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Does additional weekend and holiday physiotherapy benefit geriatric patients with hip fracture? — A case-historical control study

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Objective: To evaluate the new service model of additional weekend and holiday physiotherapy (PT) by comparing functional outcomes and hospital length of stay between a group of geriatric patients with hip fracture receiving daily PT training and a group of geriatric patients with hip fracture receiving weekdays PT training.
Methods: A retrospective case-historical control chart review was conducted and a total of 355 patients were identified. Between-group comparisons were done on functional outcomes including Modified Functional Ambulation Classification (MFAC), Elderly Mobility Scale (EMS), Modified Barthel Index (MBI) and process outcome in terms of length of stay (LOS) in hospitals.
Results: With similar characteristics, patients who received weekend and holiday PT training had a significant higher percentage of MFAC Category III and a significant lower percentage of MFAC Category II ($p = 0.015$) and significant higher MBI scores (mean $\pm$ standard deviation, median; Study group: 47.4 ± 19.6 points, 51 points; Control group: 43.0 ± 20.0 points, 43 points; $p = 0.042$) upon admission to rehabilitation hospital. A similar trend in EMS scores (Study group: 8.2 ± 5.5 points, 7 points; Control group: 8.4 ± 6.1 points, 6 points;

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$p = 0.998$) and MBI scores (Study group: 63.0 ± 23.4 points, 68 points; Control group: 61.2 ± 26.1 points, 64 points; $p = 0.743$) were observed upon discharge from the rehabilitation hospital. The average LOS in acute hospitals remained static (Study group: 7.7 ± 3.9 days, 7 days; Control group: 7.4 ± 5.0 days, 6 days; $p = 0.192$). The average LOS in rehabilitation hospital (Study group: 20.0 ± 5.5 days, 20 days; Control group: 24.3 ± 9.9 days, 23 days; $p < 0.001$) and total in-patient LOS (Study group: 26.7 ± 6.4 days, 26 days; Control group: 30.7 ± 11.2 days, 28 days; $p < 0.001$) were significantly reduced. A higher percentage of days having PT training during hospitalization in rehabilitation hospital was shown with the implementation of new service (Study group: 89.1%; Control group: 65.9%, $p < 0.001$).

Conclusion: Additional weekend and holiday PT training in post-operative acute and rehabilitation hospitalization benefits geriatric patients with hip fracture in terms of improved training efficiency, where hospital LOS was shortened with more PT sessions, without any significant impacts on functional outcome.

Keywords: Geriatric; hip fracture; physiotherapy.

Introduction

Hip fracture not only causes personal impairment and disability, but also leads to major economic burden on public healthcare system.[1,2] As projected by the Census and Statistics Department of Hong Kong Government, number of elderly persons aged 65 and over will experience an increase from 1.16 to 2.37 million and the number will remain for 30 years.[3] Although reports by International Osteoporosis Foundation pointed out that Hong Kong has a lower rate in hip fracture than Caucasians, the problems associated with hip fractures may be magnified by the aging population and shrinking overall population.[3,4] The actual number of hip fractures is on the rise.[5] Therefore, it is of paramount importance to develop strategies to improve rehabilitation outcomes and lower cost related to the care of patients with hip fractures in view of the growing number of incident cases of hip fracture every year.

In Hong Kong, Hospital Authority (HA), which is the major provider of public hospital services, has reviewed the rehabilitation services for hip fracture as one of the illustrative disease groups. As mentioned in the Strategic Service Framework for Rehabilitation Services published by HA in 2016, in-patient rehabilitation in weekends and public holidays was limited.[6] In the first to second quarters of 2013, with weekday rehabilitation only, 16 sessions of physiotherapy (PT) and 14 sessions of occupational therapy were received by patients who need in-patient rehabilitation during their average 24-day stay in extended-care hospitals. They could only receive physical training in about 60% of their stay in hospitals.[6] Thus, there is much room for improving the in-patient rehabilitation service efficiency.

In line with the recommendation of the Strategic Service Framework for Rehabilitation Services, regular 7-day per week PT service for fragility fractures has been started in several hospitals, including both acute and rehabilitation hospitals, since 1 October 2017. This is a brand-new service model for PT in the HA. This study was launched in a regional rehabilitation hospital as evaluation of a new clinical service.[7]

Several studies have shown that additional weekend PT service is effective in terms of length of stay (LOS), cost-effectiveness and functional recovery.[8–12] English *et al.*,[8] Brusco *et al.*[9] and Maidment *et al.*[10] reported additional weekend PT service may reduce LOS in hospital for patients with acute stroke, geriatric orthopedic or neurological problems and knee arthroplasty, respectively. Pengas *et al.*[11] concluded weekend PT as a cost-effective program as the cost saved from the reduced LOS outweighed the extra cost paid to physiotherapists. Peiris *et al.*[12] reported Saturday PT service may improve individuals' functional ability and reduce LOS.

Several studies concerning the effects of additional PT training on geriatric patients with hip fracture were published. A systematic review, by Auais and colleagues, showed that extended exercise program has a positive impact on physical functional recovery of hip fracture patients.[13] However, the extended program is focusing on community setting and not assessing for more intense in-patient training. Recently, Hasebe *et al.*[14] reported that the additional weekend rehabilitation training led to a faster functional recovery and reduce LOS for Japanese patients with hip fracture.

We hypothesized that functional outcomes could be improved and length of hospital staying

might be shorter in geriatric patients with hip fracture who received additional weekend and holiday PT training than those who received only weekdays PT training.

The purposes of this study were to: (1) compare the ambulatory status, functional mobility and basic activities of daily living (ADL) levels between groups of geriatric patients with hip fracture received daily PT training and received only weekdays PT training and (2) compare the change in LOS in acute, rehabilitation hospitals and overall LOS respectively between groups of geriatric patients with hip fracture received daily PT training and received only weekdays PT training.

Methods

Study design

This was a retrospective case-historical control study in which medical records of geriatric patients with hip fracture were reviewed. It was conducted in compliance with the Declaration of Helsinki and ethical approval was granted from The Joint Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee.

Study subjects

We analyzed the case notes of geriatric patients, aged $\geq$ 60 years, who were transferred from acute hospital to Department of Orthopaedic Rehabilitation of Tai Po Hospital with a new diagnosis of fracture hip (ICD-9-CM 820.X). The line for assigning case and control was 1 October 2017 when the weekend service of PT rehabilitation commenced. Patients admitted between 1 October 2017 and 31 March 2018 were included in the study group while those admitted between 1 October 2016 and 31 March 2017 were included in the control group. The main difference was that the study group received daily PT mobilization training if not contraindicated, from post-operation until discharge from hospital, while control group did not receive any weekend or holiday PT mobilization training.

Patients with hip fracture for conservative treatment, or drop-out individuals (like transferred to medical ward for active medical problems; discharged against medical advice), or patients with incomplete outcome data in Clinical Management System (CMS) of HA were excluded.

Geriatric hip fracture care (acute hospital)

Concerning PT training, assessment and treatment were part of routine acute care of geriatric hip fracture. Week-day PT training with chest PT, mobilization and strengthening exercise, mobility and gait training were provided while chest PT was offered to selected cases for life-saving maintenance in weekend and holiday before 1 October 2017. After the commencement of new program, daily PT training, including mobilization and gait training, was offered if it was not contraindicated.

Geriatric hip fracture care (rehabilitation hospital)

Before 1 October 2017, one PT session were offered every weekday. The service included comprehensive physical and social assessment and treatments, with mobilization and strengthening exercise, balance training, functional mobility and gait training, stairs, slope and outdoor walking endurance training, patient and caregiver education on home exercise, fall prevention and walking aids prescriptions according to individuals' needs. Daily PT training was provided after 1 October 2017. Despite the service extension, the content, duration, intensity and mode of delivery remained unchanged.

Outcome measures

Primary outcome measure included functional outcomes. Clinical assessment scales including Modified Functional Ambulation Classification (MFAC), Elderly Mobility Scale (EMS) and Modified Barthel Index (MBI) were used to measure individuals' ambulatory status, functional mobility and basic ADL level, respectively. Secondary outcome measure included LOS in hospitals, i.e. acute, rehabilitation and total.

Modified Functional Ambulation Classification (MFAC)

MFAC is an ordinal scale with seven categories commonly used in Hong Kong public hospitals to grade individuals' walking ability.[15] The scale ranges from Category I to VII, indicating recliner to independent outdoor walker and walking aids

were not taken into account. It has been validated in patients with hip fracture.[16]

Elderly Mobility Scale (EMS)

EMS is a 7-item, 20-point scale to assess frail elderly mobility.[17] Higher marks indicate a better mobility performance. The scale ranges from 0 to 20 and the range of 0–9, 10–13 and 14–20 indicates dependent, assisted and independent mobility, respectively.[17] The seven items included are lying to sitting, sitting to lying, sitting to standing, standing, gait, timed walk for 6 m and functional reach. Study has shown that EMS is reliable and valid to be used in frail elderly people.[17]

Modified Barthel Index (MBI)

MBI is a 10-item, 100-point scale to assess participant's basic ADL performance.[18] The scale ranges from 0 to 100, with 0–20, 21–60, 61–90, 91–99 and 100 representing total, severe, moderate, slight and no dependence in ADL, respectively.[18] Ten items of the index include feeding, grooming, dressing, toileting, bathing, transfer, ambulation, stairs, bowel and bladder control.[18] Study has shown that MBI is reliable to be used.[19]

Length of hospital stay (LOS)

Post-operative acute hospital stay was counted as the exact number of days between date of orthopedic surgery received by patient and date of discharge from acute hospital. The recorded operation date was defined as Day 0. Rehabilitation hospital stay was counted as the exact number of days between the date of admission to rehabilitation hospital and date of discharge from it. Post-operative total in-patient stay was counted as the exact number of days between the date of surgery and the date of discharge from rehabilitation hospital.

Number of PT training sessions was counted as number of days with PT records during hospitalization.

Assessments were done by case therapist-in-charge once individuals were admitted to and before discharged from the in-patient rehabilitation unit. All data were collected and recorded in the medical records by case therapist-in-charge. Data were then retrieved from the medical records by authors for analysis in this study.

Statistical analysis

Shapiro–Wilk tests were used to check the normality of data. Age, EMS and MBI scores and LOS data were not normally distributed, thus non-parametric statistics were applied. Mann–Whitney U tests for continuous variables with skewed distributions or Chi-square tests for categorical data were used to compare demographic data between groups. Comparisons between groups were done on the median scores of patients on admission to rehabilitation hospital and before discharge from rehabilitation hospital. Between-group difference on median scores/numbers of day was compared by Mann–Whitney U tests, except MFAC was compared by Chi-square tests. All statistical analyses were conducted using the IBM SPSS Statistics for Windows, Version 24.0 (Armonk, NY: IBM Corp). The statistical significance level was set at 0.05.

Results

There were 204 patients and 191 patients identified for study and control groups, respectively.

For study group, 15 patients were transferred back to acute hospitals, three patients managed conservatively, one patient aged < 60 years old were excluded from the study. There were totally 185 patients included in study group.

For control group, 10 patients were transferred back to acute hospitals, one patient discharged against medical advice, three patients managed conservatively, six patients aged < 60 years old, one patient with missing data. There were totally 170 patients included in control group.

Both groups share similar demographic data with no significant difference in terms of age, gender, pre-morbid MFAC and diagnosis (Table 1).

For functional outcome when patients admitted to rehabilitation hospital, the Chi-square test of the MFAC scores with adjusted standardized residual analysis ($p = 0.015$) (Table 2) shows that there were statistically significantly higher percentage of patients of Category II in control group (35.9%) and statistically significantly higher percentage of patients of Category III in study group (31.4%). Significantly better basic ADL level, represented by MBI, was found in study group (mean $\pm$ standard deviation, median: 47.4 ± 19.6 points, 51 points) than in control group (43.0 ± 20.0 points, 43 points) ($p = 0.042$) (Table 2). Similar functional mobility, represented by EMS, was found

Table 1. Demographics and clinical characteristics of patients.

		Study group ($n = 185$)	Control group ($n = 170$)	p-value[a]
	Age (years)	83.0 ± 8.1, 84	83.5 ± 8.6, 85	0.452
	Males, n	55 (29.7%)	44 (25.9%)	0.419
	Pre-morbid MFAC	Median: VI	Median: VII	0.637
		I: 0 (0.0%)	I: 1 (0.6%)	
		II: 1 (0.5%)	II: 2 (1.2%)	
		III: 5 (2.7%)	III: 5 (2.9%)	
		IV: 21 (11.4%)	IV: 12 (7.1%)	
		V: 13 (7.0%)	V: 12 (7.1%)	
		VI: 53 (28.6%)	VI: 43 (25.3%)	
		VII: 92 (49.7%)	VII: 95 (55.9%)	
Diagnosis	Fracture neck of Femur	97 (52.4%)	84 (49.4%)	0.638
	Trochanteric fracture of Femur	85 (45.9%)	81 (47.6%)	
	Sub-trochanteric fracture of Femur	3 (1.6%)	5 (2.9%)	

Notes: Data shown as mean ± standard deviation, median or n (%). MFAC = Modified Functional Ambulation Classification.
[a]p-values of Mann–Whitney U-test for age; Chi-square tests for others.

Table 2. Comparisons of functional scores of individuals on arrival of rehabilitation hospital.

	Study group ($n = 185$)	Control group ($n = 170$)	p-value[a]
MFAC	Median: III	Median: III	0.015*
	I: 6 (−1.6)	I: 12 (1.6)	
	II: 48 (−2.0)	II: 61 (2.0)	
	III: 58 (3.1)	III: 29 (−3.1)	
	IV: 58 (0.4)	IV: 50 (−0.4)	
	V: 11 (−0.2)	V: 11 (0.2)	
	VI: 4 (−1.1)	VI: 7 (1.1)	
EMS (points)	3.8 ± 3.0, 3	4.0 ± 3.7, 3	0.518
MBI (points)	47.4 ± 19.6, 51	43.0 ± 20.0, 43	0.042*

Notes: Data shown as mean ± standard deviation, median; each MFAC category with number of count (adjusted standardized residual). EMS = Elderly Mobility Scale; MBI = Modified Barthel Index; MFAC = Modified Functional Ambulation Classification. *$p < 0.05$.
[a]p-values of Chi-square tests for MFAC; Mann–Whitney U tests for others.

Table 3. Comparisons of functional scores of individuals upon discharge from rehabilitation hospital.

	Study group ($n = 185$)	Control group ($n = 170$)	p-value[a]
MFAC	Median: IV	Median: IV	0.003*
	I: 3 (−0.8)	I: 5 (0.8)	
	II: 14 (−3.2)	II: 32 (3.2)	
	III: 25 (1.4)	III: 15 (−1.4)	
	IV: 57 (2.2)	IV: 35 (−2.2)	
	V: 47 (0.7)	V: 38 (−0.7)	
	VI: 37 (−0.3)	VI: 36 (0.3)	
	VII: 2 (−2.3)	VII: 9 (2.3)	
EMS (points)	8.2 ± 5.5, 7	8.4 ± 6.1, 6	0.998
MBI (points)	63.0 ± 23.4, 68	61.2 ± 26.1, 64	0.743

Notes: Data shown as mean ± standard deviation, median; each MFAC category with number of count (adjusted standardized residual). EMS = Elderly Mobility Scale; MBI = Modified Barthel Index; MFAC = Modified Functional Ambulation Classification.
[a]p-values of Chi-square tests for MFAC; Mann–Whitney U tests for others.

in both study (mean ± standard deviation, median: 3.8 ± 3.0 points, 3 points) and control groups (4.0 ± 3.7 points, 3 points) ($p = 0.518$) (Table 2).

For functional outcome when patients upon discharged from rehabilitation hospital, the Chi-square test of the MFAC scores with adjusted standardized residual analysis ($p = 0.003$) (Table 3) shows that there were statistically significantly higher percentage of patients of Category II in control group (18.8%), statistically significantly higher percentage of patients of Category IV in study group (30.8%) and statistically significantly higher percentage of patients of Category VII in control group (5.3%). Similar functional mobility, represented by EMS, was found in both study (mean ± standard deviation, median: 8.2 ± 5.5 points, 7 points) and control groups (8.4 ± 6.1 points, 6 points) ($p = 0.998$) (Table 3). Similar basic ADL level, represented by MBI, was found in both study (mean ± standard deviation, median:

Table 4. Comparisons of LOS and PT training sessions.

	Study group ($n = 185$)	Control group ($n = 170$)	Between groups difference (mean, percentage change)	p-value[a]
Post-operative acute LOS (days)	7.7 ± 3.9, 7	7.4 ± 5.0, 6	0.3, 3.8%	0.192
Rehabilitation hospital LOS (days)	20.0 ± 5.5, 20	24.3 ± 9.9, 23	−4.3, −17.6%	< 0.001*
Post-operative in-patient LOS (days)	26.7 ± 6.4, 26	30.7 ± 11.2, 28	−4.0, −12.9%	< 0.001*
PT sessions	17.8 ± 5.2, 18	16.0 ± 6.7, 15	−1.8, 11.5%	< 0.001*

Notes: Data shown as mean ± standard deviation, median. *$p < 0.05$. LOS = length of hospital staying day; PT = Physiotherapy.
[a]p-values of Mann–Whitney U tests.

63.0 ± 23.4 points, 68 points) and control groups (61.2 ± 26.1 points, 64 points) ($p = 0.743$) (Table 3).

For post-operative acute hospital stay, similar LOS was found in both study (mean ± standard deviation, median: 7.7 ± 3.9 days, 7 days) and control groups (7.4 ± 5.0 days, 6 days) ($p = 0.192$) (Table 4). For rehabilitation hospital stay, significant shorter LOS was found in study group (20.0 ± 5.5 days, 20 days) than in control group (24.3 ± 9.9 days, 23 days) ($p < 0.001$) (Table 4). For post-operative total in-patient stay, significant shorter LOS was found in study group (26.7 ± 6.4 days, 26 days) than in control group (30.7 ± 11.2 days, 28 days) ($p < 0.001$) (Table 4).

For number of PT training sessions, significant more training session was found in study group (mean ± standard deviation, median: 17.8 ± 5.2 sessions, 18 sessions) than in control group (16.0 ± 6.7 sessions, 15 sessions) ($p < 0.001$) (Table 4). A higher percentage of day having PT training during rehabilitation hospital stay was shown with the implementation of new service (Study group: 89.1%; Control group: 65.9%, $p < 0.001$).

Discussion

Our results suggest that additional weekend and holiday PT training has positively contributed to rehabilitation for geriatric patients with hip fracture, in terms of service efficiency of public healthcare system.

First, additional weekend and holiday PT training may contribute to a more efficient in-patient functional training. Studies have concluded that additional weekend and holiday PT service may possibly reduce hospital LOS for individuals with various disease groups receiving in-patient rehabilitation.[8–10,14,20] Results of our study are in line with the literature. Results suggested that similar functional mobility ($p = 0.998$) and ADL level ($p = 0.743$) were achieved with a shorter LOS ($p < 0.001$) when patients were discharged from rehabilitation hospital in study group.

Similar to literature, short intensive in-patient rehabilitation was an effective mode to improve mobility and functional performance for geriatric individuals with hip fracture.[21–23] As Heiberg *et al.*[24] suggested, daily walking and other functional training give positive impact on physical outcomes than limited PT interventions on weekdays in geriatric patients with hip fracture. Although PT training in our center is not as comprehensive as the one in Heiberg's study, daily functional training has been in place after launching of additional weekend and holiday PT service. As systematic review by Scrivener *et al.*[25] concluded, additional physical rehabilitation improves functional outcome without impact in LOS. These studies suggested that with similar LOS, individuals with additional weekend and holiday PT training may possibly train up to a higher mobility level. Our results shown an improved LOS with similar functional outcomes. Here, the same principle was shared, individuals with additional PT service may have a higher rate in functional regain.

Cary *et al.*[26] reported that patients with hip fracture who have longer in-patient rehabilitation LOS are related to higher functional performance on discharge. However, prolonged mobility deterioration was expected in geriatric patients with hip fracture after discharge from hospital. Local data show that deteriorated mobility was found when compared to pre-morbid, in 3-month and 1-year time post-operation in 77.5% and 69.9% of individuals, respectively.[27] These data reveal that prolonged recovery is needed, but not having a

significant change just by adding 1.8 more PT training sessions ($p < 0.001$) in average, after our service extended. The goal of geriatric hip fracture in-patient rehabilitation is to optimize their functional level, once patients reach a certain level in functional performance and with adequate social support, they would be considered to be discharged. Now, weekend PT training may speed up patients' recovery to the level.

Second, additional weekend and holiday PT training may contribute to an improved efficiency of rehabilitation hospital stay. Results suggested that geriatric patients with hip fracture now have an 89.1% of rehabilitation hospital staying day receiving PT training. A 23% increase shown when comparing to control group with only 65.9% days with PT training. Statistically, it is an encouraging result in responding to the document of Strategic Service Framework for Rehabilitation Services in terms of expanding inpatient rehabilitation service coverage.[6]

Clinically, this was 1.8 more PT sessions received in average ($p < 0.001$), with 4.3 days less LOS ($p < 0.001$) in study group for rehabilitation hospital training. Great improvement is not expected with only 1.8 more PT session provided. However, the continuous training may affect the efficiency for staying in rehabilitation hospital. Additional weekend and holiday PT training is especially valuable for those who needed to stay in hospital during long public holidays, in preventing them to be sedentary for consecutive days during hospital stay. According to National Institute for Health and Care Excellence (NICE) guideline[28] on fracture hip management, daily mobilization and regular PT review were recommended. The extended PT service greatly improved the compliance to this recommendation. Patients have chance to mobilize and walk daily and therapists can plan for regular review without interruption by long public holiday. The time used for assessing all accumulated new cases during holiday or cases needed to be reviewed is now greatly lowered as number of new cases referral and review cases may be more evenly distributed in between the holidays, thus with more appropriate evaluation and training progression can be made on time.

Third, more patients were trained up to walk with assistance in acute phase after additional weekend and holiday PT service started. As patients would receive PT assessment within one day after admitted to rehabilitation hospital, the scores taken in admission can be considered as the status when individuals were discharged from acute hospital. Results shown that higher percentage of patients of MFAC Category III in study group (31.4%) and higher percentage of patients of MFAC Category II in control group (35.9%) ($p = 0.015$), and there were no statistically significant differences in other MFAC categories of both groups.

As the retrospective analysis done by Maidment *et al.*[10] suggested that patients with weekend PT training achieved milestone of PT treatment in a shorter period without affecting hospital staying period. These results were in line with our findings and revealed that patients in post-operative acute care period were benefited in terms of functional outcome, from the additional weekend and holiday PT training. The additional one to two PT training sessions cannot be a major reason for having more dependent walkers and less sitters in study group ($p = 0.015$), but the effect of early mobilization counts.[21,29] Previously, if patients received operation near weekend or holiday, they needed to wait until the first working day to have their 'first walk'. Mobilization was then delayed and possibly lead to higher rate of complications.[30] Now, daily PT service providing individuals timely access to rehabilitation service and chances to have early mobilization if it is not contraindicated.

For the post-operative acute LOS, as suggested by Maidment *et al.*,[10] prolonged hospital LOS may be due to administrative or organizational delay, and thus, individual mobility is only one of the determinants. These factors might also be present in this study when individuals were transferred to rehabilitation hospital. However, relevant information was not retrieved for analysis in this study.

Finally, additional weekend and holiday PT training may contribute to a cost-saving service. Geriatric patients with hip fracture had a shorter post-operative in-patient LOS ($p < 0.001$) after PT service extended to 7-day per week. According to the 'Asia-Pacific regional audit' published in 2013 by International Osteoporosis Foundation (IOF), everyone with hip fracture occupied 27 hospital bed days and leaded to USD$10,782 hospital cost in Hong Kong.[4] As our results show, the 4.0 days shorter in post-operative in-patient LOS give a clinical significance reduction in cost for each geriatric patient with hip fracture. As estimated, fragility hip fracture in Hong Kong will experience an increase from 4579 cases in 2011 to more than

14,500 cases in 2040.[5] With this single strategy on additional weekend and holiday PT service, it may possibly save a great amount of hospital staying cost. Cost-effective strategies not only will lower the financial impact toward the public health care system, but also improve the bed space availability for the increasing case number.

As mentioned before, geriatric patients with hip fracture experience a long journey in their functional recovery, more than half of them still experience a deteriorated mobility when compared to pre-morbid state.[27] In-patient rehabilitation is then a small, but critical part of geriatric hip fracture rehabilitation.[28,30,31] As suggested by Lau *et al.*,[31] simple measures in standardizing clinical pathway with multi-disciplinary approach would improve outcomes and quality of care in geriatric patients with hip fracture. Detail and precise pre-discharge planning and continuous training in ambulatory or community settings may possibly affecting further functional recovery.[22,28,30] Being a healthcare profession, we always strive for service improvement in any parts in geriatric hip fracture management for better outcomes and quality of care.

To further investigate the effect of additional weekend and holiday PT training toward geriatric patients with hip fracture, analysis on sub-group (like classify with pre-morbid mobility level or with type of surgery done, etc.) is suggested. As the staffing capacity is now limited in weekend service, only certain number of cases can be served. Case selection may be needed when facing a growing case number, results from sub-group analysis will serve as a triage purpose. Also, different modes of additional service can be studied. As mentioned in literature, extra PT time may possibly deliver with a different mode, benefit can be achieved in terms of functional outcomes and LOS.[20] The study on different modes of additional service and cost-effective strategies may provide insight in the possibility of achieving higher functional level with a shorter LOS.

Limitations of this study include: (1) the study design, (2) single hospital cases were reviewed and (3) effects of other new service were not considered. First, this is a case-historical control study of retrospective review of medical records, therefore, extra cautions should be paid when we induce causal relationship from the data. Also, as other clinical variables (like cognitive state, time to surgery, post-operative complications, etc.) were not captured in our study, there were potentially confounding factors. However, it is still an appropriate method to evaluate the new service. Randomized controlled trial is not pragmatic as this is an evaluation of a new service program with resources injected. Second, the single-center design limits its generalizability to other centers. Other hospitals may have different structure of geriatric hip fracture rehabilitation program and different criterion for discharge. Third, some new service, like Medical-Social Collaboration program and Geriatrician weekly case conference, were launched in part of the inclusion period of study group, which may possibly affect the results of LOS in some patients.

To conclude, additional weekend and holiday PT training shorten the LOS in rehabilitation hospital and total in-patient hospital stay with more PT sessions during hospitalization, without any significant impacts on functional outcome.

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Conflict of Interest

The authors declare that there is no conflict of interest relevant to this paper.

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Author Contributions

All the authors contributed to the conception and design of study and approval for the submission to publication. K.C. Mo and H.M. Ma contributed to the data analysis and interpretation. K.C. Mo and K.M. Lau contributed to the manuscript drafting. M.Y. Fung, H.M. Ma, F.O. Lau and S.W. Law contributed to the manuscript revision.

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