

ORIGINAL ARTICLE: EPIDEMIOLOGY,  
CLINICAL PRACTICE AND HEALTH**Effects of hospitalist-directed interdisciplinary medicine floor service on hospital outcomes for seniors with acute medical illness**

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**Aim:** To examine whether a hospitalist-directed interdisciplinary (ITD) team in an internal medicine residency program enhances the hospital and clinical outcomes for seniors with acute medical illness.

**Methods:** Seniors admitted to a USA teaching hospital medical floor-teaching services were allocated to the ITD ( $n = 379$ ) and usual care teams ( $n = 383$ ). Compared with the usual care team, the ITD team physicians carried out daily “geriatric” assessment and management, and led ITD team meetings.

**Results:** The mean probability of functional decline on hospital discharge in the ITD team (25%; 95% CI 19–30%) was significantly lower than that in the usual care team (36%; 95% CI 30–43%; OR 0.35; 95% CI 0.10–0.92;  $P < 0.001$ ). The mean probability of delirium in the ITD team (26%; 95% CI 20–32%) was significantly lower than that in the usual care team (34%; 95% CI 28–41%; OR 0.48; 95% CI 0.16–0.97;  $P = 0.03$ ). The mean probability of transition to an institution in the ITD team (18%; 95% CI 13–23%) was significantly lower than that in the usual care team (26%; 95% CI 19–32%; OR 0.41; 95% CI 0.14–0.95;  $P = 0.01$ ).

**Conclusions:** Hospitalist-directed ITD team care is associated with reductions of functional decline, delirium and transition to an institution for seniors with acute medical illness. **Geriatr Gerontol Int 2014; 14: 71–77.**

**Keywords:** delirium, hospitalist, interdisciplinary health teams, inter-professional relations, quality of health care.

## Introduction

Older adults account for 40% of USA hospital admissions.<sup>1</sup> When observed in parallel with a corresponding increase in life expectancy, older adults' hospital admissions have been on the rise.<sup>1</sup> Hospitalized older adults are vulnerable to the development of a complicated hospital course and catastrophic consequences, including disability and nursing home entry, from a bout of

severely acute medical illness.<sup>1,2</sup> Coupled with their vulnerability to functional decline and reduced capacity to recover, older adults are subject to several procedures and related limited physical activity, which might lead to additional functional decline during the hospital stay.<sup>1,2</sup> Hospital-associated functional decline occurs in more than one-third of hospitalized seniors.<sup>3–6</sup>

A vein of the literature has described that interdisciplinary (ITD) team care reduced or delayed hospital-associated functional decline.<sup>7–10</sup> ITD team care has been found to expedite a functional reservoir of acutely ill seniors and to defer permanent transition to a residential facility.<sup>7–9</sup>

A series of studies have linked specific collaborative behaviors to improved health outcomes for hospitalized seniors.<sup>7–11</sup> These studies present that practices as specific as providing information when it is not explicitly asked for and facilitating more frequent

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The present study was carried out at Cleveland Clinic Health System, Ohio, USA.

communication opportunities among healthcare providers have been identified as improving interprofessional collaboration.<sup>9-11</sup>

In 2008, the Institute of Medicine noted that unless academic health centers take action immediately, the healthcare workforce will be unable to effectively meet the needs of this growing population.<sup>12</sup> As hospitalist services care for an increasing number of seniors, hospitalists have been uniquely positioned to lead and infuse geriatric knowledge and interprofessional communications to collaborating healthcare providers.<sup>13,14</sup>

Either “ITD care” or “multidisciplinary care” is increasingly required to meet various demands across the medical care and welfare of the elderly and their caregivers.<sup>15-17</sup> However, little is known about the impact of a hospitalist-directed ITD team care on hospital outcomes of acutely ill seniors.

Under the Diagnosis-Related Group (DRG)-based inpatient care in Organization for Economic Co-operation and Development (OECD) countries including the USA, healthcare providers are often challenged to achieve both commitments: higher quality of care (QC) and less utilization of healthcare resources (e.g. length of stay [LOS]).<sup>18-20</sup> Care for complicated hospitalized older adults in the USA often confronts the challenge to discharge sicker older adults prematurely to avoid negative Medicare rewards directly tied to the DRG’s LOS guideline. In the Republic of Korea (ROK), the National Health Insurance System, the sole health insurance provider in the country, is expanding DRG-based financing across all hospital sectors and services.<sup>19</sup> To overcome these challenges, since 2007, the Cleveland Clinic Health System in the USA and Korea University in ROK have been collaborating on a quality improvement project for hospitalized older adults.<sup>9</sup> As a result, an ITD medicine floor team model has been developed to aim on enhancing: (i) geriatric assessment and management; and (ii) interprofessional collaboration among healthcare professionals.

The scope of the present study has been narrowed to hospitalists who are primarily caring for hospitalized older adults. We aimed to understand the effectiveness of hospital outcomes of seniors with acute medical illness cared for by the hospitalist-directed ITD medicine floor service in a USA academic medical center.

## Methods

The study site was a USA metropolitan hospital affiliated with an academic center (485 certified inpatient beds). The study site hospital has neither a geriatric unit nor geriatric consultation service teams. This GME program was an Accreditation Council for Graduate Medical Education (ACGME) accredited internal medicine program. All participating physicians in the ITD and usual care team completed 6 h of American Medical

Association (AMA) physician’s recognition awards (PRA) category 1 by either onsite (noon conference) or online Continuous Medical Education (CME) before study enrolment. This serial CME was entitled “Enhancing QC for Hospitalized Seniors” including the following topics: (i) delirium (Part I/II); (ii) Beer’s criteria: To reduce harmful medication; (iii) cognition and depression assessment; (iv) physical function assessment using activities of daily living (ADL); (v) establishing goals of care including advance directives; and (vi) minimizing unnecessary medical procedures in an acute care setting.<sup>21-27</sup> The present study was approved by the institutional review board of the Cleveland Clinic Health System. Informed consent was obtained from both participating physicians and patients or their informal primary caregivers when patients could not make their own decisions.

### *Patient inclusion and exclusion criteria*

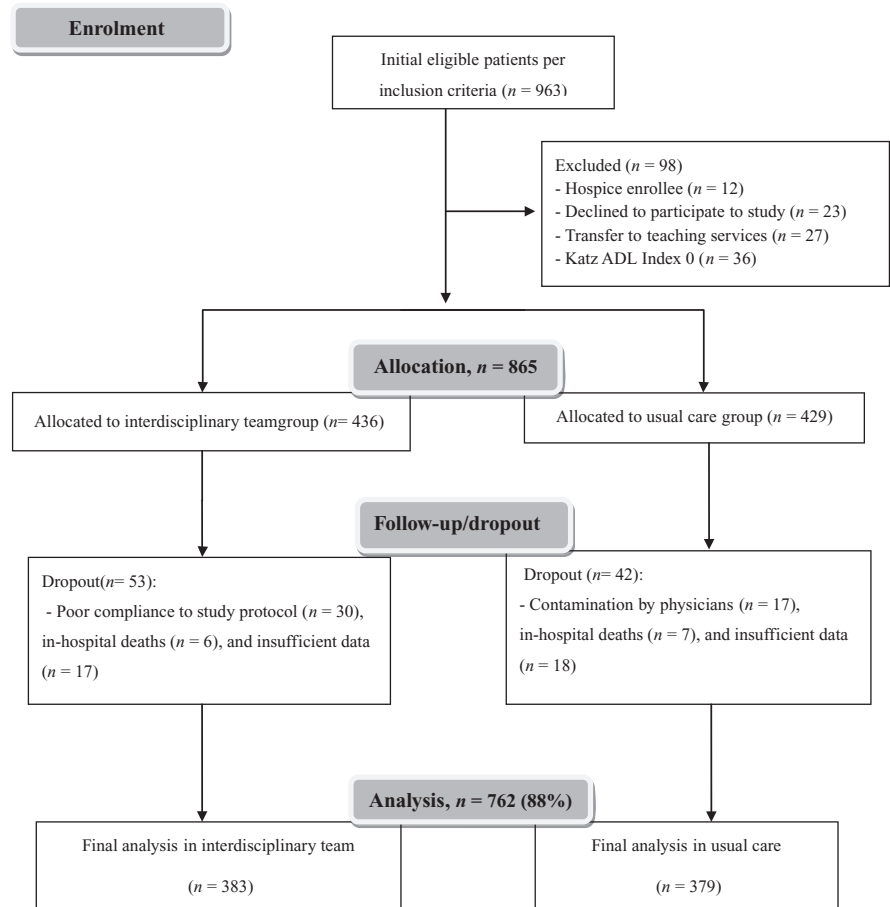
The patient enrolment was between March and June 2008 (16 weeks). Patients were chosen based on the following inclusion criteria: (i) admission to non-teaching medicine floor services; (ii) age 65 years or older; and (iii) community-dwelling person before hospital admission. Exclusion criteria were: (i) hospice enrollee; (ii) declined study participation; (iii) transfer to teaching medicine floor services; and (iv) Katz Index of Independence 0 (total dependency) at hospital admission. Figure 1 shows the flow chart of patient enrolment, allocation, follow up and analysis according to Consolidated Standards of Reporting Trials (CONSORT).

### *Physician criteria*

All participating physicians were attending physicians who had internal medicine board certification. The ITD team physicians were full-time hospitalists. Usual care team physicians were not hospitalists.

### *Study protocol: ITD care team’s geriatric assessment and management*

As opposed to their counterparts in the usual care team, hospitalists in the ITD team were asked to complete daily “geriatric” assessment and management from hospital admission to discharge as follows: (i) delirium assessment (Confusion Assessment Method [CAM]); (ii) establishing a goal of care (documenting advance directives); (iii) minimizing harmful medication based on modified Beer’s criteria; and (iv) minimizing unless medically necessary (e.g. physical restraints).<sup>21-27</sup> The checklist for carrying out “geriatric” assessment and management was distributed to these physicians. The compliance of study protocol was determined by



**Figure 1** Flow chart of patient enrolment, allocation, follow up and analysis.

whether a physician completed 80% or more of the daily assessments and management. For example, if a total number of documented items was 24 of 28 items (85.7%, hospital length of stay is 7 days,  $7 \times 4$  items = 28 items), we considered this patient care as compliant to study protocol. However, if a total number of documented items was just 20 of 28 items (71.4%), we considered this patient care as non-compliant to study protocol, and excluded this patient from the analysis. There were 30 cases of dropout as a result of poor compliance to study protocol in the ITD team.

### Allocation and analysis

The study coordinator, who did not participate in patient care, allocated physicians and patients by matching patient characteristics (demographics, severity of illness and admission diagnoses) and physicians' experience. Neither physicians nor patients were aware of their group allocation before study enrolment. Physicians were not allowed to select their team allocations. Seven hospitalists allocated to the ITD team and six physicians allocated to the usual care team declined study participation and were excluded from the study. Among the patients initially allocated to two care

teams ( $n = 865$ ), 762 (88.0%) patients were finally analyzed: 383 of 436 patients (87.7%) in the ITD team; 379 of 429 patients (88.3%) in the usual care team.

### Study protocol: ITD team meeting

The ITD team meeting consisted of physicians, nurses, pharmacists, social workers, nutritionists, and physical, occupational and speech/language therapists. The ITD team physicians attended and led the ITD team meeting to enhance interprofessional collaboration among healthcare providers. The average ITD team meeting time was 45 min. The frequency of ITD team meeting was three times per week. The place of this meeting was the medicine floor conference room. Selected patients were discussed during the ITD team meeting. The ITD team meeting had existed before this study, but had been operated by charge nurses on each floor. The usual care team physicians attended the ITD team meetings on 17 occasions, because these physicians were requested to attend the ITD team by the medicine floor's nursing staff. These occasions were considered as contamination and these were withdrawn from the analysis.

### **Main outcomes: Functional decline on hospital discharge, delirium and discharge destinations**

Physical functions on hospital discharge were assessed by the same nursing staff team of admission team. The CAM was used to detect the delirium by participating physicians. Researchers reviewing physicians' daily progress noted whether the occurrence of delirium was documented. The validity of CAM for hospitalized elders has been discussed elsewhere.<sup>21</sup> Discharge destination was obtained from administrative data.

### **Patient characteristics**

Participating patient characteristics were age, sex, ethnicity, education, marital status, severity of illness, physical function on hospital admission, cognition, home or day services and admission diagnoses. Demographics (age, gender, ethnicity, education and marital status data) were collected from the hospital administrative database. The All Patient Refined Diagnostic Related Group (APR-DRG) severity of illness classification system was used to estimate the severity of illness. The APR-DRG data were gathered from the 3 M Health Information System (Wallingford, CT, USA). The APR-DRG data were collected from the Department of Medical Operations, which was unaware of the study objectives, and were abstracted by the researchers. The validity of APR-DRG severity of illness in inpatient geriatric care has been discussed elsewhere.<sup>28</sup> As physical function assessment on hospital discharge, physical functions on hospital admission were assessed by the same nursing staff team using Katz's Index of independence of ADL. Katz's Index ranged from 1 (most dependent) to 6 (most independent). The Katz Index has been shown to have an acceptable internal consistency ( $\alpha = 0.87$ ) and validity ( $\kappa = 0.74$ – $0.88$ ) when diverse health professionals carry out the assessment in a hospital setting.<sup>29,30</sup> The interobserver agreement ( $\kappa = 0.64$ ) and intraobserver reproducibility ( $\kappa = 0.88$ ) of the Katz Index of the present study are relatively high. Cognitive impairment and home or day care services data were collected from clinical and administrative data. Admitting diagnoses at hospital admission were grouped as the following eight groups using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes: (i) cardiovascular; (ii) respiratory; (iii) cancer and blood organ; (iv) infectious; (v) endocrine and metabolic; (vi) digestive and urogenital tract; (vii) neurological; and (viii) other diseases.

### **Statistical analysis**

Bivariate comparisons of patient and physician characteristics between care teams were examined using  $\chi^2$ -tests to compare categorical data, and *t*-tests to

compare continuous data. All reported *P*-values are two-sided throughout, and  $P < 0.05$  is considered statistically significant. We estimated multivariate logistic regressions of "functional decline on hospital discharge", "delirium" and "transition to an institution" to compute odds ratios (OR) along with corresponding 95% confidence intervals (CI).<sup>31</sup> An odds ratio  $>1$  shows that the probability in the ITD team is higher than that in the usual care team. All data procedures and analyses were carried out using SAS statistical software version 9.2 (SAS Institute, Cary, NC, USA).

## **Results**

### **Patient and physician characteristics**

A total of 383 and 379 patients were cared for by the usual care and ITD care teams, respectively. The patient and physician characteristics between care teams were not statistically different. Table 1 and Table 2 present the patient and physician characteristics by care teams.

### **Multivariate logistic regressions of functional decline, delirium and transition to an institution**

Table 3 presents the logistic regressions of three outcomes: (i) functional decline upon discharge; (ii) occurrence of delirium; and (iii) transition to an institution. The mean probability of functional decline on hospital discharge in the ITD team (25%; 95% CI 19–30%) was significantly lower than that in the usual care team (36%; 95% CI 30–43%; OR 0.35; 95% CI 0.10–0.92;  $P < 0.001$ ). The mean probability of delirium in the ITD team (26%; 95% CI 20–32%) was significantly lower than that in the usual care team (34%; 95% CI 28–41%; OR 0.48; 95% CI 0.16–0.97;  $P = 0.03$ ). The mean probability of transition to an institution in the ITD team (18%; 95% CI 13–23%) was significantly lower than that in the usual care team (26%; 95% CI 19–32%; OR 0.41; 95% CI 0.14–0.95;  $P = 0.01$ ).

### **Assessment of model fit and intention to treat analysis**

All logistic regressions fit well as determined by Hosmer–Lemeshow test results ( $P = 0.61$ , functional decline on hospital discharge;  $P = 0.33$ , delirium;  $P = 0.48$ , transition to an institution).<sup>31</sup> Because there was a significant number of dropout cases ( $n = 103$ , 12%), intention to treat (ITT) analysis was carried out. The results were not changed even after ITT analysis.

## **Discussion**

We found that there were notable reductions in functional decline, delirium and in transition to an

**Table 1** Patient characteristics

Characteristics, % ( <i>n</i> )	Usual care team, <i>n</i> = 383	ITD team, <i>n</i> = 379	<i>P</i>
Age			
80 years or older	38 (145)	39 (148)	0.71
Female	56 (146)	59 (224)	0.37
Ethnicity			
Caucasians	63 (241)	60 (227)	0.25
African Americans	22 (84)	23 (87)	
Others	15 (58)	17 (65)	
High school graduate or higher education	59 (226)	61 (234)	0.54
Never married, widowed, or divorced	43 (165)	45 (171)	0.27
*APR-DRG severity of illness			
Mild	14 (54)	17 (64)	0.42
Moderate	29 (111)	28 (106)	
Major	37 (141)	38 (144)	
Extreme	20 (77)	17 (65)	
Physical function (Katz ADL Independence Index) on hospital admission			
1 (most dependent)	10 (38)	11 (42)	0.20
2	15 (57)	17 (64)	
3	20 (77)	22 (83)	
4	19 (73)	16 (61)	
5	17 (65)	18 (68)	
6 (most independent)	19 (73)	16 (61)	
Cognitive impairment	30 (115)	32 (121)	0.62
Home or day care services	34 (130)	37 (140)	0.29
Admission diagnoses			
Cardiovascular diseases	15 (57)	15 (57)	0.15
Respiratory diseases	17 (65)	14 (53)	
Cancer and blood organ diseases	7 (27)	8 (30)	
Infectious diseases	16 (61)	17 (64)	
Endocrine/metabolic diseases	11 (42)	10 (38)	
Digestive/urogenital tract diseases	16 (62)	16 (61)	
Neurological diseases	10 (38)	12 (45)	
Others	8 (31)	8 (31)	

\*APR-DRG, all patient refined-diagnosis related group. ADL, activities of daily living; ITD, interdisciplinary.

**Table 2** Physician characteristics

<i>n</i> (%) or mean (standard deviation)	Physicians at usual care team	Physicians at ITD care team	<i>P</i>
Types of participating physicians	<b>Hospitalist</b> 25	<b>Non-hospitalist</b> 26	0.56
Years in experience	10.8 (7.4)	11.5 (7.7)	0.13

ITD, interdisciplinary.

institution by ITD team care. To the best of our knowledge, the present study is the first study investigating the hospital outcomes of a hospitalist-directed ITD medicine floor service.

The aims of this hospitalist-directed ITD team were “geriatric assessment and management” and “interprofessional collaboration” for caring for hospitalized seniors. The present findings highlight that the

**Table 3** Multivariate logistic regressions of functional decline on hospital discharge, delirium and transition to an institution

Mean probability, % (95% CI),	Usual care team, <i>n</i> = 383	ITD team, <i>n</i> = 379	<sup>†</sup> Odds ratio (95% CI)	<i>P</i>
Functional decline on hospital discharge	36 (30–43)	25 (19–30)	0.35 (0.10–0.92)	<0.001
Delirium	34 (28–41)	26 (20–32)	0.48 (0.16–0.97)	0.03
Transition to an institution	26 (19–32)	18 (13–23)	0.41 (0.14–0.95)	0.01

<sup>†</sup>Odds ratio >1 indicates that the probability in the interdisciplinary (ITD) team is higher than that in the usual care team. CI, confidence interval.

reduction in transitions to residential facilities might stem from preventing or reducing hospital-associated functional decline by a hospitalist-directed ITD medicine floor team. These findings extend previous studies in several ways.<sup>8,9</sup> The hospitalist's role in an ITD team, as communication facilitator at the ITD team meeting, might contribute to more efficient health service delivery in regard to preventing or deferring functional decline and delirium of hospitalized seniors.

The precedent efforts of reducing delirium in hospitalized older adults have been linked to fewer transitions to an institution in community-dwelling seniors.<sup>7–9</sup> Delirium, a well-known trigger of functional decline in hospitalized older adults, has been targeted to improve quality of hospital care, especially in older adults.<sup>7–9</sup> Geriatric assessment and management in the ITD team reminds physicians to prioritize the recognition and prevention of delirium.

Several considerations for practice and public health can be derived from the present findings. The current hospital practice style, leaving the hospital “quicker-sicker” trend related to the introduction of the DRG, might have contributed to greater instability on hospital discharge.<sup>32,33</sup> The consequences of this “quicker-sicker” trend have been linked to poor discharge outcomes (e.g. more frequent transitions to a residential facility) compared with since the introduction of DRG.<sup>32,33</sup> The hospital-directed ITD team seemingly plays a “buffering” role in reducing hospital-associated functional decline and emancipating community-dwelling seniors from transition to a residential facility. The Medicare charge for each transition from hospital to a skilled nursing facility was \$15 141 (daily rate, \$559) in 2010.<sup>18,34,35</sup> The Medicare charge for home healthcare per user was \$5318 (rate per visit, \$145) in 2010.<sup>34,35</sup> Although no prior cost analysis study has evaluated a direct cost comparison between home health and residential services as post-acute care, several lines of evidence lead to the expectation of cost-saving effects when hospitalized seniors are transitioned to less expensive home health services instead of residential services. In terms of public health costs, less hospital-associated functional decline and fewer transitions to a residential facility hold substantial implications for the cost-saving

effects of the hospitalist-directed ITD medicine floor team. For both hospitalized older adults and their families, preventing or deferring transition to a residential facility holds substantial implications for their psychosocial stability; thus, the association between intensive rehabilitation and fewer transitions to residential facilities might promote seniors' quality of life, as previous studies have observed.<sup>36–38</sup>

In conclusion, the present study suggests the hospitalist-directed ITD service model as one of the solutions to overcome the challenges of improving QC, as well as reducing healthcare resources for caring for older adults in the USA and other OECD countries.

We acknowledge several limitations in data collection and study design. Because the data collection was limited to a USA institution, a major limitation was lack of generalizability. Selection bias might have occurred during matching processes for patients and physicians, even though patients and physicians were not aware of their allocations at the beginning of study. We observed certain dropout cases (12%), which might trigger selection bias as well, but confirmed that our results did not change even after ITT analysis. Considering the secondary analysis of clinical data (i.e. cognition), the collection of these data was not designed for the study, suggesting potential observer variation. Therefore, the present findings should be interpreted with caution and considered preliminary until they are confirmed in future studies with more representative data.

## Disclosure statement

No potential conflicts of interest were disclosed.

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