

壽命是否有上限？

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Outline

- Why should we care ?
- No limits? There is a limit?
- Empirical studies from Taiwan and other countries
- Which view should we take?

壽命延長是近年來的趨勢

○ 古語有云：「人生七十古來稀」，但台灣地區1957年男性約有41% (女性54%) 可活到70歲，2000年男性則增為67% (女性82%)。

→ 似乎變成「人生七十才開始」，活到70歲的男性平均餘命為13.18歲，女性為15.04歲。

註：資料來源為內政部完全生命表。



Soon they may live for 200 years

THE day may come when people will celebrate the start of middle age on their 100th birthday. Some of the world's most eminent experts on ageing have predicted that average life expectancy in the developed world could rise to 200 years by the end of the century.

From the end of the 19th century to the present day, the average life span has almost doubled. In new research some scientists predict a jump of even greater proportions over the next 100 years, thanks to advances in genetic medicine.

Out of 60 experts on ageing who were asked to predict life expectancy for a baby born in 2100, more than half believed it would be more than 100 years. Seven who were interviewed in the research project for the *Journal of Anti-Aging Medicine* believed it could be between 150 and 200.

If such a change were to happen, it would mean a world dominated by the over-100s and a radical increase in the retirement age.

In the past century, increases in life expectancy were a result of cleaner living conditions and

Roger Dobson and Nina Goswami

the defeat or control of mass infectious diseases, such as smallpox and tuberculosis. Over the next century, scientists say genetic advances will push the average life span significantly higher.

Michael Fouquet, clinical professor of medicine at Michigan State University, was among the experts who thought life expectancy could rise to 200 years or more. He said: "People haven't realised it, but we are in a similar position to the 1870s with regard to stopping the spread of infectious diseases."

"As you get older, your cells slowly stop repairing themselves. I think we are going to be able to reverse that process and, through genetic intervention, will be able to tell the cells to repair themselves."

Other experts interviewed for the study agreed that dramatic advances in genetic research may unlock the secrets to long life in this century. Elizabeth Blackburn, professor of biochemistry at the University of California, San Francisco, said

life expectancy could reach 175 years in 2100.

She said: "In experiments in small animals, when some genes are mutated away from their natural form, they can increase life span twofold. We don't yet have an easy picture of how this might work in humans, but it's theoretically possible. We know there is a genetic component [affecting ageing] but don't yet know whether it will be a few genes or a large number."

The sequencing of the human genetic code — or genome — is the main reason for the predictions of such dramatic increases in average life spans. The breakthrough was made four years ago by two parallel projects to map human DNA: a private-sector venture led by American scientist Dr Craig Venter and the international state-funded human genome project, in which the Sanger Centre in Cambridge played a leading role.

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He said: "Most people would have predicted that, with the removal of most causes of premature death through infectious disease, life expectancy would start to reach a plateau. What has taken people by surprise is

that over the past 25 years we have seen expectancy increase, which tells us the ageing process is undergoing change."

Kirkwood believes most of the gains in life expectancy have already been made and that there is little prospect of a genetic breakthrough this century that will reverse ageing. He estimates life expectancy will be 90 by the year 2100.

He said: "Living for 200 years is unrealistic. To do that we would have to wipe out things like cancer, heart disease and other major health problems. Despite the billions being spent on these areas, that type of eradication of disease is frustratingly slow."

It is not just genetic advances that may boost longevity. Research on animals has shown that reducing caloric intake can increase life span by 30%. Scientists are now trying to develop a "magic bullet" that could simulate the effect of calorie restriction without people having to eat less. Research published last week suggested this could be done by a protein, Sirt1, which controls when cells store or release fat.

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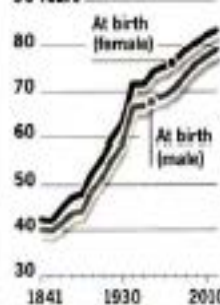
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The great leap

Life expectancy in England and Wales

90 Years



Unlocking the secrets to long life

DNA

Scientists believe interventions in the ageing genes may be able to counteract the effects of old age



Nutrition
A significant reduction in calorie intake may be able to increase lifespan by up to 50%. Scientists are now trying to devise drugs that will mimic the effects of eating less

Beating disease

Human trials are already being conducted on cancer vaccines that stimulate the body to attack cancerous cells. In future decades, it may be possible to reverse heart disease by replacing diseased cells with healthy functioning ones



Stem cell research

Doctors last month announced that within the next decade people may be able to grow new teeth from stem cells implanted in their gums. As the method develops, faulty organs could be replaced or repaired as the body begins to deteriorate

Since 1875

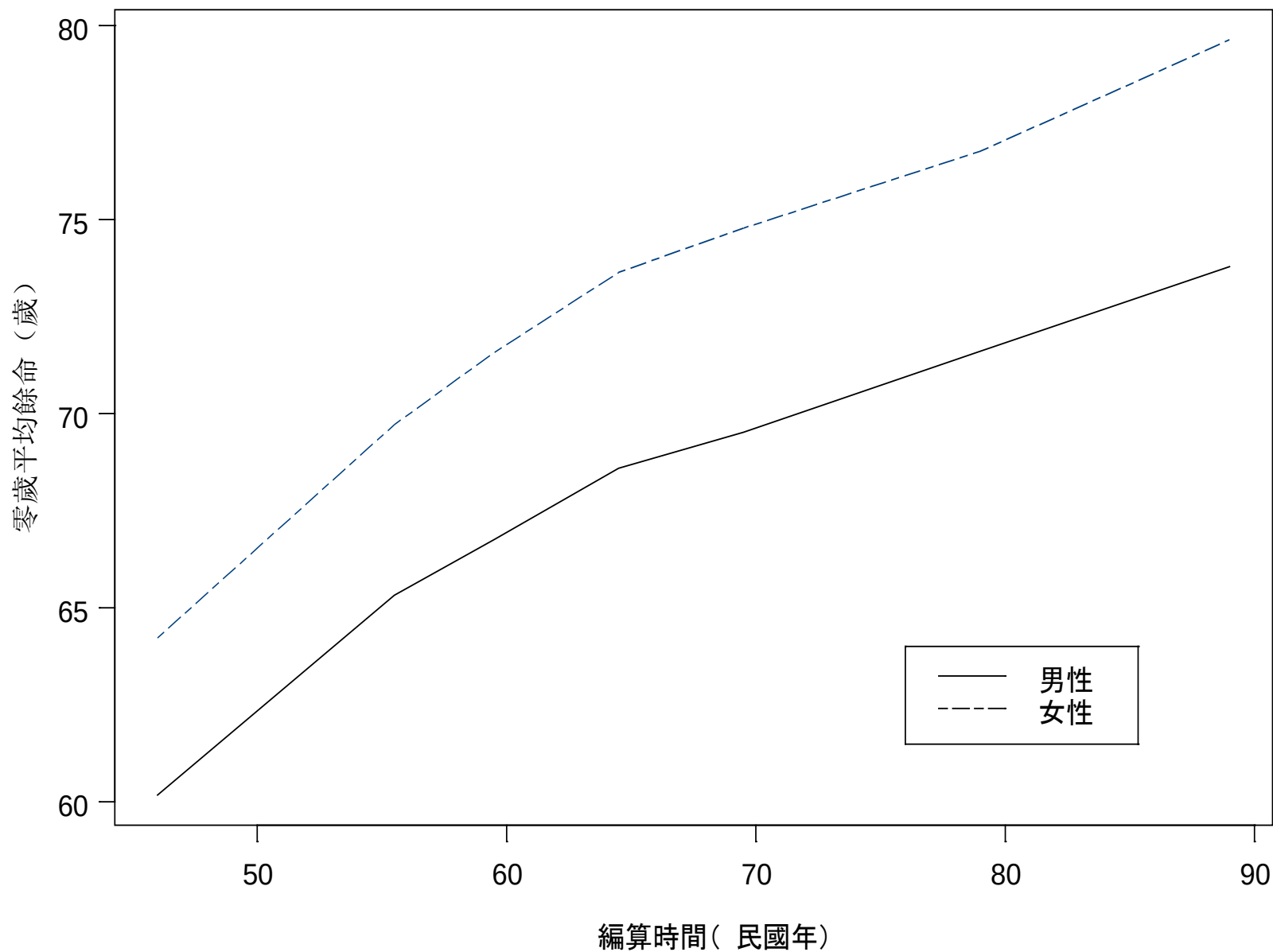
The longest recorded lifespan for a human, Jeanne Louise Calment, a Frenchwoman, was born on February 21, 1875 and died in 1997 at the age of 122 years and 164 days

Andorra in the Pyrenees has the highest life expectancy in the world, at 83 years. Mozambique has the lowest life expectancy in the world, at 51 years

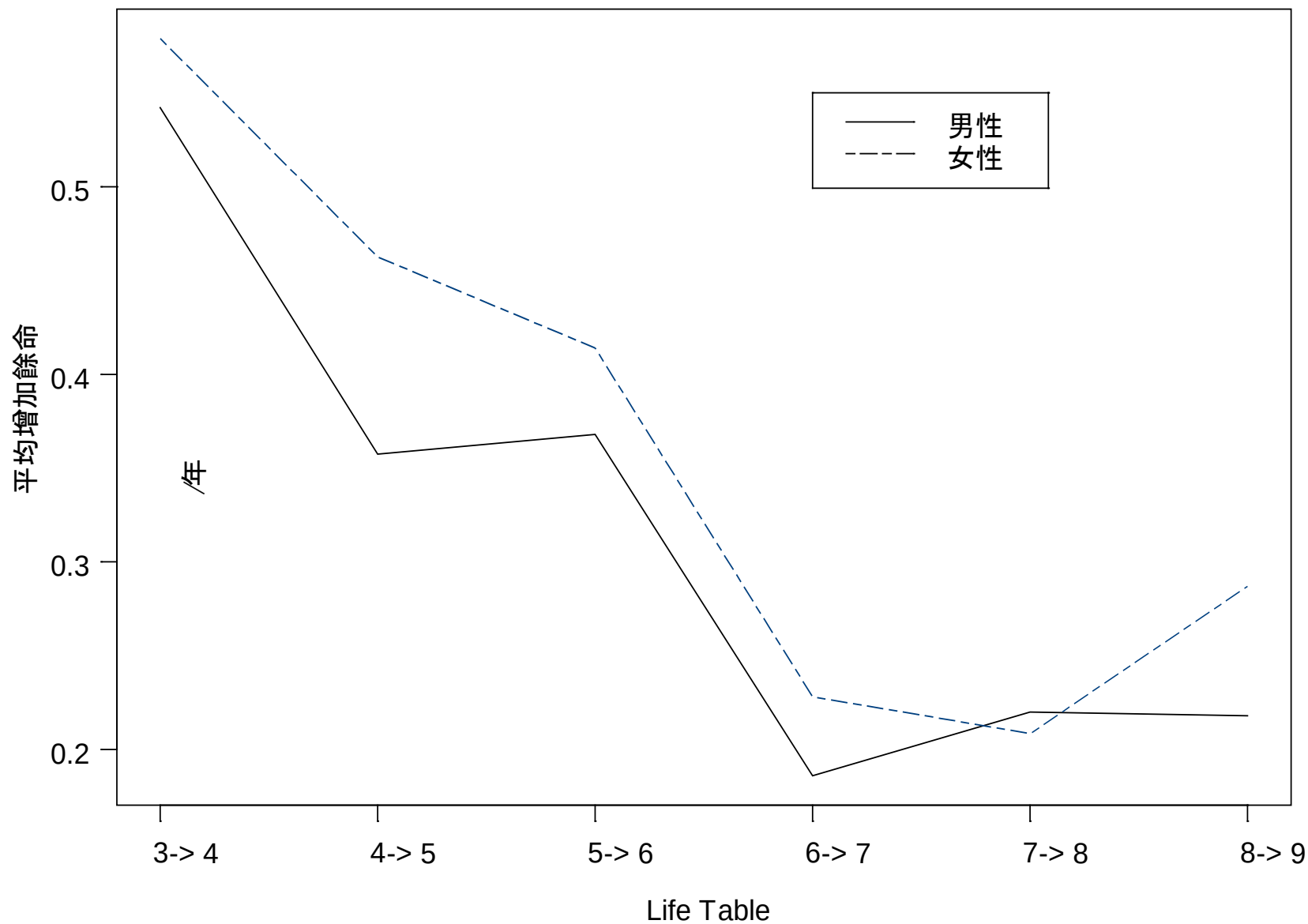
Older, bolder and better
The Magazine, pages 28-36

Sunday Times 06/06/04

台灣地區歷次國民生命表零歲平均餘命趨勢



台灣地區歷次國民生命表零歲平均餘命延長趨勢（歲 /年）



壽命延長代表的意義

- 平均每年延長0.2歲至0.3歲的平均壽命（及平均餘命），代表死亡率逐年降低。
- 如果以今天的標準規劃未來，將會產生不小的差異與問題。



Why should we care ?

- 對個人而言
 - 退休生活的規劃
- 對保險公司而言
 - 壽命延長對財務的影響
 - 壽命延長對費率計算的影響
- 對政府而言
 - 社會福利的規劃
 - 保險公司的監理

Theory of Longevity

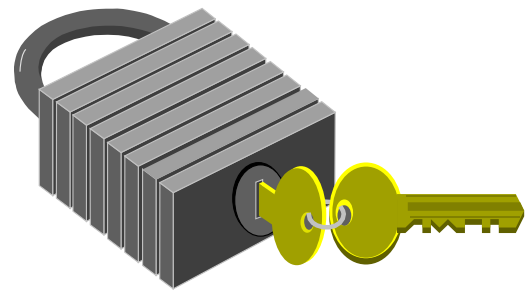
○ 國際間關於壽命的研究大致可分為兩派：

(1) There is a limit!

→ 不少生物學家及人口學家建議120歲為壽命上限。(1960年代大多認為85歲！)

(2) No limits!

→ 壽命將隨科技及生活改善而延長。



支持 “No Limits”的相關研究

學者	實證資料	實證結果
Oeppen and Vaupel (2002)	U.S.	Predicted a life expectancy of 100 in 2060
Wilmoth and Robine (2003)	Sweden	Found maximum recorded life span has been steadily increasing at least for 140 years
Robine and Vaupel (2002)	IDL	Reported that a probability of dying at age 110 of 0.52

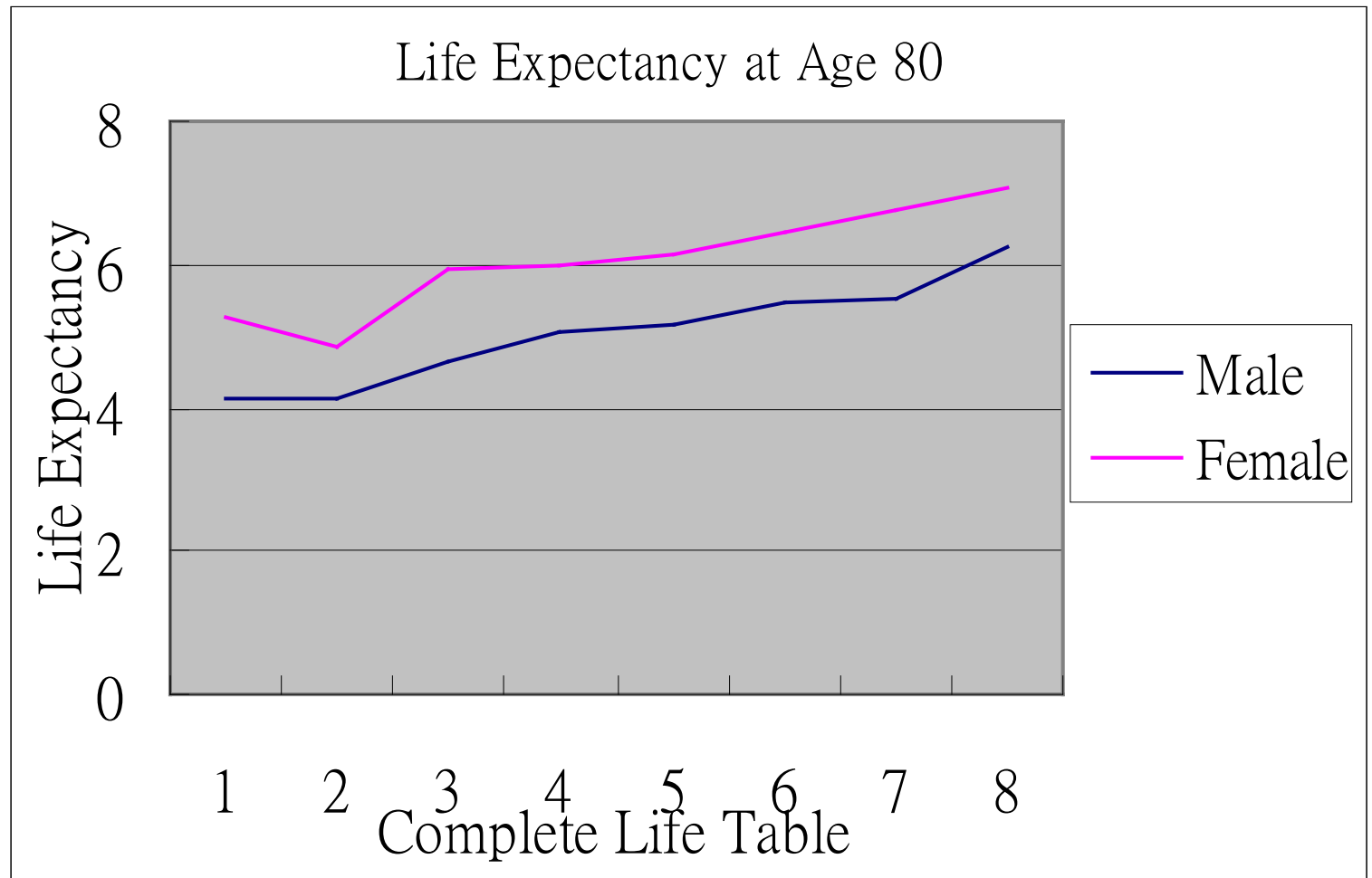
支持 “There is a Limit”的相關研究

學者	實證資料	實證結果
Carner et al. (2003)	U.S.	Discussed biological evidence for limits to the duration of life
Olshansky and Carner (2004)	U.S.	Estimated the current impact obesity on life expectancy is about 3.5 years

以實證資料探討壽命上限

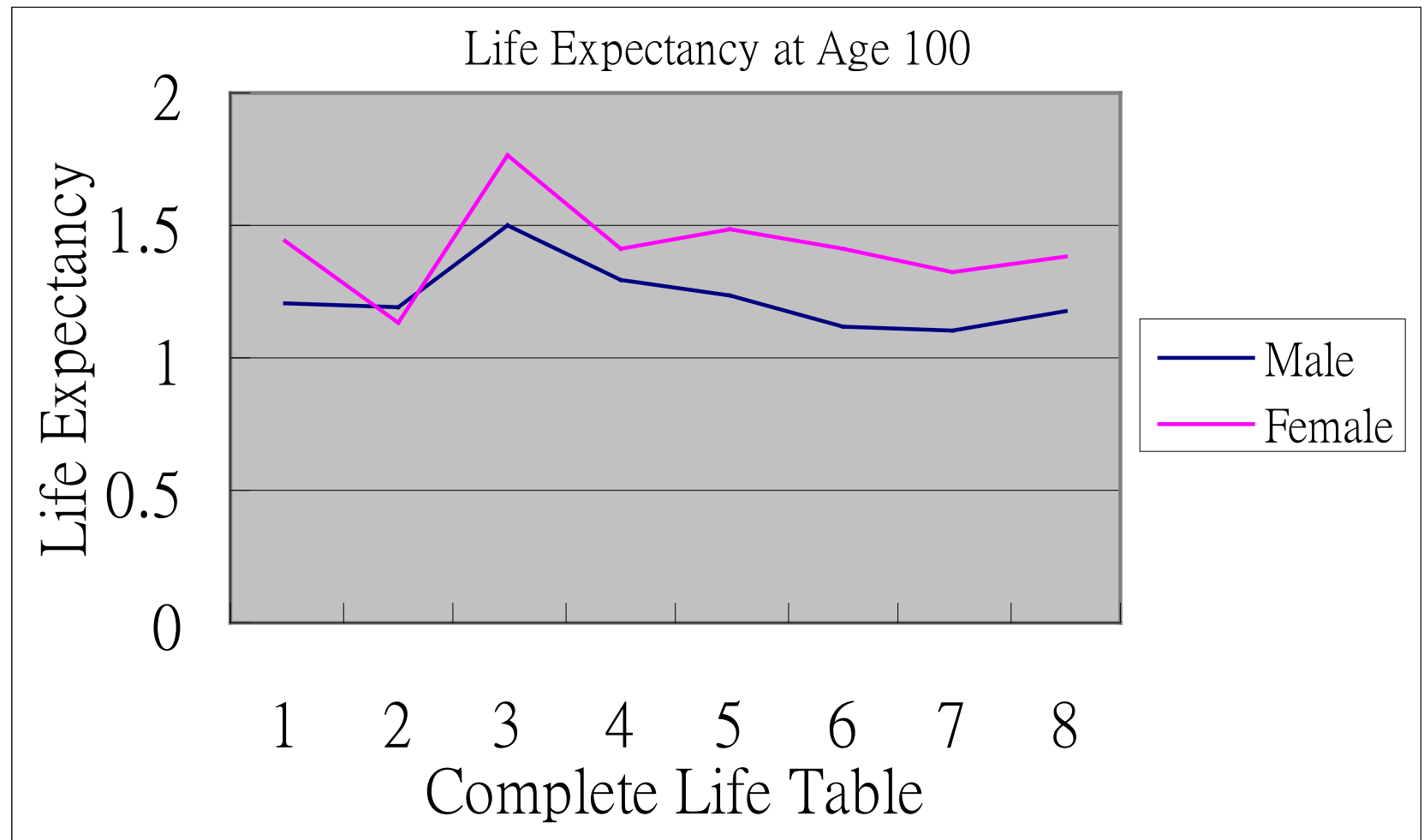
- 台灣歷年普查、完全生命表
- 美國人口普查、老人健康保險
(Medicare)
- 國際長壽資料庫
(International Database on Longevity)

台灣地區的實證資料(完全生命表)



Data source: Department of statistics, Ministry of the Interior, Taiwan

台灣地區的實證資料(完全生命表)



Data source: Department of statistics, Ministry of the Interior, Taiwan

Social Security Administration Death (U.S. Male)

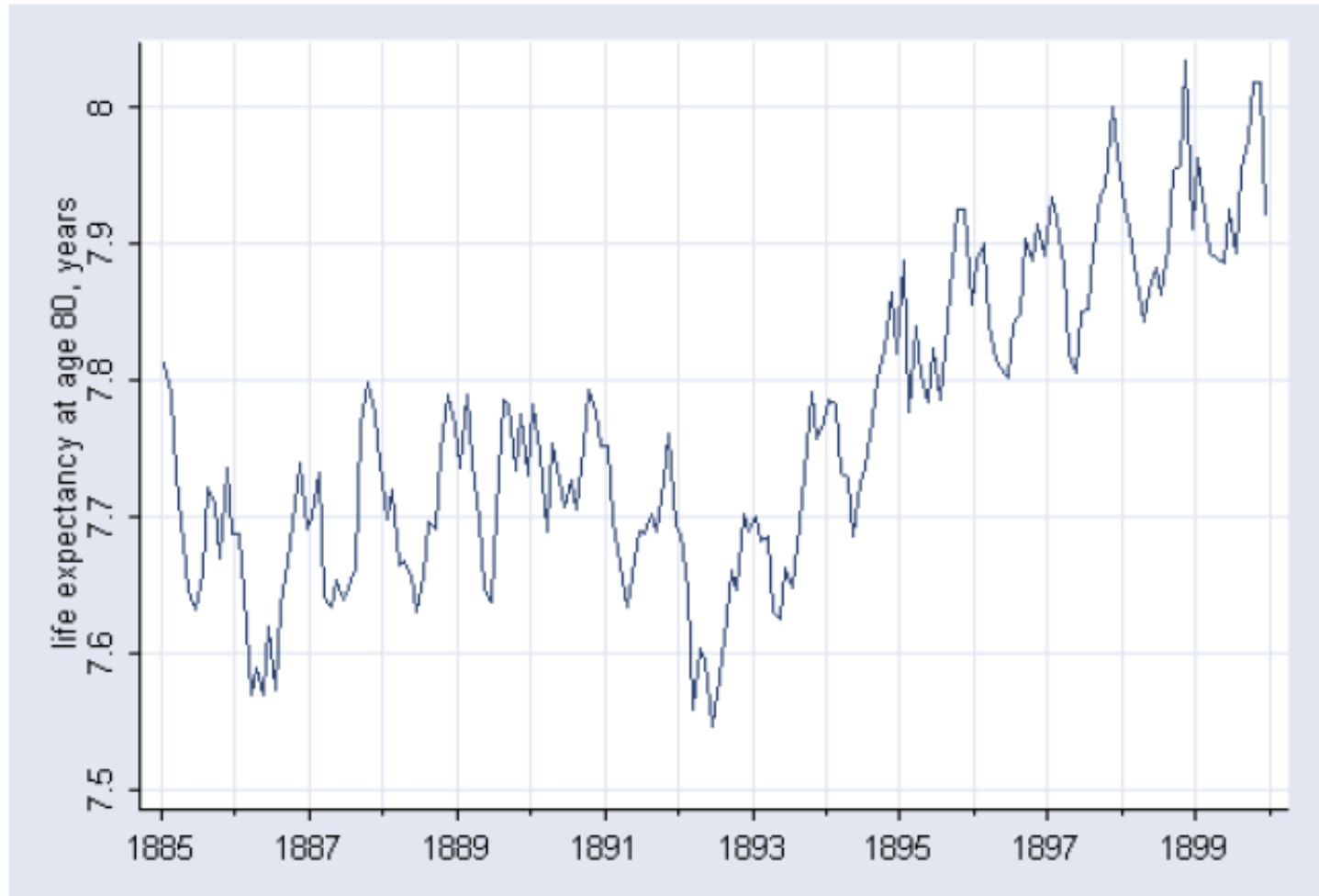


Figure 9. Periodic seasonal changes in life expectancy at age 80 for 1885-1899 birth cohorts depending on month of birth.

Social Security Administration Death (U.S. Male)

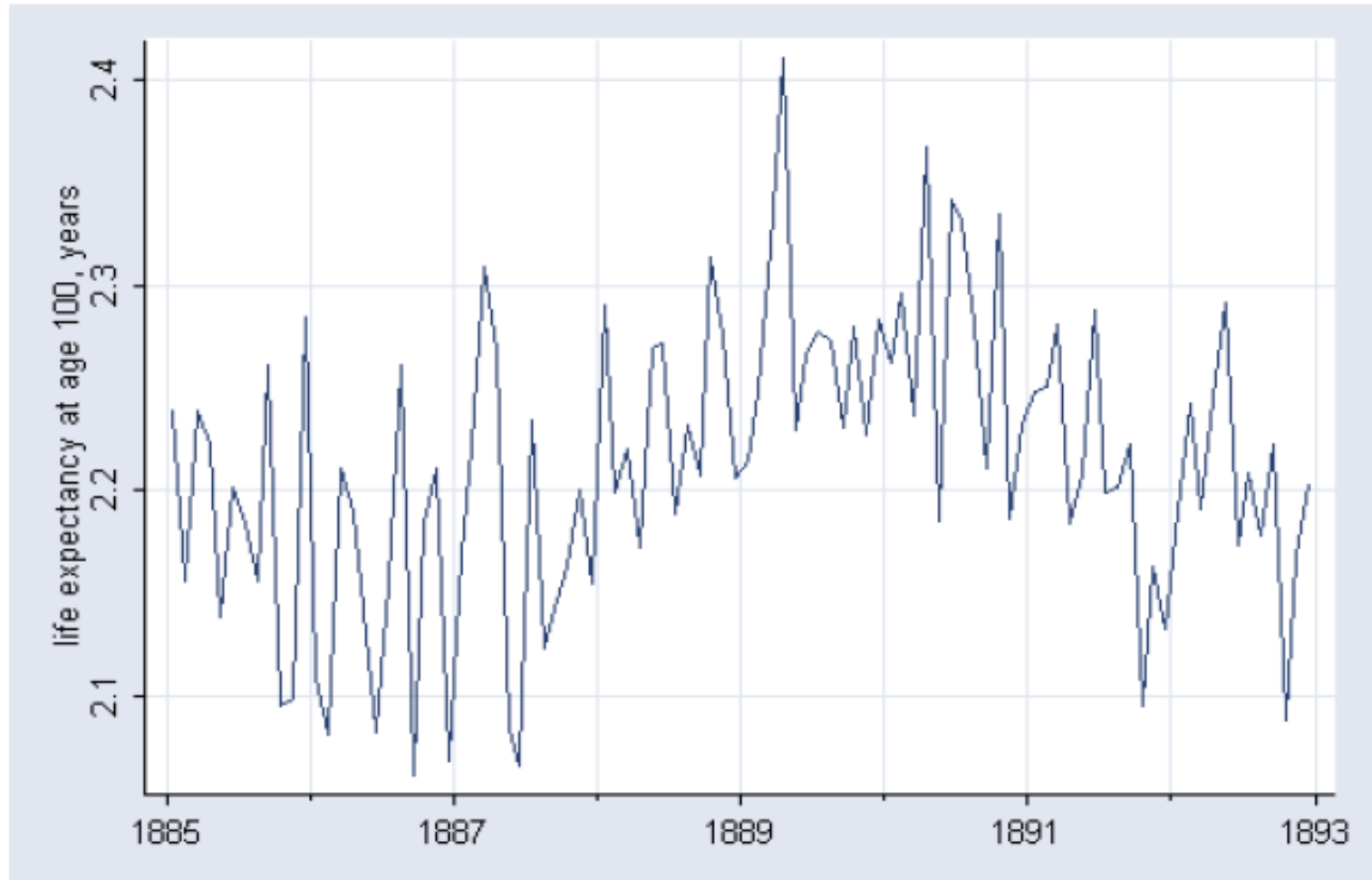


Figure 11. Life expectancy at age 100 for 1885-1893 birth cohorts.

美國百歲人瑞

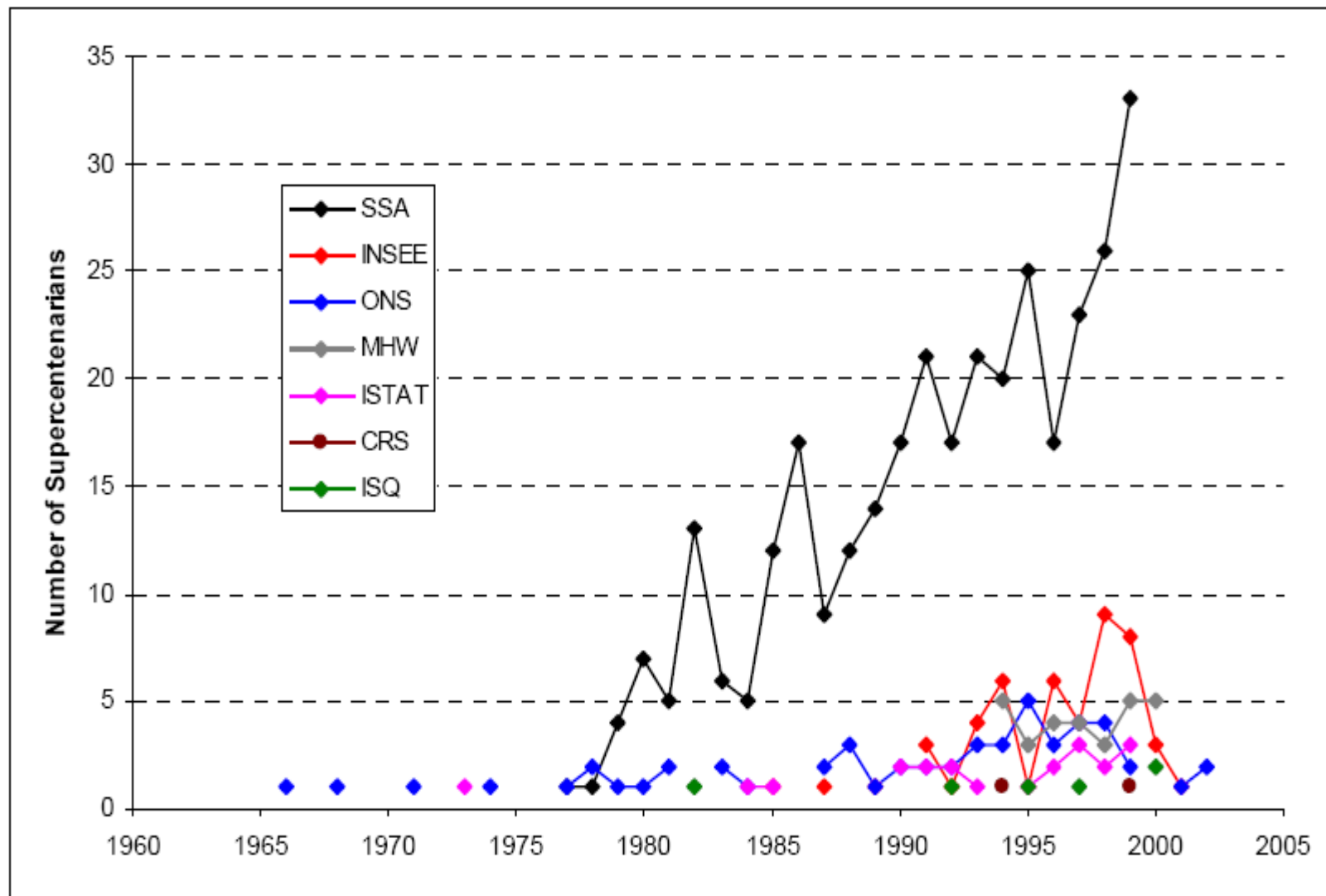
○ 美國1990年及2000年百歲人瑞人數

	Medicare	Census
1990年	22,000	37,000
2000年	33,000	50,000

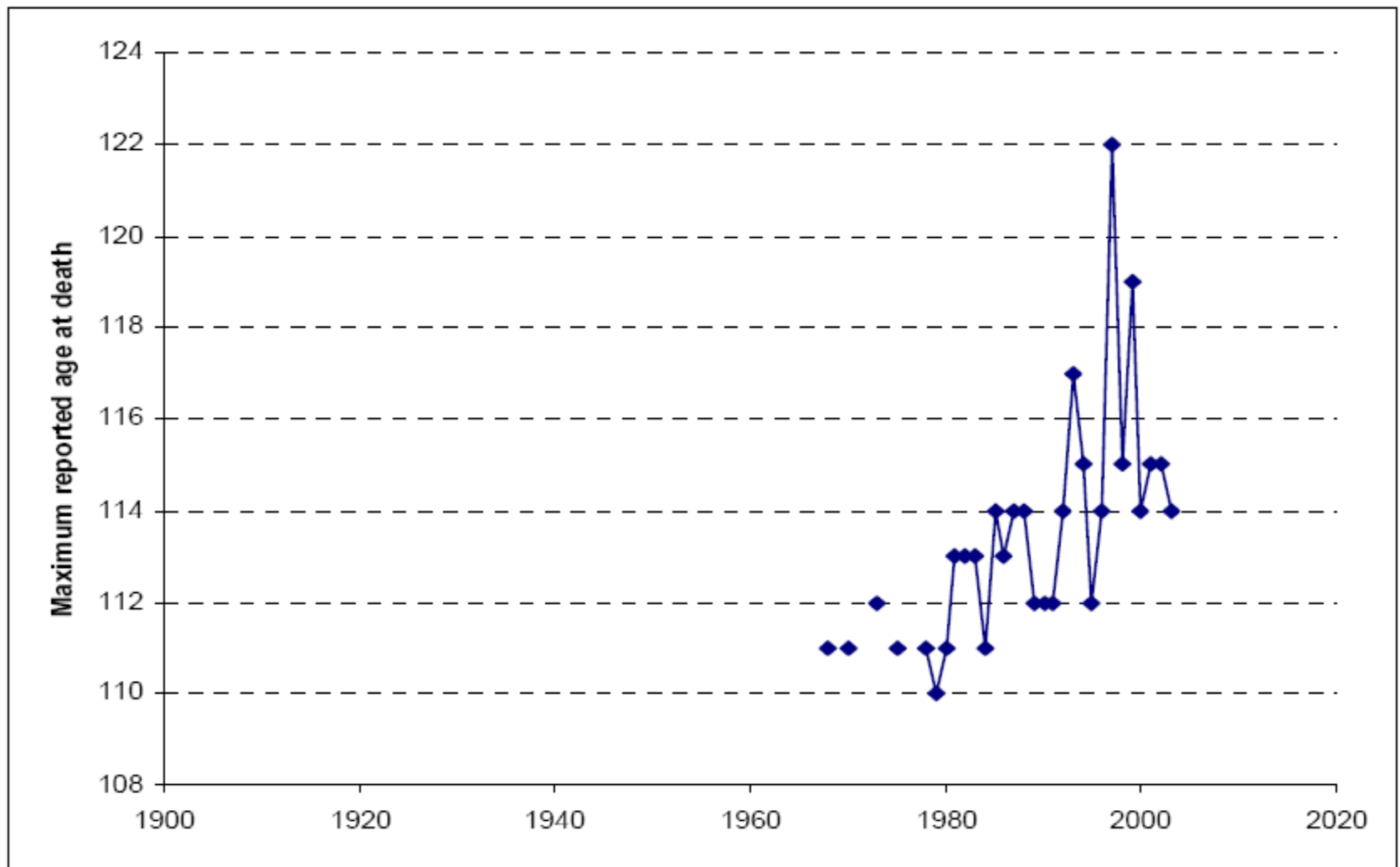
→ 無論以哪一個資料庫估計，百歲人瑞在10年間增加速度非常快。

註：美國也有110歲以上的老年人研究

<http://www.supercentenarians.org>

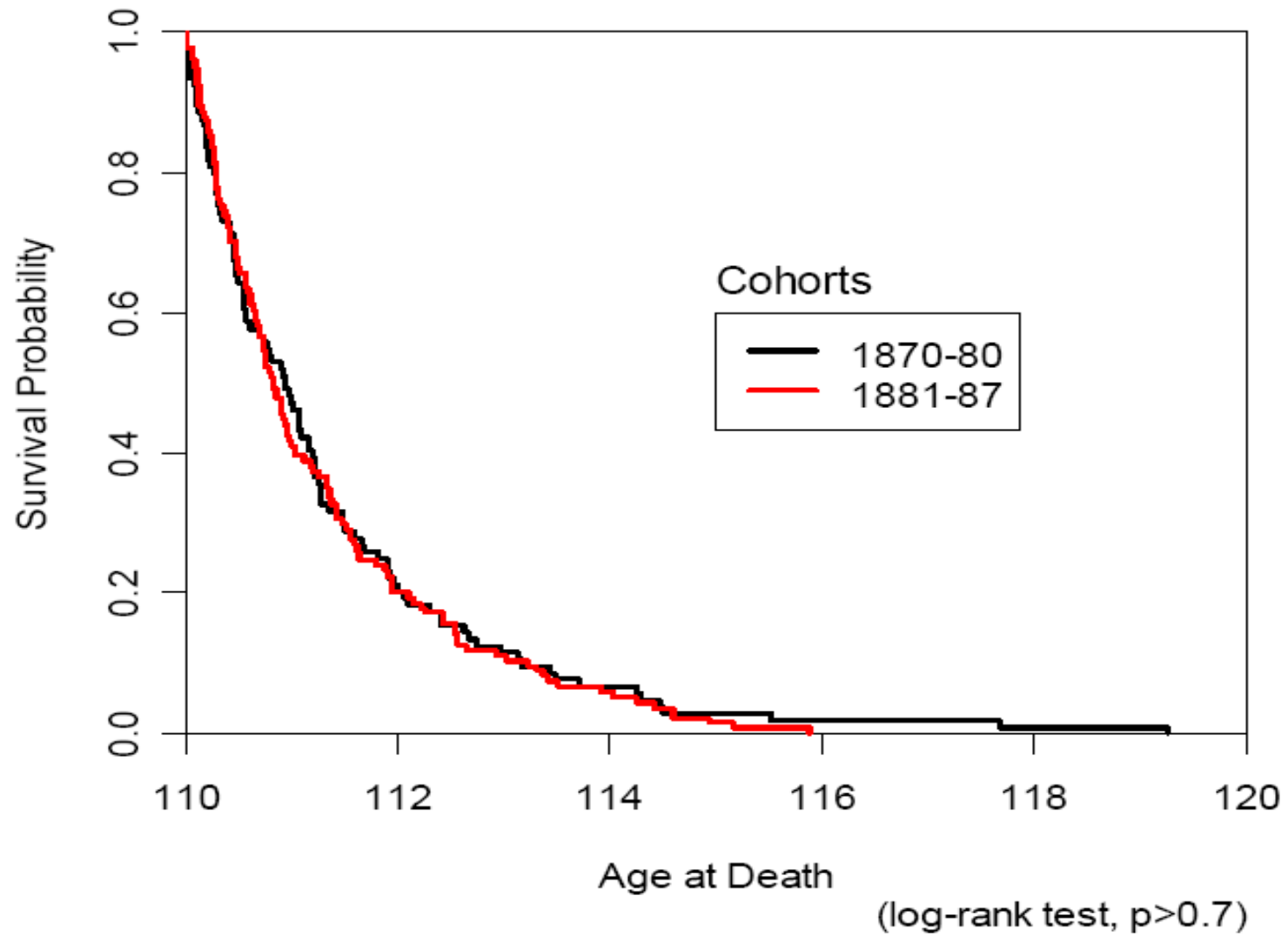


近年世界各國110歲人瑞人數記錄



歷年世界各國最高紀錄的死亡年齡

USA, Females



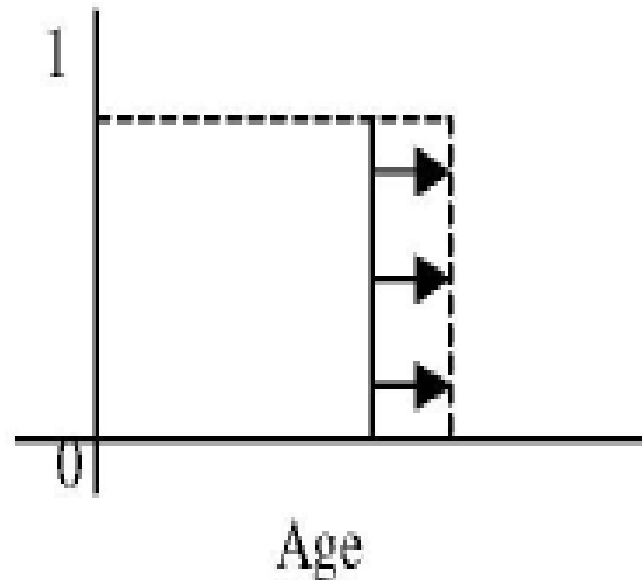
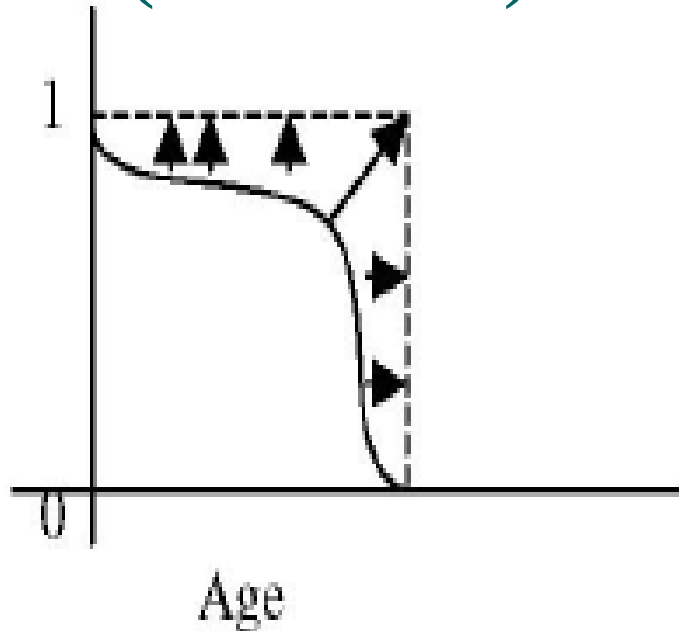
近十年110歲人瑞存活機率比較

實證資料小結

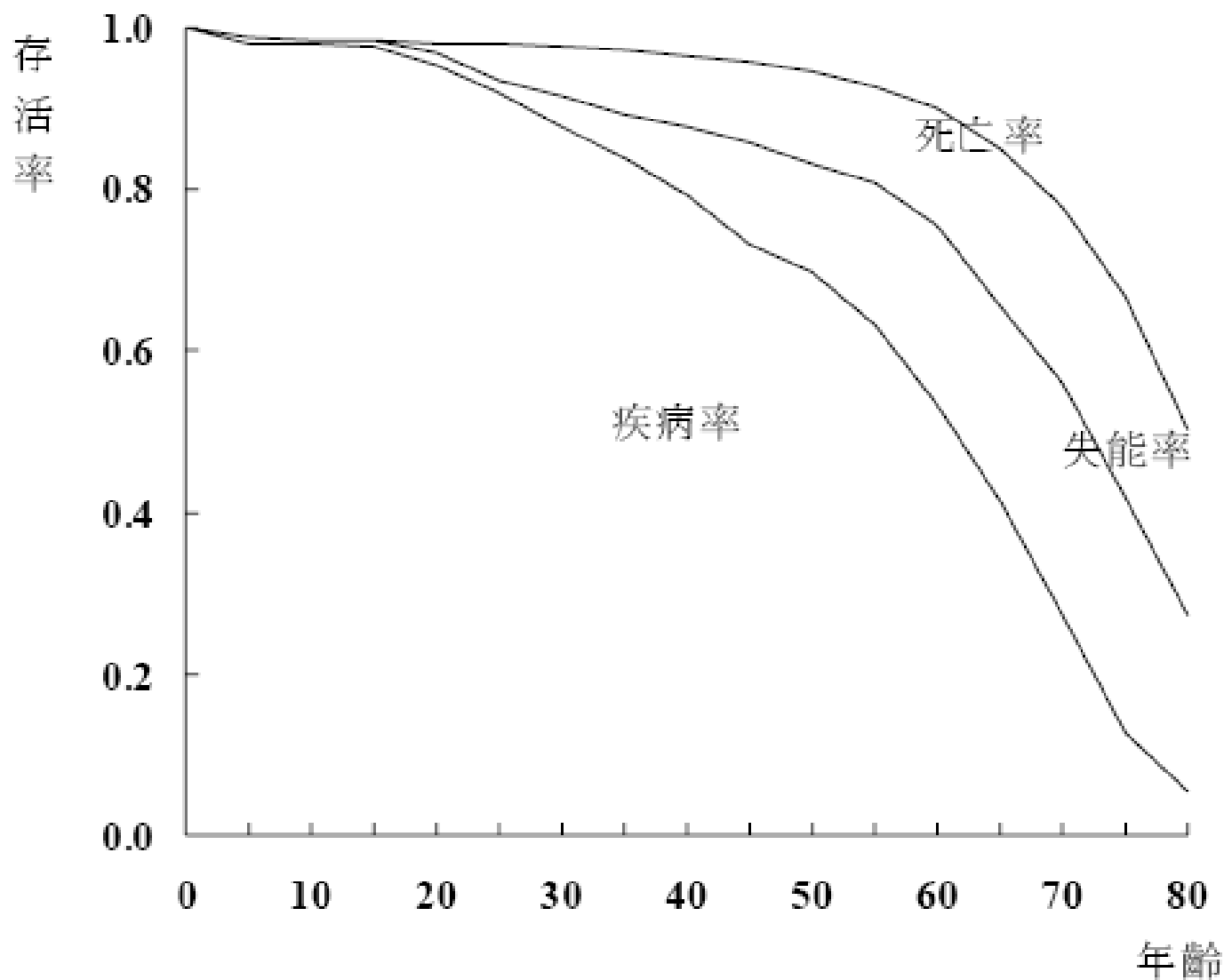
- 80歲人口的平均餘命有延長的趨勢，100歲人口卻無明顯增加。
 - 百歲人瑞人數逐年增加，最高死亡年齡也超過120歲。
- 雖然缺乏證據顯示壽命將無限延伸，但壽命確實有遞增的趨勢，如果退休年齡維持65歲，退休之後的生活安排將受到更多的關注。

Two Views of Mortality Improvement

- Rectangularization on the left
(There is a limit)
- Steady progress on the right
(No Limits)



World Health Organization (1984)



Which View Shall We Take?

- 無論壽命是否有上限，未來必須面對與老年相關的議題，包括：
 - 死亡率
 - 失能率
 - 罹病率

世界主要國家零歲平均壽命

國家別	資料時期	男性	女性
中華民國	1999-2001	73.79	79.63
日本	2000	77.70	84.60
南韓	1999	71.70	79.20
新加坡	2000	76.00	80.00
中國大陸	1990	66.80	70.50
美國	1998	73.80	79.50
奧地利	1999	75.10	81.00
丹麥	1999	74.20	79.00
法國	1998	74.80	82.40
德國	1999	74.70	80.70
義大利	1995	74.60	81.00
芬蘭	1999	73.80	81.00
挪威	2001	76.20	81.50
瑞典	1997	77.10	81.90
英國	1998	75.10	80.00
澳大利亞	1997	76.20	81.80
紐西蘭	1997	75.20	80.40

延壽與死亡率

- 台灣地區各年齡層死亡率逐年下降，其中老年人死亡率下降的比例更為明顯，對壽命延長的貢獻尤為明顯。
- ➔ 換言之，老年人死亡率變化大，但老年人人數較少，死亡率的估算將有較大的誤差與不確定性。

	Age 30	Age 89	Ages 90~94	Ages 95~99	Ages 100+
Total Population	352,879	12,597	23,898	11,190	2,484

Figure 2.1 Life Expectancy change of the male vs. Age group

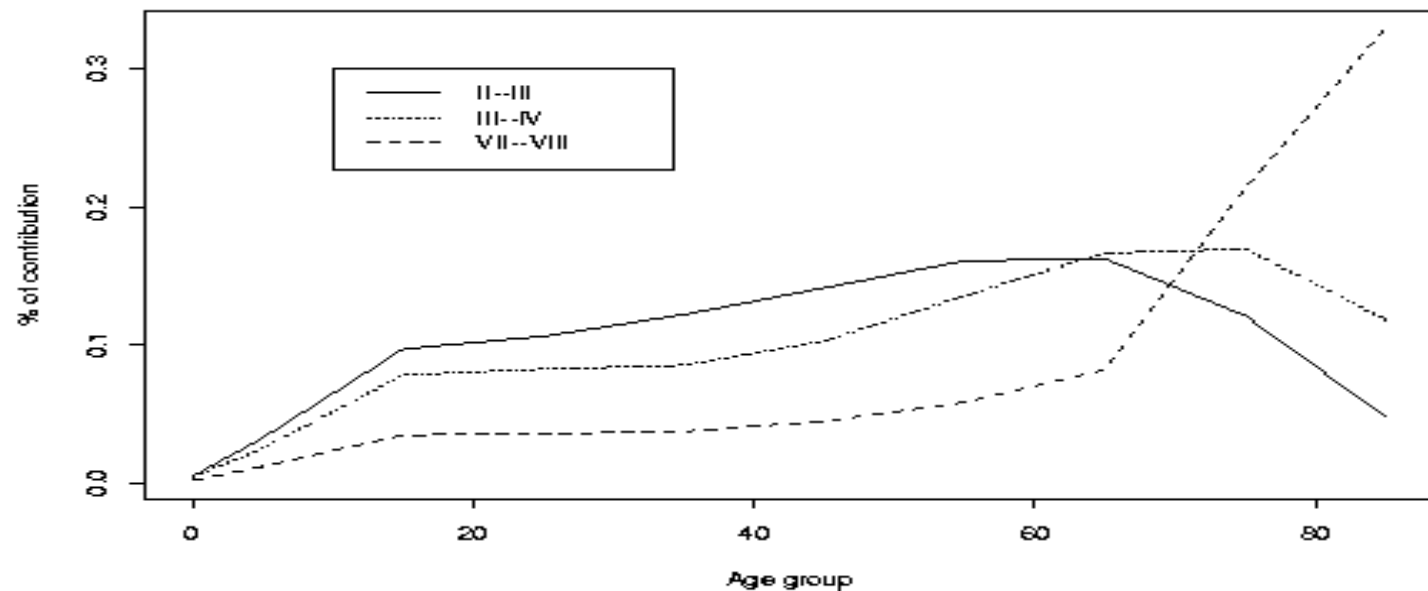
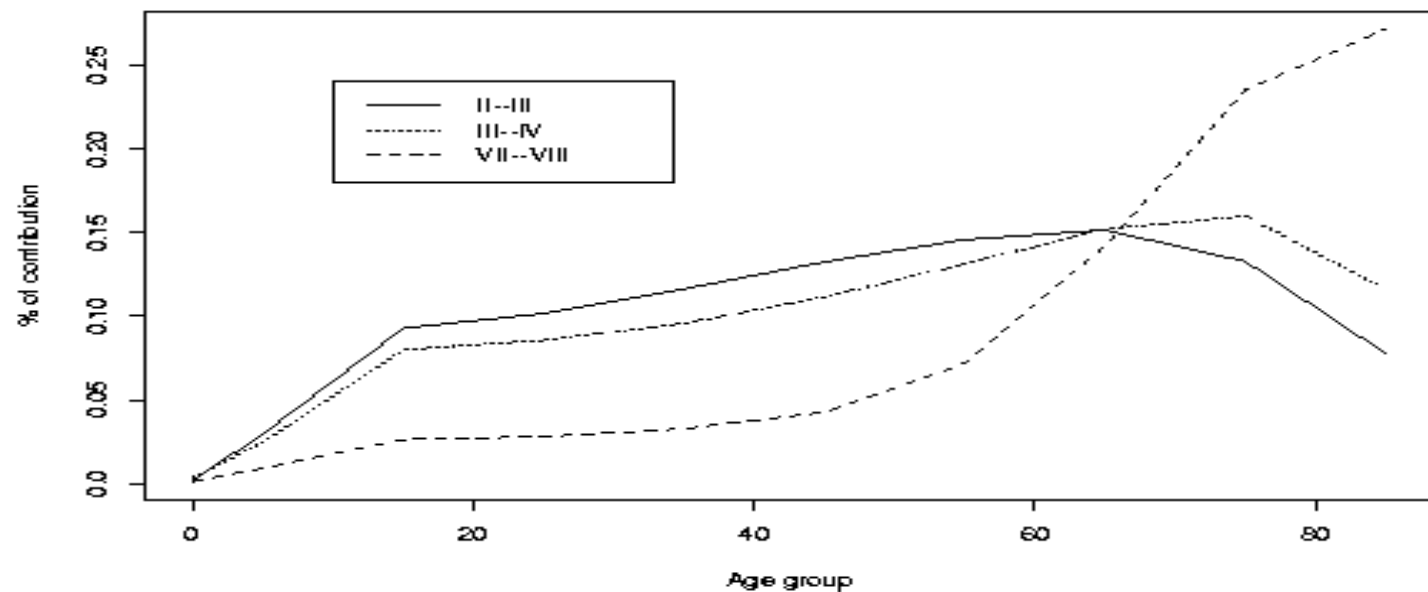


Figure 2.2 Life Expectancy change of the female vs. Age group



各年齡層對壽命延長的貢獻(台灣男性)

	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94
Tables I to II	0.003	0.027	0.073	0.090	0.103	0.178	0.195	0.177	0.114	0.036
Tables II to III	0.004	0.032	0.097	0.106	0.122	0.141	0.161	0.162	0.121	0.048
Tables III to IV	0.004	0.025	0.078	0.082	0.085	0.103	0.136	0.167	0.170	0.118
Tables IV to V	0.002	0.026	0.071	0.078	0.089	0.078	0.080	0.132	0.219	0.183
Tables V to VI	0.003	0.016	0.048	0.049	0.056	0.066	0.083	0.157	0.237	0.221
Tables VI to VII	0.002	0.015	0.041	0.041	0.042	0.049	0.039	0.111	0.302	0.290
Tables VII to VIII	0.002	0.012	0.034	0.035	0.037	0.045	0.058	0.082	0.214	0.330

各年齡層對壽命延長的貢獻(台灣女性)

	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94
Tables I to II	0.013	0.024	0.076	0.087	0.120	0.158	0.176	0.165	0.138	0.048
Tables II to III	0.002	0.030	0.093	0.102	0.116	0.133	0.146	0.151	0.133	0.078
Tables III to IV	0.003	0.025	0.080	0.086	0.096	0.111	0.131	0.152	0.160	0.116
Tables IV to V	0.002	0.022	0.063	0.071	0.084	0.099	0.112	0.132	0.190	0.165
Tables V to VI	0.002	0.012	0.037	0.041	0.050	0.067	0.096	0.136	0.210	0.243
Tables VI to VII	0.001	0.013	0.040	0.042	0.047	0.061	0.077	0.103	0.164	0.290
Tables VII to VIII	0.001	0.009	0.026	0.028	0.033	0.043	0.072	0.142	0.235	0.271

→ 主要死因由傳染病轉變為中老年疾病
與慢性病。

1935年台灣地區五大主要死因

順序	1	2	3	4	5
主要死因	肺炎	腹瀉腸炎	其他傳染病 與寄生蟲病	呼吸器官結核	先天性弱質

2001年台灣地區五大主要死因

順序	1	2	3	4	5
主要死因	惡性腫瘤	腦血管疾病	心臟疾病	事故傷害	糖尿病
佔總死亡 人數比例	26.05%	10.37%	8.69%	7.51%	7.19%

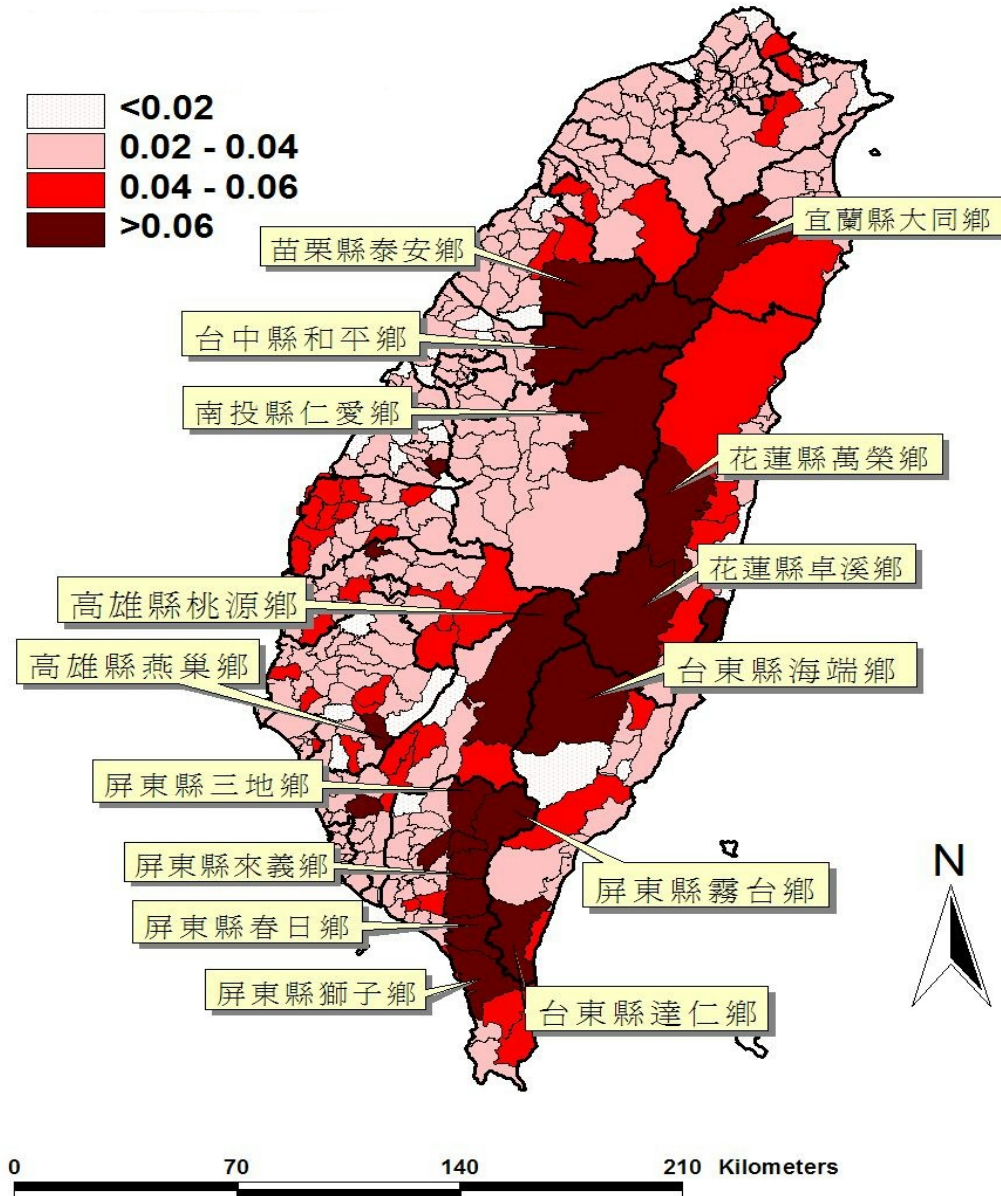
延壽與失能(Disable)

- 高齡人口有較高的失能率

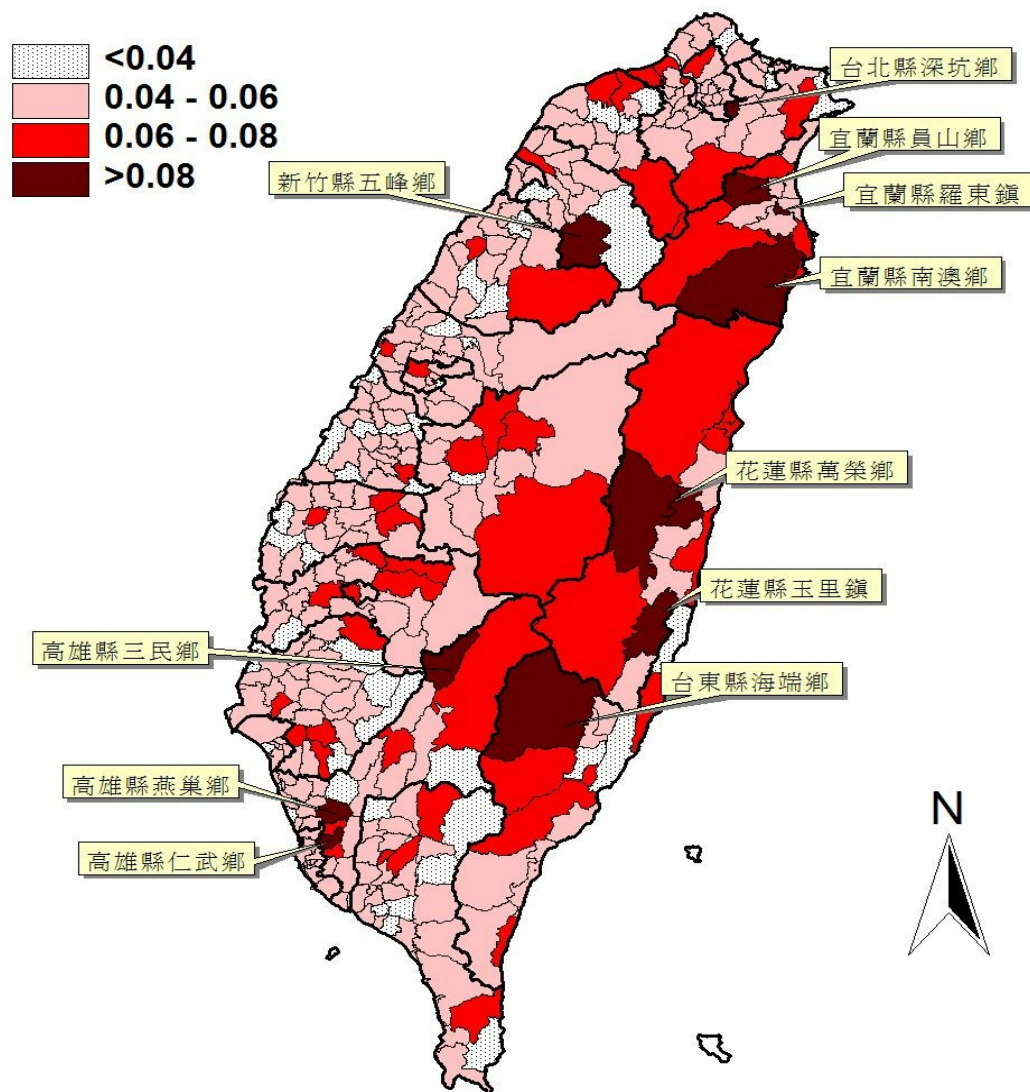
→ 2000年台灣地區65歲以上人口失能率為9.12%、0-64歲為0.57%、也就是說高齡人口為非高齡人口的16倍。

→ 其中失能高齡者又需要較多的照護。
例如：輕微失能比例在0-64歲為45.2%，但在65歲以上為38.0%。

台灣2000年高齡老人輕微失能比例



台灣2000年高齡老人重度失能比例



延壽與罹病

- 老年人罹患重大傷病、慢性疾病者的比例較高
- 資料來源：
 - 衛生署國民健康局
 - 內政部統計處
 - 全民健康保險資料庫

老人主要罹病率(1989, 1993, 1996)

單位：%

性別/年期 疾病別	男			女		
	1989 (n=2313)	1993 (n=1781)	1996 (n=1493)	1989 (n=1736)	1993 (n=1370)	1996 (n=1176)
關節炎	(1) 24.4	(2) 26.1	(3) 24.1	(1) 38.0	(3) 24.0	(2) 28.3
高血壓	(2) 23.8	(1) 31.1	(1) 33.6	(2) 30.2	(1) 31.1	(1) 31.2
胃腸潰瘍	(3) 22.3	(6) 11.9	(5) 16.4	(4) 26.0	(6) 12.2	(5) 17.4
呼吸道疾病	(4) 20.4	(5) 16.6	(6) 14.3	(6) 16.1	(5) 15.7	(6) 13.5
心臟病	(5) 17.5	(4) 22.3	(4) 21.0	(3) 27.3	(4) 21.4	(4) 21.0
白內障	(6) 11.2	(3) 24.2	(2) 26.4	(5) 18.8	(2) 26.8	(3) 25.0

資料來源：台灣地區老人保健與生活問題」調查，1989、1993、及 1996。衛生署國健局。說明：() 括號內數值為序位，序位僅限於三次調查均有之疾病。

第九次臺灣地區國民生命表死因除外零歲平均餘命

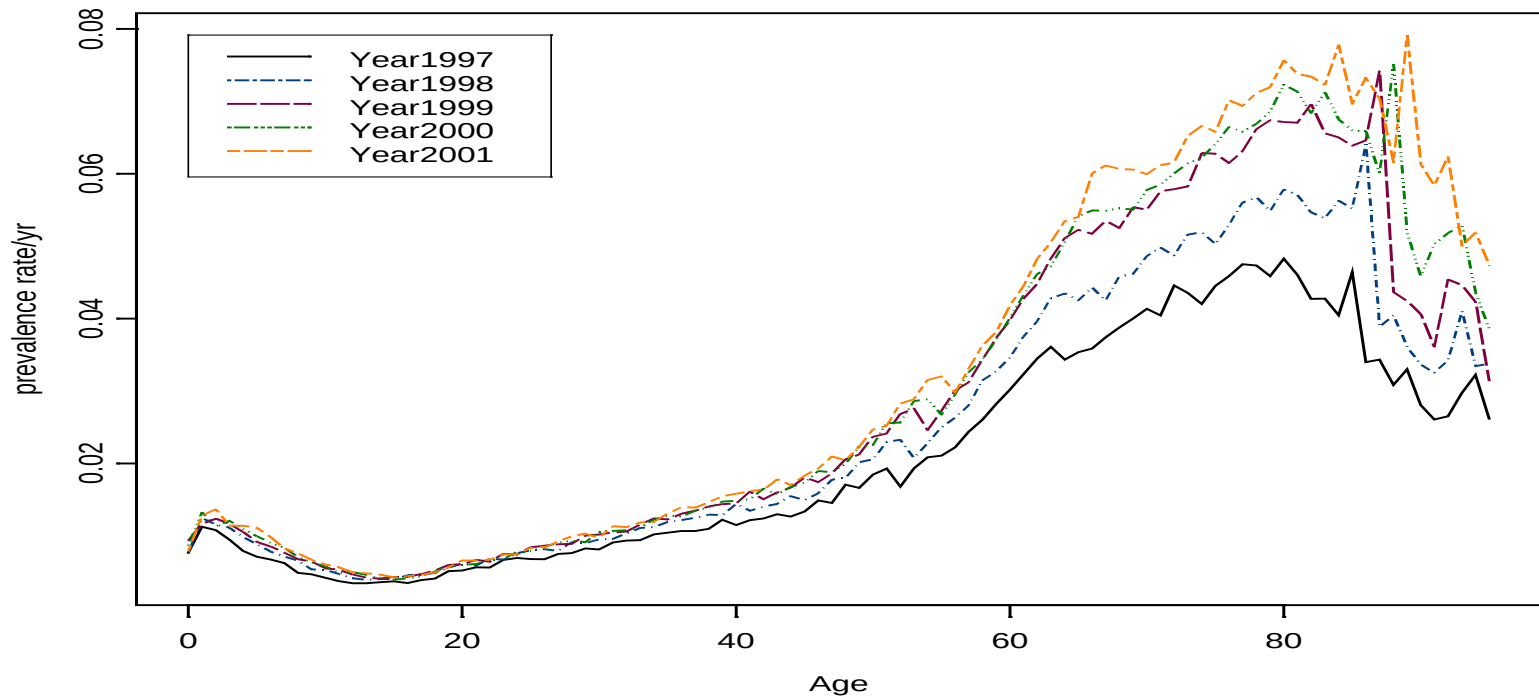
項目別	性	
	男	女
	零 歲 平均餘命	淨增加
臺灣地區國民生命表	73.79	—
特定死因除外國民生命表		
惡性腫瘤	77.72	3.93
意外事故及不良影響	75.48	1.69
腦血管疾病	75.07	1.28
心臟性疾病	74.87	1.08
糖尿病	74.53	0.74
慢性肝病及肝硬化	74.44	0.65
肺炎	74.13	0.34
腎炎、腎徵候群及腎變性病	74.09	0.30
自殺	74.11	0.32
結核病	73.96	0.17

第九次臺灣地區國民生命表死因除外零歲平均餘命

項目別	性	
	女	零歲 平均餘命
臺灣地區國民生命表	79.63	淨增加 —
特定死因除外國民生命表		
惡性腫瘤	82.31	2.68
糖尿病	80.99	1.36
腦血管疾病	80.91	1.28
心臟性疾病	80.59	0.96
意外事故及不良影響	80.43	0.80
腎炎、腎徵候群及腎變性病	80.05	0.42
慢性肝病及肝硬化	79.98	0.35
肺炎	79.87	0.24
自殺	79.81	0.18
高血壓性疾病	79.80	0.17

重大傷病盛行率現況

1997~2001 prevalence rate (Male)

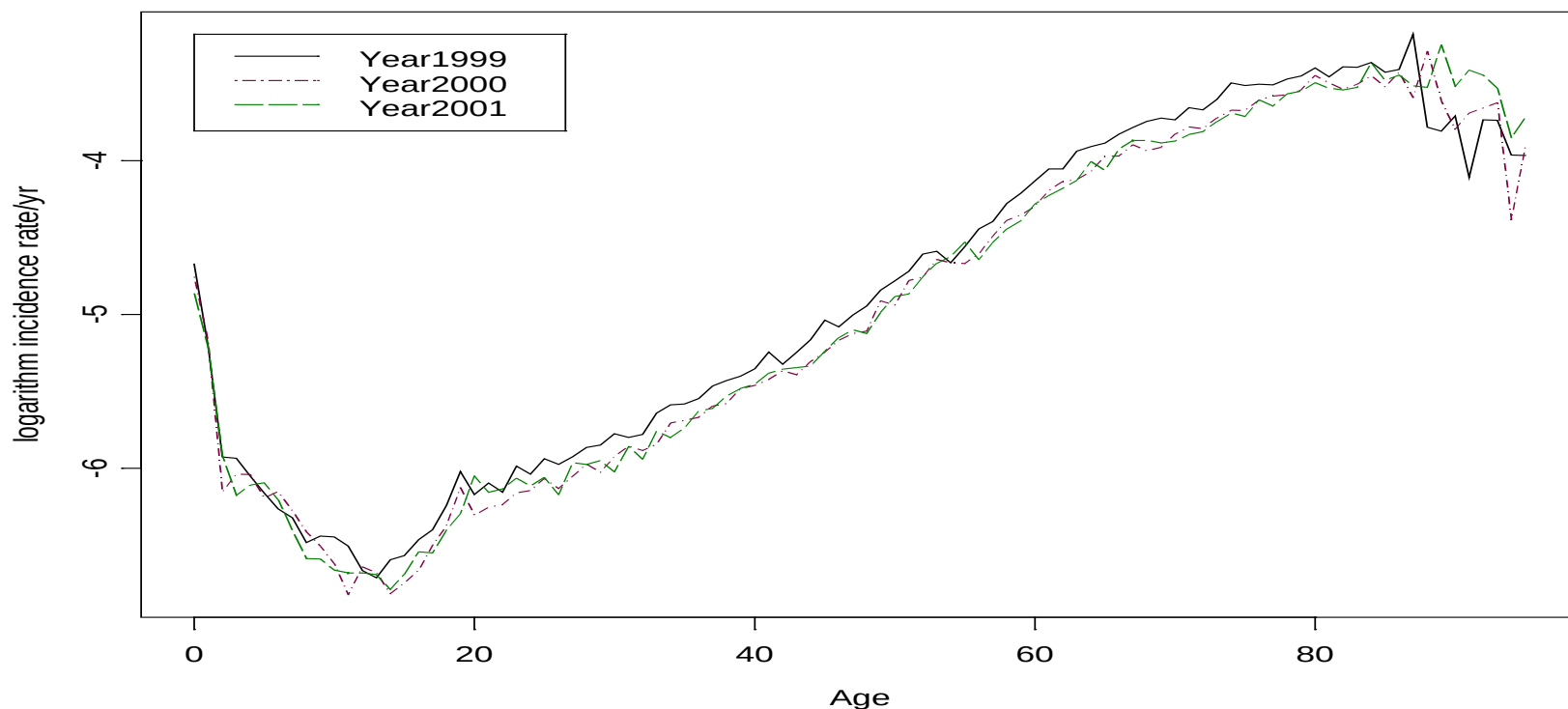


→ 重大傷病主要盛行40歲以上人口

→ 重大傷病盛行率逐年上升

重大傷病發生率現況

1999~2001 incidence rate (Male)



→ 重大傷病發生率15~85歲之間隨年齡上升

結論

- 無論壽命上限為何，壽命延長的情形各國皆然，未來的老年問題將成為重要的生活規劃。
- 壽命延長衍生消費者對更多方面的保險商品需求，包括生存保險、失能保險、健康保險等，對保險公司不啻為一重要的轉捩點。