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ORIGINAL ARTICLE

Comparative Study on Change in Degree of Independent Living between Continuation and Discontinuation of Home Medical Care among the Elderly in Japan

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Abstract

The present study focused on "fever" as an indicator or surrogate of aspiration pneumonia, which is the most commonly encountered event in home medical care and frequently requires a decision of whether to continue or discontinue (admission to hospital) home medical care. We compared the outcome of a group that continued to receive home medical care during and after a fever-related event and a group that discontinued home medical care and was hospitalized. Our analysis showed that loss of the ability of independent living was significantly ameliorated in the group that continued home medical care compared to the group that was hospitalized. One of the major reasons for worsening of independent living ability in the hospitalized group may be attributed to hospitalization-associated disability (HAD). These results indicate that continuation of home medical care is effective for the management of "fever" events that are frequently encountered in home medical care.

Keywords

Degree of independent living for elderly (DILE), Continuation of home medical care, Hospitalization, Case control study

Introduction

The Japanese population in 2015 was 127.1 million (61.8 million men and 65.3 million women), about 33.4 million (26.7%) of which were aged 65 and over and 16.0 million 75 and over. From now, the old-old aged 75 and over will increase more rapidly than the young-old aged 65-74 in Japan. The number of people over the age of 75 is estimated to increase by over 8 million between 2010 and 2040. Thus, as the super-aged society in Japan progresses further, a rapid increase in elderly people, especially the old-old, is inevitable in the near future. The characteristics of the old-old include deterioration of activities of daily living (ADL) functions and increase of chronic diseases, which are unavoidable consequences of advanced age [1]. As they are likely to suffer from chronic illness and require continuous medical treatment and care, there will be a shortage of hospital beds. After reaching an old age, it is common to go through a stage of various degrees of frailty before death. The traditional "curative healthcare", which has been provided largely by hospitals, has achieved a remarkable goal, i.e., realization of a long-life society. This achievement has to be sustained and further promoted by delivering "supportive healthcare" through inter-professional alliance. An appropriate strategy is the strengthening and diffusion of "home medical/health care" or "home medical management", which is defined as general medical care provided in the home of the person receiving care through home visits by doctors or nurses and other

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medical personnel [2]. The modality of home medical care, in which a doctor regularly visits the patent's home twice a month on average to provide medical care usually for chronic conditions, is quite unique to Japan. In addition, the results of a survey on terminal care have indicated that more than 60% of the people desire to receive health care at home [3]. In this context, home medical/health care is expected to become increasingly important in the future. Based on these circumstances, the Japanese government is promoting home medical care and is also working to set up a system to provide convenient and suitable home medical care services in the community, so-called comprehensive community care service system (CCCSS) [4]. The goal is to maintain the dignity of the elderly and support their independent living, allowing them to live their own lives as far as possible in the community they know best until the end of life.

To disseminate the concept and knowledge of home medical care, strategies based on scientific evidence are indispensable. However, scientific evidence concerning the effectiveness of home medical care has not been established adequately in Japan. The aim of this study was to provide scientific evidence concerning the effectiveness of home medical care, which will form the basis of its promotion, by identifying the factors associated with continuation and discontinuation of home medical care.

Methods

Study population

Since 1992, home medical care has been initiated by medical clinics of "Activities Supporting Medicine Systematic Services (ASMss)" group in the northern part of Kanto district in the central part of Japan. By reviewing the medical charts of patients receiving home medical care from a clinic of ASMss group in the region and those of patients admitted to hospitals in the same catchment area as the clinics, this study aimed to analyze the outcome after a fever-related event between patients who continued home medical care and patients who discontinued home medical care and were admitted to hospitals. We focused on the symptom of high fever (38.0 °C or higher), because it is the most common event occurring in the setting of home medical care and may serve as a surrogate of aspiration pneumonia. A high incidence of events related to fever and infection among the elderly is expected because of decreased immune function with aging. Occurrence of events related to high fever is also a critical time for the patient and their family to decide whether to continue or discontinue home medical care.

Study design

This clinical-based nested case-control study was conducted from April to December 2016. A total of 9 cases (elderly who discontinued home medical care) and 18 controls (elderly who continued home medical care) (1: 2 ratio) were analyzed. The selected cases were matched by Propensity Score Matching. Using SPSS Sample power, we confirmed that there is no problem with sample size in calculation.

Setting

The survey was carried out at one branch clinic, Ikiiki medical clinic from ASMss group located in Ibaraki Prefecture (northern part of Kanto district), which is a rural area approximately 100 km north of the Tokyo Metropolitan area.

Subjects

Cases: Medical charts of patients who discontinued home medical care and received hospitalized treatment: The cases were selected from patients admitted because of fever of 38.0 °C or higher to hospitals in the same catchment area as the clinics between July 2015 and June 2016, who had complete data of the "degree of independent living for elderly with disability (DILE-disability)" at admission (baseline) and at discharge (post-treatment).

Controls: Medical charts of patients who continued home medical care: Patients who received home medical care provided by the clinics between May 2008 and September 2015 were reviewed. Among 1,854 medical charts examined, 113 patients experienced symptoms including fever of 38.0 °C or higher (acute symptoms). Among these 113 patients, 37 continued home medical care and had complete data for DILE-disability at onset of fever (baseline) and at around 30 days after onset (post-treatment). This group was designated the continued home medical care group, and the datasets with no missing data were used in analysis.

Two controls per case matched by age, sex, "degree of independent living for elderly with dementia (DILE-dementia)", The Japan Respiratory Society community-associated pneumonia severity index (A-DROP score), and DILE-disability at baseline were selected. Thus, a total of 9 cases and 18 controls among the 37 patients who continued home medical care (1:2 ratio) were analyzed.

Measurements

All measured variables were extracted from past medical charts.

1) The DILE-disability is stipulated by the Ministry of Health, Labor and Welfare, and includes four major categories (Ranks J, A, B and C) [5]. Each category is subcategorized into two levels such as J1 and J2 in the J rank, and A1 and A2 in the A rank, with a total of 8 ranks. For example, J-1 is defined as "able to go out using public transportation", J-2 as "able to go out but limited to the neighborhood", C-1 as "able to turn over in bed by him/herself", and C-2 as "not able to turn over in bed by him/herself". In this study, when the patient assessed

Table 1: Baseline data of the subjects.

Parameter	Hospitalized Group (N = 9)	Continued home medical care Group (N = 18)	p
Mean age, years	84.8	85.7	n.s.
Sex, female, N (%)	5 (55.6)	9 (50.0)	n.s.
Body temperature, °C, mean (SD)	38.3 (0.8)	38.4 (0.4)	n.s.
Baseline A-DROP score, (range 1-5)	1.4	1.5	n.s.
Age, N (%) (male > or = 70, female > or = 75)	8 (88.9)	17 (94.4%)	n.s.
Dehydration, N (%) (BUN > or = 21 mg/L)	3 (33.3)	4 (22.2)	n.s.
Respiratory failure, N (%) (SaO(2) < or = 90% or PaO(2) < or = 60 mmHg)	2 (22.2)	4 (22.2)	n.s.
Orientation disturbance, N (%) (presence/absence of confusion)	0 (0.0)	5 (27.8)	n.s.
Low blood Pressure, N (%) (systolic blood pressure < or = 90 mmHg)	0 (0.0)	0 (0.0)	n.s.
Baseline DILE-dementia, (range 1-7)	3.4	3.8	n.s.
Baseline DILE-disability, (range 1-8)	6.8	6.8	n.s.

A-DROP: Japan Respiratory Society community-associated pneumonia severity index, DILE-dementia: Degree of independent living in elderly with dementia, DILE-disability: Degree of independent living in elderly with disability.

as J1 was scored as 1, J2 as 2, A1 as 3, A2 as 4, B1 as 5, B2 as 6, C1 as 7, and C2 as 8. Thus, the range of score was 1-8 in each patient.

2) Measurement of the DILE-dementia is also stipulated by the Ministry of Health, Labor and Welfare, and includes seven ranks; I, II(IIa, IIb), III(IIIa, IIIb), IV and M [5]. For example, I is defined as "almost independent or self-reliant in daily life at home and society", II as "partly independent under careful watching and support", and IV as "serious disabilities in everyday life, require constant nursing care". In this study, when the patient assessed as I, then the score was given as 1, IIa as 2, IIb as 3, IIIa as 4, IIIb as 5, IV as 6, and M as 7. Thus, the range of score was 1-7 in each patient.

3) A-DROP score was proposed by the Japanese Respiratory Society, and consists of relatively simple criteria to assess the severity of community-acquired pneumonia [6]. The A-DROP score is a modified version of the British Thoracic Society severity score (CURB-65), and is confirmed that it is equivalent to CURB-65 for predicting severity of community-acquired pneumonia [7] and is intended to help predict patient mortality and select the appropriate venue for ongoing care. A-DROP scoring system assesses the following parameters: (i) Age (A: male > or = 70 years, female > or = 75 years), (ii) Dehydration (D: blood urea nitrogen (BUN) > or = 21 mg/L), (iii) Respiratory failure (R: SaO(2) < or= 90% or PaO(2) < or = 60 mmHg), (iv) Orientation disturbance (O: presence/absence of confusion), and (v) Low blood Pressure (P: systolic blood pressure < or = 90 mmHg). In this study, patients were graded as "mild" when none of these five criteria were met (score = 0), "moderate" when one or two of the criteria were met, "severe" when three of the criteria were met, and "extremely severe" when four or five of the criteria were met (score = 5). Thus, the range of score was 0-5 in each patient.

The three parameters were used to compare the baseline characteristics of cases and controls. The DILE-disability was used as the primary outcome measure and DILE-dementia as a secondary outcome measure to evaluate the effectiveness of continued home care and hospitalized care.

Statistical analysis

The continued home medical care group and the hospitalized group were compared. For the continued home care group, the data at fever onset and at around 30 days following onset were extracted. For the hospitalized group, the data at admission and at discharge [length of hospital stay: 28.0, 34.9 ± 24.9 days (median, mean ± standard deviation)] were used in comparisons. For the primary outcome measure, the proportions of subjects showing improved, maintained, and worsened post-treatment DILE-disability compared to baseline were calculated. These proportions were compared between two groups using Fisher exact test. SPSS version 24 (IBM Corporation, Armonk, NY, USA) was used for the statistical analysis.

Results

Subject characteristics at baseline

There were 18 patients in the continued home medical care group (controls) and 9 patients in the hospitalized group (cases). The two groups did not differ significantly in age; gender distribution; A-DROP score including age, dehydration, SpO_2, disturbance of consciousness, and blood pressure; DILE-dementia; and DILE-disability at baseline (Table 1).

There were no significant differences in the baseline data between two groups. One of the reason may be in the universal health coverage (UHC) system in Japan. Under UHC system, all patients can basically use any

type of health services and its providers including clinics, hospitals and home medical care suppliers. The subjects in this study were the patients who used home medical care services and chose either to continue home medical care or to admit a hospital when they had fever-up with temperature of 38 °C or higher. In Japan, fever-up itself is recognized as a reason for admission to the hospital for the elderly patients receiving home medical care. When the doctor asked the patients and their families about admission to the hospital, they made their decision whether to continue medical care at home or to enter a hospital by themselves. In this context, the subjects used in this study were in the almost same condition between the two groups as shown in the baseline data in Table 1.

Comparison of DILE-disability after treatment

In the hospitalized group (cases, n = 9), the post-treatment DILE-disability was maintained in 1 patient (11.1%) and worsened in 8 patients (88.9%) compared to baseline. In the continued home medical care group (controls, n = 18), the post-treatment DILE-disability was improved in 1 patients (5.6%), maintained in 17 patients (94.4%), and worsened in 0 patient (0%) compared to baseline. A significant difference was observed between the two groups (Fisher exact test; $p < 0.001$) (Figure 1). As a secondary outcome measure, the post-treatment DILE-dementia was maintained in 6 patients (66.7%) and worsened in 3 patients (33.3%) of patients in the hospitalized group. In the continued home medical care group, post-treatment DILE-dementia was maintained in 17 patients (94.4%) and worsened in only 1 patients (5.6%) of the patients. Although there was a tendency of difference between case and control groups, the difference did not reach statistical significance (Fisher exact test; $p = 0.09$).

Discussion

With the rapid increase of old-old people who are most likely to be sick and require medical treatment particularly for chronic illnesses, there are serious concerns of how to allocate the limited medical resources under the Japanese universal health coverage. As one of the solutions in such circumstances, a more appropriate and effective home health/medical care system based on evidence would make home medical care more desirable for elderly people who prefer to receive medical care in their own home rather than in hospital. Actually, the Japanese government is currently promoting home health/medical care by gathering scientific evidence to support the advantages of home medical care system by which elderly people can receive medical treatment and nursing care in their home environment until the end of life.

In the setting of home health care, evidence-based high-quality services are composite services that provide not only medical care but also maintenance and improvement of the overall quality of life (QOL) of elderly persons. A systematic review of home-based primary care (HBPC) interventions for community-dwelling older adults demonstrated that specifically designed HBPC programs for homebound older adults can reduce hospitalizations and long-term care admissions while

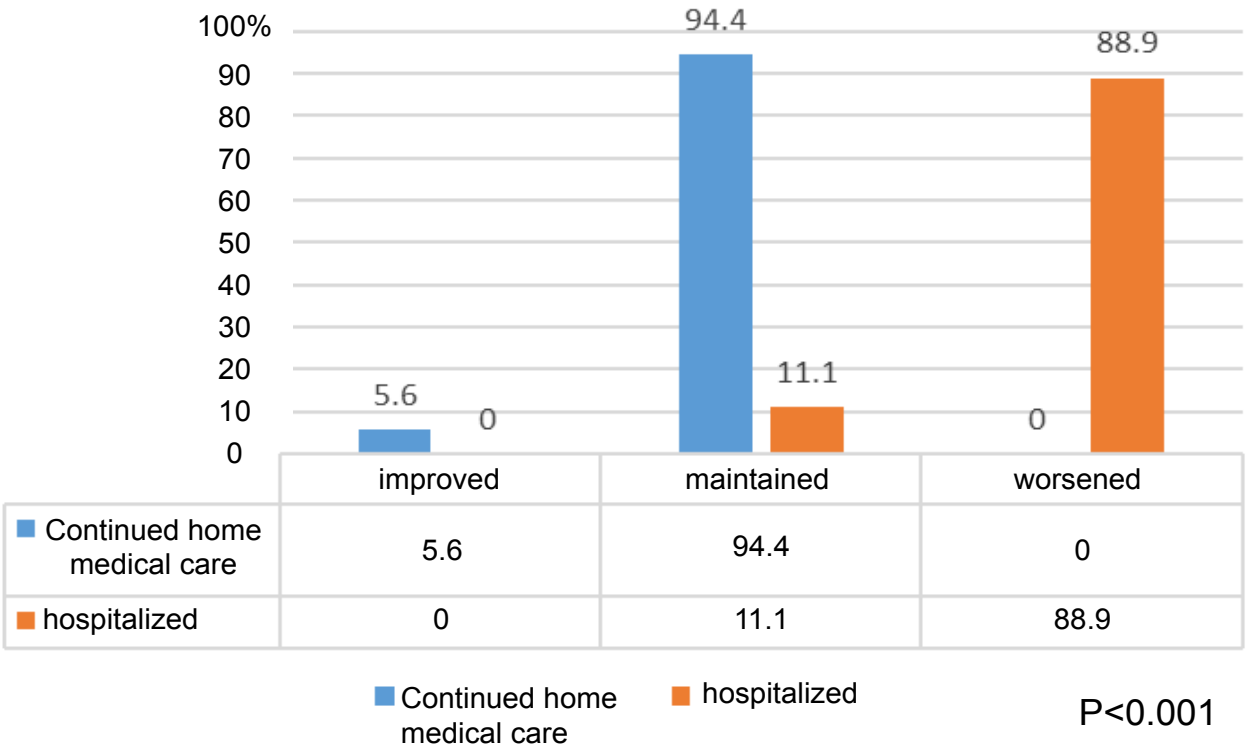

Figure 1: Comparison of changes in degree of independent living for elderly with disability before and after treatment between continued home care group and hospitalized group (Fisher exact test; $P < 0.001$).

improving individual and caregiver QOL and satisfaction with care [8]. In Japan, various services included in home medical care for the elderly people are provided by both universal health care insurance (UHCI) and public long-term care insurance (LTCI). This means that home medical care for disabled elderly suffering from chronic conditions and comorbidities should include appropriate services and integrated support from both UHCI and LTCI. The present comparative study focused on the outcome of a group that continued home medical care and a group that was hospitalized upon discontinuation of home medical care, using fever as a surrogate indicator of aspiration pneumonia.

It is well known that elderly people who receive home medical care have a high incidence of fever-related events and infections, because of decreased immune function due to aging and presence of comorbid chronic diseases. Among the elderly receiving home medical care, the major issue comprise fever and infection that impose heavy burdens on not only patients and their relatives, but also medical professionals, since events related to fever reportedly account for many night-time home visit in Japan [9]. According to a retrospective cohort study, the incidence of fever in home-dwelling elderly who received home medical care was 2.3/1000 patient-days, with fever occurring in approximately one-half of the patients during the 1-year study period [10]. Fever was more likely to occur in people at care level 5, needing the most heavy care services in LTCI than the other levels, and the top three diseases causing fever were pneumonia/bronchitis, urinary tract infection, and skin and soft tissue infection. A prospective cohort study focusing on fever incidence and risk in elderly persons living at home in Japan revealed that fever was more likely to arise in the wheelchair users or bedridden than in ambulatory individuals; and in patients with moderate-to-severe rather than those with none-to-mild cognitive impairment; and in those whose care-need levels were > = 3 rather than < = 2 [9].

In Japan, where the current home medical care system is different from the USA, accumulated epidemiological data on healthcare-associated pneumonia (HCAP) originally established in the USA, has led to the new establishment of unique category of pneumonia, known as Nursing and Health Care Associated Pneumonia (NHCAP). According to the NHCAP guideline, pneumonia occurring in patients receiving home medical care is categorized as NHCAP [11]. Positioning of NHCAP is considered between community-acquired pneumonia (CAP) and HCAP, sharing attributes with both respectively. It is also considered to be substantially the same to aspiration pneumonia among the patient who receive home medical care in Japan [12]. Fever is the most common symptom of aspiration pneumonia/NHCAP. Medical treatment for NHCAP is also generally considered to be different from that of CAP [13].

These commonly encountered events are one of the major problems not only for the patients and their families, but also for medical professionals. Furthermore, in many cases, it is very difficult for the patients and their families to decide whether to continue home medical care or to interrupt home care and be admitted to a hospital.

The results of our analysis showed that only 11.1% of patients in the hospitalized group compared with 94.4% in the continued home medical care group maintained the DILE-disability at discharge or around 30 days post-onset, with a significant difference between two groups. These data indicated that DILE-disability was improved or maintained at a significantly higher rate in subjects who continued home medical care compared to those who were hospitalized. Most of the patients (88.9%) in the hospitalization group had worsened ability of independent living. None of the patients in the hospitalized group showed improvement in degree of independent living. Additionally, as a secondary outcome measure, in the comparison of DILE-dementia, none of the patients in the hospitalized group showed improvement, and 33.3% were worsened compared to 5.6% in continued home medical care group. One of the major reasons for this remarkable difference between hospitalized group and continued home medical care group may be attributed to “hospitalization-associated disability” (HAD). Worsening functional abilities such as gait disturbance and lower extremity muscle atrophy or sarcopenia are frequently observed among elderly patients, mainly due to physical inactivity during hospitalization. In a typical case of HAD, a patient hospitalized because of pneumonia is confined to bed rest with antibiotic treatment. Consequently, the patient loses the ability to walk despite improvement of pneumonia. HAD occurs in approximately one-third of patients older than 70 years of age and may be induced even when the illness that necessitates hospitalization is successfully treated [14]. Gill, et al. [15] conducted a prospective cohort study in 754 community-living persons aged 70 years or older who were not disabled at baseline, and evaluated the relationship between intervening events and transition among states of no disability, mild disability, severe disability, and death. They found that hospitalization was strongly associated with worsening transition, with very high multivariate-adjusted hazard ratios (HRs) of 168 (95% confidence interval, 118-239) for the transition from no disability to severe disability. From the nutritional point of view, in early days following admittance to the hospital in an acute stage, the patients do not achieve target protein intake and they are likely to be in a state of iatrogenic protein under nutrition, which easily contributes to a rapid loss of lean body mass, in particular muscle mass [16]. The patients discontinued home medical care and admitted to the hospital seem to be susceptible to develop such iatrogenic sarcopenia and HAD status. HAD is preventable,

and a few institutions in Japan have applied a systematic approach to prevent HAD [17]. In the United State, since the decline in functional capacity experienced by hospitalized older persons is well recognized, Leff B, et al. compared differences in the functional outcomes experienced by patients cared for in Hospital at Home (HaH) and traditional acute hospital care. As a result, they demonstrated that HaH care is associated with modestly better improvements in IADL status and trends toward more improvement in ADL status than traditional acute hospital care [18]. On the other hand, patients under home medical care generally can lead a usual life in their home environment and feel more relaxed, and even take some small amounts of food and water by themselves under careful monitoring by visiting physician and nurses. The major implication of our finding in this comparative study may be worsening of the ability of independent living among elderly patients who discontinue home medical care and become hospitalized, rather than functional improvement among patients who continue home health care. However, because this study was conducted in a small local area in the northern part of the Kanto region, extrapolation to and implication for other areas in Japan may be difficult. Therefore, further large-scale multicenter prospective studies are needed to validate the findings.

Although this study found the effectiveness of home medical care for elderly patients, there are several limitations. (1) The study was a retrospective analysis based only on data from patients' clinical charts. (2) While the data of the continued home care group were mainly documented before 2015, the data of the hospitalized group were those from 2015-2016 records. (3) A total of only 27 subjects had no missing data for this case-control study, and the number may be not necessarily sufficient. (4) There are no information of psychometric properties or characteristics among the patients in both groups, because of lack of these data in the medical charts used in this study. From geriatrics point of view, such psychological satisfaction and QOL should be one of the most important goal and priority as health care outcome for elderly patients [19]. Despite the above limitations, the present study may provide some insight about the merit of home medical care over hospitalized care, an issue which is often encountered in home medical care. The present results suggest the efficacy and superiority of continuing home medical care over hospitalization upon discontinuing home care, with respect to the improvement or maintenance of the ability of independent living. Additionally, the findings will be suitable to fulfill major component of CCCSS which aims to support of being independent among the elderly, and allows them to live their own lives as long as possible in the community they know best until the end of life under the collaboration of medical treatment by medical staff and care provided by healthcare workers.

Since the present study was a retrospective analysis of previous patients who received home medical care (as stated in study limitations), a prospective cohort study is required to validate the findings in this research. In addition, further identification of the factors associated with continuation of home medical care from both cross-sectional and longitudinal approaches would help build stronger scientific evidence, and may provide a platform for discussion of strategies for home medical care which will become more important for the super-aged society in Japan.

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Ethics Statement

This study was conducted after obtaining approval from the ethical committees of J. F. Oberlin University, National Center for Geriatrics and Gerontology, and Okayama Prefectural University.

Disclosure Statement

The authors have no conflict of interest to be declared.

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