



The Economics of eHealth

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Outline

1. Problems related to medicine and eHealth
2. How to measure the economic effect of eHealth
3. Economic Analysis
4. Further Implementation of eHealth



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Problems related to medicine and eHealth



Issues Related to Medicine

1. Increase in medical expenditures due to the aging society, change in lifestyle
2. Financial problems of public medical insurance
3. Discrepancy of medical resources in regions



Roles of e-Health , m-Health and u-Health

1. Promote efficiency in the provision of medical services:
 - Introducing IT in medical institutions
 - Sharing information by HER or PHR
 - Saving travelling costs of doctors and patients
 - Promoting QoL of patients and family
 - Diseases management
2. Prevention of diseases by tele-monitoring
3. Improving health by telecare



What can economics do for eHealth?

Economics: Science for efficient allocation of scarce resources

Challenges to economics: Have to satisfy people's needs for medical services by a suitable mechanism;

Market mechanism vs. public services
U.S. EU, Japan



Why medical reforms failed and why eHealth did not spread?

Economics did not reply properly nor
propose reforms

Economic evaluation of eHealth with rigorous
scientific foundations and reforms based on
them



How to Measure the Economic Effect of eHealth

Research Site

- Nishi-aizu Town, Fukushima Prefecture, Japan
 - Population: 8,838 (2,949 households)
 - Elderly ratio: 38.23 %
 - 15 years implementation of e-Health system

Nishi-aizu Town

Tokyo





Health Condition of Nishi-aizu in 1985 (before the introduction of e-Health)

1. SMR (Death ratio of strokes)

176.7 (national average 100)

2. Life expectancy (1983-87)

Male 73.1 (national 74.8) 88th

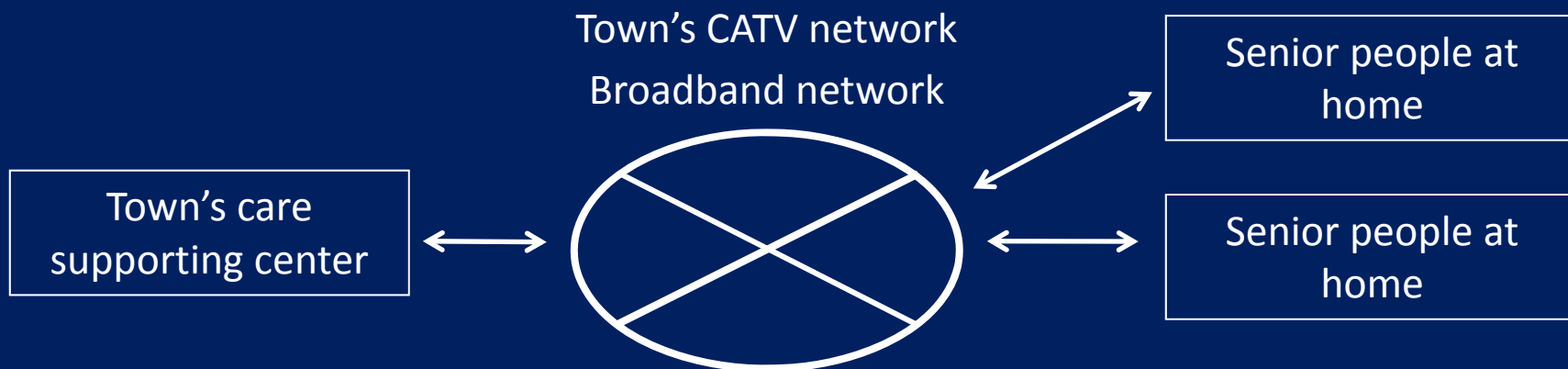
Female 80.0 (national 80.5) 69th

3. Burden of medical insurance

49,363 yen (national average 4,357yen)



e-Health System



- Host computer at center
Read and store of medical data
Advice on health care

- Peripheral device at home
Medical examination
Measurement of blood pressure, pulse, ECG...
Input of temperature, weight...

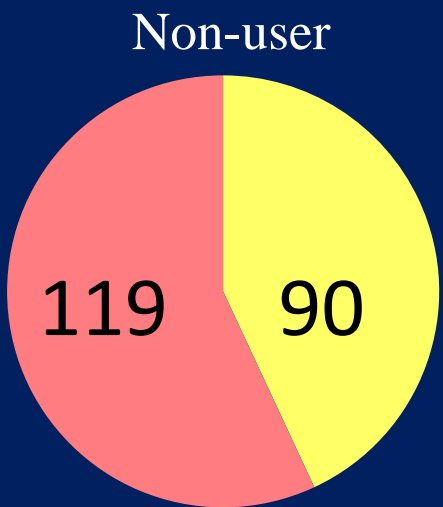
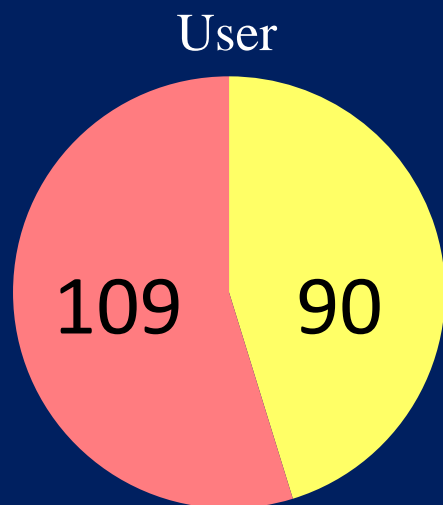




Survey Data



Sex distribution



Age distribution

	User	Non-user	Total
40 - 49	2	0	2
50 - 59	14	23	37
60 - 69	45	67	112
70 - 79	92	76	168
80 - 89	46	37	83
Over 90	0	6	6
Total	199	209	408



Number of Samples

Research Groups

User Group

	User	Non-user	Year start using the system	Male	Female	Total	Users selected as Sample
Total	523	3,528	1994	9	11	20	20
Number of sent questionnaires	412	450	1995	13	11	24	24
Number of respondents	311	239	1996	8	14	22	22
Number of valid respondents	199	209	1997	30	36	66	66
Rate of valid respondents	48.3%	46.4%	1998	13	15	28	28
			1999	4	6	10	10
			2000	8	11	19	19
			2001	3	3	6	6
			2002	6	7	13	13
			2003	91	88	179	95
			2004	53	69	122	95
			2005	6	6	12	12
			2006	2	0	2	2
			Total	246	277	523	412



Diseases Having Treated 2002–2006

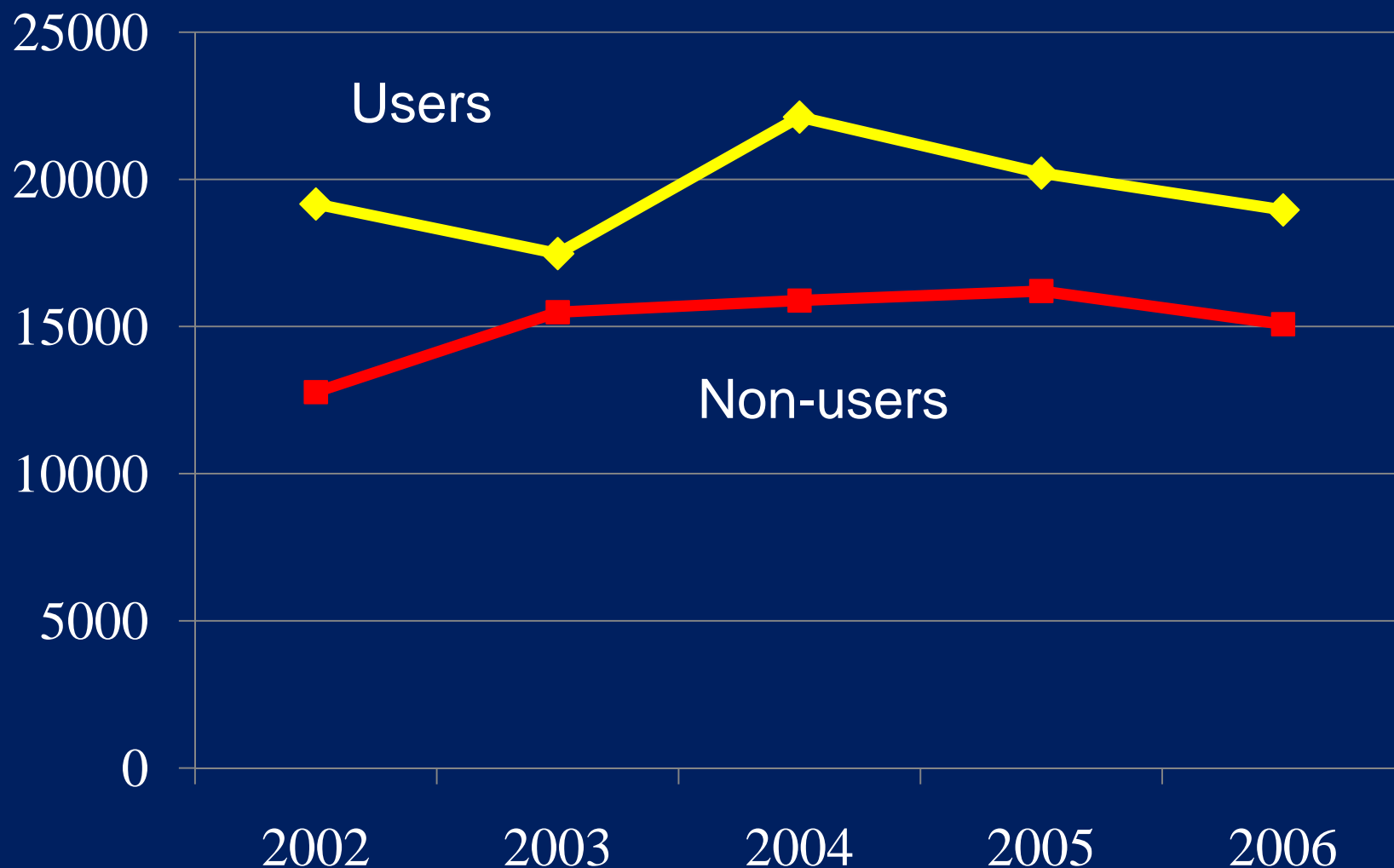
	2002		2003		2004		2005		2006	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Heart diseases	29	13	25	16	28	15	29	13	19	9
High blood pressure	99	81	89	79	95	75	90	83	83	58
Diabetes	17	16	14	17	18	20	17	19	13	20
Strokes	13	10	9	8	13	9	14	12	9	6
Respiratory diseases	38	28	28	26	16	19	21	29	21	27
Cancer	11	11	16	14	23	16	15	17	12	11
Gastropathy	40	42	37	40	32	26	34	35	22	18
Lumbago, Arthritis	28	42	34	41	30	25	34	30	28	18
Ophthalmic diseases	48	50	56	46	63	44	68	45	50	30
Kidney diseases	4	5	6	6	3	7	7	6	4	5
Anal diseases	1	3	0	4	0	4	1	3	3	2
Others	82	80	86	96	83	83	78	92	66	74



Economic Analysis

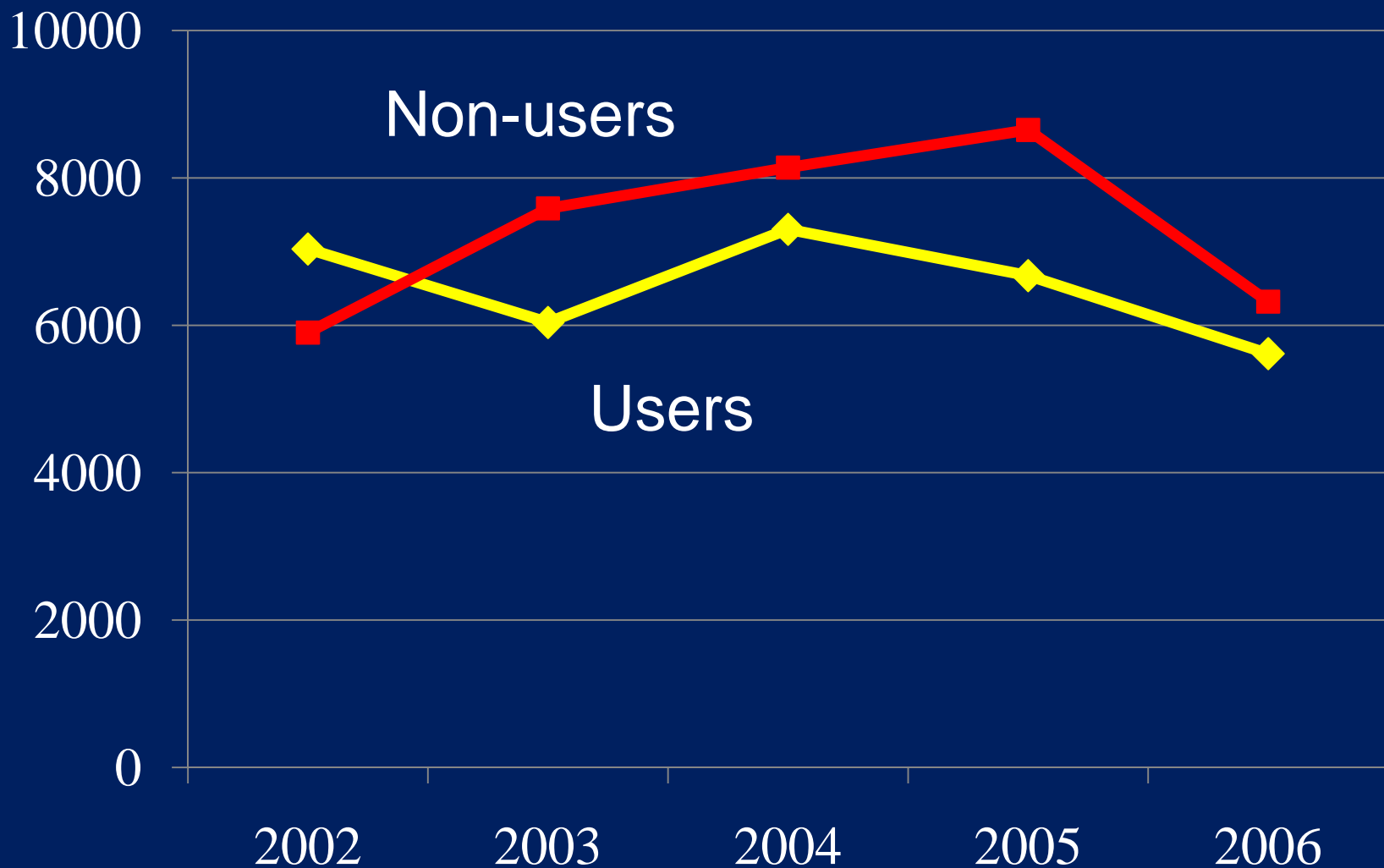


Medical Expenditures of User and Non-user Group: All Diseases



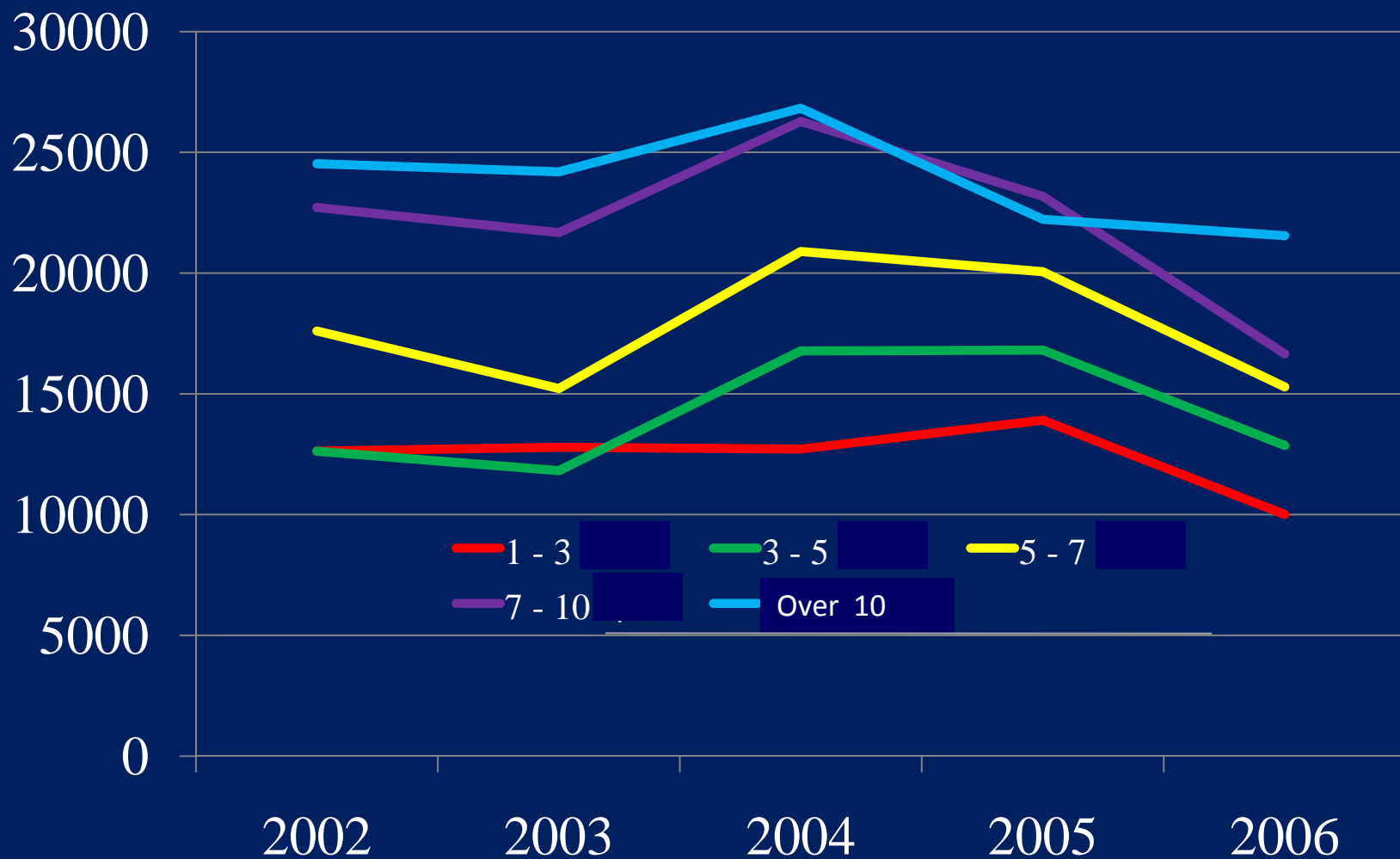


Medical Expenditures of User and Non-user Group: Lifestyle-related Diseases



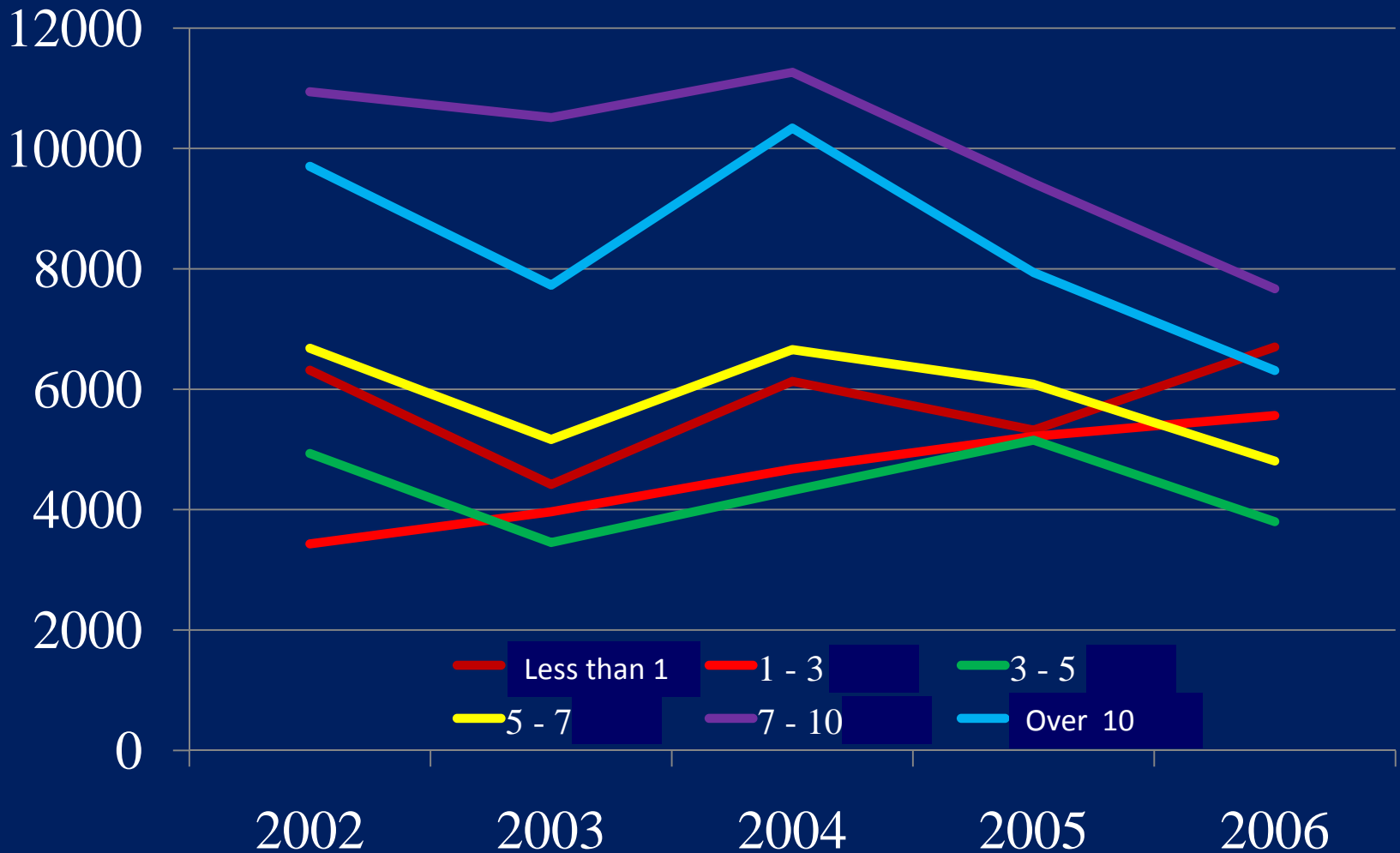


Years of Using the System and Medical Expenditures (All diseases)





Years of Using and Medical Expenditures (Life-style Related Diseases)





Result I

Variable	Coef.	Std. Err.	t-value	p-value
Sex	1467.36	473.55	3.10	0.002 ***
Age	219.67	29.12	7.54	0.000 ***
Education	309.45	315.10	0.98	0.326
Working	95.86	501.79	0.19	0.849
No. of family	289.24	126.34	2.29	0.022 **
Income	-19.09	4.08	-4.68	0.000 ***
Chronic disease	3344.00	476.34	7.02	0.000 ***
User	-1568.79	478.90	-3.28	0.001 ***
Constant	-10517.63	2378.58	-4.42	0.000 ***
Number of obs.		1820		
Adjusted R2		0.0819		

***, **, and * indicate the 1%, 5%, and 10% significant level, respectively.

➤ Medical expenditures for lifestyle-related diseases of user group is smaller than those of non-user group by **15,688 yen (US\$ 144.60, 21.2% of average)** per year.



Result I: System GMM

Dependant variable	days for outpatient	days for inpatient	medical expenditures
	Coefficient	Coefficient	Coefficient
e-Health user	-0.6968 ** (0.3123)	-2.09217 *** (0.8028)	-6.0384 ** (2.9847)
Chronic diseases	3.5057 *** (0.5636)	2.3245 *** (0.4793)	15.8556 *** (3.3771)
Age	2.0924 *** (0.4157)	2.9665 *** (0.6559)	8.0443 ** (3.3329)
Number of observations	1621	149	1290
Number of groups	390	113	385
Wald χ square	707.62	150.62	497.23
Prob. > χ square	<0.0001	<0.0001	<0.0001
Arellano-Bond test for AR(2)	0.6160	—	0.9350
Hansen test of overid. restrictions (Prob. > χ square)	0.8960	0.8380	0.9020

***, ** and * indicate at the 1%, 5% and 10% significance level, respectively.

() means corrected standard error by Windmeijer method.

Instruments variables are as follows.

Dependant variable: days for outpatient, two period lag of days of outpatient, one period lag of e-Health user, one period lag of lchronic diseases, one period lag of age, high blood pressure, respiratory diseases, year dummies (2002-2005).

Dependant variable: days for inpatients, one period lag of days of inpatients, two period lag of user of e-Health, one period lag of age, diabetes, respiratory diseases, year dummies (2002-2005).

Arellano-Bond test for AR (2) cannot be calculated because the number of observations small about result of days for inpatient.



Result II: difference of each disease

Variable	Characteristics, diseases			Cross effect		
	Coefficient (t-value)			Coefficient (t-value)		
Sex	-747.67	(-0.74)				
Age	222.37	(3.58)	***			
Education	456.51	(0.70)				
Working	-3427.97	(-3.29)	***			
No. of family	1068.60	(4.06)	***			
Income	-12.09	(-1.42)				
Heart diseases	20171.06	(7.14)	***	-6391.33	(-1.79)	*
High blood pressure	10181.37	(7.40)	***	-3080.34	(-1.71)	*
Diabetes	16166.76	(6.83)	***	-8837.79	(-2.49)	**
Strokes	9254.46	(2.92)	***	9313.10	(2.17)	**
Respiratory diseases	1668.48	(0.79)		-692.95	(-0.22)	
Cancer	16843.44	(6.25)	***	-1165.97	(-0.31)	
Gastropathy	5257.63	(2.83)	***	-5701.81	(-2.15)	***
Lumbago, Arthritis	6193.50	(3.22)	***	478.86	(0.17)	
Ophthalmic diseases	6117.03	(3.45)	***	3358.96	(1.37)	
Kidney diseases	1697.60	(0.42)		76684.07	(12.23)	***
Anal diseases	543.66	(0.10)		-11084.02	(-1.04)	
Others	4793.56	(3.49)	***	2664.82	(1.34)	
Constant	-14600.09	(-2.93)	***			
Adjusted R-squared				0.3675		
Number of observation				1820		

***, **, and * indicate the 1%, 5%, and 10% significant level, respectively.



Result of Cost-benefit Analysis

	Total costs	Operating costs
Benefit (6 years)	43,010,810	
Costs (6 years)	170,498,000	47,450,000
1. Initial costs	123,048,000	
2. Operating costs	47,450,000	
2-A. Annual salaries and wage	3,700,000	
2-B. Annual operating costs	1,900,000	
B/C ratio	0.2523	0.9064
Number of users	523	
Annual benefits per year	15,688	

➤ B/C ratio indicates less than 1 based on both total costs and operating costs, so eHealth system seems to be inefficient.

Conclusion: Further Implementation of eHealth



Towards a Broader Implementation of eHealth

- Low B/C ratio
- Conditions of Further implementation
 - (1) Public subsidies
 - (2) Reimbursement from medical insurance
- Creation of new business models
 - private businesses in health care



Promotion of e-Health

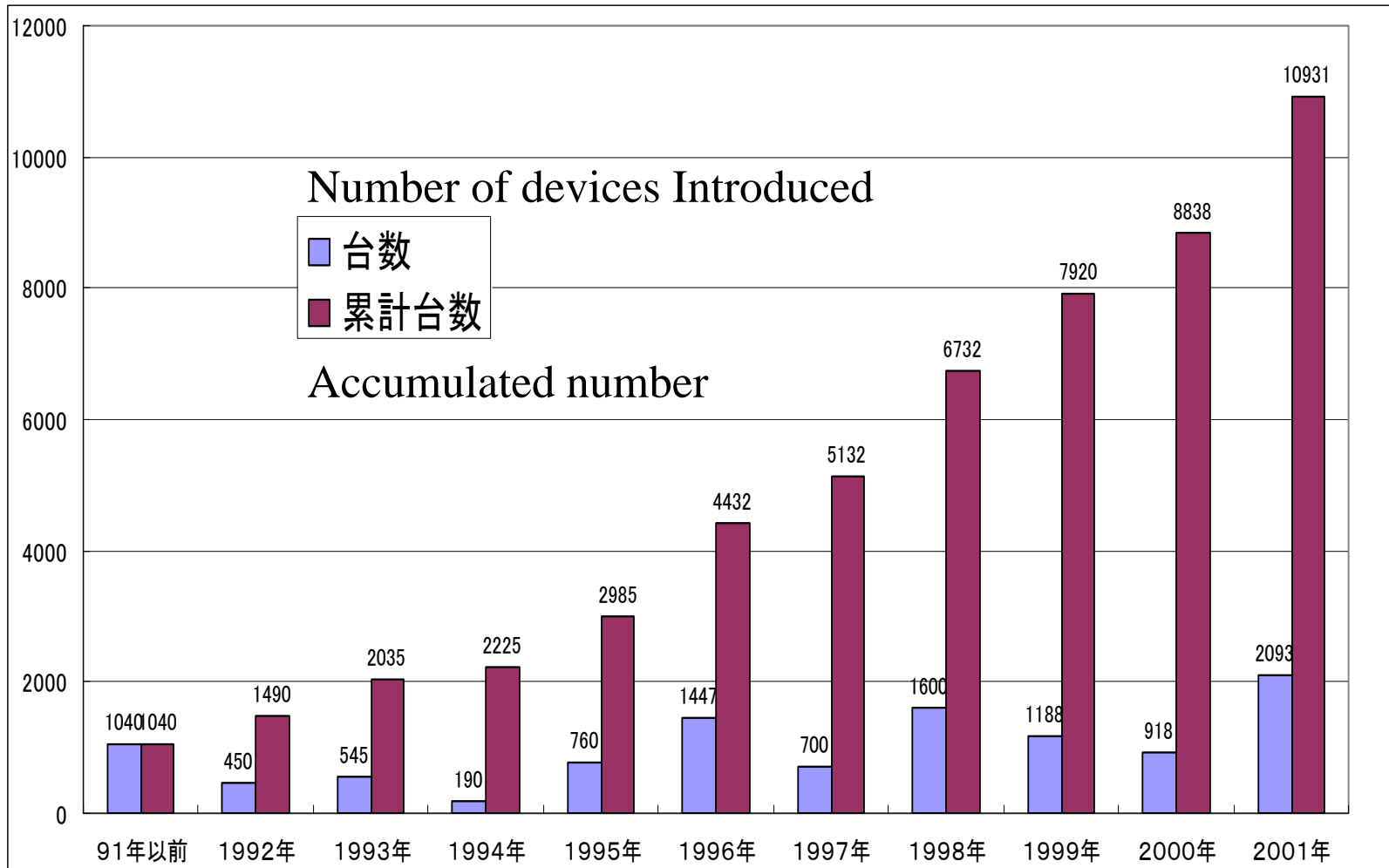
Reimbursements from medical insurance

No rewards for prevention of chronic
diseases by eHealth

Changes in medical insurance systems



Increase in eHealth System in Japan





Business Model

independent of public subsidies

Using cloud computing

Service: provision and management
of eHealth



Happy Marriage of Economics and eHealth!

Join ISfTeH eHealth
Economics Working Group!