Predictive Risk Modeling: Theory, Practice and Prospects for Japan

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Targeting Care

prevents costly events before they occur

Targeting Preventive Care

Chronic disease management to..

prevent hospitalisation

Home health care to..

prevent nursing home admission

Healthy eating programs to …

prevent metabolic syndrome

How well do health care systems

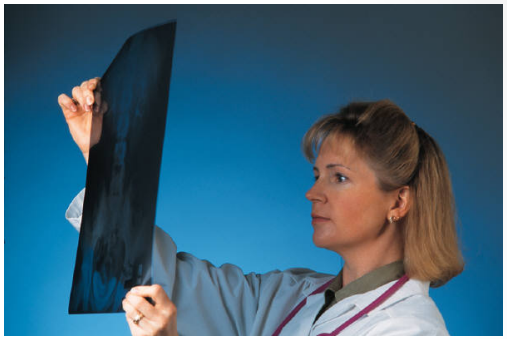
choose people

for preventive services?

Three main methods

1. Clinical judgement
2. Threshold models
3. Predictive Risk Models

Clinical Judgement



- Evidence that physicians are poor at being able to assess re-hospitalisation risk

Source: Allaudeen, N., J. Schnipper, et al., 2011

Clinical Judgement

Hospital clinicians in a US hospital asked to judge:

“ which patients more likely to be readmitted?”

Hospital clinicians in a US hospital asked to judge:

" which patients more likely to be readmitted?"

	Attending Physician	Resident Physician	Intern	Case Manager	Nurse
Area under the ROC curve and 95% c.i	0.58 (0.46–0.69)	0.58 (0.47–0.70)	0.59 (0.47–0.70)	0.50 (0.38–0.63)	0.55 (0.44–0.67)

No better than tossing a coin!

[1] Note that at Area under the ROC curve of 0.5 indicates that the prognostic power is equal to chance.
Source: Allaudeen, N., J. Schnipper, et al., 2011

Clinician Judgement

- Would recruit the wrong patient for preventive services

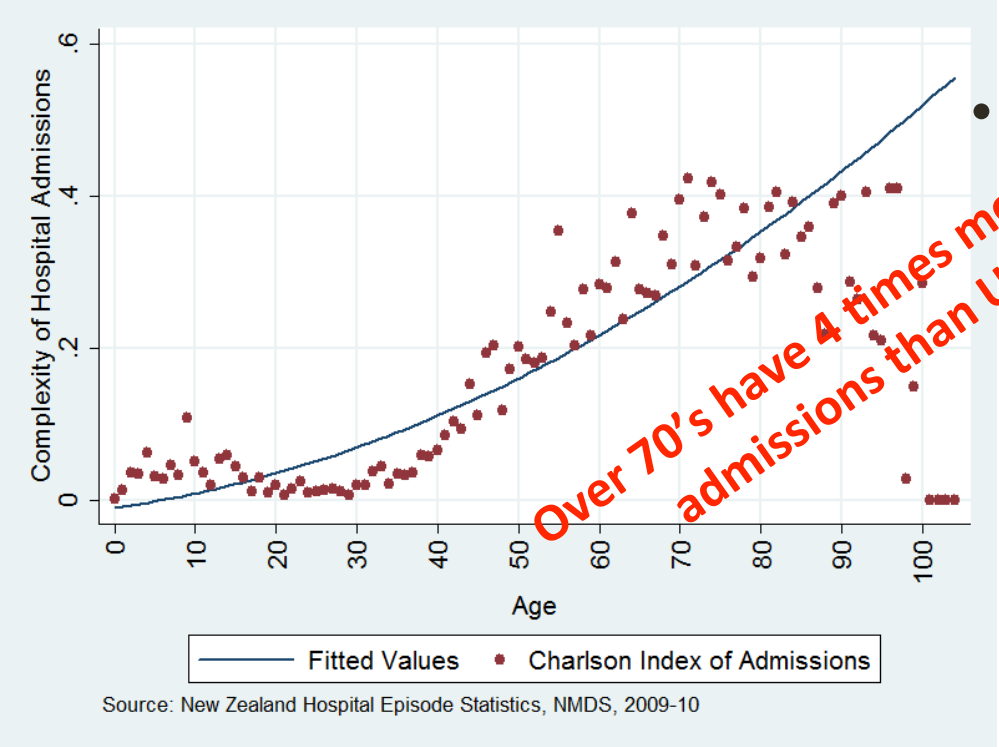
Why are physicians so poor at predicting utilisation risk?

- Single disease orientation

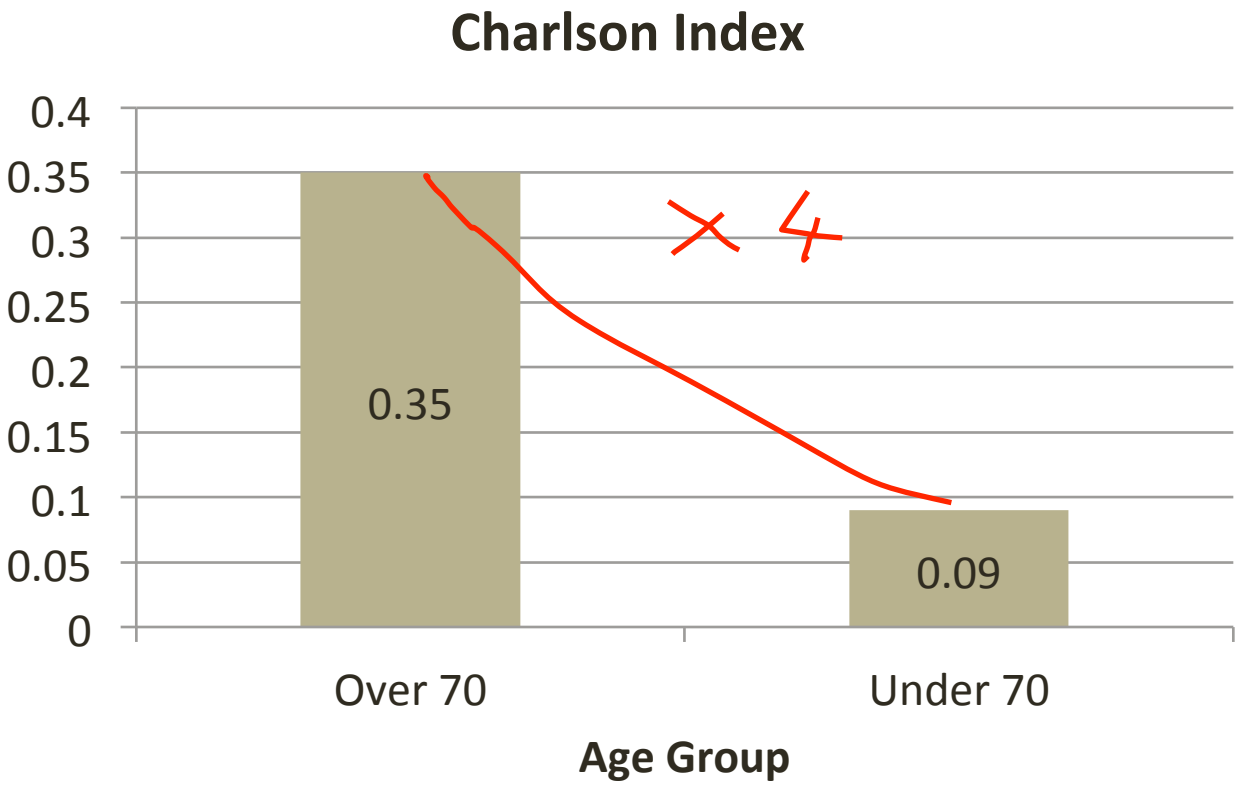
… high cost individuals have multiple diseases

…High cost elderly have multiple complex condition

Age and complexity of Health Needs



- The Charlson Index measures the complexity of conditions


Charlson Index
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.35
0.09
x 4
Over 70
Under 70
Age Group

Three main methods

1. ~~Clinical judgement~~
2. “Threshold models”
3. Predictive Risk Models

Threshold Models

Recruit patients on the basis of a few characteristics

"Aged over 65 years old and has 2 or more admissions in the past 12 months"

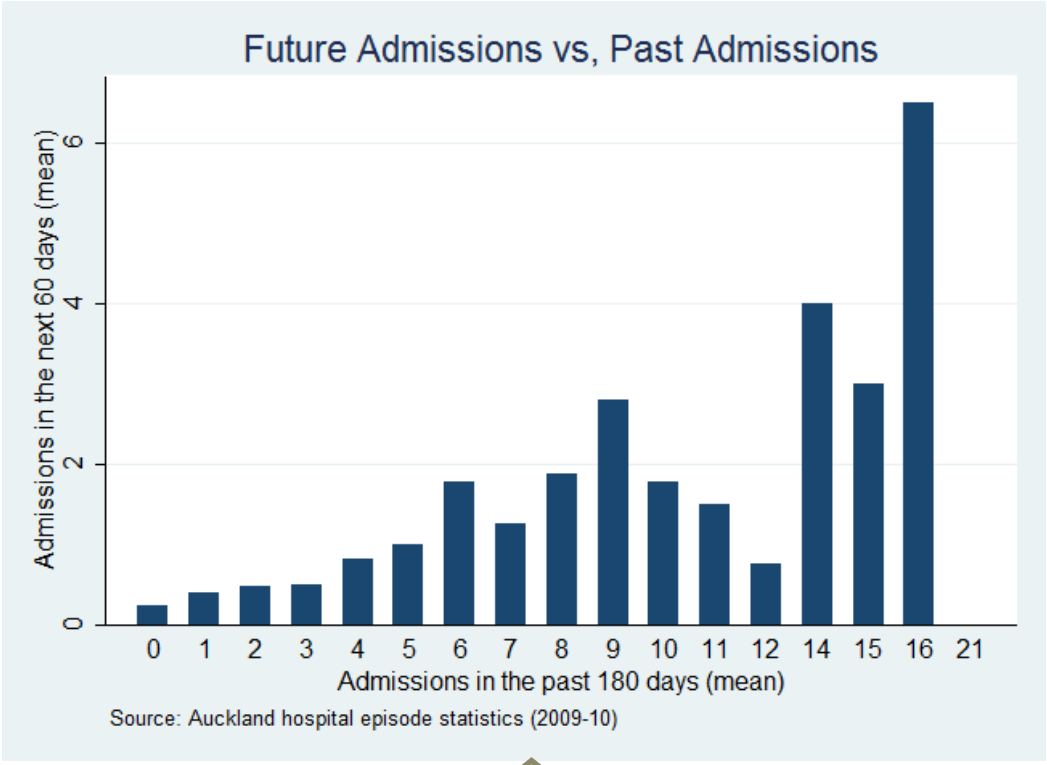
Admissions criteria for a US hospital avoidance program called Evercare

Is Past utilisation

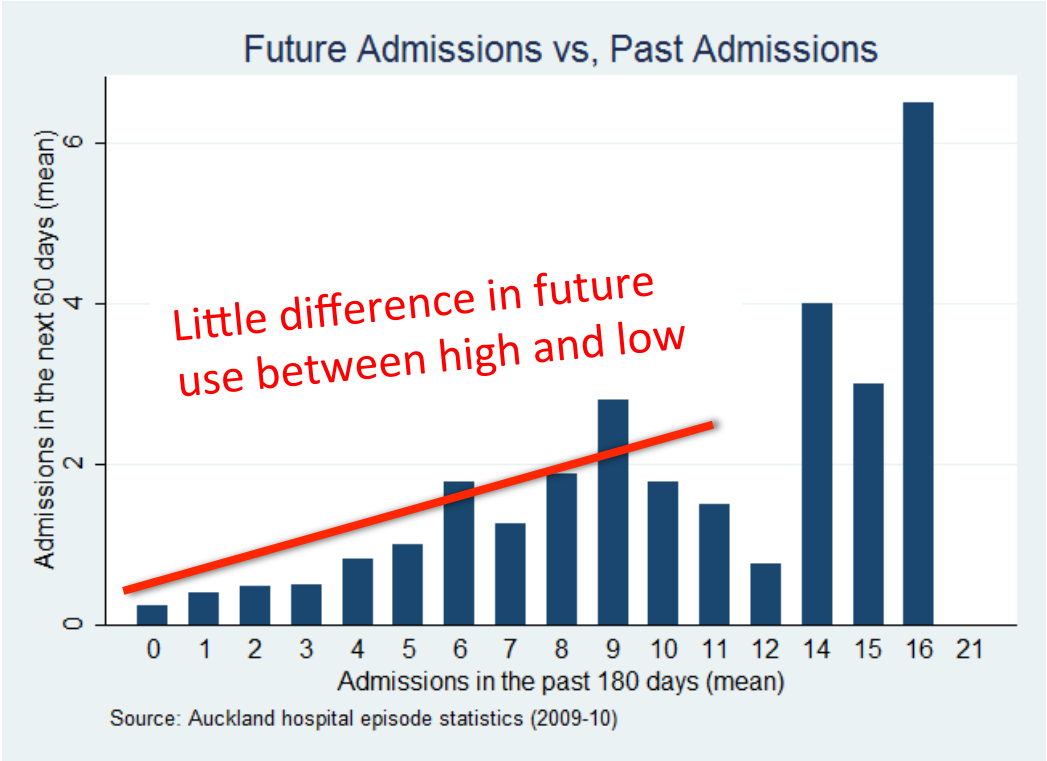
a good measure

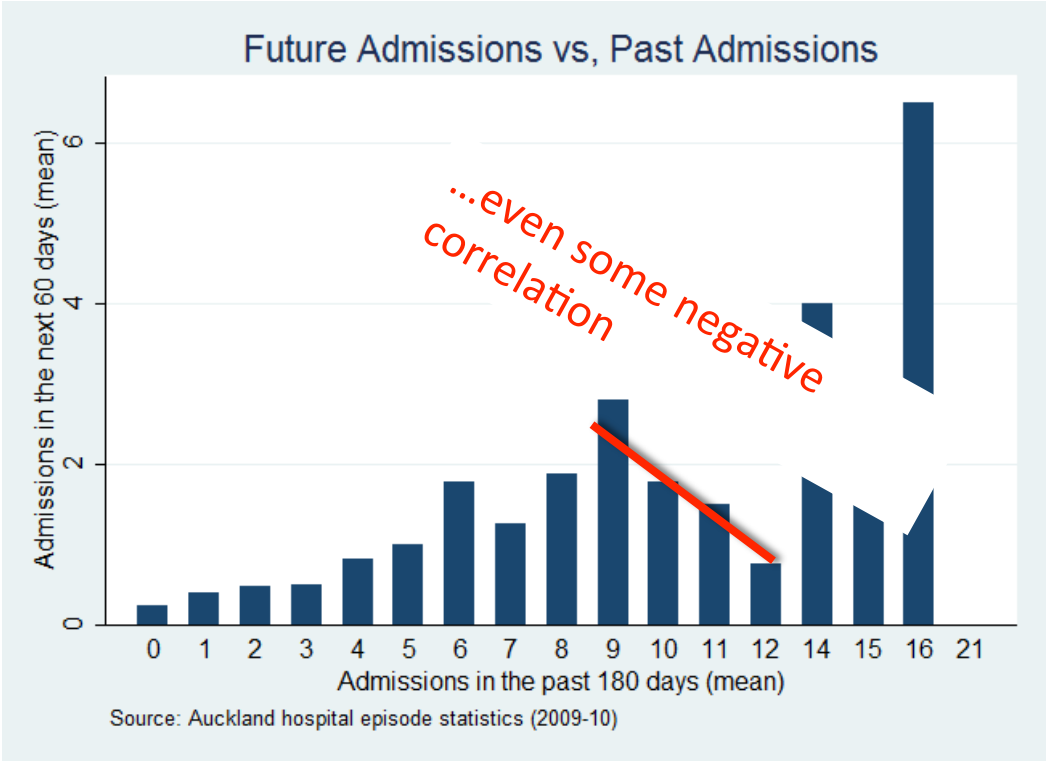
of future utilisation?

future admissions



Past admissions


Future Admissions vs, Past Admissions
Admissions in the next 60 days (mean)
0
2
4
6
Little difference in future use between high and low
0 1 2 3 4 5 6 7 8 9 10 11 12 14 15 16 21
Admissions in the past 180 days (mean)
Source: Auckland hospital episode statistics (2009-10)


Future Admissions vs, Past Admissions
Admissions in the next 60 days (mean)
0
2
4
6
…even some negative correlation
0 1 2 3 4 5 6 7 8 9 10 11 12 14 15 16 21
Admissions in the past 180 days (mean)
Source: Auckland hospital episode statistics (2009-10)

Why?

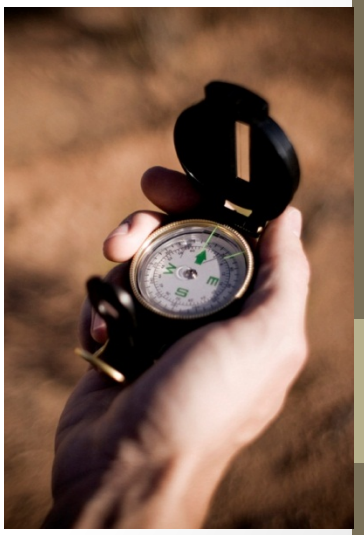
- ✓ Most diseases are self-limiting
- ✓ Intense users are likely to die (or become better)
- ✓ “Regression to the mean”

Three main methods

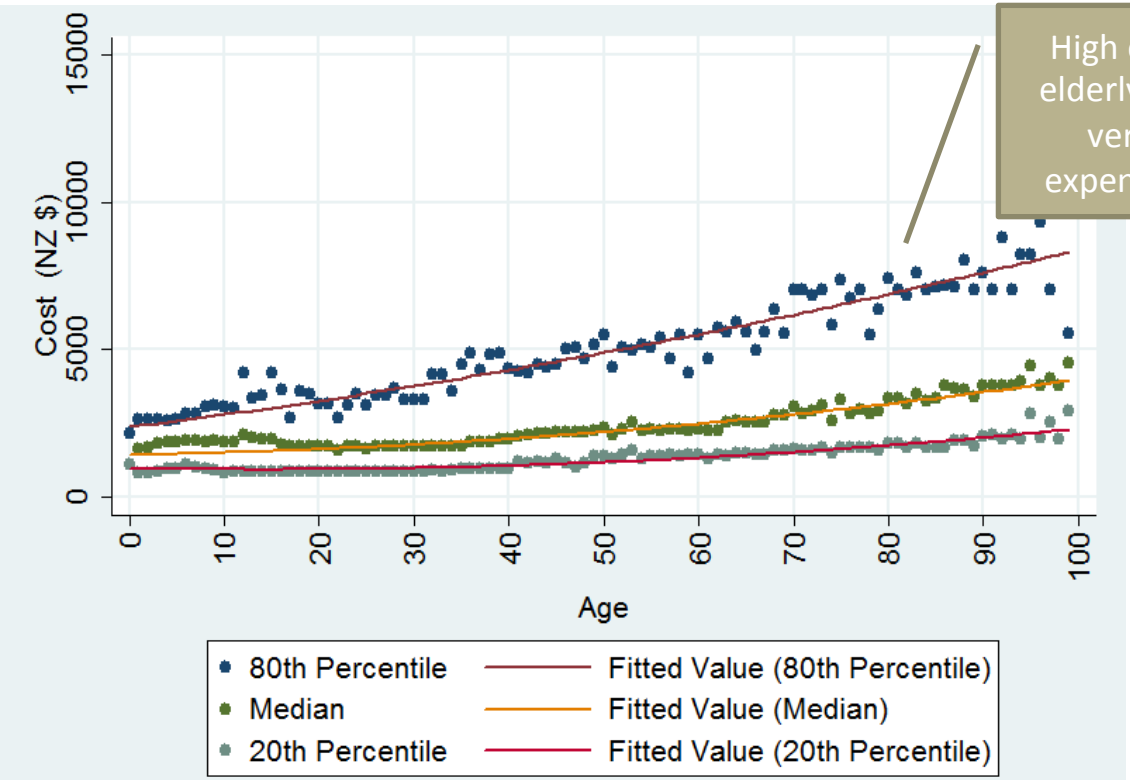
1. ~~Clinical judgement~~
2. ~~“Threshold models”~~
3. Predictive Risk Models

What is Predictive Risk Modeling?

- Using routinely collected episode data
- Algorithm to predict the probability that a person will have an expensive adverse event
- Helps health care systems target preventive care to patients who will be at high risk of becoming expensive

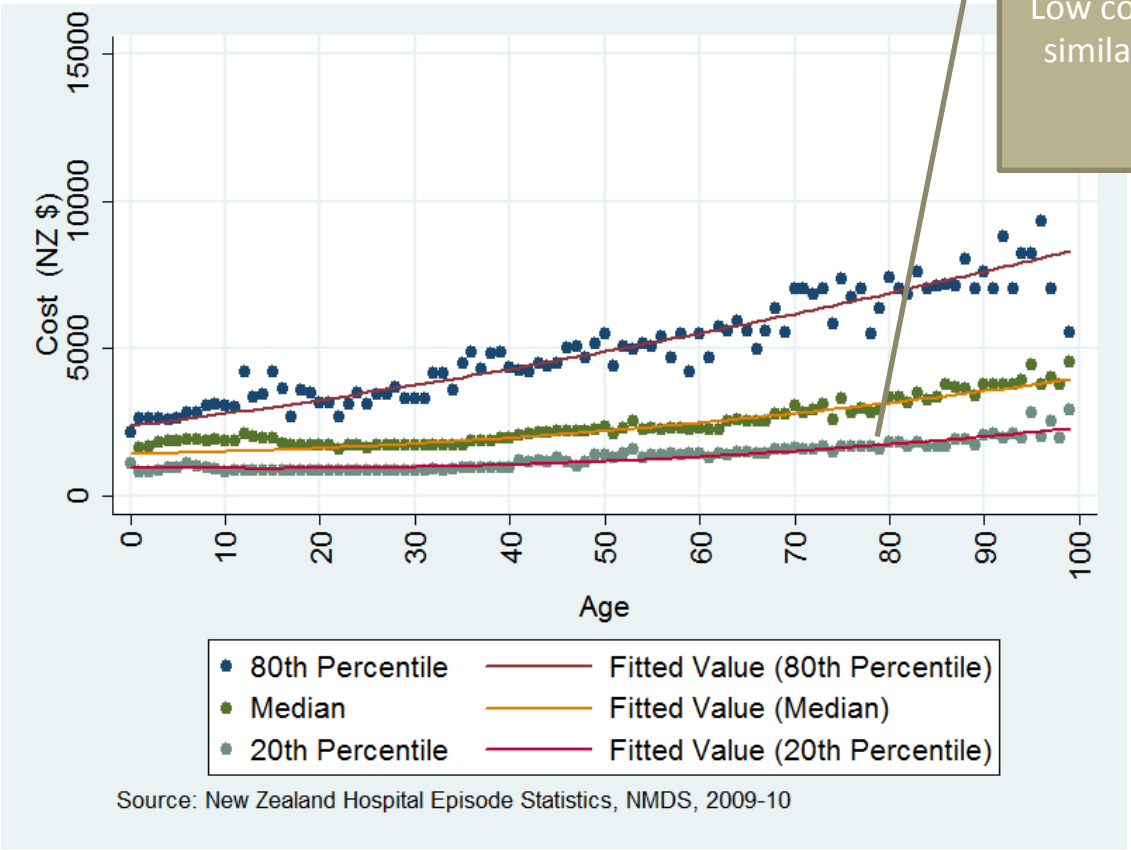


Age and Expenditure on Hospitalisation



Source: New Zealand Hospital Episode Statistics, NMDS, 2009-10

Age and Expenditure on Hospitalisation



Source: New Zealand Hospital Episode Statistics, NMDS, 2009-10

Not all elderly are high cost

→ predict the high cost elderly

→ offer them “preventive programs”

Case Finding

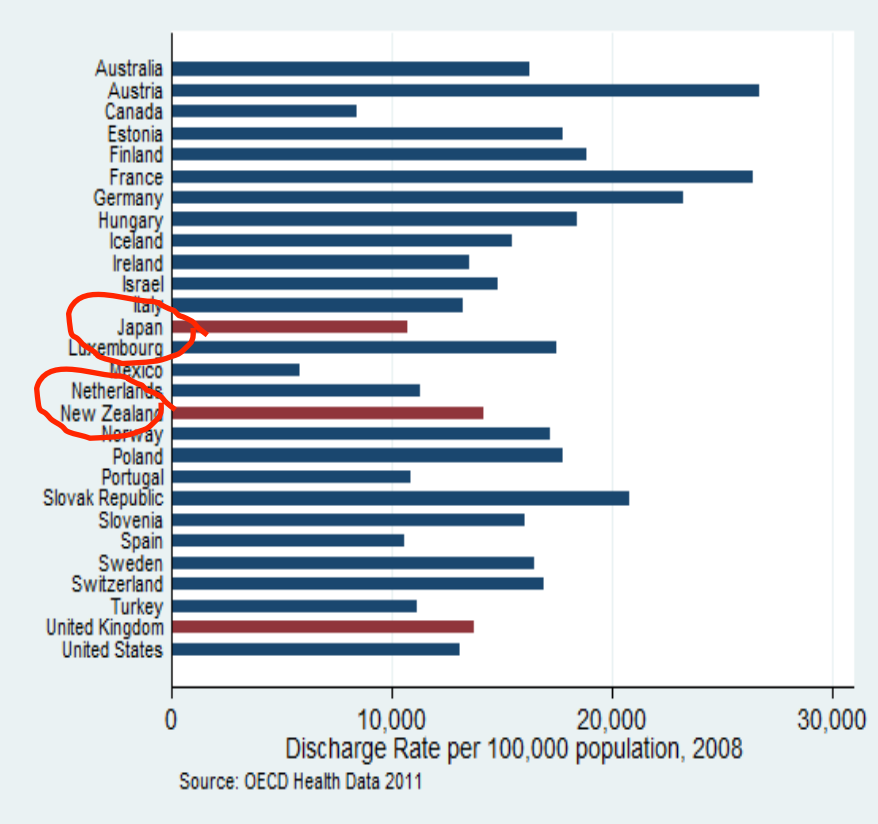
Case Finding...

Identification of patients for programs

NEW ZEALAND'S PREDICTIVE RISK MODEL

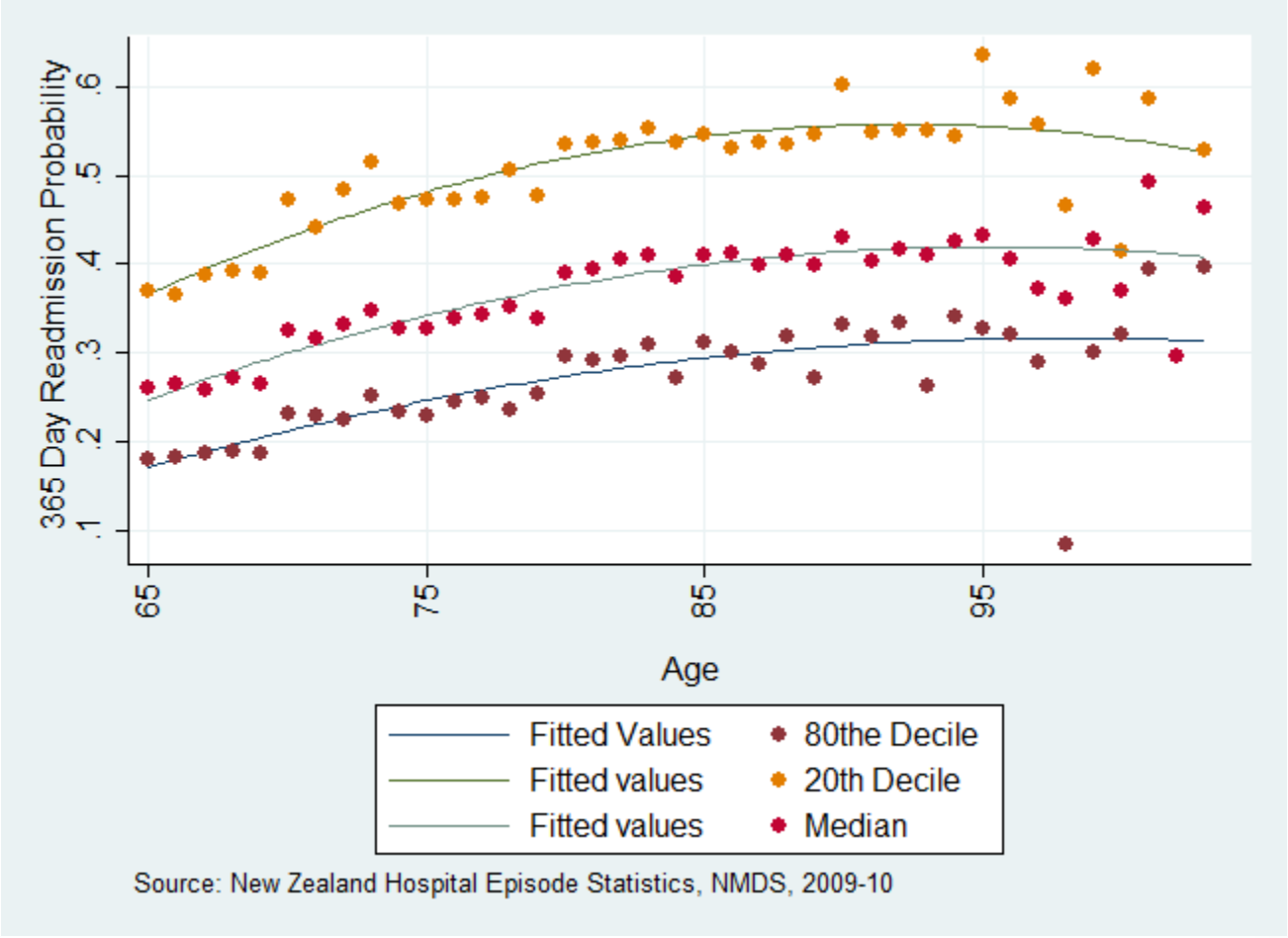
New Zealand

- Has a National Health system
- Hospitals are mainly public
- Taxpayer funded
- Has relatively high discharge rates
- Concerned about re-hospitalisation rates



Auckland PRM model (365 days)

- When patients arrive at hospital they will be risk scored
- The score indicates the risk of re-hospitalisation within 365 days
- Risk score will be sent to the General Practioner (Medical home)
- Case review high risk patients

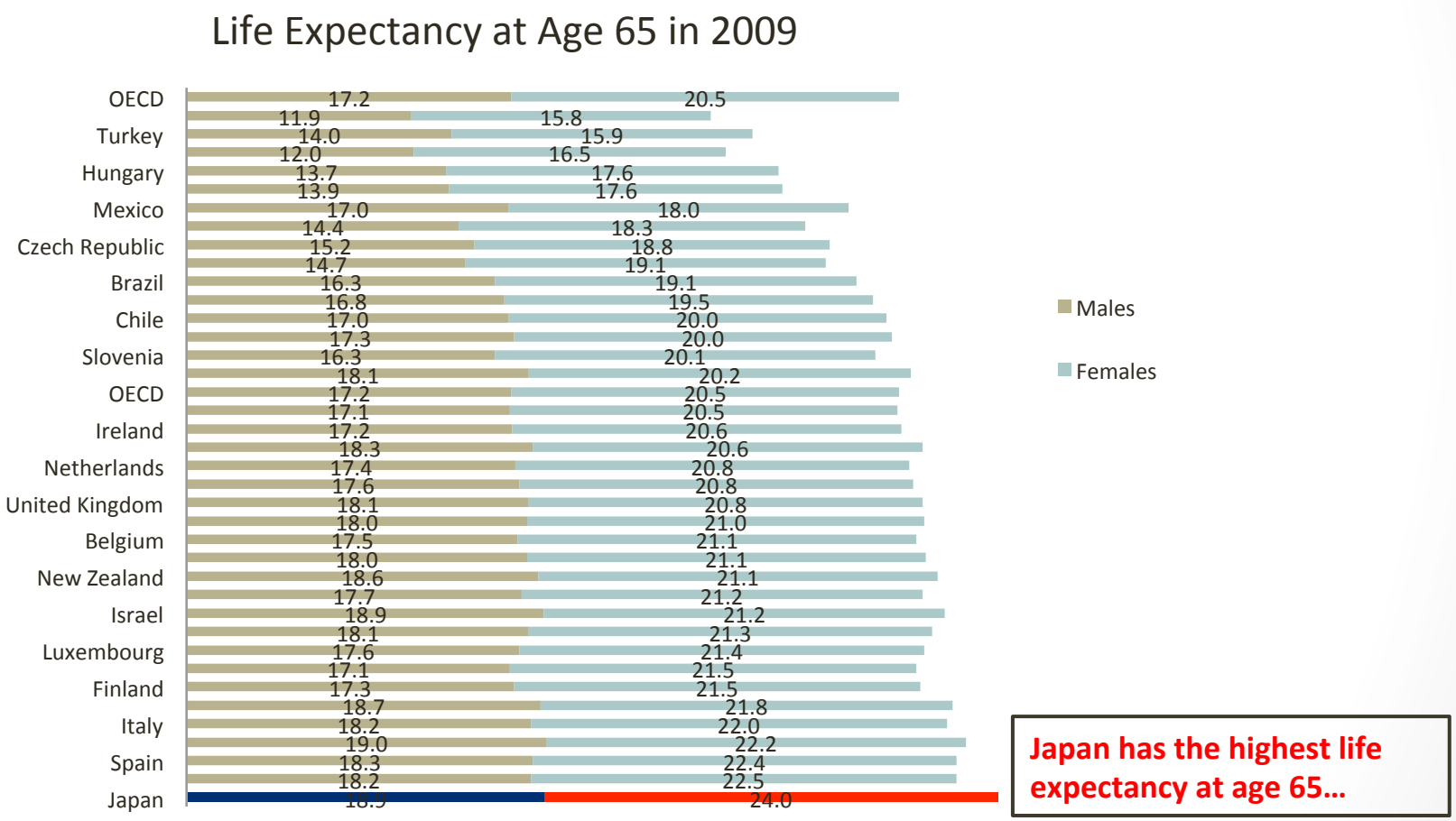

365 Day Readmission Probability
.1
.2
.3
.4
.5
.6
65
75
85
95
Age
Fitted Values
Fitted values
Fitted values
80the Decile
20th Decile
Median
Source: New Zealand Hospital Episode Statistics, NMDS, 2009-10

Advantages

- ✓ Automated
- ✓ Classifies according to future risk
- ✓ Match programs to risk class
- ✓ Can develop a Business Case for avoidance programs

PROSPECTS FOR JAPAN

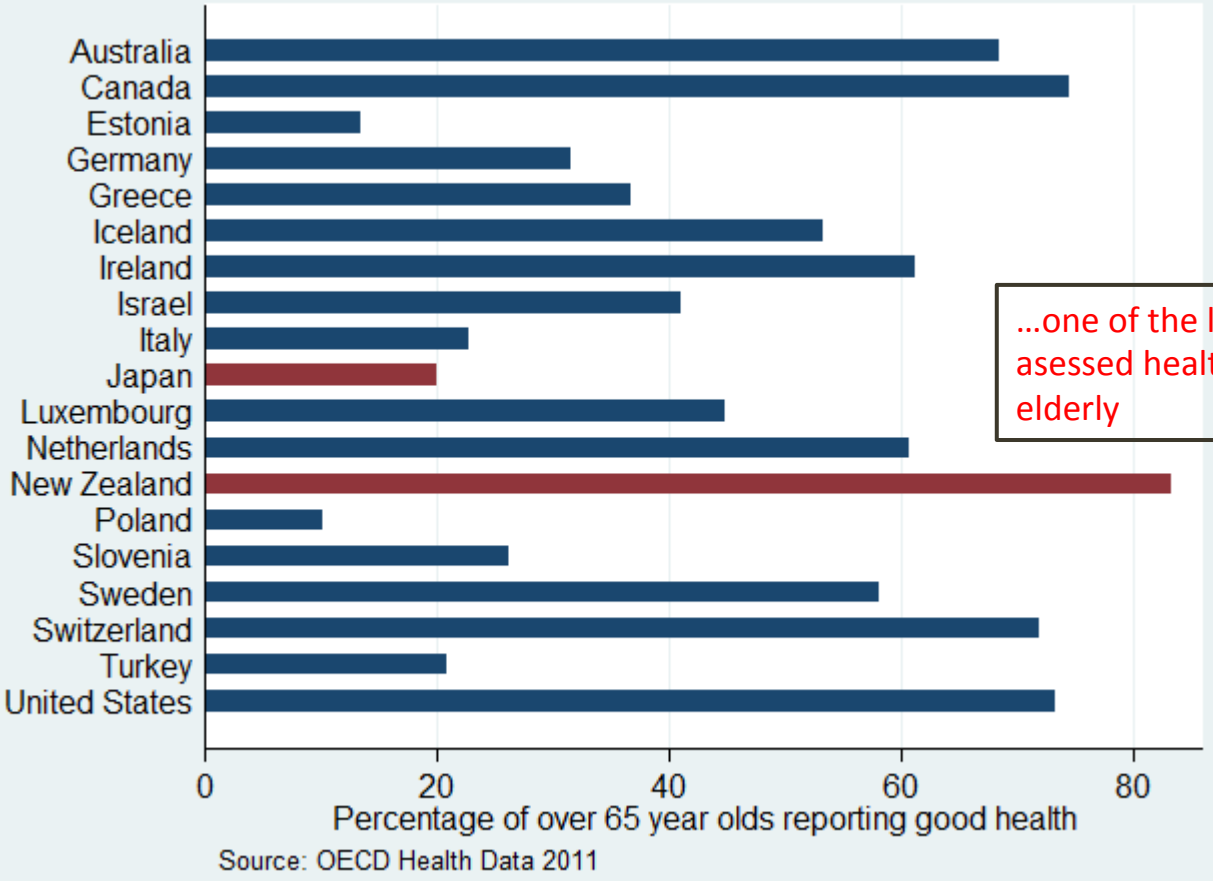
Japan's elderly have long life expectancy….



Japan has the highest life expectancy at age 65…

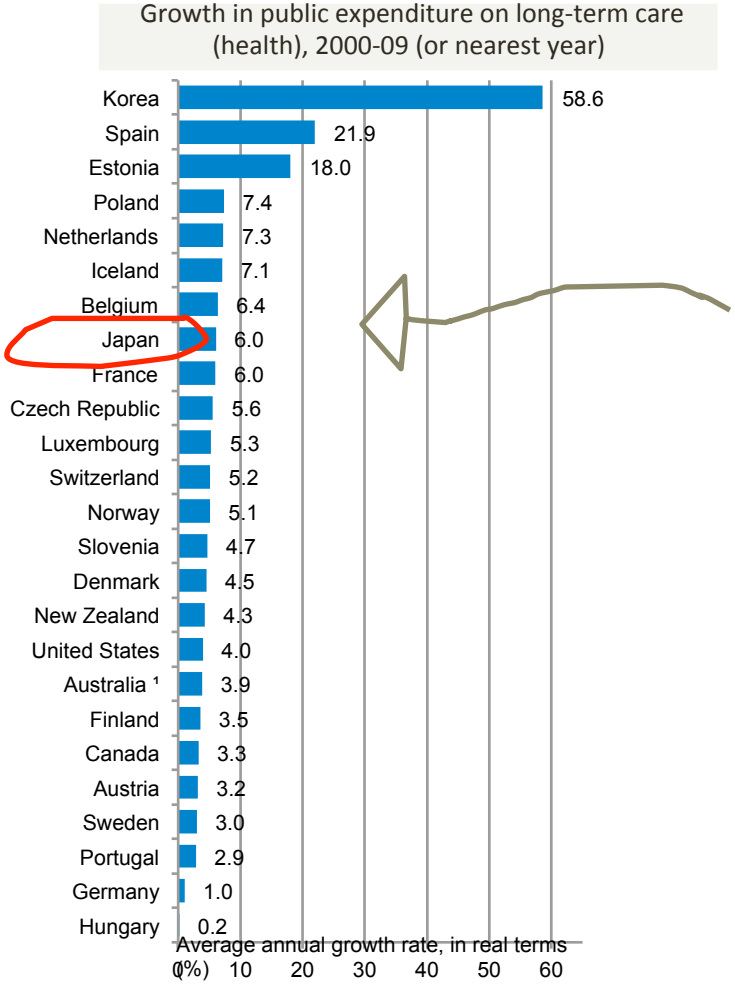
Source: OECD, 2011, "Health at a Glance"

but poor health…



…one of the lowest self-asessed health amongst the elderly

And a potential LTC crisis…

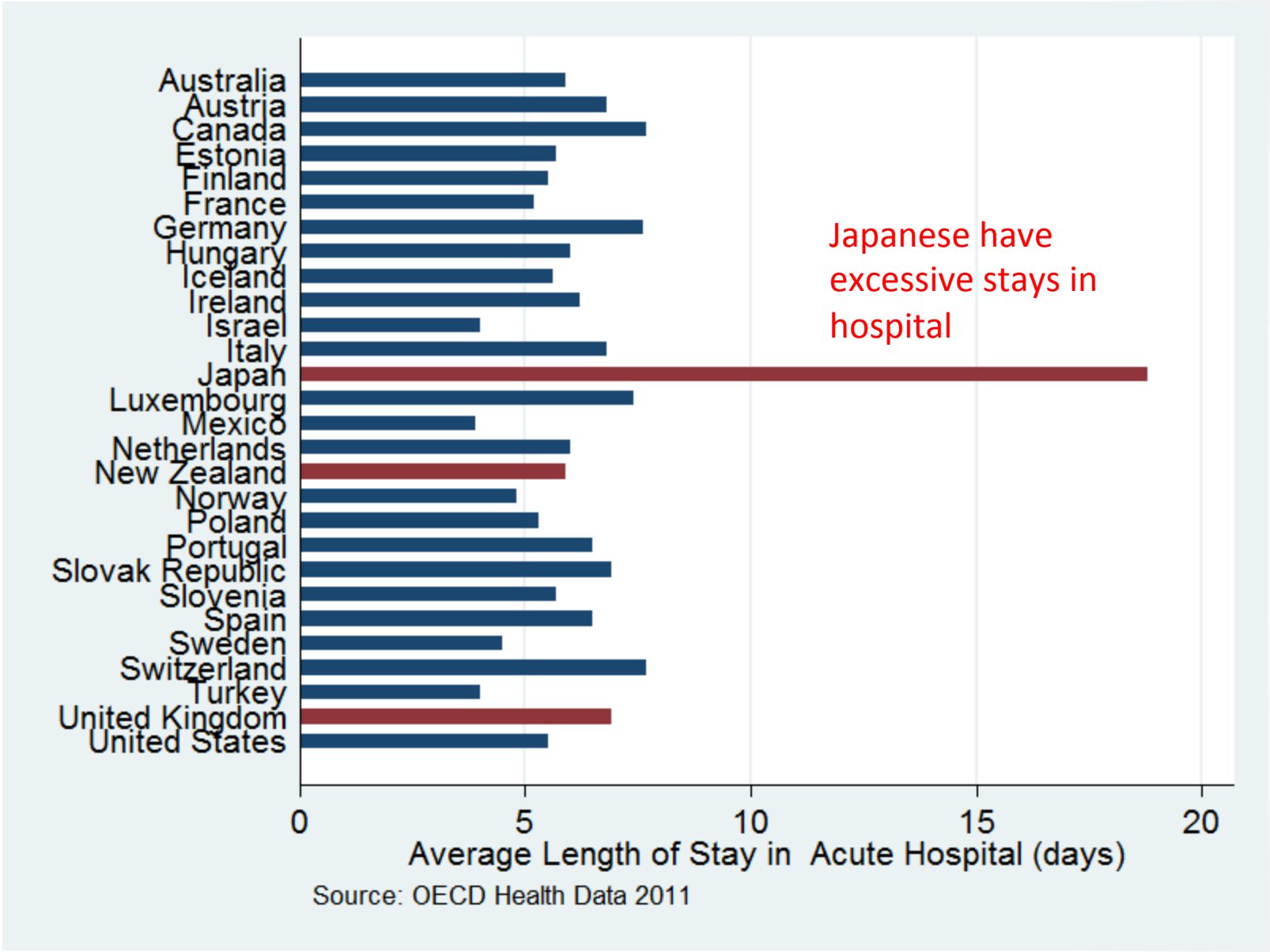


Growth in Long term care costs exceeds economic growth

Predictive Risk Modeling in Japan

Where are there prospects?

- ✓ Reduction in Length of Stay (LOS)
- ✓ Targeting of home care for the elderly


Australia
Austria
Canada
Estonia
Finland
France
Germany
Hungary
Iceland
Ireland
Israel
Italy
Japan
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States
0
5
10
15
20
Average Length of Stay in Acute Hospital (days)
Source: OECD Health Data 2011
Japanese have excessive stays in hospital

Why long length of stay?

Shortage of nursing home beds

"Social hospitalisation"

What to do about long stays?

At admission identify patients at “risk” of long LOSs

→ commence discharge planning immediately

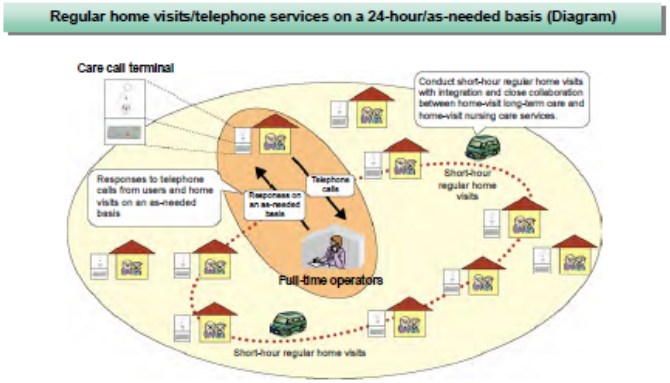
→ arrange “step-down” nursing care

→ reward hospital for shorter than predicted LOS

Targeting Home Health Services

Majority of Japanese elderly want to be cared for at home

…Comprehensive home care services is labour intensive



Taken from Japan's Ministry of Health, Labour and Welfare Service guide (2011)

Targeting Home Health Services

OECD countries rely on immigrant nursing and allied professionals

(23% of all New Zealand nurses are foreign born)

With shrinking labour force and no immigrants →

need to target home help

Home help, day care, respite care are aimed at

reducing functional decline

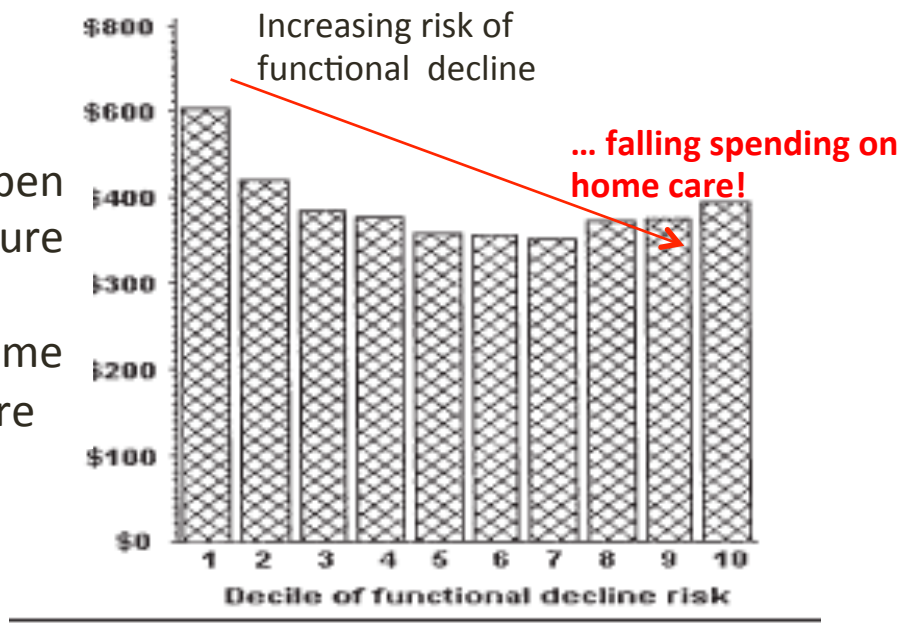
and

keeping people out of nursing homes

…. So should be given to people at risk of functional decline

Is it?

Targeting of home help is typically very poor

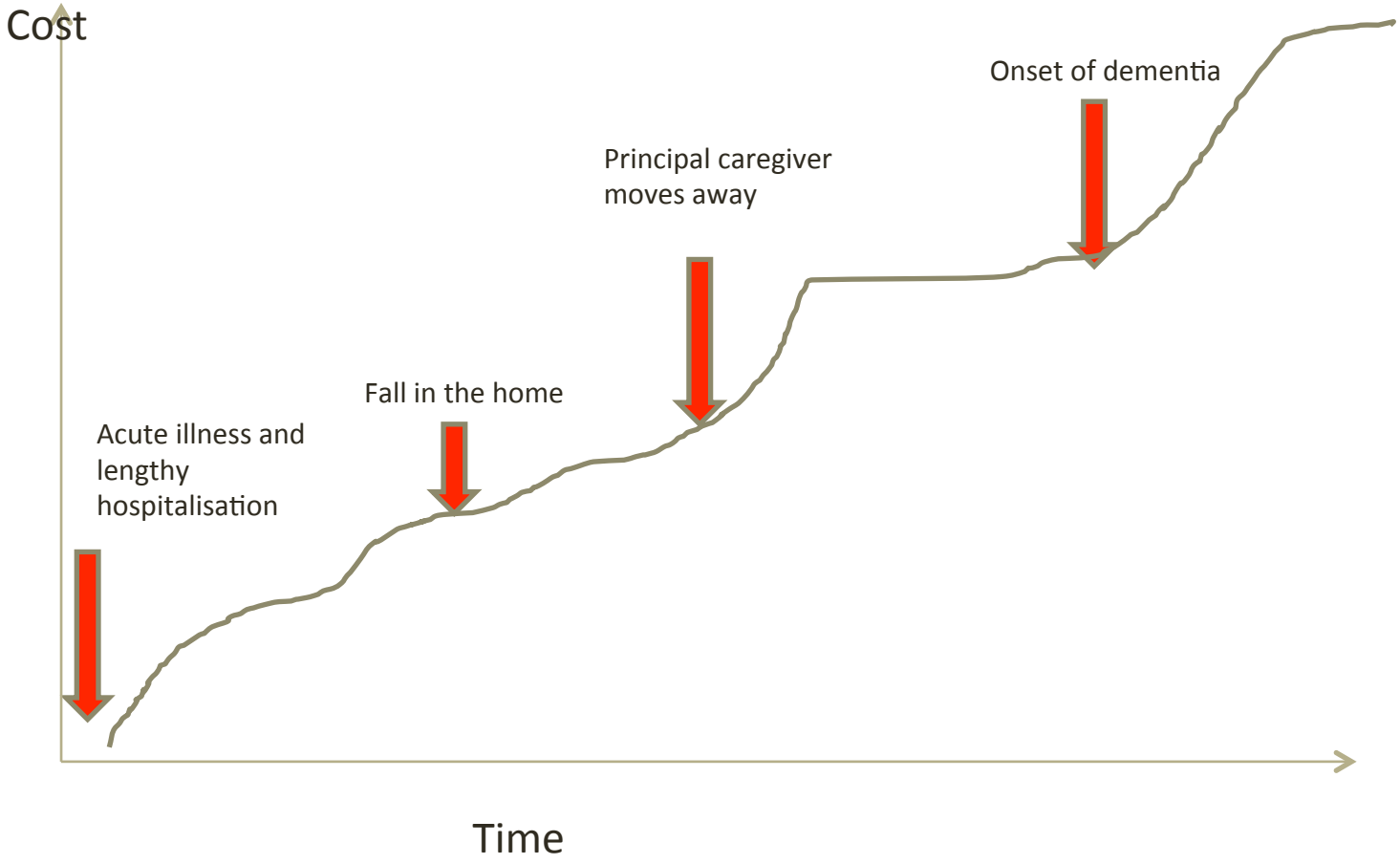


US population

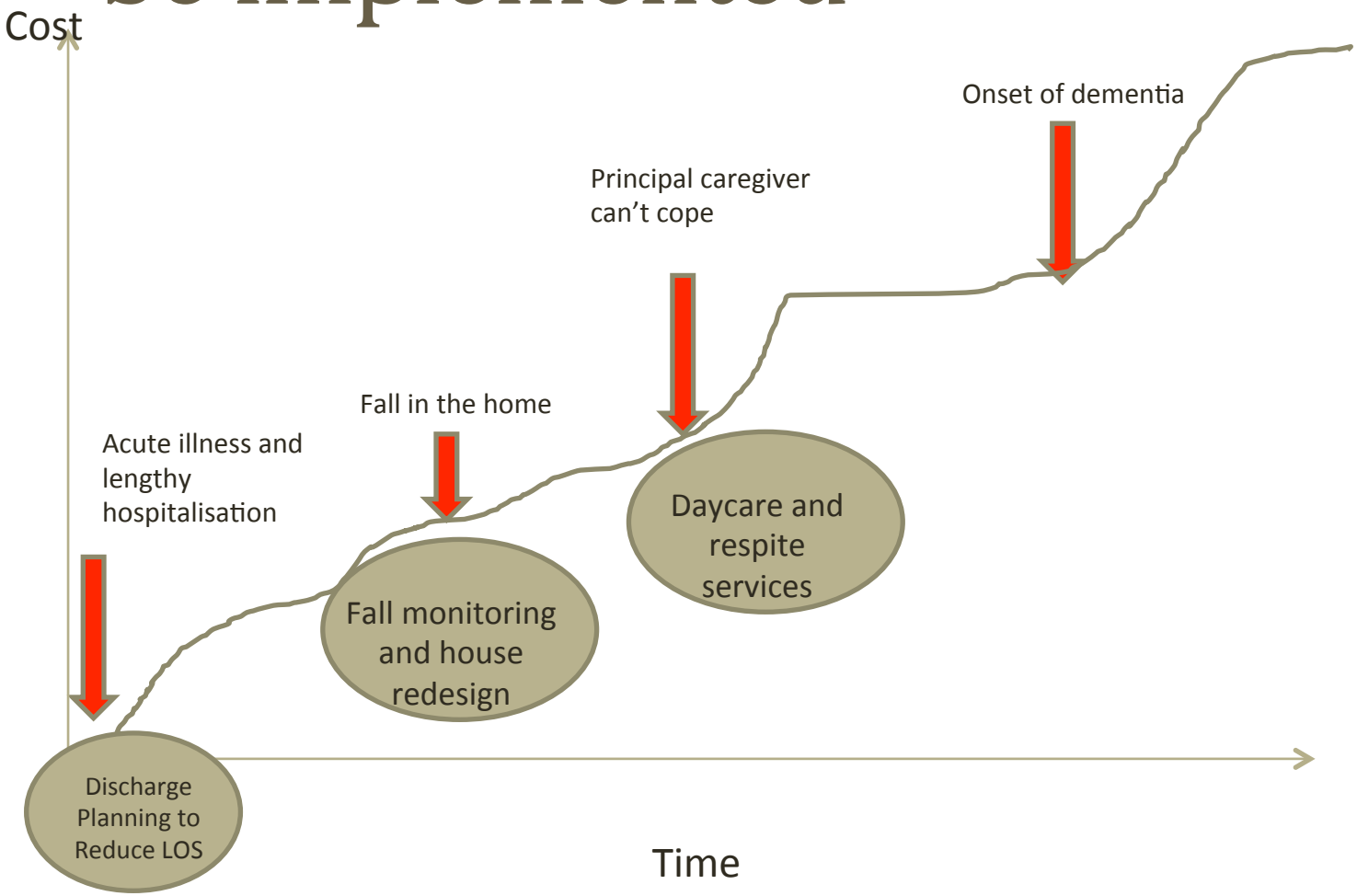
home help expenditure vs. risk of functional decline

Source: Weissert and Chernew (2003)

Predicting “the cascade to dependency” in the elderly



Allows prevention services to be implemented



Predicting Functional Decline

When first enrolled for LTC patient risk rated for functional decline

→ Care package based on risk profile

→ risk rating constantly updated

→Providers monitored on actual decline vs. predicted decline

Can decline be routinely predicted?

- What data sets are available?
- Olivares-Tirado *et al* used a City data set
- Predicted LTC expenditure
- Can Japan institute a Predictive Risk model for functional decline?

Conclusion

- ✓Predictive Risk Models help target patients
- ✓Targeting in long term care is generally very poor
- ✓Japan could benefit from exploring a predictive risk model

Further Reading

Panattoni, L. E., R. Vaithianathan, et al. (2011). "Predictive risk modelling in health: options for New Zealand and Australia." Australian Health Review 35(1): 45-51.

Curry N, et. al. Predictive Risk Project Literature Review, 2005, Kings Fund: London.