TABLE 1. Demographic data of the 73 study population

Variables	N (%)
Sex Male	36 (49.3)
Female	37 (50.7)
Major medical problems	
CVA	23 (31.5)
OA	21 (28.8)
Back pain	9 (12.3)
Other	20 (27.4)
Economic status	
Sufficient	67 (91.8)
Insufficient	6 (8.2)
Marital status	
Married	47 (64.4)
Divorced	24 (32.9)
Single	2 (2.7)
Walking aids	
None	43 (58.9)
Cane	26 (35.6)
Walker	4 (5.5)
Ability to go outside	
Independent and safe	35 (47.9)
Independent but unsafe	19 (26.0)
Dependent on assistance	19 (26.0)

Methods

After the informed consent, the subject was interviewed on their demographic data and asked to complete the test by standing up from a standard armchair, walking a distance of three meters, turning, walking back to the chair, and sitting down again. The author advised all participants to walk at a safe and comfortable speed with a customary gait aid (none, cane or walker). The subject walked through the test once before being timed in order to get familiar with the test. The timed Up & Go was measured in seconds by a stop-watch.

In addition to the timed Up & Go, we also measured the gait speed and the functional capacity. The subjects were asked to walk a 20-meter distance with their customary walking aid at a freely chosen speed. The gait speed (meter/minute) was calculated as the time taken to walk the middle 15 meters (the first three meters and the last two meters were not included).

The functional capacity was evaluated by using Barthel Index of Activities of Daily Living (ADL) and the subject's ability to go outside alone. Barthel Index[6] was used to assess the participants' levels of independence in the basic activities of daily living. The index was scored by determining whether the subject could perform fifteen tasks independently, either with assistance or not at all. These tasks were composed of three main functions, including self-care (drinking from a cup, eating, dressing the upper and lower body, grooming, and washing), continence of bowel and bladder, and mobility (transfers in and out of a chair, toilet, and a tub or shower; walking 50 yards and climbing stairs). The score ranged from 0 (totally dependent on another's help) to 100 (totally independent). The higher scores indicated the better functions. Barthel scores have demonstrated test-retest and inter-rater reliability of 0.89 and 0.95, respectively.[7]

The patient's ability to go outside alone was also estimated clinically at the initial assessment. The patients were classified into one of three groups: (1) could walk outside independently and safely; (2) walked outside independently but were judged to be unsafe; and (3) was dependent on the assistance or supervision of others to go outside.

Pearson correlation coefficient was used to assess the approximate relationship of the timed Up & Go with gait speed and the functional score (Barthel Index of ADL).

RESULTS

There were twenty-two elderly in the control group (11 men, 11 women; mean age of 71.5; ranged 64-84 years). All of them performed the timed Up & Go in 10.8 seconds or less (mean time of 8.8; ranged 6-10.8 sec).

The study population included 36 men and 37 women (mean age of 71.3 years; ranged 60-89 years). The major medical diagnoses were cerebrovascular accident (CVA) (n=23), osteoarthritis of the knee (OA) (n=21), back pain (n=9) and other diseases (n=20) such as dementia (n=6), gout (n=5), osteoporosis (n=4) and hypertension/diabetes mellitus (n=5). Most of them had a sufficient income (91.8%) and were married (64.4%). About sixty percent walked without gait aids. Concerning their ability to go outside, 35 subjects (47.9%) could go independently and safely, 19 (26%) walked outside independently but they were considered to be at risk, and the rest (26%) were dependent on assistance (Table 1).

The timed Up & Go, gait speed and Barthel Index score of the normal and disease groups are demonstrated in Table 2. Subjects in the disease group were categorized into four according to their major medical diagnoses. The timed Up & Go of the disease group was definitely different from those of normal subjects (19.0 ± 14.8 vs. 8.8 ± 1.2 seconds, respectively). The gait speed and Barthel Index score were also statistically different between the normal and disease groups (81.3 ± 10.5 vs. 48.8 ± 18.5 m/min; 100.0 ± 0.0 vs. 94.2 ± 11.4, respectively; $p<0.001$). Compared to the disease groups, the normal subjects could more easily perform the timed Up & Go test, walk faster and had a higher level of function (Barthel Index). Among the disease subjects, the one-way analysis of variance was performed with a multiple-comparison post hoc test using Dunnett method, and found that the timed Up & Go, the gait speed and the functional score of the CVA (Hemiparesis) group were different from those of knee OA, back pain and other disease groups. That was patients with CVA had the longest timed Up & Go, the slowest gait speed and the lowest functional score compared to patients with the others.

Three factors influencing the timed Up & Go were the participants' major medical problems, ability to walk with or without gait aids, and

TABLE 2. The timed Up & Go, gait speed and Barthel index between the normal and disease groups in mean ± standard deviation

Variables	Timed Up & Go (sec)	Gait speed (m/min)	Barthel score
Normal (n=22)	8.8 ± 1.2	81.3 ± 10.5	100.0 ± 0.0
Disease (n=73)	19.0 ± 14.8	48.8 ± 18.5	94.2 ± 11.4
CVA (n=23)	27.5 ± 23.1	40.8 ± 25.6	87.7 ± 17.7
OA (n=21)	17.0 ± 7.7	48.6 ± 13.1	94.5 ± 7.4
Back (n=9)	14.9 ± 5.6	53.5 ± 14.2	98.9 ± 2.2
Others (n=20)	13.3 ± 2.3	56.0 ± 10.8	99.4 ± 1.6
P-value@	<0.001	<0.001	<0.001

@ One way ANOVA test

* Statistically significant

TABLE 3. Factors influencing the timed Up & Go

	Variables	N	Timed Up & Go	P-value@
Sex	Male	36	19.9 ± 16.8	0.634
	Female	37	18.2 ± 12.7	
Age	< 75 yr	49	18.8 ± 16.7	0.816
	≥ 75 yr	24	19.6 ± 10.2	
Medical problems	CVA	23	27.5 ± 23.1	0.002*
	OA and Back pain	30	16.4 ± 7.1	
	Others	20	13.3 ± 2.3	
Using gait aids	Not using	43	12.9 ± 3.2	<0.001*
	Using	30	27.9 ± 19.8	
Ability to go outside	Independent and safety	35	13.1 ± 3.7	<0.001*
	Independent but unsafe	19	14.9 ± 3.8	
	Dependent	19	34.1 ± 22.5	

@ Independent t-test or One-way ANOVA

*Statistically significant

abi-lity to go outside (Table 3). The correlation among the timed Up & Go, gait speed and functional capacity was analyzed by Pearson correlation coefficient. The timed Up & Go related well to the gait speed (r= -0.78; p= <0.001) and the score on Barthel Index of ADL (r= -0.79; p= <0.001).

DISCUSSION

The timed "Up & Go" is a practical method to measure the ability of basic mobility skills.[5] It can be used easily in the geriatric clinic for assessing a population of frail elderly patients or can be used with community-dwelling persons. It is quick and easy to perform without special equipment or training.[4,5]

The result of the present study revealed that the timed Up & Go of the normal group was significantly shorter than that of the disease group. Among subjects in the disease group, CVA patients had a longer timed Up & Go than others. CVA is a disease causing extinguished disability which disturbs patients' physical functions, especially mobility and transferring.[8] Compared to patients with back pain or OA, these diseases cause less disability. This result confirmed that the timed Up & Go can differentiate subjects according to the underlying diseases and functional abilities.

Concerning factors influencing the timed Up & Go, there were evidences of significant difference among various medical problem groups, using gait aids or not and the ability to go outside. Subjects who had CVA, ambulated with gait aids or were dependent on someone to go outside performed longer timed Up & Go. The timed Up & Go test is a test measured a complex activity composed of sit to stand ability, balancing, ability to walk, and turning capability. All of these activities are difficult to perform when people get older.[9] In addition, many frail elderly patients will fall when rising from a chair, when walking, turning, or attempting to sit down.[4] Therefore, whether the patients can perform this test better or not depends on their physical limitations.

The author also evaluated the subjects' gait speed and found that normal subjects could walk significantly faster than those in the disease group (p<0.001). Among the disease group, nine out of 73 subjects (eight for CVA and one for severe back pain) had a gait speed of less than 30 m/min. This speed has been suggested as the minimal gait velocity required to cross the street.[10]

Only two of the 73 subjects (in the CVA group) had functional Barthel Index scores of less than 60 which is the cutting point of the dependency level.[11] Participants with low functional ability usually walk with a slow speed and performed longer timed Up & Go.

The correlation analysis among the timed Up & Go, gait speed and functional capacity was analyzed by Pearson correlation. The correlation coefficient of greater than 0.75 (or -0.75) indicates a very good to excellent relationship.[12] It revealed that the timed Up & Go was well related to the gait speed (r= -0.78; p= <0.001) and to Barthel Index score of ADL (r= -0.79; p= <0.001). This meant that it could be used as an indicator of functional capacity as indicated by a good correlation among the timed Up & Go, the gait speed and the functional score.

CONCLUSION

The timed Up & Go test is an easy and practical method to evaluate basic physical mobility in the elderly. It can be performed at any place, and only needs a watch to measure the time spent for this test. It correlates well to the subject's gait speed and functional score. It can be used as an indicator for functional capacity of the elderly.

ACKNOWLEDGEMENTS

The author would like to thank Dr. Somsri Ratanavijitsilpa and Mr. Suthipol Udompunturak for statistical analysis. The author also wishes to thank Mrs. Aroon Leureharusamee and Ms. Yananee Wongsaranuchit for their work as research assistants. Finally, I am indebted to all participants who willingly participated in this study.

REFERENCES

1. Isaacs B. Clinical and laboratory studies of falls in old people. Clin Geriatr Med 1985;1:513.
2. Tinetti ME, Ginter SF. Identifying mobility dysfunctions in elderly patients. J Am Geriatr Soc 1988;259:1190.
3. Berg K. Balance and its measure in the elderly: a review. Physiother Can 1989;41:240.
4. Mathias S, Nayak USL, Isaacs B. Balance in the elderly patient: The "Get-up and Go" test. Arch Phys Med Rehabil 1986;67:387.
5. Podsiadlo D, Richardson S. The timed "Up & Go": A test of basic functional mobility for frail elderly persons. J Am Geriatr Soc 1991;39:142-8.
6. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. Md Med J 1965;14:61-5.
7. Gresham GE, Phillips TF, Labi MLC. ADL status in stroke: relative merits of three standard indexes. Arch Phys Med Rehabil 1980;61:355-8.
8. Roth EJ, Harvey RL. Rehabilitation of stroke syndromes. In: Braddom RL, ed. Physical Medicine and Rehabilitation. Philadelphia: WB Saunders, 1996:1053-85.
9. Tideiksaar R. Disturbances of gait, balance, and the vestibular system. In: Tallis R, Fillit H, Brocklehurst JC, eds. Geriatric Medicine and Gerontology, 5th ed. Edinburgh: Churchill Livingstone, 1998:595-609.
10. Robinett CS, Vondran MA. Functional ambulation velocity and distance requirements in rural and urban communities. Phys Ther 1988;68:1371-3.
11. Mahoney FJ, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J 1965;14:61-5.
12. Dawson-Saunder B, Trapp RG. Summarizing data. In: Dawson-Saunder B, Trapp RG, eds. Basic & clinical biostatistics, 2nd ed. London: Prentice-Hall International Inc, 1994:41-63.

บทคัดย่อ

การทดสอบทักษะการเคลื่อนที่พื้นฐานโดยการจับเวลาในผู้สูงอายุ

วิไล คุปต์นิรัติศัยกุล พ.บ.*, ปิยะภัทร เดชพระธรรม พ.บ.*, รุ่งนิรันดร์ ประดิษฐสุวรรณ พ.บ.**

**ภาควิชาเวชศาสตร์ฟื้นฟู, **ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กทม 10700. ประเทศไทย*

วัตถุประสงค์: ทักษะความสามารถในการเคลื่อนที่เป็นสิ่งจำเป็นในการดำรงชีวิตแบบอิสระของผู้สูงอายุ การตรวจร่างกายทางระบบประสาทและกล้ามเนื้อช่วยในการวินิจฉัยโรค แต่ไม่ได้บอกถึงระดับความสามารถทางกาย การทดสอบความสามารถในการเคลื่อนที่โดยการจับเวลาน่าจะเป็นสิ่งสำคัญที่ปฏิบัติได้สะดวกในเวชปฏิบัติทั่วไป วัตถุประสงค์ของการศึกษานี้คือเพื่อประเมินประโยชน์ทางคลินิกของการทดสอบทักษะด้านการเคลื่อนที่ของผู้สูงอายุ ณ. คลินิกผู้สูงอายุ

วิธีการ: ทำการศึกษาในประชากรผู้สูงอายุจำนวน 95 ราย จากคลินิกผู้สูงอายุ โรงพยาบาลศิริราช อาสาสมัครทดสอบทักษะการเคลื่อนที่โดยลุกจากเก้าอี้นั่งเดินเป็นระยะทาง 3 เมตร หมุนตัว เดินกลับมาที่เดิม และนั่งลง และวัดอัตราเร็วในการเดินโดยให้เดินด้วยความเร็วตามสะดวกเป็นระยะทาง 20 เมตร และประเมินระดับความสามารถทางกายโดยใช้แบบประเมิน Barthel Index วิเคราะห์ข้อมูลโดยใช้สถิติ independent t-test , One-way ANOVA, Multiple-comparison post hoc test และ Pearson Correlation Coefficient

ผลการศึกษา : อาสาสมัครปกติจำนวน 22 ราย และอาสาสมัครที่มีโรคทางระบบประสาทและระบบกล้ามเนื้อและกระดูกจำนวน 73 ราย ทุกรายทำการทดสอบทักษะการเคลื่อนที่ ค่าเฉลี่ยระยะเวลาที่ใช้คือ 8.8 ± 1.2 และ 19.0 ± 14.8 วินาที ในกลุ่มอาสาสมัครปกติและกลุ่มผู้ป่วยตามลำดับ ผู้ป่วยอัมพาตหลอดเลือดสมองใช้เวลาในการทดสอบทักษะการเคลื่อนที่นานกว่าผู้ป่วยข้อเข่าเสื่อม ผู้ป่วยปวดหลัง และกลุ่มโรคอื่น ๆ รวมทั้งมีอัตราเร็วในการเดินช้ากว่าและคะแนนความสามารถต่ำกว่า นอกจากนี้ยังพบว่าการทดสอบทักษะการเคลื่อนที่นี้มีความสัมพันธ์ในเกณฑ์ดีกับอัตราเร็วในการเดิน ($r = -0.78$, $p < 0.001$) และสัมพันธ์ดีกับคะแนนความสามารถในการทำกิจวัตรประจำวัน ($r = -0.79$, $p < 0.001$)

สรุป : การทดสอบทักษะการเคลื่อนที่ด้วยการเดินและจับเวลานี้ เป็นวิธีการที่ปฏิบัติได้ง่าย สะดวก และสามารถประเมินทักษะการเคลื่อนที่ของผู้สูงอายุได้ สามารถปฏิบัติได้ในทุกสถานที่ และไม่ต้องการอุปกรณ์พิเศษใด ๆ จึงสามารถนำมาใช้เป็นการทดสอบทักษะการเคลื่อนที่ในคลินิกผู้สูงอายุได้