

Geriatric Health Measurement for care-management using the International Classification of Functioning (ICF)

Use of the ICF to quantify health information

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Special Thanks to

Prf. Tai Takahashi International University of Health and Welfare
Dr. Kiyoshi Takamuku Association of Geriatric health care facilities

My speech today

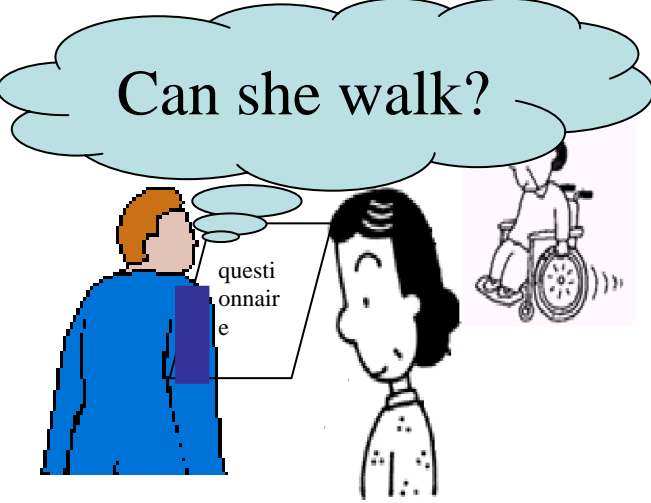
1. Background 1: lessons from case-mix system for elderly persons used in Japan.
2. Background 2: ICF
3. Development of ICF based geriatric health scales
4. Discussion

Background 1

Lessons from
developing Japanese
long-term care case mix system
in Japan

Type of Insurance and Care system by its funding in Japan

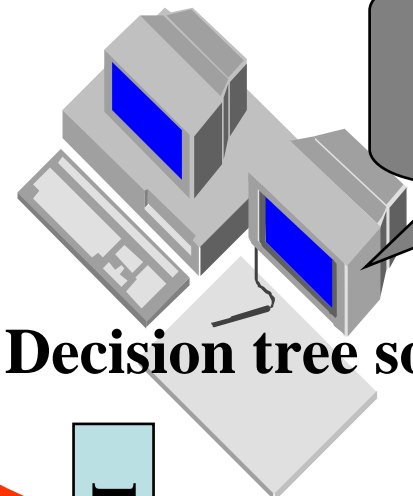
- Medical Insurance
 - compulsive, funded by premium
 - Co-payment 30%
- Long-term care insurance (LTCI) for the elderly people since year 2000
 - Compulsive, funded by premium(50%) and Tax
 - Co-payment 10%



85 questions

Results

First step judgment



Her level of required care is 3

Result

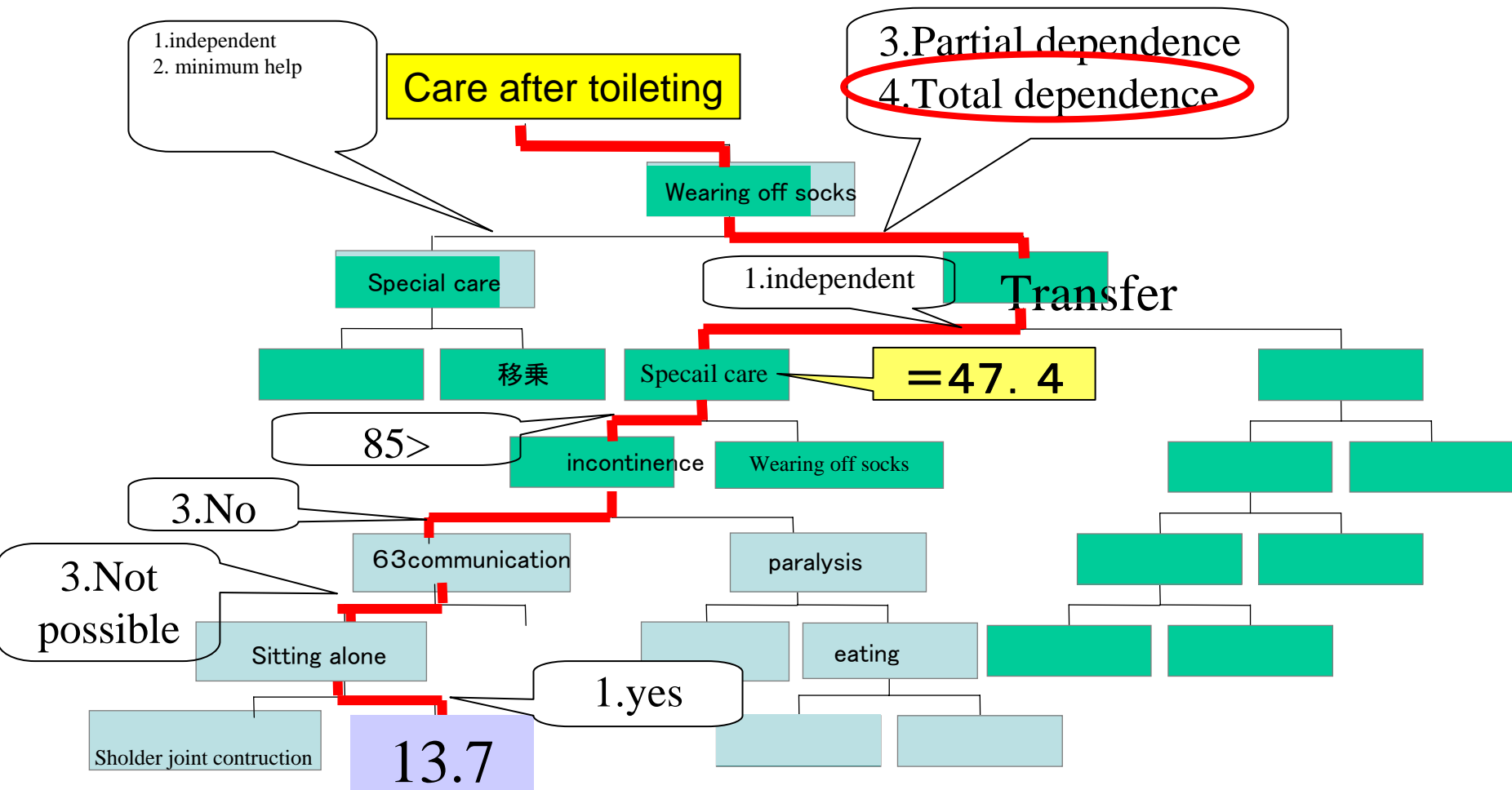
Physician's opinion



Second step judgment

Determining the level of care requirement

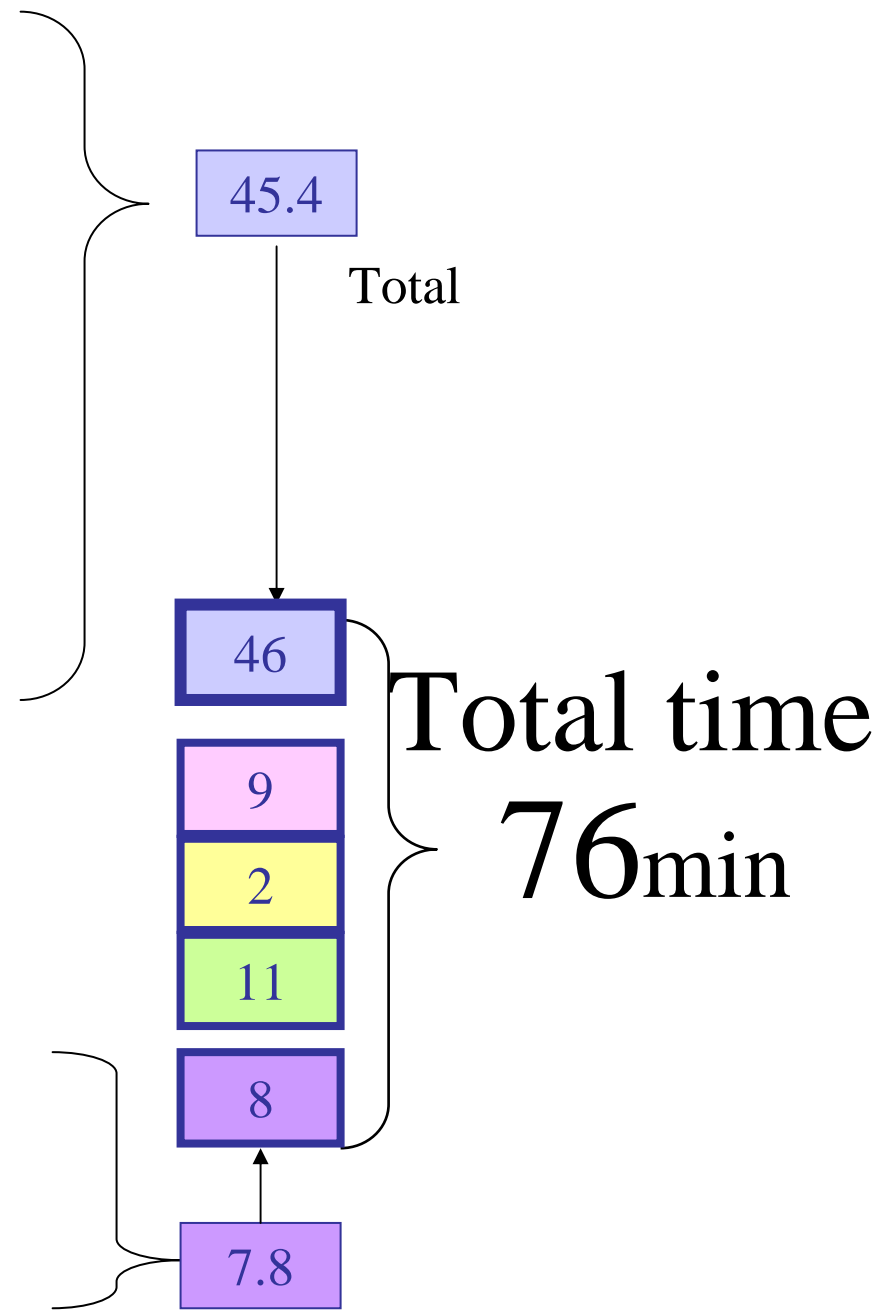
Toileting



Direct IADL care	12.1
Toileting	13.7
Eating	7.9
Bathing	2.2
Mobility	9.5

Indirect Care	
Rehabilitation	
Problem Behavior	

Medical care	7.8
Other special care	0



76min.



110min/day

Degree5

Degree4

90min/day

Degree3

70min/day

Degree2

n/day

Degree1

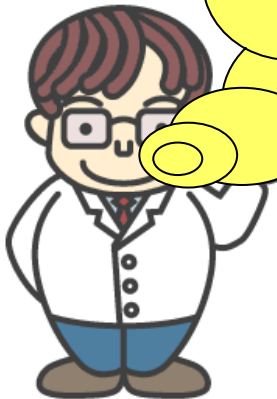
day

Preventive services

20 min/day

Not eligible

Because her time is between 70 min. and 90 min., her level is 3.



Eligibility Level and Benefit Limit

Case-mix classification system according to the elderly ADL and IADL

Table 1 The amount of benefit according to the eligibility level (in the case of home care)

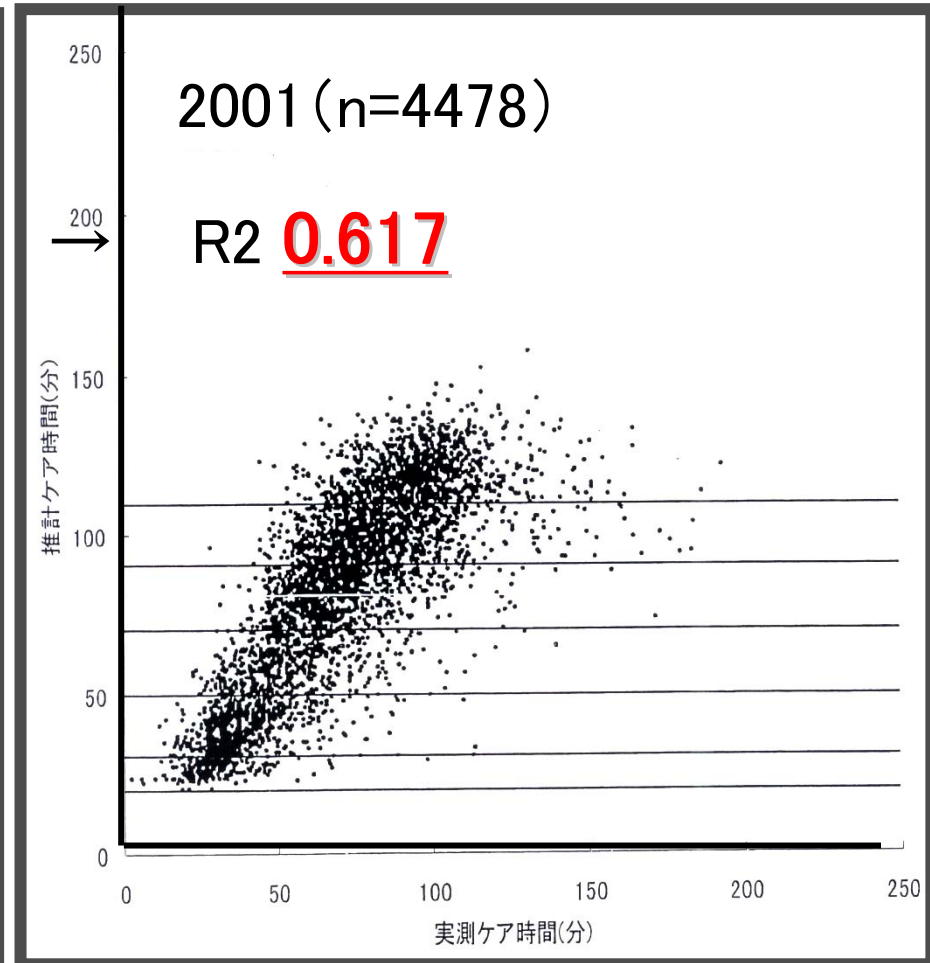
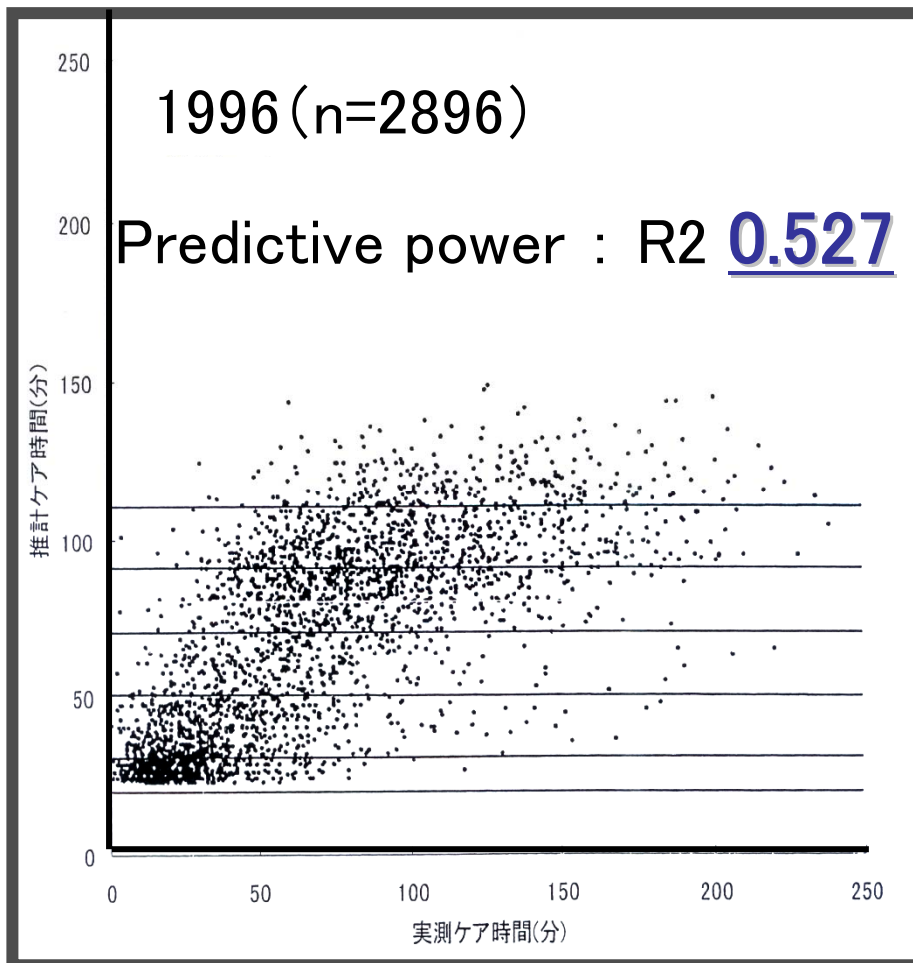
Eligibility level	Eligibility criteria ^{*1}	Monthly benefit limit ^{*2}
Assistance required	" 25 to 29 minutes " or " Sum of indirect ADI care and rehabilitation care \geq 10	\ 61,500
Care required: level 1	30 to 49 minutes	\ 165,800
Care required: level 2	50 to 69 minutes	\ 194,800
Care required: level 3	70 to 89 minutes	\ 267,500
Care required: level 4	90 to 109 minutes	\ 306,000
Care required: level 5	110 minutes and more	\ 358,300

*1: Level of eligibility

267.500yen/month
Institutional service,
or at home service 7 day care per week

Decision tree model using Time study data

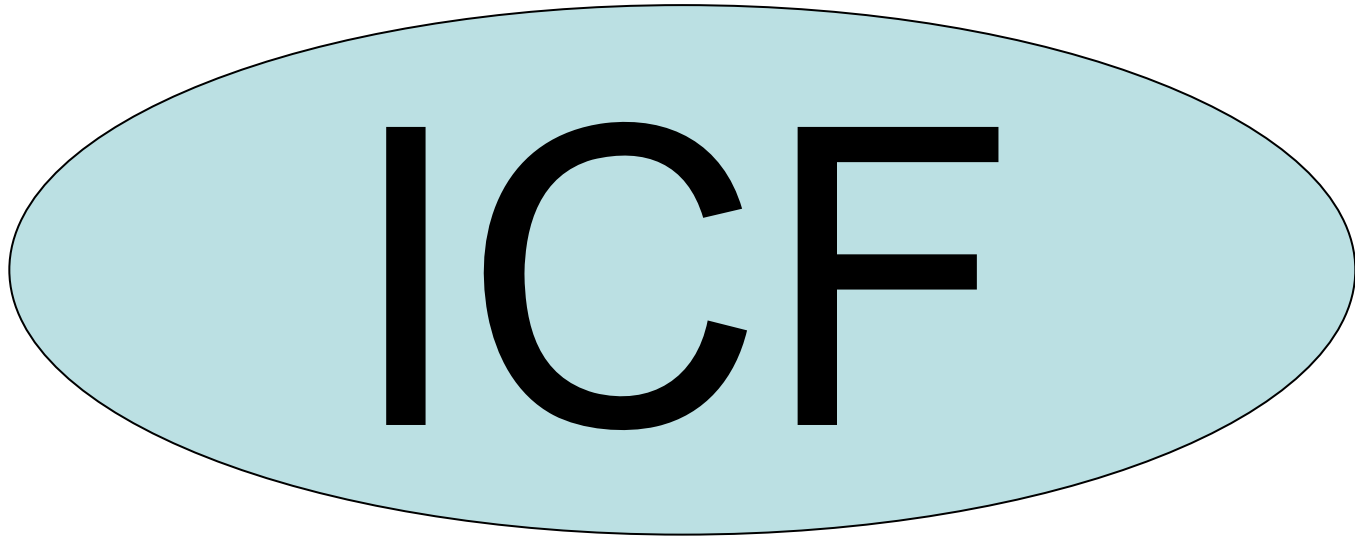
Predictive power of the eligibility test in Japanese long-term care Insurance system: predicted vs actual time



Limitation

- To many scales (80 items)
- High management cost
 - Municipality
 - Physicians and other professional costs
- Can't measure change of functioning
 - Not suitable for rehabilitation services

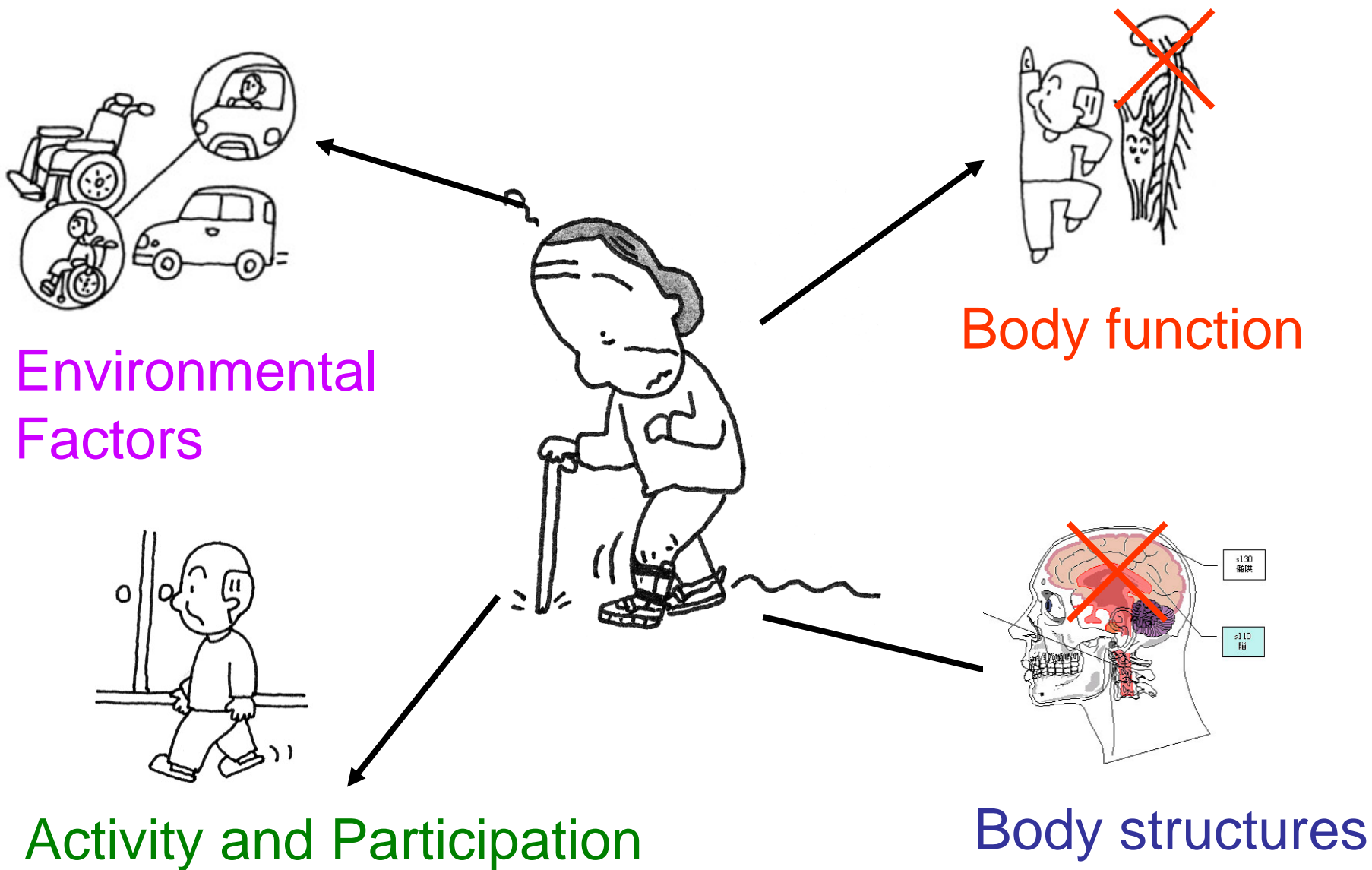
Back ground 2



ICF (International Classification of Functioning, Disability and Health)

- **ICF (International Classification of Functioning, Disability and Health)** was developed and approved by WHO in 2001 for classifying the functioning, health and disability
- According to WHO, the ICF has been accepted as the international standard to describe and measure health and disability
- Application is still underway

ICF domains



Index of ICF (chapter level)

ICF inclusively covers human functions, but there are to many codes.

ICF

BODY FUNCTIONS

- + CHAPTER 1 MENTAL FUNCTIONS
- + CHAPTER 2 SENSORY FUNCTIONS AND PAIN
- + CHAPTER 3 VOICE AND SPEECH FUNCTIONS
- + CHAPTER 4 FUNCTIONS OF THE CARDIOVASCULAR, HAEMATOLOGICAL, IMMUNOLOGICAL AND RESPIRATORY SYSTEMS
- + CHAPTER 5 FUNCTIONS OF THE DIGESTIVE, METABOLIC AND ENDOCRINE
- + CHAPTER 6 GENITOURINARY AND REPRODUCTIVE FUNCTIONS
- + CHAPTER 7 NEUROMUSCULOSKELETAL AND MOVEMENT-RELATED FUNCTIONS
- + CHAPTER 8 FUNCTIONS OF THE SKIN AND RELATED STRUCTURES

BODY STRUCTURES

- + CHAPTER 1 STRUCTURES OF THE NERVOUS SYSTEM
- + CHAPTER 2 THE EYE, EAR AND RELATED STRUCTURES
- + CHAPTER 3 STRUCTURES INVOLVED IN VOICE AND SPEECH
- + CHAPTER 4 STRUCTURES OF THE CARDIOVASCULAR, HAEMATOLOGICAL, IMMUNOLOGICAL AND RESPIRATORY SYSTEMS
- + CHAPTER 5 STRUCTURES RELATED TO DIGESTION, METABOLISM AND ENDOCRINE
- + CHAPTER 6 STRUCTURES RELATED TO GENITOURINARY AND REPRODUCTIVE
- + CHAPTER 7 STRUCTURES RELATED TO NEUROMUSCULOSKELETAL AND MOVEMENT-RELATED
- + CHAPTER 8 SKIN AND RELATED STRUCTURES

ACTIVITIES AND PARTICIPATION

- + CHAPTER 1 LEARNING AND ACQUISITION OF KNOWLEDGE
- + CHAPTER 2 GENERAL TASKS AND ACTIVITIES
- + CHAPTER 3 COMMUNICATION
- + CHAPTER 4 MOBILITY
- + CHAPTER 5 SELF-CARE
- + CHAPTER 6 DOMESTIC LIFE
- + CHAPTER 7 INTERPERSONAL INTERACTIONS AND RELATIONSHIPS
- + CHAPTER 8 MAJOR LIFE AREAS
- + CHAPTER 9 COMMUNITY, SOCIAL AND CIVIC LIFE

ENVIRONMENTAL FACTORS

- + CHAPTER 1 PRODUCTS AND TECHNOLOGY
- + CHAPTER 2 NATURAL ENVIRONMENT AND HUMAN-MADE CHANGES TO ENVIRONMENT
- + CHAPTER 3 SUPPORT AND RELATIONSHIPS
- + CHAPTER 4 ATTITUDES
- + CHAPTER 5 SERVICES, SYSTEMS AND POLICIES

Contents of chapter 4 (Mobility)



- + CHAPTER 7 NEUROMUSCULOSKELETAL AND MOVEMENT-RELATED FUNCTIONS
 - + Functions of the joints and bones (b710-b729)
 - b710 Mobility of joint functions
 - > b7100 Mobility of a single joint
 - > b7101 Mobility of several joints
 - > b7102 Mobility of joints generalized
 - > b7109 Mobility of joint functions, other specified
 - > b71099 Mobility of joint functions, unspecified
 - b715 Stability of joint functions
 - > b7150 Stability of a single joint
 - > b7151 Stability of several joints
 - > b7152 Stability of joints generalized
 - > b7159 Stability of joint functions, other specified
 - > b71599 Stability of joint functions, unspecified
 - b720 Mobility of bone functions
 - > b7200 Mobility of scapula
 - > b7201 Mobility of pelvic
 - > b7202 Mobility of carpal bones
 - > b7203 Mobility of tarsal bones
 - > b7209 Mobility of bone functions, other specified
 - > b72099 Mobility of bone functions, unspecified
 - > b729 Functions of the joints and bones, other specified and unspecified
 - + Muscle functions (b730-b749)
 - b730 Muscle power functions
 - > b7300 Power of isolated muscles and muscle groups
 - > b7301 Power of muscles of one limb
 - > b7302 Power of muscles of one side of the body
 - > b7303 Power of muscles in lower half of the body
 - > b7304 Power of muscles of all limbs
 - > b7305 Power of muscles of the trunk
 - > b7306 Power of all muscles of the body
 - > b7309 Muscle power functions, other specified
 - > b73099 Muscle power functions, unspecified
 - b735 Muscle tone functions
 - > b7350 Tone of isolated muscles and muscle groups
 - > b7351 Tone of muscles of one limb
 - > b7352 Tone of muscles of one side of body
 - > b7353 Tone of muscles of lower half of body
 - > b7354 Tone of muscles of all limbs
 - > b7355 Tone of muscles of trunk
 - > b7356 Tone of all muscles of the body
 - > b7359 Muscle tone functions, other specified
 - > b73599 Muscle tone functions, unspecified
 - b740 Muscle endurance functions
 - > b7400 Endurance of isolated muscles
 - > b7401 Endurance of muscle groups
 - > b7402 Endurance of all muscles of the body
 - > b7409 Muscle endurance functions, other specified
 - > b74099 Muscle endurance functions, unspecified
 - > b749 Muscle functions, other specified and unspecified
 - + Movement functions (b760-b789)
 - b760 Motor reflex functions
 - > b7600 Stretch motor reflex
 - > b7601 Reflexes generated by noxious stimuli
 - > b7602 Reflexes generated by other exteroceptive stimuli
 - > b7609 Motor reflex functions, other specified
 - > b76099 Motor reflex functions, unspecified
 - > b765 Involuntary movement reaction functions
 - b765 Control of voluntary movement functions
 - > b7650 Control of simple voluntary movements
 - > b7651 Control of complex voluntary movements
 - > b7652 Coordination of voluntary movements
 - > b7653 Supportive functions of arm or leg
 - > b7659 Control of voluntary movement functions, other specified
 - > b76599 Control of voluntary movement functions, unspecified
 - b766 Involuntary movement functions
 - > b7660 Involuntary contractions of muscles
 - > b7661 Tremor
 - > b7662 Tic and mannerisms
 - > b7663 Stereotypies and motor perseveration
 - > b7669 Involuntary movement functions, other specified
 - > b76699 Involuntary movement functions, unspecified
 - > b770 Gait pattern functions
 - b780 Sensations related to muscles and movement functions
 - > b7800 Sensation of muscle stiffness
 - > b7801 Sensation of muscle space
 - > b7809 Sensations related to muscles and movement functions, other specified
 - > b78099 Sensations related to muscles and movement functions, unspecified
 - > b789 Movement functions, other specified and unspecified
 - > b799 Neuromusculoskeletal and movement-related functions, other specified
 - > b7999 Neuromusculoskeletal and movement-related functions, unspecified

ICD and ICF

- ICD (international Classification of Disease)
 - To describe causes of death for health statistics
 - To classify diseases for financing=DRG/DPC
- ICF
 - To describe and measure health and disability



Coding



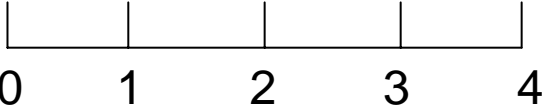
Measurement

ICD and ICF

Coding

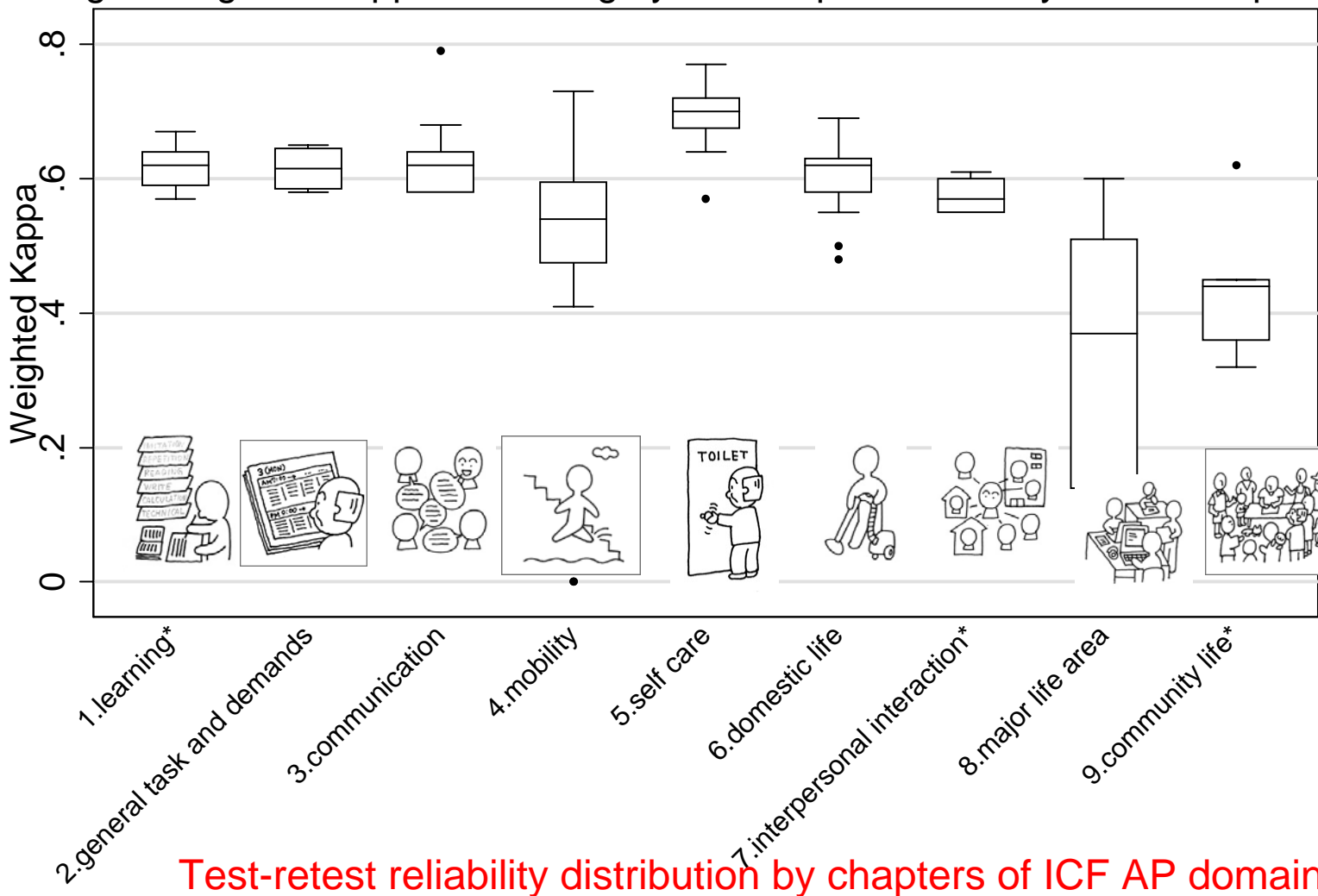
- By physician
- By professional coder
- Dichotomous data
- Reliability and Validity has improved through revisions

Measurement

- By health care staff
- 
- 0 1 2 3 4
- Polychotomous data
 - 1400 codes
 - Reliability study 2003

Weighted kappa (test-retest reliability) by chapter (Activity and Participation domain) Average Weighted kappa 0.55

Fig 1 Weighted Kappa According by the Chapter of Activity and Participation



ICF Illustration library

ICF illustration library

ICF illustration library English version

International Classification of Functioning, Disability and Health

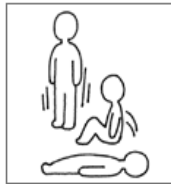
ACTIVITIES AND PARTICIPATION

▶ TOP

CHAPTER 4

MOBILITY

Changing and maintaining body position






The cartoon is from ICF illustration library

Japanese

English

Spanish

d410	d415	d420
Changing basic body position	Maintaining a body position	Transferring oneself
		

Getting into and out of a body position and moving from one location to another, such as getting up out of a chair to lie down on a bed, and getting into and out of positions of kneeling or squatting.

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Moving from one surface to another, such as sliding along a bench or moving from a bed to a chair, without changing body position.

Development of ICF based geriatric health scales

- Japanese Association of Geriatric Care facilities decided to develop new ICF based coding/assessment system
- ICF used as measurement scale

Purpose

Intermediate facility

- Measurement of improvement
- Care-management
- Standardization of care

Improve quality of care

Selection of ICF items

- 134 ICF items were selected based on
 - Former reliability study
 - Delphi method
- Used of dichotomous qualifier
 - Dichotomous qualifiers were more reliable than polytomous qualifiers

Method: samples and measurement

- **sample institution**

- 15 Geriatric health facility.

- **sample selection**

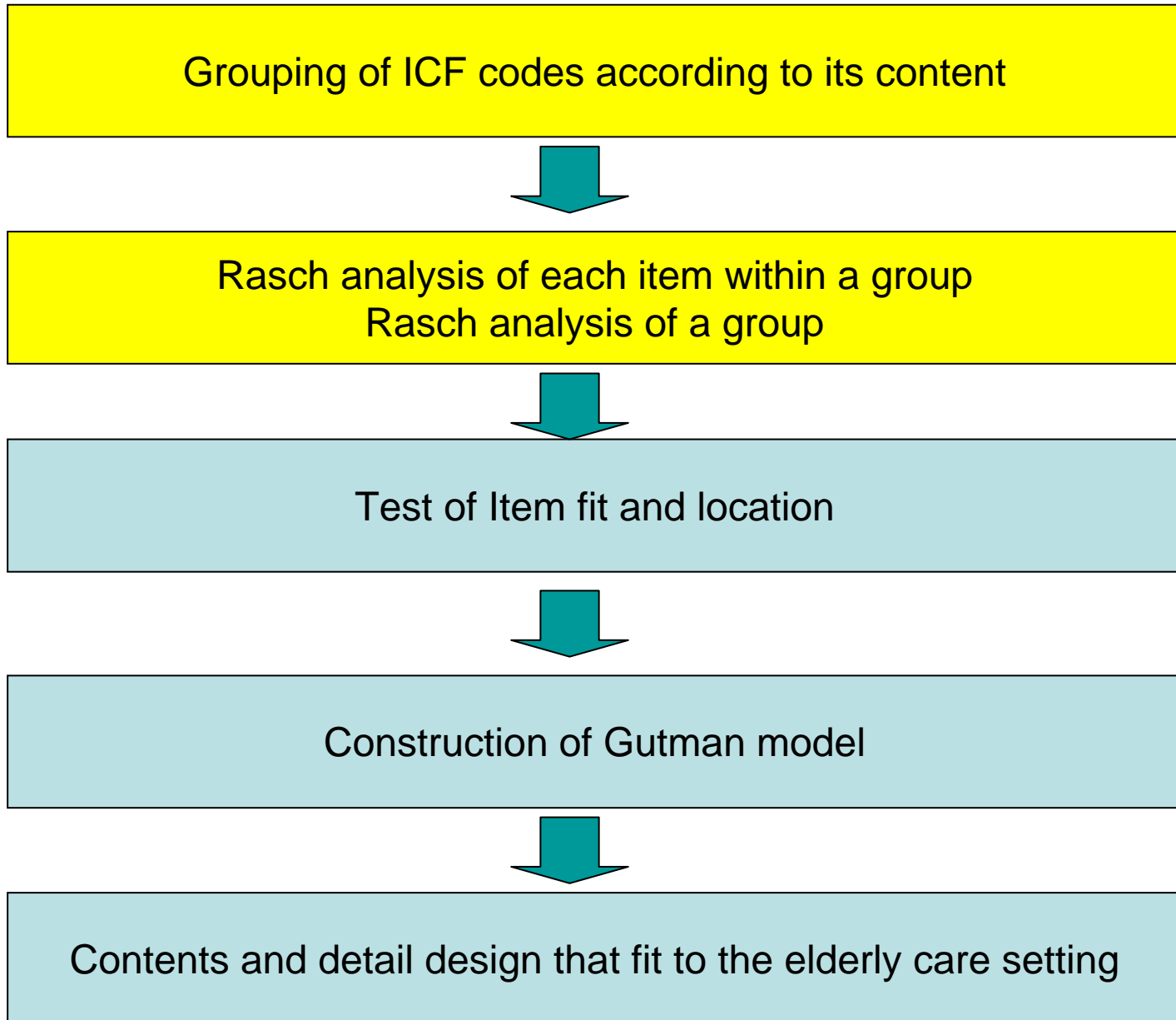
- Elderly person over 65 years old was selected from each facility.

- 1166 elderly persons were eligible for this study

- Man 19.8% Women 80.2%

- Average age 84

Flow of the ICF scale development



About Rasch methodology

- An statistical method to evaluate and forecast response pattern using relationship between item difficulty and person ability based on item responsive theory
- The only available statistical method to construct meaningful scale

$$\Pr\{X_{ni} = 1\} = \frac{\exp(\beta_n - \delta_i)}{1 + \exp(\beta_n - \delta_i)},$$

(probability of answering correctly)

β_n : ability of person n

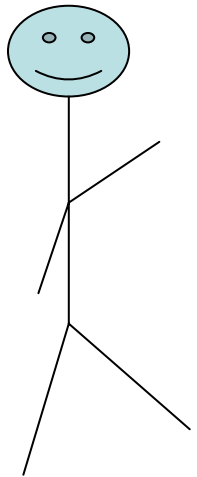
δ_i : difficulty of item "I" (item location)

IF $\beta = \delta$ Probability of correct answer = 0.5

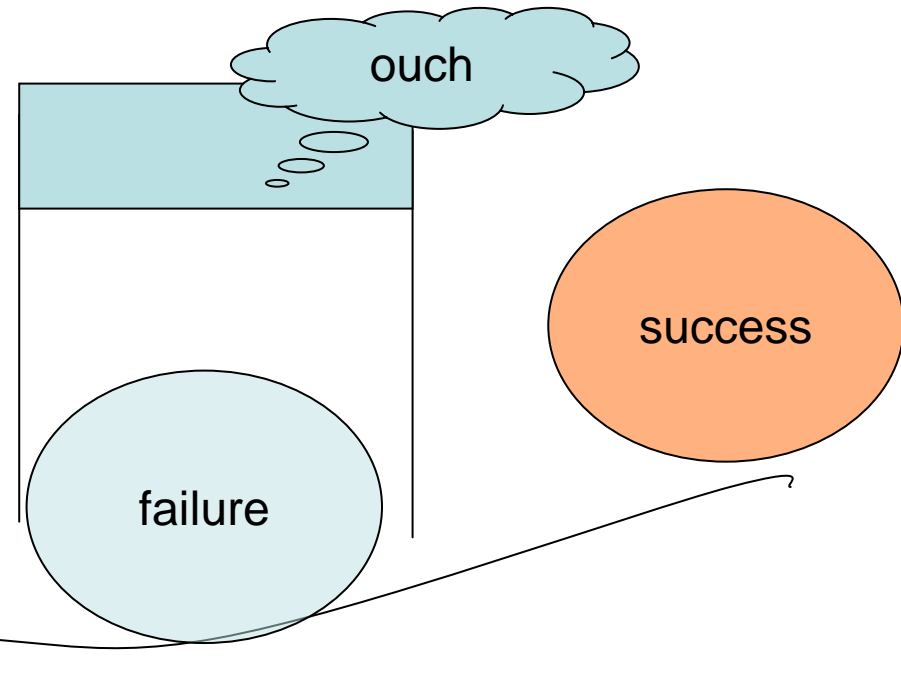
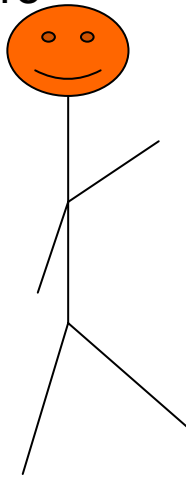
Jump trial

$$\Pr\{X_{ni} = 1\} = \frac{\exp(\beta_n - \delta_i)}{1 + \exp(\beta_n - \delta_i)},$$

Tai



Giro

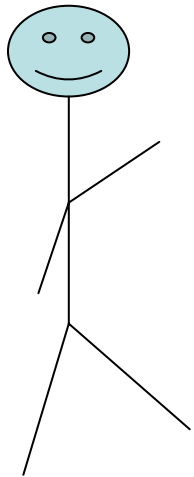


When two person tries an Jump, or answering a question item.
The higher the ability, the higher the possibility to jump successfully
(correct response)

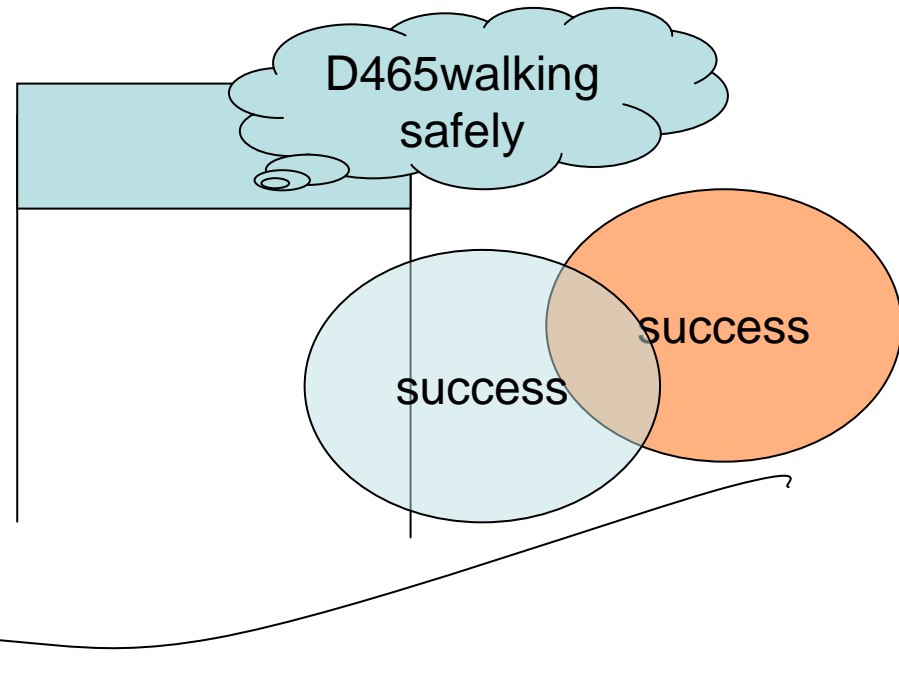
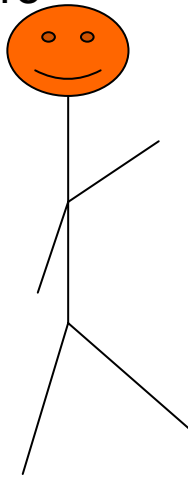
β : person ability $>$ δ : item difficulty (height of a bar)

If the item are very easy, both of them jump

Tai



Giro



Two person responding「ICFd465 walking safely」

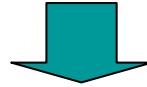
Result 1

Initial Rasch analysis using 21 mobility related ICF codes

items	Location	SE	FitResid	DF	ChiSq	DF	Prob
1 walking 50 meters on a flat floor with/without assistive devices	-0.9	0.2	-0.9	167.0	4.5	2	0.11
2 walking 50 meters on a flat floor without assistive devices	-1.5	0.2	-2.6	170.7	13.9	2	0.00
3 walking 100 meters	1.6	0.6	-1.2	95.7	1.9	2	0.38
4 walking avoiding barriers	-1.9	0.2	-3.0	96.6	12.9	2	0.00
5 climbing up	1.6	0.4	-1.2	167.0	0.5	2	0.77
6 climbing down	1.2	0.4	-2.0	167.0	2.8	2	0.25
7 moving within a house/institution	-4.2	0.3	-1.1	96.6	1.4	2	0.49
8 moving within a building not home	-0.5	0.3	-2.7	96.6	6.6	2	0.04
9 moving outdoor	1.4	0.5	-1.7	96.6	2.8	2	0.24
10 walking using cane	0.1	0.3	-2.3	96.6	5.4	2	0.07
11 walking using both cane and brace	1.0	0.5	-1.5	95.7	3.5	2	0.17
12 use of Tcane	-0.2	0.2	-2.4	170.7	3.7	2	0.16
13 using four point cane	1.3	0.4	-0.6	170.7	2.3	2	0.32
14 moving using walker and senior car	-0.4	0.2	-0.7	170.7	3.7	2	0.16
15 walking using cicle type walker	1.6	0.4	0.0	170.7	2.1	2	0.36
16 moving using a wheelchair	-2.4	0.2	9.7	170.7	187.3	2	0.00
17 walking using braces	1.0	0.3	-0.6	170.7	4.4	2	0.11
18 going out with assistance person	-1.9	0.2	-3.3	170.7	29.7	2	0.00
19 going out neighborhood	1.1	0.3	-2.2	170.7	3.1	2	0.21
20 going out using private transportation	-1.0	0.2	-2.1	170.7	6.9	2	0.03
21 going out using public transportation	3.0	0.8	-0.4	170.7	1.2	2	0.56

Flow of ICF scale development

Grouping of ICF codes according to its content



Rasch analysis of each item within a group
Rasch analysis of a group



Test of Item fit and location



Construction of Gutman model



Contents and detail design that fit to the elderly care setting

Result 2

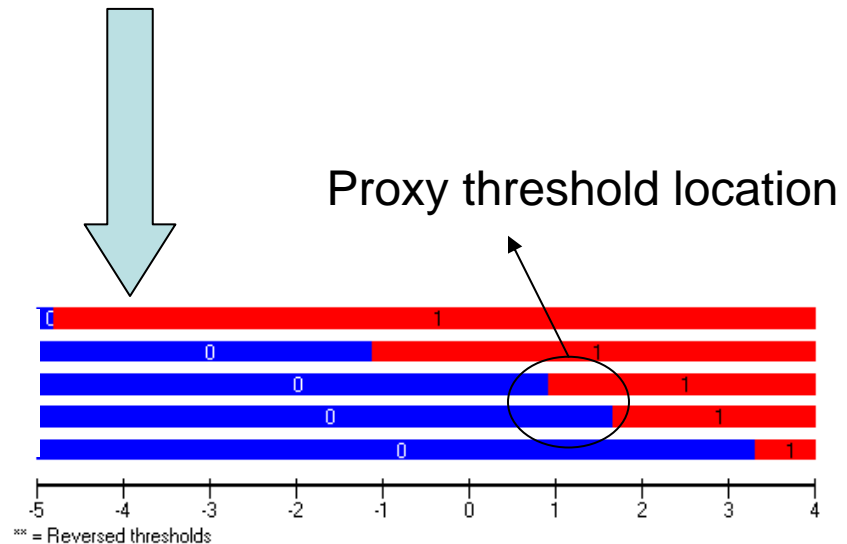
Item fit and location analysis

Item selection criteria fitness of good χ square <10

ICF item

ICF item	Location	SE	FitResid	DF	ChiSq	DF	Prob
7 moving within a house/institution	-5.447	0.4	-1.007	69.92	2.753	2	0.25
1 walking 50 meters on a flat floor with/without assistive devices	0.477	0.4	-1.99	69.1	2.124	1	0.15
9 moving outdoor	0.682	0.4	-1.857	69.92	2.008	2	0.37
5 climbing up	1.472	0.3	-2.257	106.9	8.167	2	0.02
21 going out using public transportation	3.47	0.8	-0.092	108.6	3.059	2	0.22



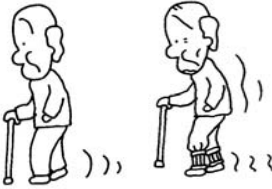
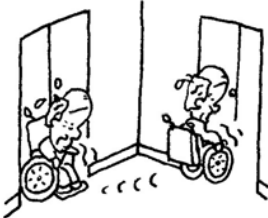
7 moving within a house/institution
 1 walking 50 meters on a flat floor with/without assistive devices
 9 moving outdoor
 5 climbing up
 21 going out using public transportation



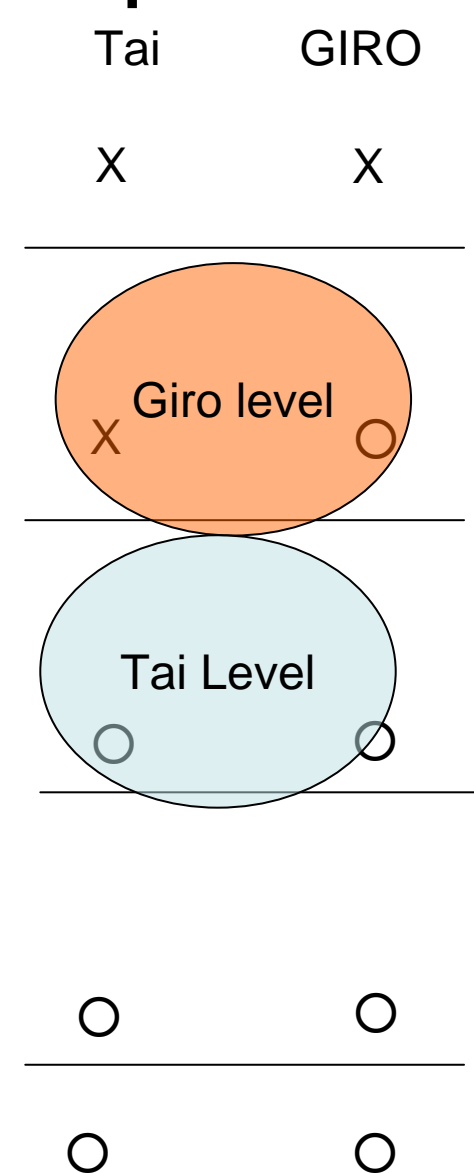
Our product : Gutman type scale

ICF code	tytle	explanation	state	classification
d4702	Going out using public transportation	Going out using public transportation (regardless of using assistive devises)	yes	5 Going out of home using pulic and/or private transportation
			no	
d4551	Climbing up	Climbing more than 5 stares	yes	4 can not going out, but can climb stairs. Without limitation
			no	
d465	walking	Walking safely (regardless of using cane and/or brace)	yes	3 walking around safely
			no	
d450a	Moving around within an instituti on	Moving around within an building (regardless of using assistive devises such as wheelchair)	yes	2 can not walk, but move around within a building
			no	
				1 can not walk around with in a building

Then we know the level of the person

	ICF code	tytle	explanation	state
	d4702	Going out using public transportation	Going out using public transportation (regardless of using assistive devises)	yes
				no
	d4551	Climbing up	Climbing more than 5 stares	yes
				no
	d465	walking	Walking safely (regardless of using cane and/or brace)	yes
				no
	d450a	Moving around within an instituti on	Moving around within an building (regardless of using assistive devises such as wheelchair)	yes
				no

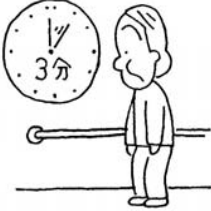

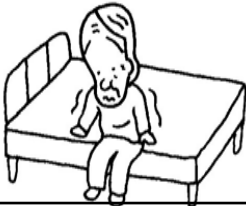
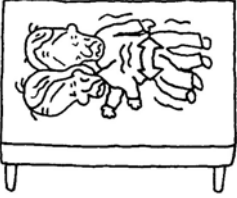
classification
5 Going out of home using pulic and/or private transportation
4 can not going out, but can climb stairs. Without limitation
3 walking around safely
2 can not walk, but move around within a building
1 can not walk around with in a building





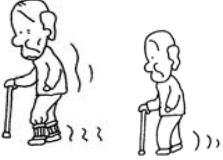

Merit of knowing level of a person By using Gutman type scale

- A single result using multiple question item
- Require same level of health resource
- Standardization of care-plan and interventions

Basic Movement





1. 基本動作	ICF code	title	explanation	choice	Status
	d4154a	Maintain Standing position	Maintain standing position without help for 3minutes	Yes	5 maintain standing position
				no	4 can not maintain standing position but can transfer from sitting position to lying position
	d4200	Transfer while sitting	As transferring from sitting to bed, transferring oneself from and to different level of surface	yes	3 Can not transfer while sitting, but maintain sitting without assistance
				no	
	d4155a	Maintain Sitting position	Maintain sitting position without assistance	yes	1 can not change lying position
				no	
	d429	Change lying position	Change lying position (with/without holding assistive device)	yes	
				No	

Walking/Mobility





	ICF code	title	explanation	state
	d4702	Going out using public transportation	Going out using public transportation (regardless of using assistive devices)	yes
				no
	d4551	Climbing up	Climbing more than 5 stairs	yes
				no
	d465	walking	Walking safely (regardless of using cane and/or brace)	yes
				no
	d450a	Moving around within an institution	Moving around within an institution (regardless of using assistive devices such as wheelchair)	yes
				no

classification
5 Going out of home using public and/or private transportation
4 can not going out, but can climb stairs. Without limitation
3 walking around safely
2 can not walk, but move around within a building
1 can not walk around within a building

Eating maneuver

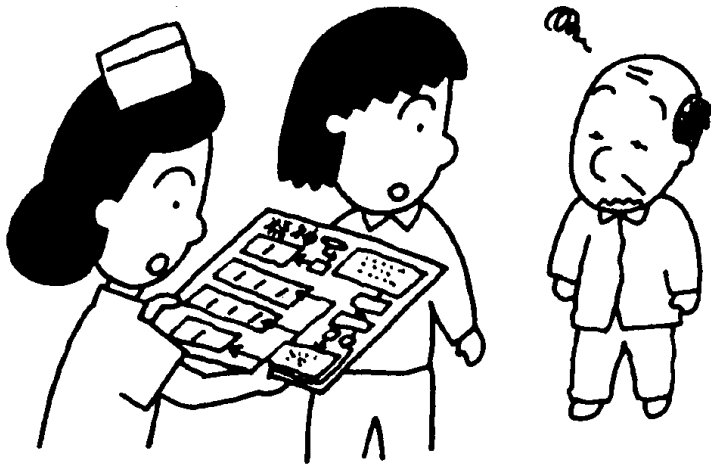
	ICF コード	タイトル	説明	選択肢	状態の判定
	d550a	Eating	Eating cleanly by himself using chopstick or knife and folk	yes	5 eat cleanly using knife or fork or chpstick
				no	
	d550b	Eating maneuver	Eating without help	yes	4 eat somehow using hand
				no	
	d550c	Setting on eating	Require setting arrangement when eating	yes	3 require setting when eating
				no	
	d550d	Direct help on eating	Require direct help when eating	yes	2 require direct help on eating
				no	

Toileting

	ICF コード	タイトル	説明	選択肢
	d53001	Use of toilet	Coordinating and managing urination, and do it properly on toilet	Yes
				No
	d5401	Putting on and Taking off of clothes	Carrying out the coordinated actions and tasks of putting on and taking off clothes	Yes
				No
	d420a	Transferring oneself on and off toilet	Moving from one surface to another, such as sliding along a bench or moving from a bed to a chair, without changing body position.	Yes
				No
	d5308a	Toileting otherwise specified	Can not transfer to toilet, and using assistive device	Yes
				No

状態の判定
5 Use toilet clean and properly
4 taking off and putting on clothes while toileting
2 transfer to toilet by himself
Require assistive device for toileting

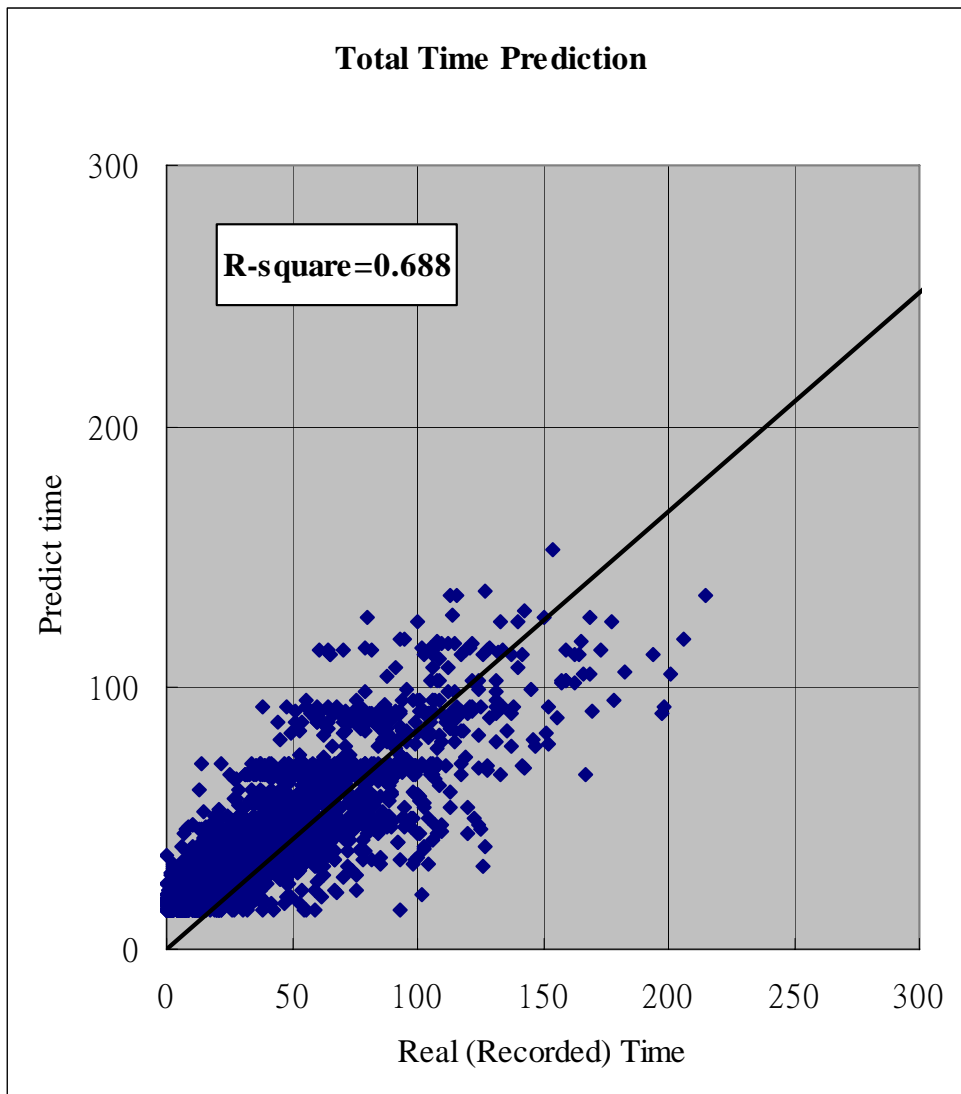
Functional monitoring



Re-evaluation
(every 3 month)

	1月	2月	3月	4月	5月	6月
mobility	3	3	3	3	3	3
mmnicati	4	3	4	4	3	2
eating	5	4	4	4	4	4
toileting	4	4	4	3	2	2

Predictive Validity



Four scales and intensity of medical service were used to estimate the total care-staff time required in geriatric care facilities.

This is not ICF based scale , but TAI scale with similar constructs we have developed using the ICF codes.

TAI高齡者照護計劃之制定
中華民國長期照護專業協會, 2005. 3,

ICF based Gutman type scale

- By fitting to the Rasch model and then by re-constructing a Gutman type scale, we successfully decreased the number of geriatric scales.
 - 4 ICF items are remodeled in one scale, measuring same constructs, but with different difficulty;
 - We constructed 13 scales, that contain $13 \times 4 = 52$ ICF codes
 - Use of international valid language

Conclusion

- With this simple scale, the users can
 - share image of the elderly persons
 - monitor change in functioning
 - standardization of care

