



The Effectiveness of an Orthogeriatric  
Multidisciplinary Care Model in  
Improving Clinical Outcomes and Cost-  
effectiveness for Fragility Hip Fractures

Prof. Frankie Leung

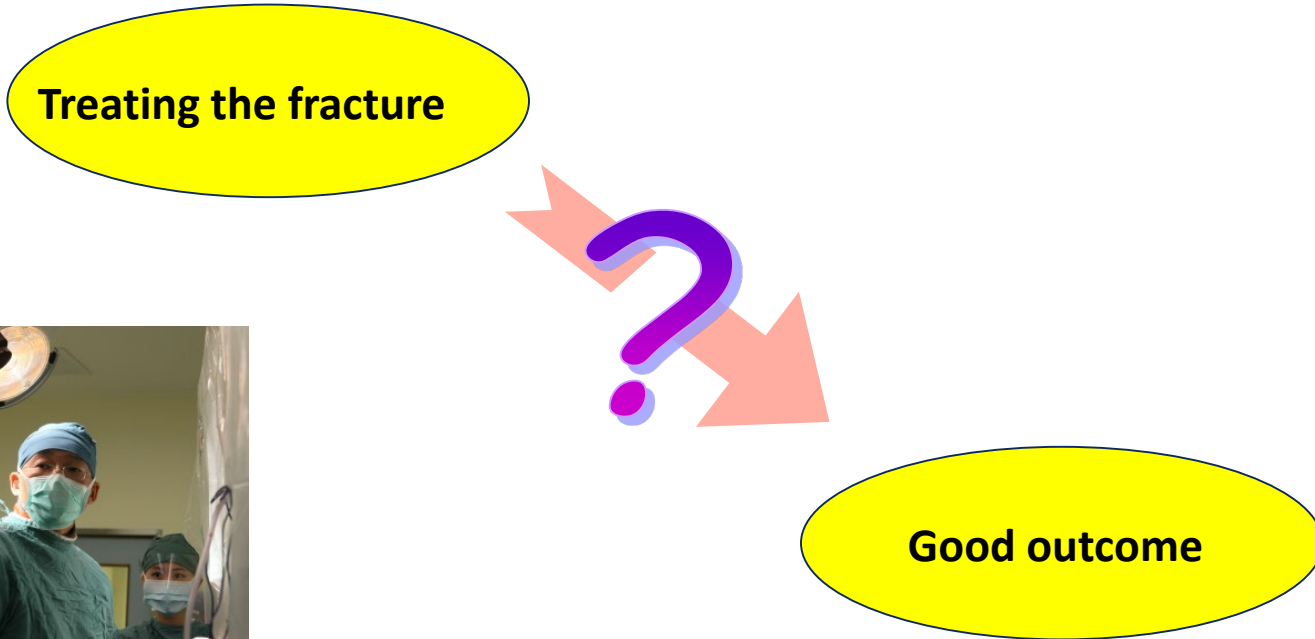


# Preamble

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- Aging population and constant increase in fragility fractures
- Two main challenges
  - Osteoporosis
  - Comorbidities
- Need combined effort of orthopaedic surgeons and geriatricians

Clearly, performing a successful surgery does not guarantee a good outcome...



# Background

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## ■ A multidisciplinary geriatric hip fracture clinical pathway (GHFCP) program was adopted in 2007

- shortens the hospital stay by 6.1 days in the acute setting and 14.2 days in the rehabilitation setting respectively, and thus improves clinical outcomes, including pneumonia
- the average cost of manpower also decreases per hip fracture case

Health and  
Medical Research  
( HMRF  
11122031)

The effectiveness of a multidisciplinary approach to geriatric hip fractures on improving clinical outcomes and cost of care



## Surgery for fragility hip fracture—streamlining the process

F. Leung • M. Blauth • S. Bavonratanavech

## Does timing of surgery matter in fragility hip fractures?

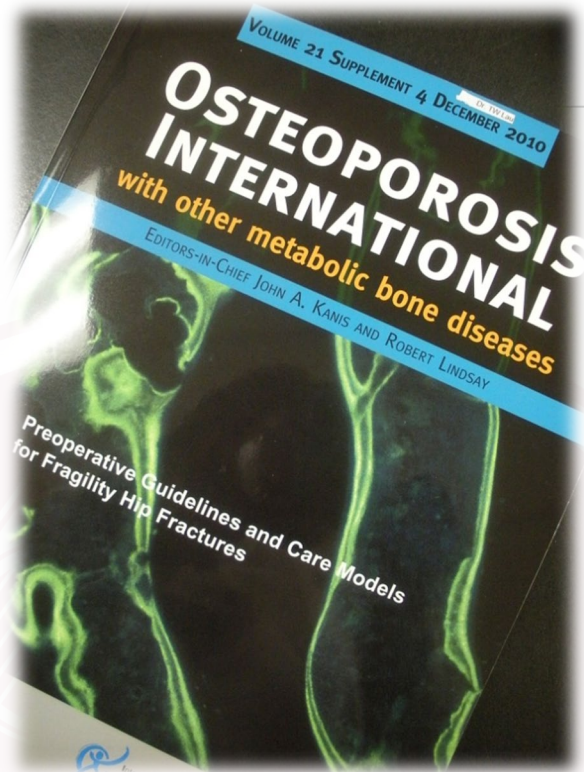
F. Leung • T. W. Lau • K. Kwan • S. P. Chow •  
A. W. C. Kung

## Geriatric hip fracture clinical pathway: the Hong Kong experience


T. W. Lau • F. Leung • D. Siu • G. Wong • K. D. K. Luk

## Preoperative cardiac risk assessment in geriatric patients with hip fractures: an orthopedic surgeons' perspective

C. W. Siu • N. C. H. Sun • T. W. Lau • K. H. Yiu •  
F. Leung • H. F. Tse

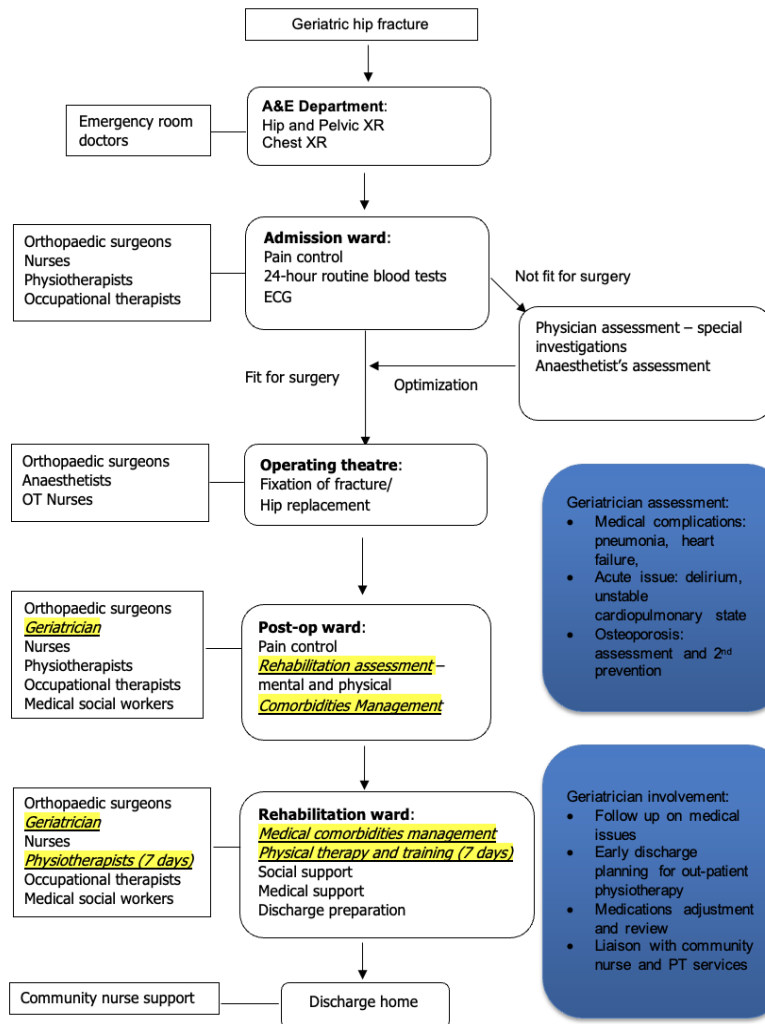


Guidelines on peri-operative  
hip fracture management



# History of Ortho-geriatric service

- Orthopaedic-geriatric units started in the 60s in England at Stoke-on-Trent and Hastings
- Orthopaedic-geriatric liaison were later established in Edinburgh (1979) and Belfast (1980)
- Modern orthogeriatric fracture centres, e.g. Rochester model



**Geriatrician assessment:**

- Medical complications: pneumonia, heart failure,
- Acute issue: delirium, unstable cardiopulmonary state
- Osteoporosis: assessment and 2<sup>nd</sup> prevention

**Geriatrician involvement:**

- Follow up on medical issues
- Early discharge planning for out-patient physiotherapy
- Medications adjustment and review
- Liaison with community nurse and PT services

## Hong Kong experience

■ A newly developed orthogeriatric co-management multidisciplinary care model has been implemented since November 2018

- Geriatrician input in the acute and rehabilitation phase to improve the whole management process of hip fracture patients



### Aims

To evaluate the effectiveness of an orthogeriatric multidisciplinary care model in improving clinical outcomes and cost-effectiveness for fragility hip fractures

### Hypothesis

Orthogeriatric multidisciplinary care model can

- shorten hospital length of stay
- decrease avoidable hospital readmission
- improve clinical outcomes
- improve cost-effectiveness per hip fracture patient





# Outcome Variables

## Primary Outcomes

To evaluate the effect on

1. mortality rates (30-day, 3-month, 6-month and 1 year mortality)
2. functional recovery upon discharge from hospital
3. the development of delirium state
4. surgical complication rate
5. medical complication rate
6. rehabilitation

## Secondary Outcomes

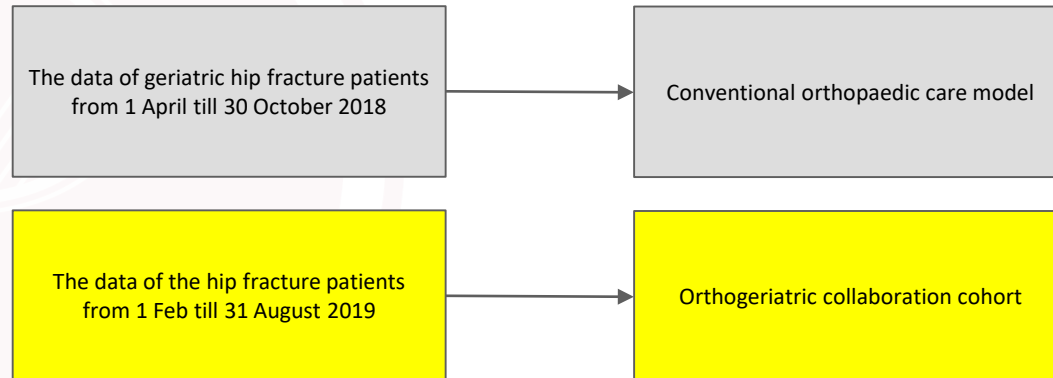
To evaluate the effect on

1. length of hospital stay in acute and rehabilitation hospital
2. the avoidable hospital unplanned readmission rate
3. the average cost of care per hip fracture patient



## Methodology- Study Design

- Prospective cohort study looking into two groups of patients treated by the same orthopaedic trauma team before and after the implementation of an orthogeriatric co-management model
  - one acute hospital (Queen Mary Hospital)
  - two rehabilitation hospitals (Fung Yiu King Hospital and Maclehos Medical Rehabilitation Centre)



	Before geriatrician collaboration	After geriatrician collaboration (Joint round 3 times/ week)
Acute Orthopaedic ward	<b>Medical problems</b>	
	<ul style="list-style-type: none"> <li>Managed by orthopaedic surgeon</li> <li>Individual subspecialty consultation</li> </ul>	<ul style="list-style-type: none"> <li>Comanaged by orthopaedic surgeons and geriatricians</li> <li>Screening for high risk patients for further stabilization before transferal</li> <li>Plan of medical treatment formulated and continued in rehab. hospital</li> </ul>
	<b>Acute delirium</b>	
	<ul style="list-style-type: none"> <li>Managed by orthopaedic surgeon</li> </ul>	<ul style="list-style-type: none"> <li>Managed by geriatrician</li> </ul>
	<b>Polypharmacy</b>	
	<ul style="list-style-type: none"> <li>No intervention</li> </ul>	<ul style="list-style-type: none"> <li>Managed by geriatrician</li> </ul>
	<b>Osteoporosis:</b>	
<ul style="list-style-type: none"> <li>Individual surgeon preference</li> </ul>	<ul style="list-style-type: none"> <li>Comanaged by orthopaedic surgeons and geriatricians</li> </ul>	
Transferal to rehabilitation hospital		
Rehabilitation ward	<b>Medical problems</b>	
	<ul style="list-style-type: none"> <li>Managed by orthopaedic surgeon</li> <li>In case of any difficulty, transferred back to acute hospital</li> </ul>	<ul style="list-style-type: none"> <li>Comanaged by surgeons and geriatricians</li> <li>Follow on plan of treatment formulated from acute hospital</li> <li>Consultant level support for patients with difficult medical problems</li> <li>Follow-up on issues that can be managed by out-patient geriatrician clinic</li> </ul>
	<b>Discharge planning</b>	
<ul style="list-style-type: none"> <li>Follow up of plan from MSW in acute hospital</li> <li>PT and OT assessment until patients adequately rehabilitated to cope with daily activities</li> </ul>	<ul style="list-style-type: none"> <li>Follow up of plan from MSW</li> <li>Joint ward round of surgeons, geriatricians, nurses, PT, OT and MSW to organize outpatient rehabilitation, e.g. GDH</li> <li>Weekly team meetings for difficult discharge issues</li> </ul>	

## Summary of the differences between the conventional and orthogeriatric care models

### Conventional model

- the orthopaedic surgeon was responsible for managing care and treatment of all medical problems

### Interventional model

- differed in the addition of a geriatrician during the postoperative phase
- co-managed the patient in both the acute and rehabilitation hospital



## Methodology- Inclusion & Exclusion Criteria

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### ■ Inclusion Criteria

- age  $\geq$  65
- diagnosis of acute (time of injury within 14 days) isolated hip fracture patients from low energy trauma

### ■ Exclusion Criteria

- high-energy trauma, pathological fractures, multiple trauma, or old fractures that occurred more than 2 weeks ago



## Outcome Assessment and Data Collection

Data Collected	<ul style="list-style-type: none"><li>- Demographics of the patients, (age, sex, original placement where the patients lived before admission, premorbid mobility, and walking aids)</li><li>- The number of comorbidities</li><li>- Classification of the fractures</li><li>- Surgery types</li><li>- Charlson comorbidity index</li><li>- Preoperative hemoglobin level</li><li>- The postoperative requirement of blood transfusion</li><li>- Placement arrangements</li></ul>
Clinical outcomes used to compare the effectiveness of the pathway	<ol style="list-style-type: none"><li>1. Length of hospital stay</li><li>2. Mortality rates including 30-day, 3-month, 6-month and 1-year mortality</li><li>3. Functional recovery upon discharge from hospital: EMS &amp; MBI</li><li>4. Medical and surgical complication rates</li><li>5. Development of delirium state</li><li>6. To evaluate the effect on rehabilitation</li><li>7. Prescription of anti-osteoporotic management</li><li>8. Unplanned hospital readmission rates</li></ol>



## Results - Demographics

	Conventional (n=194)	Orthogeriatric (n=207)	P
Age, mean (SD), y	84.8 (7.6)	83.6 (8.2)	.17
Sex, no. (%)			.70
Men	52 (26.8)	59 (28.5)	
Women	142 (73.2)	148 (71.5)	
Abbreviated mental test on admission; median (IQR)	5.1 (5.8)	7 (8.1)	.08
Rehabilitation hospital admission Modified Barthel Index; median (IQR)	48 (24)	49 (27)	.06
Pre-morbid residence (%)			
Old age home	53 (27.3)	38 (18.4)	.04
Home	141 (72.7)	169 (81.6)	
Pre-morbid mobility (%)			
Unaided	61 (31.4)	69 (33.3)	.58
With aids	121 (62.4)	124 (59.9)	
Chairbound	11 (5.7)	10 (4.8)	
Bedbound	1 (.5)	4 (1.9)	
Fracture site; n (%)			.13
Neck of femur	97 (50.8)	120 (58.8)	
Petrochanteric	94 (49.2)	84 (41.2)	
Surgery performed; n (%)			
Replacement	65 (33.5)	84 (40.6)	.15
Fracture fixation	129 (66.5)	123 (59.4)	
Charlson comorbidity index; median (IQR)	2 (5)	2 (5)	.13
Preoperative haemoglobin level (g/dL); mean +/- SD	11.4 +/- 1.8	11.6 +/- 1.9	.39
Postoperative blood transfusion (number of packed cells); mean +/- SD	.7 +/- 1.0	.5 +/- 0.9	.02

401 patients eligible for participation

- conventional group (194)
- orthogeriatric group (207)

the mean age was 84.2 years

290 patients (72.3%) were female

219 cases (54.6%) were femoral neck fractures & 182 (45.4%) were pertrochanteric fractures

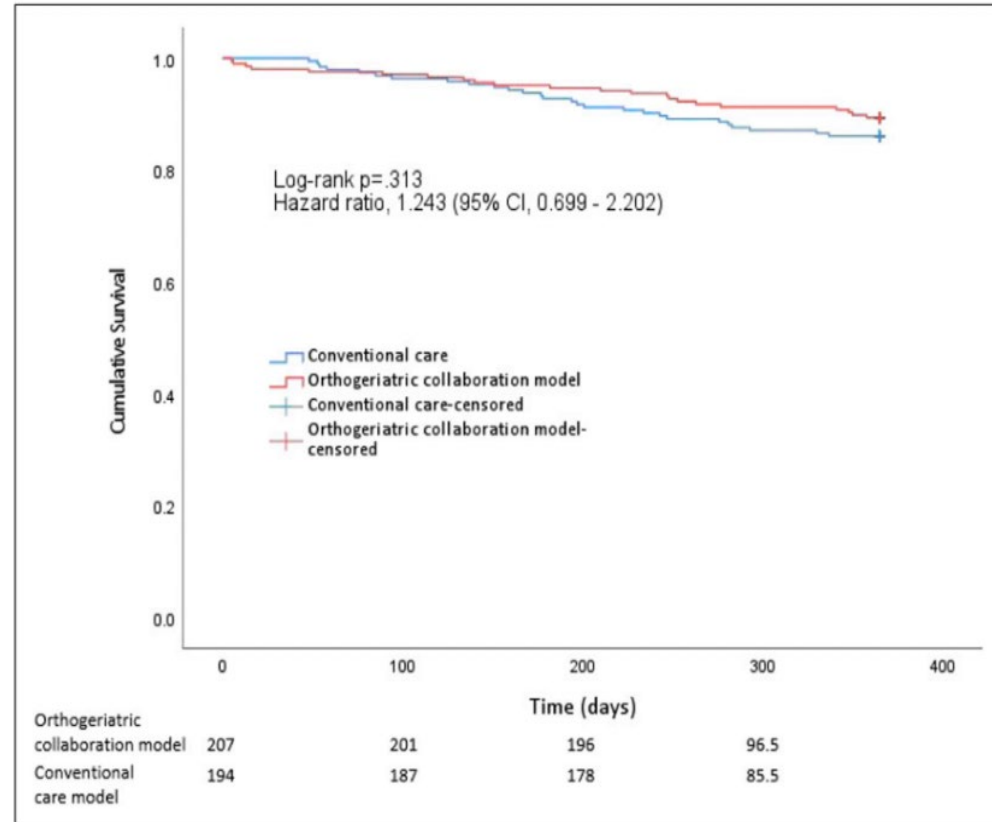


## Results - Mortality

■ A decreasing trend for 3-month, 6-month and 12-month patient mortality between the conventional and interventional group

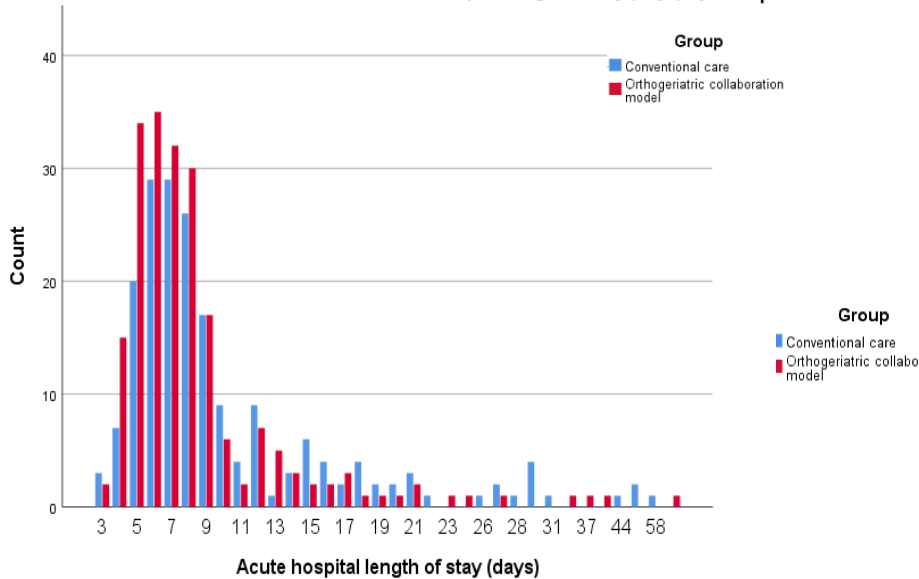
■ The results were not significant

■ For orthogeriatric co-management, there was no evidence of a benefit in survival (adjusted HR=.8, [95% CI, .5–1.4]; P=.81).



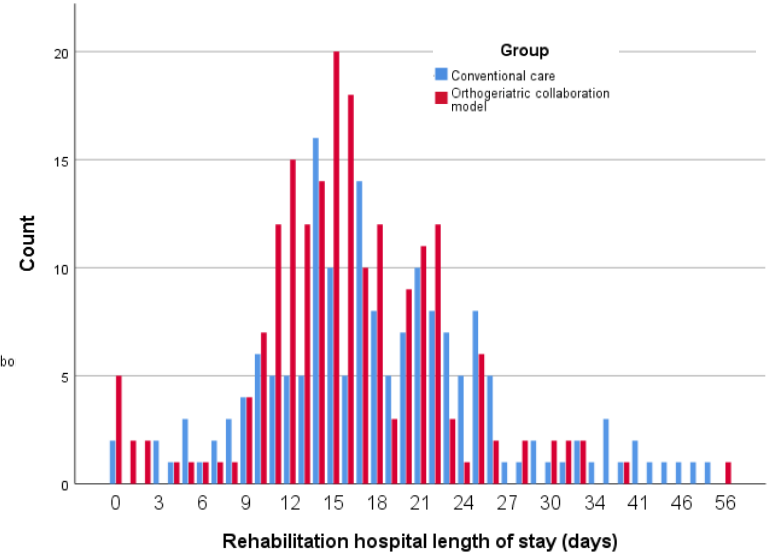
# Results - Length of Stay

Clustered Bar Count of Acute hospital length of stay (days) by Group



The median (interquartile range [IQR]) acute hospital length of stay (LOS) was significantly different between the conventional group (**8.0** [4-12] days) and orthogeriatric collaboration group (**7.0** [3-11] days)

Clustered Bar Count of Rehabilitation hospital length of stay (days) by Group



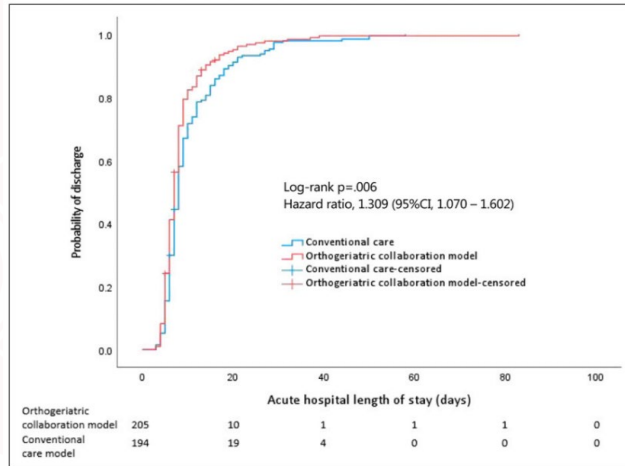
The median (IQR) rehabilitation hospital LOS was significantly different between the conventional group (**18** [9-27] days) and orthogeriatric collaboration group (**16.0** [9-23] days)



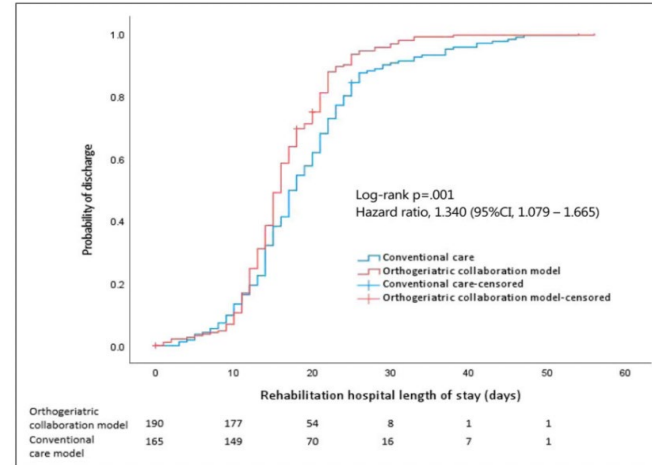


## Results - Length of Stay

- Extended LOS saw a dramatic significant reduction following implementation of the new care model
- more patients with extended LOS in the conventional group vs orthogeriatric collaboration (64.4% vs 39.1%; difference 25.3% [95% CI,15.838%–34.767%];  $P < .001$ )



significant differences between both groups  
in the median acute hospital LOS



significant differences between both groups  
in the median rehabilitation hospital LOS



## Results - Functional Recovery

- No difference in EMS scores, however there was a significant difference between the two groups for MBI scores (Recorded before discharge from the rehabilitation hospital)

	Conventional Group	Orthogeriatric Collaboration Group	P-value
The median (IQR) MBI	63.5 (28)	81 (27)	P<.001
The median (IQR) EMS	9 (8)	12 (8)	P=.07

- Accelerated rehabilitation, monitoring and management of medical complications by the geriatrician and discharge planning during the rehabilitation phase
  - led to a significant increase in functional recovery for the patients



## Results - Complications

A significant reduction in the number of chest infections in the orthogeriatric group

- (5.3% vs 10.8%, difference, 5.5% [95% CI 2%–10.9%], P=.04)

No statistically significant differences between the two groups in other complications or presence of any medical complications

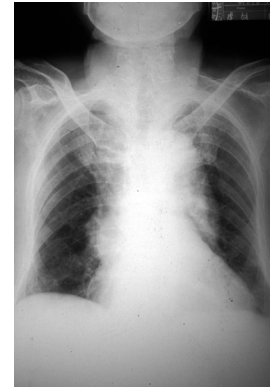
Wound complications and blood transfusions both saw decreases

- reached near-significance

**Table 2.** Analysis of adverse outcomes between the conventional and orthogeriatric group.

Adverse Outcomes No. (%)	Conventional (n=194)	Orthogeriatric (n=207)	Total (n=401)	P
<b>Wound complications</b>				
Yes	14 (7.2)	7 (3.4)		.09*
No				
<b>Surgical complications (except wound complications)</b>				
Yes	3 (1.5)	5 (2.4)		.53*
No				
<b>Postoperative blood transfusion (D0-D5)</b>				
Yes	73 (37.6)	61 (29.5)	134 (33.4)	.08*
No	121 (62.4)	146 (70.5)	267 (66.6)	
<b>Chest infection</b>				
Yes	21 (10.8)	11 (5.3)	32 (8)	.04*
No	173 (89.2)	196 (94.7)	369 (92)	
<b>Urinary tract infection</b>				
Yes	41 (21.1)	43 (20.8)	84 (20.9)	.93*
No	153 (78.9)	164 (79.2)	317 (79.1)	
<b>Acute retention of urine</b>				
Yes	34 (17.5)	32 (15.5)	66 (16.5)	.58*
No	160 (82.5)	175 (84.5)	335 (83.5)	
<b>Delirium</b>				
Yes	35 (18.0)	28 (13.5)	63 (15.7)	.21*
No	159 (82.0)	179 (86.5)	338 (84.3)	
<b>Gastrointestinal bleeding</b>				
Yes	0 (0)	3 (1.4)	3 (7)	.09*
No	194 (100)	204 (98.6)	398 (99.3)	
<b>Renal failure (Stage 2 or stage 3)<sup>44</sup></b>				
Yes	19 (9.8)	23 (11.1)	42 (10.5)	.67*
No	175 (90.2)	184 (88.9)	359 (89.5)	
<b>Any medical complications</b>				
Yes	72 (37.1)	75 (36.2)	147 (36.7)	.86*
No	122 (62.9)	132 (63.8)	254 (63.3)	

\*Chi-Square Goodness of Fit Test.



## Results - Osteoporosis

- Enhanced secondary prevention of fracture is one of the goals in orthogeriatric collaboration
- Bisphosphonate prescription saw a dramatic increase in the orthogeriatric group, from 12.9% to 66.7%
  - (difference, 53.8% [95% CI, 45.8%–61.7%],  $P < .001$ )
- No difference in the number of subsequent fractures within 1 year of index fracture between the orthogeriatric group and conventional group
  - (1.4% vs 3.1%, difference, 1.6% [95% CI, !1.3% to 4.6%],  $P = .27$ ).

**Table 3.** Osteoporosis medication prescription within one year from index fracture.

	Conventional (n=194)	Orthogeriatric (n=207)	Total (n=401)	P
Started bisphosphonate within 1 year of index fracture				
Yes	25 (12.9)	138 (66.7)	163 (40.6)	<.001 <sup>a</sup>
No	169 (87.1)	69 (33.3)	238 (59.4)	
Subsequent fracture within 1 year of index fracture				
Yes	6 (3.1)	3 (1.4)	9 (2.2)	.27 <sup>a</sup>
No	188 (96.9)	204 (98.6)	392 (97.8)	

<sup>a</sup>Chi-Square Goodness of Fit Test.



## Results - Discharge Destination From Rehabilitation Hospital

- For the 246 patients who lived at home before the injury
  - no statistically significant difference between the 2 groups group in the proportion of patients being able to go back to their original placement
    - (69.1% vs 71.0%; difference, 2.0% [95% CI, !9.6 to 13.5]; P=.74)

**Table 4.** Destination upon discharge from rehabilitation hospital

Destination upon Discharge from Rehabilitation Hospital (Pre-Morbid Residence = Home)	Conventional (n=107)	Orthogeriatric (n=139)	Total (n=246)	P
Old aged home	31 (29.0)	43 (30.7)	74 (30.1)	.74
Home	76 (71.0)	96 (69.1)	172 (69.9)	



## Results - Readmission Rates

	Conventional Group		Orthogeriatric Collaboration Group
28-day readmission rate	14.9%	↓	12.6%
Readmission due to medical reasons	11.3%	↓	8.2%
Readmission due to orthopaedic reasons	3.6%	↑	4.3%

These changes did not reach statistical significance (P=.55)

## Results – Cost analysis

Cost per episode was similar between the two models.

The decreased cost in acute hospitals was offset by the increased cost in rehabilitation hospitals.



# Summary



- A multidisciplinary orthogeriatric collaboration hip fracture clinical pathway is effective in managing this problem
  - improves the functional outcomes of the patients
  - shortens the total length of stay in acute and rehabilitation hospitals

# Acknowledgement

- HMRF (project no: 15162751) for supporting clinical study on novel service model

Orthogeriatric service model adopted in most HA clusters (as in 2024)