Strategy to Prevent Falls in the Thai Elderly : A Controlled Study Integrated Health Research Program for the Thai Elderly

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Abstract

Instability or falls are one of the important warning symptoms of underlying serious illness among the elderly, so many studies have concentrated on the risk factors for falls. However, a study involving a strategic method to reduce the incidence of falls is the next step and is the main objective of this study. 1,043 elderly subjects living in the urban area around Siriraj Hospital Medical School, Bangkok, were recruited, 585 of them were allocated to the study group and 458 subjects to the control group. A leaflet containing information on important risk factors of falls within their community was enclosed with a follow-up postcard in the study group only. In addition, this particular group was allowed free access to the geriatric clinic at Siriraj Hospital if there was any health problem. All of them received a postcard asking about any falls which had occurred over the previous 2 months on 6 occasions and a telephone call if the postcards were not returned to the team. The percentage of elderly who kept in contact was 92.5 per cent, 90.6 per cent, 89.3 per cent, 89.2 per cent, 86.2 per cent and 85.45 per cent for the first to final follow-up respectively. After one year of longitudinal study, the overall incidence of falls was 6.6 per cent in the study group and 10.1 per cent in the control group. The incidence of falls began to show a statistically significant difference between the two groups at the fourth and sixth episodes of follow-up (P = 0.002 and 0.004). The Kaplan-Meier survival analysis also revealed a statistically significant difference in the incidence of falls between the two groups (P =0.01). In conclusion, the incidence of falls was significantly reduced in the study group and a repeated campaign to alert the elderly to the risk of falling is a cost-effective way of fall prevention among the healthy elderly in the community.

Key word : Prevention, Fall, Elderly

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Following the decline in the crude birth rate as well as an increased life expectancy at birth, Thailand is seen as one of the contributors to the dramatic rise of the elderly population in Asia[1]. As the inevitable ageing of the population gives rise to an increase in degenerative disease, the incidence of many crippling diseases is more prevalent in this particular age group. However, the number of older persons with fall-induced injuries is increasing at a rate that could not be explained solely by demographic trends[2]. In addition, there is evidence that one or more injurious falls were associated with an increase in annual hospital costs of 11,042 US dollars in 1996 and total health care costs of 19,440 US dollars[3]. Furthermore, the problem of falls is poorly detected by general practitioners due to the reluctance on the part of elderly people to report the problem and the relative inability of general practitioners to manage the problem successfully[4]. Research is therefore needed in order to evaluate how to incorporate the most effective fall prevention programs into community care for the elderly[5]. Although there has been a national survey in rural areas revealing the prevalence of falls as 18.7 per cent with some significant factors associated with falls, a study to verify a cost-effective way of fall prevention among the Thai elderly has never been conducted before[6]. As a cross-sectional study determining the significant risk factors of falls among the elderly living in the vicinity of Siriraj Hospital has already been done, it would be appropriate to apply such factors to the study of fall prevention in the community.

MATERIAL AND METHOD

Given that the prevalence of falls among the Thai elderly is around 20 per cent, the sample size needed to allow a one-third decrease in the occurrence of falls with a confidence level of 0.95 and a power of 0.8 including continuity correction would be 372 cases in each group, using the statistical program SAM. However, a figure of around 500 cases in each group was initially required to compensate for the dropout rate. Sequentially, 585 elderly subjects living in 6 local communities and 458 cases living in 5 local communities were allocated to the study and control groups respectively. All of them lived within the vicinity of Siriraj Hospital. Various socioeconomic and health backgrounds were compared between the two groups to avoid selection bias. A one-year longitudinal follow-up of falls was done by postcard every two months and by telephone in cases of failure to return the postcard. The definition of fall i.e. the elderly lost their balance and any part of the body, except the feet, hit the ground regardless of any cause was reported initially. Within the study group, all subjects received a leaflet identifying the significant risk factors of falls among their communities and the appropriate way to prevent, correct, or cope with them. These included 6 main categories namely kyphoscoliosis, nutritional status, activity of daily living, hypertension, special sense function and cognitive problem. However, as kyphoscoliosis is an irreversible problem and it relates to osteoporosis and falls leading to vertebral fracture, nutrition counseling regarding a high calcium intake was emphasized. Likewise, cognitive problems are often made worse by polypharmacy, especially with psychoactive agents such as the benzodiazepines. Advice not to take unnecessary medication was also highlighted[7-9]. In addition, they were able to have free access to the geriatric clinic operated by the authors' team which embraces a holistic approach should they have any health problem.

The activities of daily living including a mobility index designed by the Survey in Europe on Nutrition and the Elderly and Concerted Action (SENECA) were employed[10]. The Thai Mental State Exam (TMSE), a screening tool for the mental health of the Thai elderly, was used to screen for subjects suffering from cognitive impairment with a cut-off point of 23 or lower from a possible 30 points was used to define cognitive impairment[11]. A Snellen chart was employed to test visual acuity, a portable screening audiometer (Welch Allyn Audioscope 3™) was used to test hearing. Anyone who failed to hear a sound at a threshold of 40 dB at any frequency 500, 1,000, 2,000 and 4,000 Hz in both ears was labeled as hearing impaired. Musculoskeletal deformity includes kyphoscoliosis, genu varum and foot deformity.

The Chi-square test and Student *t*-test were used in univariate analysis to determine differences in the incidence of falls between the subjects of both groups as well as to match the various socioeconomic and health backgrounds at the beginning of the study. The Kaplan-Meier survival curve was

employed sequentially to verify the impact of intervention upon the occurrence of falls over a one year period.

RESULTS

A comparison of various socioeconomic background factors and health problems in both the study and control group is shown in Table 1. There was no significant difference in terms of gender, primary school education, financial status, number of subjects with abnormal gait, hearing difficulty, musculoskeletal deformity, arthralgia, hypertension, vision impairment, age, lean body mass, hemoglobin level, the mental test score, body mass index and mobility index of both groups at the beginning of the study ($P > 0.10$). The majority of these factors were significant risk factors for falls among these populations from a multiple logistic regression analysis.

Following the longitudinal study on the basis of every two months, the incidence of falls in the control group was higher than that of the study group i.e. 8.6 per cent *vs* 6.9 per cent for the first two months, 9.5 per cent *vs* 7.6 per cent for the second two months and 7.0 per cent *vs* 6.1 per cent for the third two months. However, the difference in the number of falls between the two groups did not achieve statistical significance until the second half of the study period. The benefit of intervention could be seen at the end of the fourth two months when the incidence of falls was 9.4 per cent and 5.9 per cent of the control and study groups respectively. At the end of the study, the overall decrease in the incidence of falls in the study group compared with the control group was highly significantly different ($P < 0.0001$). Considering the effect of the intervention against the incidence of falls by Kaplan-Meier survival analysis (Fig. 1), the incidence of falls was significantly higher in the control group ($P = 0.012$ by log rank analysis).

DISCUSSION

Although falls among the elderly are usually associated with significant morbidity and mortality, a longitudinal study of falls had not previously been considered until Gryfe CI et al reported the first longitudinal study in an active ambulatory institutionalized population in 1977[12]. However, according to the MEDOS Study group in European countries, great diversity was found both among those who fell and the environment in which they fell and fractured the hip[13]. Therefore, suggestions for fall prevention should include different target groups and be country and site specific. This first longitudinal study among the Thai elderly, was designed to study specifically the elderly dwelling in the community, due to the fact that the majority of the Thai elderly live in the community as there are very few nursing homes available around the country. Another important reason is although older people in institutions

Table 1. A comparison of demographic, socioeconomic background factors and various common risk factors between the study and control groups at the beginning of the study.

	Control group	%*	Study group	%*	P value
Female gender	298	65	283	62.9	0.54
Achieved only primary school education	225	61.5	237	58.7	0.39
Poor financial status	65	18.1	65	16.8	0.10
Abnormal gait	60	13.4	42	9.8	0.12
Hearing difficulty	102	27.9	96	28.3	0.98
Musculoskeletal deformity	55	12.5	52	12	0.91
Arthralgia	153	33.7	129	29.3	0.18
Hypertension	141	30.8	140	31.1	0.97
Vision impairment	208	45.4	219	48.7	0.36
Mean ± SD of lean body mass (kilogram)	35.4 ± 7.9		35.1 ± 7.1		0.47
Mean ± SD of age (year)	67.5 ± 5.9		67.7 ± 6.4		0.60
Mean ± SD of hemoglobin (gram per deciliter)	13.3 ± 1.7		13.3 ± 1.7		0.56
Mean ± SD of TMSE score	22.5 ± 4.9		22.8 ± 4.9		0.45
Mean ± SD of body mass index (kg/m^2)	24.5 ± 4.4		24.7 ± 4.3		0.60
Mean ± SD of ADL	19.6 ± 6.4		19.0 ± 5.3		0.16
Mean ± SD of mobility index	5.7 ± 2.6		5.5 ± 2.3		0.36

* the percentage of number of cases in each group

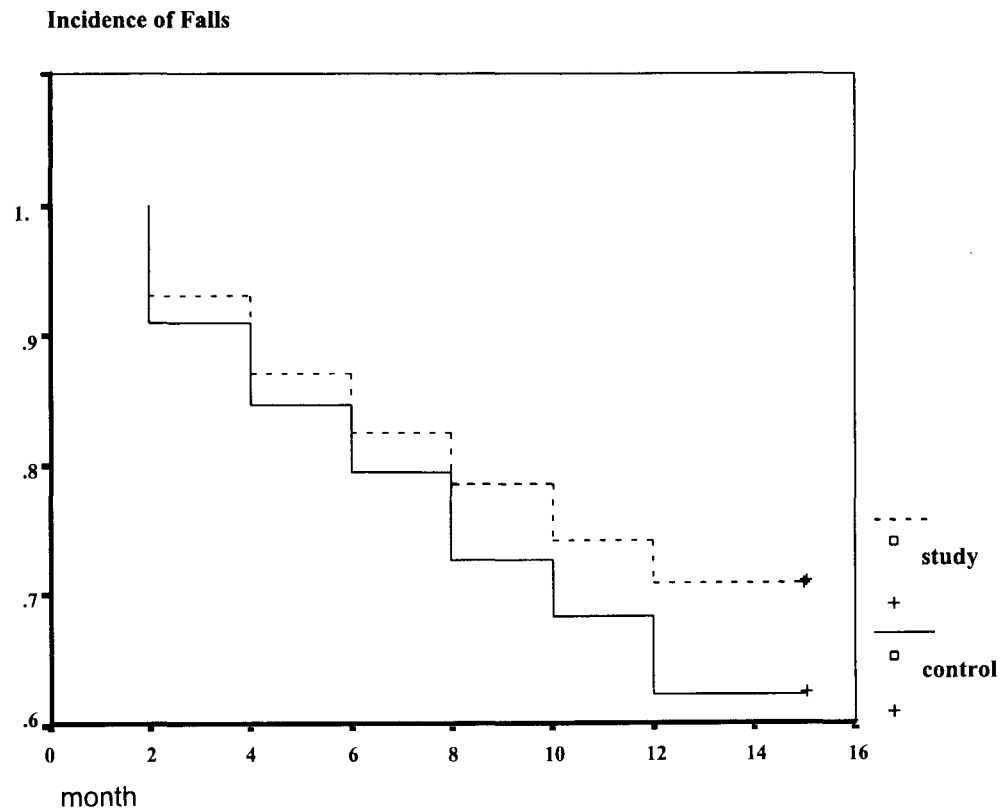

Fig. 1. The Kaplan-Meier survival curve of incidence of falls between the study and control groups.

experienced higher overall fall rates, vigorous old people living with more home hazards were more likely to fall[14]. Furthermore, a two month interval of follow-up was set in accordance with Cummings SR et al whose report revealed that an elderly person often did not recall falls that occurred during specific periods of time over the preceding 3 to 12 months[15].

Regarding case control studies of fall prevention in the older person, nearly all of them identified the risk factors either from a literature review or from the sample population per se and the specially designed intervention was placed on the target population. This involves mainly 5 areas i.e. demographic, medical and psychosocial host factors, environmental factors and the agent in falls[5]. As far as the medical host factors are concerned, the common factors involve psychotropic agents especially the benzodiazepine group, vision impairment, cognitive deterioration, postural hypotension, peripheral neuropathy, abnormal gait, nutrition, poor performance in activity of daily living and so on[8-9,16-18]. However, the design in this study was different in terms of the application of identified risk factors. The six main risk factors ; namely kyphoscoliosis, poor nutritional status, poor performance in activity of daily living, hypertension, poor special sense function and cognitive problems were arranged and published as a simplified preventive measure in a leaflet and circulated regularly among the whole study group. The main goal of the intervention involved the whole sample population, not just the ones with identified risk factors. This approach is certainly appropriate for community-based older people for whom a handful of staff are responsible. Unlike the controlled trial in institutionalized older people in which the targeted older people could be identified and treated individually[19]. Hale WA et al conducted a one-year prospective study and suggested that fall prevention should be applied to the whole elderly population and the use of risk factors to select primary care patients who should be assessed further for fall risk was insufficient[20]. The efficacy of this approach can be supported by the study of Braun BL who concluded that community-dwelling elderly individuals considered falls to

Table 2. The comparison of the incidence of falls between the study and control groups for each episode of follow-up.

	Number of cases who fell	Percentage of case who fell in each group	Number of cases who did not fall	Total	P value
First episode (month 0-2)					
Control group	35	8.6	371	406	0.426
Study group	30	6.9	404	434	
Total	65		775	840	
Second episode (month 3-4)					
Control group	37	9.5	353	390	0.405
Study group	33	7.6	400	433	
Total	70		753	823	
Third episode (month 5-6)					
Control group	27	7.0	356	383	0.676
Study group	26	6.1	402	428	
Total	53		758	811	
Fourth episode (month 7-8)					
Control group	48	12.5	337	385	0.002
Study group	25	5.9	400	425	
Total	73		737	810	
Fifth episode (month 9-10)					
Control group	35	9.4	339	374	0.116
Study group	25	6.1	384	409	
Total	60		723	783	
Sixth episode (month 11-12)					
Control group	50	13.5	321	371	0.004
Study group	28	6.9	376	404	
Total	78		697	775	

be preventable and understood the importance of fall-related risk factors, but they did not consider themselves to be susceptible to falling[21]. When they received a leaflet which repeatedly informed them about the serious effects of falls and the methods of preventing them, this could to some extent alert them in an efficient way to adjust their life-style as well as promote fall preventing behavior. Schoenfelder DP et al reported pilot results which revealed that older people were somewhat more concerned about falling after attendance in the fall prevention program and the perception that their risk of falling was lower than others of the same age and sex increased following the fall prevention program[22]. This finding supports the present results when the older people realized that a fall could happen to anyone and how important it is to apply preventive measures against the known risk factors into their routine life without delay.

Although the identified risk factors for falls in the present study were nearly the same as those reported by Tinetti ME et al in a prospective study in 1990, the success of the present fall prevention program depended mainly on the simplified message used in the leaflet which was made attractive to read by using cartoons[23]. For example, kyphoscoliosis was found to be strongly related to the risk of fall, the underlying causes of which are poor calcium

intake, poor exercise and vertebral compression. Instructions to eat more calcium-rich food and the need for gentle weight bearing exercise as well as an awareness of environmental hazards were emphasized. Vellas B et al reviewed the possible relationship between nutritional status and the occurrence of falls among the elderly(24). Advice concerning keeping fit by routine engagement in daily activity and exercise especially the quadriceps strength training were clearly illustrated in the leaflet. There are many studies supporting the benefit of various kinds of exercise and increased physical activity in fall prevention(16,25,26). Likewise, Sherrington C et al also pointed out that quadriceps strength is one of the most important variables for distinguishing between hip fracture and no hip fracture groups on multivariate analysis(27). Regarding subjects with hypertension, avoiding salty food and avoiding adverse drug reactions that might produce postural dizziness were mentioned by the authors. It is well known that diuretics and hypotensive drugs pose a significant threat to increased falls in the elderly(28,29). As far as the impact of the special senses upon body balance is concerned, they were informed about keeping their eyes open and looking around first whenever they went outside. Finally, as cognitive impairment is a common risk factor for falls and usually gets worse on polypharmacy, advice about avoidance of unnecessary medication is one of the main issues included in the leaflet(9,30-32).

SUMMARY

Health education for fall prevention by repeated delivery of leaflets informing the elderly of common risk factors such as nutrition advice, environmental hazards, strengthening exercises to maintain activities of daily living, hypertension, special sense function and adverse drug reactions could reduce the incidence of falls among the elderly in the community. Health education is therefore, not only the main aspect of a fall prevention strategy in the community but also a cost-effective method for implementation nationwide(22,26,33).

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REFERENCES

1. Economic and Social Commission for Asia and the Pacific, Japanese Organization for International Cooperation in Family Planning, Inc. Population Ageing in Asia and the Pacific. New York: United Nations, 1996: 6-12.
2. Kannus P, Parkkari J, Koskinen S, et al. Fall-induced injuries and deaths among older adults. JAMA 1999; 281: 1895-9.
3. Rizzo JA, Friedkin R, Williams CS, et al. Health care utilization and costs in a Medicare population by fall status. Med Care 1998; 36: 1174-88.
4. Vetter NJ, Lewis PA. Reasons for poor detection of frequent falls in elderly people by general practitioners. Aging (Milano) 1995; 7: 430-2.
5. Cwikel J, Fried AV. The social epidemiology of falls among community-dwelling elderly: Guidelines for prevention. Disabil Rehabil 1992; 14: 113-21.
6. Jitapunkul S, Na Songkhla M, Chayovan N, et al. Falls and their associated factors: A national survey of the Thai elderly. J Med Assoc Thai 1998; 81: 233-42.
7. Trewin VF, Lawrence CJ, Veitch GB. An investigation of the association of benzodiazepines and other hypnotics with incidence of falls in the elderly. J Clin Pharm Ther 1992; 17: 129-33.
8. Cumming RG, Miller JP, Kelsey JL, et al. Medications and multiple falls in elderly people: The St Louis OASIS study. Age Ageing 1991; 20: 455-61.
9. Koski K, Luukinen H, Laippala P, et al. Physiological factors and medications as predictors of

injurious falls by elderly people: A prospective population-based study. Age Ageing 1996; 25: 29-38.
10. Euronut SENECA investigators. Life-style: Physical activities and activities of daily living. Eur J Clin Nutr 1991; 45 (Suppl 3): 139-51.
11. Train The Brain Forum Committee. Thai mental state examination (TMSE). Siriraj Hosp Gaz 1993; 45: 359-74.
12. Gryfe CI, Amies A, Ashley MJ. A longitudinal study of fall in an elderly population: I. Incidence and morbidity. Age Ageing 1977; 6: 201-10.
13. Allander E, Gullberg B, Johnell O, et al. Circumstances around the fall in a multinational hip fracture risk study: a diverse pattern for prevention. MEDOS Study Group (Mediterranean Osteoporosis Study). Accid Anal Prev 1998; 30: 607-16.
14. Northridge ME, Nevitt MC, Kelsey JL, et al. Home hazards and falls in the elderly: the role of health and functional status. Am J Public Health 1995; 85: 509-15.
15. Cummings SR, Nevitt MC, Kidd S. Forgetting falls. The limited accuracy of recall of falls in the elderly. J Am Geriatr Soc 1988; 36: 613-6.
16. Rubenstein LZ, Josephson KR, Trueblood PR, et al. Effects of a group exercise program on strength, mobility and falls among fall-prone elderly men. J Gerontol A Biol Sci Med Sci 2000; 55: M317-21.
17. Close J, Ellis M, Hooper R, et al. Prevention of falls in the elderly trial (PROFET): A randomized controlled trial. Lancet 1999; 353: 93-7.
18. Mahoney JE. Falls in the elderly: Office-based evaluation, prevention and treatment. Cleve Clin J Med 1999; 66: 181-9.
19. Bueno Cavanillas A, Padilla Ruiz F, Peinado Alonso C, et al. Risk factors associated with falls in institutionalized elderly population. A prospective cohort study. Med Clin (Barc) 1999; 112: 10-5.
20. Hale WA, Delaney MJ, McGaghie WC. Characteristics and predictors of falls in elderly patients. J Fam Pract 1992; 34: 577-81.
21. Braun BL. Knowledge and perception of fall-related risk factors and fall-reduction techniques among community-dwelling elderly individuals. Phys Ther 1998; 78: 1262-76.
22. Schoenfelder DP, Van Why K. A fall prevention educational program for community dwelling seniors. Public Health Nurs 1997; 14: 383-90.
23. Tinetti ME, Williams TF, Mayewski R. Fall risk index for elderly patients based on number of chronic disabilities. Am J Med 1986; 80: 429-34.
24. Vellas B, Baumgartner RN, Wayne SJ, et al. Relationship between malnutrition and falls in the elderly. Nutrition 1992; 8: 105-8.
25. Shumway-Cook A, Gruber W, Baldwin M, et al. The effect of multidimensional exercises on balance, mobility and fall risk in community-dwelling older adults. Phys Ther 1997; 77: 46-57.
26. Tibbitts GM. Patients who fall: How to predict and prevent injuries. Geriatrics 1996; 51: 24-8.
27. Sherrington C, Lord SR. Increased prevalence of fall risk factors in older people following hip fracture. Gerontology 1998; 44: 340-4.
28. Prudham D, Evans JG. Factors associated with falls in the elderly: A community study. Age Ageing 1981; 10: 141-6.
29. Lipsitz LA. Abnormalities in blood pressure homeostasis that contribute to falls in the elderly. Clin Geriatr Med 1985; 1: 637-48.
30. Salgado R, Lord SR, Packer J, et al. Factors associated with falling in elderly hospital patients. Gerontology 1994; 40: 325-31.
31. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. N Engl J Med 1988; 319: 1701-7.
32. Macdonald JB. The role of drugs in falls in the elderly. Clin Geriatr Med 1985; 1: 621-36.
33. Rizzo JA, Baker DI, McAvay G, et al. The cost-effectiveness of a multifactorial targeted prevention program for falls among community elderly persons. Med Care 1996; 34: 954-69.

กลยุทธ์การป้องกันภาวะหกล้มในผู้สูงอายุไทย แผนงานวิจัยเพื่อสุขภาพผู้สูงอายุ

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ภาวะหกล้มแม้จะเป็นภาวะที่ไม่จำเพาะเจาะจงในผู้สูงอายุ แต่มักเป็นการเตือนถึงพยาธิสภาพที่รุนแรงที่ซ่อนอยู่ การศึกษาวิธีป้องกันภาวะหกล้มในผู้สูงอายุไทยในชุมชนที่เป็นการป้องกันในระดับปฐมภูมิจึงมีความสำคัญในการลดค่าใช้จ่ายในการดูแลสุขภาพของผู้สูงอายุที่ได้ผล การศึกษาแบบติดตามไปข้างหน้าเป็นเวลาหนึ่งปีนี้ ได้รวบรวมผู้สูงอายุ 1,043 รายที่อาศัยรอบโรงพยาบาลศิริราช โดยแบ่งเป็นสองกลุ่ม กลุ่มควบคุม 458 รายและกลุ่มศึกษา 585 ราย กลุ่มศึกษาจะได้รับข้อมูลที่เป็นปัจจัยเสี่ยงที่สำคัญต่อภาวะหกล้มพร้อมกับไปรษณียบัตรติดตามอุบัติการณ์การหกล้มทุก 2 เดือน ผู้สูงอายุกลุ่มนี้ยังสามารถเข้ามารับบริการที่คลินิกผู้สูงอายุโรงพยาบาลศิริราชได้ตลอดเวลาทำการ กรณีที่ไม่มีไปรษณียบัตรตอบกลับ คณะผู้ศึกษาจะโทรศัพท์สอบถามที่บ้าน ร้อยละของผู้สูงอายุที่ติดตามได้ในแต่ละงวด 2 เดือนได้แก่ ร้อยละ 92.5 ร้อยละ 90.6 ร้อยละ 89.3 ร้อยละ 89.2 ร้อยละ 86.2 และร้อยละ 85.5 ตามลำดับ หลังครบหนึ่งปีอุบัติการณ์หกล้มทั้งหมดในกลุ่มศึกษาและกลุ่มควบคุมเท่ากับร้อยละ 6.6 และ 10.1 ตามลำดับ อุบัติการณ์เริ่มลดลงในกลุ่มศึกษาอย่างมีนัยสำคัญทางสถิติในการติดตามครั้งที่ 4 และ 6 (ค่าพี = 0.002 และ 0.004) การวิเคราะห์โดยใช้วิธี Kaplan–Meier survival analysis พบความแตกต่างของอุบัติการณ์อย่างมีนัยสำคัญ ได้ค่าพี = 0.01 แสดงว่าวิธีลดอุบัติการณ์ภาวะหกล้มในผู้สูงอายุในชุมชนที่ได้ผลและมีประสิทธิภาพคุ้มค่า ควรเป็นการกระตุ้นเตือนให้ผู้สูงอายุเห็นถึงความสำคัญและส่งเสริมสุขภาพตนเองเพื่อลดปัจจัยเสี่ยงอย่างต่อเนื่อง

คำสำคัญ : การป้องกัน, หกล้ม, ผู้สูงอายุ

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