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Workshop C3: CMI Income Protection
Joan Coverson and Neil Robjohns

An update on recent CMI experience with a layman's guide to IPM 1991-98

Health and Care Conference 2012
Manchester, 01 May 2012

C3: CMI Income Protection Investigation

Outline

- What has the CMI IP Committee been up to?
- A layman's guide to analysis of CMI IP experience
- Features of the latest graduations, IPM 1991-98
- A comparison of IPM 1991-98 with CMIR12 / SM1975-78
- Trends in Individual IP experience: 1991 – 2009
- Features of the Individual IP experience: 2003 – 2009
- What are the CMI IP Committee's plans?

CMI Income Protection Committee Members

• **Joan Coverson** (Chair)	Gen Re
• **Debbie Akers**	Friends Life
• **Hannah Cook**	L&G
• **Duncan Heald**	SCOR Global Life
• **Gerry Kennedy**	Southampton University
• **Tim Pindar**	Wesleyan
• **David Wilkie**	InQA
• **Neil Robjohns** (Secretariat)	Barnett Waddingham
• **Andrea Spencer** (Secretariat)	Barnett Waddingham

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Recent activity and outputs

CMI IP Committee
Recent activity and outputs

- Graduations of the 1991-98 IIP, Male, Class 1 experience
  - Claim Terminations: CMI Working Papers 5, 6 and 7
  - Claim Inceptions: CMI Working Papers 46, 47
  - Overview of IPM 1991-98: CMI Working Paper 48
- Reporting experience for 1991 – 2006 using IPM 1991-98
  - CMI Working Papers 59 and 60
  - Improved reporting format using MS Office Excel spreadsheets
  - Updated methodology and revised statistical tests
- Data Collection
  - 2007 results released to CMI member offices
  - 2008 and 2009 results well advanced (see later slides)

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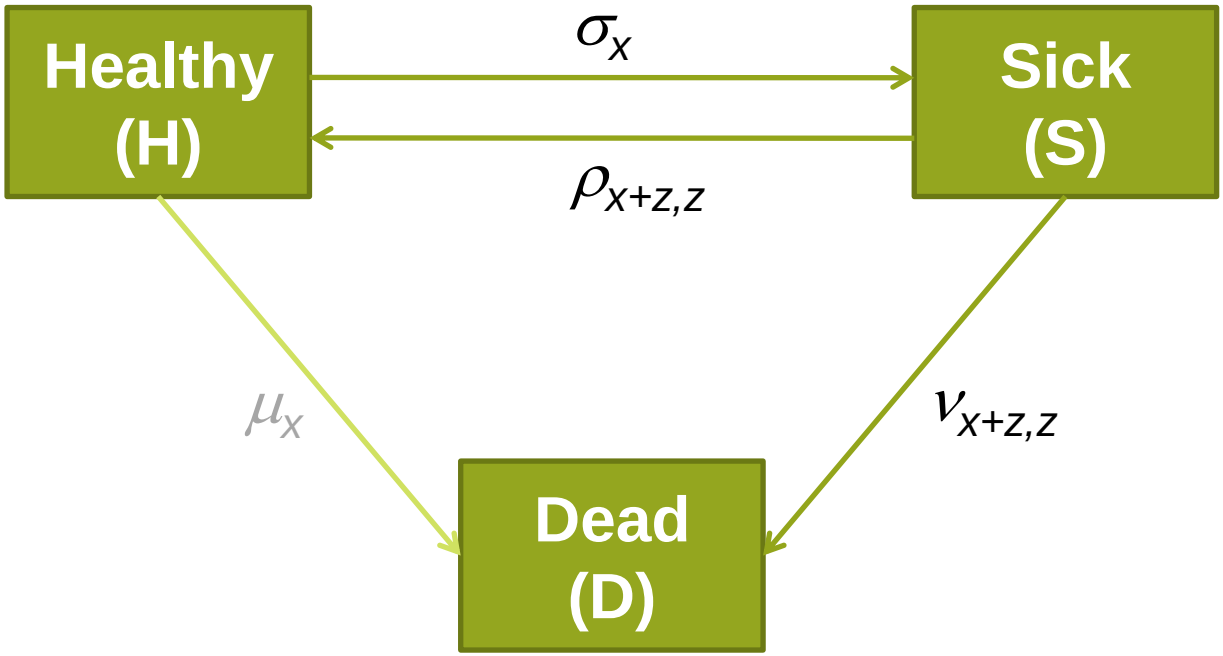
A layman's guide to analysis of CMI IP experience

A layman's guide to analysis of CMI IP experience
Nature, format and limitations of CMI IP data

- Calendar year data collection
  - In force policy records at beginning and end of year (census)
  - Claim record for each claim in payment during the year
- Data fields and attributes
  - Age, sex, deferred period (DP), CMI Occupation Class, (etc)
  - Modes and dates of start and end of sickness and claim
- Limitations
  - No unique life or policy identifiers in the data
  - Calendar year data, often with discontinuities between years
  - Cannot always match claims to in force policy records
  - Resource constraints / inertia hamper upgrades to specification

A layman's guide to analysis of CMI IP experience
The CMIR12 model of sickness



age at start of sickness, x ; sickness duration, z

transition intensities: σ_x , $\rho_{x+z,z}$, $\nu_{x+z,z}$ and μ_x

A layman's guide to analysis of CMI IP experience General issues for the analysis

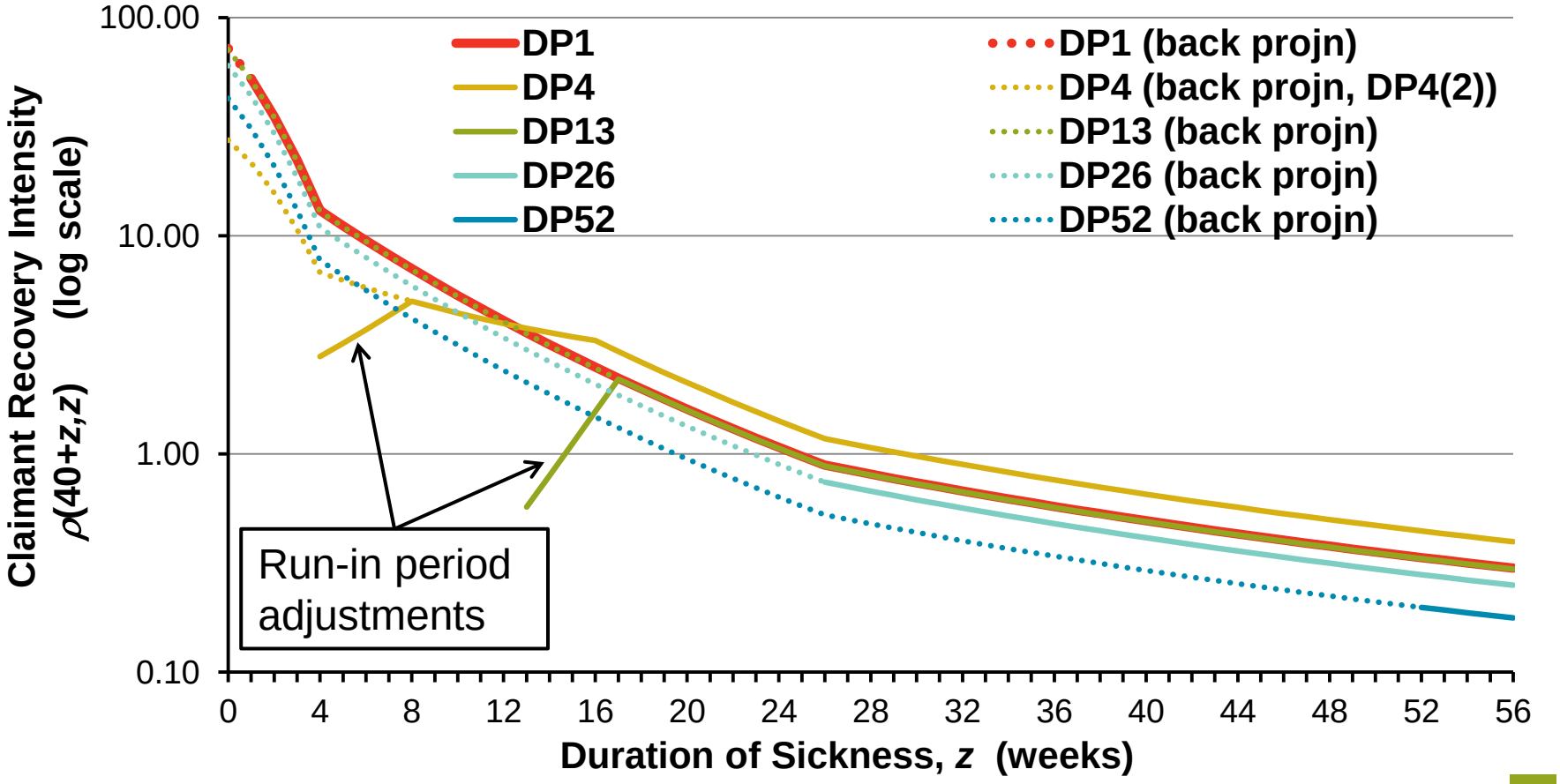
- In CMI data we can only observe IP claims not sicknesses
  - Link sicknesses (σ) to claim inceptions (i) by allowing for:
  - The probability of a sickness continuing to the end of the DP, π
  - The probability that a claim is then made, η
  - π and η are estimated by extrapolating graduated termination rates back to start of sickness
- Keep calculations separate for each investigation year
- Accumulate and sub-divide data by:
  - Sex, DP, Occ Class, Investigation Year, age and duration sick
- High prevalence of duplicate records
  - Can identify duplicates in claim records but not in the in force

A layman's guide to analysis of CMI IP experience Claim Terminations

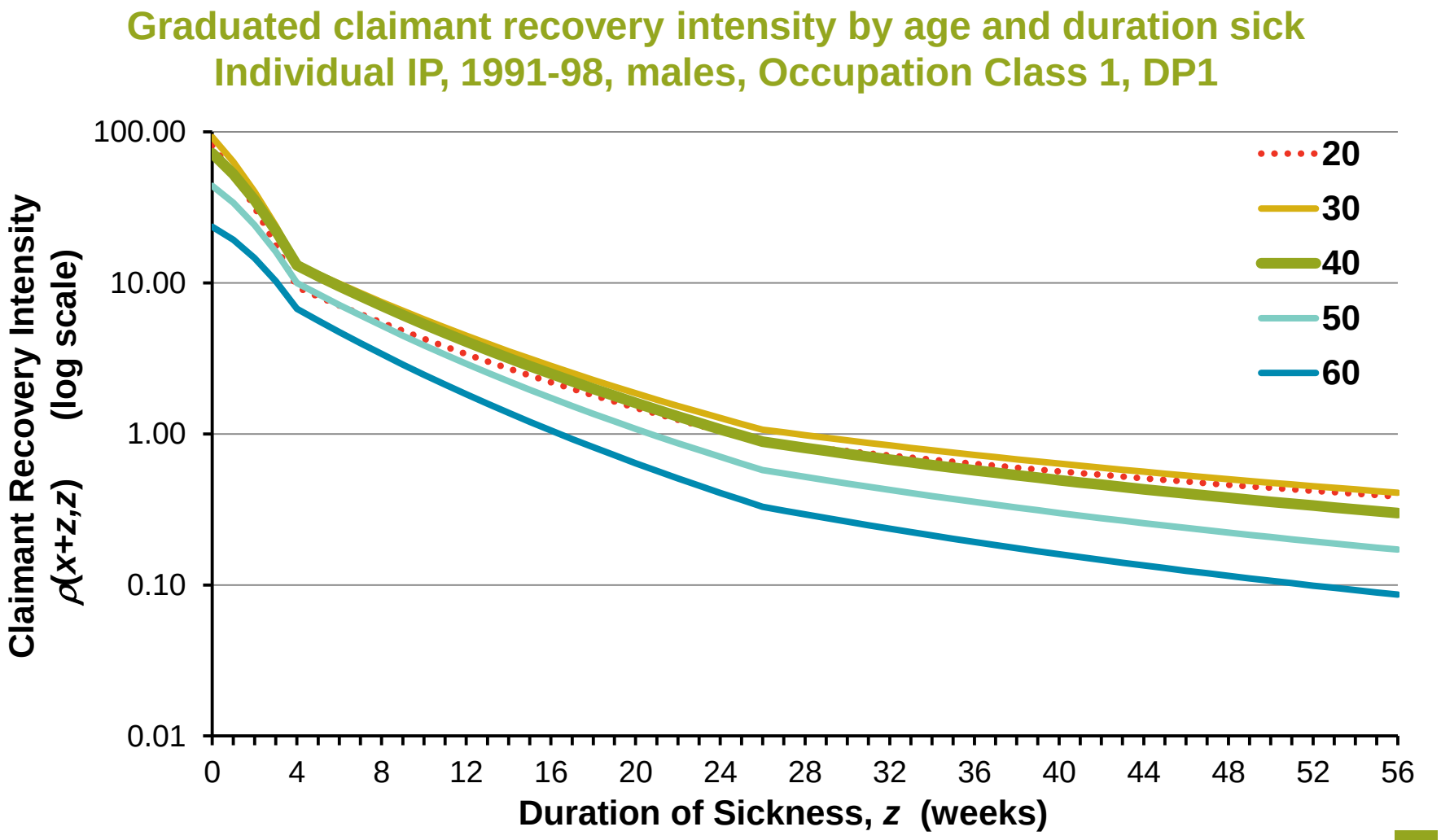
- Only require claim records for this analysis
- First, identify and remove duplicate claim records
- Then, evaluate exposure and count claim terminations
  - Exposure (R): count days observed in claim during record year
  - Claim events: count claimant recoveries (r) and deaths (d)
  - Sub-divide counts by main data attributes plus 'age last birthday at start of sickness' and 'duration of sickness (in days)'
- Compare experience with an appropriate, defined basis
  - Compare actual (r and d) with expected claim terminations, calculated by applying ρ and ν to each day's exposure
- Graduate crude recovery ($\hat{\rho} = r/R$) and death rates ($\hat{\nu} = d/R$)

Features of IPM 1991-98
Graduated Claimant Recovery Intensities

Graduated claimant recovery intensity by DP and duration sick
Individual IP, 1991-98, males, Occupation Class 1, age 40 at start of sickness

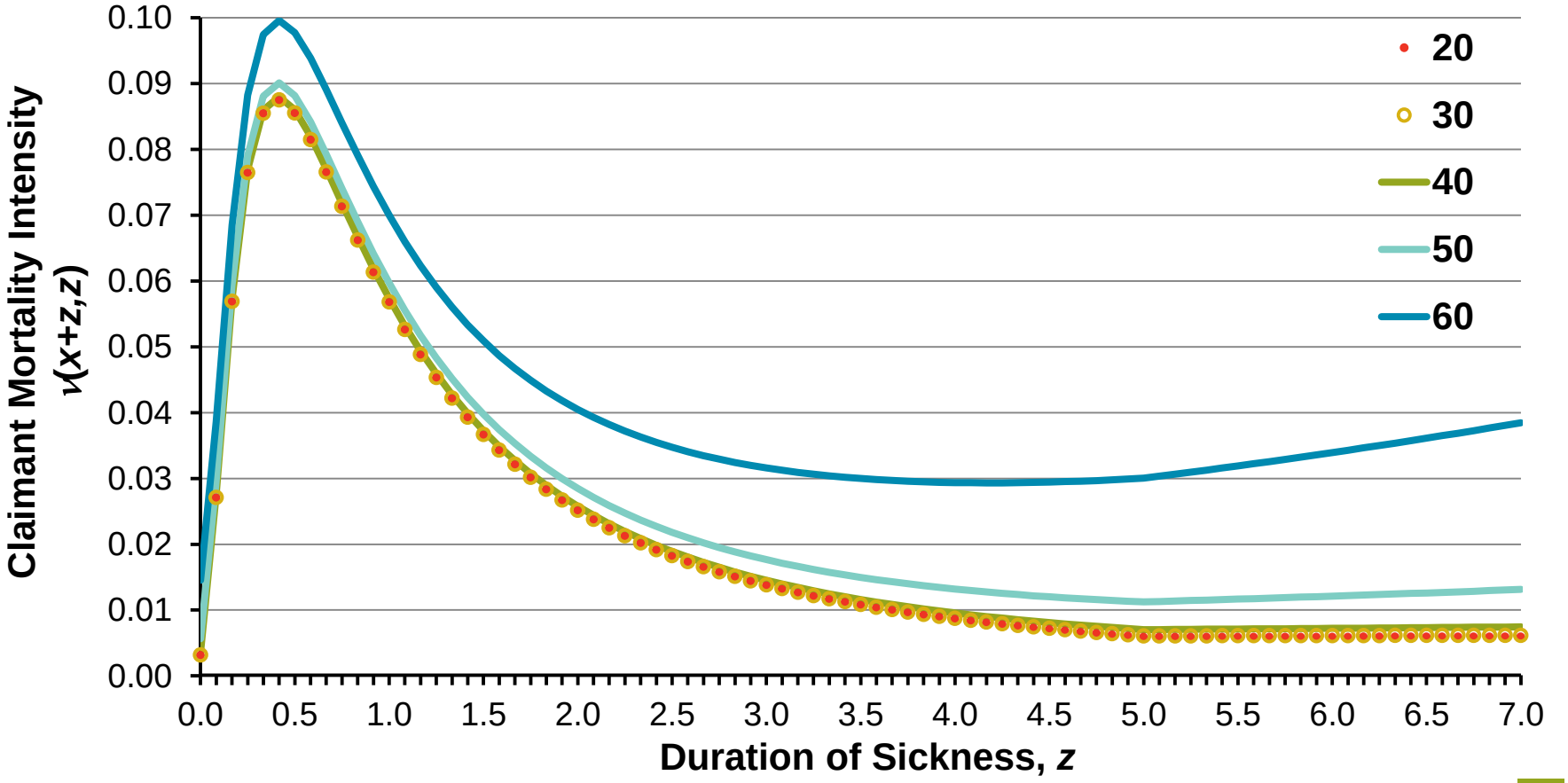


Features of IPM 1991-98
Graduated Claimant Recovery Intensities



Features of IPM 1991-98
Graduated Claimant Mortality Intensities

Graduated claimant mortality intensity by age and duration sick
Individual IP, 1991-98, males, Occupation Class 1, all DPs (except DP1)



A layman's guide to analysis of CMI IP experience Claim Inceptions

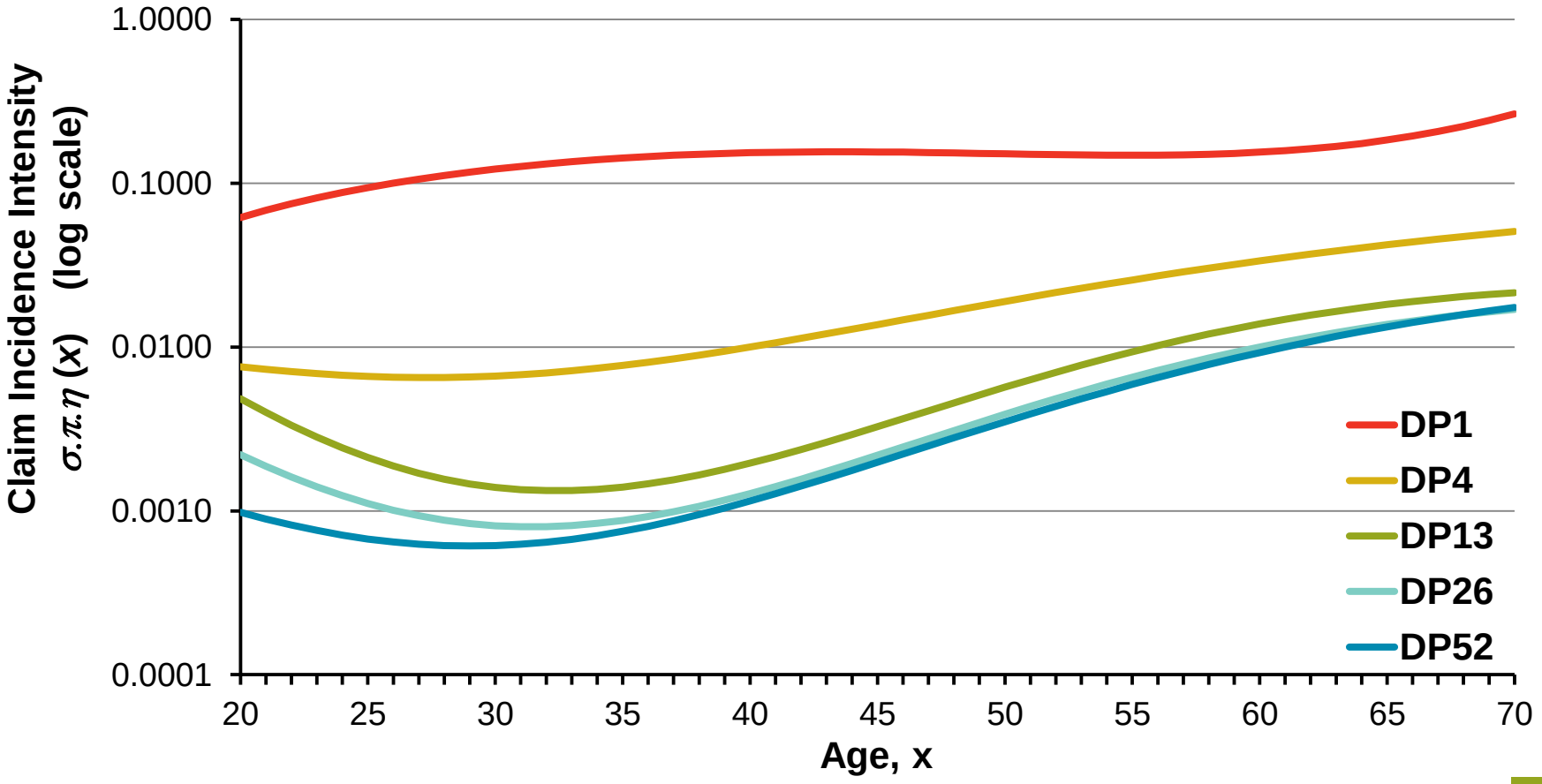
- Require both in force and claim records for this analysis
- First, evaluate exposure and count claim inceptions
  - Exposure (*R*): complex calculation – see next slide
  - Claim events: count claim inceptions (i)
  - Sub-divide counts by main data attributes plus age last birthday at census dates (for exposure) and at start of sickness (for i)
- Then remove duplicates, exactly for i, approximately for *R*
- Compare experience with an appropriate, defined basis
  - Calculate expected claim inceptions in each cell as $R\sigma\pi\eta$
- Graduate crude sickness rates ($\hat{\sigma} = i/R\pi\eta$)
  - Then calculate graduated inception rates as $\hat{\imath} = \hat{\sigma}\pi\eta$

A layman's guide to analysis of CMI IP experience Claim Inceptions: calculation of exposure

- Inceptions observed in year Y relate to exposure in 'Y – dp'
- Estimate 'all lives' central exposure for 'Y – dp'
  - Census method using start / end year Y in force and projection
- Adjust from 'all lives' to 'healthy lives' by removing:
  - Time spent in claim in year 'Y – dp'
  - Time spent in the DP for known claims
  - Estimate of time sick for those who recovered before end of DP
  - Estimate of time sick for those who recovered after end of DP but did not claim
- Remove exposure less than a DP prior to policy expiry

Features of IPM 1991-98
Graduated Claim Inception Intensities

Graduated claim inception intensity by age and DP
Individual IP, 1991-98, males, Occupation Class 1



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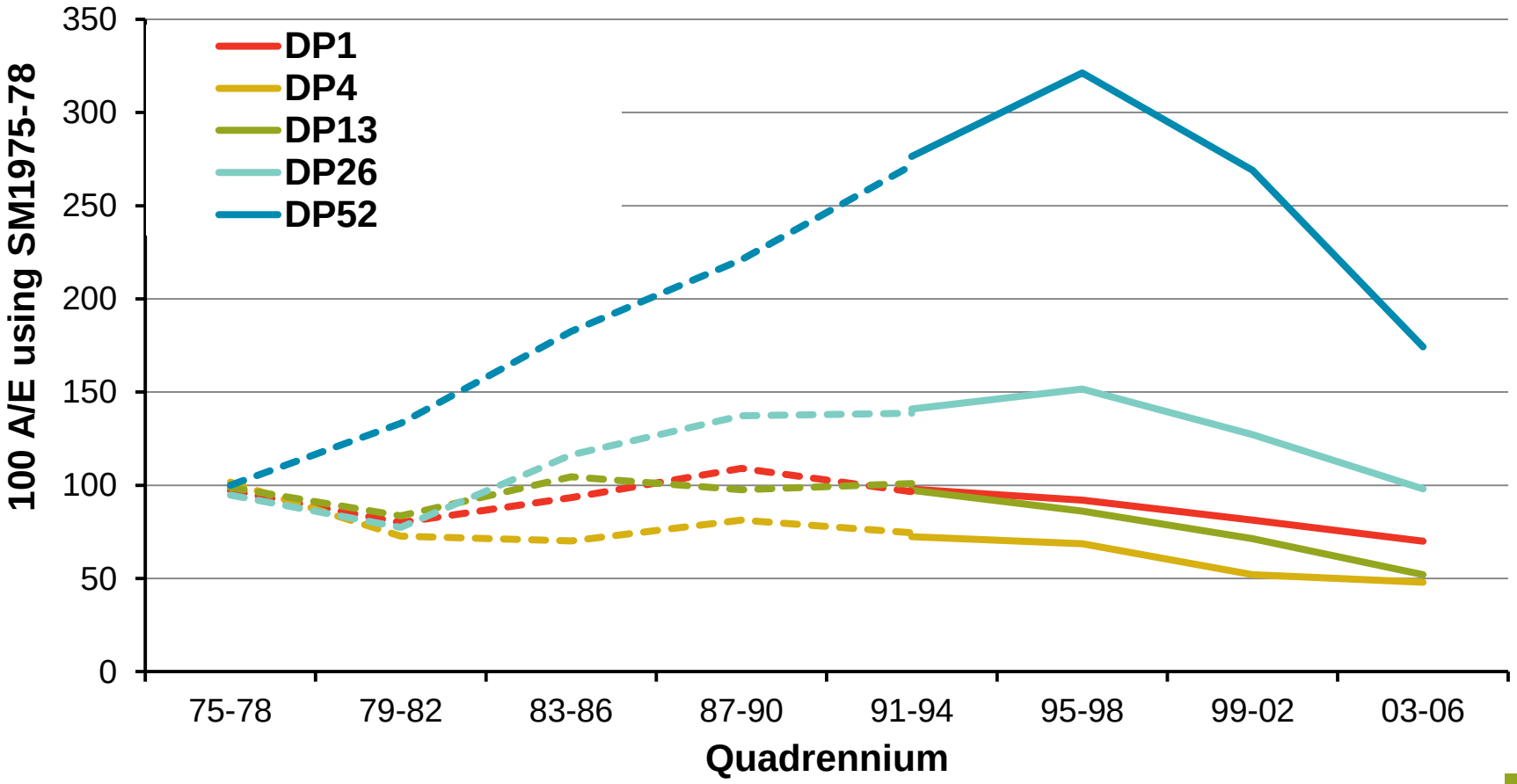
A comparison of IPM 1991-98 with SM1975-78

Comparison of IPM 1991-98 with SM1975-78

- SM1975-78 (also referred to as CMIR 12) [1991]
  - Dataset: CMI Individual IP, *Standard* data, Males, 1975-78
  - *Standard* data is broadly equivalent to CMI Occ Class 1
  - No adjustments made for females or occupation classes
  - CMIR 12, Sections B (Terminations) and C (Inceptions); CMIR 15, Section 2 (for extension to DP52)
- IPM 1991-98 [2010]
  - Dataset: CMI Individual IP, *Standard** data, Males, CMI Occupation Class 1, 1991-98
  - No adjustments made for females or other occupation classes
  - CMI Working Paper 48 provides an overview; detail is set out in CMI Working Papers 5 (Terminations) and 47 (Inceptions)

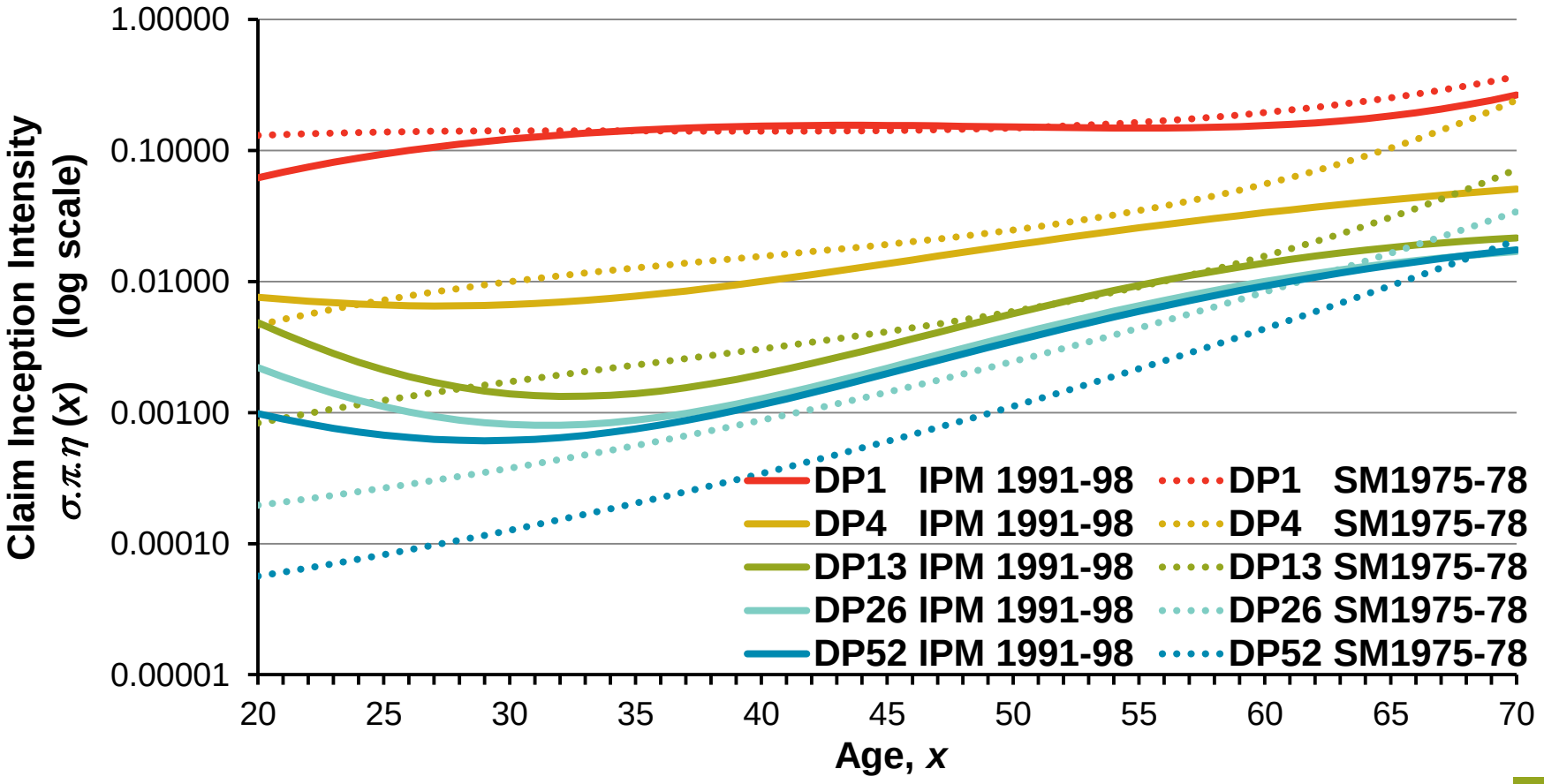
Individual IP experience: Trends over 1975 – 2006 Claim Inceptions, males, by Deferred Period

Individual IP claim inceptions experience, males by DP, all ages combined
Standard data 1975-1994; *Standard** data, Occupation Class 1, 1991-2006



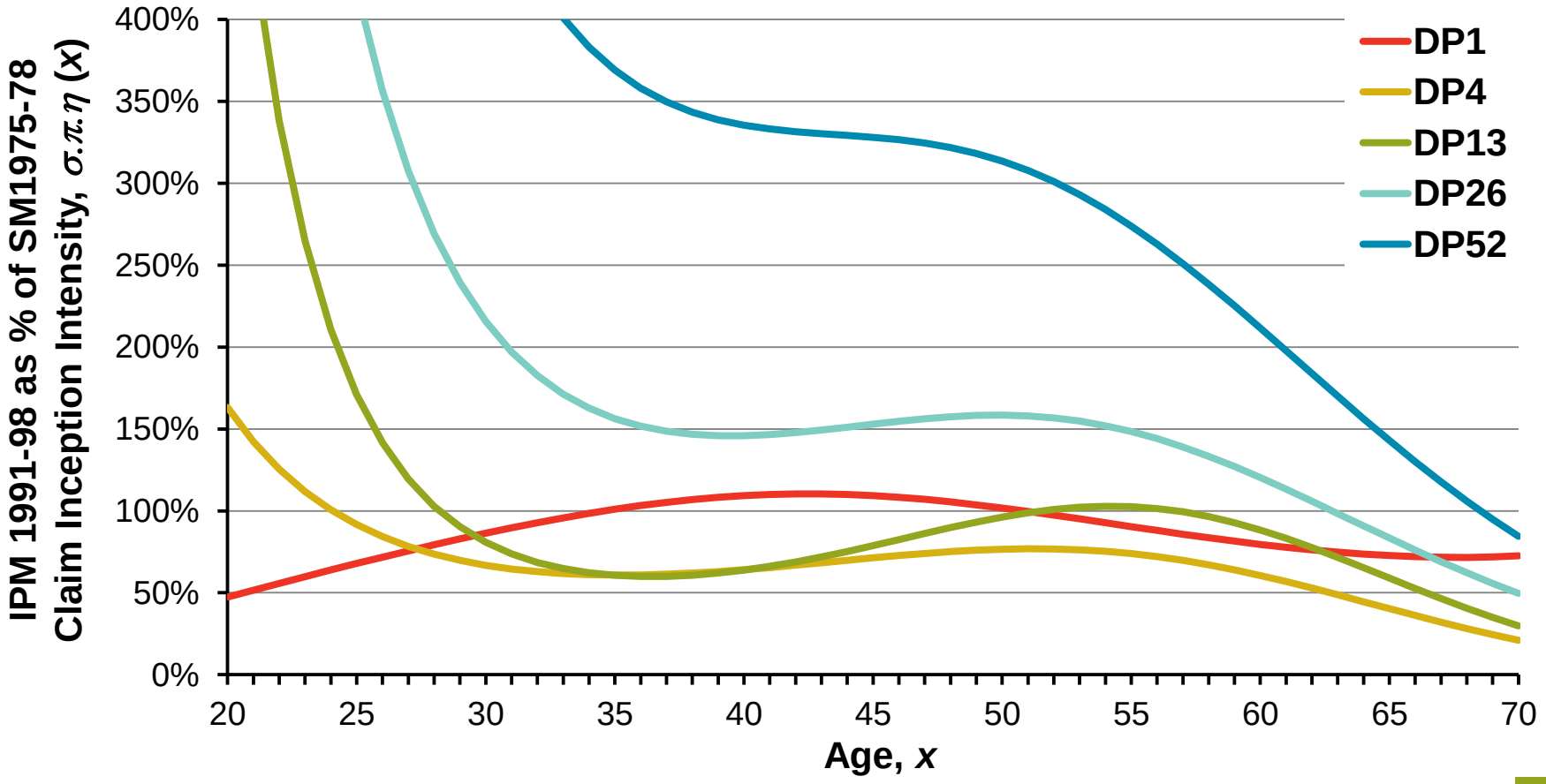
Comparison of IPM 1991-98 with SM1975-78 Graduated Claim Inception Intensities

Graduated claim inception intensity by table: SM1975-78 and IPM 1991-98
Individual IP, males, by age and DP



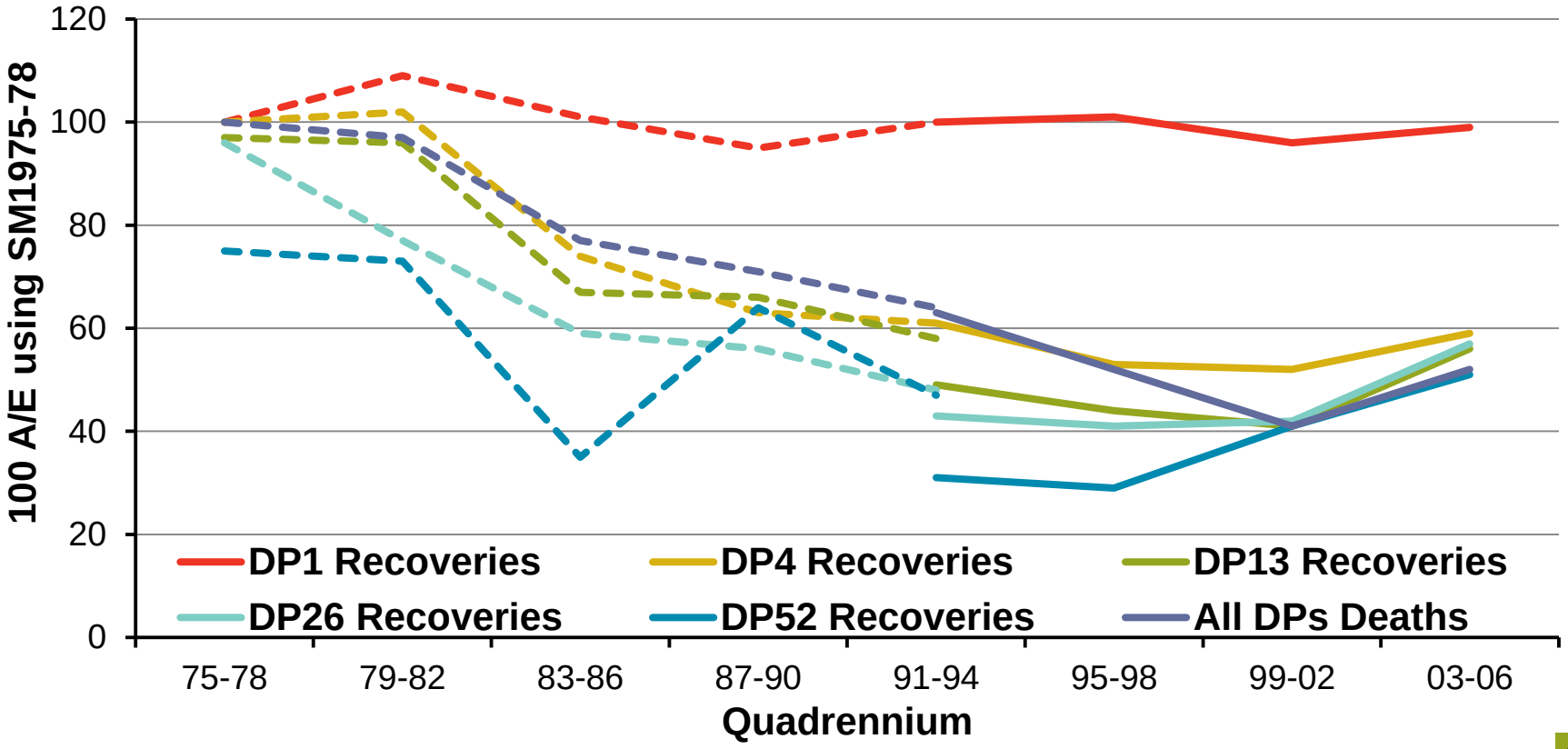
Comparison of IPM 1991-98 with SM1975-78
Ratio of Graduated Claim Inception Intensities

Ratio of graduated claim inception intensities: IPM 1991-98 as % SM1975-78
Individual IP, males, by age and DP



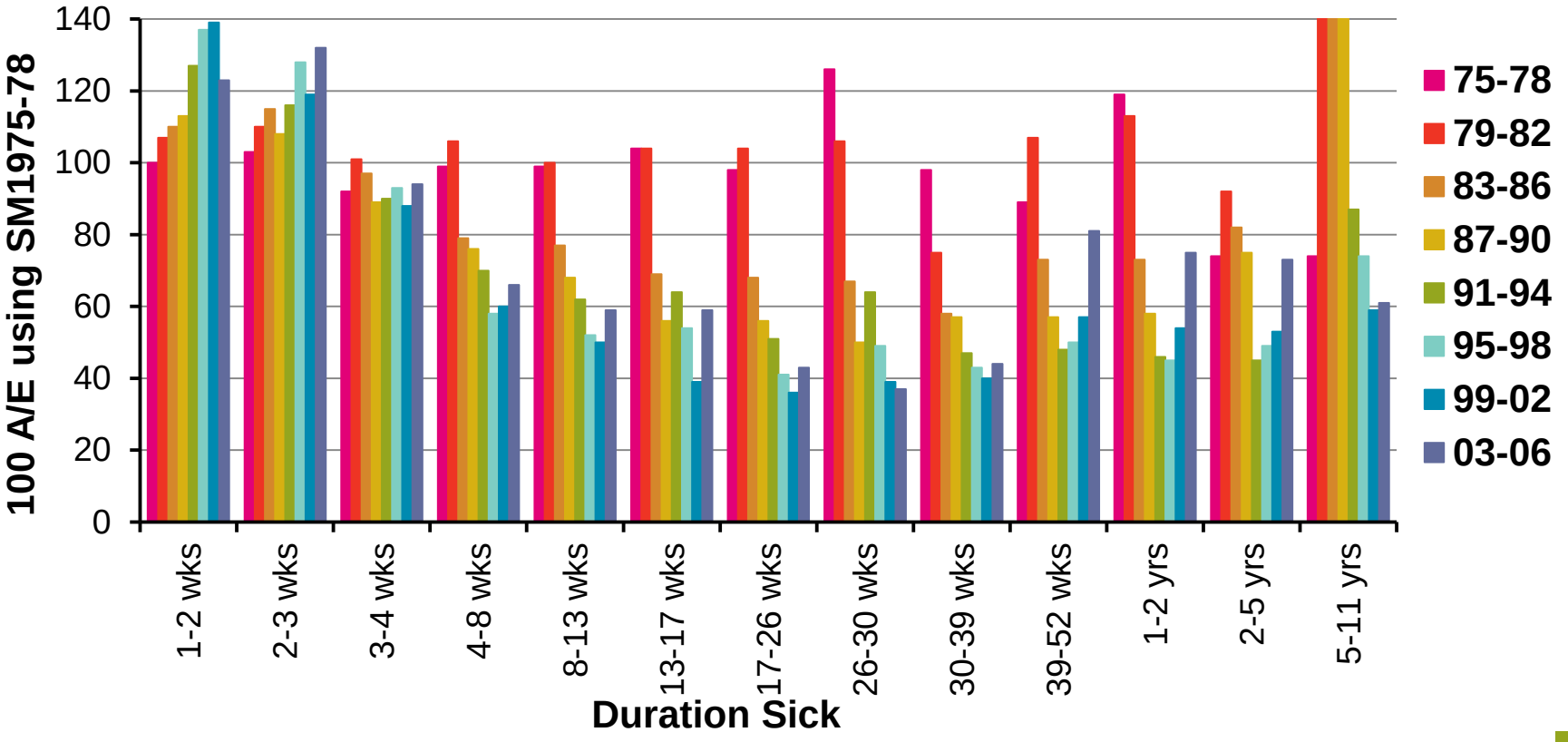
Individual IP experience: Trends over 1975 – 2006
Claim Terminations, males, by Deferred Period

Individual IP claim terminations experience, males by DP
All ages and durations combined
***Standard* data 1975-1994; *Standard** data, Occupation Class 1, 1991-2006**



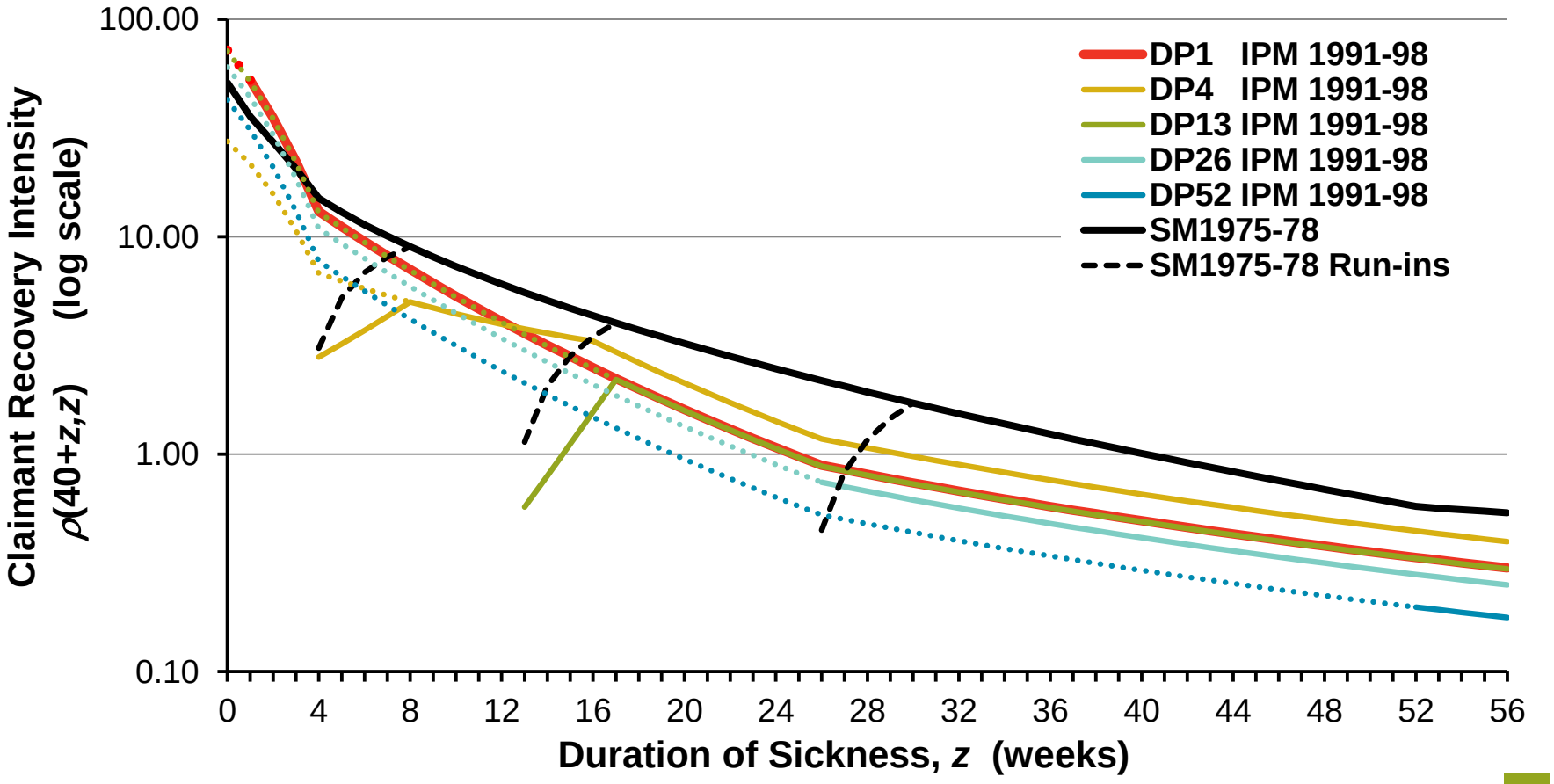
Individual IP experience: Trends over 1975 – 2006
Claimant Recoveries, males, by duration sick

Individual IP claimant recoveries experience, males by duration sick
All ages and DPs combined
***Standard* data 1975-1994; *Standard** data, Occupation Class 1, 1991-2006**



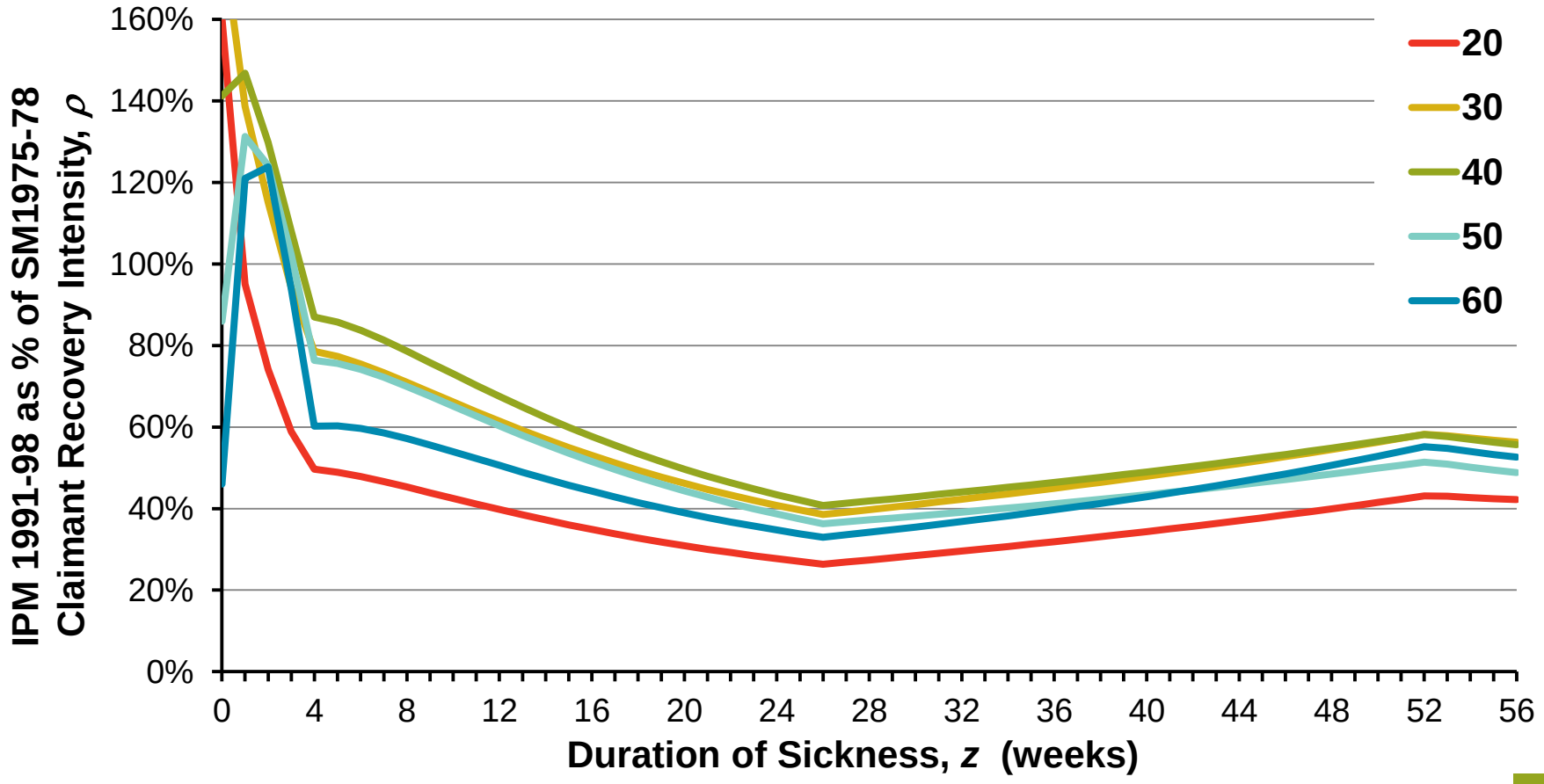
Comparison of IPM 1991-98 with SM1975-78 Graduated Claimant Recovery Intensities

Graduated claimant recovery intensity by table: SM1975-78 and IPM 1991-98
Individual IP, males, age 40 at start of sickness, by duration sick and DP



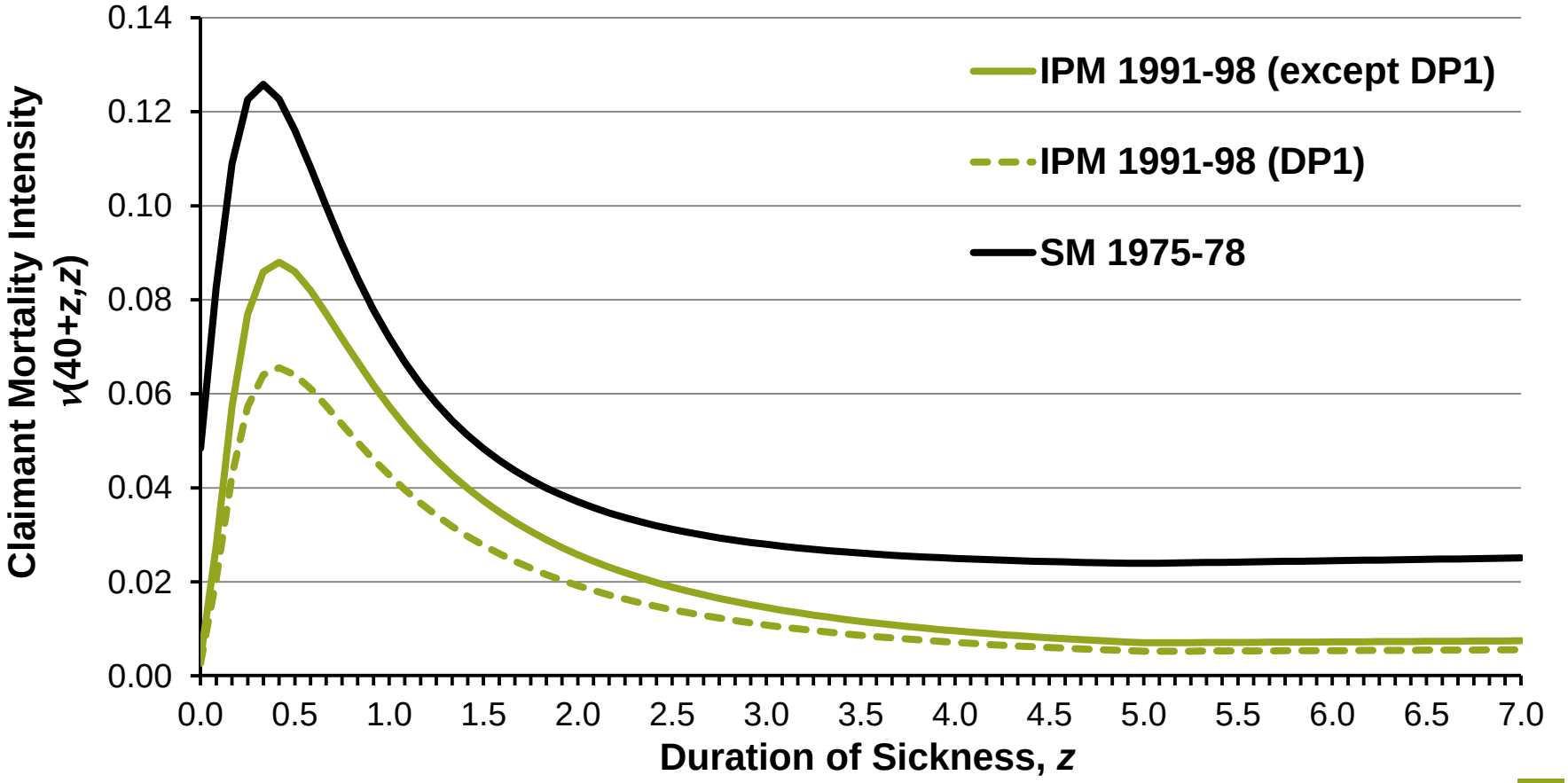
Comparison of IPM 1991-98 with SM1975-78
Ratio of Graduated Claimant Recovery Intensities

Ratio of graduated claimant recovery intensities: IPM 1991-98 as % SM1975-78
Individual IP, males, DP1, by age and duration sick



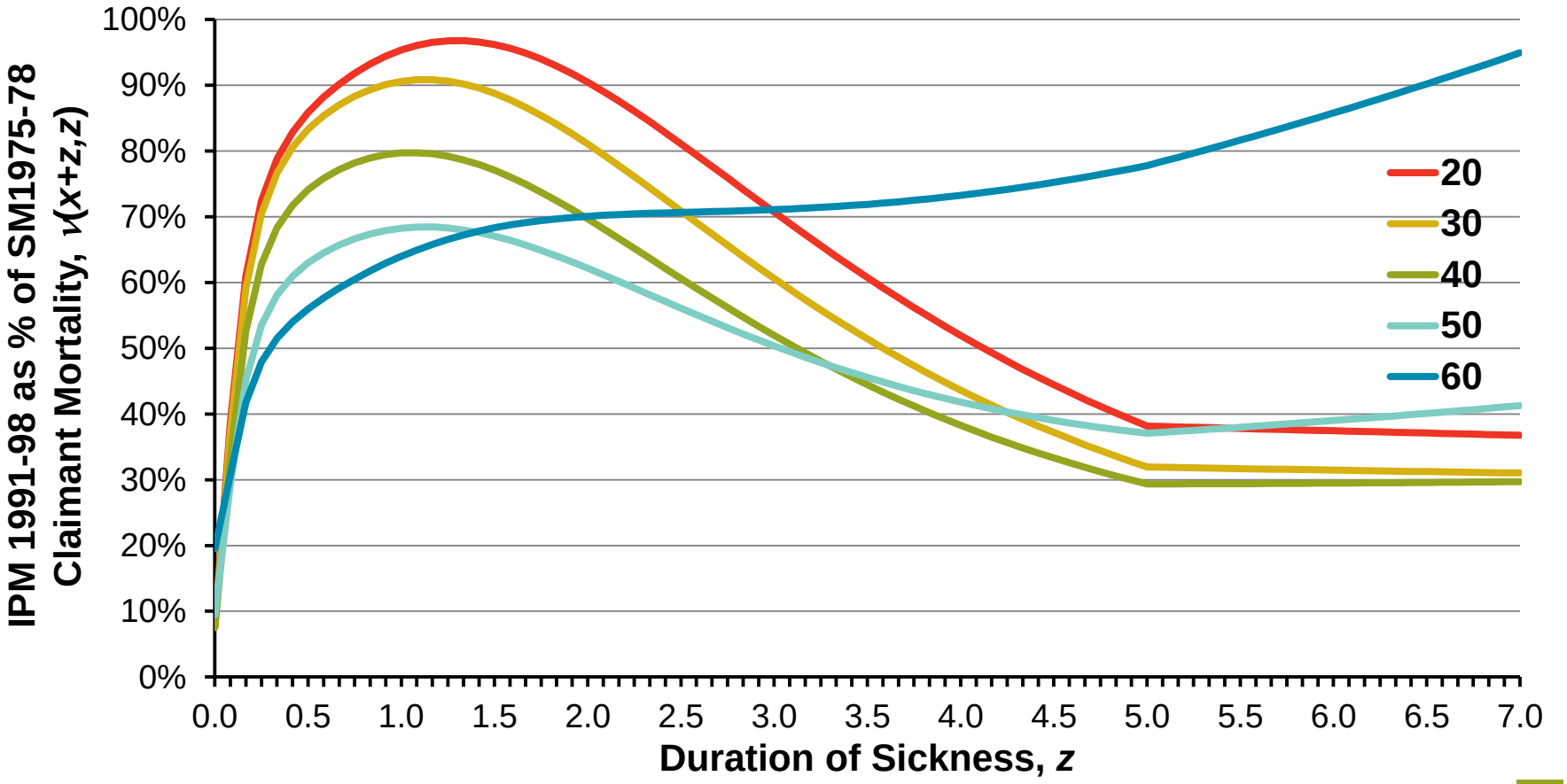
Comparison of IPM 1991-98 with SM1975-78 Graduated Claimant Mortality Intensities

Graduated claimant mortality intensity by table: SM1975-78 and IPM 1991-98
Individual IP, males, age 40 at start of sickness, by duration sick and DP



Comparison of IPM 1991-98 with SM1975-78
Ratio of Graduated Claimant Mortality Intensities

Ratio of graduated claimant mortality intensities: IPM 1991-98 as % SM1975-78
Individual IP, males, all DPs (except DP1), by age and duration sick



Comparison of IPM 1991-98 with SM1975-78
Ratio of expected value of IP claims

DP \ Age *x*		30	40	50	60
DP 1	i × a	122 × 0.2	154 × 0.4	151 × 0.8	155 × 0.9
	R	2.8	2.8	2.9	1.8
DP 4	i × a	7 × 1.4	10 × 2.1	19 × 3.1	34 × 2.1
	R	2.5	2.1	2.3	1.4
DP13	i × a	1 × 5.3	2 × 6.7	6 × 6.8	14 × 3.2
	R	3.2	2.0	2.3	1.4
DP26	i × a	1 × 9.2	1 × 10.5	4 × 9.0	10 × 3.6
	R	6.1	3.4	2.9	1.5
DP52	i × a	1 × 15.5	1 × 14.9	3 × 10.7	9 × 3.5
	R	12.6	7.0	4.9	2.4

Males; Occupation Class 1; age *x* exact at start of sickness; expiry age 65

i = Annualised claim inception rate, per mille per annum

a = Expected average duration of claims, in years, for sickness starting age *x*

R = Ratio of i × a for IPM 1991-98 compared with SM1975-78

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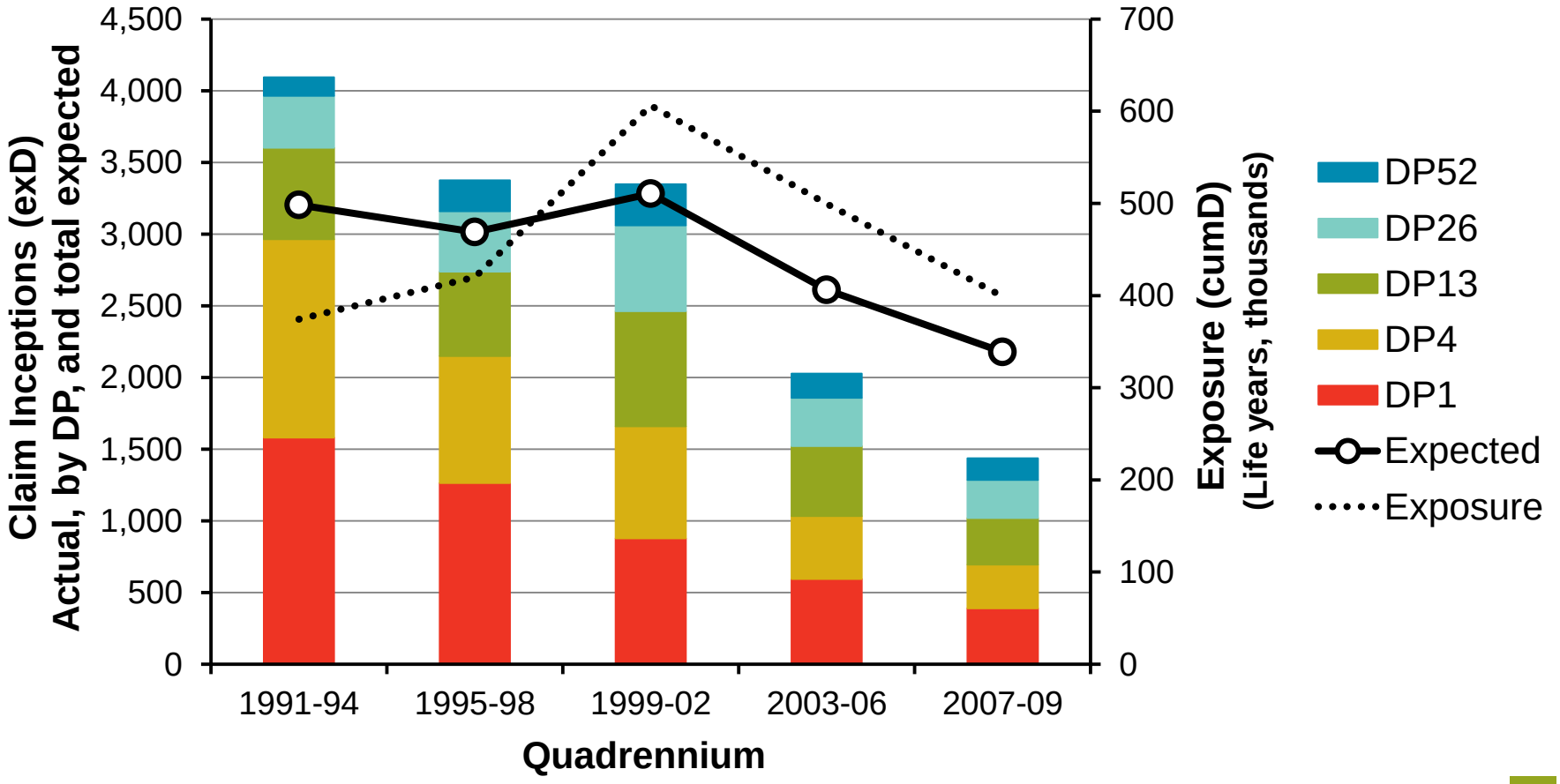
Individual IP experience: Trends over 1991 – 2009

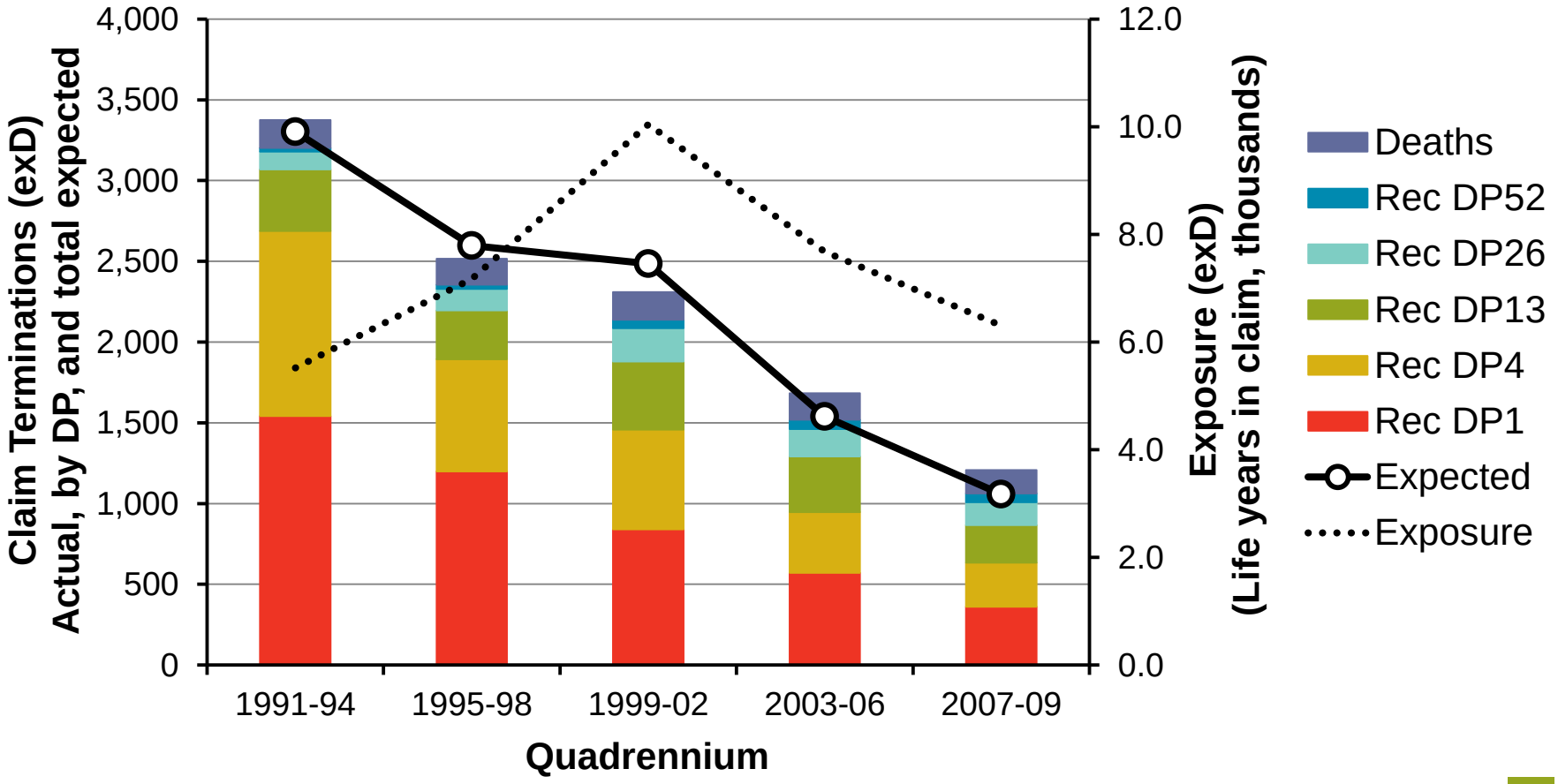
Individual IP experience: trends over 1991 – 2009
Data volumes for claim inceptions analysis

Average annual Individual IP claim inception counts, by quadrennium
Actual (by DP) and expected (total) claim inceptions (exD); exposure (cumD)



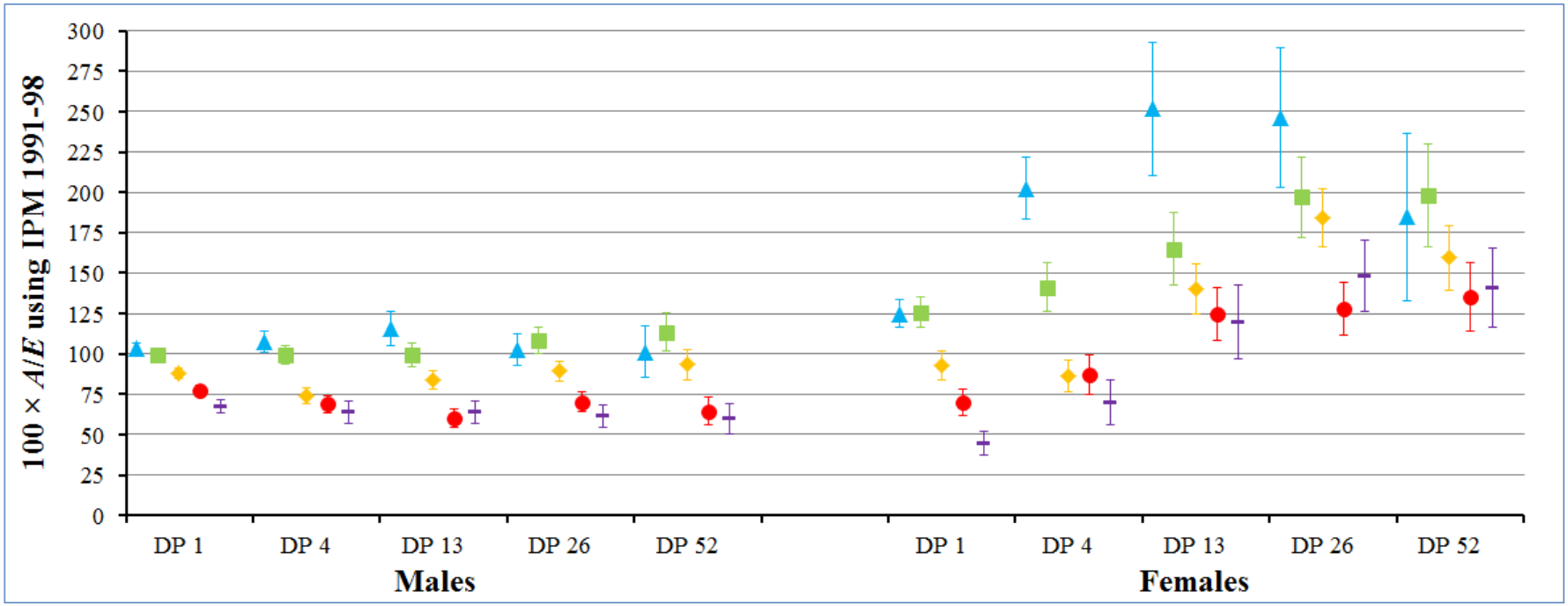
Individual IP experience: trends over 1991 – 2009
Data volumes for claim terminations analysis

Average annual Individual IP claim termination counts, by quadrennium
Actual (by DP) and expected (total) claim terminations (exD); exposure (exD)



Individual IP experience: Trends over 1991 – 2009 Claim Inceptions by sex and DP

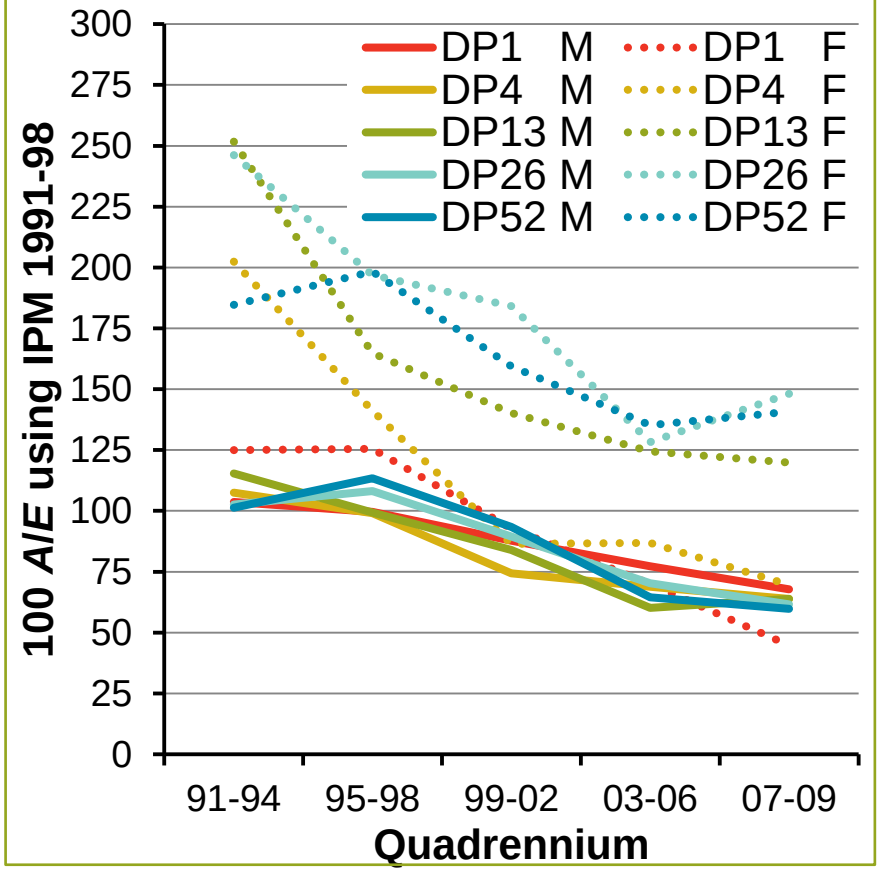
Comparison of actual claim inceptions with those expected using IPM 1991-98
Individual IP *Standard** experience for CMI Occupation Class 1
1991-2009 by quadrennium, sex and DP; all ages combined



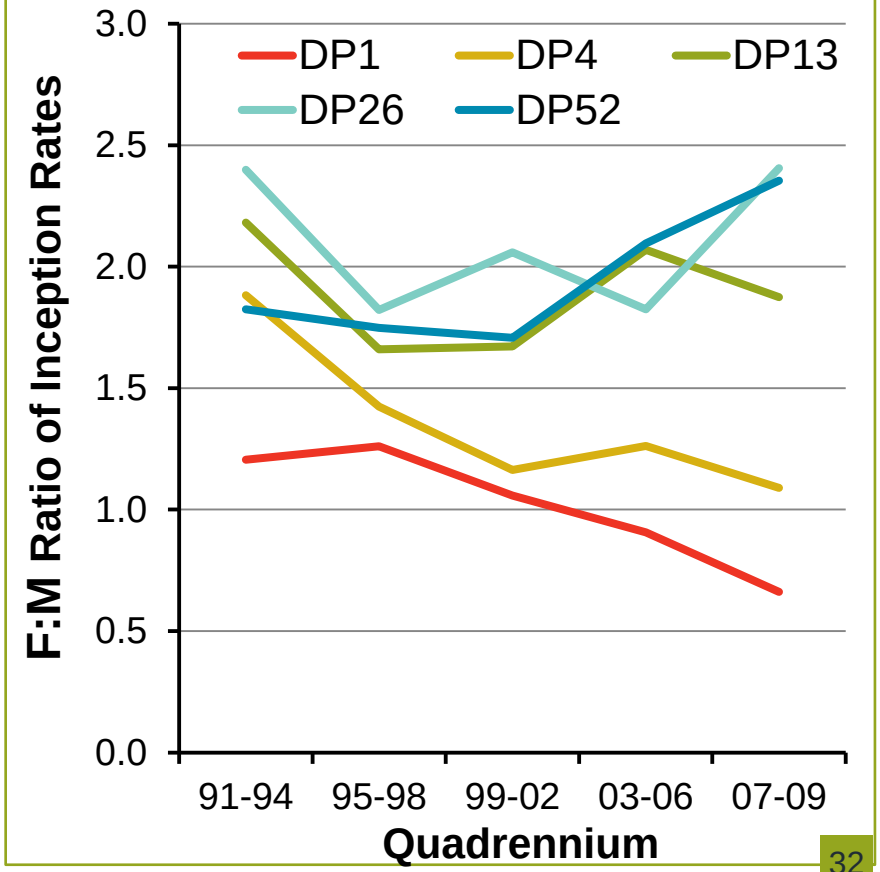
The error bars show approximate 95% confidence intervals, $100 \times A/E \pm 1.96\sigma$, where $\sigma = 100 \times \sqrt{A}/E$.
Data points based on fewer than 10 actual claim inceptions are omitted from the above chart.

Individual IP experience: Trends over 1991 – 2009
Claim Inceptions by sex and DP

A/E by sex, DP and quadrennium
IIP *Standard** experience for
CMI Occ Class 1; all ages combined

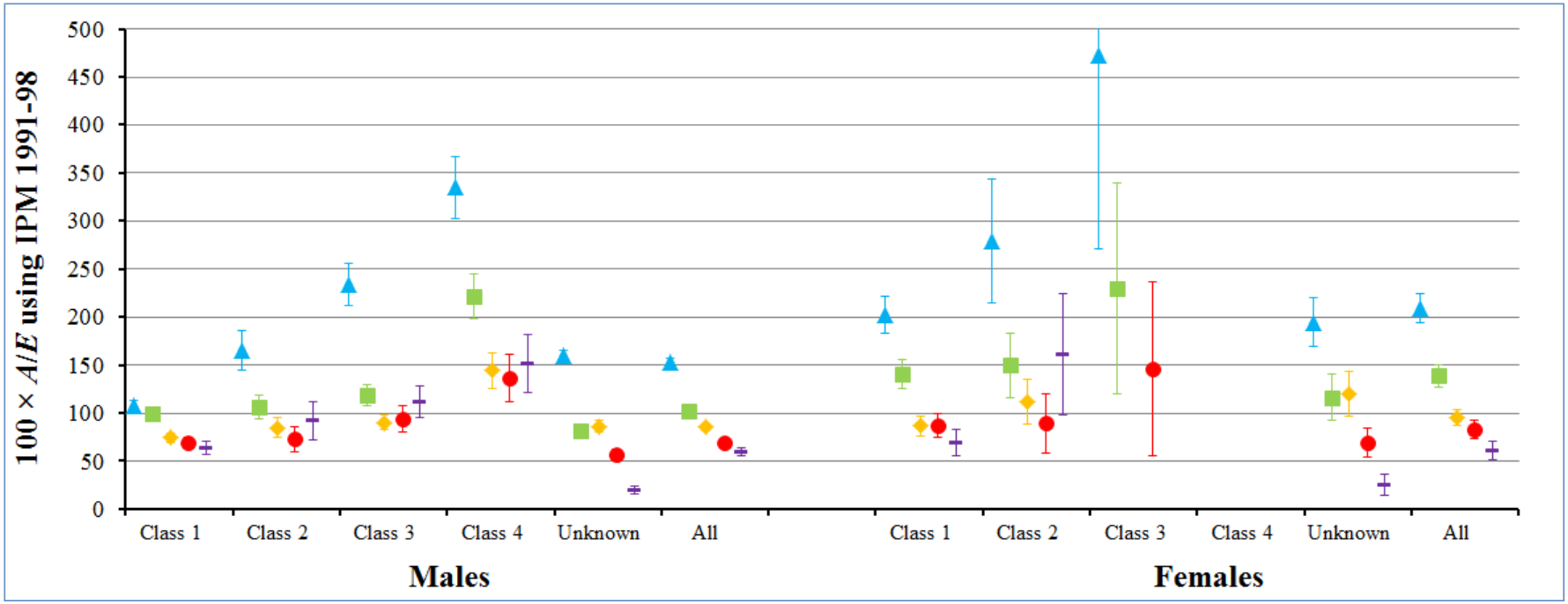


Female:Male ratio of Inception Rates
IIP *Standard** experience for
CMI Occ Class 1; all ages combined



Individual IP experience: Trends over 1991 – 2009 Claim Inceptions by sex and Occupation Class

Comparison of actual claim inceptions with those expected using IPM 1991-98
Individual IP *Standard** experience for DP 4
1991-2009 by quadrennium, sex and Occupation Class; all ages combined



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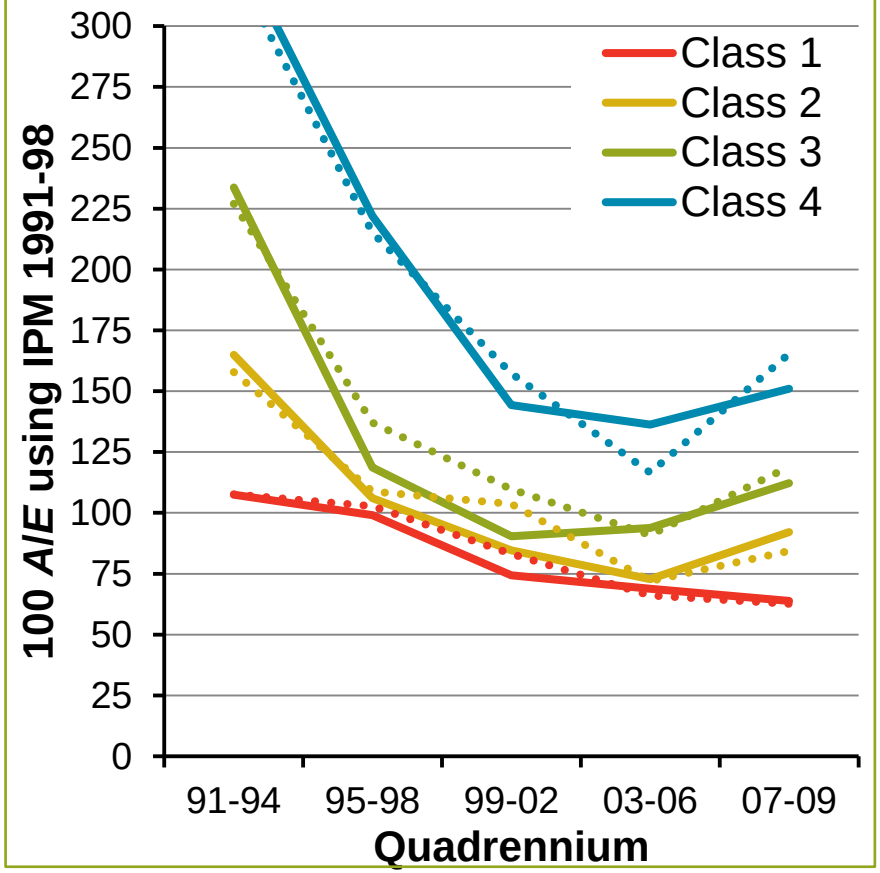
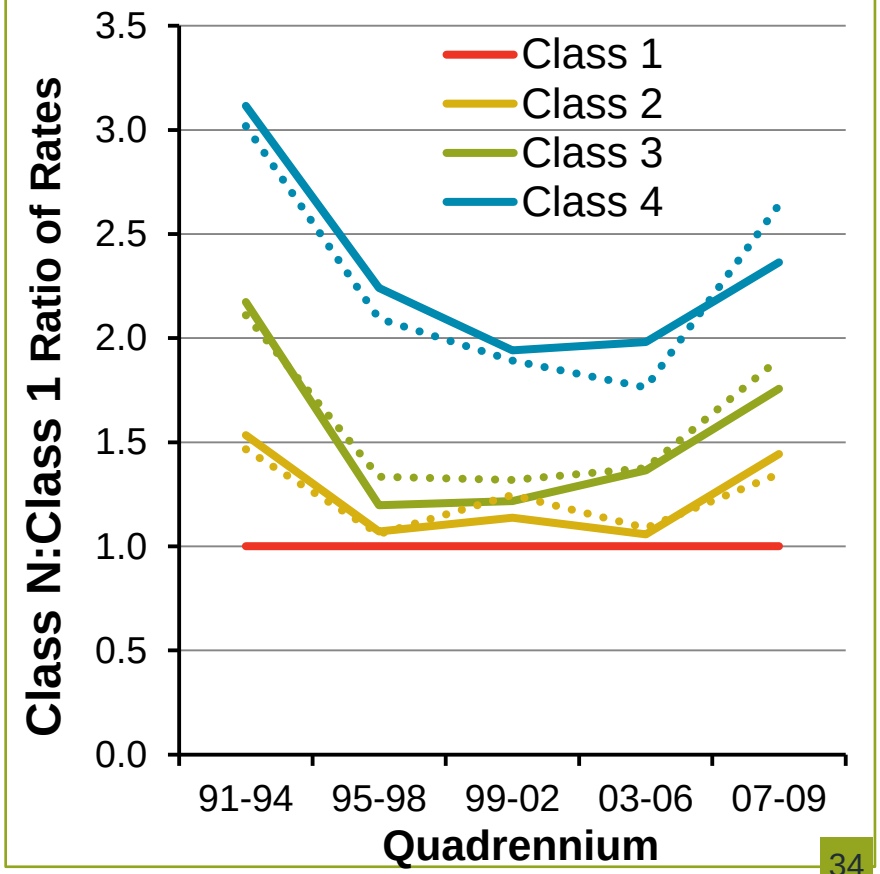
Individual IP experience: Trends over 1991 – 2009 Claim Inceptions by Occupation Class

A/E by Occ Class and quadrennium IIP *Standard** experience for Males; DP4 (DP 4-52 dotted); all ages

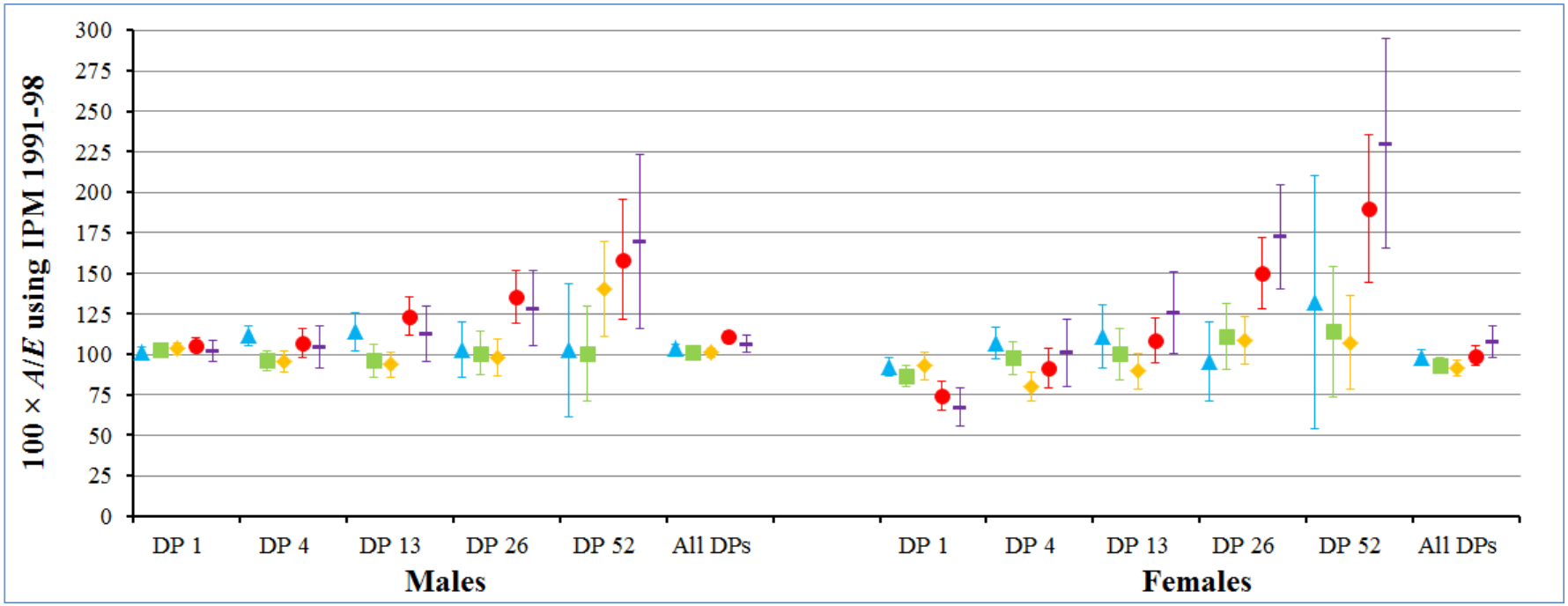


Ratio of Inception Rates by Class IIP *Standard** experience for Males; DP4 (DP 4-52 dotted); all ages



Individual IP experience: Trends over 1991 – 2009 Claimant Recoveries by sex and DP

Comparison of claimant recoveries with those expected using IPM 1991-98
Individual IP *Standard** experience for CMI Occupation Class 1
1991-2009 by quadrennium, sex and DP; all ages and durations sick combined



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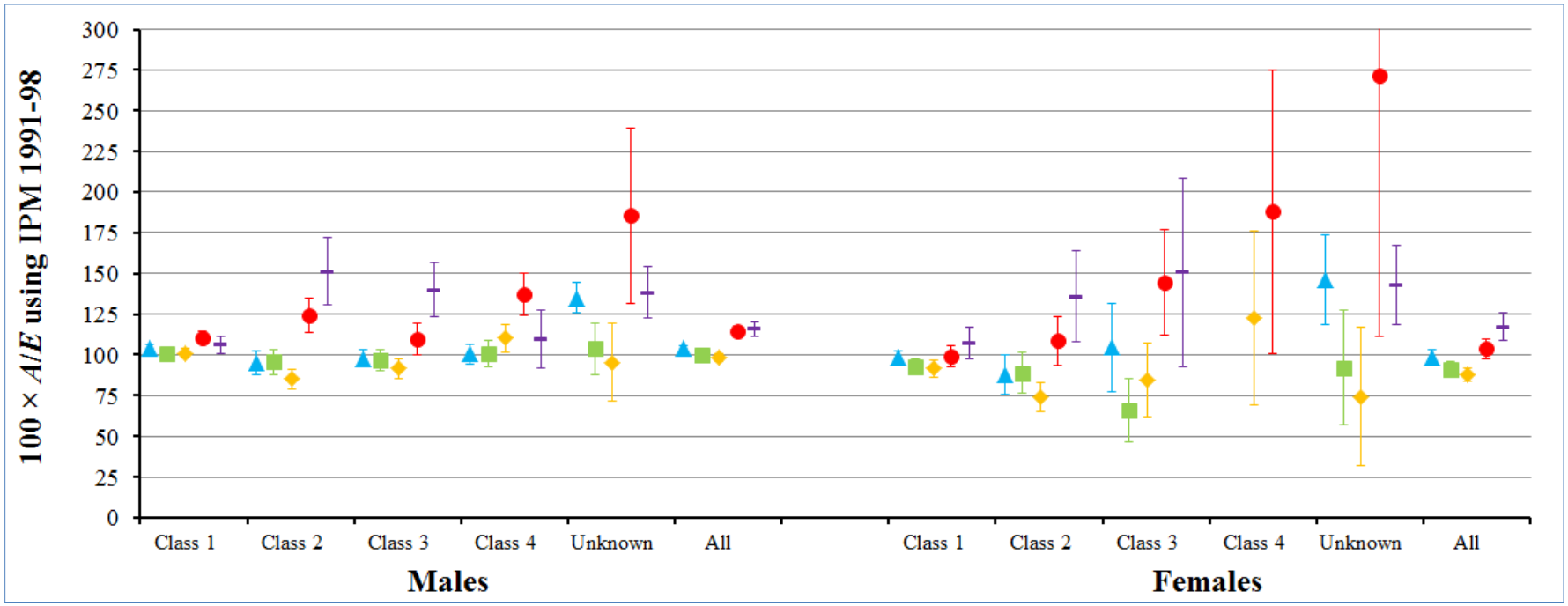
Individual IP experience: Trends over 1991 – 2009 Claimant Recoveries by sex and Occupation Class

Comparison of claimant recoveries with those expected using IPM 1991-98
Individual IP *Standard** experience for all DPs combined
1991-2009 by quadrennium, sex and OC; all ages and durations sick combined



▲ 1991-94 ■ 1995-98 ◆ 1999-02 ● 2003-06 – 2007-09

The error bars show approximate 95% confidence intervals, $100 \times A/E \pm 1.96\sigma$, where $\sigma = 100 \times \sqrt{A}/E$.
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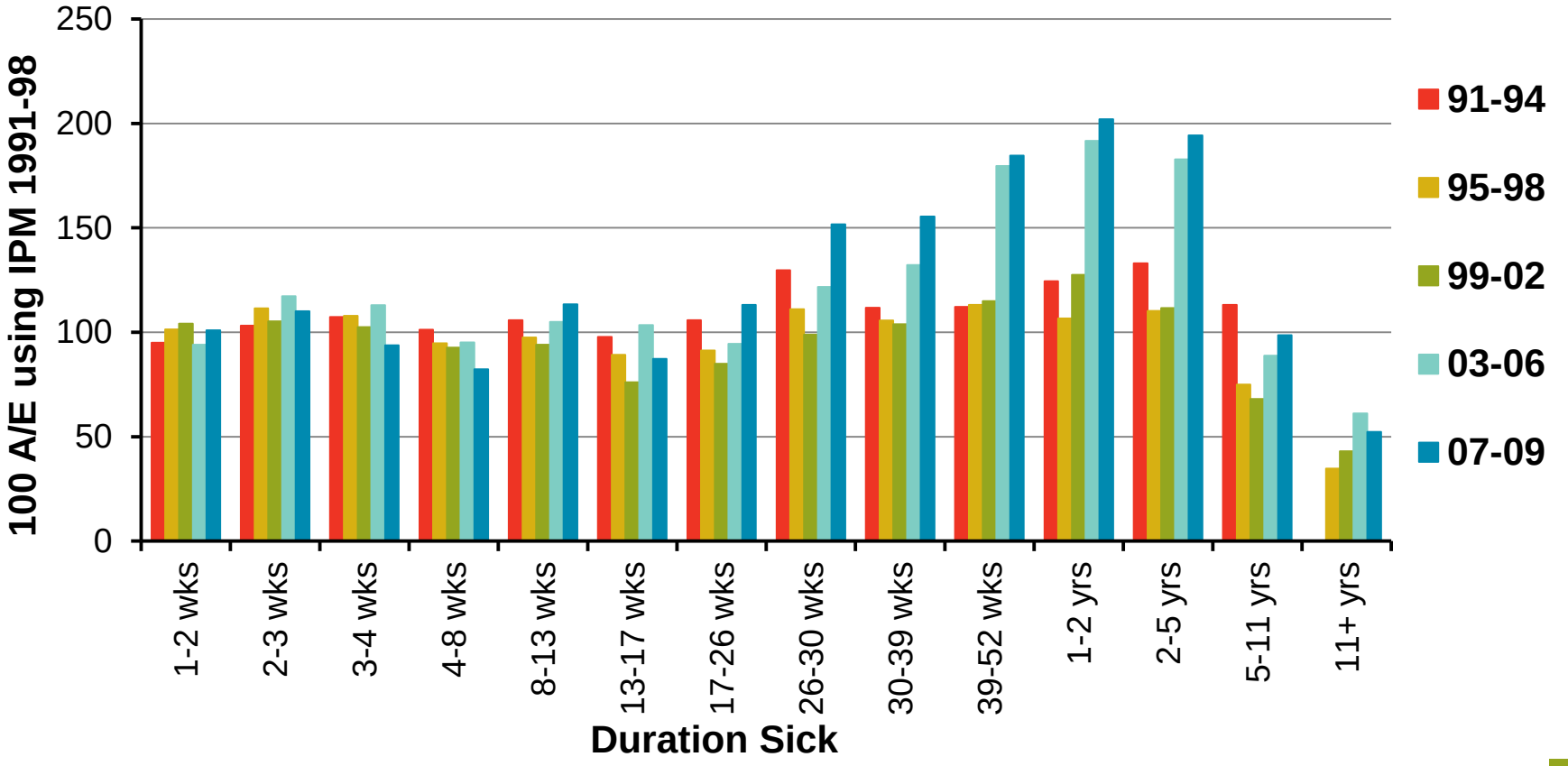
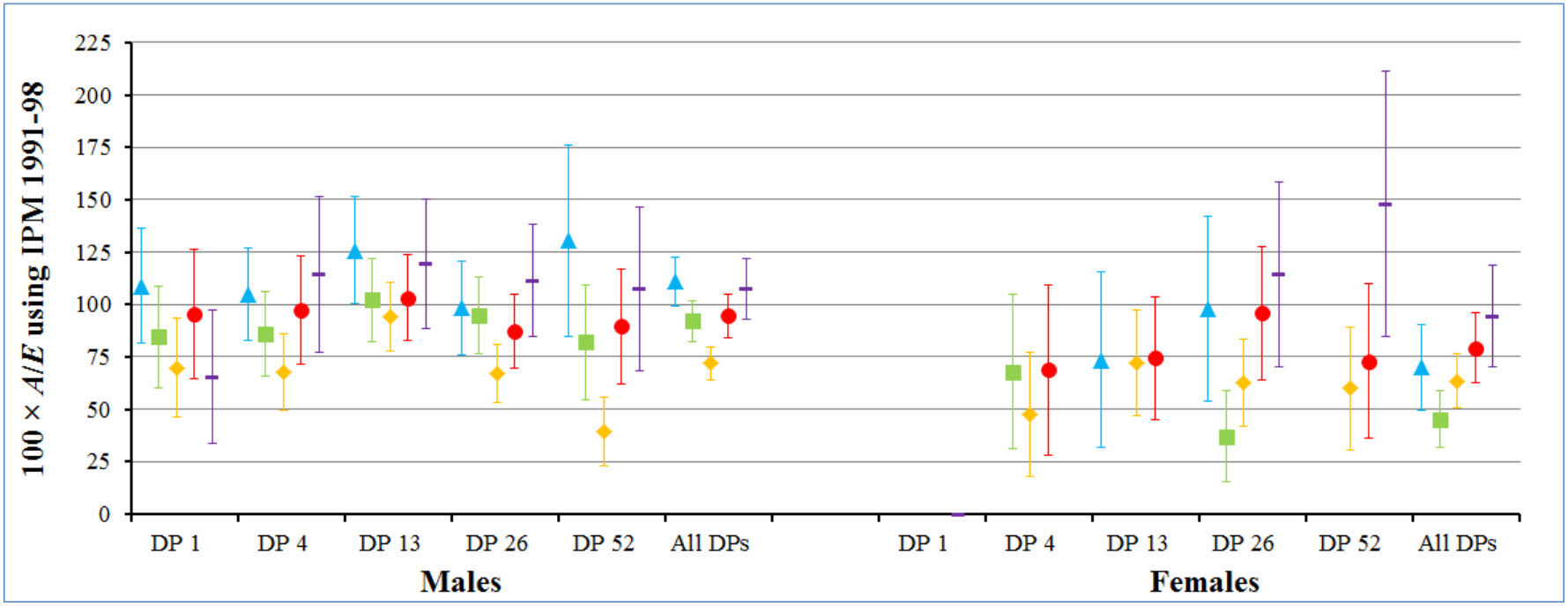
Individual IP experience: Trends over 1991 – 2009 Claimant Recoveries, males, by duration sick

Comparison of claimant recoveries with those expected using IPM 1991-98
Individual IP *Standard experience for 1991-2009 for males by quadrennium**
All DPs, Occupation Classes and ages combined



Individual IP experience: Trends over 1991 – 2009 Claimant Deaths by sex and DP

Comparison of actual claimant deaths with those expected using IPM 1991-98 Individual IP *Standard** experience for CMI Occupation Class 1 1991-2009 by quadrennium, sex and DP; all ages and durations sick combined



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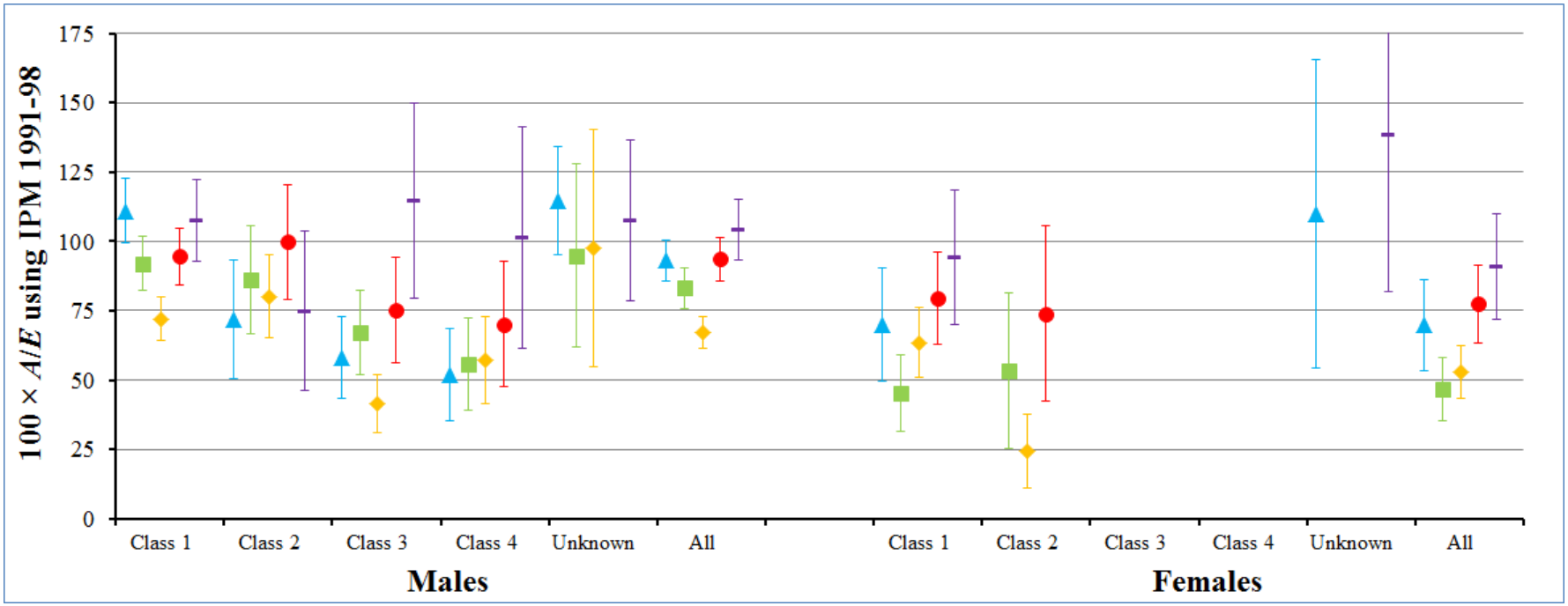
Individual IP experience: Trends over 1991 – 2009
Claimant Deaths by sex and Occupation Class

Comparison of actual claimant deaths with those expected using IPM 1991-98
Individual IP *Standard** experience for all DPs combined
1991-2009 by quadrennium, sex and OC; all ages and durations sick combined



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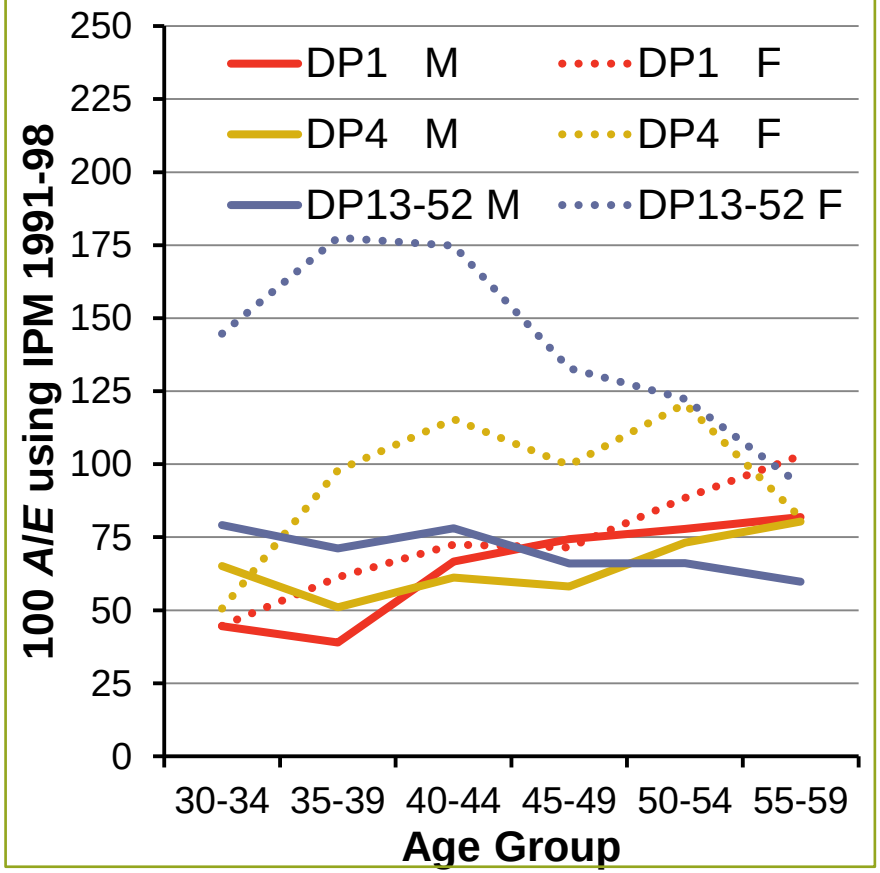
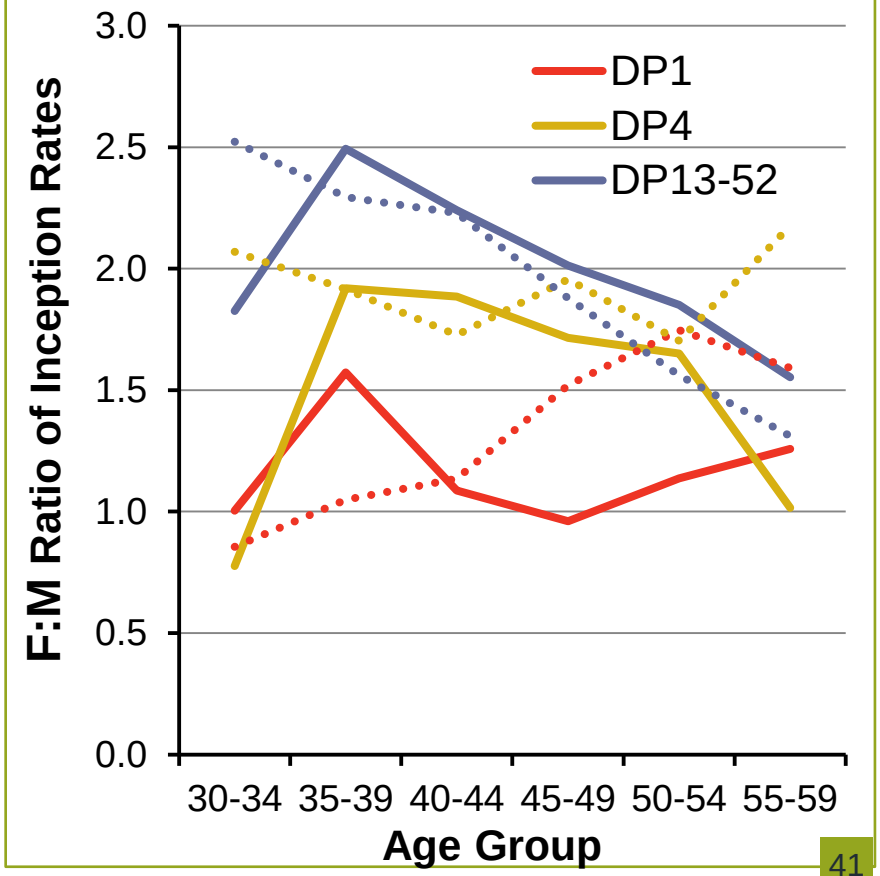
Features of the latest Individual IP experience

Features of Individual IP experience: 2003 – 2009 Claim Inceptions by age and sex

A/E by age, sex and DP IIP *Standard** experience for CMI Occ Class 1, 2003-09

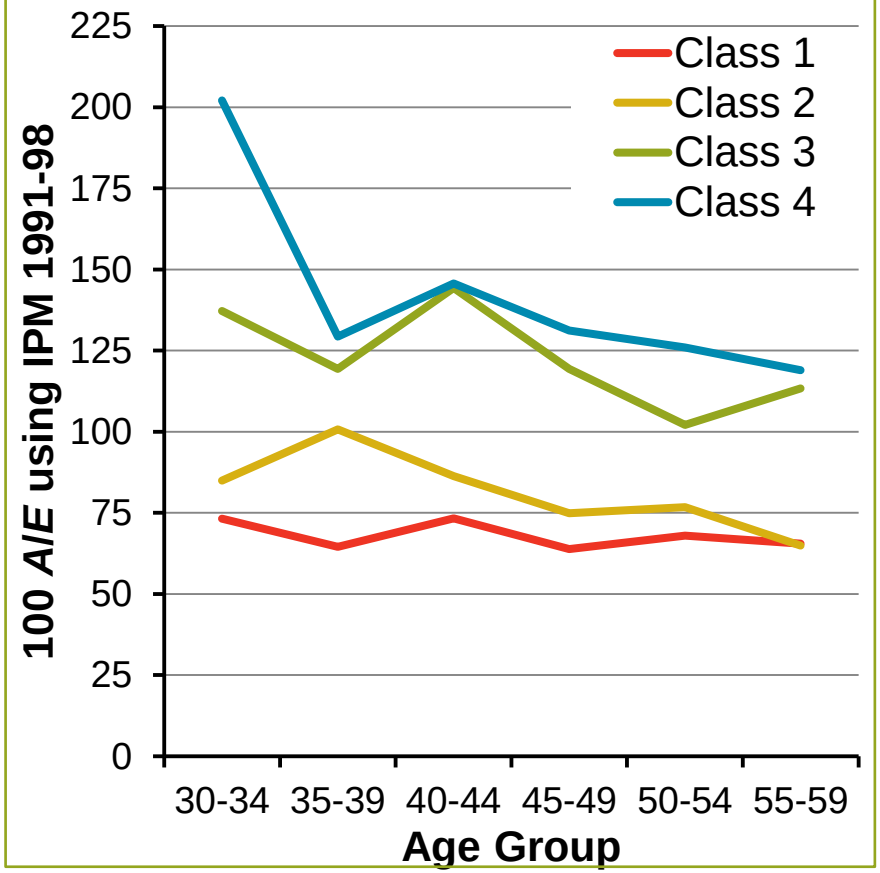


Female:Male ratio of Inception Rates IIP *Standard** experience for CMI Occ Class 1, 03-09 (91-98 dotted)

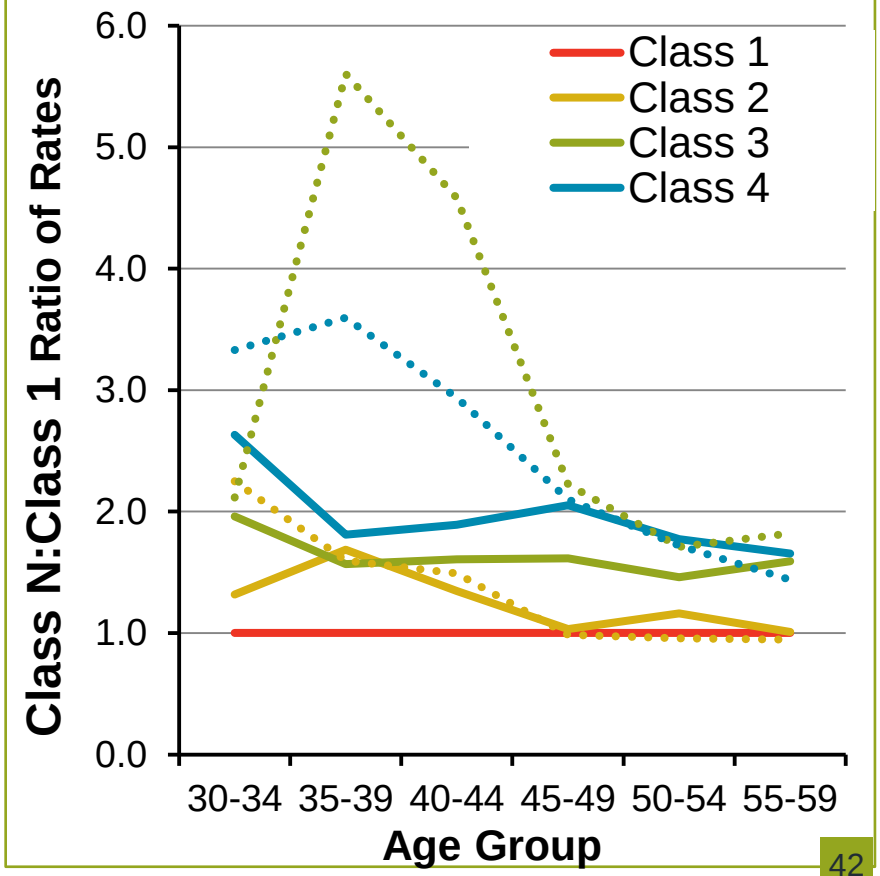


Features of Individual IP experience: 2003 – 2009 Claim Inceptions by age and Occupation Class

A/E by age and Occ Class IIP *Standard** experience for males, DPs 4-52 combined, 2003-09

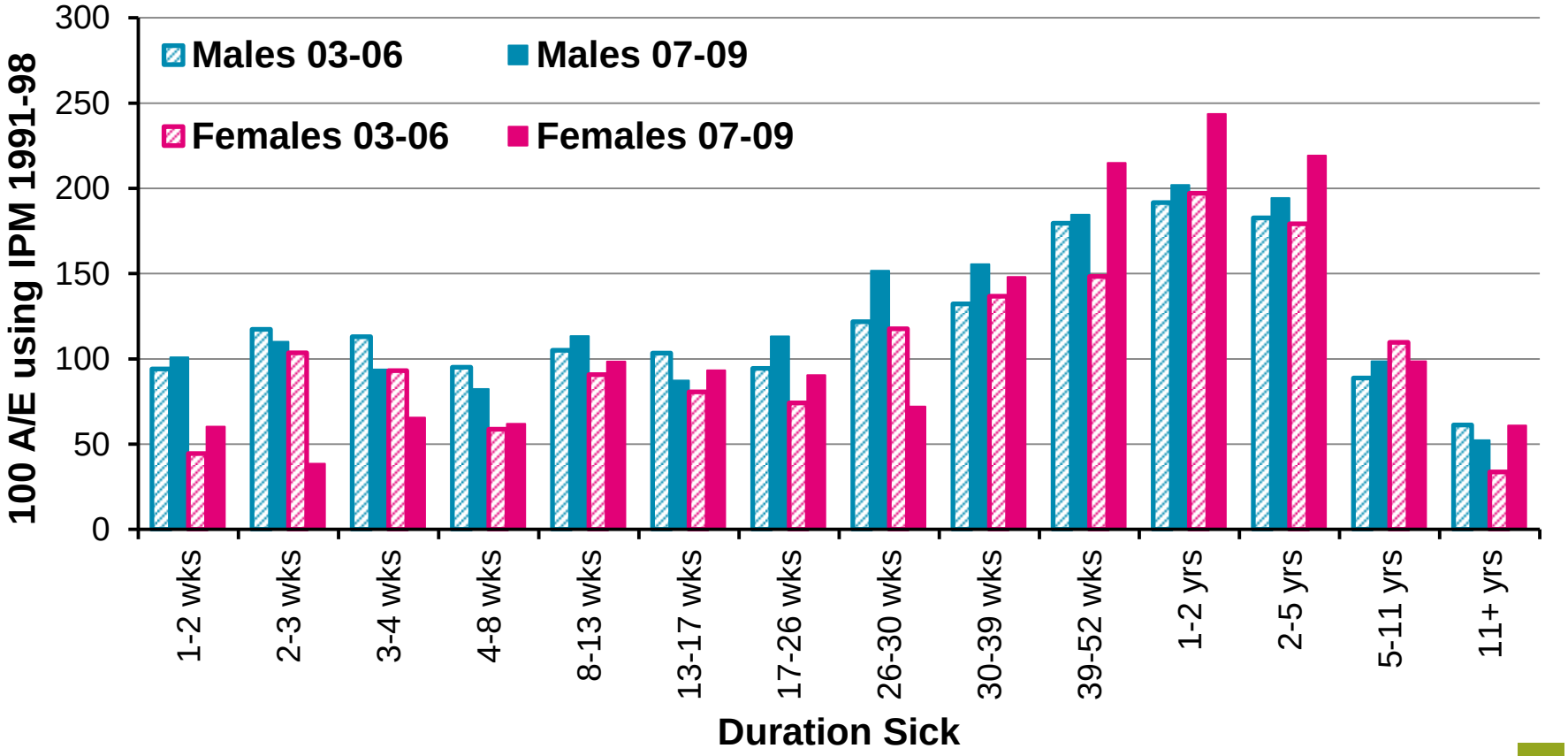


Ratio of Inception Rates by Class IIP *Standard** experience for males DPs 4-52; 2003-09 (1991-98 dotted)



Features of Individual IP experience: 2003 – 2009 Claimant Recoveries, by sex and duration sick

Comparison of claimant recoveries with those expected using IPM 1991-98 Individual IP *Standard** experience for 2003-2009 by sex and quadrennium All DPs, Occupation Classes and ages combined



The Actuarial Profession
making financial sense of the future

C3: CMI Income Protection Investigation

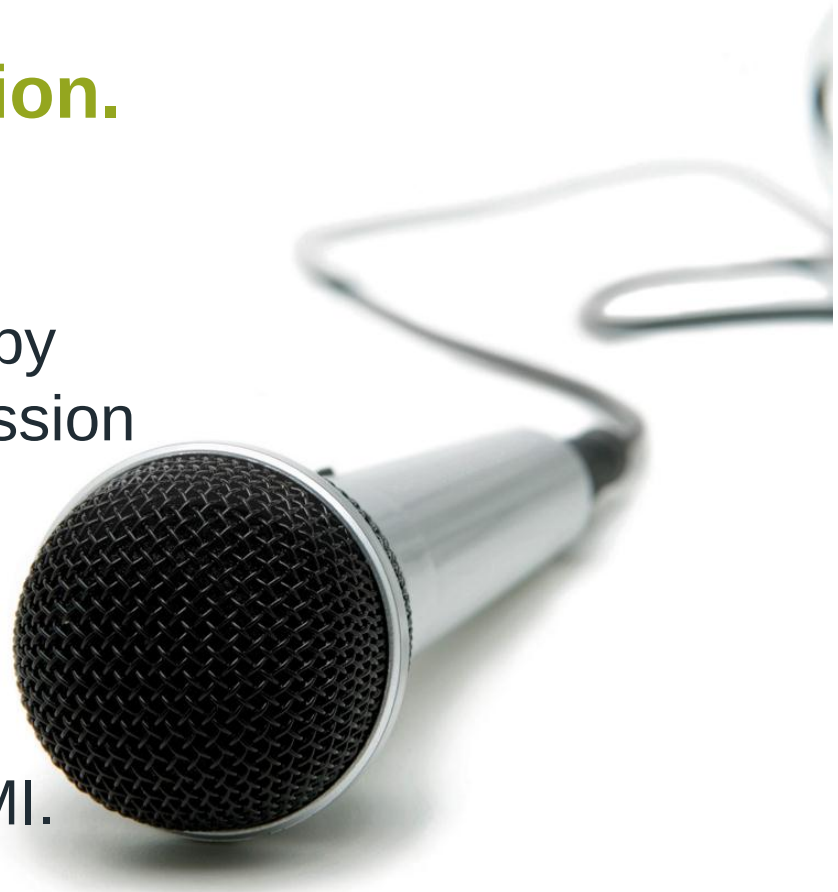
Future plans and request for feedback

CMI IP Committee
Future plans and request for feedback

- All Office results for 2008 – 2011
- Improving data quality and volumes
- 3 working parties for 2012
  - Individual IP experience by cause of claim
  - Rate calculation tools for IP practitioners
  - Analysis methodologies and systems
- Considering further graduations work in 2013+
  - Incorporate variation by sex and Occupation Class?
  - 2003 – 2010 dataset?

Questions or comments?

Thank you for your attention.



Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the CMI.

http://www.actuaries.org.uk/research-and-resources/pages/income-protection-investigation