The Actuarial Profession
making financial sense of the future

CMI Critical Illness Investigation

"*Critical Illness – MOT or Cosmetic Surgery?*" seminar
6 December 2006, Staple Inn

Dave Grimshaw
Secretary, CMI Critical Illness Committee

Agenda

- History of the CI investigation
- Key Challenges
- Recent Progress
- Results
- Future work

History of the CMI CI Investigation (1)

- Started life in 1995 reporting into the Mortality Committee
- Initial attempts at data collection failed
- Investigation re-launched from 1998 data
- Released results for 1998, 1999 & 2000 in 2003
- Problems in collecting and analysing data for 2001-2:
  - Delays in some offices submitting data
  - A significant number of data re-submissions
  - Data issues have forced us to exclude some offices whose data was used until 2000
  - Re-appraisal of treatment of dates of claim

History of the CMI CI Investigation (2)

- Results for 1999, 2000, 2001, 2002 & quad released in May 2005
- Working Paper 14:
  - Detailed methodology underlying 1999-2002 results
  - Estimate of overall grossing-up factor
- Working Paper 18:
  - Responses to feedback on WP14
  - Reasons for not graduating (yet)
- 1999-2002 data available to CMI members
- Working Paper 19 – "Per-Policy" data submission
- 2003 Results released in April 2006

The Holy Grail !

Age x	Duration 0	Duration 1	Duration 2	Duration 3	Dur
17	0.000193	0.000251	0.000294	0.000337	0.0
18	0.000194	0.000251	0.000295	0.000338	0.0
19	0.000195	0.000253	0.000297	0.000340	0.0
20	0.000196	0.000254	0.000298	0.000342	0.0
21	0.000197	0.000256	0.000300	0.000344	0.0
22	0.000199	0.000258	0.000302	0.000347	0.0
23	0.000200	0.000260	0.000305	0.000350	0.0
24	0.000202	0.000263	0.000308	0.000353	0.0
25	0.000204	0.000265	0.000311	0.000357	0.0
26	0.000207	0.000269	0.000316	0.000362	0.0
27	0.000211	0.000274	0.000321	0.000368	0.0
28	0.000214	0.000278	0.000326	0.000374	0.0
29	0.000220	0.000285	0.000334	0.000383	0.0
30	0.000227	0.000294	0.000344	0.000394	0.0
31	0.000237	0.000306	0.000357	0.000409	0.0
32	0.000250	0.000320	0.000373	0.000426	0.0
33	0.000264	0.000337	0.000391	0.000446	0.0
34	0.000280	0.000355	0.000412	0.000469	0.0
35	0.000297	0.000376	0.000435	0.000494	0.0
36	0.000315	0.000398	0.000459	0.000521	0.0

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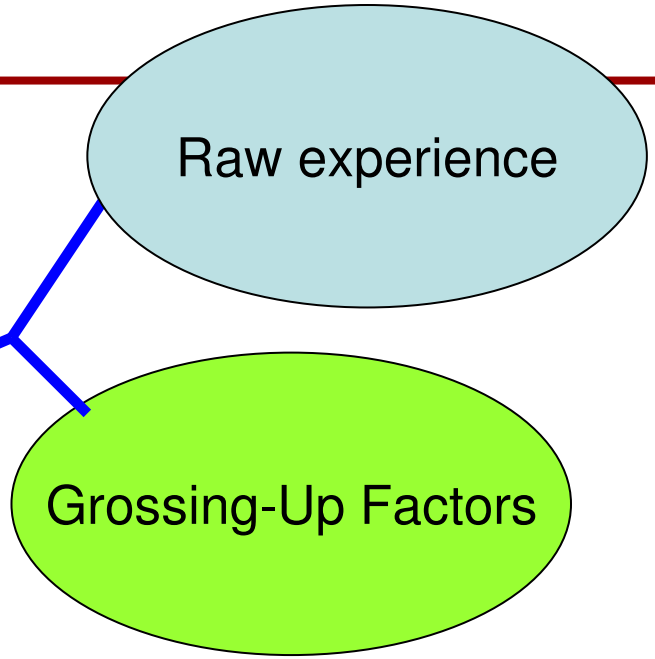

Agenda

- History of the CI investigation
- **Key Challenges:**
  - **Growing Exposure**
  - **Immature Experience**
  - **Claim Dates and Claims Delays**
- Recent Progress
- Results
- Future work

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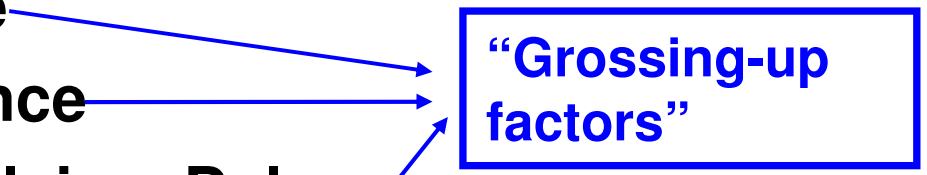
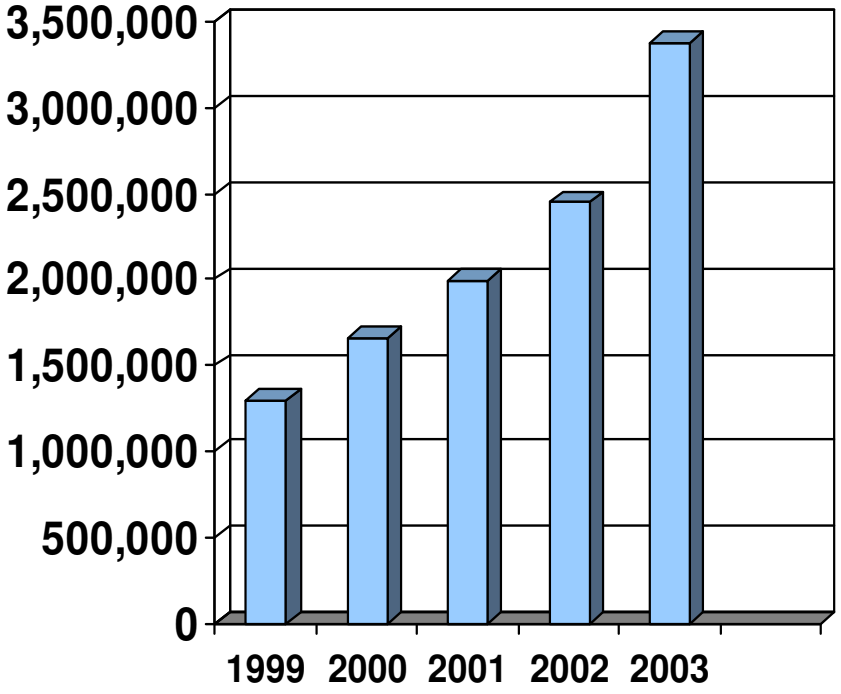


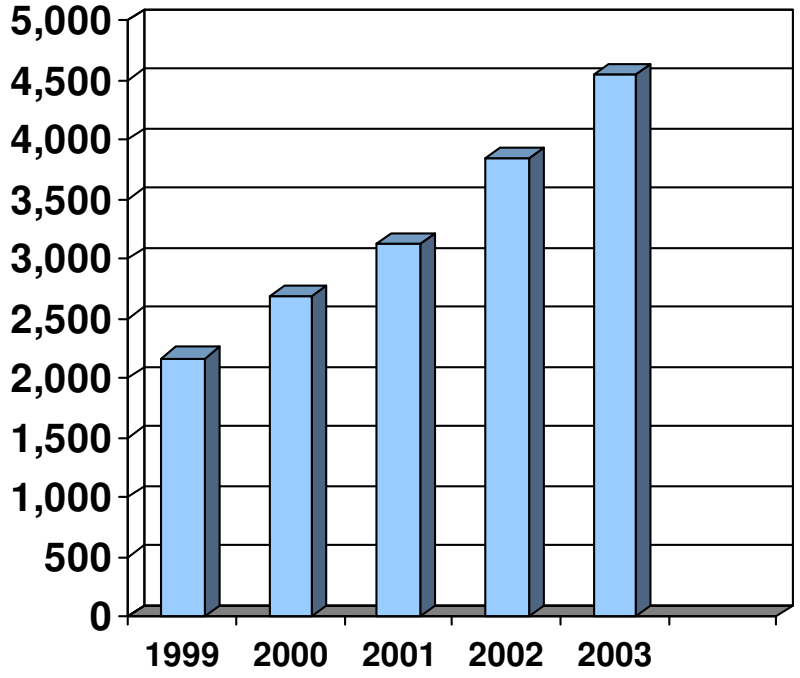
- Recent Progress
- Results
- Future work

Growing Exposure 1999-2003

Exposure



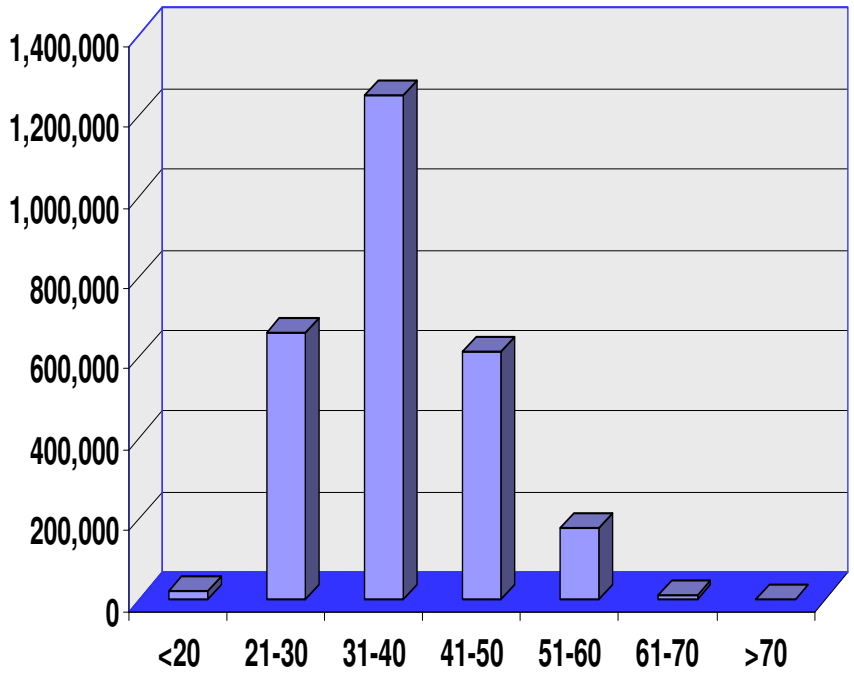
Settled Claims



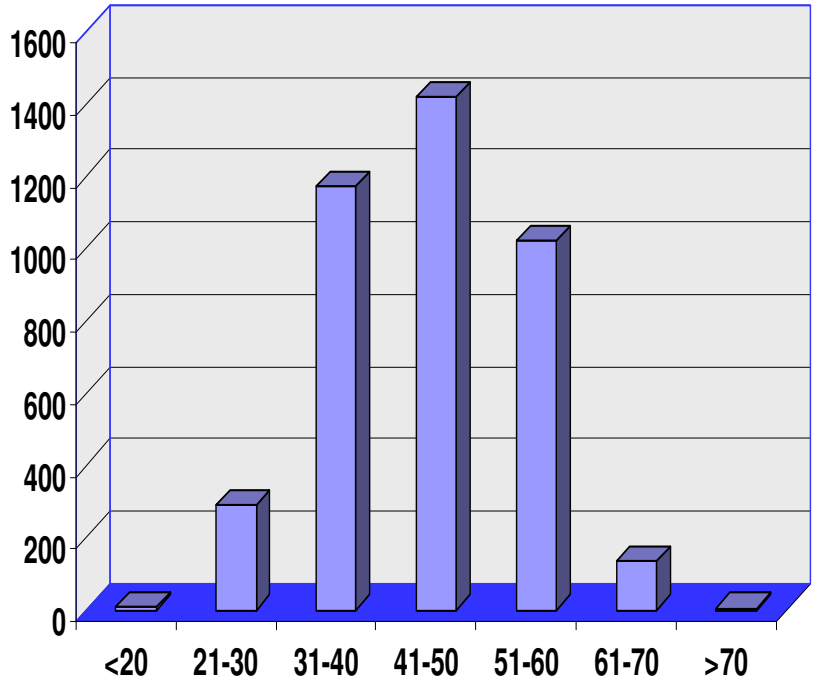
Immature Experience – by age

2003

Exposure



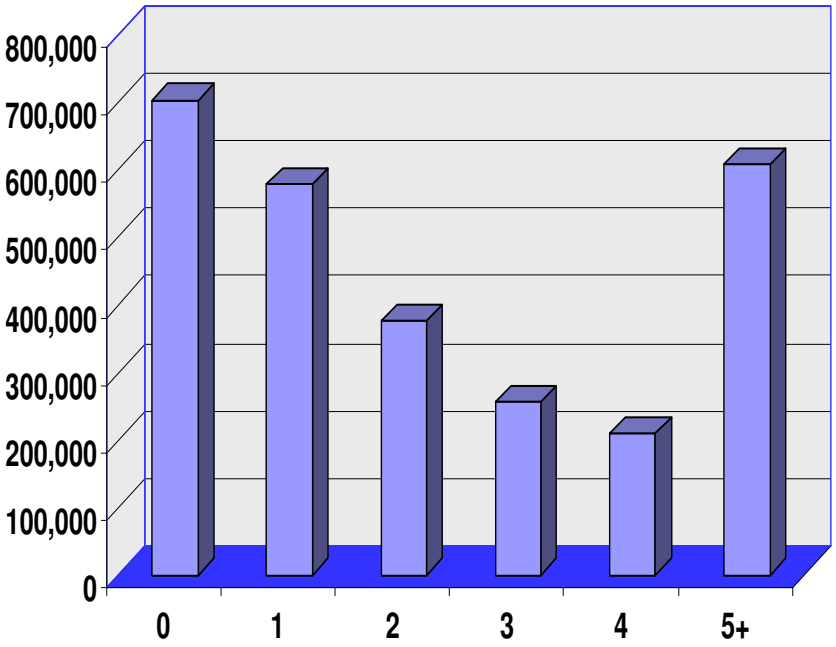
Claims



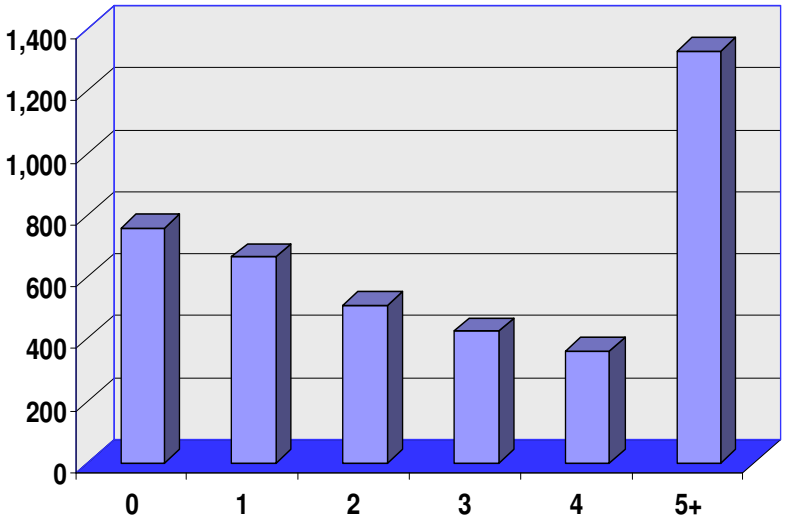
Immature Experience – by duration

2003

Exposure



Claims



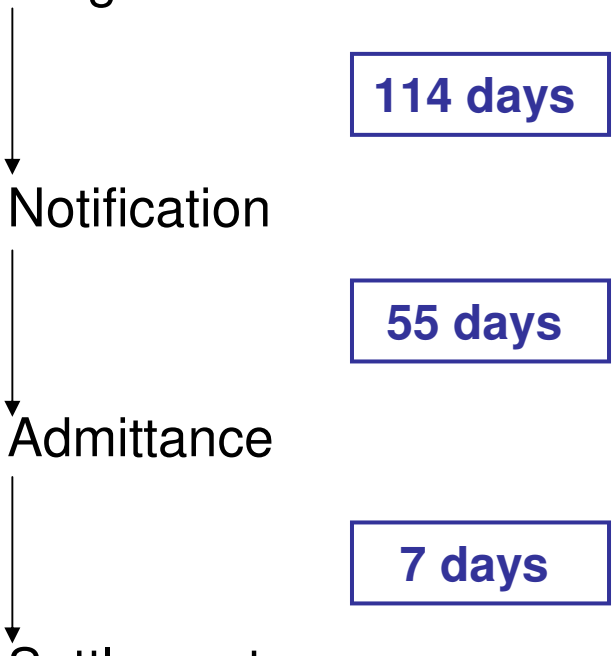
Claim Dates

- CMI request 4 dates for each claim: Date of Diagnosis, Date of Notification, Date of Admittance & Date of Settlement
- Date of diagnosis matches exposure and matches the risk incurred by the office
- But:
  1. The claims we receive are those settled in the period.
  2. Offices only supply date of diagnosis for some claims. In other cases we estimate it from the dates we are given:

	1999-2002	2003	2004
Actual Date of Diagnosis	56.3%	64.3%	74.9%
Estimated from Date of Settlement	42.3%	35.4%	23.5%
Estimated from Date of Admittance	1.2%	0%	0.1%
Estimated from Date of Notification	0.4%	0.3%	1.5%

Claim Delays

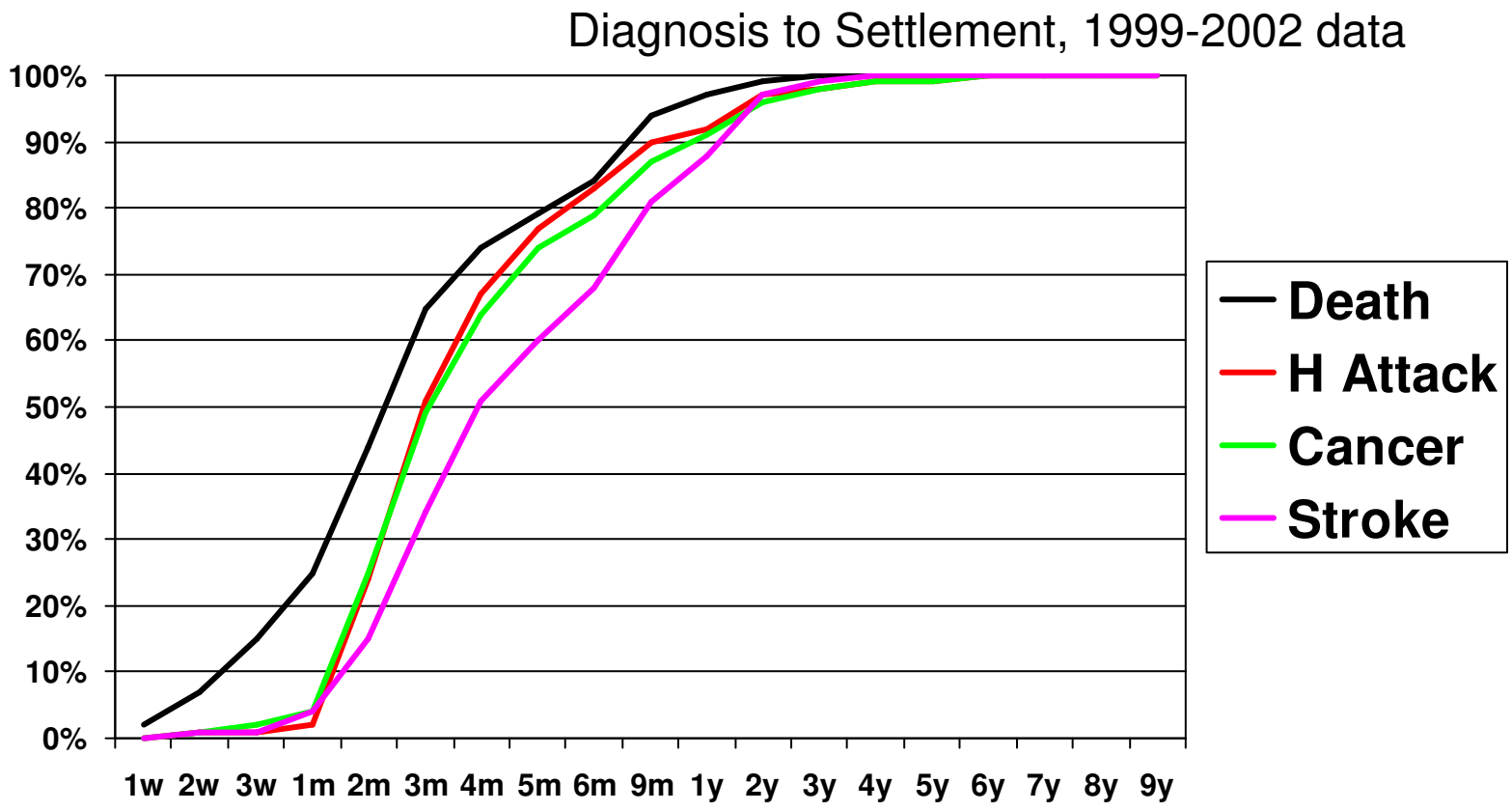
- Approx. observed delays between claim dates:
  - Date of Diagnosis



  - Date of Notification
  - Date of Admittance
  - Date of Settlement

1999-2002 data

Observed claim delays by cause



Importance of Claim Dates

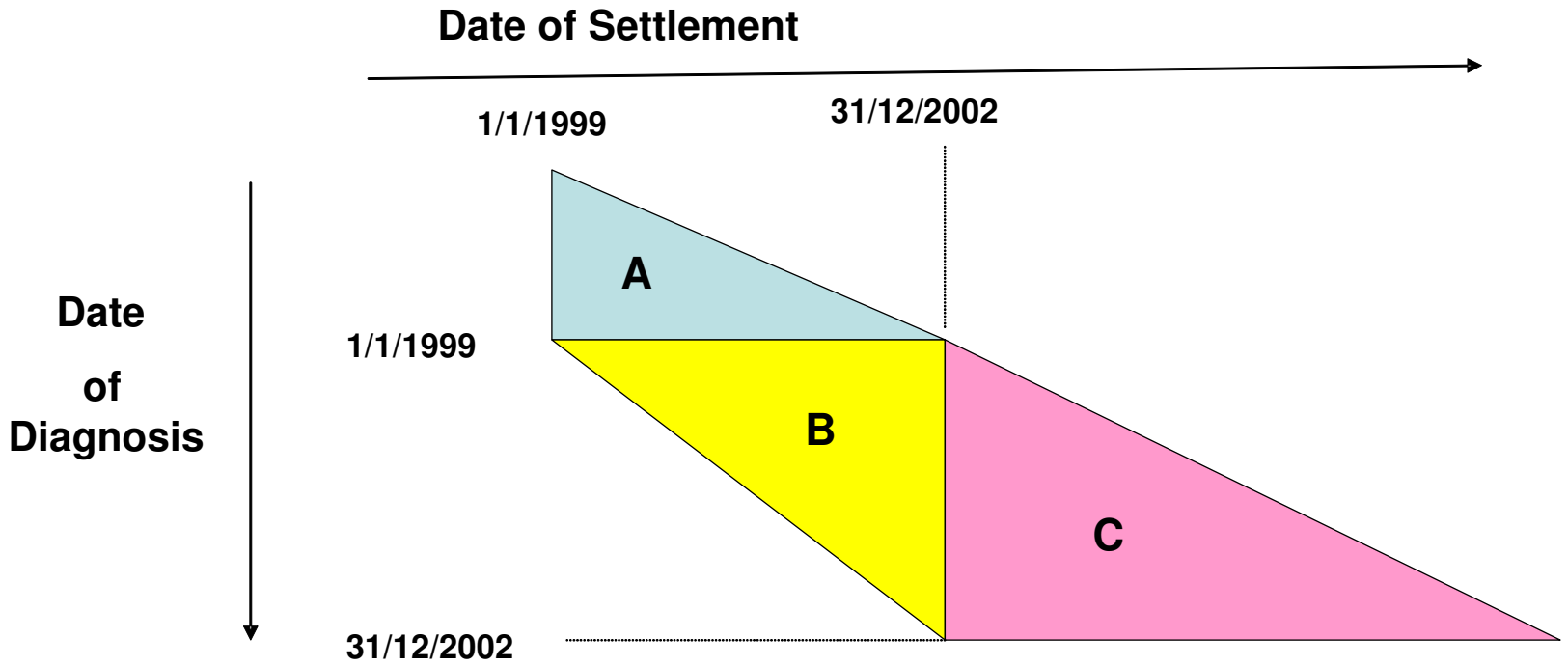
- Date of diagnosis is estimated where not known
- The date of diagnosis is used to correctly calculate the age and duration but not to re-allocate claims in or out of the analysis
- This would not be a major issue with a stable portfolio
- BUT VOLUMES HAVE INCREASED RAPIDLY
- The effect of this is that 1999-2002 results are under-stated by a factor of the order of 15%
- This factor will vary between offices according to the growth rate in their claims portfolio

Impact of growth in exposure on Grossing-Up Factors

- **Guidelines provided in Working Paper 14:**

Rate of growth in expected claims	Approximate grossing-up factor
Nil	100%
10%	107%
20%	112%
30%	117%
50%	124%
75%	132%
100%	139%

Date of Diagnosis v Date of Settlement



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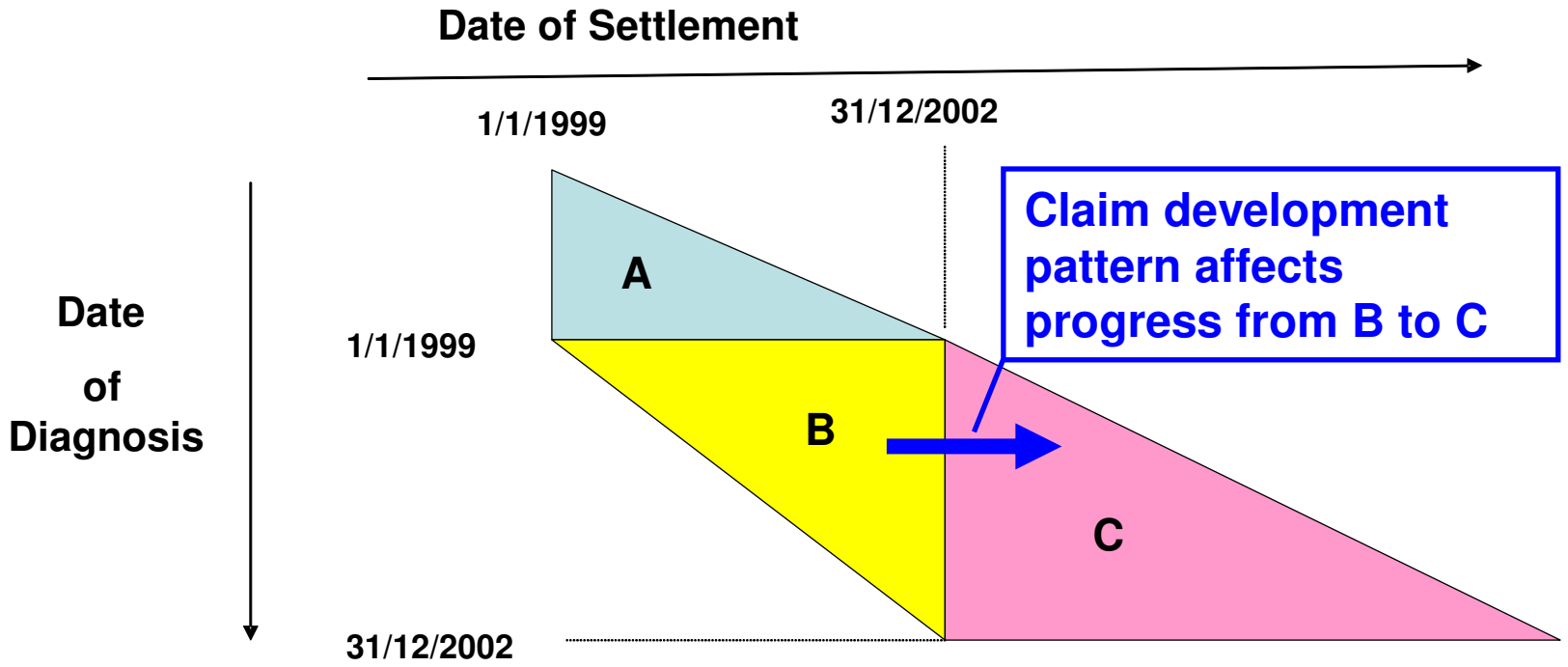

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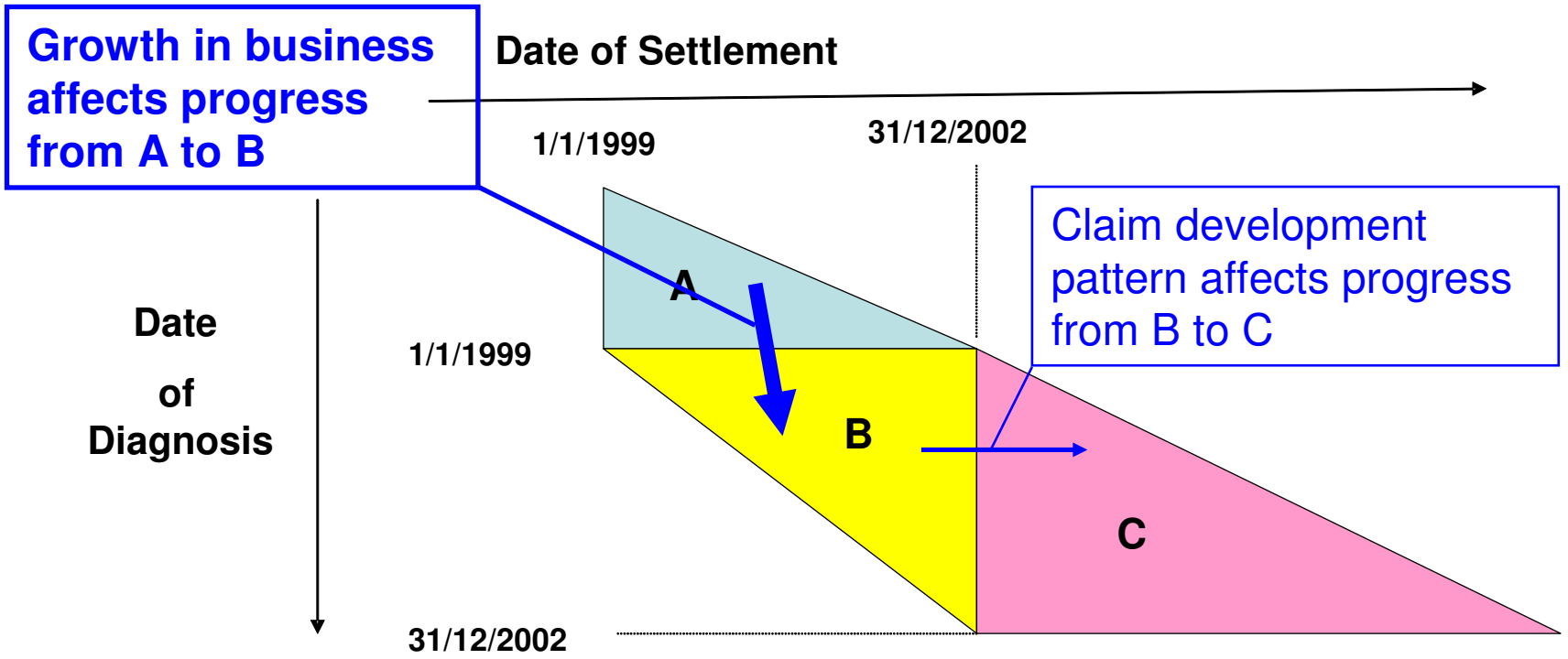

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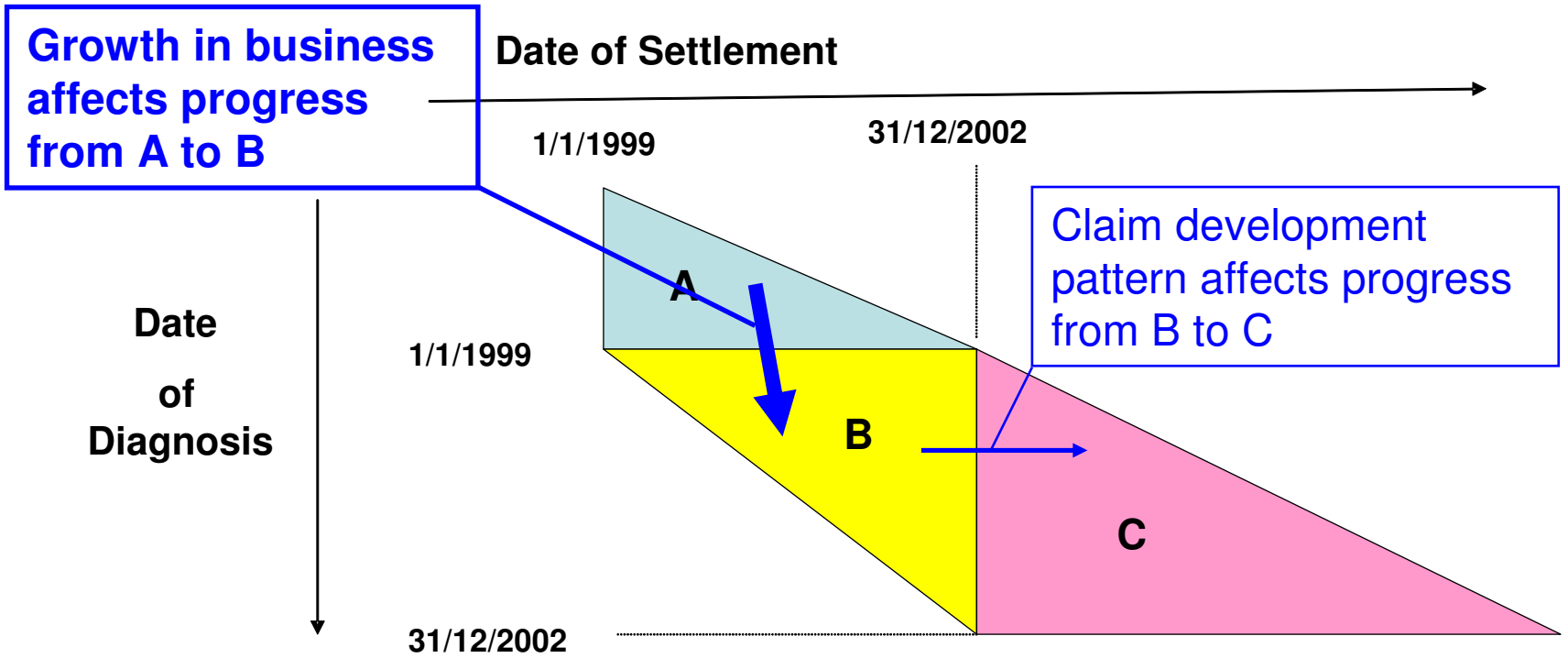
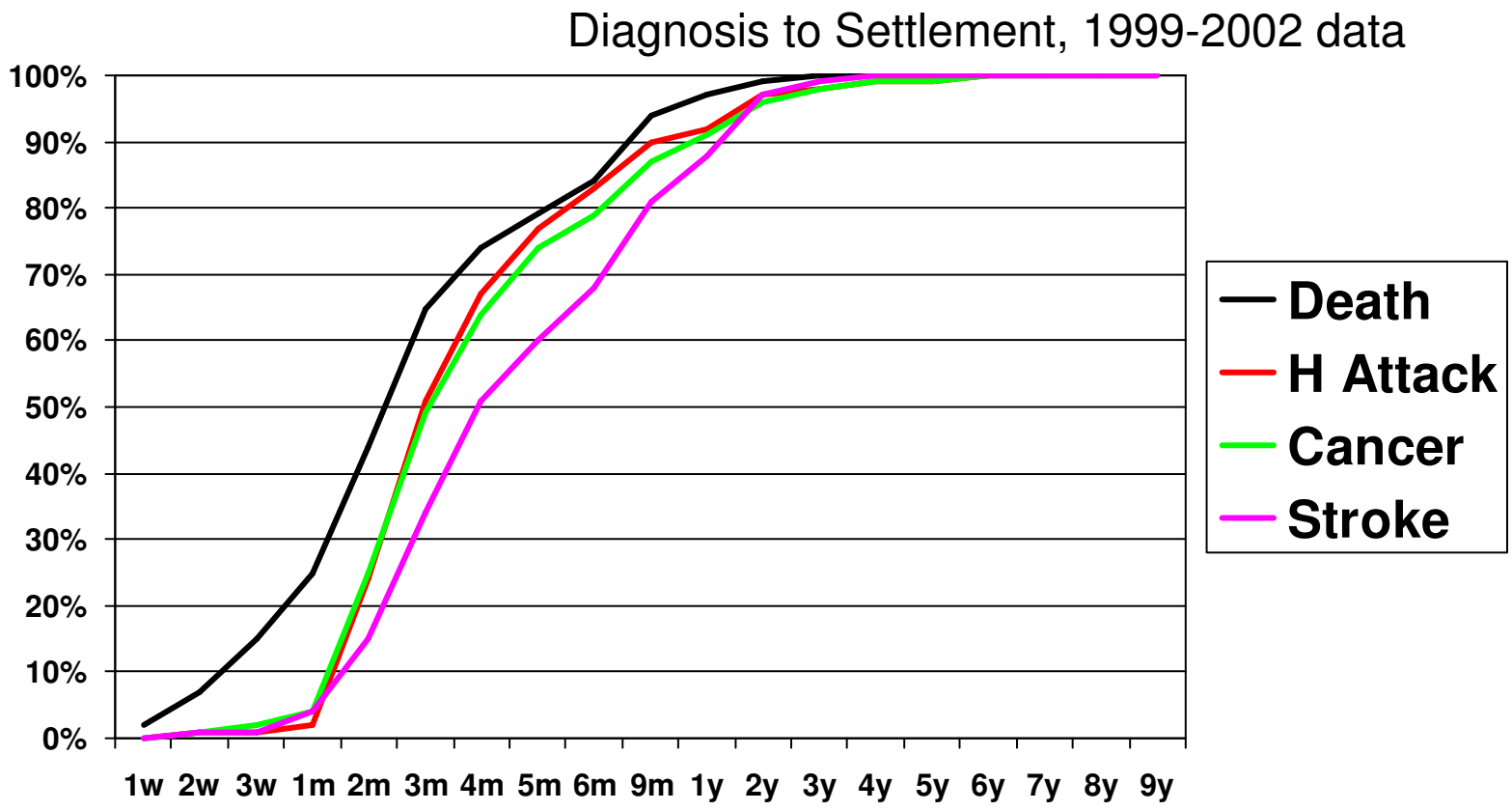


(A + B) x (1 + grossing-up factor) = (B + C)

Observed claim delays by cause



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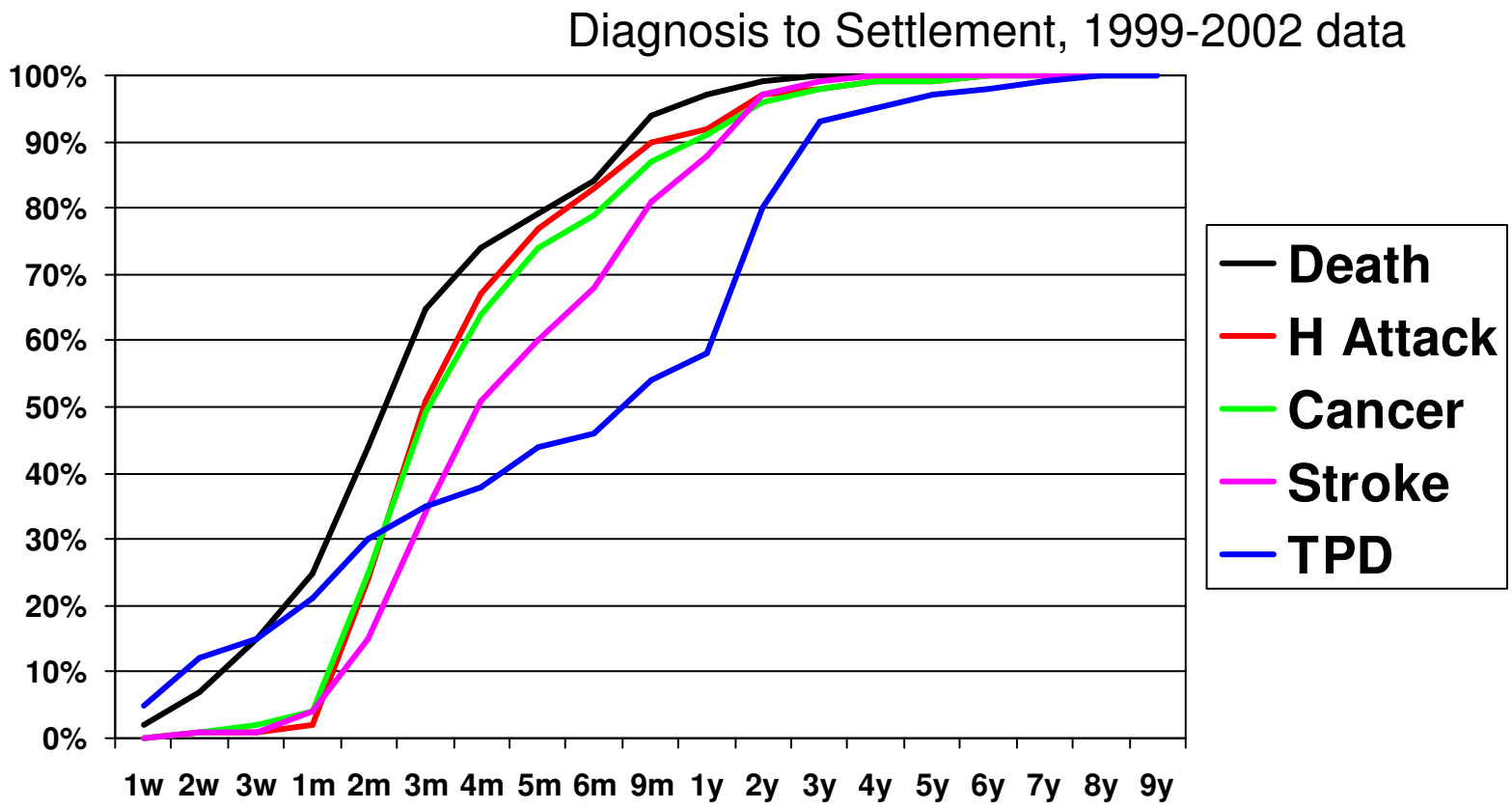

What do we mean by Date of Diagnosis?

- **For some events it has a clear intuitive meaning, e.g. :**
  - **Heart Attack**
  - **Surgery events**
  - **Death**
- **For Cancer, is it the date symptoms are detected by the GP, or when a diagnosis is confirmed by the consultant?**
- **ABI definition of MS:**

  A definite diagnosis of Multiple Sclerosis by a Consultant Neurologist. There must be current clinical impairment of motor or sensory function, which must have persisted for a continuous period of at least 6 months.

  So is the Date of Diagnosis when the definite diagnosis is obtained or after the 6 months continuous symptoms?
- **Definition may vary between offices or even between assessors within an office**

Discussions with the Health Claims Forum

- Can we agree a clear definition of “Date of Diagnosis”?
- Can we record Date of Diagnosis more often?
- Can we record Date of Diagnosis consistently?

Agenda

- History of the CI investigation
- Key Challenges:
- **Recent Progress**
  - **Health Claims Forum consultation**
  - Estimation of grossing-up factors
  - GLM analysis of raw experience
- Results
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Health Claims Forum consultation

Proposed definition:

The date of diagnosis is **the date at which the critical illness definition was fulfilled**

Key Points:

- **Interpretation specified for April 2006 ABI definitions**
- **Companies asked to adapt these for older and non-ABI definitions -**
  - **Where there is a clear event date – use that (e.g. Heart Attack)**
  - **Where it is a degenerative disease then allow for permanence to be established**
- **Proposed adoption date of 1st January 2007**

Health Claims Forum Consultation – the future

- We hope that HCF guidelines will be adopted
- We will look to "incorporate" them into CMI Coding Guide
- We hope that the guidelines:
  - Will introduce consistency between offices (where using the same definition)
  - Will improve consistency within an office
  - Will encourage recording of 'Date of Diagnosis'

- Likely to lead to shorter delays (i.e. the Date of Diagnosis will be later in many cases)
- There should be less variation in delay between diagnosis and settlement for different CI events
- … but it will affect results over time!!

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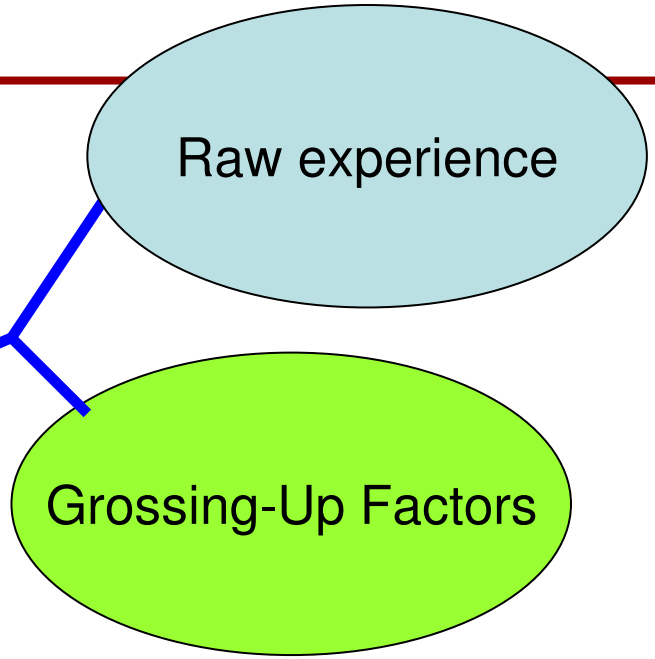


Estimation of claims development/GUF

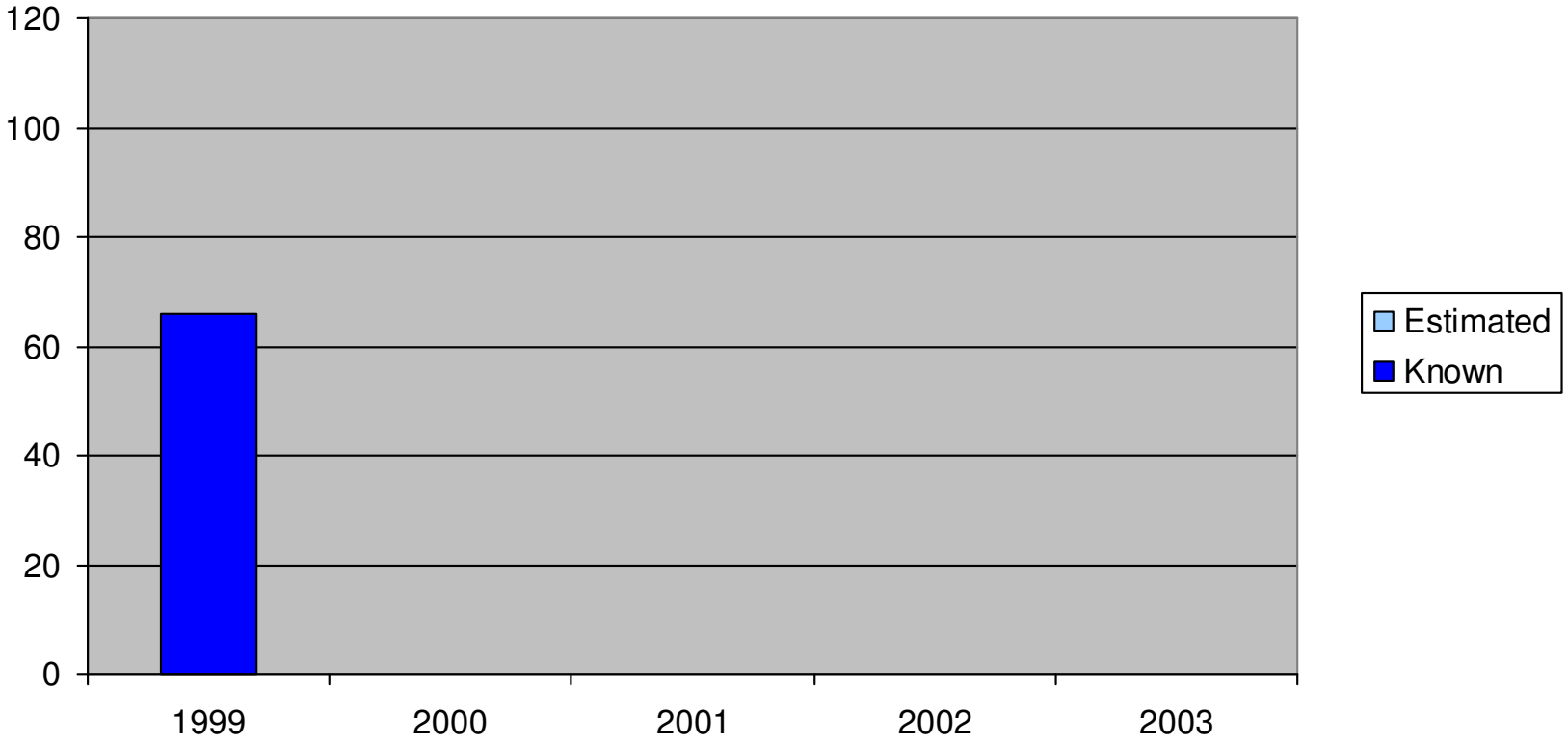
- **Use claims where we know:**
  - **date of diagnosis, and**
  - **year of settlement**

  to estimate a claim development pattern

- **Attempting to use only consistent data submissions**

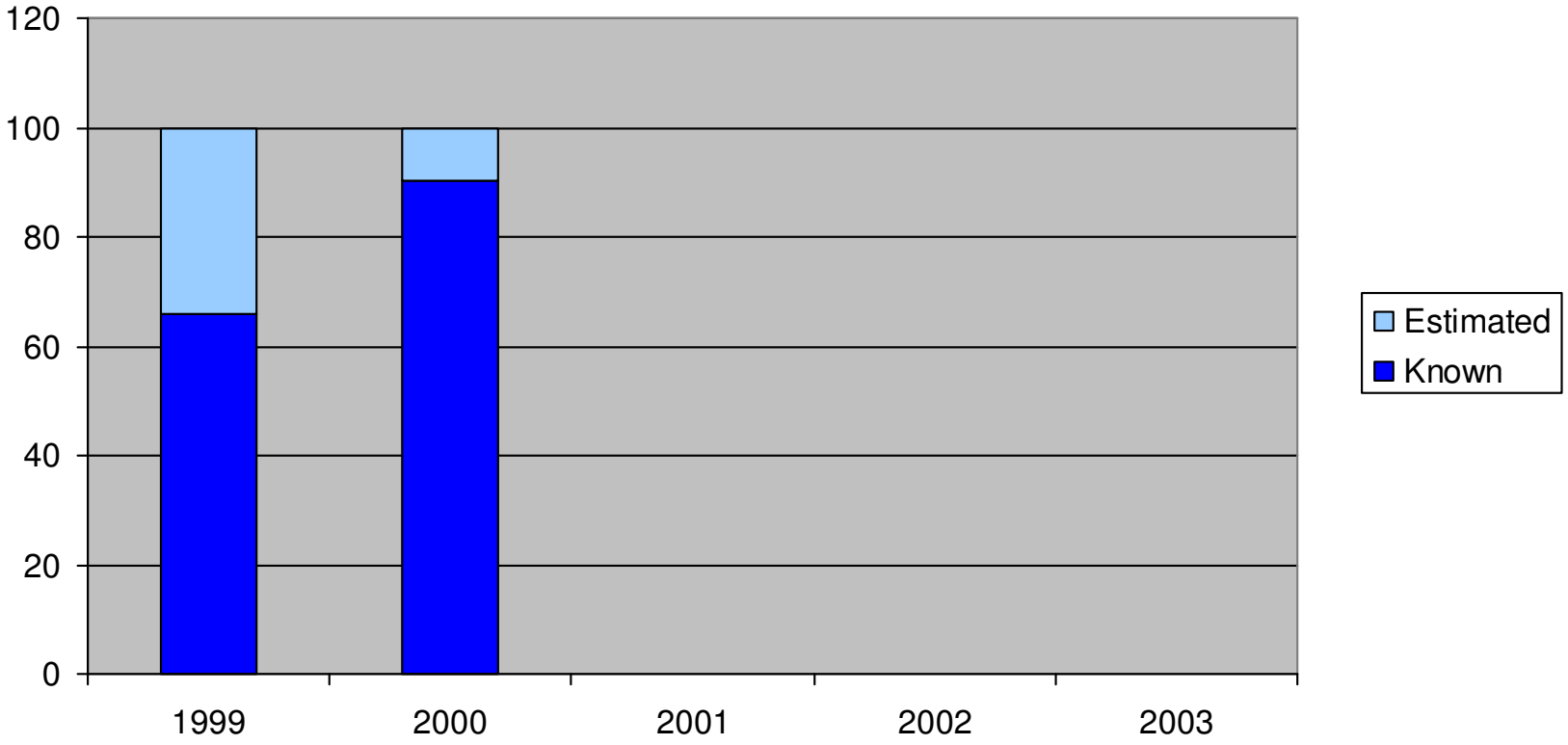
- **Each additional year's data:**
  - **Provides additional information from which to estimate development pattern**
  - **Reduces the tail on prior year claims that needs to be estimated**

Estimation of claims development for 1999



1999 data 639 known claims
Limited information on delays to estimate the outstanding claims

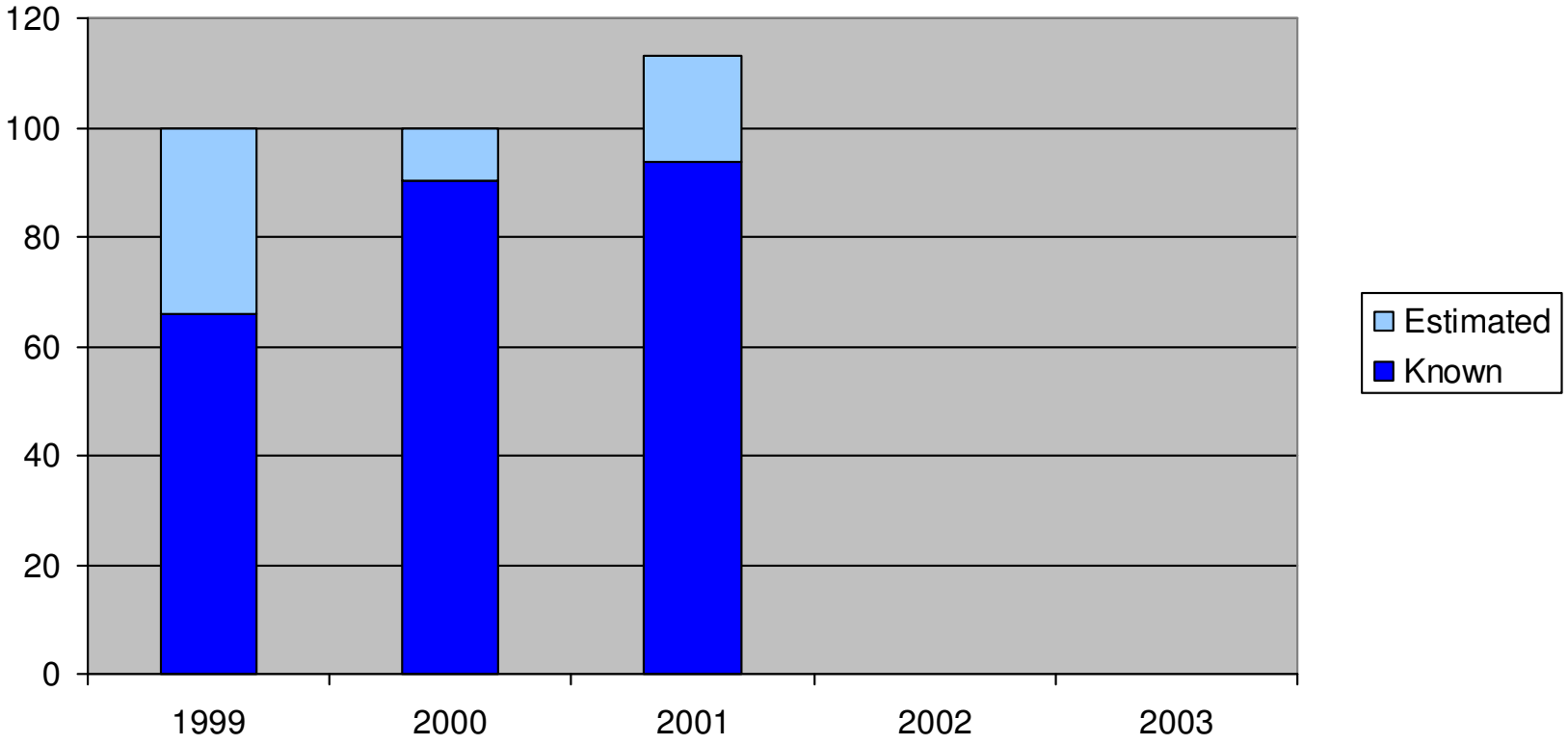
Estimation of claims development for 1999



Estimate of fully-developed claims at end of year 0 = 100

1999 data	**639 known claims**	**360 estimated outstanding**
2000 data	**875 known claims**	**94 estimated outstanding**

Estimation of claims development for 1999



Estimate of fully-developed claims at end of year 0 = 100

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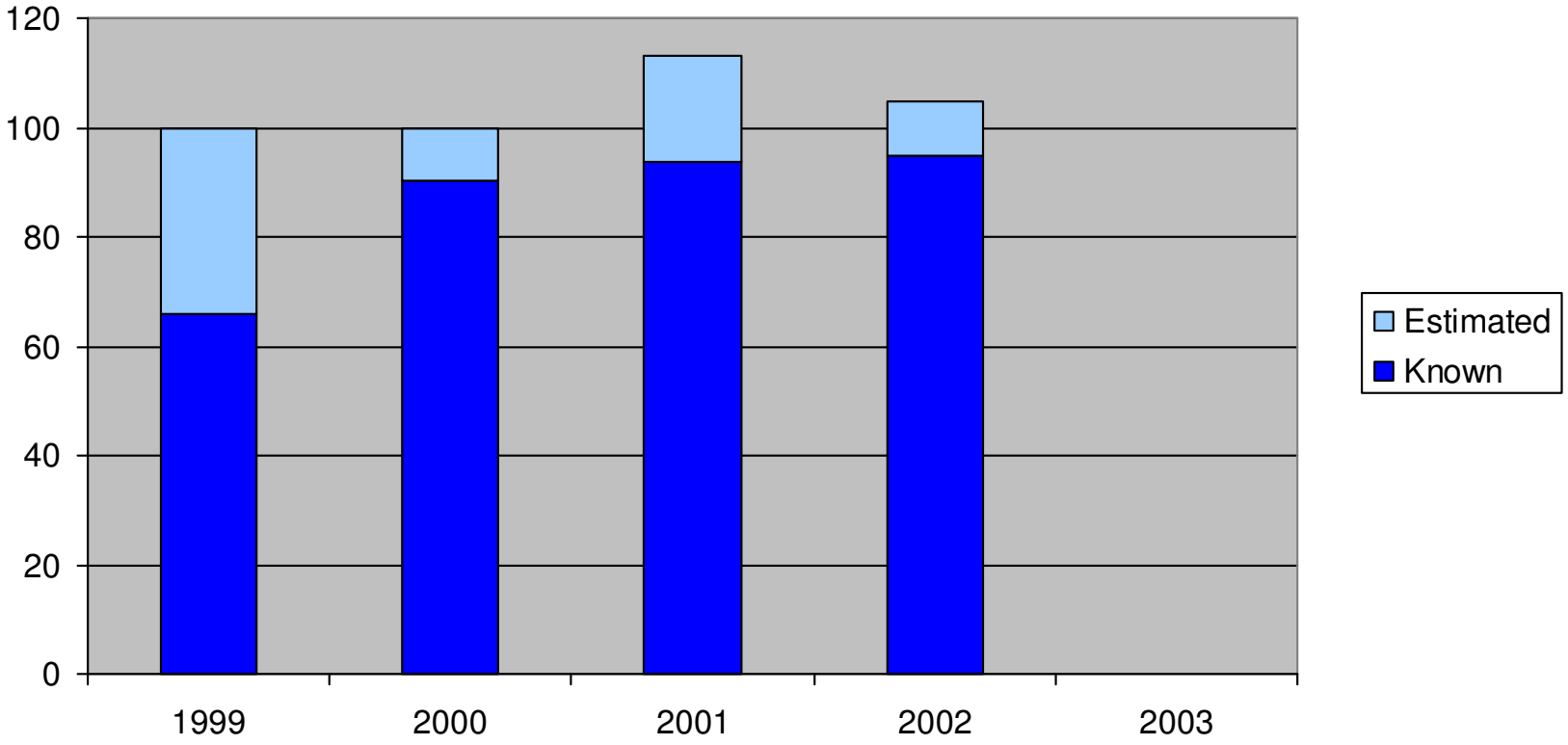
2001 data	**907 known claims**	**190 estimated outstanding**

Estimation of claims development for 1999



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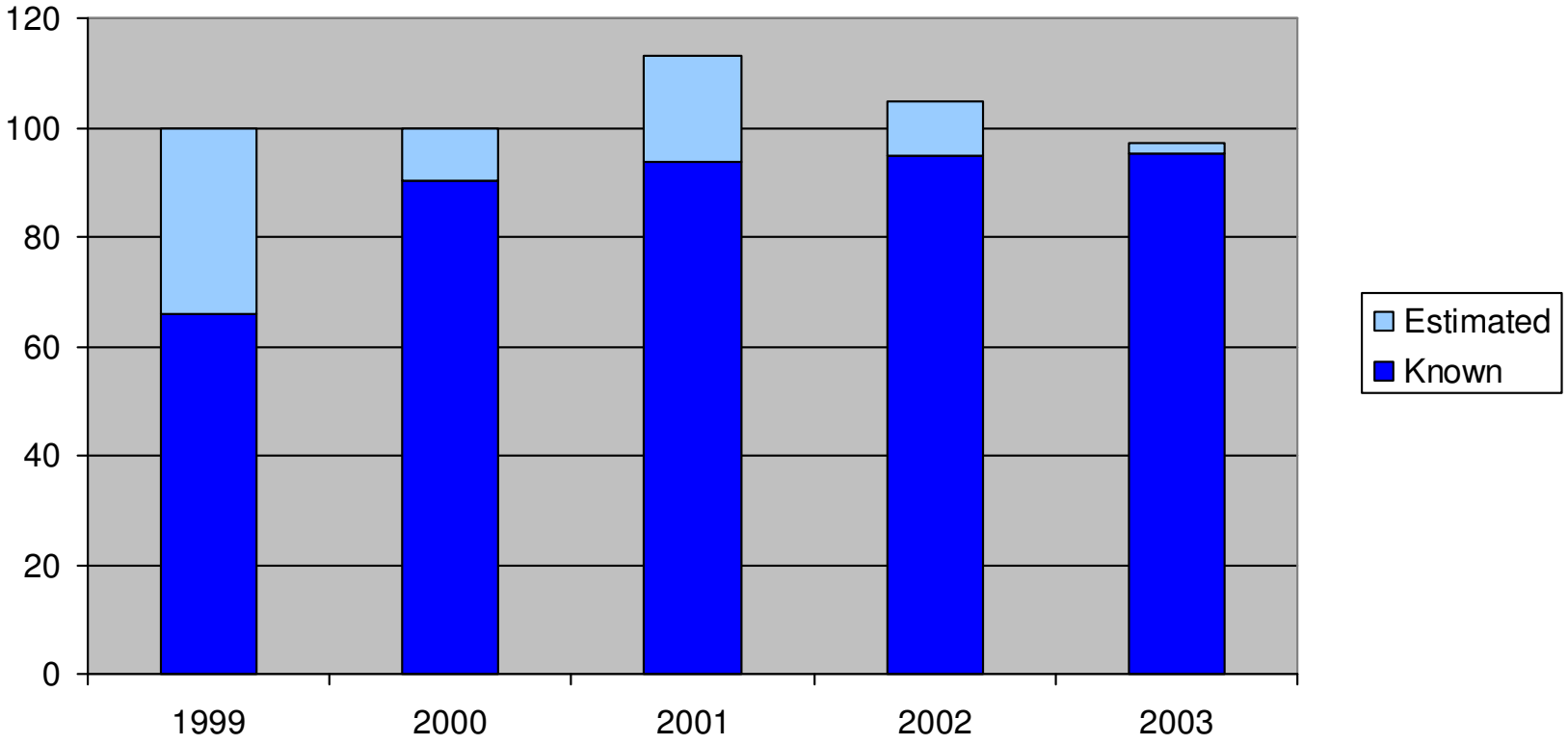
2002 data	**918 known claims**	**97 estimated outstanding**

Estimation of claims development for 1999



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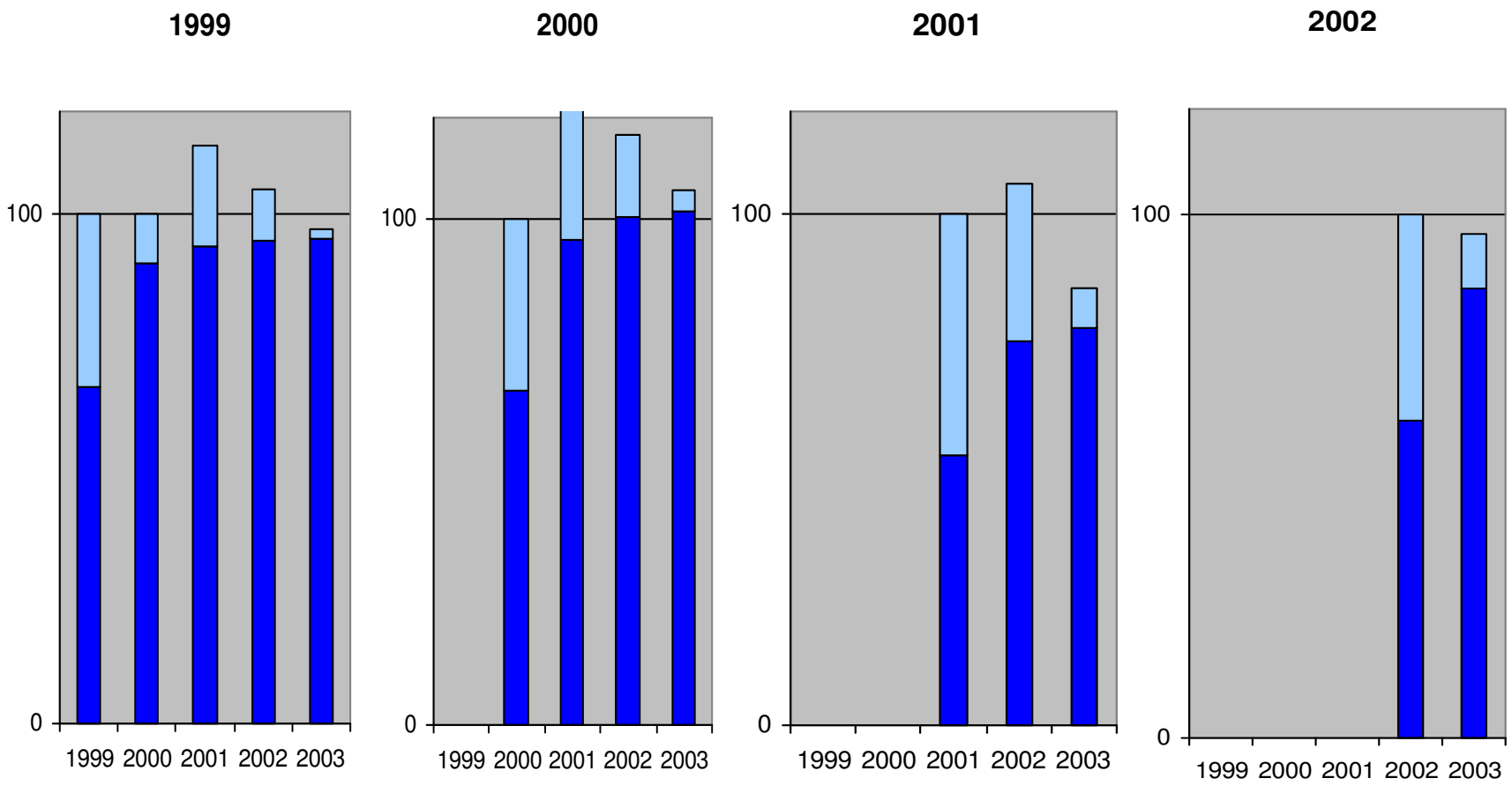
2001 data	**907 known claims**	**190 estimated outstanding**
2002 data	**918 known claims**	**97 estimated outstanding**
2003 data	**922 known claims**	**18 estimated outstanding**

Estimation of claims development



Estimate of fully-developed claims at end of year 0 = 100

Dark blue = Actual claims

Light blue = Estimated claims

Estimation of Grossing-Up Factors

- Using development patterns derived from data from 1999-2003:
- Overall GUF for 1999-2002 estimated to be 14.8%
- Segregated GUFs for 1999-2002 estimated to be:
  - Males 13.9% Females 16.2%
  - Non-smoker 13.0% Smoker 15.4%
  - Accelerated 13.1% Stand-Alone 27.2%
  - Age:

<30	31-40	41-50	51-60	61+
12.8%	16.9%	14.6%	13.3%	16.0%

  - Duration

0	1	2	3	4	5+
17.1%	11.0%	11.3%	12.7%	10.3%	21.4%

  - Calendar Year

1999	2000	2001	2002
18.7%	12.4%	14.9%	14.7%

Estimation of Grossing-Up Factors

- Using development patterns derived from data from 1999-2003, overall GUF for 1999-2002 estimated to be **14.8%**
- But, using development patterns derived from data from 1999-2002, overall GUF for 1999-2002 estimated to be **17.8%**
- Overall GUF for 2003 estimated using this approach and development patterns derived from data from 1999-2003 is just **3.6%**
- Other approaches give higher numbers (5% to 10%)
- So are GUFs too unstable to use?

Agenda

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- Key Challenges:
- **Recent Progress**
  - Health Claims Forum consultation
  - Estimation of grossing-up factors
  - **GLM analysis of raw experience**
- Results
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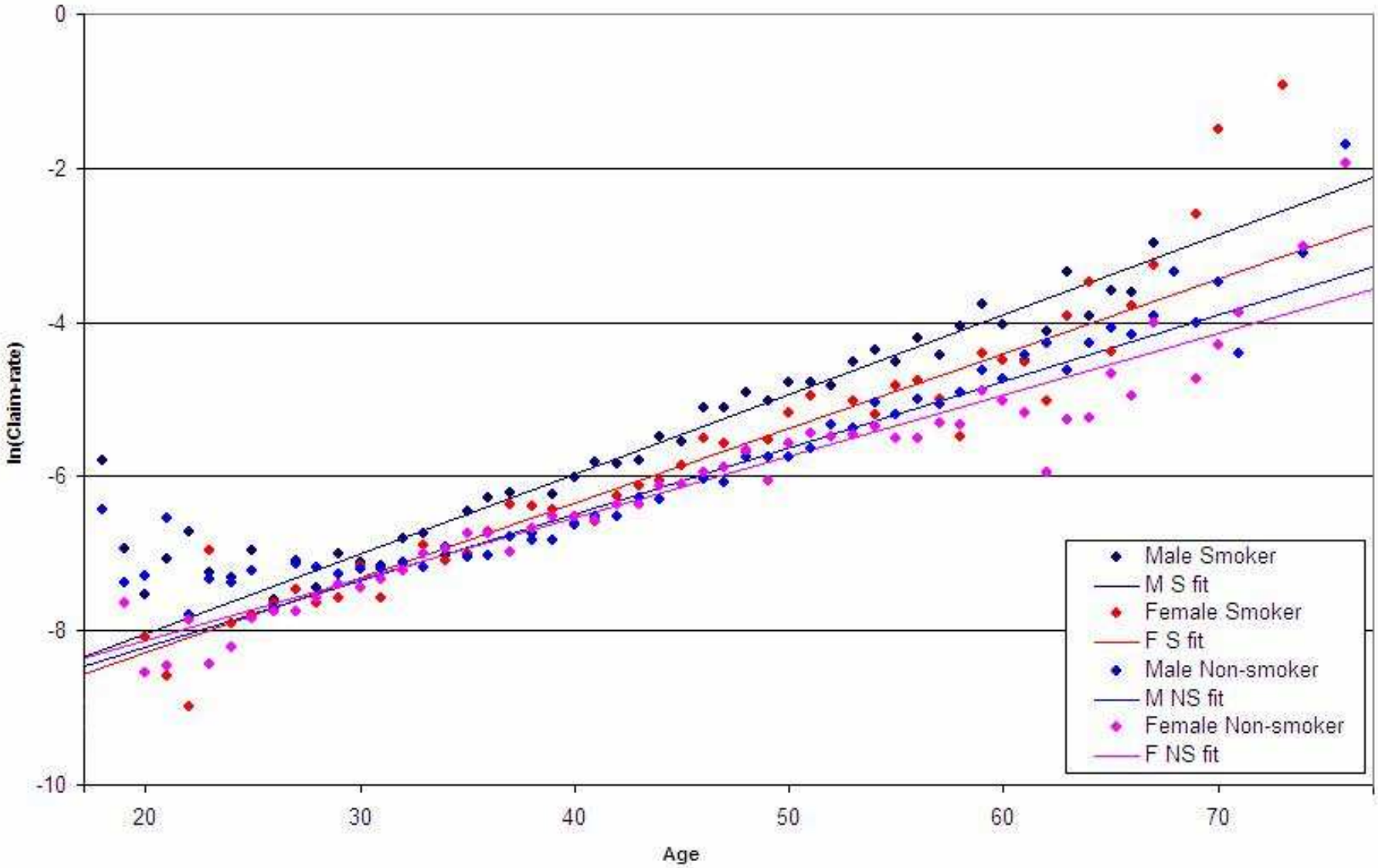
Generalised Linear Modelling of Claim Rates

- Work to date has been on the "raw" claim rates – patterns and conclusions may change when grossing-up factors are applied
- "Top down" approach, introducing factors to very simple model to assess whether they help to explain experience
- 1st level conclusions:
  - Age, gender and smoker status all exhibit statistical significance
  - All 2nd order interactions also show significance (Age / gender, age / smoker status and gender / smoker status)


Claim-rates against Age, with model fits based on Age, Gender and Smoker Status
ln(Claim-rate)
0
-2
-4
-6
-8
-10
20
30
40
50
60
70
Age
Male Smoker
M S fit
Female Smoker
F S fit
Male Non-smoker
M NS fit
Female Non-smoker
F NS fit

GLM – other variables

Duration

- Data too sparse to analyse long durations separately
- Statistical evidence indicates grouping by 0, 1-3 and 4+

Benefit Amount

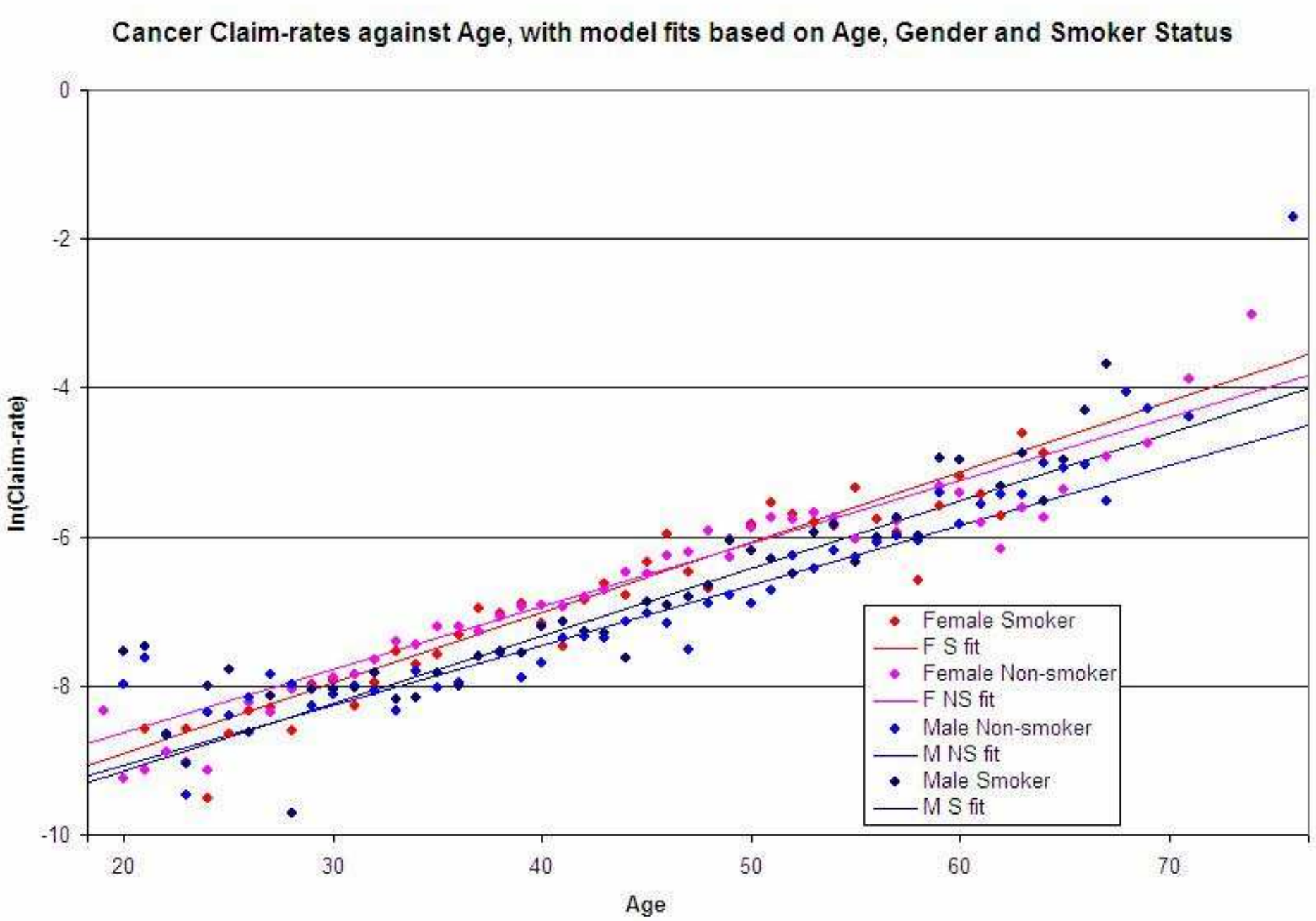
- Split benefit amount into 4 bands
- Statistically significant but no clear pattern

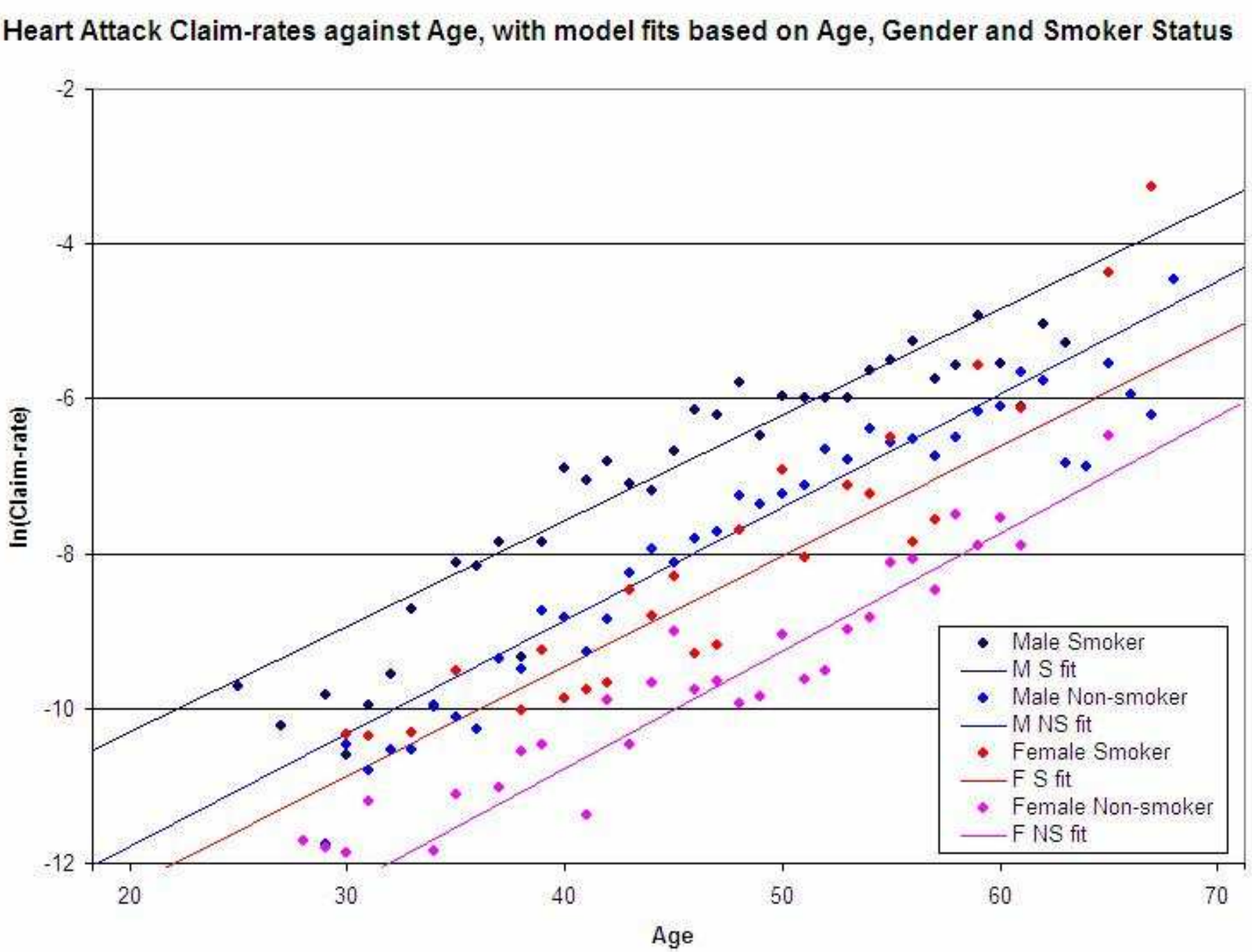
Sales Channel

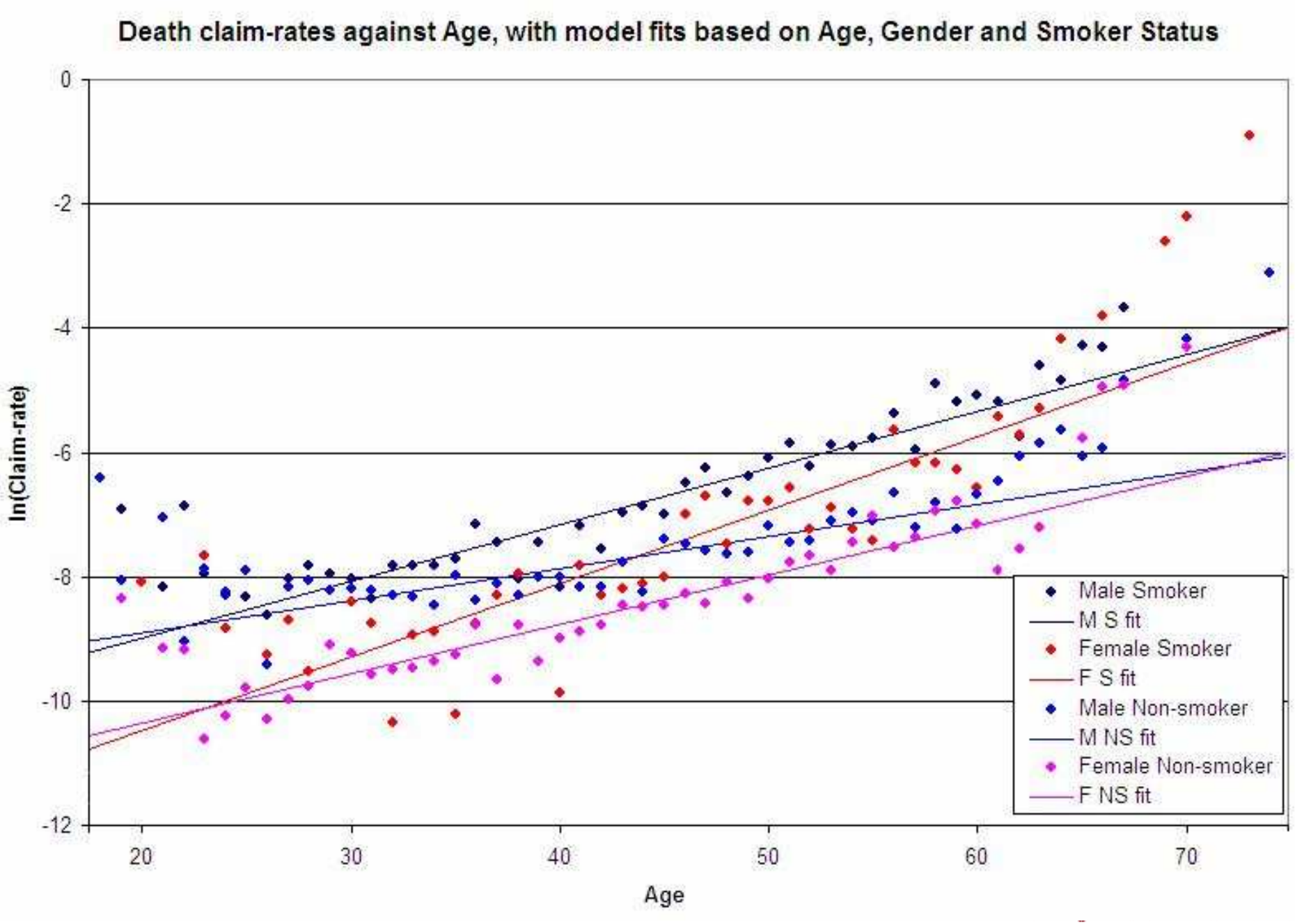
- No conclusions yet

Analysis by Cause

- Limited to Cancer, Heart Attack and (residual) Death so far
- Each cause shows very different experience


Cancer Claim-rates against Age, with model fits based on Age, Gender and Smoker Status
ln(Claim-rate)
0
-2
-4
-6
-8
-10
20
30
40
50
60
70
Age
Female Smoker
F S fit
Female Non-smoker
F NS fit
Male Non-smoker
M NS fit
Male Smoker
M S fit


Heart Attack Claim-rates against Age, with model fits based on Age, Gender and Smoker Status
ln(Claim-rate)
-2
-4
-6
-8
-10
-12
20
30
40
50
60
70
Age
Male Smoker
M S fit
Male Non-smoker
M NS fit
Female Smoker
F S fit
Female Non-smoker
F NS fit


Death claim-rates against Age, with model fits based on Age, Gender and Smoker Status
ln(Claim-rate)
0
-2
-4
-6
-8
-10
-12
20
30
40
50
60
70
Age
Male Smoker
M S fit
Female Smoker
F S fit
Male Non-smoker
M NS fit
Female Non-smoker
F NS fit

GLM – other variables

Duration

- Data too sparse to analyse long durations separately
- Statistical evidence indicates grouping by 0, 1-3 and 4+

Benefit Amount

- Split benefit amount into 4 bands
- Statistically significant but no clear pattern

Sales Channel

- No conclusions yet

Analysis by Cause

- Limited to Cancer, Heart Attack and (residual) Death so far
- Each cause shows very different experience

GLM – other variables

Duration

- Data too sparse to analyse long durations separately
- Statistical evidence indicates grouping by 0, 1-3 and 4+

Benefit Amount

- Split benefit amount into 7 bands
- Statistically significant but no clear pattern

Sales Channel

- No conclusions yet

Analysis by Cause

- Limited to Cancer, Heart Attack and (residual) Death so far
- Each cause shows very different experience

Work to date has been on the "raw" claim rates – patterns and conclusions may change when grossing-up factors are applied

Agenda

- History of the CI investigation
- Key Challenges:
- Recent Progress
  - Health Claims Forum consultation
  - Estimation of grossing-up factors
  - GLM analysis of raw experience
- **Results**
- Future work

Results of the CMI CI Investigation

- Released results for 1998, 1999 & 2000 in 2003
- Results for 1999, 2000, 2001, 2002 & quad released in May 2005
- 2003 Results released in April 2006 for the “quad” offices (those who had submitted data at the end of 1999-2002)

Issues with 2003/4 results

- The CMI also received data from several "new" offices from 2003. Results incorporating these offices have not yet been released
- The CMI has not (yet) received 2004 data from a number of the "quad" offices – will we?
- 2004 data has highlighted a likely issue with the 2003 results for one (substantial) office:
  - Revised 2003 data is being sought
  - Issue appears to be that some actual claims were omitted
  - Impact is likely to increase overall 'All Office' results by around 10%
- These issues impact claim delay work as well as raw results
- Grossing-up factors also affected by market changes

Results by Calendar Year

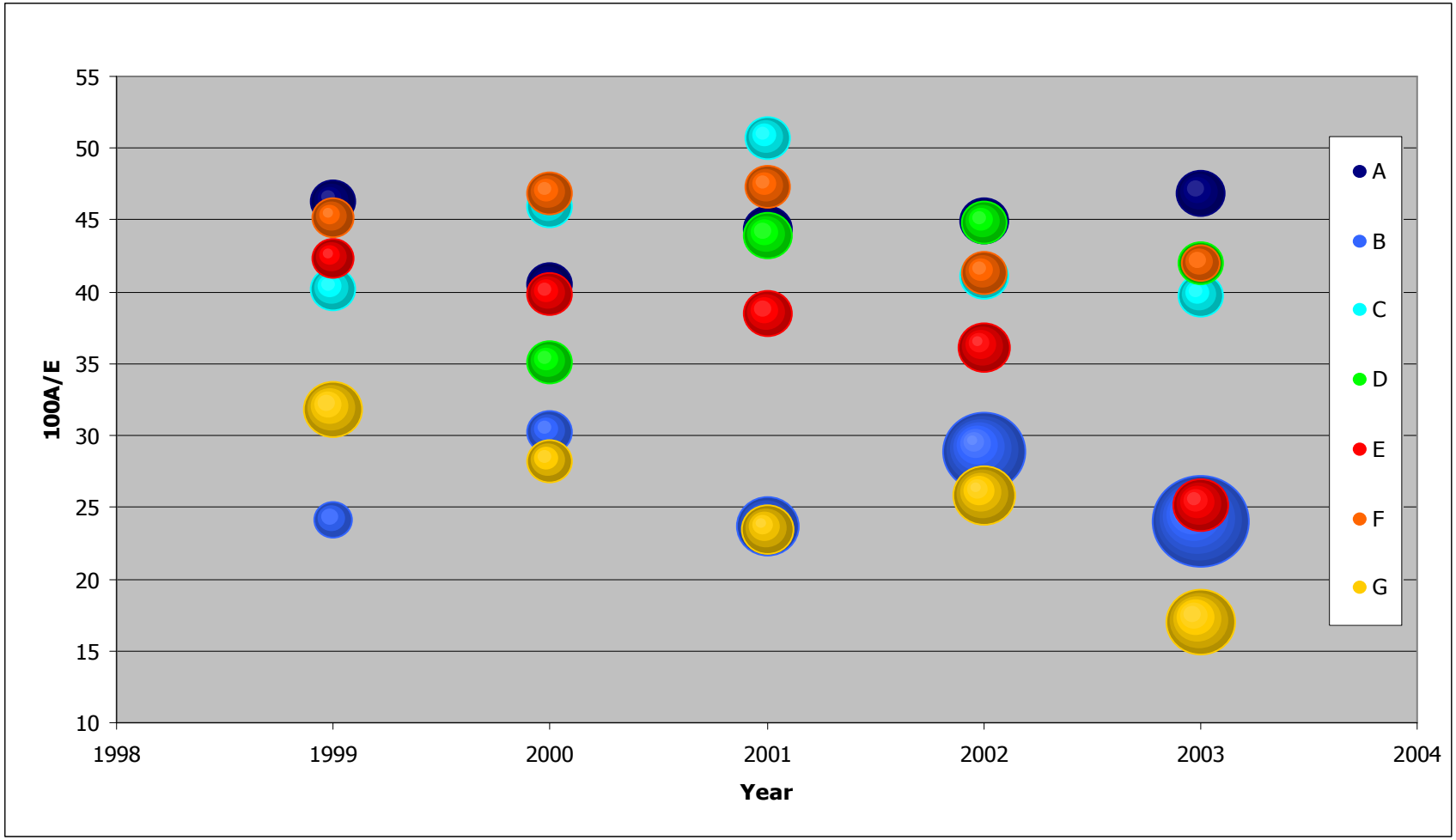
Accelerated business, all ages, all durations, Lives (E=CIBT93)

		1999-2002	2003 orig	2003 rev	Draft 2004
Male	NS	**38**	**31**	**31**	**34**
	Sm	**69**	**54**	**51**	**59**
Female	NS	**45**	**40**	**39**	**43**
	Sm	**57**	**53**	**53**	**56**

Raw results - no Grossing-Up Factors applied

2003 results under-stated due to data error

Results by office



Graph shows 100xA/E for 7 largest data contributors from 1999-2003 original + a large new contributor from 2003-4.

The size of each ball reflects its relative growth – all balls are equal size in 2000, except "new" office which takes base value in 2003.

Results by Duration

Accelerated business, Male Non-smoker only, all ages, Lives (E=CIBT93)

	1999-2002	2003 orig	2003 rev	Draft 2004
Duration 0	**31**	**27**	**25**	**36**
Duration 1	**37**	**25**	**25**	**37**
Duration 2+	**41**	**35**	**35**	**32**
All Durations	**38**	**31**	**31**	**34**

Raw results - no Grossing-Up Factors applied

2003 results under-stated due to data error

Results by Age

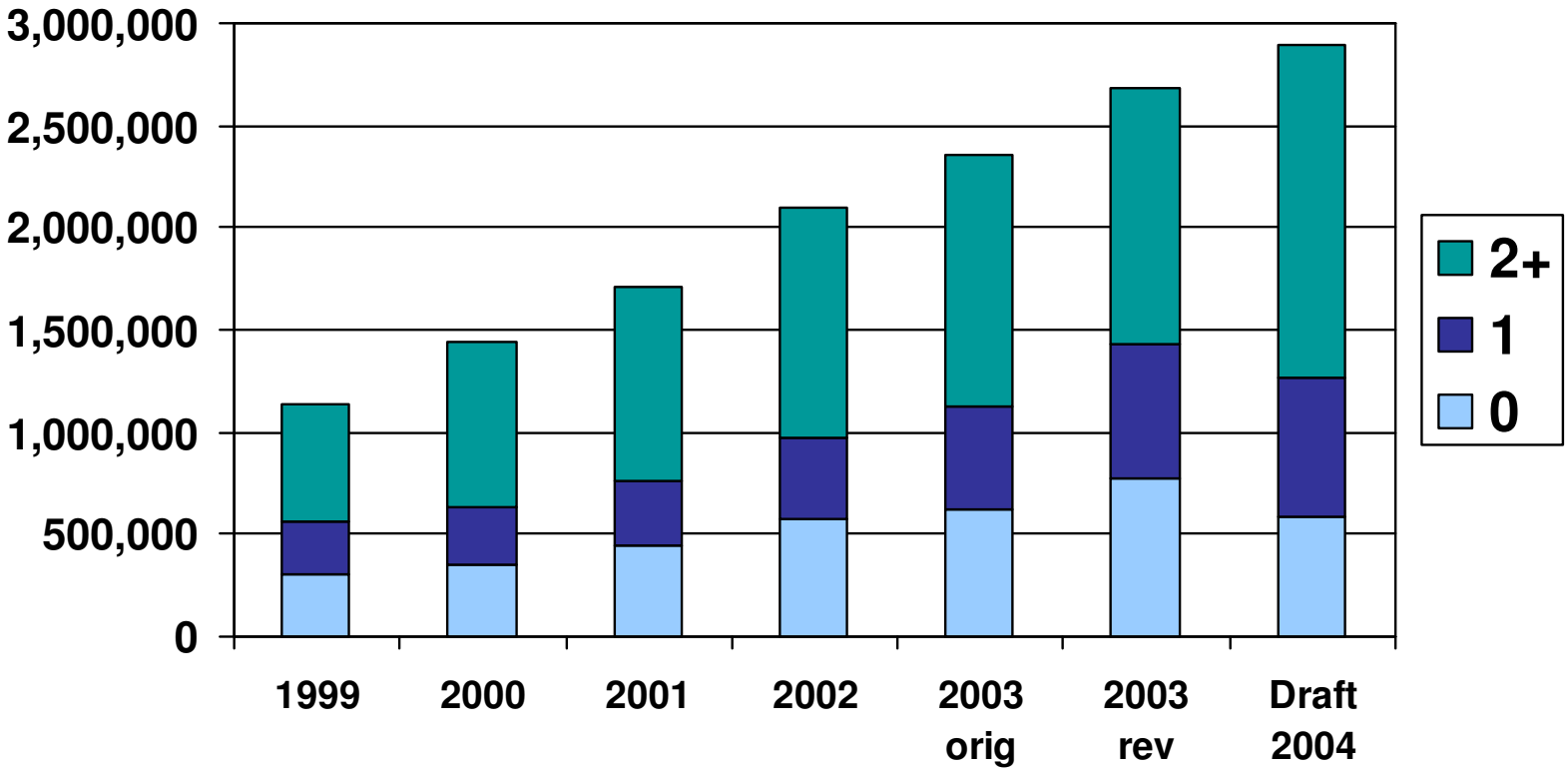
Accelerated business, Male Non-smoker only, all durations, Lives (E=CIBT93)

	1999-2002	2003 orig	2003 rev	Draft 2004
Up to 30	**50**	**36**	**33**	**47**
31 – 40	**40**	**30**	**29**	**36**
41 – 50	**36**	**32**	**29**	**28**
51 – 60	**35**	**32**	**33**	**36**
61+	**39**	**32**	**31**	**38**
All Ages	**38**	**31**	**31**	**34**

Raw results - no Grossing-Up Factors applied

2003 results under-stated due to data error

CMI CI Exposure by year and duration



Accelerated business only

Key Learning Points

- Importance of "date of claim"
  - Choice of "Date of Diagnosis"
  - Consistency of reporting
- Nature of claim delays
- Impact of growth rate on grossing-up factors
- Trends in results may reflect changes in business mix, not changes in the underlying experience
- Need to consider grossing-up factors before interpreting results

Future Work

- **2004 Final Results**
  - **Unlikely to receive further data**
  - **Hope to provide alongside corrected 2003 results**
  - **Also need to provide guidance on grossing-up factors**
- **Further Analysis of grossing-up factors**
  - **Ongoing work into grossing-up factors to adjust raw results**
  - **Attempting to track maturing 1999-2002 experience using claims settled in 2003 and 2004**
- **Hope to use GLM as graduation tool on grossed-up results to produce individual age rates**
- **=> Working Paper in 2007**

The Actuarial Profession
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CMI Critical Illness Investigation

"*Critical Illness – MOT or Cosmetic Surgery?*" seminar
6 December 2006, Staple Inn

Dave Grimshaw
Secretary, CMI Critical Illness Committee

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