†	24.3	13.5†

Error	Rural (%)			
	Case		Non-case	
	Error	Refusal	Error	Refusal
Name shown object (1)	2.2	0	0.6	1.1
Name shown object (2)	2.2	0	1.1‡	1.1
Follow written command	6.7‡	0‡	1.1	6.2‡
Write a sentence	4.4‡	4.4‡	3.4	10.6‡
Copy a pair of pentagons	33.3‡	33.3	20.7‡	36.3‡

* Taipei vs township $p < 0.05$ † Township vs rural $p < 0.05$ ‡ Rural vs Taipei $p < 0.05$

interviewers, before interviewing in each segment of the study were, however, trained by the same investigators with exactly the same teaching materials and schedule. Thus, theoretically, the inter-site reliability of interview data can be expected to be satisfactory. In view of the unusually high refusal rate to the questions "follow written command" and "write a sentence" in Taipei samples, the significantly lower rate of cognitive impairment among the elderly population in Taipei may partly be explained by defensive attitudes of the responders to this study, rather than by the bias in interviewing technique and rating of the data. The comparison of lifetime prevalence of cognitive impairment in general population aged 18 and over between the NIMH ECA sites and the TPEP, as shown in Table 9, seems to be in support of this speculation. The lower rate of cognitive impairment in urban than in rural is also supported by the two recent studies conducted in Taiwan, as shown in Table 9. Lin *et al.* (1984) and Rin (1987) used a two-stage case-finding method consisting of screening by non-medical interviewers with specifically designed interview schedule in the first stage and clinical examinations of the suspected cases in the second stage, and found 2.7% of clinically diagnosable dementia in rural area in southern Taiwan and 1.7% in Taipei, respectively. The cases of clinically diagnosable dementia that were screened out from the first stage interview in the above two studies are presumably equivalent to the definitely severe cases as defined in our study. The lower prevalence rate of cognitive impairment in the general population of urban than in rural is also seen in the NIMH ECA studies as shown in Table 10 (Blazer *et al.* 1985).

That the prevalence of overall as well as each category of cognitive impairment in townships are significantly higher than those in Taipei and rural is difficult to explain, and deserves further study.

Comparison of the TPEP findings with those of the NIMH ECA program shows that the prevalence rate of definitely severe cases both in Taipei and rural is significantly lower, and that in townships is seemingly higher than that in each of the NIMH ECA sites, as shown in Table 11 (Robins *et al.* 1984). Again, whether these findings are due to under-detection of the cases in Taipei and rural sites of the TPEP, or these are representing the true figures, need further study.

The rates of mild cognitive impairment are all higher among the females than males across the three sites of the Taiwan community, while the six-month prevalence for this group of cases is roughly the same in the three sites of NIMH ECA program, as shown in Table 12 (Weissman *et al.* 1985). The differences in prevalence of severe cognitive impairment between both sexes in the two countries are inconsistent. These seem to indicate the different vulnerability to dementia and the related disorders which caused cognitive impairment, and the survival rate between males and females in each of these two countries.

TABLE 9
Prevalence of Dementia in Different Populations of Taiwan

Investigator	Type of community	Size of population studied	Method of case identification	Prevalence %
Lin <i>et al.</i> 1984	Rural	1023	Screening and clinical diagnosis	2.7
Rin 1987	Urban	1586	Screening and clinical diagnosis	1.7
Lin <i>et al.</i> 1981-2	Homes for elderly	1400	Screening and clinical diagnosis	7.4

TABLE 10
Cross-cultural Comparison of Lifetime Prevalence of Cognitive Impairment (Severe) in Population Age ≥ 18 by NIMH Diagnostic Interview Schedule

NOMH ECA Sites				TPEP			
New Haven %	Balti-more %	St Louis %	Durham (Six-month) %		Taipei %	Town-ship %	Rural %
			Urban	Rural			
1.3	1.3	1.0	1.2	2.1	0.4*	2.3*	1.3*

* Including definitely and possibly severe cases

TABLE 11
Cross-cultural Comparison of Lifetime Prevalence of Cognitive Impairment (Severe) in Population Age ≥ 65 by NIMH Diagnostic Interview Schedule

NIMH ECA Sites			TPEP		
New Haven %	Baltimore %	St Louis %	Taipei %	Township %	Rural %
5.0	5.1	4.0	1.3	7.6	1.8

TABLE 12
Cross-cultural Comparison of Cognitive Impairment in Population Age ≥ 65 by NIMH
Diagnostic Interview Schedule (By Severity and Sex)

	NIMH ECA Sites				TPEP	
	New Haven	(6-month)		St Louis	Taipei	Rural
		Baltimore				
Male						
	Mild	13.8	14.2	18.4	3.2*	9.1*
	Severe	2.6	5.7	4.6	0.5	1.7
Female						
	Mild	12.0	16.6	15.0	5.9*	28.9*
	Severe	3.9	4.8	3.6	2.4	1.9

* Including definitely mild and definitely mild, possibly severe cases

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