The Actuarial Profession
making financial sense of the future

Life conference and exhibition 2010
Dave Heeney and Dave Grimshaw, CMI Critical Illness Committee

Critical Illness
Learning from experience

7-9 November 2010

Critical Illness:
Learning from experience

Agenda

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

CMI Critical Illness – Outputs

- 2005 Results for 1999, 2000, 2001, 2002
  WP14 – Initial methodology (Grossing-up factors)
  Dec 05: WP18 – Feedback on WP14 & future work
- 2007 2003 (Revised) and 2004 (Unadjusted) Results
  WP28 – Towards improved methodology
- 2008 **WP33 – A new methodology (Adjusted Results)**
  1999-2004 Adjusted Results
  2005 Unadjusted and Adjusted Results
- 2009 2006 Unadjusted and Adjusted Results
  2003-2006 Unadjusted Results
- 2010 **WP43 – Diagnosis Rates (Accelerated 1999-2004)**
  2003-2006 Adjusted Results
  Draft 2003-2006 diagnosis rates

CMI Critical Illness – Methodology

- ‘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

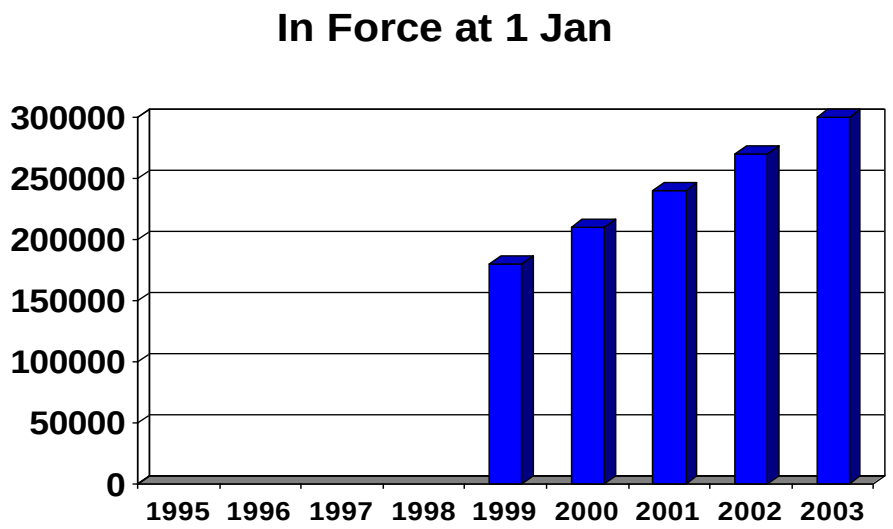
- The approach starts with estimating prior years' in force data and hence exposure
- … from which we estimate diagnosed claims in each year (at each age and duration) using an initial set of claim rates
- … we then apply a claim development distribution (CDD) to estimate settled claims in each year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

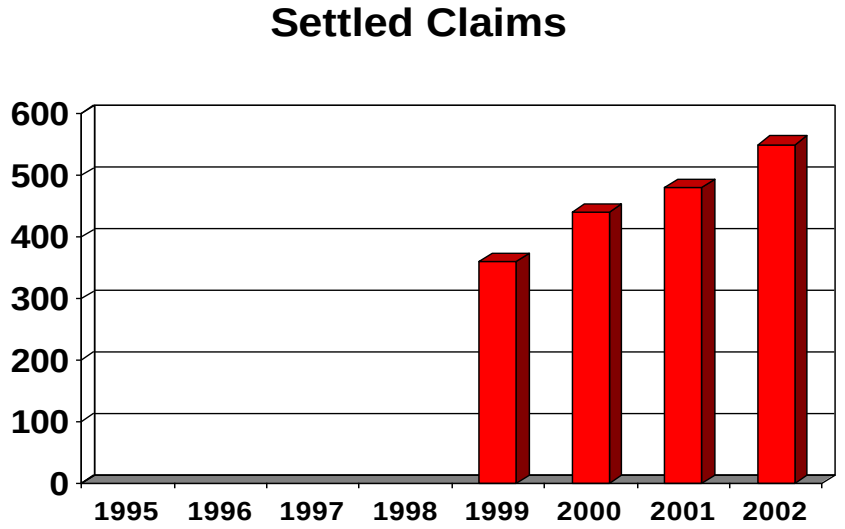
WP43:

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

CMI Critical Illness - WP33 Methodology

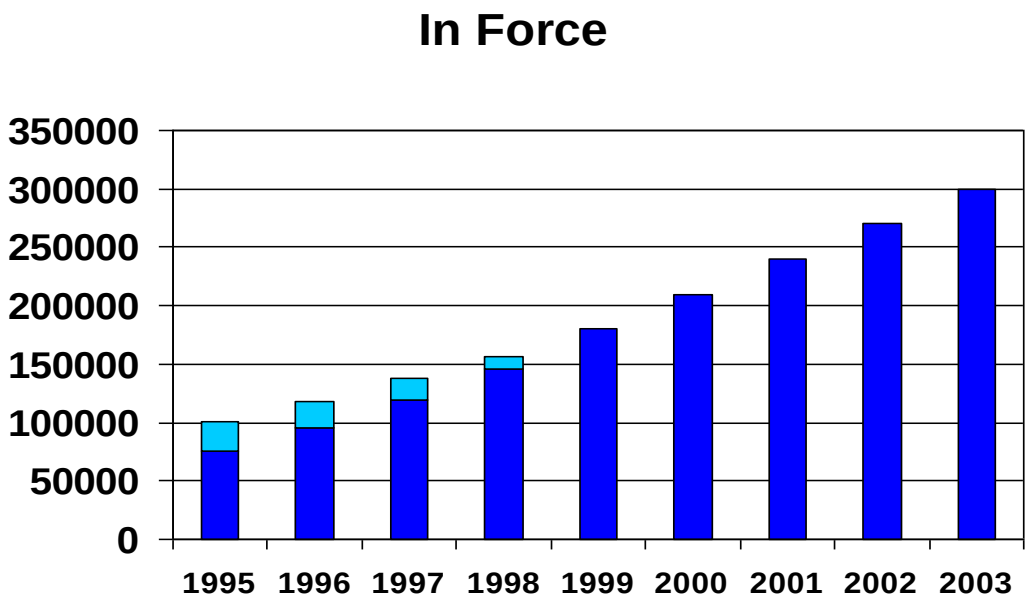
- CMI CI data / analysis problem:
  - Claims collected by year of settlement; diagnosis date often unknown; material lag from diagnosis to settlement
- Start with the known in-force and settled claims





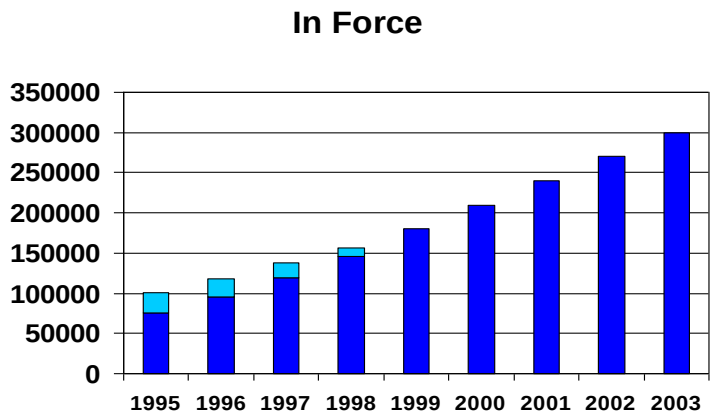
CMI Critical Illness - WP33 Methodology

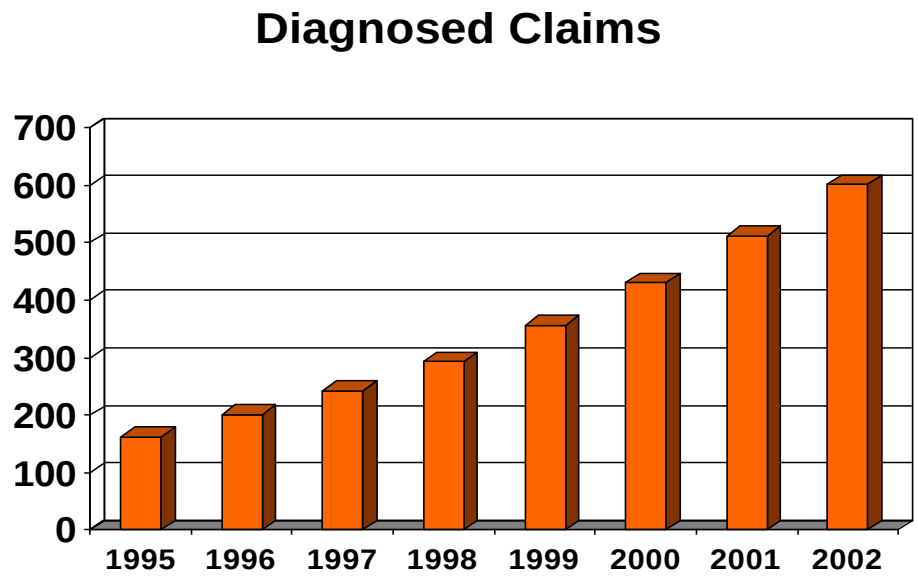
- From known in-force, estimate prior years in-force
  - Roll back known data (over time, age and duration)
  - Add back an estimate of business exiting before start date



CMI Critical Illness - WP33 Methodology

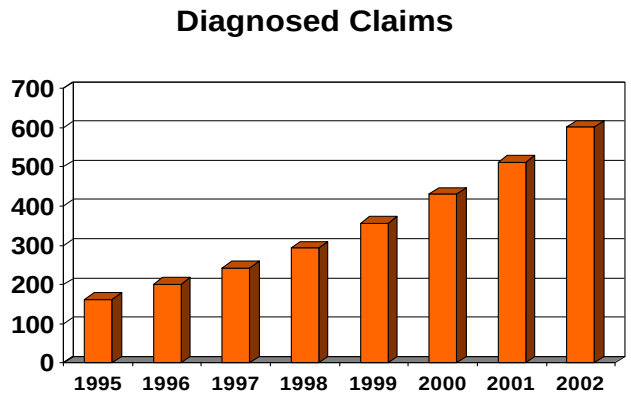
- From the in-force, estimate exposure in each year, then estimate diagnosed claims by year (at each age & duration) using an initial set of claim rates

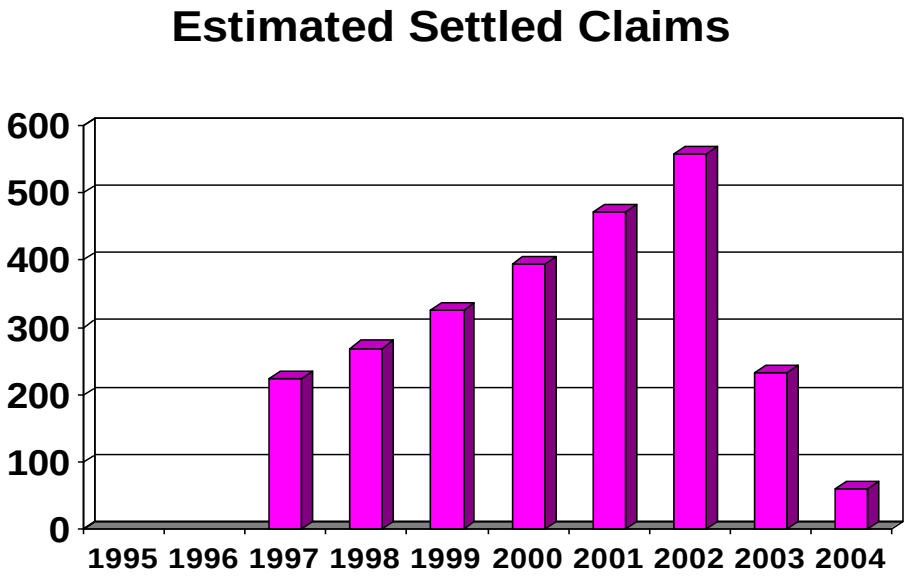




CMI Critical Illness - WP33 Methodology

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

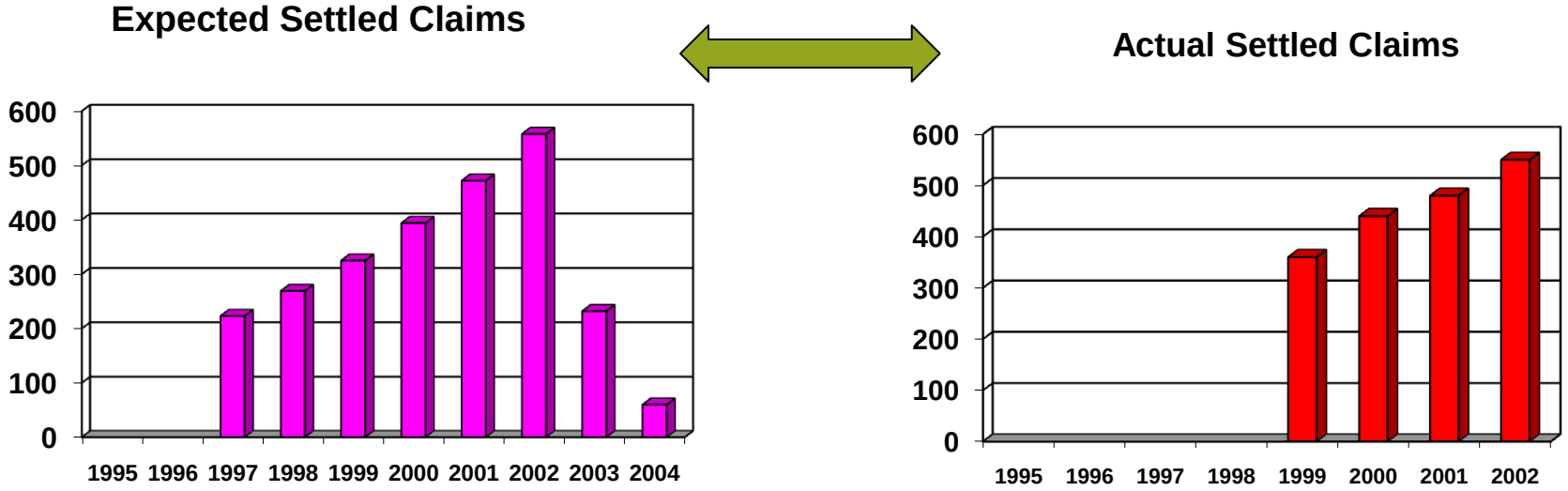




NB Max interval from diagnosis to settlement = 2 years in this illustration

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

Critical Illness:
Learning from experience

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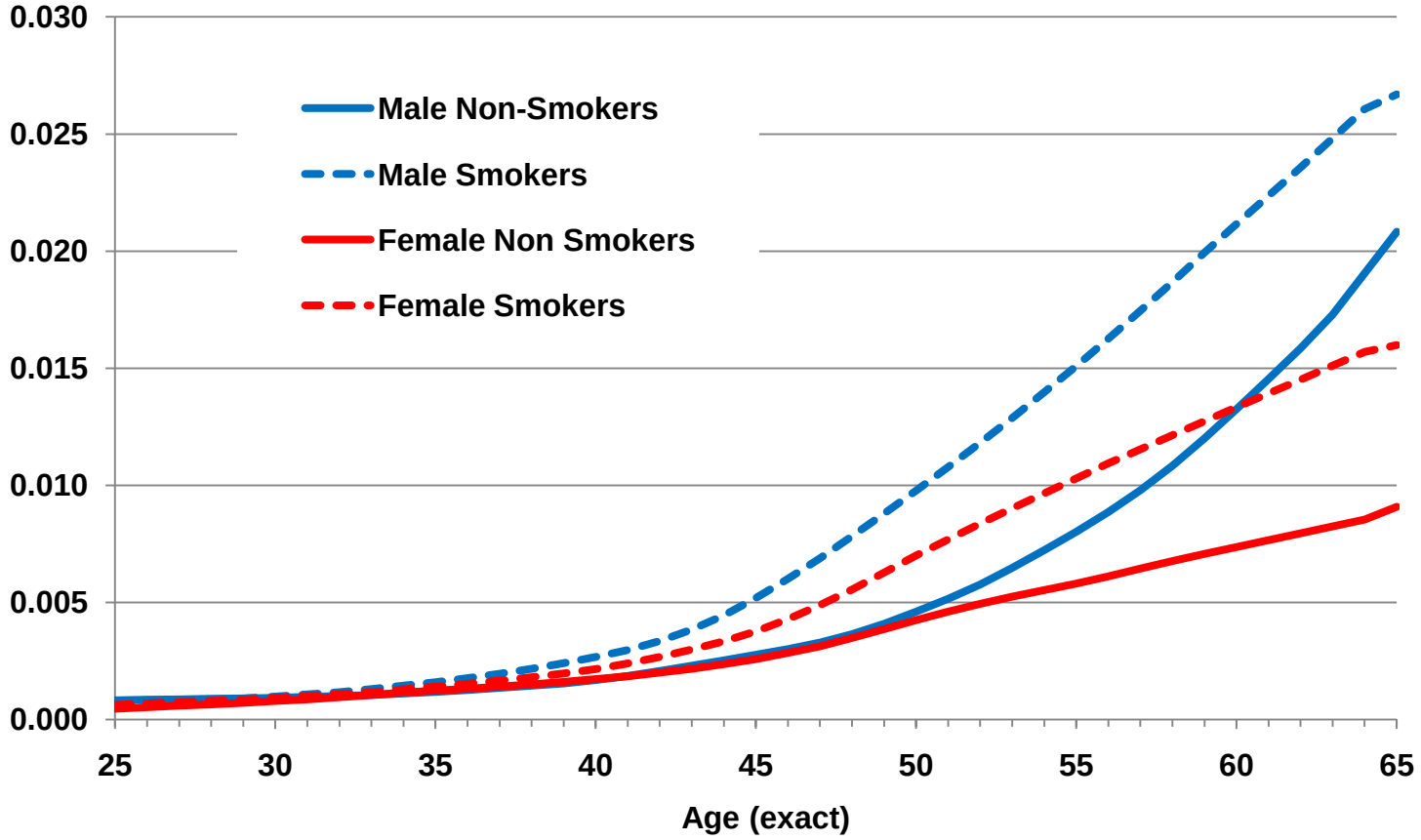
Working Paper 43 – Diagnosis Rates

- 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)

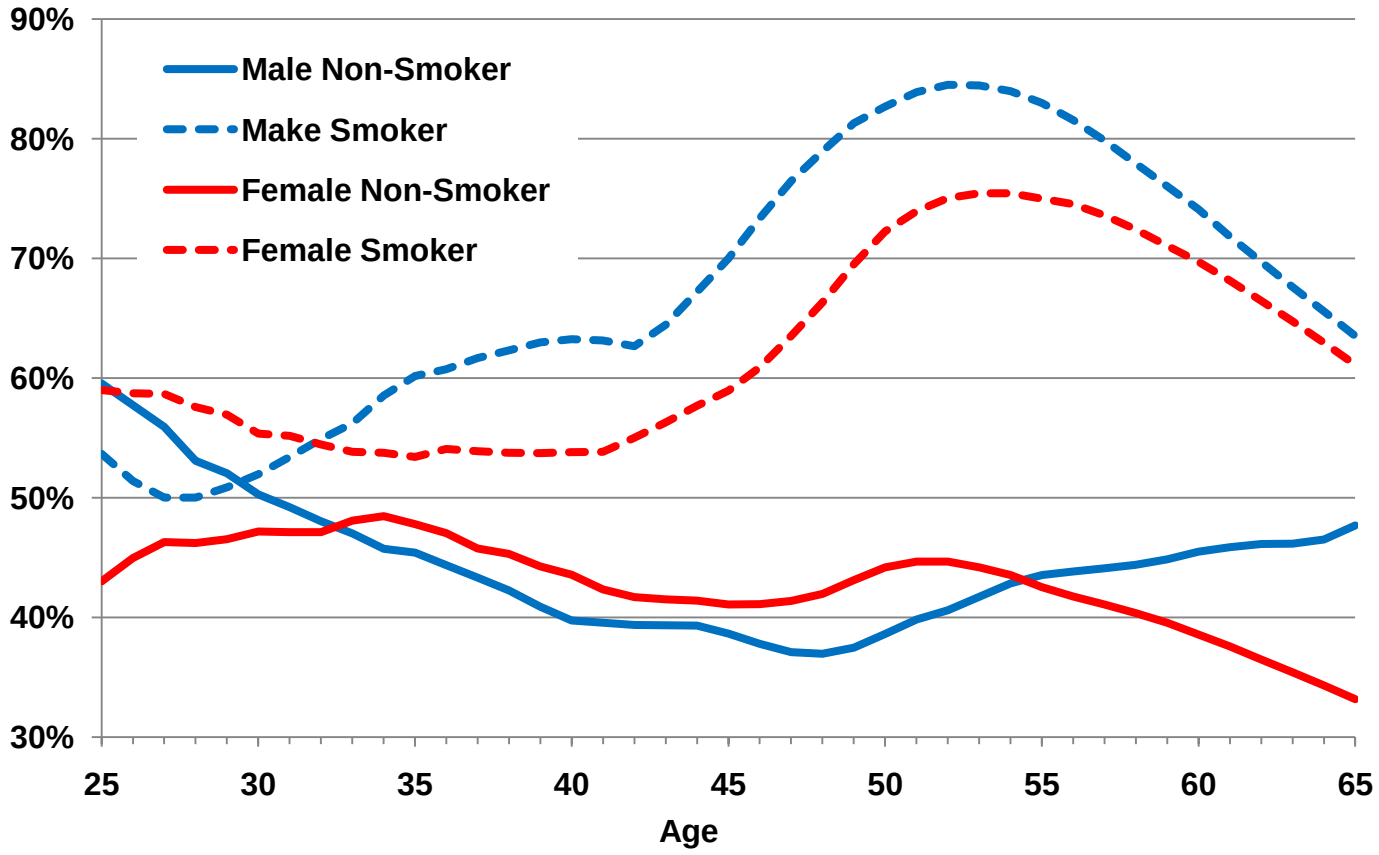
Working Paper 43 – All-causes Diagnosis Rates

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



Working Paper 43 – All-causes Diagnosis Rates

Smoothed Annualised CI Diagnosis Rates by Gender and Smoker Status; Accelerated CI; Ultimate; 1999-2004 as % of CIBT02



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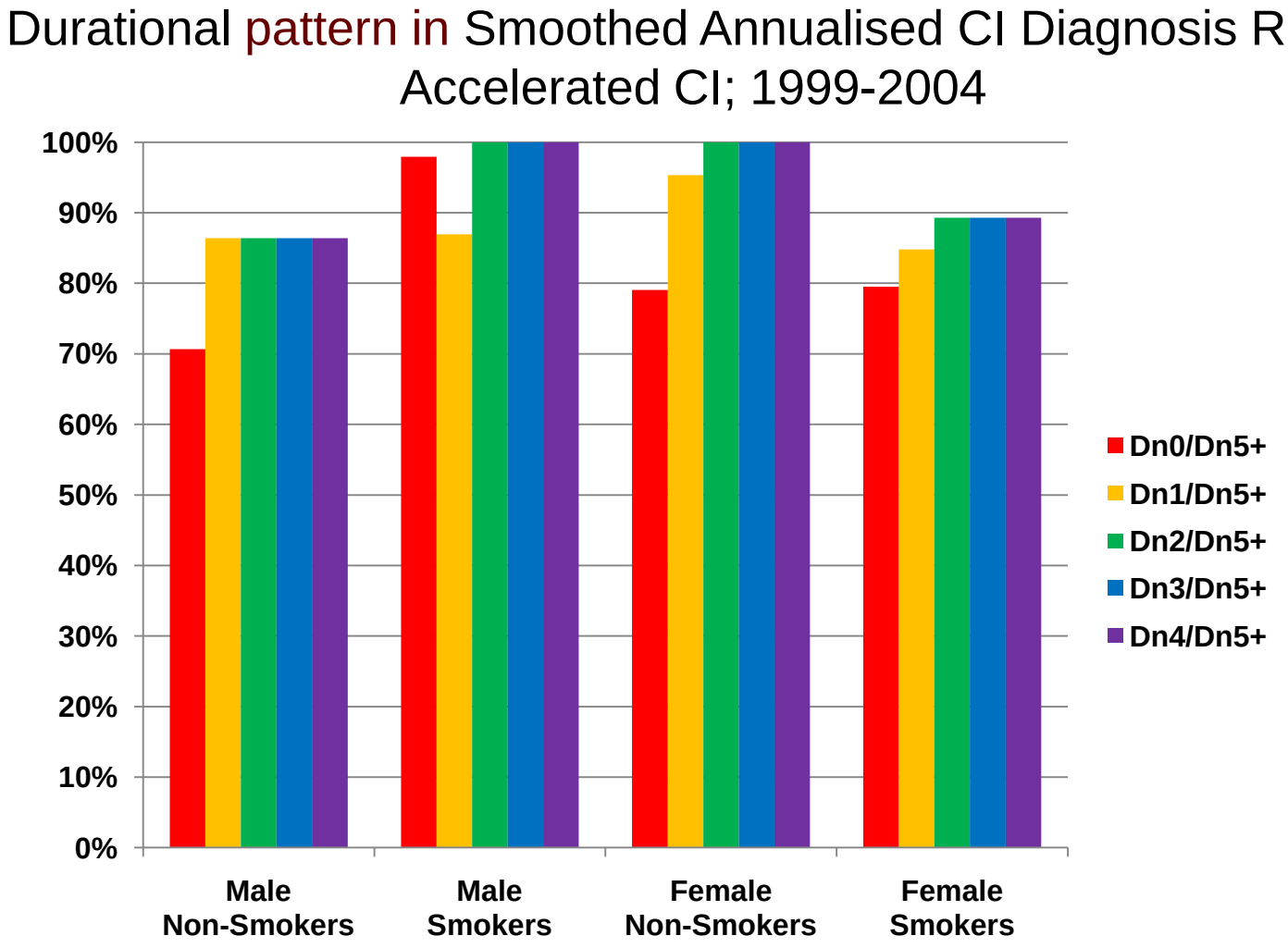
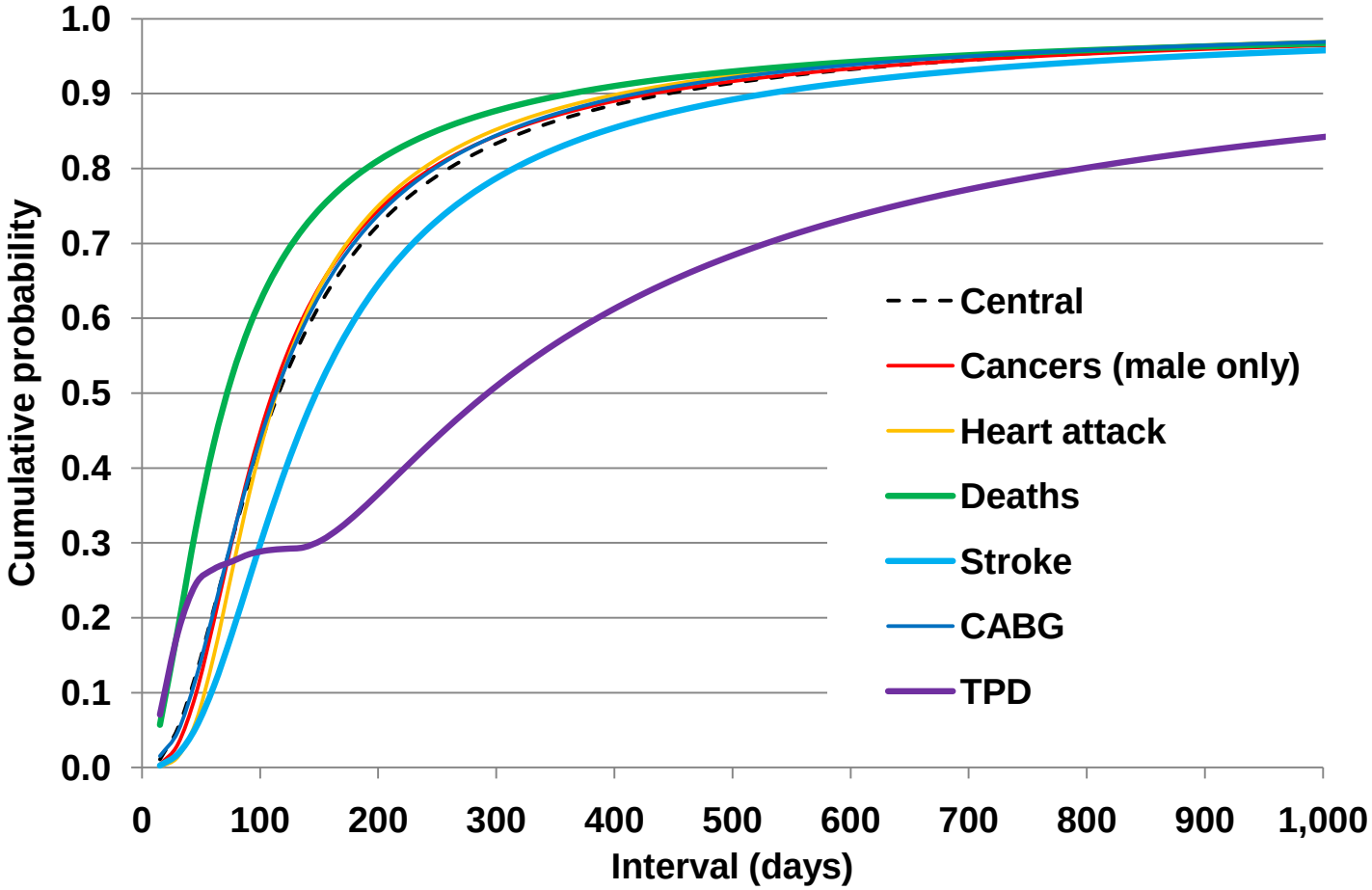
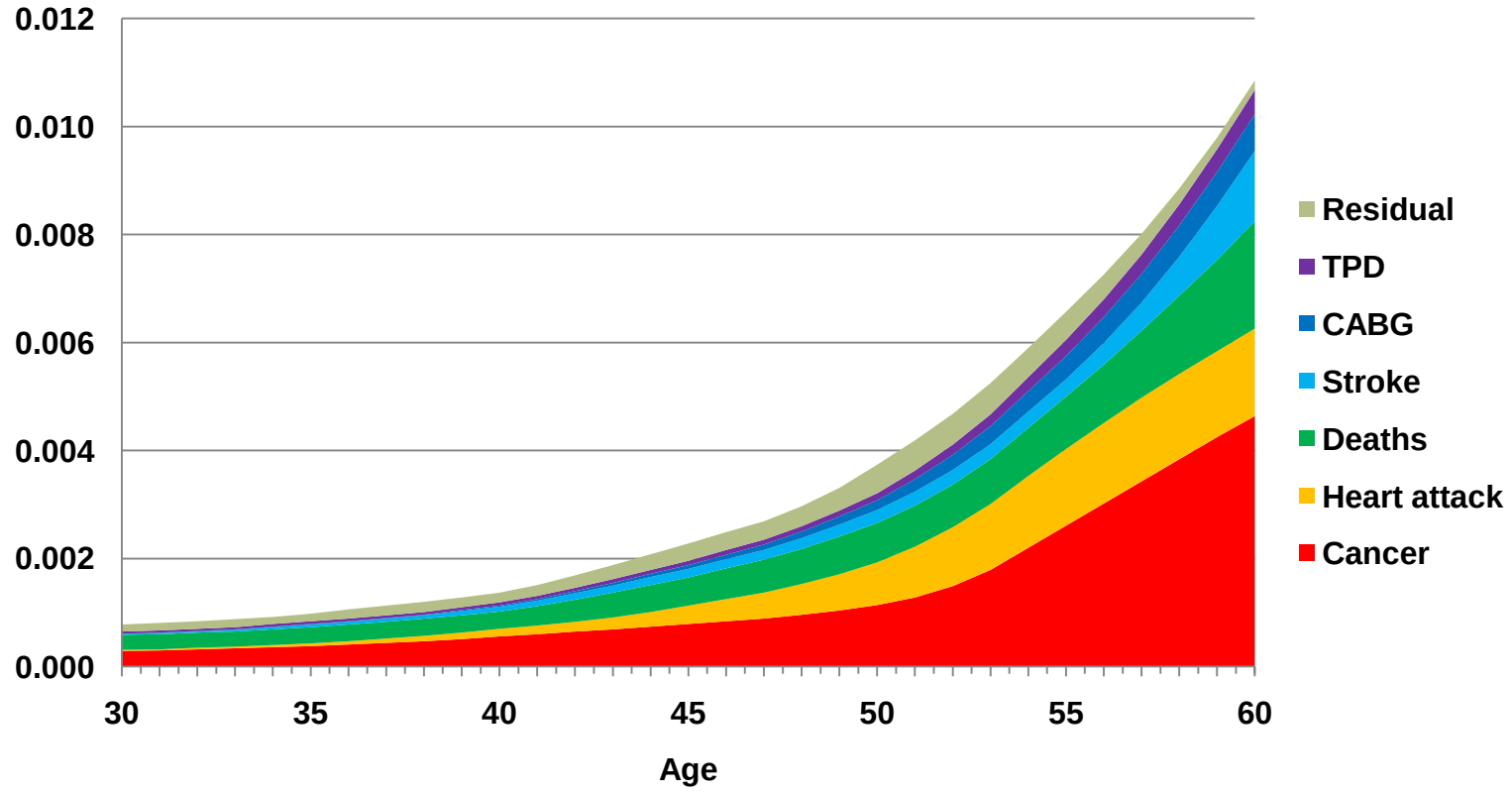


Working Paper 43 – Cause-specific CDDs



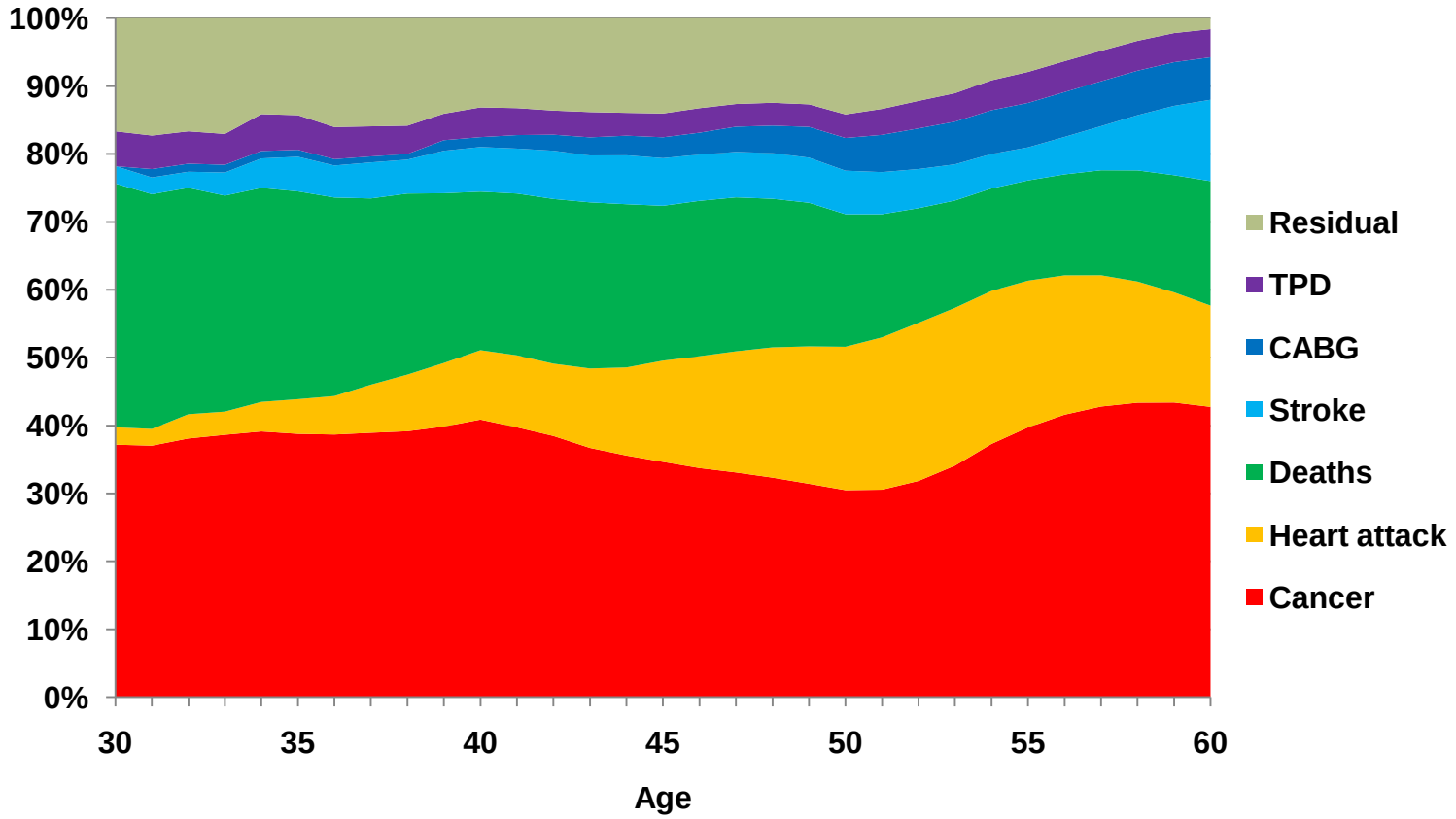
Working Paper 43 – Cause-specific Diagnosis Rates

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



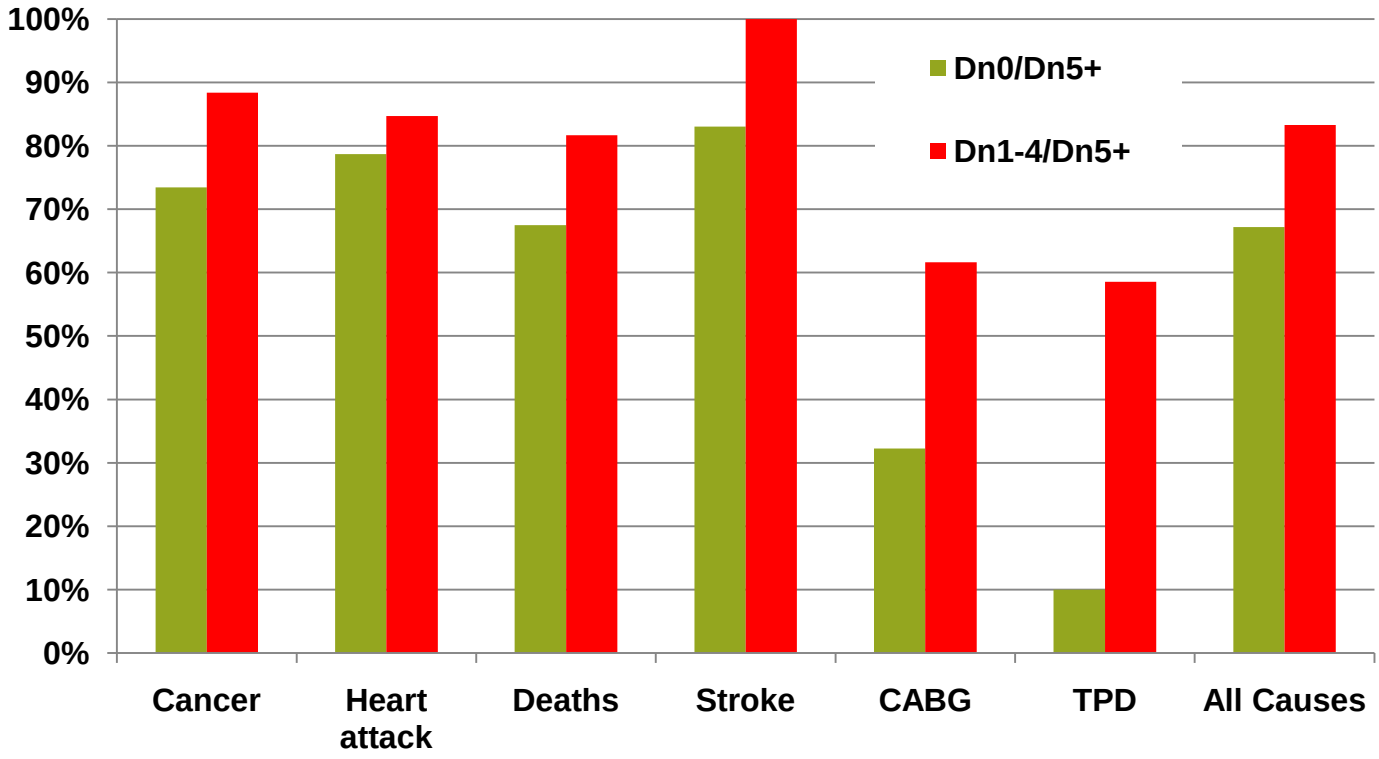
Working Paper 43 – Cause-specific Diagnosis Rates

CI Diagnosis Rates by Cause as % of All-causes Rates
Accelerated CI; Males; Non-Smokers; Durations 1-4; 1999-2004



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.

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?

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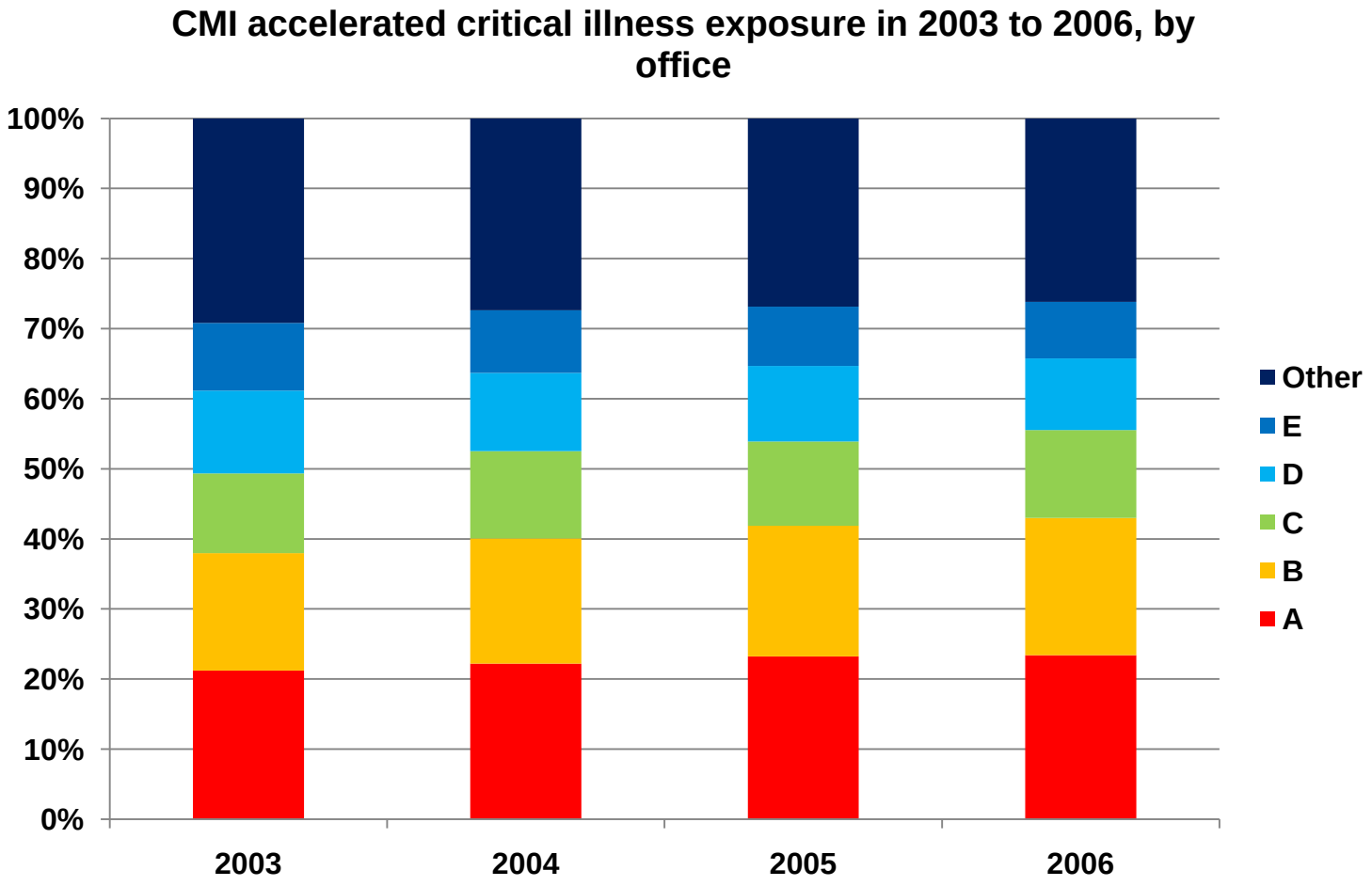
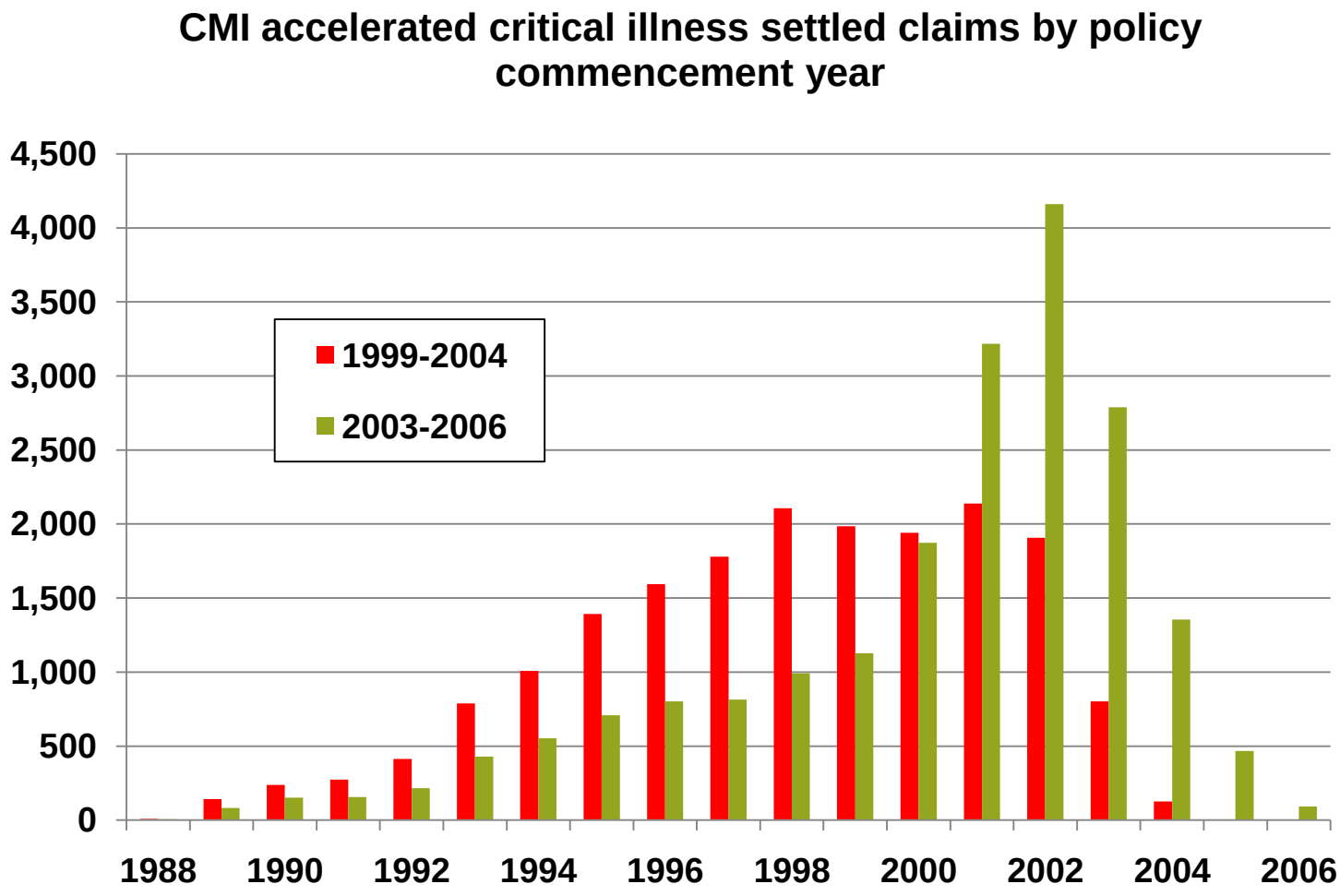
Benefits of moving to 2003-2006 dataset

- 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.

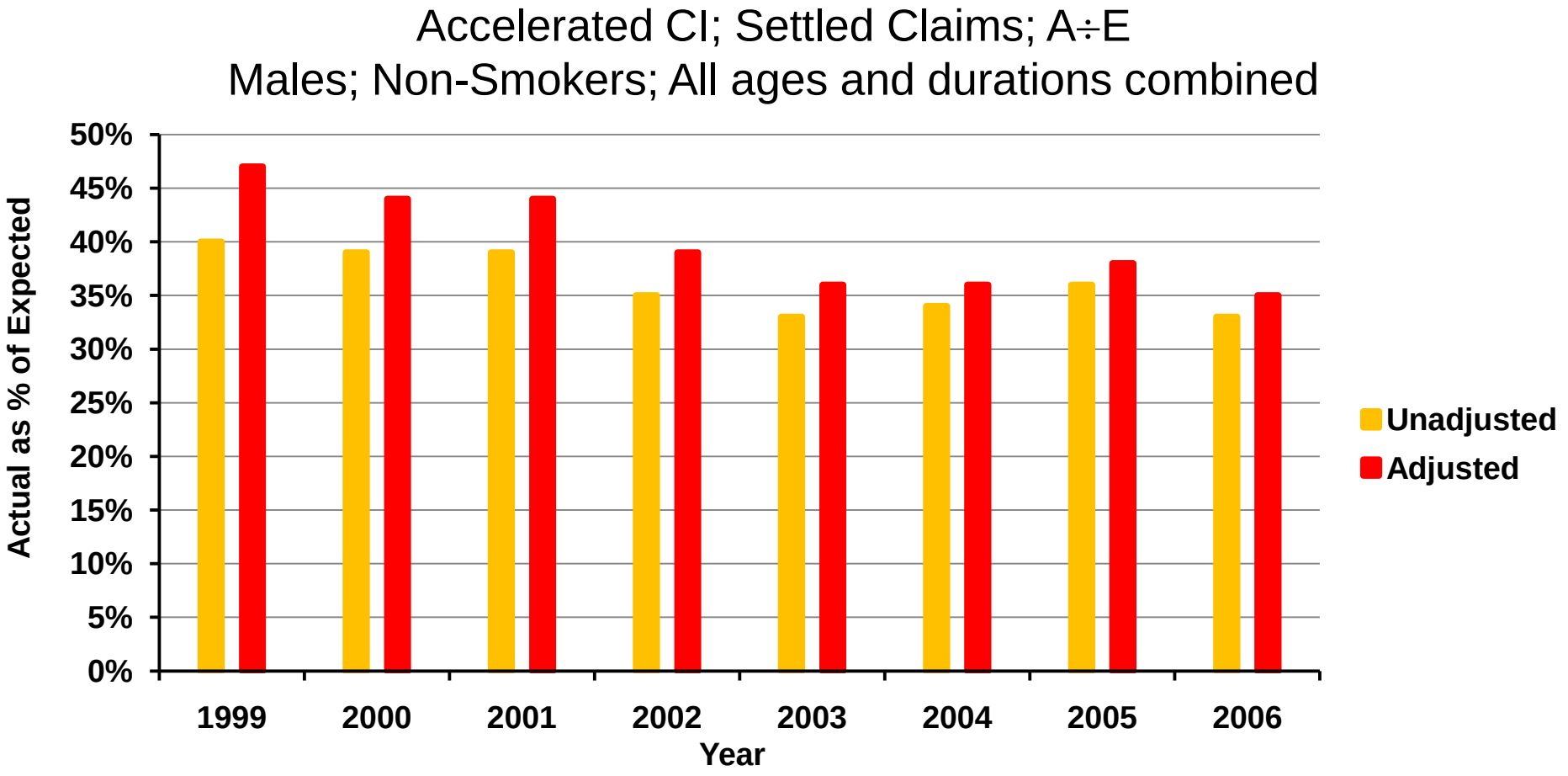
Benefits of moving to 2003-2006 dataset



Vulnerability of 2003-2006 dataset to market changes



CI Experience Summary - by Year



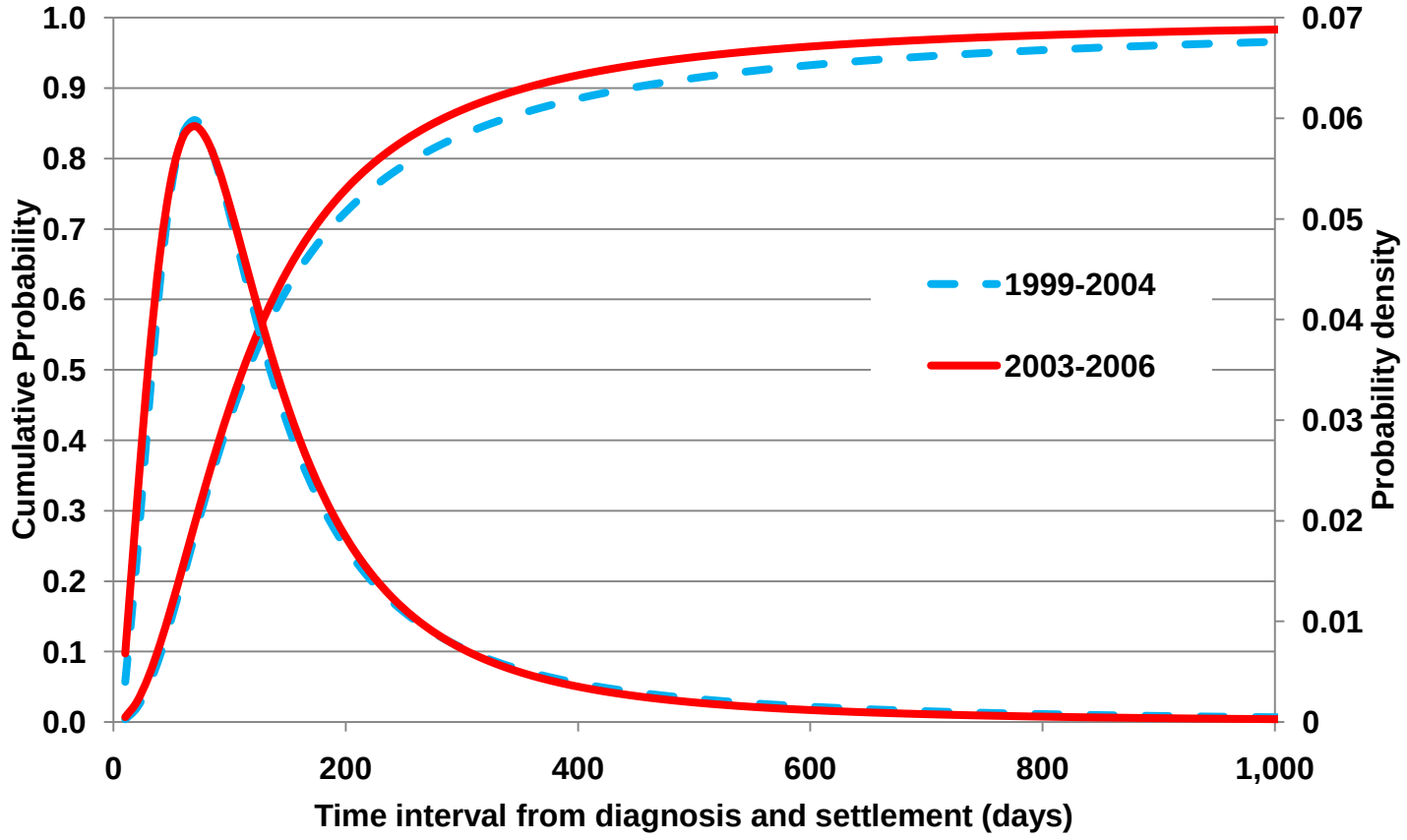
Annual results issued to member offices: Expected based on CIBT93 and 1999-2004 Central CDD for 'adjusted' results

CI Experience Summary 2003-2006: Data changes

- 2003-2006 $\neq$ 2003+2004+2005+2006
- Addition of data from offices who submitted 2003-2006 “late”
- Doubts over accuracy of data from one (small) office
- Minor data corrections

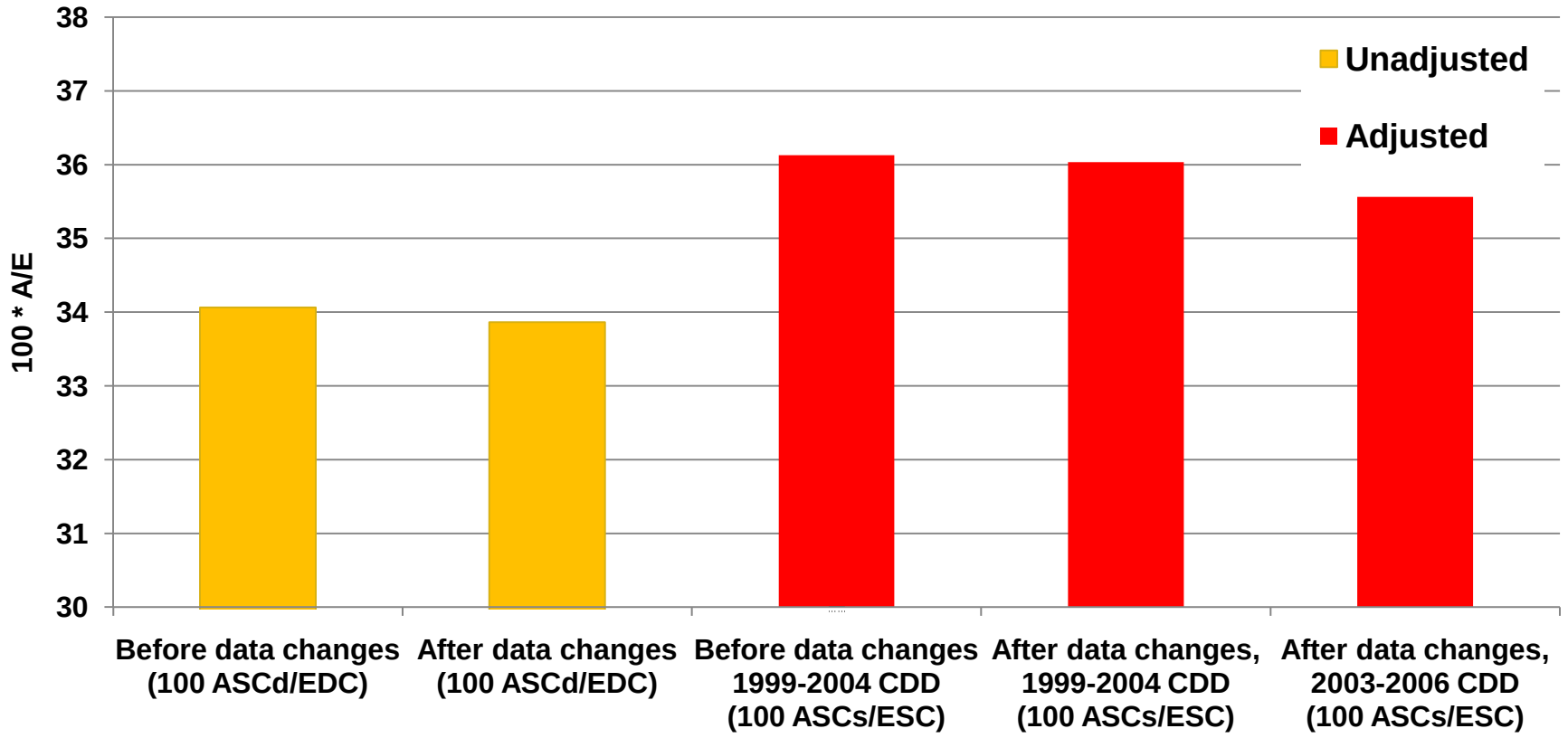
2003-2006 Claim Development Distribution (CDD)

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



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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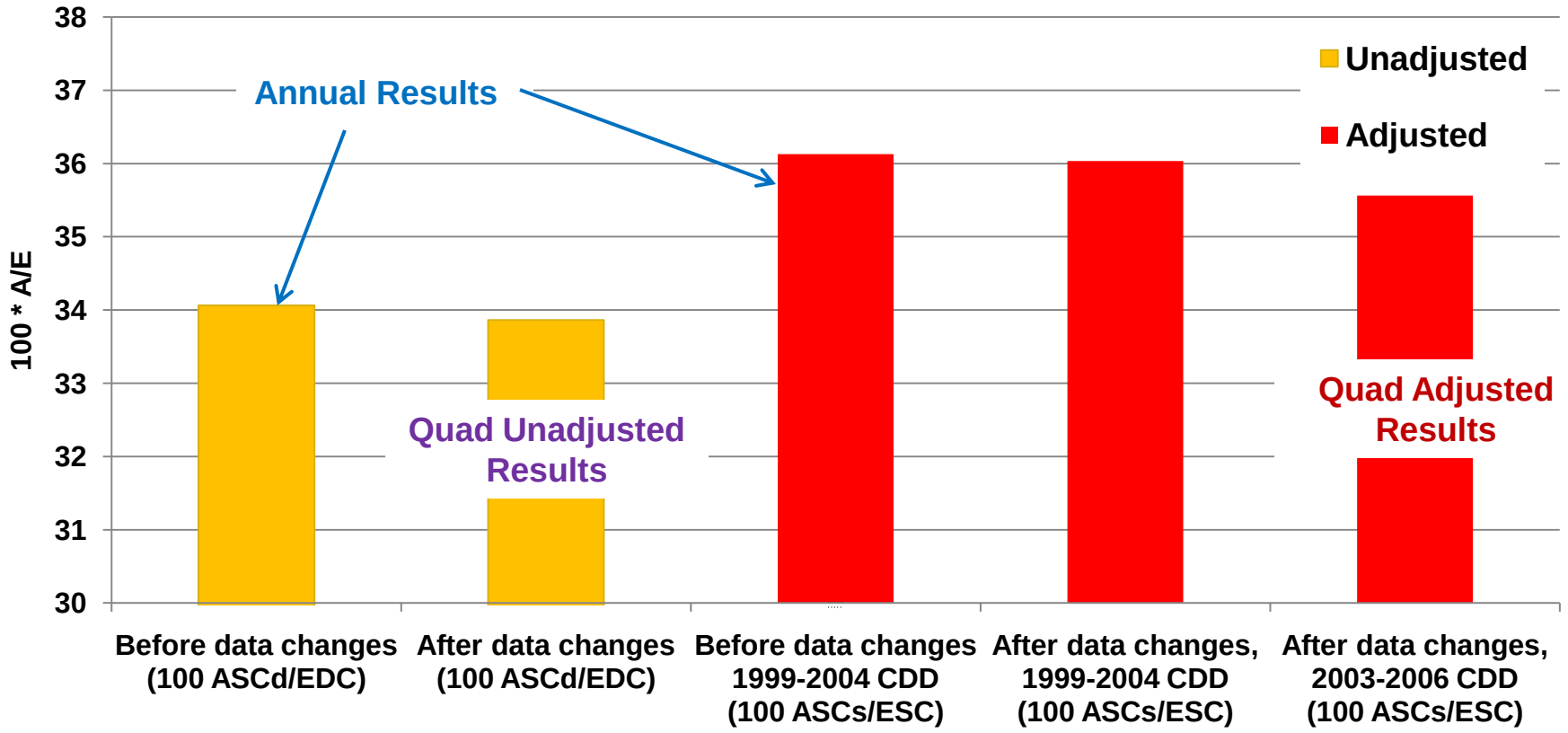

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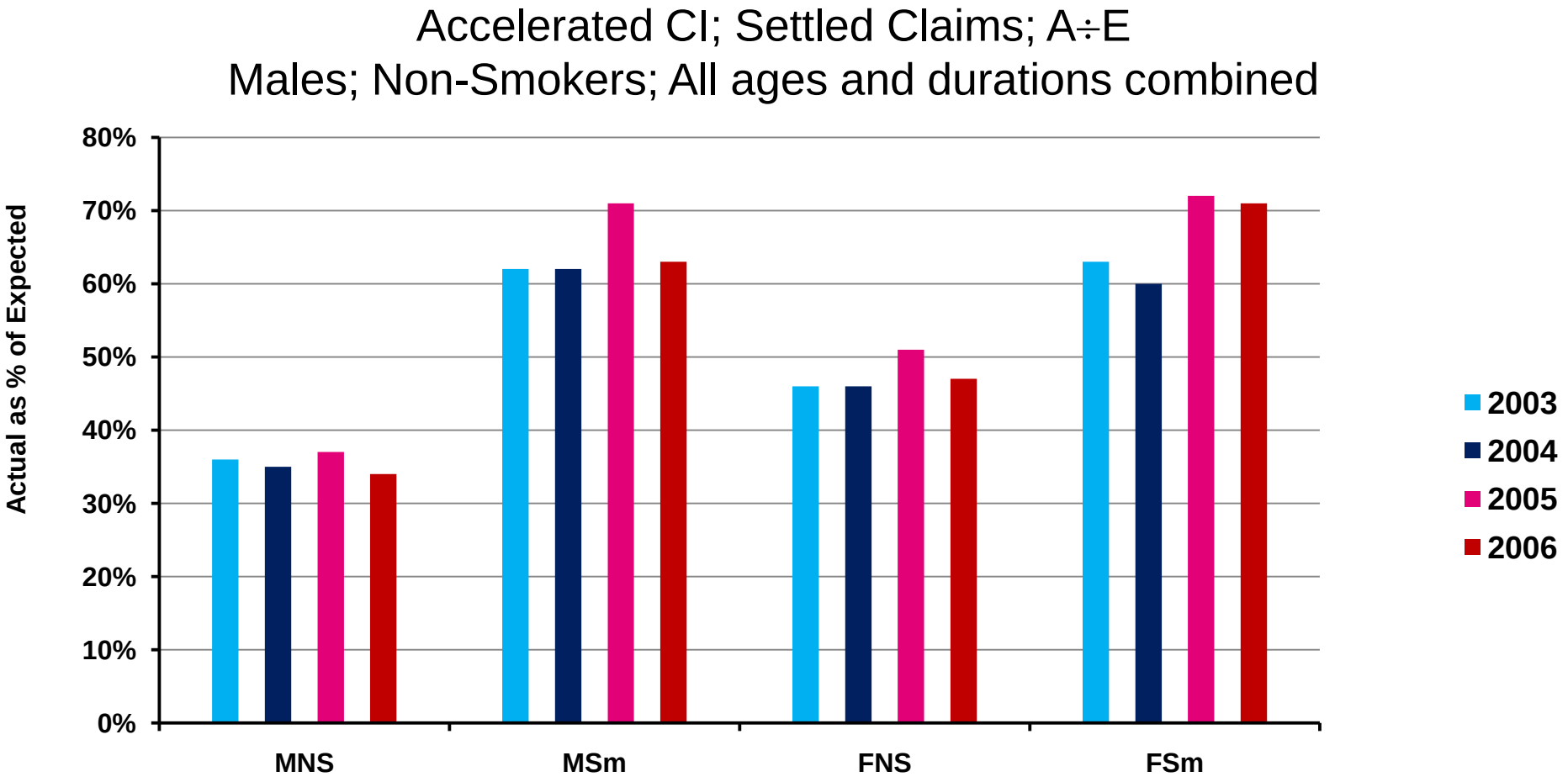


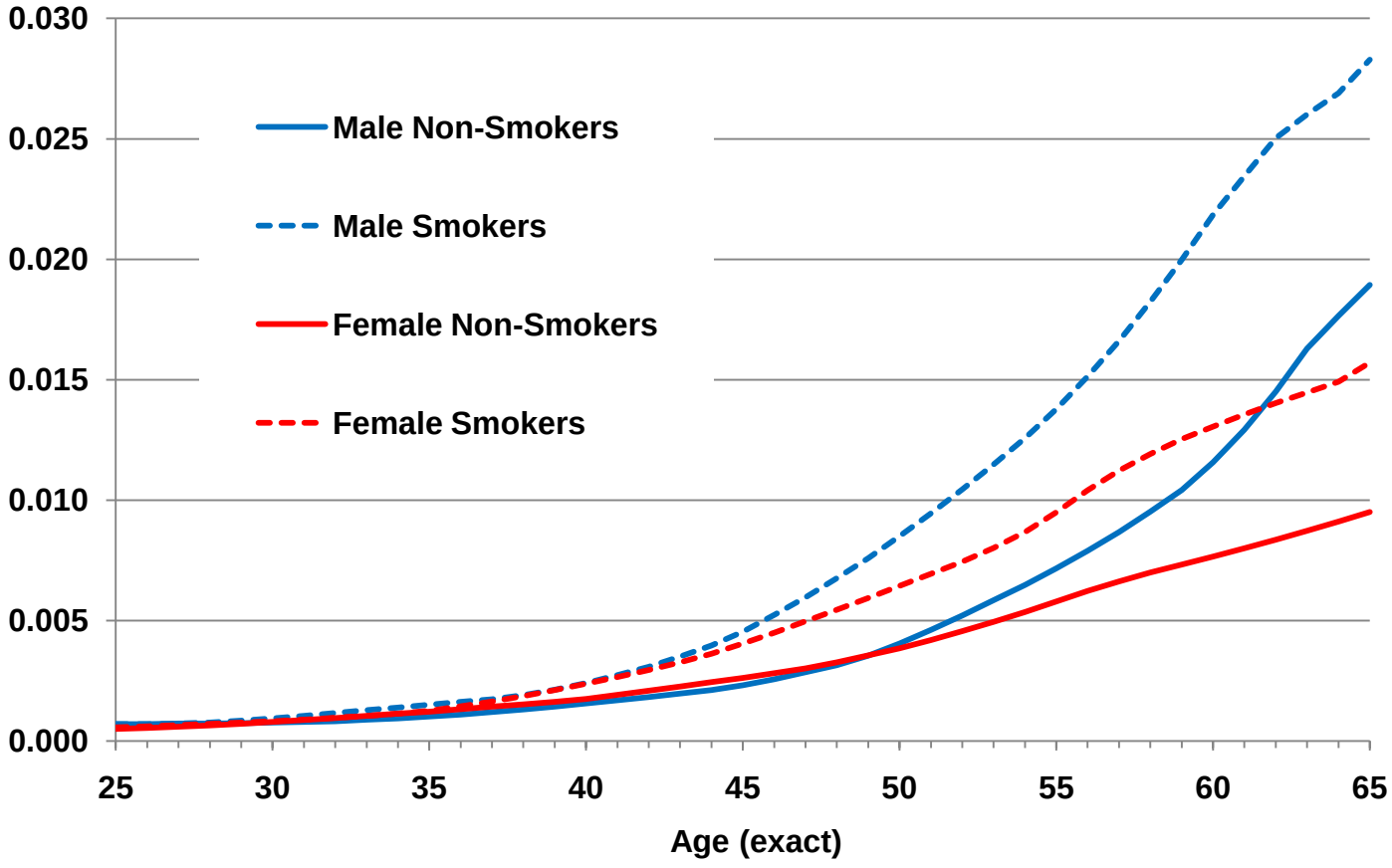
Expected based on CIBT93 and 2003-2006 CDD

2003-2006 Draft Diagnosis Rates

- Initial phase of work was 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?
- Draft rates issued to member offices in August 2010

2003-2006 All-causes Diagnosis Rates

Smoothed Annualised CI Diagnosis Rates by Gender and Smoker Status; Accelerated CI; Ultimate; 2003-2006



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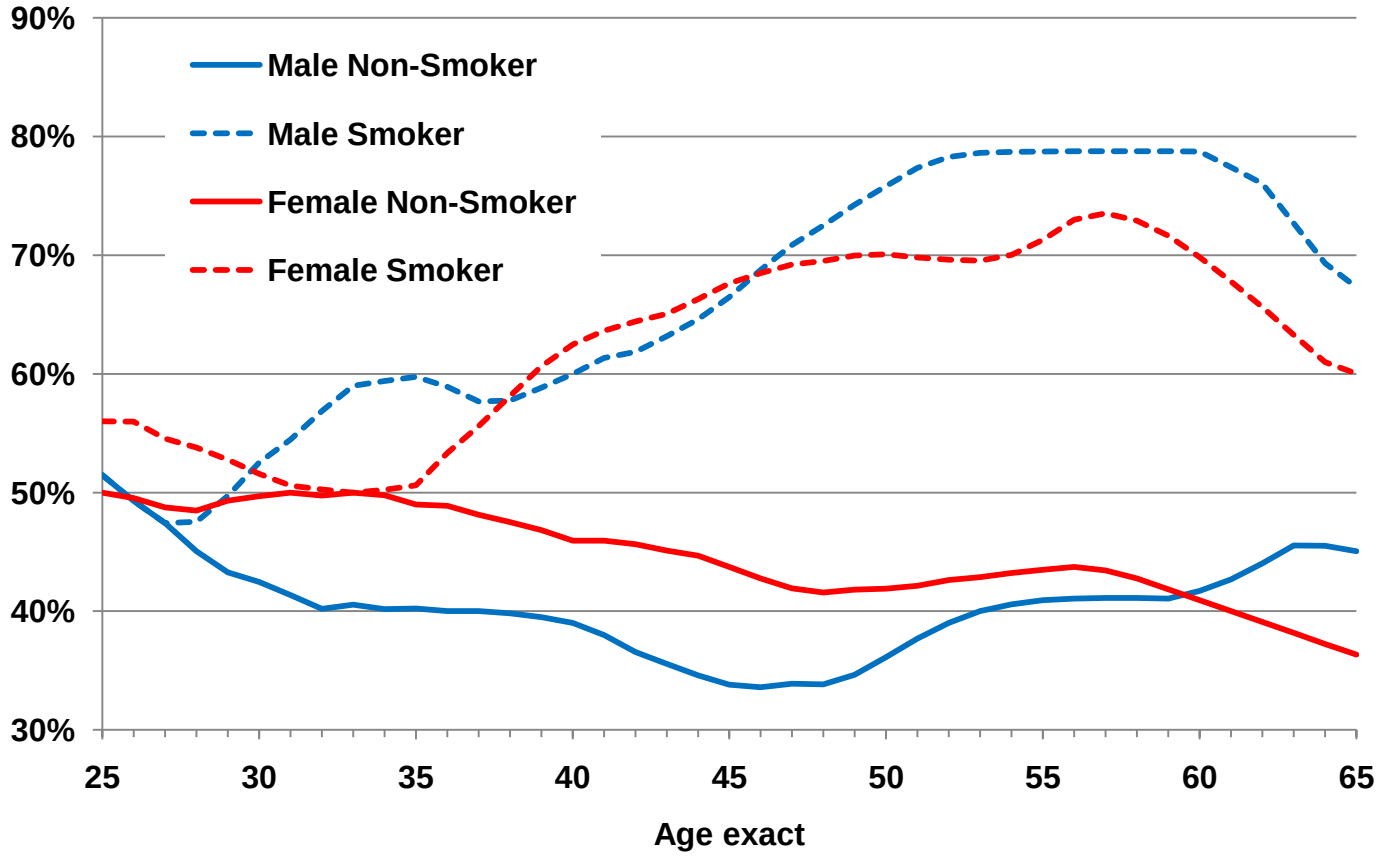

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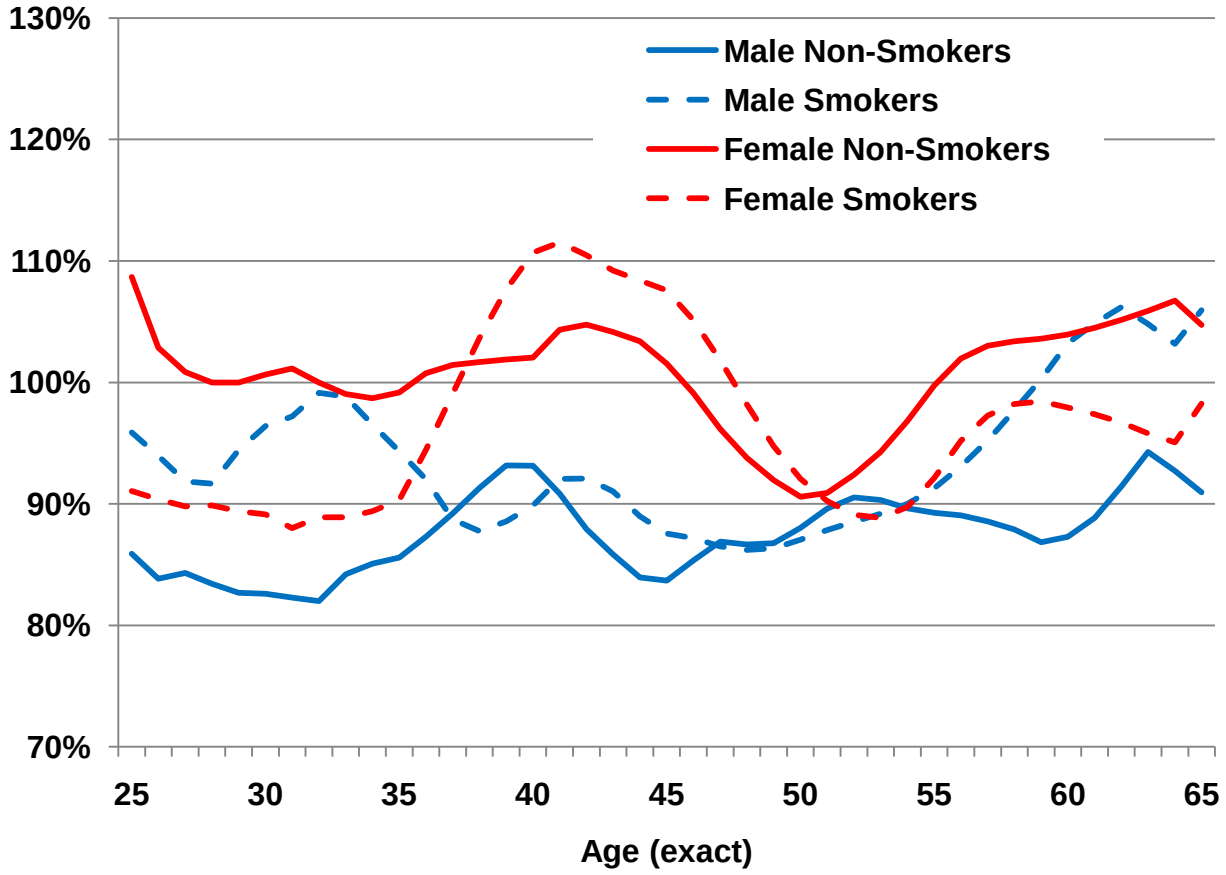
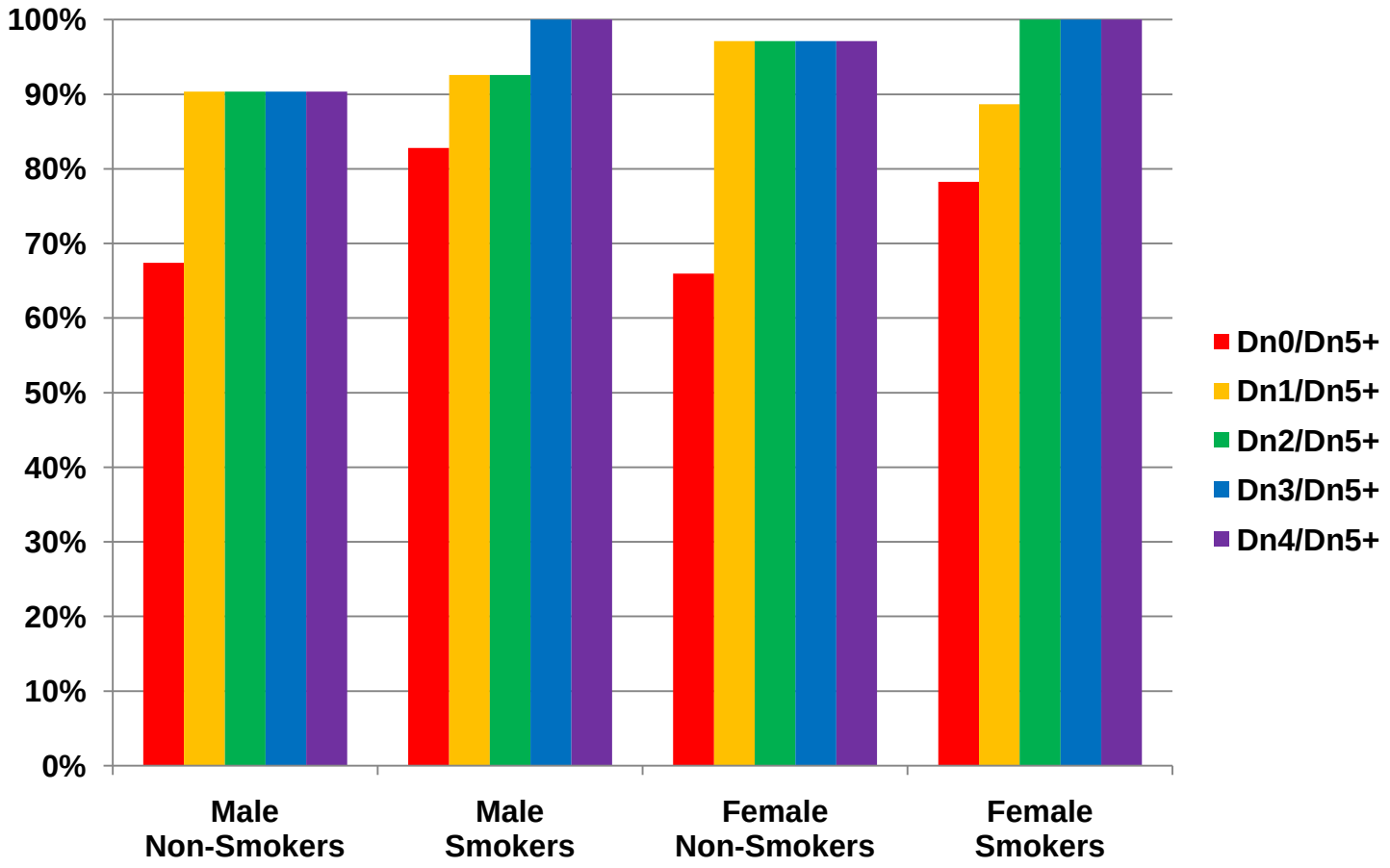
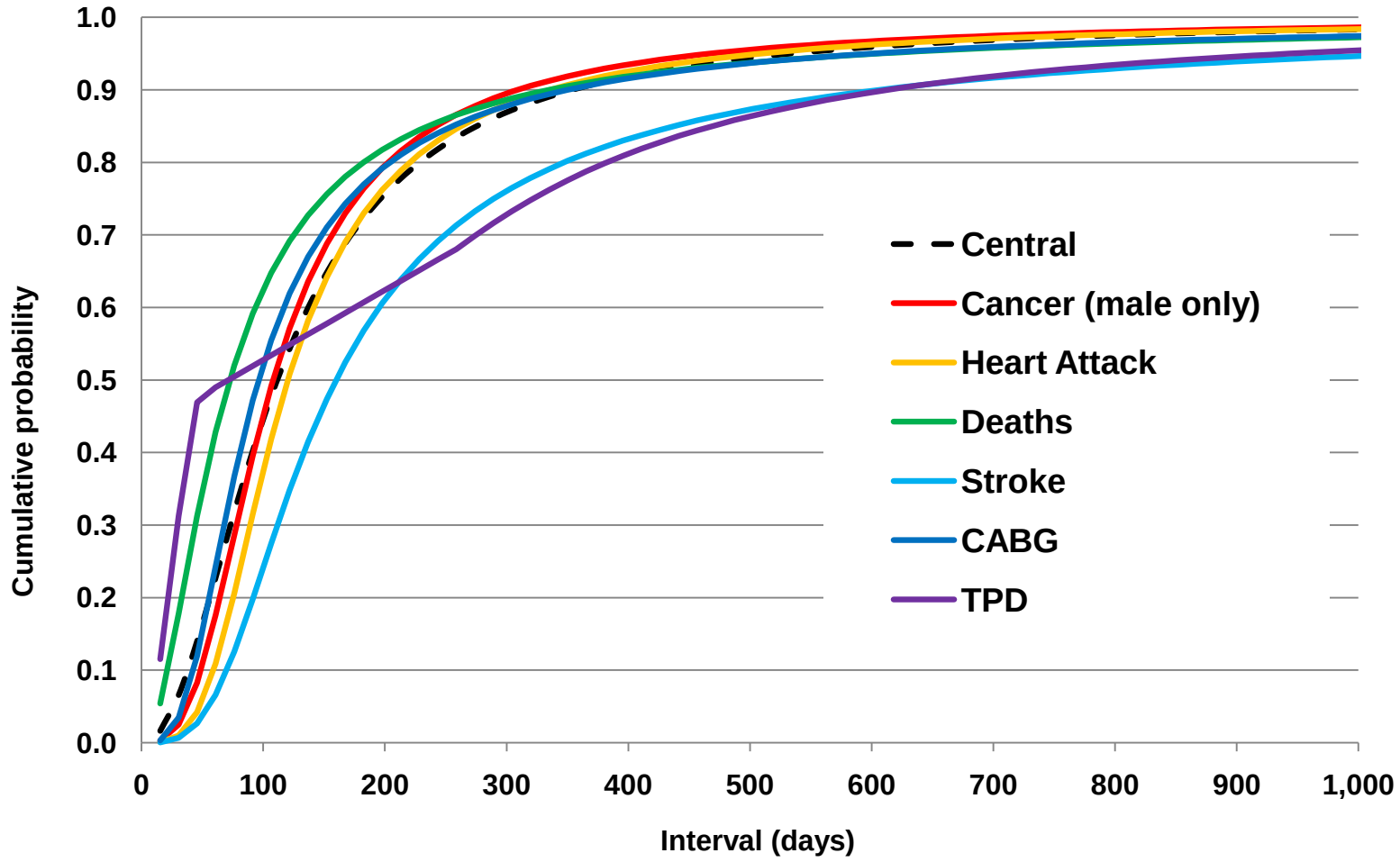


2003-2006 All-causes Diagnosis Rates

Durational pattern in Smoothed Annualised CI Diagnosis Rates
Accelerated CI; 2003-2006

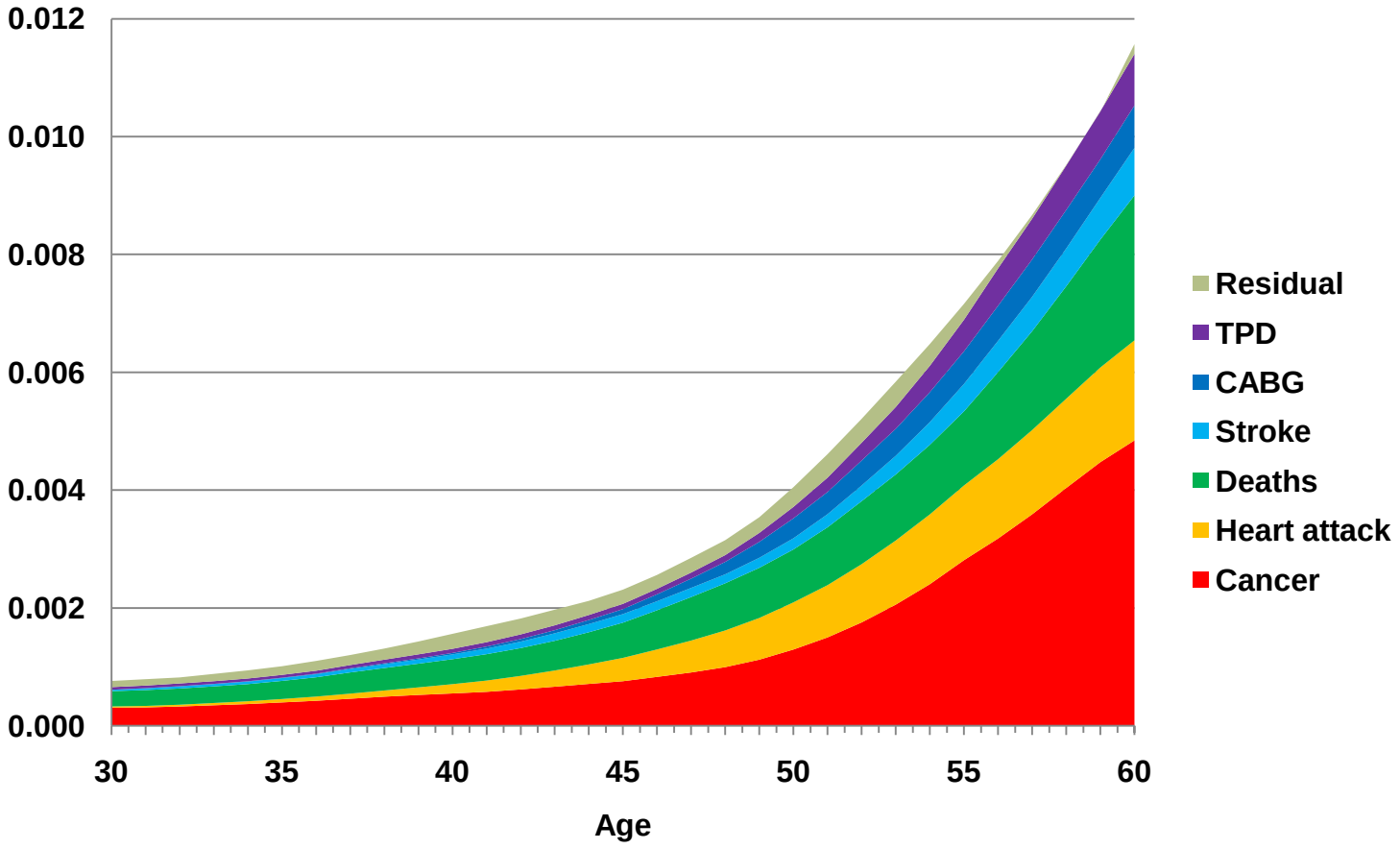


2003-2006 Cause-specific CDDs



2003-2006 Cause-specific Diagnosis Rates

Smoothed Annualised CI Diagnosis Rates by Cause
Accelerated CI; Males; Non-Smokers; Durations 5+; 2003-2006



2003-2006 Cause-specific Diagnosis Rates

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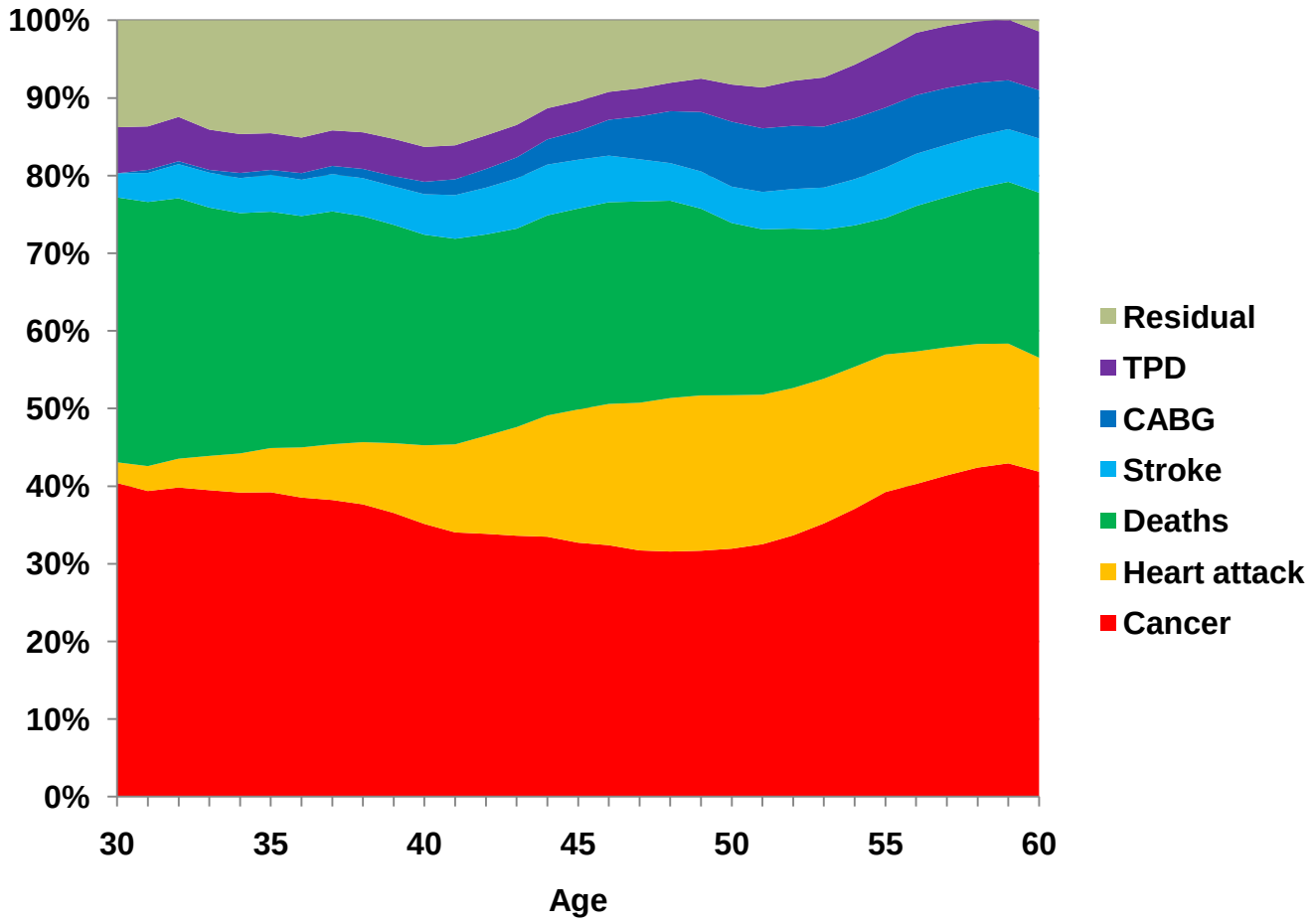

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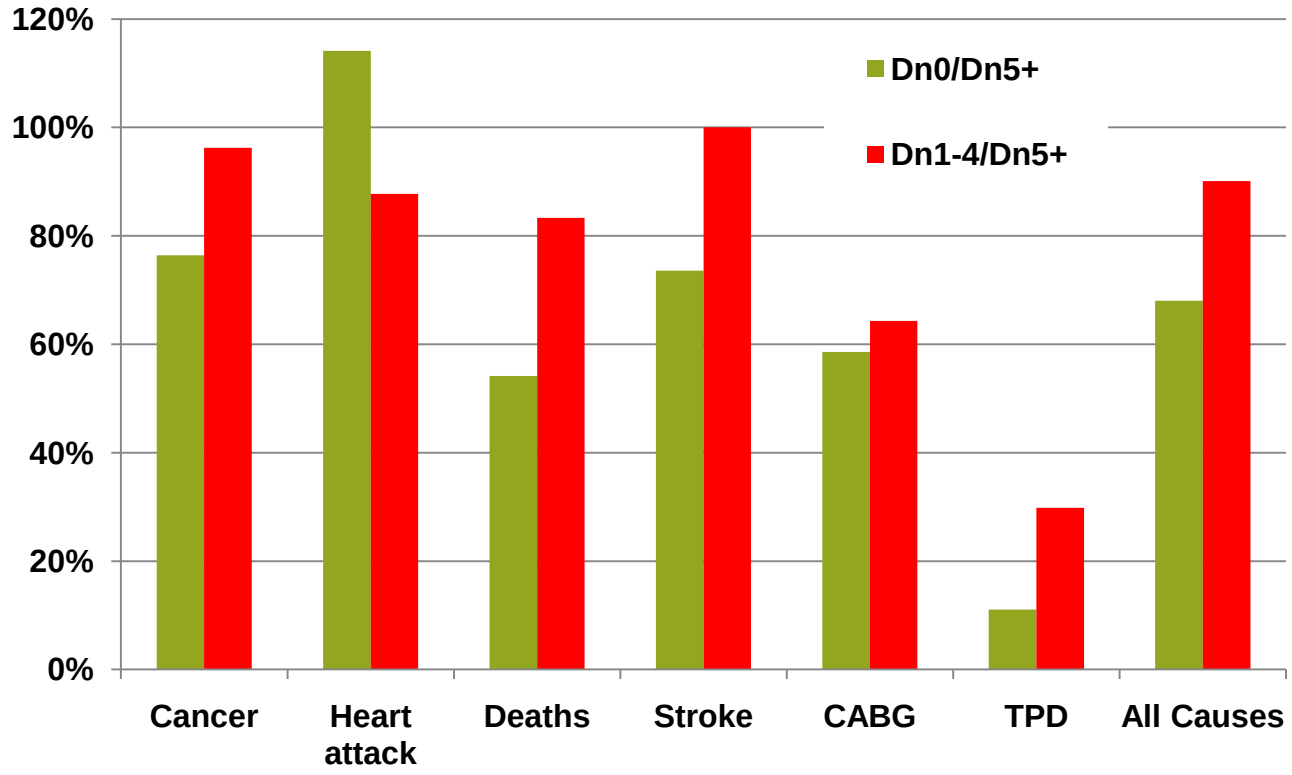

2003-2006 results and Diagnosis rates: Observations

- 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
- Cause-specific rates (for male non-smokers) comparable ... But issue for 2003-2006 given increase in unspecified types of claim

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CMI Critical Illness: Scope of final rates

- All-causes Accelerated Critical Illness; Lives table only
- Based on claims settled in 2003-2006
- Four tables:
  - ACMNL04
  - ACMSL04
  - ACFNL04 and
  - ACFSL04.
- Durations 0, 1, 2, 3, 4 and 5+ for ages 18 to 65; ultimate only for ages 66+
- Published in Working Paper in December?

CMI Critical Illness: Supplementary Analyses

- Analyses by product type, office, sales channel, benefit amount
- Sensitivity of final rates, e.g. to CDD
- Cause-specific rates:
  - M Non-Smoker Cancer, HA, Death, Stroke, CABG, TPD
  - M Smoker Cancer, HA, Death
  - F Non-Smoker Cancer, Death, Stroke, MS
  - F Smoker Cancer, Death
- Imputed stand-alone rates + comparison of experience
- Published in Working Paper in 2011

CMI Critical Illness: A Plea for Help!!!

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?!

Critical Illness:
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Questions??

Slides on website next week:

www.actuaries.org.uk/research-and-resources

Any queries to ci@cmib.org.uk