Findings of Anthropometric and Laboratory Data from Adult Health Screening under the National Health Insurance Plan in Taiwan

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Background: From April of 1996, all adults over 40 years old insured by the National Health Insurance (NHI) plan of Taiwan are eligible for a physical check-up once a year by most NHI-contracted family physicians. This study provides a benchmark data of their current physical health.

Methods: In total, 9016 adult health examination reports were systematically sampled from 692,311 claims from April to September 1996. A subject profile included basic personal information, a physical examination, and routine blood and urine laboratory tests. The reliability of the data was verified by comparing the results of anthropometrical measures to others obtained from a nationwide nutrition survey.

Results: The mean height was 165 ¡ 6.3 cm for men and 154 ¡ 5.6 cm for women. Totally 54.3% of the people sampled were overweight, especially younger adults. The average systolic/diastolic blood pressure was 129 ¡ 19.9/80.9 ¡ 11.7 mmHg for men and 127.2 ¡ 21.2/78.9 ¡ 12.0 mmHg for women. There were 17.6% with high blood sugar, while only 8.0% were self-reported as diabetes mellitus (DM) sufferers. Women over 65 had higher cholesterol levels (>6.24 mmol/L) than did their younger peers and men. Men's blood triglyceride levels decreased from 1.74 to 1.28 g/L with age, while women's increased from 1.04 to 1.55 g/L with age.

Conclusions: Taiwanese adults over 40 are 2-3 kg heavier and 2 cm taller than their counterparts 10 years ago, but may not be healthier. Future study may need to focus upon cost-effectiveness of this nationwide adult health screening program.

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Key words: anthropometry, adult health screening, physical status, National Health Insurance.

Following economic growth and rising living standards, the main leading causes of deaths in Taiwan have switched from infectious diseases to chronic diseases. Since 1982, cancer has been the leading cause of death in Taiwan.[1] The Department of Health in Taiwan advocates health promotion and routine check-ups for adults in order to diagnose and treat chronic disease early.[2] Based on a belief in preventive medicine, the Bureau of National Health Insurance covers routine check-ups for adults aged

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40-65 years old every 3 years and annual ones for those beyond 65 years old.[3] Between April and September 1996, 10% of the insured over 40 years old received this service voluntarily. The service included personal health behavioral counseling, physical examination, and routine blood and urine laboratory tests.[4-6]

Most past studies of health status focused on children or youth; less attention has been paid to adult populations.[7-10] This paper focuses on the general health status of adults in Taiwan who utilized adult health screening services covered by the National Health Insurance program. Since more than 95% of the population is insured, hopefully these data will provide a baseline information for local practitioners, government policy makers, and academic scholars.

METHODS

In total, 692,311 claims for adult health screening (about 10% of insurers aged over 40 years old) were made by all providers from April to September 1996. A systematic sampling method was developed to select 1 from every 60 claims at each health insurance branch office. Ideally this should result in 11,538 records for analysis. However, about 21% of the selected records (2506 records) from the claimed list did not have complete information available for analysis because some providers did not send it to the branch offices. In addition, 16 records with incomplete information were excluded from analysis. In total, 9016 records with complete information were valid for analysis.

Every client filled out his/her personal data (name, age, address, personal and family health history, and health behavior of smoking, drinking, eating habits, etc.) when he/she was waiting to see a family physician. Routine blood and urine laboratory tests were then processed. Items of the blood test paid by the national health insurance program included white blood cell (WBC), red blood cell (RBC), hemoglobin (Hb), albumin, globulin, glutamic-oxaloacetic transaminase(GOT), glutamic-pyruvic transaminase (GPT), cholesterol, triglyceride, uric acid, blood urea nitrogen (BUN), creatinine, and glucose aute cibum (a.c.). Results of the physical examination and routine blood and urine laboratory tests were filled in by the medical staff later. At the end of the visit, the physician made a final recommendation according to the above information.

Since the main purpose of this paper is to share the baseline data, most data are presented using simple descriptive statistics. On some occasions, chi-square test was used to examine differences in abnormality percentages for physical and biochemical indicators in terms of age and gender. In order to avoid measurement errors, the normal ranges for laboratory data are decided by the most common and comprehensive values currently used in the health care industry.[11-13]

RESULTS

Basic characteristics and history

The age distribution in the sample was more

Table 1. Sample Characters in the Adult Preventive Services of National Health Insurance, Taiwan

	The Sample						Population 40 yr in end 1996*			
	Men			Women			Men		Women	
Age (yr)	N	Percent of sample[1]	Percentof popul.[2]	N	Percent of sample[1]	Percent of popul.[2]	N	%	N	%
40-44	669	17.1	0.08	956	18.7	0.11	865,322	23.9	839,492	24.6
45-49	594	15.2	0.09	928	18.1	0.15	645,763	17.9	628,543	18.4
50-54	393	10.1	0.09	693	13.5	0.17	415,441	11.5	411,136	12.0
55-59	460	11.8	0.11	661	12.9	0.16	408,983	11.3	419,746	12.3
60-64	456	11.7	0.13	601	11.7	0.17	357,322	9.9	350,865	10.3
65-69	635	16.3	0.17	614	12.0	0.21	378,848	10.5	290,593	8.5
≥70	694	17.8	0.13	662	12.9	0.14	542,441	15.0	477,865	14.0
Total	3,901	100	0.80	5,115	100	1.11	3,614,120	100	3,418,240	100

* Department of Health: ROC Public Health Overview,1997.

[1] Numbers in the column are percentages of records in that gender category

[2] Numbers in the column are percentages of records within the population in that age and gender category

evenly distributed than that of the total insured population. The utilization rate appeared to correspond with age, that is, the elderly except those over 70 years old had a higher utilization of this service than the younger people except those over 70 years old. In addition, the results showed that women had more utilization rate than did men (Table 1). In order to examine the reliability of the data, the results of anthropometrical measures (i.e. height and weight) were compared to those collected from a national Nutrition and Health Survey in Taiwan (NAHSIT) 1993-1996.[14] As shown in Table 2, similar distributions were found for height and weight in age and gender categories between these 2 data sets. The similarity of anthropometrical measures between these two data sets may indirectly verify the reliability of the current data.

The rankings of self-reported disease prevalence showed a minor variation between men and women. Results of the self-reported history suggest that hypertension is the most prevalent disease for both genders. Diabetes, peptic ulcer, and cardiovascular disease were among the top four.

Physical exams

The mean height was 164.9 ¡ 6.3 cm for men and 154.1 ¡ 5.6 cm for women. The average height decreased slightly by age for both genders, as did the average weight for men. For women, the average weight at 40-59 years old increased with age and then decreased in the 60-64 years range (Table 3). Being overweight is a serious problem nowadays. Women were more overweight than men. Approximately 58% of 40-64-year-old women

Table 2. Comparison of Anthropometrical Data with Results from the Nutrition and Health Survey in Taiwan (NAHSIT) 1993-1996

	Gender	Age (yr)	NHI N	NHI Mean (SD)	NAHSIT* N	NAHSIT* Mean (SD)
Height (cm)	Men	45-64	1891	165.0 (6.0)	612	165.3 (5.9)
		≥ 65	1300	163.6 (6.4)	319	163.6 (5.5)
	Women	45-64	2848	154.6 (5.4)	678	153.6 (4.9)
		≥ 65	1262	151.7 (5.8)	313	150.7 (6.6)
Weight (kg)	Men	45-64	1891	66.5 (9.8)	612	65.2 (10.4)
		≥ 65	1300	63.2 (9.9)	319	61.2 (11.1)
	Women	45-64	2848	58.9 (9.2)	678	58.0 (8.8)
		≥ 65	1262	55.9 (9.6)	313	56.3 (9.6)

* Source: Pan WH, Kao MD, Tzeng MS, Yen LL, Hung YT, Li LA, Hsiao S-Y, Yeh W-T, Huang P-C. Nutrition and health survey in Taiwan (NAHSIT) 1993-1996: design, contents, and operations. Nutr Sci J 1999;24:1-10.

Table 3. The Physical Examination Result by Sex And Age in Preventive Service of National Health Insurance, Taiwan

Men	(N=3901)			
Age (yr)	Height (cm)	Weight (kg)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
40-44	167.0 ¡ 6.1*	68.6 ¡ 10.3	121.5 ¡ 16.5	79.7 ¡ 11.4
45-49	165.8 ¡ 6.0	67.9 ¡ 10.3	123.9 ¡ 16.3	80.8 ¡ 11.2
50-54	165.2 ¡ 5.8	66.8 ¡ 9.4	124.8 ¡ 18.4	80.8 ¡ 11.5
55-59	164.8 ¡ 5.9	65.5 ¡ 9.6	128.5 ¡ 19.2	82.6 ¡ 12.0
60-64	164.1 ¡ 6.1	65.4 ¡ 9.5	133.5 ¡ 19.6	82.8 ¡ 11.2
65-69	164.6 ¡ 6.1	64.8 ¡ 9.7	133.9 ¡ 20.1	81.0 ¡ 11.9
≥70	162.1 ¡ 6.4	60.5 ¡ 9.8	137.2 ¡ 21.9	80.1 ¡ 12.3
Total	164.9 ¡ 6.3	65.8 ¡ 10.1	129.0 ¡ 19.9	80.9 ¡ 11.7
Women	(N=5115)			
Age (yr)	Height (cm)	Weight (kg)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
40-44	155.9 ¡ 5.2	57.0 ¡ 8.7	114.5 ¡ 16.0	74.0 ¡ 11.0
45-49	155.6 ¡ 5.2	58.9 ¡ 9.2	122.1 ¡ 17.7	78.2 ¡ 11.2
50-54	154.7 ¡ 5.4	59.2 ¡ 9.4	126.2 ¡ 19.0	79.8 ¡ 12.0
55-59	154.1 ¡ 5.3	59.1 ¡ 9.2	129.6 ¡ 20.7	80.1 ¡ 11.9
60-64	153.4 ¡ 5.3	58.5 ¡ 9.1	133.8 ¡ 21.2	81.8 ¡ 11.8
65-69	152.4 ¡ 5.7	57.3 ¡ 9.2	135.1 ¡ 21.5	80.4 ¡ 11.9
≥70	152.5 ¡ 5.7	53.6 ¡ 9.4	138.8 ¡ 23.2	81.2 ¡ 13.5
Total	154.1 ¡ 5.6	57.8 ¡ 9.3	127.2 ¡ 21.2	78.9 ¡ 12.0

*: mean ¡ standard deviation.

weighed 10% heavier than the ideal weight (Table 4).

The average systolic/diastolic blood pressure was 128 ¡ 20.6/79.8 ¡ 11.9 mmHg for the entire sample, of which values were 129 ¡ 19.9/80.9 ¡ 11.7 mmHg for men and 127.2 ¡ 21.2/78.9 ¡ 12.0 mmHg for women. In general, systolic blood pressure increased with age. The normal ranges of blood pressures were 100-140 mmHg for systolic and 60-90 mmHg for diastolic. More older (over 65) women (38.6%) had high systolic blood pressure than men (33.4%). However, fewer women (11.3%) between 40-64 years old had high diastolic blood pressure than men (15.1%). The average pulse rate was 75 per minute. Regularity of pulse rate was judged directly by the physician who was responsible for the examination. The results showed that irregular pulse was occasionally (3.5%) found in men and women over 65.

Examination of uncorrected bare visual acuity was derived by asking subjects to read a chart on the wall. The average score for visual acuity by the sample population was around 0.7. People over 65 years old had poor visual acuity. Among the sample, 2.6% of patients showed complete loss of eye sight, i.e., the score of bare visual acuity was reduced to 0 (Table 4).

Physiology

Results of routine blood tests suggest that men had higher WBC and RBC counts than did women, with no significant differences among age groups. The total average count for WBC was 6.5 ¡ 2.2 ¡ 10^9/L, and 4.6 ¡ 0.6 ¡ 10^{12}/L for RBC. Men aged above 65 (37.7%) had a greater delinquency in RBC in comparison to those aged between 40 and 64 (17.0%). In terms of age comparison, a similar pat-

Table 4. Percentage of Abnormal Results of Physical Examination in the Adult Preventive Services of the National Health Insurance, Taiwan

Item	Men		Women		Total		Chi-square
	N (%)		N (%)		N (%)		
	Age (yr) 40-64	≥ 65	40-64	≥ 65	40-64	≥ 65	
I. Difference with ideal weight							
< ideal weight -20%	28 (1.1)	42 (3.2)	27 (0.7)	20 (1.6)	55 (0.9)	62 (2.4)	sex***
< ideal weight -10%	135 (5.3)	114 (8.8)	144 (3.8)	65 (5.2)	279 (4.4)	179 (7.0)	age***
> ideal weight -10%	675 (26.5)	302 (23.3)	890 (23.5)	265 (21.1)	1565 (24.7)	567 (22.2)	
> ideal weight -20%	698 (27.4)	273 (21.0)	1295 (34.2)	429 (34.1)	1993 (31.4)	702 (27.4)	
II.Blood pressure							
Systolic blood pressure							
< 100 mmHg	82 (3.2)	28 (2.1)	251 (6.6)	26 (2.1)	333 (5.3)	54 (2.1)	sex***
> 140 mmHg	432 (16.9)	440 (33.4)	644 (16.9)	465 (38.6)	1076 (16.9)	905 (35.1)	age***
Diastolic blood pressure							
< 60 mmHg	33 (1.3)	32 (2.4)	95 (2.5)	30 (2.4)	128 (2.0)	62 (2.4)	sex***
> 90 mmHg	385 (15.1)	200 (15.2)	430 (11.3)	189 (14.9)	815 (12.8)	389 (15.1)	age**
Pulse irregular							
	35 (1.9)	31 (3.5)	44 (1.6)	31 (3.5)	79 (1.7)	62 (3.5)	
III.Uncorrected eye sight							
Right eye							
= 0	21 (0.9)	23 (1.9)	28 (0.8)	33 (2.8)	49 (0.8)	56 (2.4)	sex***
< 0.6	572 (24.2)	623 (52.1)	1056 (30.3)	725 (62.1)	1628 (27.6)	1348 (57.0)	age***
≥ 0.6	1888 (79.9)	550 (46.0)	2412 (69.2)	408 (35.0)	4300 (71.5)	958 (40.6)	
Left eye							
= 0	19 (0.8)	29 (2.4)	31 (0.9)	37 (3.2)	50 (0.9)	66 (2.8)	sex***
< 0.6	562 (23.8)	596 (49.9)	994 (28.5)	711 (61.2)	1556 (26.6)	1307 (55.4)	age***
≥ 0.6	1779 (75.4)	570 (47.7)	2463 (70.6)	414 (35.6)	4242 (72.5)	986 (41.8)	

The formula to calculate ideal weight is as follows: male ideal weight = (height - 80) ¡ 0.7; female ideal weight = (height-70) ¡ 0.6. This is a standard formula suggested by the Department of Health, Taiwan and popularly applied by health screening centers.

**: $p < 0.01$, ***: $p < 0.001$

Table 5. Age Specific Laboratory Results of Blood Samples in the Adult Preventive Services under the National Health Insurance. Taiwan. (N=9016)

Test Item	Gender	Age 40-44	45-49	50-54	55-59	60-64	65-69	≥70	Total
WBC	M	6.6 (1.7)	6.8 (2.0)	6.8 (1.9)	6.8 (1.9)	6.9 (2.3)	6.7 (2.1)	7.0 (2.2)	6.8 (2.0)
(x 10^9/L)	W	6.2 (1.6)	6.3 (2.9)	6.1 (1.8)	6.2 (1.9)	6.4 (2.1)	6.3 (1.7)	6.6 (3.0)	6.3 (2.2)
RBC	M	5.0 (0.5)	5.0 (0.5)	5.0 (0.5)	4.9 (0.6)	4.8 (0.6)	4.7 (0.7)	4.6 (0.6)	4.8 (0.6)
(x 10^{12}/L)	W	4.4 (0.5)	4.4 (0.5)	4.5 (0.5)	4.5 (0.5)	4.4 (0.5)	4.4 (0.5)	4.4 (0.6)	4.4 (0.5)
Hb	M	2.33 (0.2)	2.33 (0.2)	2.29 (0.2)	2.26 (0.2)	2.25 (0.2)	2.25 (0.3)	2.17 (0.3)	2.26 (0.3)
(mmol/L)	W	1.98 (0.2)	2.00 (0.3)	2.03 (0.2)	2.05 (0.2)	2.03 (0.2)	2.02 (0.2)	2.00 (0.3)	2.02 (0.2)
Albumin	M	45.3 (5.4)	44.9 (5.7)	44.5 (5.7)	44.1 (5.3)	43.5 (5.2)	42.6 (7.6)	42.4 (8.0)	43.9 (6.4)
(g/L)	W	43.8 (4.8)	43.6 (4.9)	44.1 (5.0)	44.2 (5.0)	44.3 (10.2)	43.1 (6.4)	42.4 (6.4)	43.6 (6.2)
Globulin	M	29.1 (6.5)	29.2 (5.5)	29.4 (6.1)	29.9 (5.3)	29.5 (5.2)	29.4 (6.7)	29.9 (6.4)	29.5 (6.0)
(g/L)	W	29.7 (5.3)	30.3 (5.8)	30.5 (7.0)	30.2 (5.7)	30.5 (5.8)	30.8 (6.4)	30.8 (6.0)	30.3 (6.2)
GOT	M	28.9 (19.4)	32.0 (42.4)	28.4 (26.1)	31.4 (28.9)	30.0 (20.7)	29.7 (22.4)	27.2 (15.4)	29.6 (26.2)
(IU/L)	W	23.2 (29.3)	24.9 (21.3)	26.5 (16.4)	31.8 (59.4)	29.8 (21.6)	30.7 (21.8)	29.4 (18.8)	27.5 (30.0)
GPT	M	36.6 (36.3)	35.8 (52.2)	34.1 (71.8)	32.6 (28.9)	31.0 (27.1)	30.3 (33.3)	24.7 (22.0)	32.0 (40.4)
(IU/L)	W	22.8 (34.5)	26.0 (35.1)	27.6 (23.5)	33.1 (78.9)	29.6 (30.3)	29.0 (26.0)	26.3 (21.9)	27.3 (39.8)
Cholesterol	M	5.1 (1.1)	5.0 (1.1)	5.1 (1.1)	5.2 (1.1)	5.1 (1.1)	5.0 (1.1)	4.9 (1.0)	5.1 (1.1)
(mmol/L)	W	4.8 (0.9)	5.0 (1.1)	5.3 (1.1)	5.4 (1.1)	5.5 (1.1)	5.4 (1.2)	5.5 (1.2)	5.2 (1.1)
Triglyceride	M	1.74 (2.1)	1.71 (1.5)	1.69 (1.6)	1.56 (1.3)	1.5 (1.5)	1.36 (1.0)	1.28 (0.9)	1.54 (1.5)
(g/L)	W	1.05 (0.8)	1.28 (1.1)	1.34 (1.0)	1.43 (1.0)	1.53 (1.2)	1.54 (1.0)	1.55 (1.0)	1.36 (1.0)
Uric acid	M	0.39 (0.2)	0.39 (0.2)	0.40 (0.2)	0.38 (0.1)	0.38 (0.1)	0.38 (0.2)	0.39 (0.1)	0.39 (0.2)
(mmol/L)	W	0.28 (0.1)	0.30 (0.1)	0.31 (0.1)	0.31 (0.1)	0.33 (0.2)	0.32 (0.1)	0.34 (0.1)	0.31 (0.1)
BUN.	M	10.7 (4.5)	10.9 (3.0)	11.7 (3.3)	12.1 (3.5)	12.2 (3.7)	12.6 (4.0)	13.9 (4.9)	12.0 (4.1)
(mmol/L)	W	9.4 (3.0)	9.8 (3.4)	10.7 (3.2)	11.4 (3.9)	11.8 (4.1)	12.3 (4.2)	13.6 (7.3)	11.1 (4.5)
Creatinine	M	88.8 (17.8)	97.6 (115.4)	97.6 (26.6)	97.6 (17.8)	106.5 (26.6)	106.5 (44.4)	115.4 (53.3)	97.6 (53.3)
(umol/L)	W	71.0 (26.6)	79.9 (44.4)	79.9 (150.9)	79.9 (44.4)	79.9 (26.6)	88.8 (26.6)	97.6 (53.3)	79.9 (71.0)
Glucose AC	M	5.4 (1.8)	5.7 (2.2)	6.1 (3.2)	6.0 (3.3)	5.7 (2.3)	5.9 (2.6)	5.7 (2.2)	5.8 (2.5)
(mmol/L)	W	5.2 (1.5)	5.4 (2.1)	5.7 (2.5)	5.9 (2.5)	6.1 (2.9)	6.0 (2.4)	6.1 (2.7)	5.7 (2.4)

*Data are mean and (standard deviation).

tern of RBC delinquency was found for women. In comparison with men, women generally had less RBC delinquency. The average level of Hb was 2.12 ¡ 0.28 mmol/L. Older adults and women, compared to men, had lower levels of Hb.

The average blood cholesterol level was 5.0 ¡ 1.1 mmol/L for men, 5.2 ¡ 1.5 mmol/L for women, and 5.2 ¡ 1.3 mmol/L for the entire sample. More than 20% of women over 65 had a blood cholesterol level higher than 6.24 mmol/L, while levels of only 13.8% of women 40-64 years old and 11.6% of men over 65 were higher. Men's blood triglyceride levels decreased from 1.74 ¡ 2.1 g/L at 40-44 years old to 1.50 ¡ 1.5 g/L at 60-64 years old and the lowest of 1.28 ¡ 0.9 g/L for the elderly over 70 (Table 5). On the contrary, women's blood triglyceride levels increased from an average of 1.04 ¡ 0.8 g/L to 1.53 ¡ 1.2 g/L at 60 and reached the peak of 1.55 ¡ 1.0 g/L after 70. Among these, 37.5% of men 40-64 years old and 39.4% of women over 65 had triglyceride levels over 1.5 g/L (Table 6).

The average blood sugar level was 5.8 ¡ 2.5

mmol/L for men and 5.7 ¡ 2.4 mmol/L for women. It increased with age. More 40-64 year-old men (17.3%) had high glucose a.c. (glucose a.c.>6.1 mmol/L) than did women in the same age group (14.1%). But, for the age group over 65, women had higher glucose a.c. than did men (Table 6).

There were 4 tests for liver function: albumin and globulin for changes in serum protein and GOT and GPT for changes in serum enzymes. The average levels for albumin and globulin were 43.7 ¡ 6.3 and 30.0 ¡ 6.0 g/L respectively. The abnormality rates for albumin and globulin in each age group were less than 6%. The average levels for GOT and GPT were 28.4 ¡ 28.4 and 29.4 ¡ 40.1 IU/L respectively. The 40-64-year-old men had higher (21.4%) GPT (>40 IU/L) than those in other categories. Significant age

Table 6. Percentage of Abnormal Lab Results in the Adult Preventive Services of National Health Insurance, Taiwan. (N=9016)

Item (unit)	Criteria	Men		Women		Total		Chi-square
		N (%)	N(%)	N(%)				
		Age (y/o) 40-64	≥ 65	40-64	≥ 65	40-64	≥ 65	
I. Blood routine examination								
WBC	< 4	59 (2.3)	39 (3.0)	211 (5.5)	62 (4.9)	270 (4.2)	101 (3.9)	sex***
(¡ 10^9/L)	> 10	141 (5.5)	85 (6.5)	126 (3.3)	43 (3.4)	267 (4.2)	128 (5.0)	
RBC	< 4	435 (17.0)	495 (37.7)	520 (13.6)	283 (22.6)	955 (14.9)	778 (30.3)	sex***
(¡ 10^{12}/L)	> 6.2	64 (2.5)	17 (1.3)	122 (3.2)	26 (2.1)	186 (2.9)	43 (1.7)	age***
Hb	< 1.9	216 (8.6)	235 (18.2)	630 (16.8)	262 (20.8)	846 (13.5)	497 (19.5)	sex***
(mmol/L)	> 2.8	15 (0.6)	9 (0.7)	30 (0.8)	19 (1.5)	45 (0.7)	28 (1.1)	age***
II. Blood biochemical examination								
Albumin	< 35	61 (2.4)	74 (5.7)	46 (1.2)	58 (4.6)	107 (1.7)	132 (5.1)	sex***
(g/L)	> 55	31 (1.2)	26 (2.0)	34 (0.9)	16 (1.3)	65 (1.0)	42 (1.6)	age***
Globulin	< 15	23 (0.9)	28 (2.2)	42 (1.1)	17 (1.4)	65 (1.0)	45 (1.8)	
(g/L)	> 40	51 (2.0)	50 (3.9)	99 (2.6)	59 (4.7)	150 (2.4)	109 (4.3)	age***
GOT (IU/L)	> 40	333 (13.0)	147 (11.2)	360 (9.4)	183 (14.4)	693 (10.9)	330 (12.8)	
GPT (IU/L)	> 40	549 (21.4)	161 (12.3)	498 (13.0)	195 (15.4)	1047 (16.4)	356 (13.9)	
Cholesterol	< 2.9	23 (0.9)	11 (0.8)	27 (0.7)	11 (0.9)	50 (0.8)	22 (0.8)	sex***
(mmol/L)	> 6.2	331 (12.9)	153 (11.6)	528 (13.8)	265 (20.9)	859 (13.4)	418 (16.1)	age**
Triglyceride	< 0.3	13 (0.5)	3 (0.2)	19 (0.5)	1 (0.1)	32 (0.5)	4 (0.2)	sex***
(g/L)	> 1.5	963 (37.5)	345 (26.2)	975 (25.5)	500 (39.4)	1938 (30.3)	845 (32.8)	age**
Uric acid	< 0.14	5 (0.2)	7 (0.5)	42 (1.1)	11 (0.9)	47 (0.8)	18 (0.7)	sex***
(mmol/L)	> 0.41	312 (12.2)	155 (11.8)	118 (3.1)	91 (7.2)	430 (6.7)	246 (9.5)	age***
BUN	< 3.4	5 (0.2)	1 (0.0)	4 (0.1)	5 (0.4)	9 (0.2)	6 (0.2)	sex***
(mmol/L)	> 16.4	144 (5.6)	210 (16.0)	141 (3.7)	176 (13.9)	285 (4.5)	386 (15.0)	age***
Creatinine	< 35.5	3 (0.1)	1 (0.0)	8 (0.2)	1 (0.1)	11 (0.1)	2 (0.2)	sex***
(μmol/L)	> 133	92 (3.6)	132 (10.0)	4 (1.0)	68 (5.4)	96 (5.8)	200 (2.1)	age***
Glucose AC	< 3.3	13 (0.5)	11 (0.8)	19 (0.5)	6 (0.5)	32 (0.5)	17 (0.6)	
(mmol/L)	> 6.1	443 (17.3)	270 (20.6)	538 (14.1)	326 (25.7)	981 (15.4)	596 (23.1)	age***
III. Urine routine examination								
Protein	+/-	369 (9.6)		424 (8.4)		793 (8.9)		
Glucose	+/-	249 (6.5)		277 (5.5)		526 (6.0)		
Occult blood	+/-	271 (7.2)		657 (13.3)		928 (10.7)		sex***
RBC	> 5/HPF	196 (5.1)		462 (9.2)		658 (7.4)		sex***
WBC	> 5/HPF	229 (6.0)		844 (16.8)		1073 (12.1)		sex***
Pus cell	≥ 1/HPF	155 (4.2)		224 (4.6)		379 (4.4)		
Epith. cell	> 5/HPF	86 (2.3)		1300 (26.3)		1386 (16.0)		sex***
Cast	≥ 1/LPF	155 (3.1)		171 (3.5)		326 (3.3)		

*: $p < 0.05$,**: $p < 0.01$,***: $p < 0.001$.

Urine routine examination showed no evident difference between ages, so the data were not classified by age.

variations were found indicating changes in serum protein, but not for changes in serum enzymes. Gender variations were not significant for these indices of liver function, except for the magnitude of albumin for which men had a higher delinquency rate than did women.

In general, women's creatinine levels were 17.8 μmol/L lower than men's level of in every age group, and ranged from 79.9 to 115.4 μmol/L. There were 296 (7.9%) adults whose creatinine levels were higher than the normal level of 133 μmol/L. Among them, 5.8% were in the 40-64 age group, and 2.1% were over 65 years old. Both men and women's BUN increased slightly as they grew older, but no significant difference was found between genders. There were 671 (19.5%) adults whose BUN levels were higher than the normal value of 16.4 mmol/L. More men than women had high levels of creatinine and BUN.

On routine urine examinations, women had higher levels for each item except protein and glucose. More women than men had much higher levels on items of occult blood, WBC, and epithetical cells.

On average, adult men had higher uric acid than did women, and had higher percentage abnormal rate at greater than 0.41 mmol/L. The average uric acid levels for men were homogenous (0.38-0.4 mmol/L) among different age groups, and slightly increased with age in women (0.28-0.34 mmol/L). The uric acid levels greater than 0.41 mmol/L were considered abnormal. The abnormal rates for men were consistent for each age group while the rate for women over 65 (7.2%) was doubled that of women between 40 and 64 years old (3.1%) (Table 6).

Physician recommendations for follow-up

At the end of this adult health screening, the physician checked either "not abnormal", "needs follow-up or further check-up", or "needs further treatment" according to the above results. In this study, only 21.6 % adults of 40-64 years old were considered not to be abnormal, 47.7 % of them needed a further check-up, and 30.7% needed further treatment. The relative ratios for those older than 65-years old, were 12.6%, 45.1%, and 42.3%. However, the national health insurance policy did not track those patients who may have needed further check-up or treatment.

DISCUSSION

Most recent studies of adult health status in Taiwan were conducted on a small scale or some years ago,[15-18] except one that was conducted on a nationwide scale.[14] Because the data of this study are from records of adults health examinations provided by the National Health Insurance in Taiwan, we are very interested in comparing the results with those obtained from other studies.

Changes and variations in height and weight for men and women in this study are consistent with those of studies by Pan et al. in 1993-1996 and Kao in 1986-1988.[14,18] Women's weight increased as they grew older and reached a peak at the 50-59-year age group, and then slightly decreased after 60. Compared to the data 10 years ago, adult's height changed little during this decade. However, their current weight was 2 kg heavier nowadays in each age group. The percentage of overweight was around 50% in this study as well as in recent community studies by Chiu et al. and Kao.[15,18] Being overweight should not be overlooked since it is related to many chronic diseases, such as hypertension, diabetes, heart diseases, stroke, etc.[8,10]

In our study, 16.9% of 40-64 years old and 35.1% of adults over 65 had high systolic blood pressure (>140 mmHg). These results differ from those of Yen and Lin at 20.4% of adults over 65 and Huang et al. at a prevalence of 44.3% in community studies.[16,17] The levels of blood cholesterol and triglyceride differed among men and women. Women's cholesterol levels increased significantly after menopause. Men usually had higher triglyceride than did women, but values were similar after 60 years old. Other studies also showed that the levels of triglyceride increased to a certain age, and then gradually decreased later.[16-18]

In this study, 15.4% of 40-64 years old and 23.1% of those 65 and older had high blood sugar, compared to 8.1% from the self-reported history. These results are similar to those from Chiu et al.'s, Huang et al.'s, and Yen and Lin's community studies.[15-17]

In general, the results from this study are consistent with those of other studies on either smaller or national scales. In daily medical practice, these data

can be used as guidelines for different age and gender groups. Our analysis of physical and blood biochemical variables reveals that age and gender are easily identifiable, invariably strong, indicators of disease risk and are useful selective criteria for those who merit further attention. For example, triglyceride decreased with age in men but increased with age in women. A similar result was also seen in a nationwide nutrition survey.[14] After communicating with several family physicians about this finding, one possible suggestion is that this may be brought about by a change in weight, because there was a significant positive correlation ($r=0.20$) between weight and the level of triglyceride. However, this speculation should remain tentative despite these finding possibly having important implications. Women's weight in the present study increased as they grew older and reached a peak at the 50-59-year age group, and then slightly decreased after 60. Such information is important in the daily practice of general physicians because serious overweight is an important risk factor for diabetes, hypertension, and other serious diseases.[19] In addition, most of the normal values of physical and biochemical indicators may change as age increases. Reference data for elder adults may be higher or lower than corresponding values for young adults. If the correct reference data are not used, then some false-negative or false-positive diagnoses may create unnecessary problems for patients.[4,11,20-21]

Several steps have been taken to strengthen the reliability of these data gathered from a massive voluntary physical examination. These include systematic sampling and comparisons with data collected from a nationwide nutrition survey program.[14] The sampling caused the data set to deviate little from the general population in terms of age and gender. Comparisons showed that the distribution of both weight and height were consistent in terms of age and gender. Although precautionary steps to ensure the reliability and representativeness of these data were taken, several limitations of the present report should be noticed. First, data were gathered from different NHI-contracted agents and laboratories. The authors believe that the procedures for physical and laboratory examination should have been standardized throughout Taiwan; however, we were unable to trace all the agents for further confirmation. Second, not all the insured people over 40 years old took this free physical examination because it is not a compulsory policy. Although no major differences in terms of age and gender distribution have been found between the sampled and general population data, the authors suggest that one must be conservative in applying the results to represent the general population.

Successful population-based health screening requires a well-planned delivery to the target population and coordinated follow-up care which can deal adequately with those who are screened as requiring some follow-up measures.[22] The free mass health screening program initiated by the Bureau of National Health Insurance of Taiwan may help ease the economic burden of the targeted population and increase service accessibility; however, the efficacy of this population-based health screening program remains questionable. At this time, there is not enough evidence to support the view that the benefits of population-based screening for adults and elderly outweigh the costs.[23] Until the potential benefits and costs of mass screening are elaborated, a more-selective approach may be justified. Despite the effort to establish baseline indicators in the present paper, future research on population-based screening programs needs to pay close attention to adequate follow-up to determine the efficacy of such programs, and to determine the effectiveness of lifestyle changes in reducing risk factors for important diseases.

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fl`¤œ' ƒL¥»‡B¡G·¿f ¥`‡ /h¡A"‡' /j · ´ ¨" †z¤t¡Cfi ¶Ø¿/ t/s¶m/ /˜/@, 259 „‚C Tel.: (03)3283016´ 5434Fax: (03)3287345; E-mail: tsenghm@mail.cgu.edu.tw