Original Article

The Long-Term Trends of the Association Between Falls Among the Elderly in Taiwan and their Utilization of Medical Facilities

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S U M M A R Y

Background: Every year many adults aged 65 and over, suffer falls. This study used longitudinal data to investigate the long-term trend of falls among the elderly in Taiwan, and the association between falls and the utilization of medical facilities.
Methods: This study included 1653 elderly adults who completed questionnaires for a nationwide survey at different times. The data were analyzed with Chi-square test, independent-sample t-test, one-way ANOVA, Scheffe's post-hoc analysis and Generalized Estimating Equations (GEE), using SPSS 19.0 and Stata version SE 11.0.
Results: The proportion of elderly who had fallen has been increased 1.6 times from 1999 to 2007. The probability of using the traditional Chinese medicine (TCM) clinics (RR = 1.44) for those who had fallen was higher, as well as these of using the ER (RR = 1.81) and hospital (RR = 1.89), and the number of days hospitalized (RR = 1.85). There was no significant difference in their use of western medicine clinics (P > 0.05).
Conclusion: The government should provide appropriate medical care and services to reduce the incidence of falls in elderly and their uses of medical resources, thus improving elderly adults' quality of life.
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1. Introduction

Every year approximately 30—50% of adults aged 65 and over suffer a fall[1]. Among these, 10—50% of them experience severe injuries, such as fractures, loss of independence and even death. Physical falls affect elderly persons' physiological functions, thus increasing their use of medical services by 30—80%[2]. Bohl et al. (2012) indicated that the utilization of outpatient clinics, ER and hospitalization is significantly higher for people who have fallen than for those who have not fallen[3]. Within the Asian population, the incidence of falls in the elderly in Japan was 10—30%[4]. In Singapore the proportion of elderly who had fallen exceeded 17.2%. While 30—40% of those who had experienced mild or moderate injuries due to falling, 3—6% experienced severe injuries[5]. Approximately 30% of the elderly living in communities in Korea had fallen, resulting in disability, increased family burden, increased medical expenditure and even death[6]. Based on the above, the incidence and effects of falling pose a significant health problem for the elderly.

In Taiwan, the 6th leading cause of death is accidental injuries[7]. The proportion of fall-induced injuries accounted for 7.2% of all accidental injuries in 1981, but by 2012 this had risen to 18.5%, an increase of more than 10%. Among all reported incidents, falls among the elderly were the highest; 10%—20% of adults aged 65 and over died from falls, and was the 2nd leading cause of death among the elderly[7]. In 2007, statistics from Taiwan's Health Promotion Administration (HPA) indicated that the prevalence of falls among the elderly was 20.5%, with 63.7% of them experiencing a fracture, dislocation, or sprain from the fall, indicating that falls are quite common among elderly adults in Taiwan. The effects of falls on individuals' health and their utilization of medical facilities vary since the causes are many and complex. It is crucial to follow up a generation for a certain period to clarify the effects of falls and its

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related factors. For study purposes, a longitudinal cohort method was used to investigate data collected from Taiwan's HPA national survey, in order to observe the long-term trend of changes to falls among the elderly, as well as to probe the influence of these changes on use of medical facilities.

2. Materials and methods

2.1. Data sources and sampling

The primary data source was the dataset collected by the HPA that had conducted a "Survey of Health and Living Status of the Elderly" in Taiwan. This survey was conducted from 1989 to 2007 and sampled people aged 60 and over. The sampling method was divided into three stages: (1) a sampling of several townships; (2) a sampling of several villages from the selected townships; and (3) a sampling of selected villages. The home-interviews were performed. The Cohort and Panel Study of Longitudinal Design were set. In this study, most of information was measured by the self-report. In order to assess the validity of these self-report data, researchers use data from the physical examination to assess the accuracy of self-reports. Few kinds of information was found to appear certain biases, which correlated with the variable of ages, receiving formal education, and taking physical exams. The limitation of self-report data and recall biases were described later.

This study is a secondary data analysis derived from the HPA data pool from the years 1999, 2003 and 2007. These data-use has been granted an exemption from requiring ethics approval according to the regulations set by Ministry of Justice in Taiwan (http://mohwlaw.mohw.gov.tw/Chi/FLAW/FLAWDAT0202.asp).The objective of this study was to observe the relationship between falls among the elderly and the use of medical facilities during this time period. Therefore, the 2 inclusion criteria for these samples were: (1) adults aged 65 and over in 1999; and (2) those who had full completed three interviews in this study period. A total of 1653 elderly adults were enrolled in the study's final analysis.

2.2. Measurements

The dependent variable was the use of medical services. In order to reduce the recall bias, people were asked how many visits they had made to western medicine outpatient clinics and Traditional Chinese Medicine (TCM) clinics in the past month, as well as the number of ER visits, the number of hospitalizations and the total duration of their hospital stays within the past year.

Additionally, participants were asked about whether they had fallen and were divided into two groups: those who had not ever fallen and those who had fallen at least once in past year[2,5].

Several explanatory variables were controlled, including their demographic characteristics, lifestyles and functional health status. Demographic characteristics included: gender, age, marital and economic status, and the number of family members living with the elderly. Lifestyle included body mass index (BMI), smoking, drinking and exercise. This study asked the participants whether they wore glasses or used crutches, whether they liked their current living environment, and to state the leisure activities in which they usually participated. In addition, this study also calculated the total number of activities. Functional health status included the current number of diseases and the current types/number of drugs they were required to take. Only diseases diagnosed by physician and official prescribed medication have been taken into consideration. In addition, this study used the Center for Epidemiological Studies' Depression Scale (CES-D scale) to assess levels of depression. This scale includes 10 items with the highest scores reflecting severe depression. Moreover, 6 items were used to measure the

elderly adults' perceived pressure. Here too the higher the score, the higher the level of perceived pressure.

2.3. Statistical analysis

SPSS 19.0 and Stata version SE 11.0 were used for the statistical analysis. Several statistical methods were used in this study: Chi-square test, independent-sample t-test, one-way ANOVA and Scheffe's post-hoc analysis. The changes of falls, the utilization of medical facilities, the demographic characteristics, the lifestyles, and other functional health status can be understand in the period of observation by these statistics. Generalized Estimating Equations (GEE) were used to assess whether the changes of falls and controlled variables affect the utilization of medical facilities. In statistical computation, the use of medical facilities was considered as dependent variable whereas the status of falls, the demographic characteristics, the lifestyles, and other functional health status were considered as independent variables to clarify how the changes of falls and control variables affect the utilization of medical resources.

3. Results

Table 1 presents observations of changes in the trend: status of falls, demographic characteristics, lifestyle and functional health status for the nine years of this study period. Except for two variables, gender and the number of family members living with the elderly, all of the variables changed significantly ($P < 0.05$) over a longer observation period. For example, the percentage of adults who had fallen increased with the increase in time, from 16.2% in 1999 to 21.3% in 2003, and to 26.1% in 2007.

Table 2 describes the differences in status of falls and the use of medical facilities. When compared with the elderly who had not ever fallen within the past year, the use of medical facilities by those who had fallen was higher ($P < 0.05$). For example, when looking at the number of visits to western medicine outpatient clinics during one month in 2007, the average number of outpatient visits was 1.36 times for adults who had not fallen, while those who had fallen was 1.58 times.

Table 3 shows the statistical analysis results of the GEE on the observation of the influence of change in status of falls on the use of medical services. The results showed that, after adjustment of other possible affecting factors, the frequency of utilization of medical facilities in those who had ever fallen has apparently been increased. The probability of using the TCM (RR = 1.44) for those who had fallen was higher, as well as these of using the ER (RR = 1.81) and hospital (RR = 1.89), and the number of days hospitalized (RR = 1.85). There was no significant difference in their use of western medicine clinics ($P > 0.05$).

4. Discussion

The overall results indicated that the proportion of elderly who had not fallen decreased year by year, whereas the proportion of those who had fallen increased year by year. During the 9 year observation period, the proportion of elderly who had fallen increased 1.6 times from 16.2% to 26.1%. The results showed that, falls in the elderly become common with increasing age, and the attendant problems also became more severe. Compared with the elderly who had fallen was 30%, as shown in the previous studies[4,5,8], the proportion of those was slightly lower in this study. The possible reason may be that the number of falls within the past year was recorded using the "interviews" with the elderly. There might be a recall bias, which might lead to an underestimation of falls among the elderly. It is recommended that follow-up studies improve the recording method, in order to reflect the actual