The Actuarial Profession

making financial sense of the future

The 3rd Younger Members Convention

29-30 November 2004, The Chesford Grange Hotel, Kenilworth

B2

Critical Illness Pricing the Unknown

- Working Party / Research Group Update
- Scott Reid Revios Reinsurance UK Ltd.

Critical Illness Trends Research Group

Our Aims :

- To examine underlying trends in the factors influencing UK Insured Critical Illness claim rates, and from these, to assess :
 - The historic trend in incidence and death rates for the major CI's
 - Any pointers for future trends in Standalone CI, Mortality and hence Accelerated CI.
- Formed in March 2001



Trends in Critical Illness Risk Costs An update from the Critical Illness Trends Research Group

- Historic trends in incidence for the major CIs
 Variations over time, by sex, by smoker status, by socioeconomic group
 - Focussing on the age group 40 60
- Exploring scenarios for future trends
 Learning from the past and looking to the future
- Mapping a range of possible future outcomes for CI risk costs

Trends in Critical Illness Risk Costs An update from the Critical Illness Trends Research Group

- Historic trends in incidence for the major CIs
 Variations over time, by age, sex, by smoker status, by socio-economic group
- Exploring scenarios for future trends
 Learning from the past and looking to the future
- Mapping a range of possible future outcomes for CI risk costs





















	0 00					
	Inci	dence R	ates	Мо	rtality Ra	ites
	1980's	1990's	Overall	1980's	1990's	Overall
Heart Attack	-3.3%	-2.3%	-2.8%	-6.1%	-8.1%	-7.1%
Stroke	2.3%	3.0%	2.6%	-4.3%	-3.0%	-3.7%
CABG	13.3%	7.5%	10.4%	0%	0%	0%
Lung Cancer	-4.1%	-3.3%	-3.7%	-4.3%	-3.0%	-3.7%
Other Cancer	1.3%	0.5%	0.9%	-0.2%	-1.5%	-0.9%
Non CI Mortality	-1.5%	0.0%	-0.8%	-1.5%	0.0%	-0.8%
Overall						
Standalone	-1.1%	0.2%	-1.0%			
Accelerated	-1.3%	0.1%	-0.9%	-2.9%	-2.3%	-2.6%
After Stripping ou	t Impact of	f Fall in Sn	noking			
Standalone	-0.1%	0.7%	-0.2%			
Accelerated	-0.3%	0.6%	-0.1%	-1.9%	-2.0%	-2.0%



	Inci	idence Ra	ates	Mortality Rates		
	1980's	1990's	Overall	1980's	1990's	Overall
Heart Attack	-2.5%	-1.3%	-1.9%	-4.8%	-8.2%	-6.5%
Stroke	1.3%	2.5%	1.9%	-4.9%	-2.4%	-3.6%
CABG	13.3%	3.8%	8.5%	0%	0%	0%
Breast Cancer	2.0%	2.5%	2.2%	-0.6%	-3.1%	-1.9%
Lung Cancer	-1.9%	0.2%	-0.9%	-2.1%	-0.3%	-1.2%
Other Cancer	0.5%	-0.4%	0.0%	-0.9%	-2.3%	-1.6%
Non CI Mortality	-3.0%	0.4%	-1.3%	-3.0%	0.4%	-1.3%
Overall						
Standalone	0.5%	0.9%	0.6%			
Accelerated	-0.2%	0.8%	0.2%	-2.3%	-1.6%	-2.0%
After Stripping ou	t Impact o	f Fall in Sn	noking			
Standalone	1.1%	1.2%	1.0%			
Accelerated	0.4%	1.1%	0.6%	-1.6%	-1.4%	-1.5%

Summary of Trends in CI Incidence and Mortality





Trends in Critical Illness Risk Costs An update from the Critical Illness Trends Research Group

- Historic trends in incidence for the major CIs
 Variations over time, by age, sex, by smoker status, by socio-economic group
- Exploring scenarios for future trends
 Learning from the past and looking to the future
 Part 1
 Part 2
- Mapping a range of possible future outcomes for CI risk costs

Exploring scenarios for future trends Part 1

- Impact of statins on heart attack
- Troponin and incidence of heart attack, CABG and angioplasty
- Obesity scenario impact on critical illness claims
- International comparisons

Statins and the Incidence of Heart Attack

- Statins reduce cholesterol
 - Iower levels of cholesterol are associated with a lower risk of cardiovascular disease
- Currently prescribed to people with a 30% chance heart attack in next 10 years
- To become available without prescription from a pharmacist to people at "moderate risk" of CHD
- Allow more people to protect themselves from CHD

Statins - Those at 'Moderate Risk' of Heart Attack

Men age 55 or more

- Men age 45-54 and women 55 or more if also have one of the following risk factors
 - Family history of CHD in 1st degree relative
 - Smoker or given up for less than a year
 - Overweight
 - South Asian ethnicity

	Ν	/lales	Fe	emales	
Age	Non Smok	er Smoker	Non Smoker Smoker		
Up to 44	0%	0%	0%	0%	
45_49	48%	100%	0%	0%	
50_54	48%	100%	0%	0%	
Over 55	100%	100%	38%	100%	



Statins - What is the potential impact

- For adults in Western societies it can be beneficial to reduce cholesterol levels whatever the starting point
- Need to take regularly on a long term basis
- Cholesterol can be reduced in the first month
- Risk of heart attack reduced by
 - 10% after one year
 - 33% after three years

Statins - Will people take them?

- Can not predict the take up rate
 - price not yet confirmed
- Compliance will people continue to take their medicine in the longer term?
- Adverse reaction from some medical professionals







Statins and Heart Attack Incidence for Insured Lives

- Higher take up amongst higher socio-economic groups?
 smaller 'moderate risk' group
- Compliance still an unknown
- Impact over the next 5 to 10 years









Obesity - overview

- Obesity why?
- Modelling Obesity
- Underwriting and socio-economic effect
- Conclusion



Obesity - why?

How is it measured?

■ Body Mass Index (BMI) = (Weight in Kg)/(height in metres)²

Is this a good measure?

Obesity - why?

Fundamental cause:

- Consuming more calories than are expended
- Why has number of obese people trebled over the last 20 years:
 Less active lifestyle
 - Changes in eating patterns
- Genetic
- Women after menopause
- Social economic effect
- Ethnic and cultural background

Obesity - overview

- Obesity why?
- Modelling Obesity
- Underwriting and socio-economic effect
- Conclusion

Modelling Obesity

Project BMI by weight category Project BMI by weight cate Weight Categories: Underweight (<20) Healthy (20<BMI<25) Overweight (25<BMI<30) Obese (30<BMI<40) Morbidly obese (BMI>40) Optimistic



Government initiatives Halt upward trend Improve back to 1993 levels



Pessimistic Upward trend continues Catches America by 2022



Modelling obesity

- Historical trends key facts (in UK)
 - 1980: 6% male and 8% female are obese
 - 1993: 13% males and 16% females are obese
 - 2002: 22% male and 23% female are obese
 - No sign upward trend moderating
 - Optimistic trend assumes 1993 levels in 20 years
- USA prevalence:
 - 28% males and 34% females are obese
 - Pessimistic: 52% males and 56% females





Modelling obesity

- Project the BMI by weight categoryBreakdown historic aggregate incidence by weight category Project separate breakdown of incidence:
- i (healthy)

 i (morbidly obese)
- Aggregate the breakdown of incidence using:
 Future BMI trends by weight category
 Relative risk factors by weight category





Morbidity from major coro	hary heart disease,	stroke, diabetes and co	mbined, UK stud
	20.0-22.0	BMI 24.0-26.0	>=30
Heart, stroke, diabetes	1.00	1.07	1.97
eart	1.00	1.38	2.13
troke	1.00	1.20	1.70



Modelling obesity

	18.5-24.9	BMI 25.0-29.9	30.0-34.9	35.0-39.9	>= 40.0
All Cancer	1.00	0.97	1.09	1.20	1.52
Stomach	1.00	1.01	1.20	1.94	
Colorectal	1.00	1.20	1.47	1.84	
Lung	1.00	0.78	0.79	0.67	
Melanoma	1.00	0.95	0.85		
Prostate	1.00	1.08	1.20	1.34	

Mortality from Cano	er According to Body-Mas	s Index among U.S. W	omen in the Cancer Pre	evention Study II, 1982	through 1998
	18.5-24.9	BMI 25.0-29.9	30.0-34.9	35.0-39.9	>= 40.0
All Cancer	1.00	1.08	1.23	1.32	1.0
Stomach	1.00	0.89	1.30	1.08	
Colorectal	1.00	1.10	1.33	1.36	1.
Lung	1.00	0.88	0.82	0.66	0.1
Melanoma	1.00	0.85	1.10		
Breast	1.00	1.34	1.63	1.70	2.
Quarian	1.00	1 15	1.16	1.51	







EM	Heart Allack, Market, Ade // 61 Incidence X, conge J accord	Cunert act Flope tion de categore e 2000	Feestriisik essnerit Poperier 27 Ottopoly	Guiniste servit Poptiero, Goder,
	32000	1 2002	411-101-11	44437
9	. 19	1.0	245	o 45
C-2	2,78	22.6%	13.3%	35.354
25 K	4.58	25,4%	XX25	45.9%
2242	5.92	010%	41.1%	10.0%
4 +	н	н Б	17.18	075
Casal		<i>0</i> 0.0%	00 C2.	00.2%
se esste leidence		400	: 10	41
			124.55	-4014
	nistic and Demoistic at			22.42





























Obesity - overview

- Obesity why?
- Modelling Obesity
- Underwriting and socio-economic effect
- Conclusion



	 Obese applica Other right factor 	ins sent for a me	Jicai	
	Other risk facto	ors are rated sepa	arately:	
	Diabetes	pressure		
■ Ir	surers rate ob	esity risk or d	ecline	
BMI	Reinsurer A	Reinsurer B	Reinsurer C	Reinsurer D
ВМІ 30	Reinsurer A	Reinsurer B	Reinsurer C	Reinsurer D
BMI 30 35	Reinsurer A 0% 50%	Reinsurer B 22% 100%	Reinsurer C 0% 50%	Reinsurer D 75% 125%



Obesity - overview

- Obesity why?
- Modelling Obesity
- Underwriting and socio-economic effect
- Conclusion

Obesity - conclusion

- Biggest relative impact on heart attack
- Cancer less impact
- Insurance population needs to allow for:
 - UnderwritingSocial-economic effect
 - Lower proportion of women
- Obesity has become a focus point
 - Over 50 government initiatives
 - cost to NHS
- Minor impact on insured population for critical illness claims?

New Remote Control Can Be Operated by

Remote

No more leaning forward to get remote from coffee table means greater convenience for TV viewers.

Television watching became even more convenient this week with Sony's introduction of a new remote-controlled remote control.



Male Female
Heart Attack 115% 144%
Angioplasty 570%
Coronary Artery By Pass Graft 108%

Internationa US Incidend	al Comparisons Cancer – ce as % Incidence England and Wales				
Male					
Ages	Prostate	Malignant Melanoma	All CI Cancers		
20 - 39	1011%	192%	137%		
40 - 59	555%	248%	163%		
60+	200%	279%	125%		
All	223%	256%	132%		

Female			
Ages	Breast	Malignant Melanoma	All Cl Cancers
20 - 39	96%	156%	128%
40 - 59	106%	147%	118%
60+	139%	127%	117%
All	123%	139%	118%





Learning from the past and log
 Part 1

Part 2

Mapping a range of possible future outcomes for CI risk costs

Exploring scenarios for future trends Part 2

- Cancer Screening
 - Breast Cancer
 - Prostate Cancer
 - Bowel Cancer

Smoking Prevalence / Lung Cancer











Breast Cancer Screening

Current programme for ages 50 to 65

- Initial catch-up surge phase saw 50% increase in reported breast cancer incidence rates for the 50 to 65 age group
- Settled phase reflects around 25% increase in reported breast cancer incidence rates for the 55 to 65 age group
- Overall consistent with advancing breast cancer diagnosis by up to 3 years
- Possible extension to start age 40
 - New surge for ages 40 to 50
 - Rates for age 40 remain high but those at ages 50 to 55 would fall back













Prostate Cancer Screening

- Example taken from USA data
- No formal programme but PSA tests widely available
 - Initial catch-up surge phase saw 140% increase in reported prostate cancer incidence rates across a wide age group
 - Settled phase reflects around 40% increase in reported prostate cancer incidence rates across a wide age group
 - Overall consistent with advancing prostate cancer diagnosis by up to 5 years

















- Models based on pilot screening studies, covering age range 50 to 70
 - Initial catch-up surge phase gives 80% increase in reported bowel cancer incidence rates for the 50 to 65 age group
 - Overall consistent with advancing diagnosis by 2 to 3 years
- Settled phase critically depends on whether the screening also detects pre-cancerous polyps
 - No polyps detected settle at around 20% increase
 - 10% polyps detected settle perhaps 50% below current reported incidence rates, except for starting age group
- Recent government announcement signals national screening starting at age 60 from 2006







Lung Cancer Projection

- We can build a well-founded model of lung cancer rates
 - We have good time series data on lung cancer rates
 - We have reasonable time series data on smoking habits
 - Linkages are well established through medical research
 Sir Richard Doll : 50-year study of smoking / British males doctors
- Our models show a reasonable fit to past data
 - Modelled rates shown as solid lines ; actual rates as dotted lines
 - Note the strong cohort patterns by age for both males and females
- We can project forward with scenarios of future smoking habits
- Changes in smoking habits take many years to work through
- These models can also be calibrated to overall mortality or CI

Trends in Critical Illness Risk Costs An update from the Critical Illness Trends Research Group

- Historic trends in incidence for the major CIs ■ Variations over time, by age, sex, by smoker status, by socio-economic group
- Exploring scenarios for future trends Learning from the past and looking to the future
- Mapping a range of possible future outcomes for CI risk costs

Mapping a range of possible future outcomes for CI risk costs

Summarize and compare a selection of scenarios we have evaluated

- Cautions :
 - Illustrative, but very rough, estimates
 - Still "work in progress"
 - Focus on cancer, heart attack, CABG and stroke only
 - Far from exhaustive, even for the CIs partially covered
 - Mix of high and low likelihood Many overlaps and lots of gaps
 - Modelled individually how might the scenarios combine ?

Mapping a range of possible future outcomes for CI risk costs Key - Part 1 $% \left({\left({r_{\rm s}} \right)_{\rm s}} \right)$

- Ο Extrapolation of trends from the 1990's
- O Obesity "optimistic" and "pessimistic" scenarios
- Ο Smoking - continuation of recent trends in smoking habits
- Convergence to USA CI incidence rates
- \bigcirc Convergence to EU CI incidence rates "best" and "worst"
- 0 Cancer Screening - Breast (extended down to age 40)
- Cancer Screening Breast (extended down to age 40)
 Cancer Screening Bowel Cancer No polyps detected
 Cancer Screening Bowel Cancer 40%
- - Cancer Screening Bowel Cancer 10% polyps detected
- \Diamond Cancer Screening - Prostate (similar to USA experience)



- O Cancer Screening "1 year" advancement in detection
- Cancer Screening "3 year" advancement in detection Cancer Screening "3 year" advancement in detection Cancer Screening "5 year" advancement in detection 0
- Ō
- O Impact of Troponin on heart attack diagnoses
- $\diamond 0 \diamond$ Definition drift on Strokes / TIAs
- Impact of Statins on heart attack rates
- Blue sky polypills and cancer vaccinations

0			- (M-l
Scer % Ch	ange in Overall CI ri	sk Rate	s for males
30% T		[]	
25% -		•	
20% -			
15% -			
10% -			•
5% -		•	
0%	•• <u>°</u> * •	●● ●●	• <u>%</u> •*
59/		$\bullet \circ \bullet$	• •
-5%			•
-10% +			•
-15% ⊥			
	Near Term	Medium Term	Long Term











Mapping a range of possible future outcomes for CI risk costs Shifting viewpoint from Population to Insured Lives

- Segregated non-smoker / smoker rates
 Remove past beneficial trend in smoking prevalence
 Affects extrapolation scenario and future impact of smoking habits
- Different socio-economic mix
 Cancer gains in importance at expense of heart attack and stroke
 Different access and attitudes to medical checks and treatment
- Different mix by sex
- Possible impacts from policyholder actions
 Non-disclosure ; anti-selective lapses





Mapping a range of possible future outcomes for CI risk costs - Key Observations

- Caution : Work-in-progress and incomplete !
- \blacksquare Many of the illustrated scenarios have relatively small impact +/- 5% \ldots
- \blacksquare \ldots but we can readily can envisage most dramatic scenarios
- Balance or imbalance of competing forces is critical
- Of the work so far, convergence with international rates perhaps gives the best indication of possible future ranges
- Typically, shifting from a population to an insured portfolio view magnifies the impact, particularly on cancer

B2

Critical Illness Pricing the Unknown

- Working Party / Research Group Update
- Scott Reid Revios Reinsurance UK Ltd
- We welcome your :
 Questions and Discussion Points
 Proposals for Further Research