

Trends in Rehabilitation Efficiency and Effectiveness of a Community Hospital (1998 – 2005)



Bright Vision Hospital

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Introduction

- Rehabilitation improves functional recovery and quality of life in disabled elderly¹⁻⁵, especially if started early⁶ and intensively⁷.

1. Werner RA, Kessler S. Effectiveness of an intensive outpatient rehabilitation programme for post-acute stroke patients. Am J Phys Med Rehabil. 1996;75:114-20.
2. Tangeman PT, Banaitis DA, Williams AK. Rehabilitation of chronic stroke patients. Changes in functional performance. Arch Phys Med Rehabil. 1990;71:876-80.
3. Wade DT, Collen FM, Robb GF, Warlow CB. Physiotherapy intervention late after stroke and mobility. BMJ. 1992;304:609-13.
4. Shyu YI, Liang J, Wu CC, Su JY, Cheng HS, Chou SW, Yang CT. A pilot investigation of the short-term effects of an interdisciplinary intervention program on elderly patients with hip fracture in Taiwan. J Am Geriatr Soc 2005;53(5):811-8.
5. Stahle A, Mattsson E, Ryden L, Unden A, Nordlander R. Improved physical fitness and quality of life following training of elderly patients after acute coronary events. A 1 year follow-up randomized controlled study. Eur Heart J 1999;20(20):1448-50.
6. Paolucci S, Antonucci G, Grasso MG, Morelli D, Troisi E, Coiro P, Bragoni M. Early versus delayed inpatient stroke rehabilitation: a matched comparison conducted in Italy. Arch Phys Med Rehabil 2000;81:695-700.
7. Salter K, Jutai J, Hartley M, Foley N, Bhogal S, Bayona N, Teasell R. Impact of early vs delayed admission to rehabilitation on functional outcomes in persons with stroke. J Rehabil Med 2006;38(2):113-7.

Introduction

- Geriatric rehabilitation in Singapore is provided mainly by community hospitals (CHs).
- There are 4 CHs in Singapore:
 - Ang Mo Kio Thye Hua Kwan Hospital (AMKTHKH).
 - St Luke's Hospital (SLH).
 - St Andrew's Community Hospital (SACH).
 - Bright Vision Hospital (BVH).
- All CHs use the 100-point Shah-Modified Barthel Index to quantify functional impairment, as recommended by our Ministry of Health.¹

1. Ministry of Health (Singapore), Elderly and Continuing Care Division. Healthcare Services for the Elderly. An information booklet for healthcare professionals. 1st Edition. Singapore. Ministry of Health. 2004

Introduction

- Singapore has invested in development of geriatric rehabilitation in community hospitals in the past decade.
- However, is there evidence that rehabilitation efficiency (REy) and rehabilitation effectiveness (REs) has changed?

Introduction

Rehabilitation Efficiency (REy)¹

- The degree of functional improvement (e.g. using the 100-point Shah-Modified Barthel Index²) divided by the duration of rehabilitation .
- It is the improvement in BI score, divided by the days between time point T_x and a later time point T_y :

$$\text{REy} = \frac{\text{BI}_y - \text{BI}_x}{[\text{Days bet } T_x \text{ and } T_y]}$$

- REy is multiplied by 30 days to obtain the improvement in BI score in a month.

1. Shah S, Vanclay F, Cooper B. Efficiency, effectiveness, and duration of stroke rehabilitation. Stroke 1990;21:241-6.

2. Shah S, Vanclay F, Cooper B. Improving the sensitivity of the Barthel Index for stroke rehabilitation. J Clin Epidemiol. 1989;42(8):703-709.

Introduction

Rehabilitation Effectiveness (REs)¹

- The degree of functional improvement divided by potential functional improvement.
- It is the improvement in BI score, divided by the maximum possible functional recovery (between time point T_x & a later time point T_y) where the maximum score for the Shah-Modified Barthel Index² is 100:

$$REs = \frac{BI_y - BI_x}{(100 - BI_x)} \times 100\%$$

- The value is multiplied by 100% to obtain a percentage.

1. Shah S, Vanclay F, Cooper B. Efficiency, effectiveness, and duration of stroke rehabilitation. Stroke 1990;21:241-6.

2. Shah S, Vanclay F, Cooper B. Improving the sensitivity of the Barthel Index for stroke rehabilitation. J Clin Epidemiol. 1989;42(8):703-709.

Introduction

Rehabilitation Efficiency (REy)

Independent factors for poorer REy*:

- Dementia
- Peripheral vascular disease
- Lower Admission Barthel Index (BI) score
- Increasing age
- Amputations as primary diagnosis for admission

* As determined by an earlier study which will be presented later today during Breakout Session B3, Ballroom 3, 4.30 – 4.50 pm.

Introduction

Rehabilitation Effectiveness (REs)

Independent factors for poorer REs*:

- Dementia**
- Hemiplegia
- Lower admission Barthel Index (BI) Score**
- Peripheral vascular disease**
- Increasing age**
- Ischaemic heart disease
- Greater number of potential caregivers available.
- Stroke and amputations** as primary diagnoses for admission

* As determined by an earlier study which will be presented later today during Breakout Session B3, Ballroom Three, 4.30 – 4.50 pm.

** Independent predictors of REy are a subset of independent predictors of REs.

Aim

To study the trend in annual mean REy and REs of a community hospital from 1998 to 2005



Methods

- Study design:
 - Longitudinal study based on manual data extraction from medical records.
- Study population:
 - All first admissions for rehabilitation and whose length of hospital stay was ≥ 14 days from 1998 to 2005.

* Data from only one CH is presented here. This study is part of an ongoing study involving all 4 community hospitals in Singapore.

Statistical analysis

- Crude and adjusted mean REy and REs were calculated for each year from 1998 to 2005.
- All REy and REs values were adjusted (i.e. standardized) for their respective independent factors as identified by earlier study.*
- All reported p-values are two-tailed and $p < 0.05$ taken as level of statistical significance.

*To be presented later today during Breakout Session B3, Ballroom Three, 4.30 – 4.50 pm).

Results



Study Population

- Out of 3,395 eligible subjects, only 2,322 subjects had both admission and discharge BI scores recorded (68.4%).
- Mean age \pm SD = 74.1 \pm 11.1 yrs
- Gender: Male : Female = 42.7% : 57.3%
- Ethnicity:
 - Chinese 88.2%
 - Malay 7.1%
 - Indian 3.8%
 - Others 0.9%



Socio-Demographics

Table 6: Demographic profile of the valid study population (N=2,322)

Demographic Variable	n (%)*
Age (years)	
≤ 60	242 (10.4)
> 60 to 70	502 (21.6)
> 70 to 80	851 (36.6)
>80	727 (31.3)
Mean ± SD	74.1 ± 11.1
Median (Inter-quartile range)	75.0 (67.4 – 82.0)
Gender	
Male	991 (42.7)
Female	1329 (57.3)
Ethnicity	
Chinese	2048 (88.2)
Malay	165 (7.1)
Indian	89 (3.8)
Others	20 (0.9)
Marital Status	
Single, widowed or divorced	1339 (57.8)
Married	979 (42.2)
Religion	
No	341 (14.7)
Yes	1981 (85.3)
Government Subsidy Level	
Low or no subsidy	307 (13.2)
High subsidy	2015 (86.8)
Primary diagnosis for admission	
Stroke (infarct or haemorrhage)	1067 (46.0)
Fracture	575 (24.8)
Amputations	50 (2.2)
Others	630 (27.1)
No. of carers available	
None	235 (10.1)
One	456 (19.6)
Two	784 (33.8)
Three or more	847 (36.5)
Charlson Co-Morbidity Index	
Mean ± SD	3.7 ± 2.5
Median (Inter-quartile range)	3 (2 – 6)
Admission BI score (units)	
0 – 25	341 (14.7)
26 – 50	542 (23.3)
51 – 75	885 (38.1)
76 - 100	554 (23.9)
Mean ± SD	55.3 ± 24.1
Median (Inter-quartile range)	59 (39 - 75)

Clinical Profile

Table 7: Specific co-morbidities in valid study population (N=2,322)

Co-Morbidity	n (%)
AIDS	9 (0.4)
Cerebrovascular disease	1338 (57.6)
Chronic pulmonary disease	132 (5.7)
Congestive heart failure	122 (5.3)
Connective tissue disease	39 (1.7)
Dementia	456 (19.6)
Hemiplegia	1341 (57.8)
Leukaemia	26 (1.1)
Lymphoma	32 (1.4)
Myocardial infarct	103 (4.4)
Peripheral vascular disease	184 (7.9)
Ulcer disease	419 (18.0)
Diabetes	
Without end organ damage	132 (5.7)
With end organ damage	742 (32.0)
Liver disease	
Mild	21 (0.9)
Moderate or severe	10 (0.4)
Renal Disease	
Mild	2272 (97.8)
Moderate or severe	50 (2.2)
Malignant tumour	
Non-metastatic	117 (5.0)
Metastatic	32 (1.4)
Hypertension*	1651 (71.1)
Hyperlipidaemia*	864 (37.2)
Ischaemic heart disease (with or without myocardial infarct)*	634 (27.3)

* Co-morbidities not considered in calculation of Charlson Co-Morbidity Index.

Valid Admission & Discharge BI Score Per Year (1)

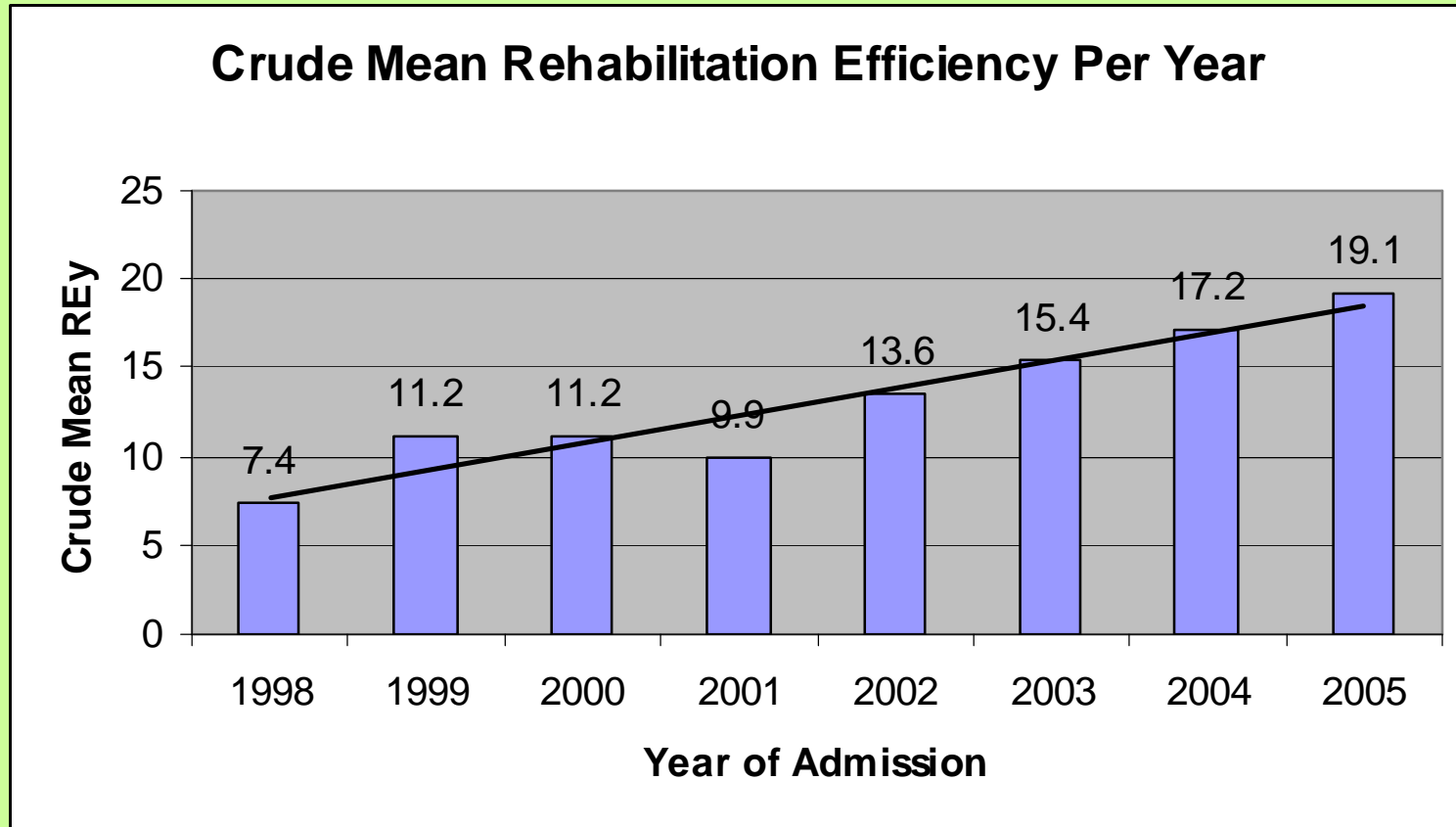
Year	Valid Admission & Discharge BI n (%)
1998	135 (47.4)
1999	188 (54.3)
2000	254 (63.2)
2001	276 (70.8)
2002	151 (83.9)
2003	479 (88.5)
2004	438 (81.4)
2005	342 (79.0)
Total	2322 (68.4)

Valid Admission & Discharge BI Score Per Year (2)

The demographic variables which were significantly different between these two groups were (1) government subsidy levels, (2) renal disease, (3) hypertension and (4) hyperlipidaemia, but none were predictors of REs or REy.

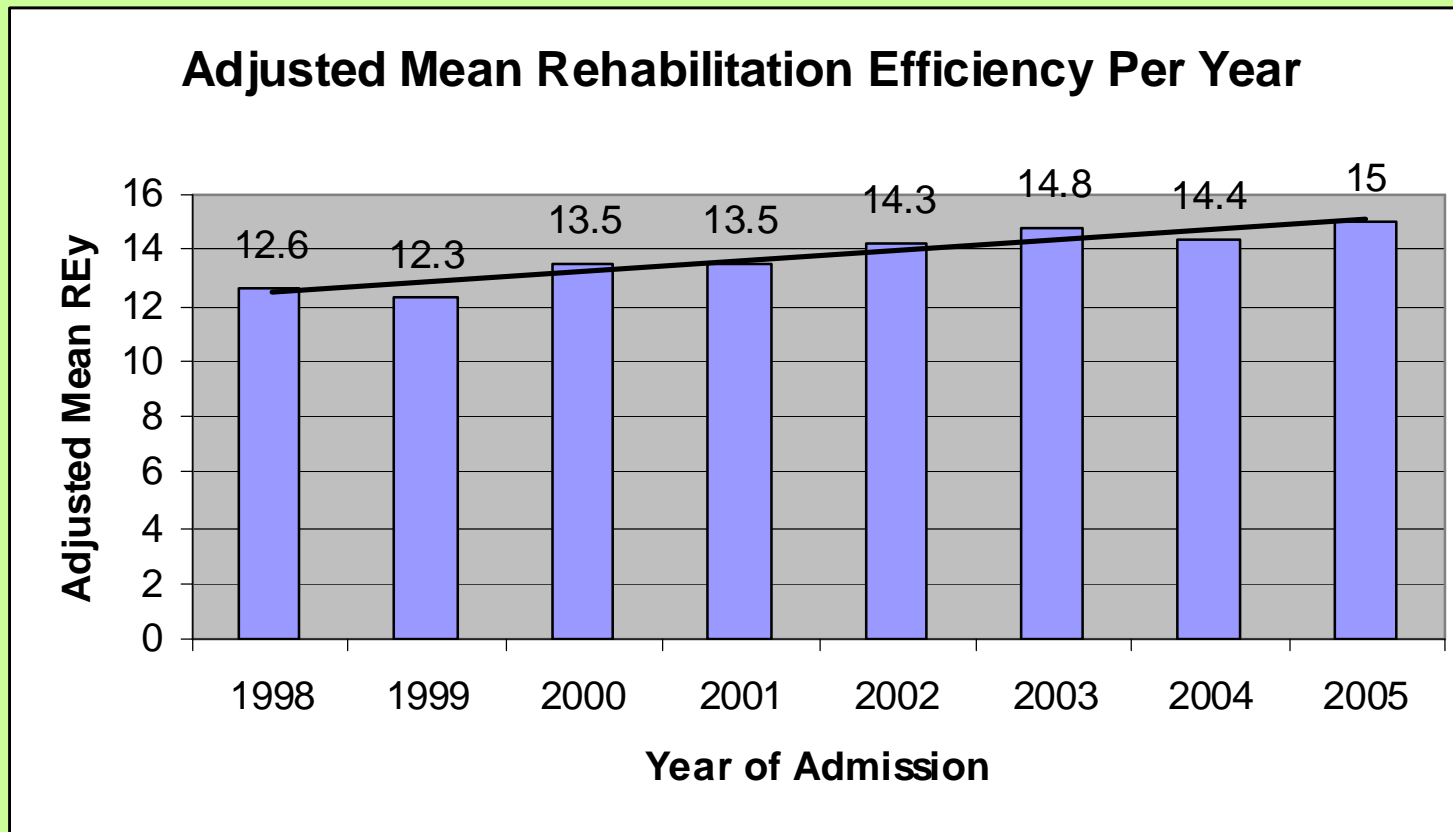
Trends in Rehabilitation Efficiency (REy)

Crude Mean REy per Year



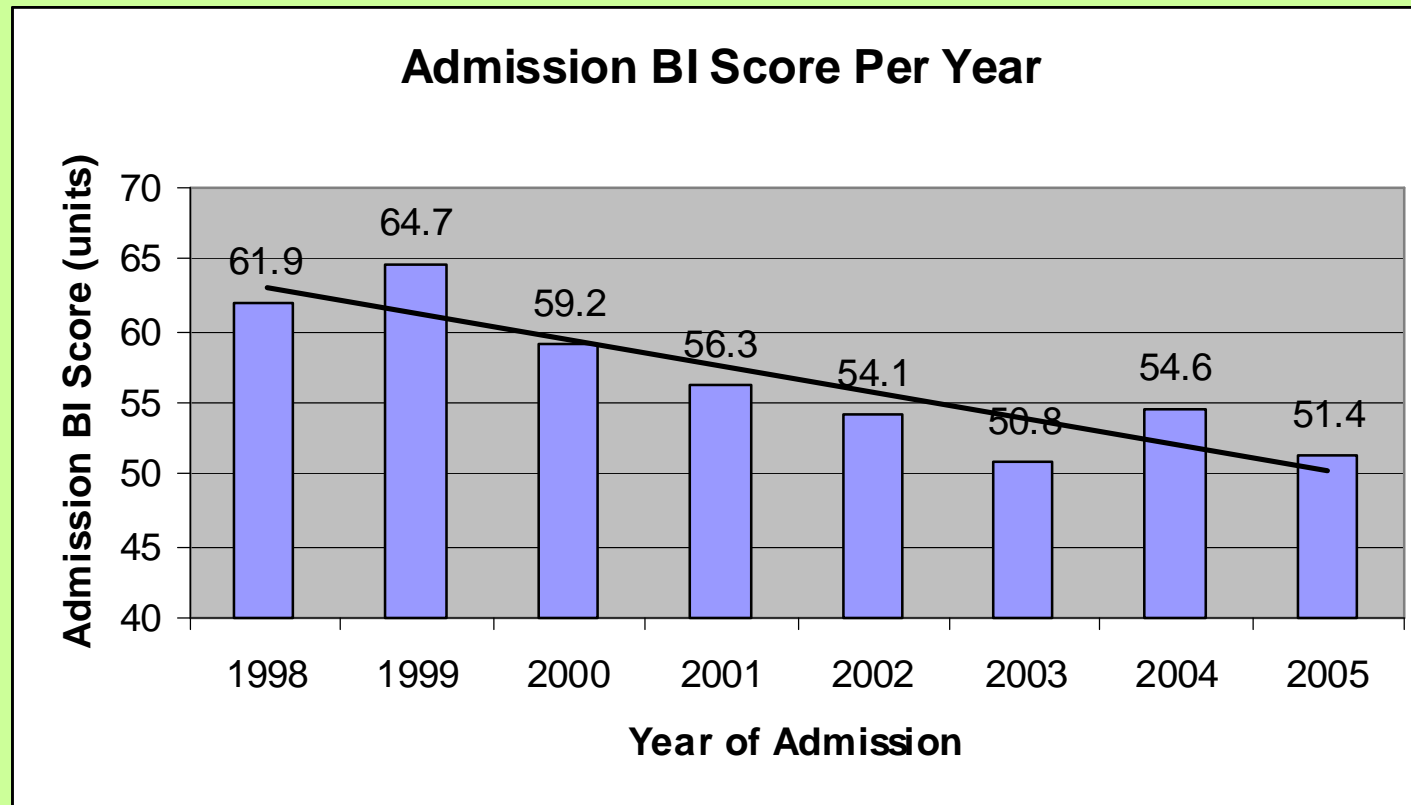
Bivariate linear regression: β -coefficient=1.54 [1.04, 2.04], $p < 0.001$

Adjusted Mean REy per Year



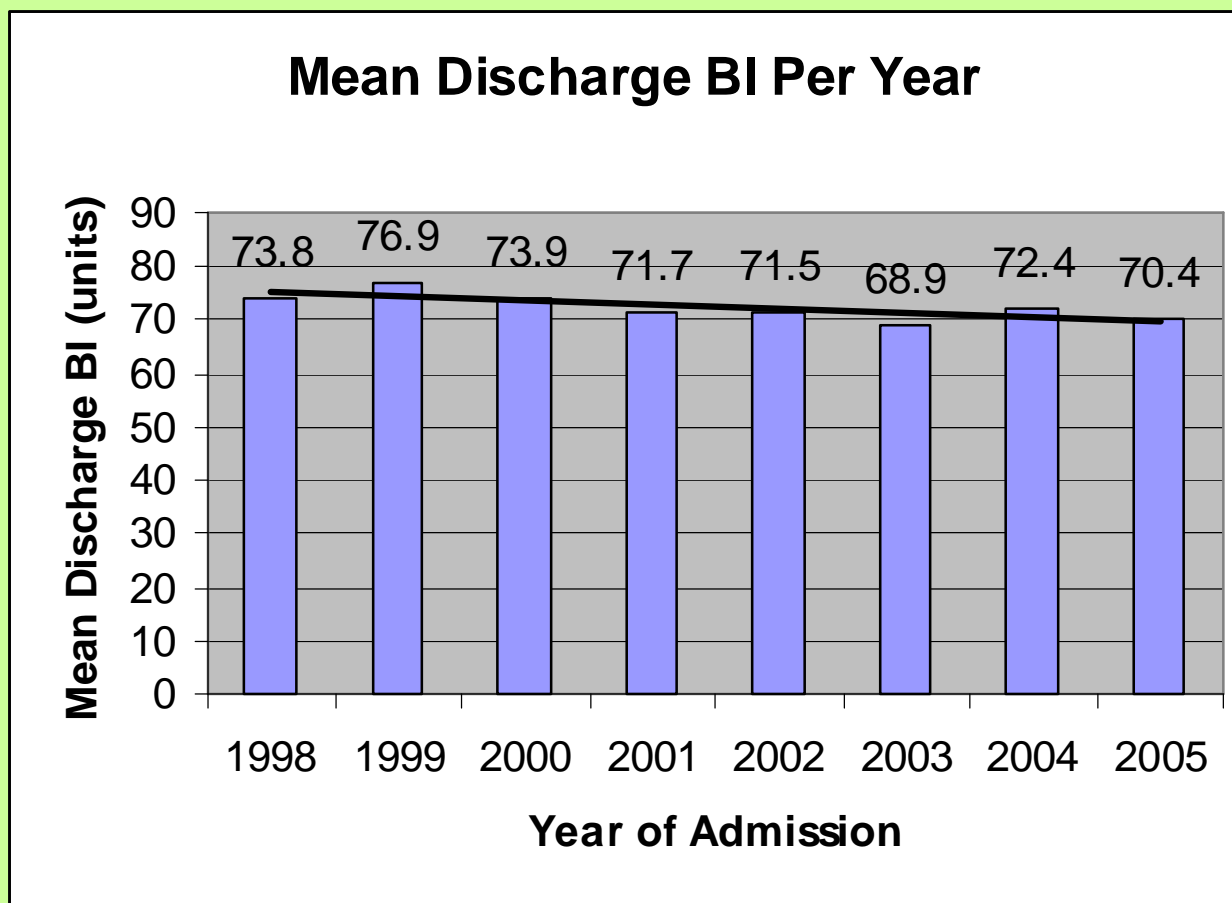
Bivariate linear regression: β -coefficient=0.34 [0.26, 0.42], $p < 0.001$

Mean Admission BI Scores (1998 – 2005)



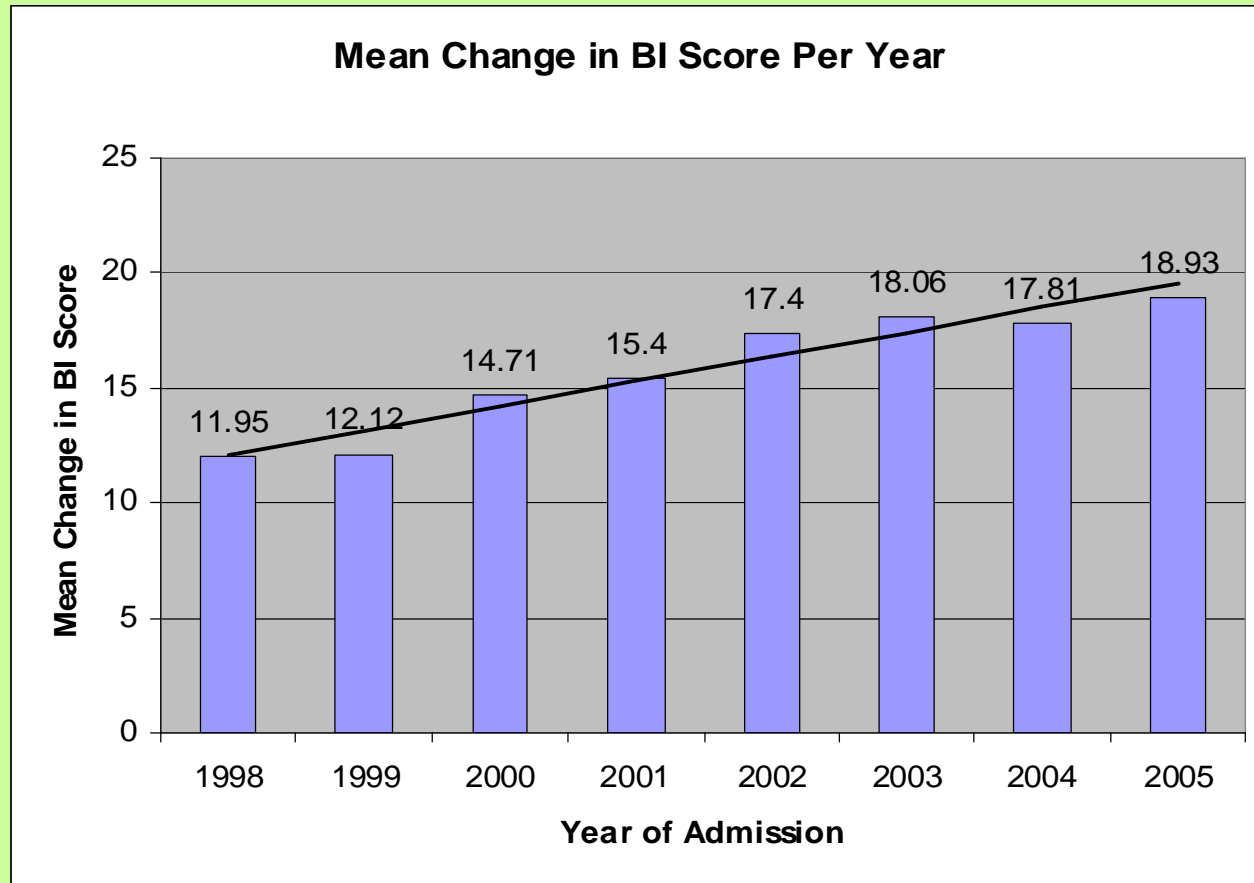
Annual mean admission BI score decreased during this period (β -coefficient=-1.52 [-1.94, -1.09], $p<0.001$)

Mean Discharge BI (1998 – 2005)



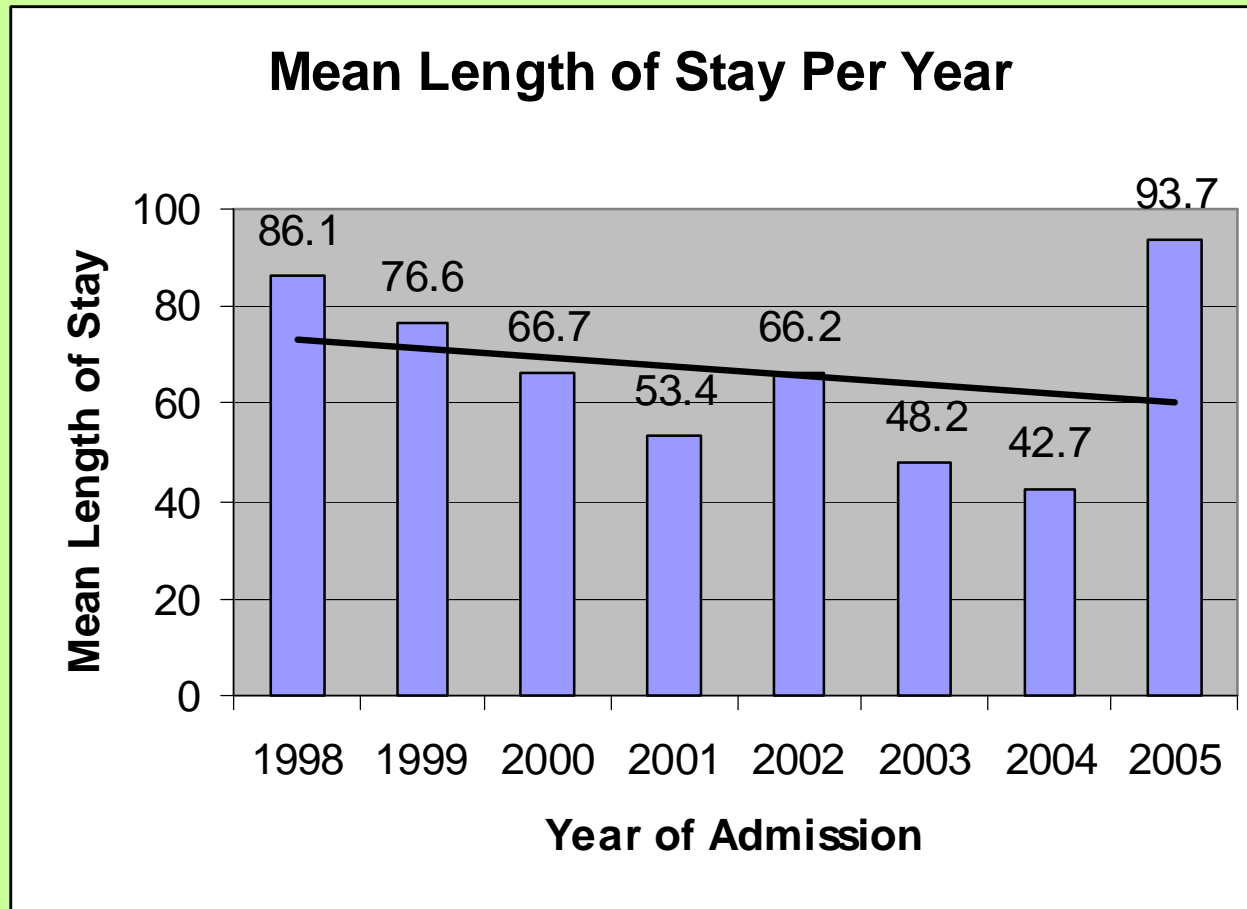
Annual mean discharge BI scores decreased during this period (β -coefficient = -0.586 [95%CI: -1.035 to -0.136], $p=0.011$).

Mean Change in Score BI (1998 – 2005)



Annual mean change in BI score increased during this period (β -coefficient = 0.730 [95%CI: 0.492 to 0.969], $p < 0.001$).

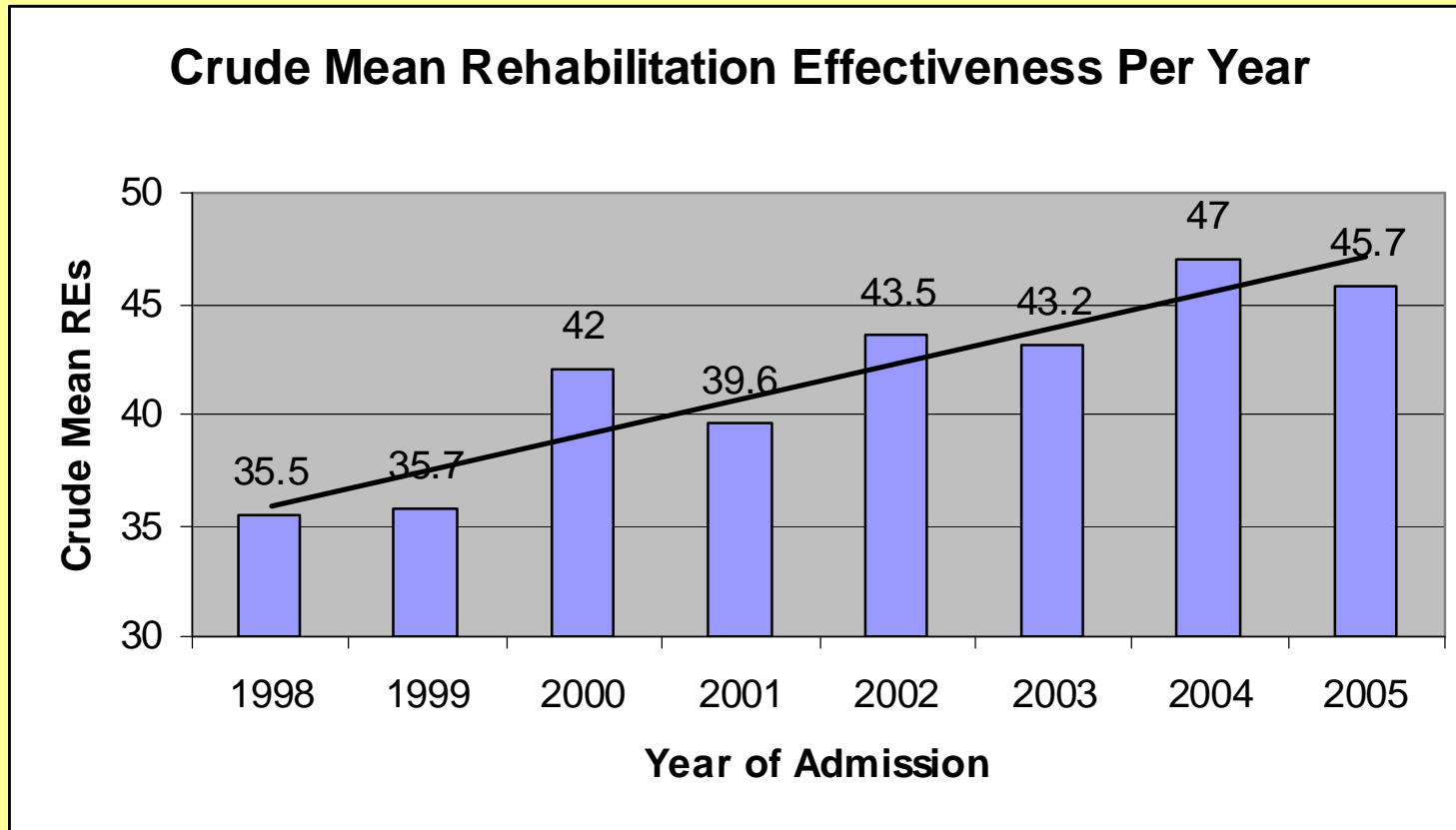
Mean Length of Hospital Stay (1998-2005)



If 2005 is omitted, then the annual decline in mean length of hospital stay from 1998 to 2004 was statistically significant (β coefficient = -4.84 [95%CI: -7.77 to -1.92], $p=0.001$)

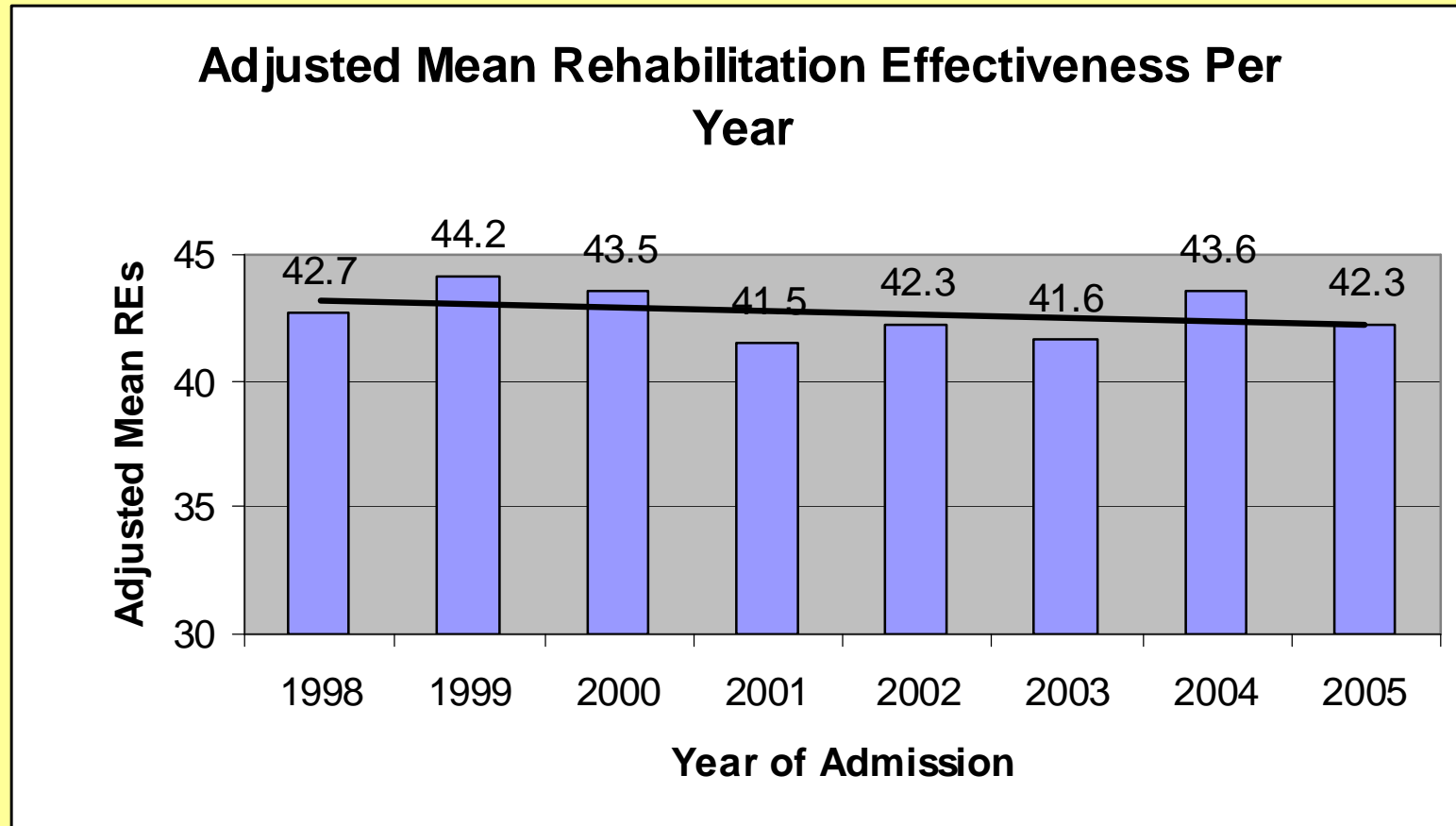
Trends in Rehabilitation Effectiveness (REs)

Crude Mean REs per Year



Bivariate linear regression: β -coefficient=1.42 [0.77, 2.07], $p < 0.001$

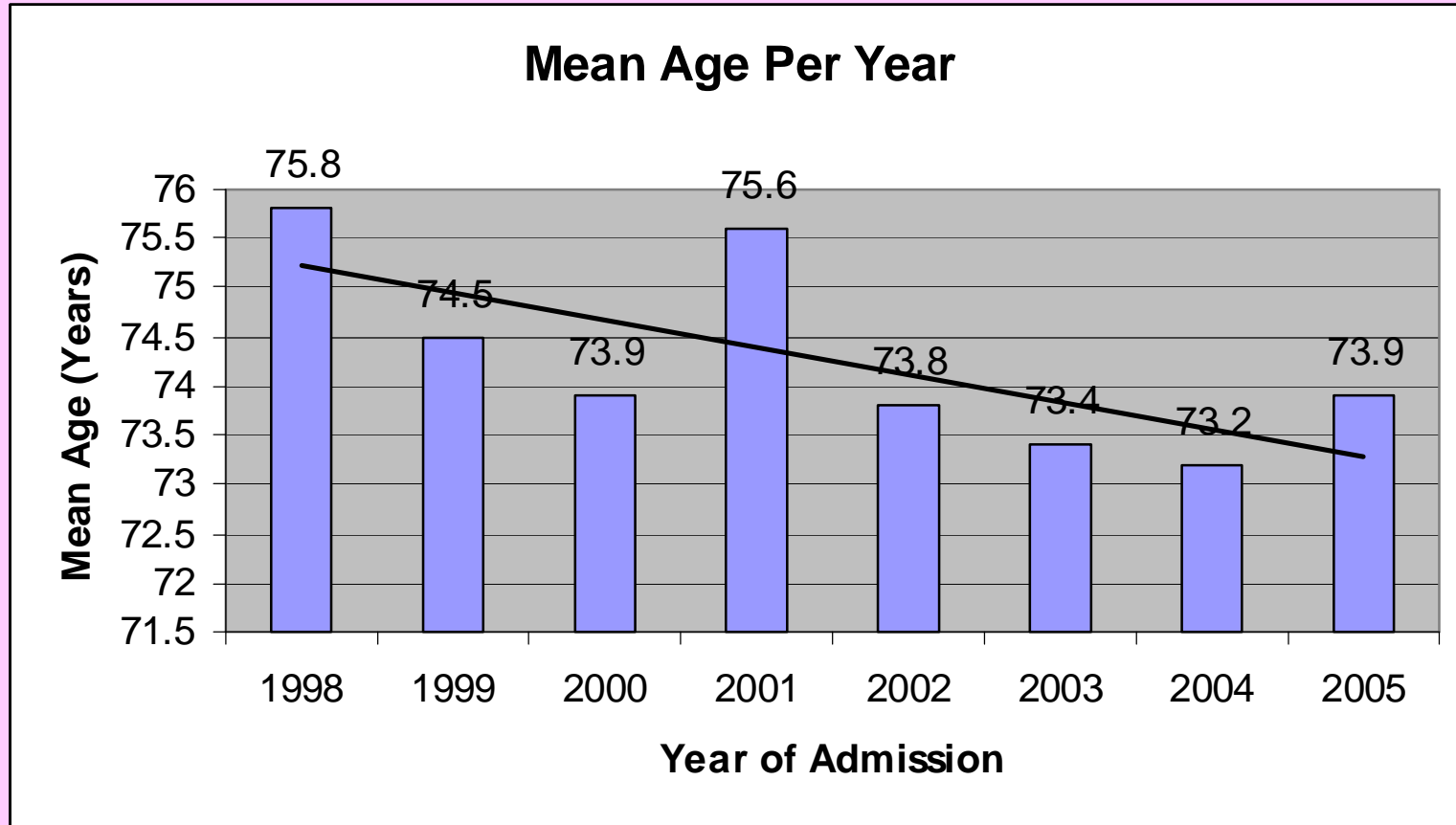
Adjusted Mean REs per Year



Bivariate linear regression: β -coefficient = -0.08 [-0.33, 0.16], $p=0.499$

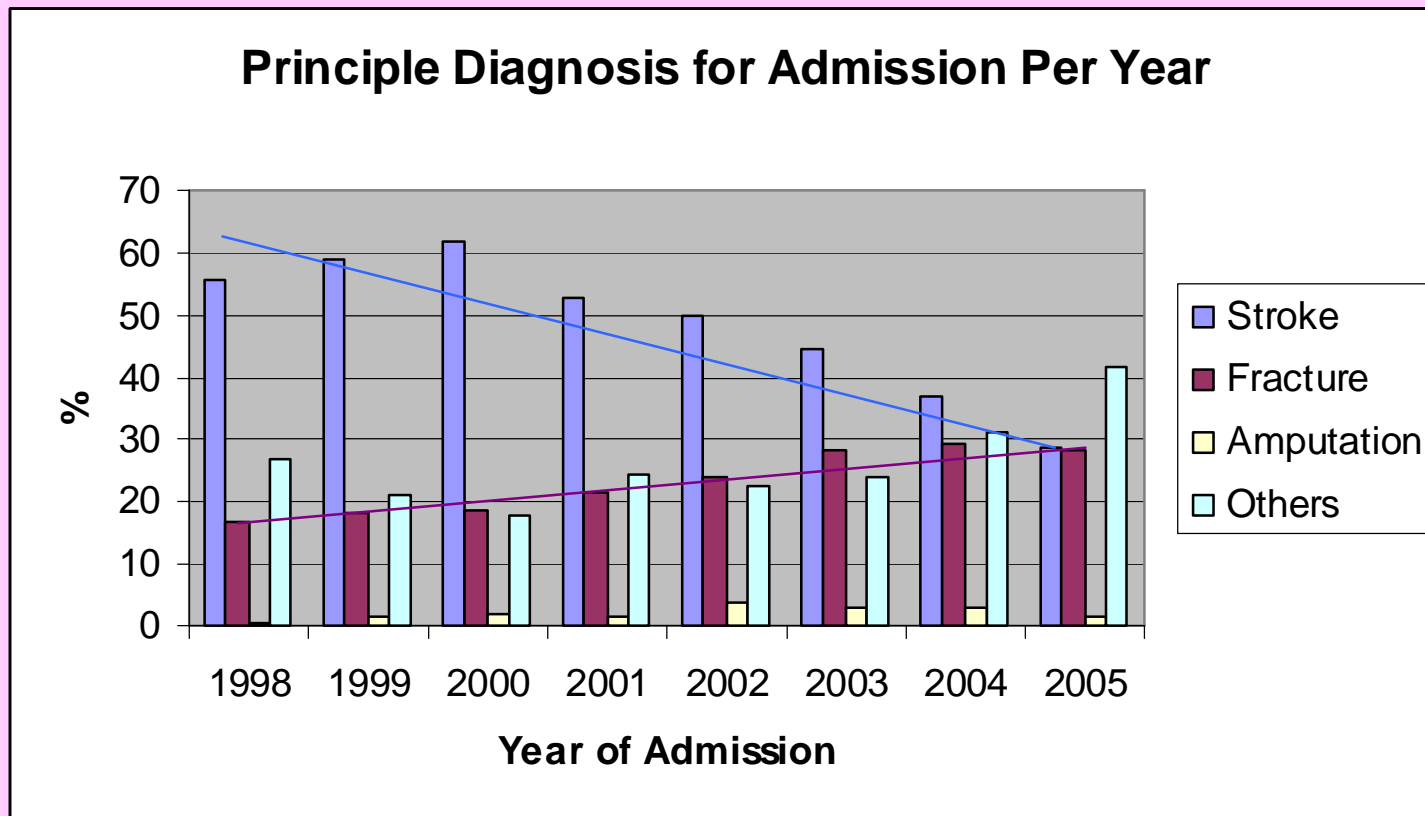
Trends in Independent Predictors of REy and REs

Mean Age (1998 – 2005)



The decreasing mean age would increase REs (ANOVA: β -coefficient = -0.29 [-0.49, -0.09], $p=0.005$)

Primary Diagnosis for Admission (1998 – 2005)



The decreasing proportion of strokes and increasing proportion of fractures would increase REs. (Chi-square: $p < 0.001$)

Independent predictors of REs with no significant trends

- Dementia
- Ischaemic heart disease
- Number of potential caregivers available



Conclusion



Conclusions

- After adjustment for key socio-demographic and clinical variations from 1998 to 2005, we found an increase in rehabilitation efficiency with no change in rehabilitation effectiveness during this period.
- The difference in trend between crude and adjusted mean REs during this period was because of concomitant declines in (1) mean age and (2) proportion of primary diagnosis as stroke .

Strengths & Limitations

Strengths

- Complete sampling of population.
- Large sample size.
- Wide range of variables studied.

Limitations

- As the study was limited to only one community hospital, the results cannot be fairly extrapolated to other community hospitals or other inpatient rehabilitation settings.

Thank You



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