

**The Actuarial Profession**  
making financial sense of the future

Health and care conference 2010  
Dave Heeney and Dave Grimshaw, CMI Critical Illness Committee



## Critical Illness Learning from experience

14 May 2010

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### Critical Illness: Learning from experience

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#### Agenda

- Summary of past work
- 1999-2004 Diagnosis rates
- 2003-2006 results and Diagnosis rates
- Future Work

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## CMI Critical Illness – Outputs

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- May 05: Results for 1999, 2000, 2001, 2002
- May 05: **WP14 – Initial methodology (Grossing-up factors)**
- Dec 05: WP18 – Feedback on WP14 & future work
- Apr 07: 2003 (Revised) and 2004 (Unadjusted) Results
- Jul 07: **WP28 – Towards improved methodology**
- Jul 08: **WP33 – A new methodology (Adjusted Results)**
- Jul 08: 1999-2004 Adjusted Results
- Oct 08: 2005 Unadjusted and Adjusted Results
- Oct 09: 2006 Unadjusted and Adjusted Results
- Dec 09: 2003-2006 Unadjusted Results
- Feb 10: **WP43 – Diagnosis Rates (Accelerated 1999-2004)**

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## CMI Critical Illness – Methodology

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- ‘Unadjusted Results’ / WP14 methodology
  - Actual Settled Claims v Expected Diagnosed Claims
  - Mismatch ... ‘Grossing-up factors’
- ‘Adjusted Results’ / WP33 methodology
  - Actual Settled Claims v Expected Settled Claims
  - Match A & E, but presented using settlement timing
- Diagnosis Rates / WP43 methodology
  - Derive from ‘Adjusted Results’ / WP33 methodology
  - Smoothed, fitted diagnosis rates for claims settled in 99-04

## CMI Critical Illness – WP33 Methodology

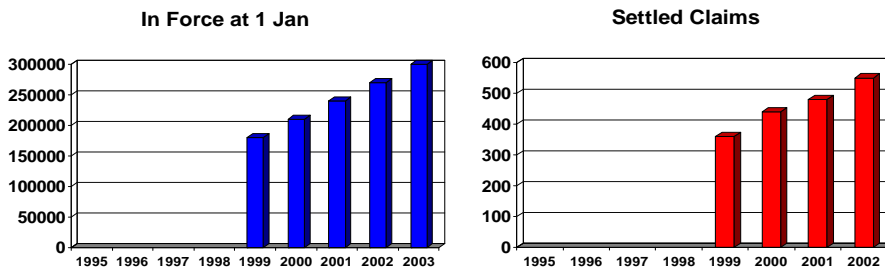
- The approach starts with estimating prior years' in force data and hence exposure
- ... from which we estimate diagnosed claims in each year (at each age and duration) using an initial set of claim rates
- ... we then apply a claim development distribution (CDD) to estimate settled claims in each year
- ... these can be compared to known settled claims to produce 'adjusted' results

WP43:

- ... and equating estimated settled claims with known settled claims will generate a set of diagnosed claim rates

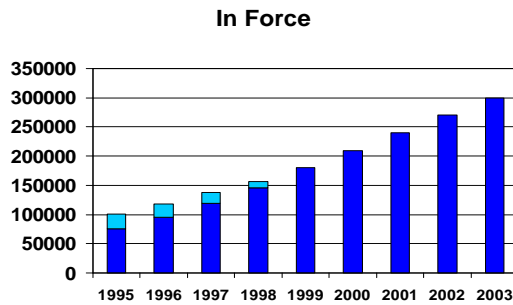
## CMI Critical Illness - WP33 Methodology

- CMI CI data / analysis problem:
  - Claims collected by year of settlement; diagnosis date often unknown; material lag from diagnosis to settlement
- Start with the known in-force and settled claims



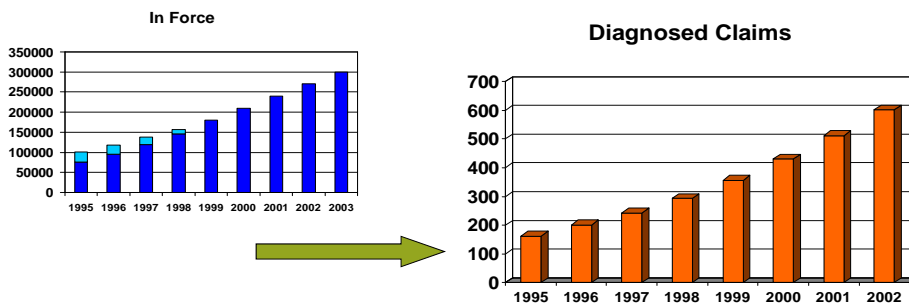
## CMI Critical Illness - WP33 Methodology

- From known in-force, estimate prior years in-force
  - Roll back known data (over time, age and duration)
  - Add back an estimate of business exiting before start date



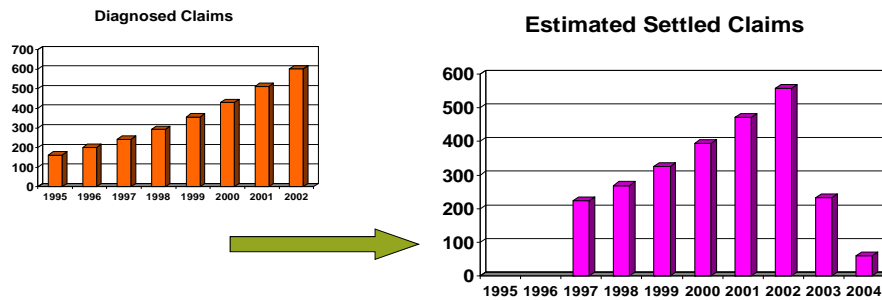
## CMI Critical Illness - WP33 Methodology

- From the in-force, estimate exposure in each year, then estimate diagnosed claims by year (at each age & duration) using an initial set of claim rates



## CMI Critical Illness - WP33 Methodology

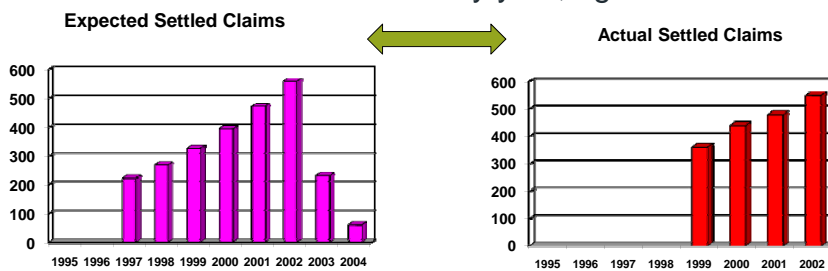
- From estimated diagnosed claims by year, estimate settled claims by year (by age & duration) using an assumed claim development distribution (CDD)



NB Max interval from diagnosis to settlement = 2 years in this illustration

## CMI Critical Illness - WP33 Methodology

- Compare estimate of expected settled claims in investigation period with known settled claims by year, age and duration



- Produces 'adjusted' results (Actual Settled Claims/Expected Settled Claims), for a given base table and CDD
- WP43 – Used to derive a set of 'best fit' CI claim diagnosis rates

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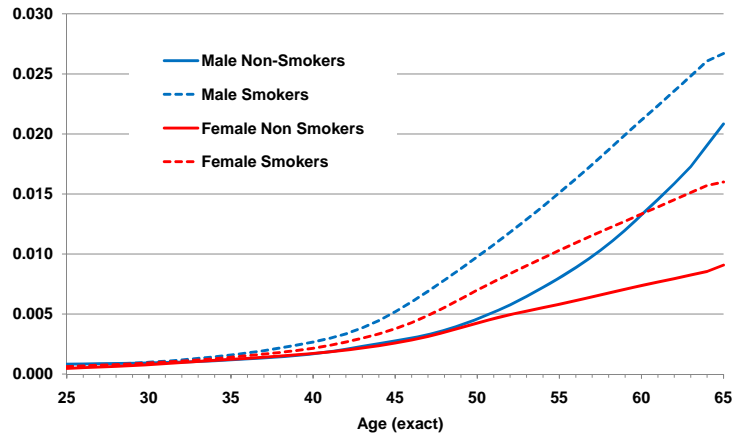
## Working Paper 43 – Diagnosis Rates

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- Extension of WP33 methodology
- Pragmatic approach (not mathematical model)
- Claim Development Distribution derived for all genders/smokers
- Judgement required on many aspects:
  - selection / application of constraints (prior beliefs)
  - smoothness versus goodness-of-fit
  - identifying viable age range
  - identifying variations in rates by duration
  - analysis of subsets (gender, smoker status, cause, ...)
  - derivation of CDD(s)

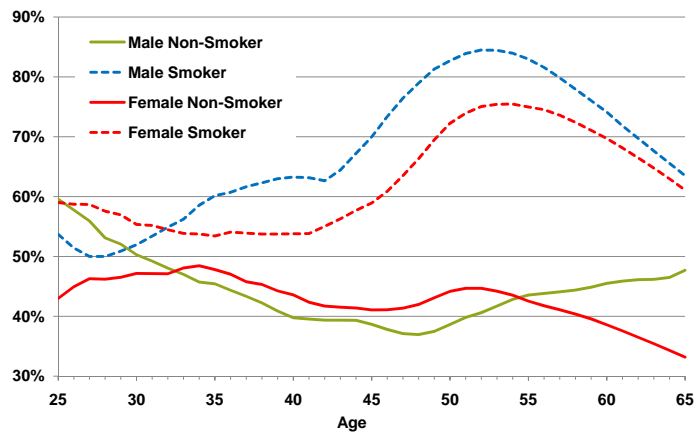
### Working Paper 43 – All-causes Diagnosis Rates

Smoothed Annualised CI Diagnosis Rates by Gender and Smoker Status; Accelerated CI; Ultimate; 1999-2004



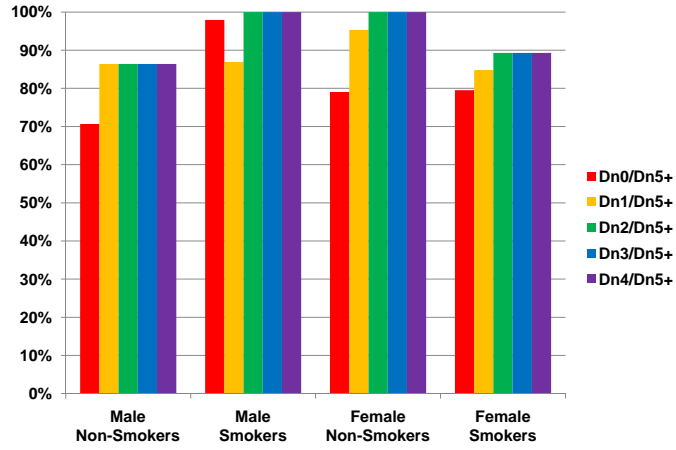
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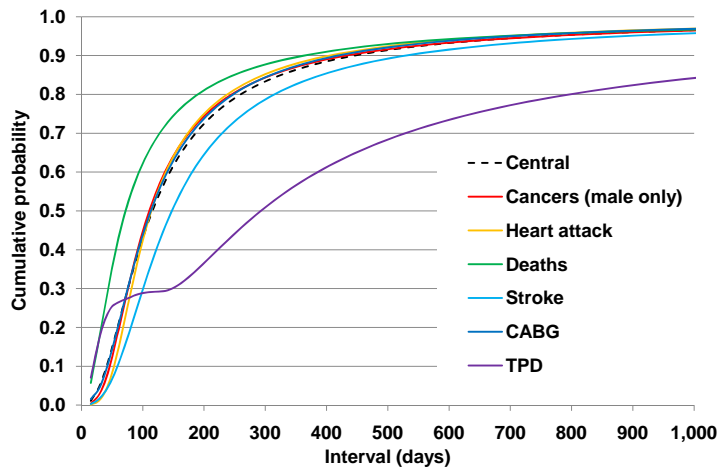


## Working Paper 43 – All-causes Diagnosis Rates

Durational pattern in Smoothed Annualised CI Diagnosis Rates  
Accelerated CI; 1999-2004



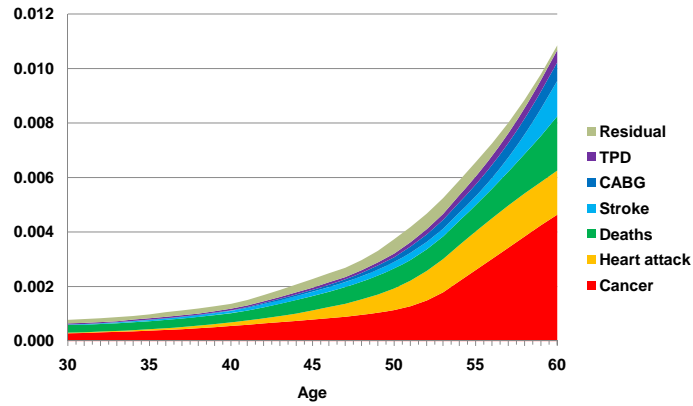
## Working Paper 43 – Cause-specific CDDs





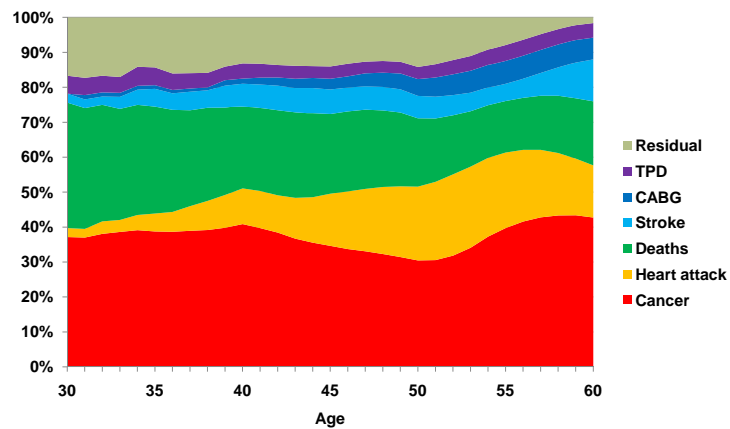
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Smoothed Annualised CI Diagnosis Rates by Cause  
Accelerated CI; Males; Non-Smokers; Durations 1-4; 1999-2004



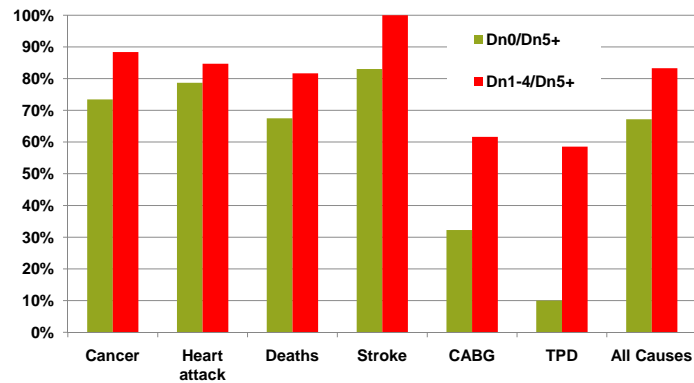
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CI Diagnosis Rates by Cause as % of All-causes Rates  
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## Working Paper 43 – Cause-specific Diagnosis Rates

Durational pattern in CI Diagnosis Rates by Cause  
Accelerated CI; Males; Non-Smokers; 1999-2004



## Key Features of WP43 work

- Rates fitted by age only and by duration only, to broadly fit the expected settled claims to the actual settled claims; each gender/smoker dataset considered independently.
- Different selection patterns:
  - Male Non-smoker 0, 1-4, 5+
  - Male Smoker 0, 1, 2+
  - Female Non-smoker 0, 1, 2+
  - Female Smoker 0, 1, 2-4, 5+
- Shapes of rates by age differ significantly from current tables
- Shape of rates by age and duration may be distorted by market changes.

## Benefits of moving to 2003-2006 dataset

- More up-to-date
- Experience in 1999-2004 appears to have reduced in period
- Less affected by changes in the critical illness market?
- Shorter period (4 years v 6 years) ... But similar number of settled claims
- Higher % of claims with date of diagnosis  $\Rightarrow$  CDD more reliable
- Reduced dependency on off rates
- More stable contributing offices
- Analysis of two periods may show “real” features.

## Questions from WP43

- Prioritisation of various 2003-2006 rates?
- The need for a full age-range table?
- The appropriateness of the constraints, particularly by duration?
- Other constraints, e.g. between non-smoker and smoker rates?
- Derive all-causes rates directly or sum of cause-specific rates?
- Anti-selection in male smoker rates?
- Increased selection at ages 46-55 in male non-smoker rates?
- All-causes rates including or excluding TPD?

## Critical Illness: Learning from experience

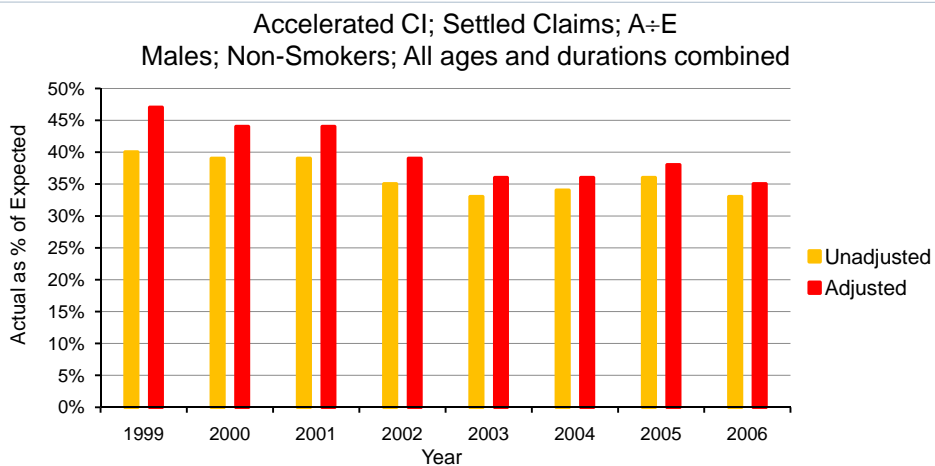
### Agenda

- Summary of past work
- 1999-2004 Diagnosis rates
- **DRAFT** 2003-2006 results and **PROVISIONAL** Diagnosis rates
- Future Work

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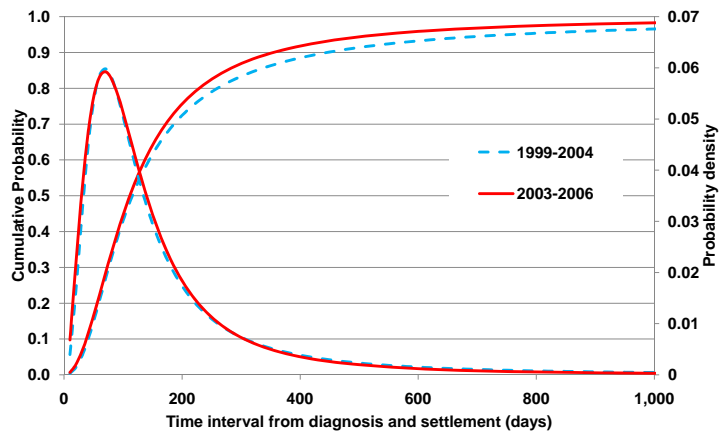
## CI Experience Summary - by Year



Annual results issued to member offices: Expected based on CIBT93 and 1999-2004 Central CDD for 'adjusted' results

## 2003-2006 Claim Development Distribution (CDD)

Comparison of 2003-2006 CDD with the 1999-2004 CDD:

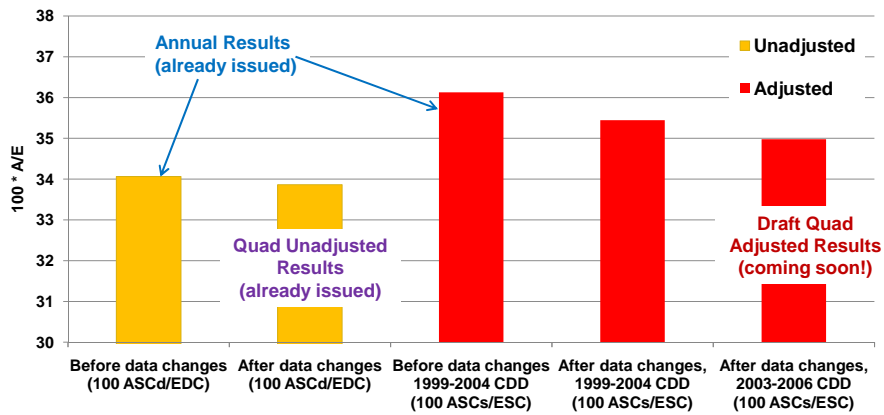


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## CI Experience Summary 2003-2006 Impact of data changes and revised CDD

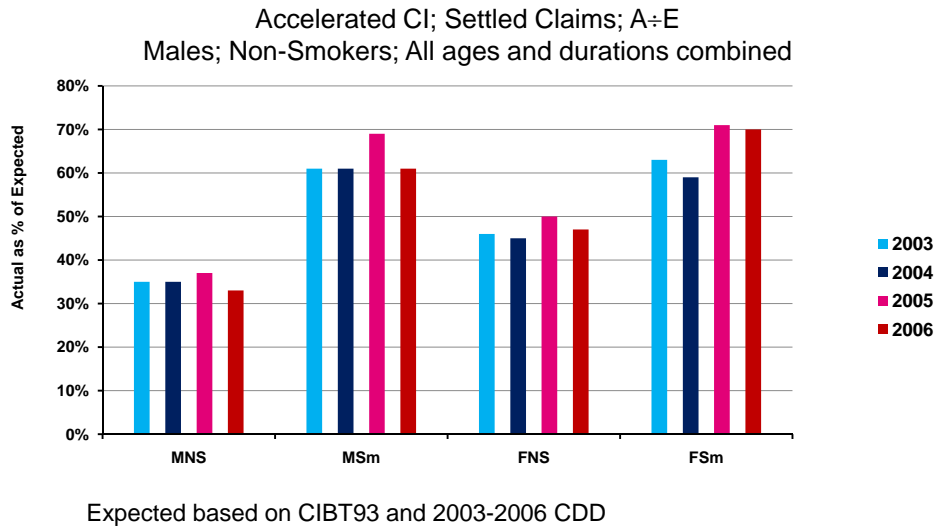
Accelerated CI; Settled Claims; A÷E (E=CIBT93)  
Males; Non-Smokers; All ages and durations combined



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## Draft CI Experience Summary 2003-2006 By Year

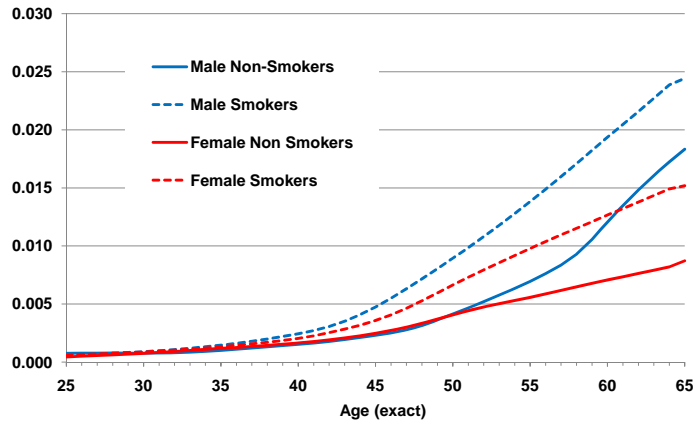


## 2003-2006 Provisional Diagnosis Rates

- Initial phase of work is to “repeat” the work on 1999-2004 (WP43 methodology, 2003-2006 CDD, by cause for MNS only)
- Seeking to assess how the rates compare:
  - Do the selection patterns inferred from the data differ?
  - How do the “selection discounts” compare? (Is there still evidence of anti-selection for male smokers?)
  - Is the fit still poor for male non-smokers at ages 36-55?
  - How do the cause-specific rates (for male non-smokers) compare?
- PROVISIONAL FINDINGS AT THIS STAGE

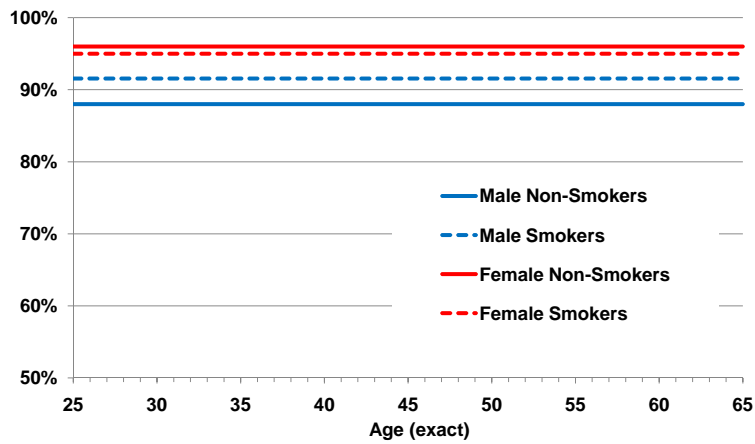
### 2003-2006 Provisional All-causes Diagnosis Rates

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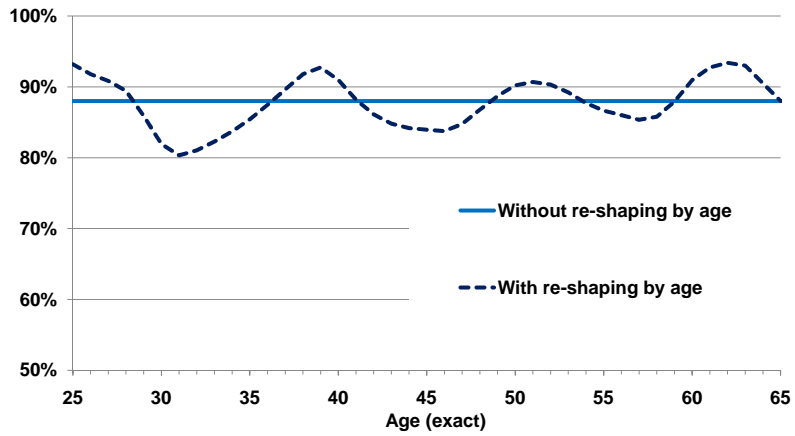
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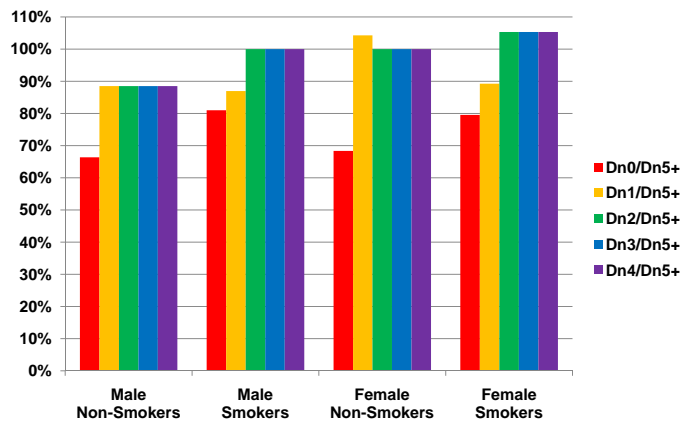
### 2003-2006 Provisional All-causes Diagnosis Rates

Smoothed Annualised CI Diagnosis Rates Male Non-Smoker only;  
Accelerated CI; Ultimate; 2003-2006 as % of 1999-2004



### 2003-2006 Provisional All-causes Diagnosis Rates

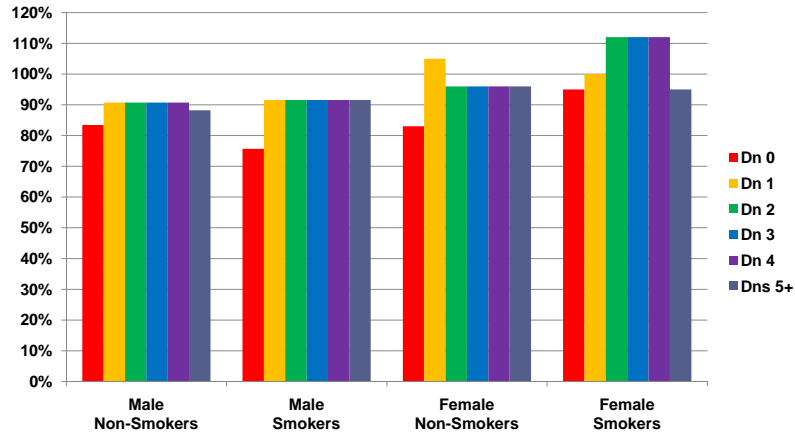
Durational pattern in Smoothed Annualised CI Diagnosis Rates  
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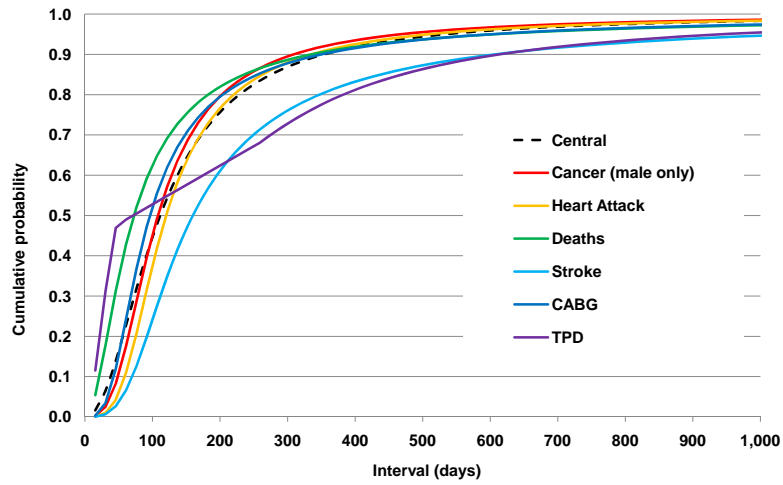


## 2003-2006 Provisional All-causes Diagnosis Rates

Annualised CI Diagnosis Rates by Gender and Smoker Status; Accelerated CI; by Duration; unsmoothed 2003-2006 as % of 1999-2004

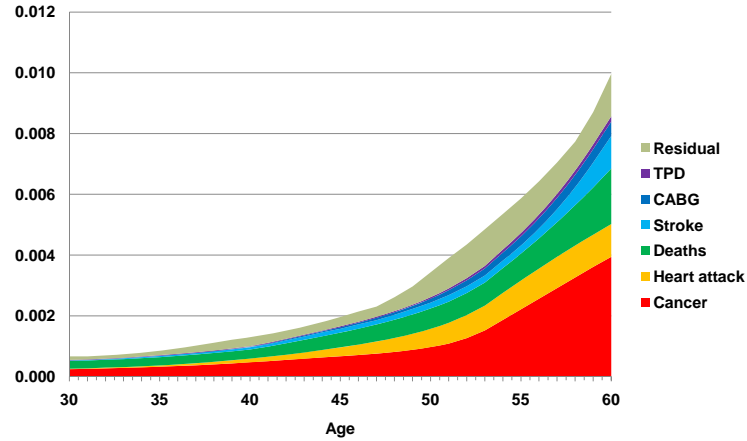


## 2003-2006 Provisional Cause-specific CDDs



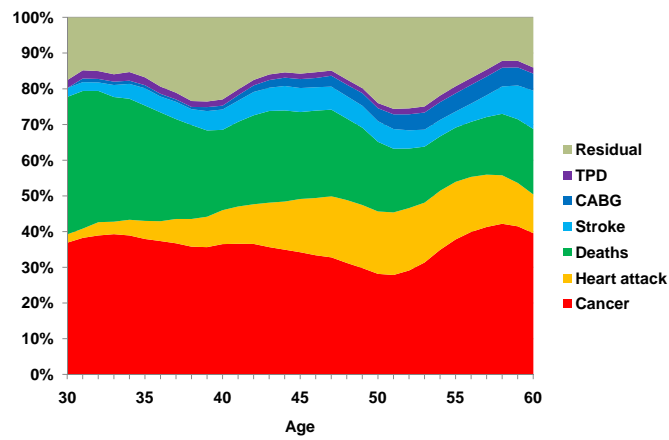
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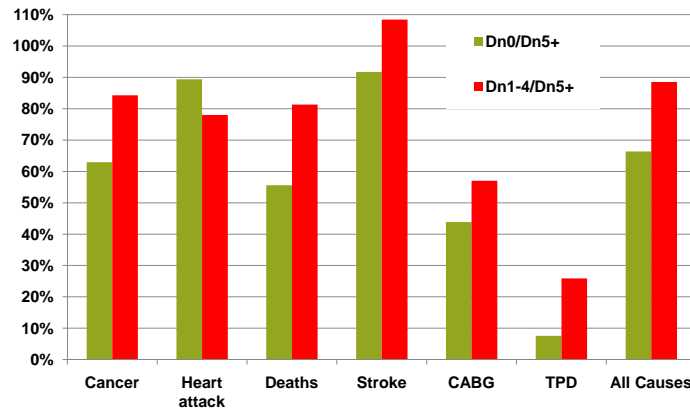
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## 2003-2006 Provisional Cause-specific Diagnosis Rates

Durational pattern in CI Diagnosis Rates by Cause  
Accelerated CI; Males; Non-Smokers; 2003-2006



## 2003-2006 results and Diagnosis rates: Preliminary findings

- Experience appears to have improved between 1999 and 2002
- 2003-2006 results appear more stable
- (Female) selection patterns differ – may be random effects?
- “Selection discounts” comparable but no apparent anti-selection for male smokers in 2003-2006
- Fit for male non-smokers at ages 36-55 is still poor ... May need to vary selection discounts by age
- Cause-specific rates (for male non-smokers) comparable ... But issue for 2003-2006 given increase in unspecified types of claim

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## Critical Illness: Learning from experience

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- Summary of past work
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## CMI Critical Illness: Probable Future Outputs

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- 2003-06 Adjusted Quad Results (to member offices)
- Provisional 2003-06 diagnosis rates (to member offices) ...
- ... As additional call for feedback!
- Working Paper with derived CI diagnosis rates for 2003-06
- 2007 Results (to member offices)

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## **CMI Critical Illness: A Plea for Help!!!**

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Direct insurers:

- Do you contribute data?
- Are you up-to-date (soon asking for 2009!!)
- Do you record Dates of Diagnosis consistent with Health Claims Forum guidance?
- Do you provide Dates of Diagnosis to the CMI?!
- Do you record and provide Cause of Claim?

Reinsurers

- Are you asking your (potential) clients these questions?!