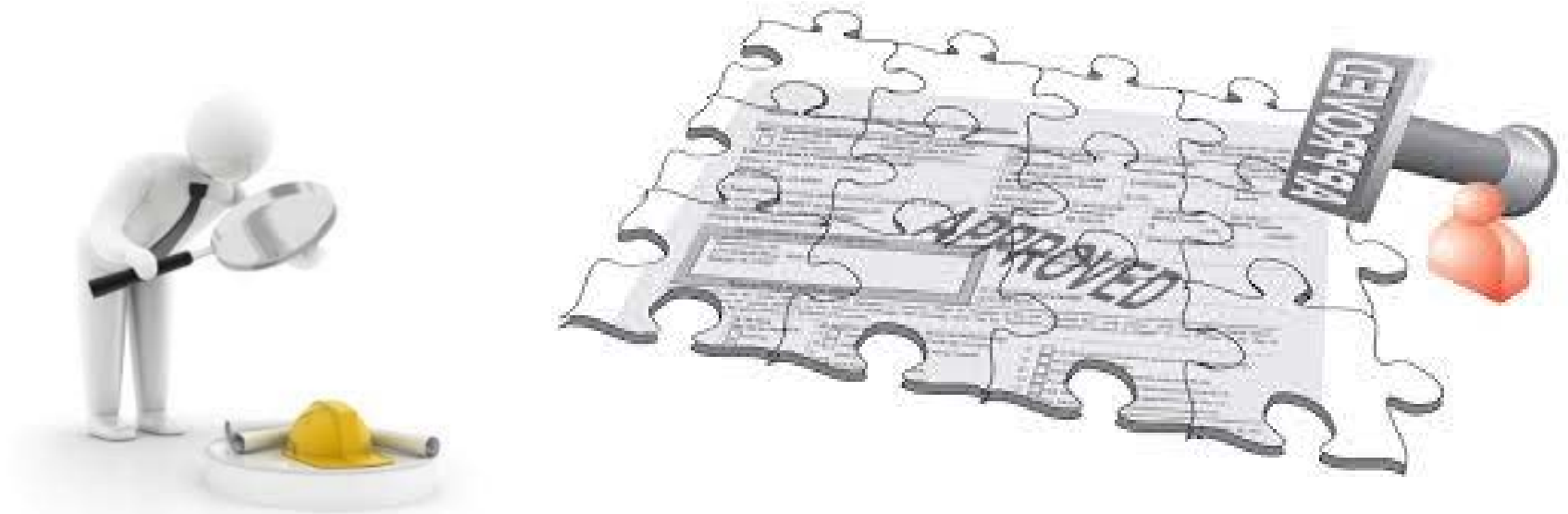


Actuaries and Underwriting

In the brave new world



Underwriting 101

Underwriting is a term used by life insurers to describe the process of assessing risk, ensuring that the cost of the cover is proportionate to the risks faced by the individual concerned. People with the same or similar risk pay the same or similar premium rates.

The ideal underwriting process would:

- Protect the office from undue risk or selection
- Be efficient and economical to implement
- Group lives of similar risk together
- Help the office experience claims in line with pricing assumptions
- Be straight forward for the client and adviser
- Make sense.

Trends over time

1990	Current	Future ?
Actuaries involved in underwriting	Little actuarial involvement outside reinsurers	
Ratings and policies based on theoretical analysis	Manuals still based on research, but individual companies application far more subjective	
Underwriters sometimes seen as being in ivory tower	Underwriters working closely with distributors and clients	
Little input from the market, or discussion of assessments	Much greater connection with the market	
Policies and ratings often conservative	Market pressure to often give a commercial rather than 'correct' assessment	
Assessments made manually, products relatively simple	Products significantly more complicated. Increasing utilisation of technology, but little other innovation in underwriting approach.	
Strong growth, generous budgets	Budgets increasingly tight	

Underwriting Challenges and opportunities

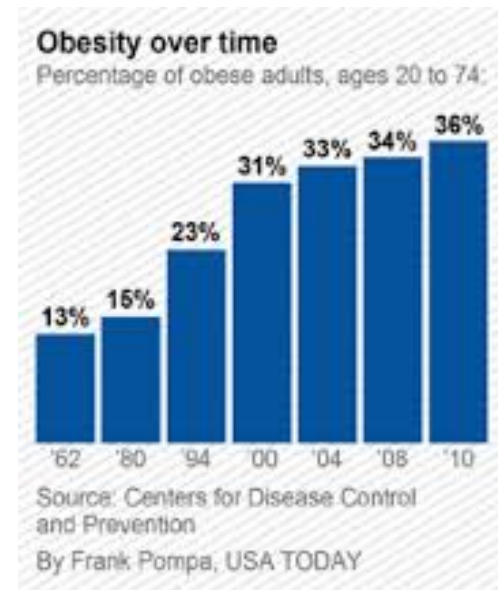
- Obesity epidemic
- Genetic testing
- New technologies and opportunities to do things differently
- Predictive modelling
- Medical advances
- Human Rights

Obesity epidemic

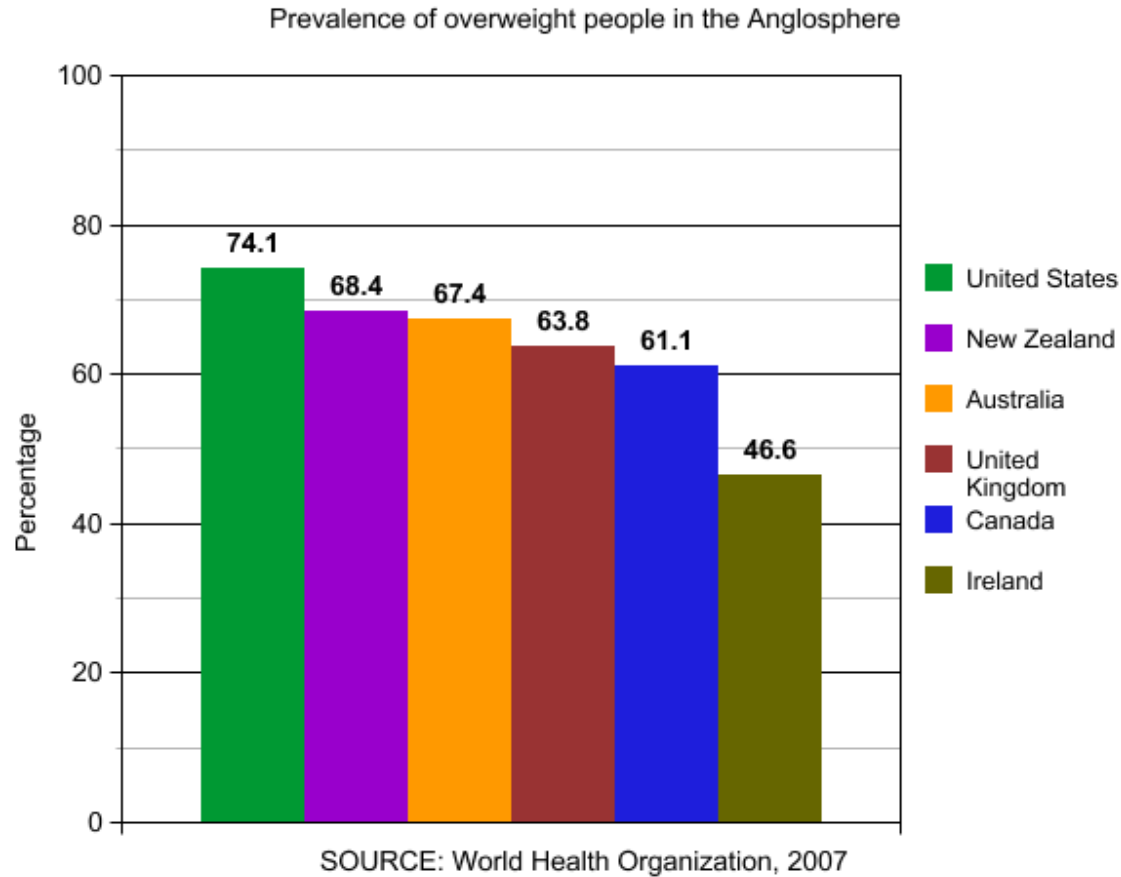
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Over the past 33 years worldwide adult overweight and obesity rates have increased by 27%



NZ has second highest level of obesity in the English speaking World



Rates of Obesity

The 2012/13 New Zealand Health Survey found that:

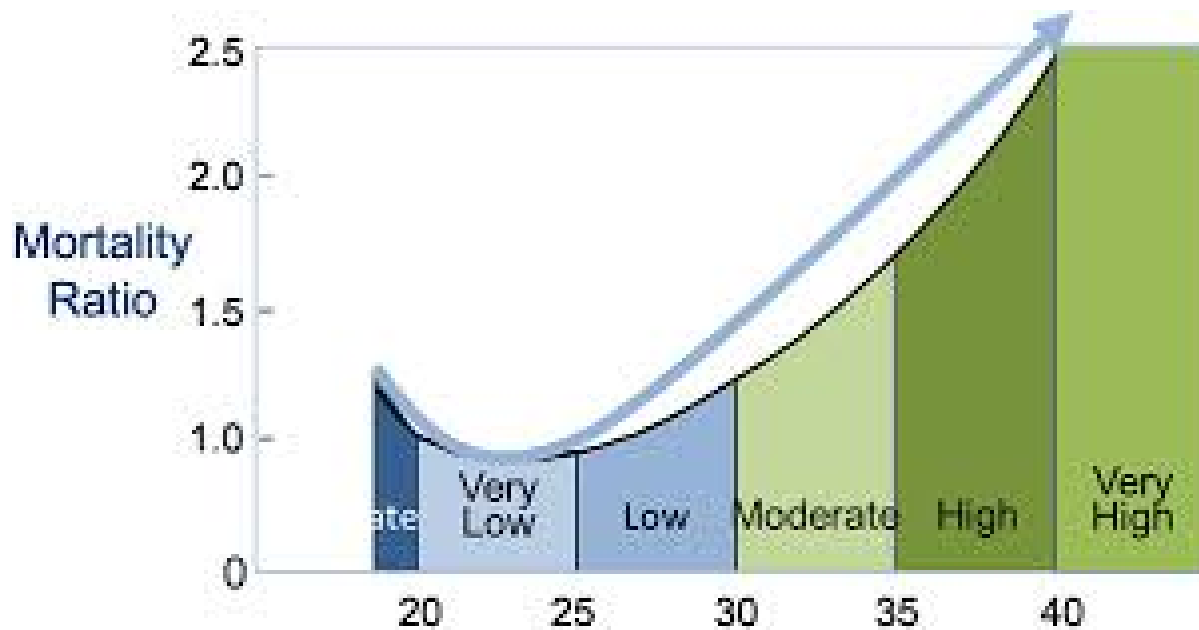
- almost 1 in 3 adults (aged 15 years and over) were obese (31%), a further 34% were overweight
- 1 in 9 children aged 2–14 years were obese (11%), a further 1 in 4 children were overweight (22%).

Obesity significantly increases the risk of:

- Coronary heart disease
- Type 2 diabetes
- Cancers (endometrial, breast, and colon)
- Hypertension (high blood pressure)
- Dyslipidemia
- Stroke
- Liver and Gallbladder disease
- Sleep apnoea and breathing problems
- Osteoarthritis
- Gynecological problems

BMI and mortality

- Mortality rates increase steeply with weight



Male build - conservative

males	Height																	
Weight	150	152.5	155	157.5	160	162.5	165	167.5	170	172.5	175	177.5	180	182.5	185	187.5	190	192.5
40	17.78	17.20	16.65	16.12	15.63	15.15	14.69	14.26	13.84	13.44	13.06	12.70	12.35	12.01	11.69	11.38	11.08	10.79
42.5	18.89	18.27	17.69	17.13	16.60	16.09	15.61	15.15	14.71	14.28	13.88	13.49	13.12	12.76	12.42	12.09	11.77	11.47
45	20.00	19.35	18.73	18.14	17.58	17.04	16.53	16.04	15.57	15.12	14.69	14.28	13.89	13.51	13.15	12.80	12.47	12.14
47.5	21.11	20.42	19.77	19.15	18.55	17.99	17.45	16.93	16.44	15.96	15.51	15.08	14.66	14.26	13.88	13.51	13.16	12.82
50	22.22	21.50	20.81	20.16	19.53	18.93	18.37	17.82	17.30	16.80	16.33	15.87	15.43	15.01	14.61	14.22	13.85	13.49
52.5	23.33	22.57	21.85	21.16	20.51	19.88	19.28	18.71	18.17	17.64	17.14	16.66	16.20	15.76	15.34	14.93	14.54	14.17
55	24.44	23.65	22.89	22.17	21.48	20.83	20.20	19.60	19.03	18.48	17.96	17.46	16.98	16.51	16.07	15.64	15.24	14.84
57.5	25.56	24.72	23.93	23.18	22.46	21.78	21.12	20.49	19.90	19.32	18.78	18.25	17.75	17.26	16.80	16.36	15.93	15.52
60	26.67	25.80	24.97	24.19	23.44	22.72	22.04	21.39	20.76	20.16	19.59	19.04	18.52	18.01	17.53	17.07	16.62	16.19
62.5	27.78	26.87	26.01	25.20	24.41	23.67	22.96	22.28	21.63	21.00	20.41	19.84	19.29	18.77	18.26	17.78	17.31	16.87
65	28.89	27.95	27.06	26.20	25.39	24.62	23.88	23.17	22.49	21.84	21.22	20.63	20.06	19.52	18.99	18.49	18.01	17.54
67.5	30.00	29.02	28.10	27.21	26.37	25.56	24.79	24.06	23.36	22.68	22.04	21.42	20.83	20.27	19.72	19.20	18.70	18.22
70	31.11	30.10	29.14	28.22	27.34	26.51	25.71	24.95	24.22	23.52	22.86	22.22	21.60	21.02	20.45	19.91	19.39	18.89
72.5	32.22	31.17	30.18	29.23	28.32	27.46	26.63	25.84	25.09	24.36	23.67	23.01	22.38	21.77	21.18	20.62	20.08	19.56
75	33.33	32.25	31.22	30.23	29.30	28.40	27.55	26.73	25.95	25.20	24.49	23.80	23.15	22.52	21.91	21.33	20.78	20.24
77.5	34.44	33.32	32.26	31.24	30.27	29.35	28.47	27.62	26.82	26.04	25.31	24.60	23.92	23.27	22.64	22.04	21.47	20.91
80	35.56	34.40	33.30	32.25	31.25	30.30	29.38	28.51	27.68	26.89	26.12	25.39	24.69	24.02	23.37	22.76	22.16	21.59
82.5	36.67	35.47	34.34	33.26	32.23	31.24	30.30	29.41	28.55	27.73	26.94	26.19	25.46	24.77	24.11	23.47	22.85	22.26
85	37.78	36.55	35.38	34.27	33.20	32.19	31.22	30.30	29.41	28.57	27.76	26.98	26.23	25.52	24.84	24.18	23.55	22.94
87.5	38.89	37.62	36.42	35.27	34.18	33.14	32.14	31.19	30.28	29.41	28.57	27.77	27.01	26.27	25.57	24.89	24.24	23.61
90	40.00	38.70	37.46	36.28	35.16	34.08	33.06	32.08	31.14	30.25	29.39	28.57	27.78	27.02	26.30	25.60	24.93	24.29
92.5	41.11	39.77	38.50	37.29	36.13	35.03	33.98	32.97	32.01	31.09	30.20	29.36	28.55	27.77	27.03	26.31	25.62	24.96
95	42.22	40.85	39.54	38.30	37.11	35.98	34.89	33.86	32.87	31.93	31.02	30.15	29.32	28.52	27.76	27.02	26.32	25.64
97.5	43.33	41.92	40.58	39.30	38.09	36.92	35.81	34.75	33.74	32.77	31.84	30.95	30.09	29.27	28.49	27.73	27.01	26.31
100	44.44	43.00	41.62	40.31	39.06	37.87	36.73	35.64	34.60	33.61	32.65	31.74	30.86	30.02	29.22	28.44	27.70	26.99
102.5	45.56	44.07	42.66	41.32	40.04	38.82	37.65	36.53	35.47	34.45	33.47	32.53	31.64	30.78	29.95	29.16	28.39	27.66
105	46.67	45.15	43.70	42.33	41.02	39.76	38.57	37.42	36.33	35.29	34.29	33.33	32.41	31.53	30.68	29.87	29.09	28.34
107.5	47.78	46.22	44.75	43.34	41.99	40.71	39.49	38.32	37.20	36.13	35.10	34.12	33.18	32.28	31.41	30.58	29.78	29.01
110	48.89	47.30	45.79	44.34	42.97	41.66	40.40	39.21	38.06	36.97	35.92	34.91	33.95	33.03	32.14	31.29	30.47	29.68
112.5	50.00	48.37	46.83	45.35	43.95	42.60	41.32	40.10	38.93	37.81	36.73	35.71	34.72	33.78	32.87	32.00	31.16	30.36
115	51.11	49.45	47.87	46.36	44.92	43.55	42.24	40.99	39.79	38.65	37.55	36.50	35.49	34.53	33.60	32.71	31.86	31.03
117.5	52.22	50.52	48.91	47.37	45.90	44.50	43.16	41.88	40.66	39.49	38.37	37.29	36.27	35.28	34.33	33.42	32.55	31.71
120	53.33	51.60	49.95	48.37	46.88	45.44	44.08	42.77	41.52	40.33	39.18	38.09	37.04	36.03	35.06	34.13	33.24	32.38
122.5	54.44	52.67	50.99	49.38	47.85	46.39	45.00	43.66	42.39	41.17	40.00	38.88	37.81	36.78	35.79	34.84	33.93	33.06
125	55.56	53.75	52.03	50.39	48.83	47.34	45.91	44.55	43.25	42.01	40.82	39.67	38.58	37.53	36.52	35.56	34.63	33.73

Male build - liberal

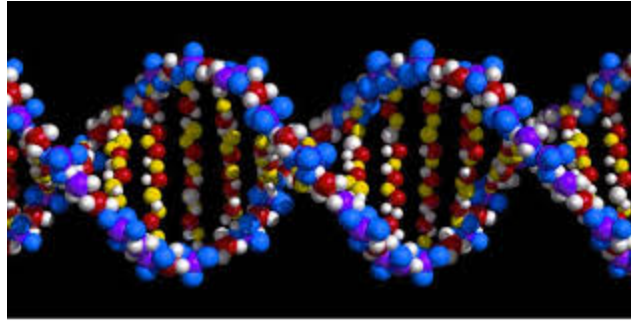
males	Height																				
Weight	150	152.5	155	157.5	160	162.5	165	167.5	170	172.5	175	177.5	180	182.5	185	187.5	190	192.5	195	197.5	200
40	17.78	17.20	16.65	16.12	15.63	15.15	14.69	14.26	13.84	13.44	13.06	12.70	12.35	12.01	11.69	11.38	11.08	10.79	10.52	10.25	10.00
42.5	18.89	18.27	17.69	17.13	16.60	16.09	15.61	15.15	14.71	14.28	13.88	13.49	13.12	12.76	12.42	12.09	11.77	11.47	11.18	10.90	10.63
45	20.00	19.35	18.73	18.14	17.58	17.04	16.53	16.04	15.57	15.12	14.69	14.28	13.89	13.51	13.15	12.80	12.47	12.14	11.83	11.54	11.25
47.5	21.11	20.42	19.77	19.15	18.55	17.99	17.45	16.93	16.44	15.96	15.51	15.08	14.66	14.26	13.88	13.51	13.16	12.82	12.49	12.18	11.88
50	22.22	21.50	20.81	20.16	19.53	18.93	18.37	17.82	17.30	16.80	16.33	15.87	15.43	15.01	14.61	14.22	13.85	13.49	13.15	12.82	12.50
52.5	23.33	22.57	21.85	21.16	20.51	19.88	19.28	18.71	18.17	17.64	17.14	16.66	16.20	15.76	15.34	14.93	14.54	14.17	13.81	13.46	13.13
55	24.44	23.65	22.89	22.17	21.48	20.83	20.20	19.60	19.03	18.48	17.96	17.46	16.98	16.51	16.07	15.64	15.24	14.84	14.46	14.10	13.75
57.5	25.56	24.72	23.93	23.18	22.46	21.78	21.12	20.49	19.90	19.32	18.78	18.25	17.75	17.26	16.80	16.36	15.93	15.52	15.12	14.74	14.38
60	26.67	25.80	24.97	24.19	23.44	22.72	22.04	21.39	20.76	20.16	19.59	19.04	18.52	18.01	17.53	17.07	16.62	16.19	15.78	15.38	15.00
62.5	27.78	26.87	26.01	25.20	24.41	23.67	22.96	22.28	21.63	21.00	20.41	19.84	19.29	18.77	18.26	17.78	17.31	16.87	16.44	16.02	15.63
65	28.89	27.95	27.06	26.20	25.39	24.62	23.88	23.17	22.49	21.84	21.22	20.63	20.06	19.52	18.99	18.49	18.01	17.54	17.09	16.66	16.25
67.5	30.00	29.02	28.10	27.21	26.37	25.56	24.79	24.06	23.36	22.68	22.04	21.42	20.83	20.27	19.72	19.20	18.70	18.22	17.75	17.30	16.88
70	31.11	30.10	29.14	28.22	27.34	26.51	25.71	24.95	24.22	23.52	22.86	22.22	21.60	21.02	20.45	19.91	19.39	18.89	18.41	17.95	17.50
72.5	32.22	31.17	30.18	29.23	28.32	27.46	26.63	25.84	25.09	24.36	23.67	23.01	22.38	21.77	21.18	20.62	20.08	19.56	19.07	18.59	18.13
75	33.33	32.25	31.22	30.23	29.30	28.40	27.55	26.73	25.95	25.20	24.49	23.80	23.15	22.52	21.91	21.33	20.78	20.24	19.72	19.23	18.75
77.5	34.44	33.32	32.26	31.24	30.27	29.35	28.47	27.62	26.82	26.04	25.31	24.60	23.92	23.27	22.64	22.04	21.47	20.91	20.38	19.87	19.38
80	35.56	34.40	33.30	32.25	31.25	30.30	29.38	28.51	27.68	26.89	26.12	25.39	24.69	24.02	23.37	22.76	22.16	21.59	21.04	20.51	20.00
82.5	36.67	35.47	34.34	33.26	32.23	31.24	30.30	29.41	28.55	27.73	26.94	26.19	25.46	24.77	24.11	23.47	22.85	22.26	21.70	21.15	20.63
85	37.78	36.55	35.38	34.27	33.20	32.19	31.22	30.30	29.41	28.57	27.76	26.98	26.23	25.52	24.84	24.18	23.55	22.94	22.35	21.79	21.25
87.5	38.89	37.62	36.42	35.27	34.18	33.14	32.14	31.19	30.28	29.41	28.57	27.77	27.01	26.27	25.57	24.89	24.24	23.61	23.01	22.43	21.88
90	40.00	38.70	37.46	36.28	35.16	34.08	33.06	32.08	31.14	30.25	29.39	28.57	27.78	27.02	26.30	25.60	24.93	24.29	23.67	23.07	22.50
92.5	41.11	39.77	38.50	37.29	36.13	35.03	33.98	32.97	32.01	31.09	30.20	29.36	28.55	27.77	27.03	26.31	25.62	24.96	24.33	23.71	23.13
95	42.22	40.85	39.54	38.30	37.11	35.98	34.89	33.86	32.87	31.93	31.02	30.15	29.32	28.52	27.76	27.02	26.32	25.64	24.98	24.36	23.75
97.5	43.33	41.92	40.58	39.30	38.09	36.92	35.81	34.75	33.74	32.77	31.84	30.95	30.09	29.27	28.49	27.73	27.01	26.31	25.64	25.00	24.38
100	44.44	43.00	41.62	40.31	39.06	37.87	36.73	35.64	34.60	33.61	32.65	31.74	30.86	30.02	29.22	28.44	27.70	26.99	26.30	25.64	25.00
102.5	45.56	44.07	42.66	41.32	40.04	38.82	37.65	36.53	35.47	34.45	33.47	32.53	31.64	30.78	29.95	29.16	28.39	27.66	26.96	26.28	25.63
105	46.67	45.15	43.70	42.33	41.02	39.76	38.57	37.42	36.33	35.29	34.29	33.33	32.41	31.53	30.68	29.87	29.09	28.34	27.61	26.92	26.25
107.5	47.78	46.22	44.75	43.34	41.99	40.71	39.49	38.32	37.20	36.13	35.10	34.12	33.18	32.28	31.41	30.58	29.78	29.01	28.27	27.56	26.88
110	48.89	47.30	45.79	44.34	42.97	41.66	40.40	39.21	38.06	36.97	35.92	34.91	33.95	33.03	32.14	31.29	30.47	29.68	28.93	28.20	27.50
112.5	50.00	48.37	46.83	45.35	43.95	42.60	41.32	40.10	38.93	37.81	36.73	35.71	34.72	33.78	32.87	32.00	31.16	30.36	29.59	28.84	28.13
115	51.11	49.45	47.87	46.36	44.92	43.55	42.24	40.99	39.79	38.65	37.55	36.50	35.49	34.53	33.60	32.71	31.86	31.03	30.24	29.48	28.75
117.5	52.22	50.52	48.91	47.37	45.90	44.50	43.16	41.88	40.66	39.49	38.37	37.29	36.27	35.28	34.33	33.42	32.55	31.71	30.90	30.12	29.38
120	53.33	51.60	49.95	48.37	46.88	45.44	44.08	42.77	41.52	40.33	39.18	38.09	37.04	36.03	35.06	34.13	33.24	32.38	31.56	30.76	30.00
122.5	54.44	52.67	50.99	49.38	47.85	46.39	45.00	43.66	42.39	41.17	40.00	38.88	37.81	36.78	35.79	34.84	33.93	33.06	32.22	31.41	30.63
125	55.56	53.75	52.03	50.39	48.83	47.34	45.91	44.55	43.25	42.01	40.82	39.67	38.58	37.53	36.52	35.56	34.63	33.73	32.87	32.05	31.25
127.5	56.67	54.82	53.07	51.40	49.83	48.28	46.83	45.44	44.12	42.85	41.63	40.47	39.35	38.28	37.25	36.27	35.32	34.41	33.53	32.69	31.88
130	57.78	55.90	54.11	52.41	50.78	49.23	47.75	46.34	44.98	43.69	42.45	41.26	40.12	39.03	37.98	36.98	36.01	35.08	34.19	33.33	32.50
132.5	58.89	56.97	55.15	53.41	51.76	50.18	48.67	47.23	45.85	44.53	43.27	42.06	40.90	39.78	38.71	37.69	36.70	35.76	34.85	33.97	33.13
135	60.00	58.05	56.19	54.42	52.73	51.12	49.59	48.12	46.71	45.37	44.08	42.85	41.67	40.53	39.44	38.40	37.40	36.43	35.50	34.61	33.75
137.5	61.11	59.12	57.23	55.43	53.71	52.07	50.51	49.01	47.58	46.21	44.90	43.64	42.44	41.28	40.18	39.11	38.09	37.11	36.16	35.25	34.38
140	62.22	60.20	58.27	56.44	54.69	53.02	51.42	49.90	48.44	47.05	45.71	44.44	43.21	42.03	40.91	39.82	38.78	37.78	36.82	35.89	35.00
142.5	63.33	61.27	59.31	57.45	55.66	53.96	52.34	50.79	49.31	47.89	46.53	45.23	43.98	42.78	41.64	40.53	39.47	38.46	37.48	36.53	35.63
145	64.44	62.35	60.35	58.45	56.64	54.91	53.26	51.68	50.17	48.73	47.35	46.02	44.75	43.54	42.37	41.24	40.17	39.13	38.13	37.17	36.25
147.5	65.56	63.42	61.39	59.46	57.62	55.86	54.18	52.57	51.04	49.57	48.16	46.82	45.52	44.29	43.10	41.96	40.86	39.80	38.79	37.81	36.88

Female build tables - conservative

Females	Height																		
Weight																			
	152.5	155	157.5	160	162.5	165	167.5	170	172.5	175	177.5	180	182.5	185	187.5	190	192.5	195	197.5
40	17.20	16.65	16.12	15.63	15.15	14.69	14.26	13.84	13.44	13.06	12.70	12.35	12.01	11.69	11.38	11.08	10.79	10.52	10.25
42.5	18.27	17.69	17.13	16.60	16.09	15.61	15.15	14.71	14.28	13.88	13.49	13.12	12.76	12.42	12.09	11.77	11.47	11.18	10.90
45	19.35	18.73	18.14	17.58	17.04	16.53	16.04	15.57	15.12	14.69	14.28	13.89	13.51	13.15	12.80	12.47	12.14	11.83	11.54
47.5	20.42	19.77	19.15	18.55	17.99	17.45	16.93	16.44	15.96	15.51	15.08	14.66	14.26	13.88	13.51	13.16	12.82	12.49	12.18
50	21.50	20.81	20.16	19.53	18.93	18.37	17.82	17.30	16.80	16.33	15.87	15.43	15.01	14.61	14.22	13.85	13.49	13.15	12.82
52.5	22.57	21.85	21.16	20.51	19.88	19.28	18.71	18.17	17.64	17.14	16.66	16.20	15.76	15.34	14.93	14.54	14.17	13.81	13.46
55	23.65	22.89	22.17	21.48	20.83	20.20	19.60	19.03	18.48	17.96	17.46	16.98	16.51	16.07	15.64	15.24	14.84	14.46	14.10
57.5	24.72	23.93	23.18	22.46	21.78	21.12	20.49	19.90	19.32	18.78	18.25	17.75	17.26	16.80	16.36	15.93	15.52	15.12	14.74
60	25.80	24.97	24.19	23.44	22.72	22.04	21.39	20.76	20.16	19.59	19.04	18.52	18.01	17.53	17.07	16.62	16.19	15.78	15.38
62.5	26.87	26.01	25.20	24.41	23.67	22.96	22.28	21.63	21.00	20.41	19.84	19.29	18.77	18.26	17.78	17.31	16.87	16.44	16.02
65	27.95	27.06	26.20	25.39	24.62	23.88	23.17	22.49	21.84	21.22	20.63	20.06	19.52	18.99	18.49	18.01	17.54	17.09	16.66
67.5	29.02	28.10	27.21	26.37	25.56	24.79	24.06	23.36	22.68	22.04	21.42	20.83	20.27	19.72	19.20	18.70	18.22	17.75	17.30
70	30.10	29.14	28.22	27.34	26.51	25.71	24.95	24.22	23.52	22.86	22.22	21.60	21.02	20.45	19.91	19.39	18.89	18.41	17.95
72.5	31.17	30.18	29.23	28.32	27.46	26.63	25.84	25.09	24.36	23.67	23.01	22.38	21.77	21.18	20.62	20.08	19.56	19.07	18.59
75	32.25	31.22	30.23	29.30	28.40	27.55	26.73	25.95	25.20	24.49	23.80	23.15	22.52	21.91	21.33	20.78	20.24	19.72	19.23
77.5	33.32	32.26	31.24	30.27	29.35	28.47	27.62	26.82	26.04	25.31	24.60	23.92	23.27	22.64	22.04	21.47	20.91	20.38	19.87
80	34.40	33.30	32.25	31.25	30.30	29.38	28.51	27.68	26.89	26.12	25.39	24.69	24.02	23.37	22.76	22.16	21.59	21.04	20.51
82.5	35.47	34.34	33.26	32.23	31.24	30.30	29.41	28.55	27.73	26.94	26.19	25.46	24.77	24.11	23.47	22.85	22.26	21.70	21.15
85	36.55	35.38	34.27	33.20	32.19	31.22	30.30	29.41	28.57	27.76	26.98	26.23	25.52	24.84	24.18	23.55	22.94	22.35	21.79
87.5	37.62	36.42	35.27	34.18	33.14	32.14	31.19	30.28	29.41	28.57	27.77	27.01	26.27	25.57	24.89	24.24	23.61	23.01	22.43
90	38.70	37.46	36.28	35.16	34.08	33.06	32.08	31.14	30.25	29.39	28.57	27.78	27.02	26.30	25.60	24.93	24.29	23.67	23.07
92.5	39.77	38.50	37.29	36.13	35.03	33.98	32.97	32.01	31.09	30.20	29.36	28.55	27.77	27.03	26.31	25.62	24.96	24.33	23.71
95	40.85	39.54	38.30	37.11	35.98	34.89	33.86	32.87	31.93	31.02	30.15	29.32	28.52	27.76	27.02	26.32	25.64	24.98	24.36
97.5	41.92	40.58	39.30	38.09	36.92	35.81	34.75	33.74	32.77	31.84	30.95	30.09	29.27	28.49	27.73	27.01	26.31	25.64	25.00
100	43.00	41.62	40.31	39.06	37.87	36.73	35.64	34.60	33.61	32.65	31.74	30.86	30.02	29.22	28.44	27.70	26.99	26.30	25.64
102.5	44.07	42.66	41.32	40.04	38.82	37.65	36.53	35.47	34.45	33.47	32.53	31.64	30.78	29.95	29.16	28.39	27.66	26.96	26.28
105	45.15	43.70	42.33	41.02	39.76	38.57	37.42	36.33	35.29	34.29	33.33	32.41	31.53	30.68	29.87	29.09	28.34	27.61	26.92
107.5	46.22	44.75	43.34	41.99	40.71	39.49	38.32	37.20	36.13	35.10	34.12	33.18	32.28	31.41	30.58	29.78	29.01	28.27	27.56
110	47.30	45.79	44.34	42.97	41.66	40.40	39.21	38.06	36.97	35.92	34.91	33.95	33.03	32.14	31.29	30.47	29.68	28.93	28.20
112.5	48.37	46.83	45.35	43.95	42.60	41.32	40.10	38.93	37.81	36.73	35.71	34.72	33.78	32.87	32.00	31.16	30.36	29.59	28.84
115	49.45	47.87	46.36	44.92	43.55	42.24	40.99	39.79	38.65	37.55	36.50	35.49	34.53	33.60	32.71	31.86	31.03	30.24	29.48
117.5	50.52	48.91	47.37	45.90	44.50	43.16	41.88	40.66	39.49	38.37	37.29	36.27	35.28	34.33	33.42	32.55	31.71	30.90	30.12
120	51.60	49.95	48.37	46.88	45.44	44.08	42.77	41.52	40.33	39.18	38.09	37.04	36.03	35.06	34.13	33.24	32.38	31.56	30.76
122.5	52.67	50.99	49.38	47.85	46.39	45.00	43.66	42.39	41.17	40.00	38.88	37.81	36.78	35.79	34.84	33.93	33.06	32.22	31.41
125	53.75	52.03	50.39	48.83	47.34	45.91	44.55	43.25	42.01	40.82	39.67	38.58	37.53	36.52	35.56	34.63	33.73	32.87	32.05
127.5	54.82	53.07	51.40	49.80	48.28	46.83	45.44	44.12	42.85	41.63	40.47	39.35	38.28	37.25	36.27	35.32	34.41	33.53	32.69
130	55.90	54.11	52.41	50.78	49.23	47.75	46.34	44.98	43.69	42.45	41.26	40.12	39.03	37.98	36.98	36.01	35.08	34.19	33.33
132.5	56.97	55.15	53.41	51.76	50.18	48.67	47.23	45.85	44.53	43.27	42.06	40.90	39.78	38.71	37.69	36.70	35.76	34.85	33.97
135	58.05	56.19	54.42	52.73	51.12	49.59	48.12	46.71	45.37	44.08	42.85	41.67	40.53	39.44	38.40	37.40	36.43	35.50	34.61

Female build - liberal

Females	Height																		
Weight																			
Weight	152.5	155	157.5	160	162.5	165	167.5	170	172.5	175	177.5	180	182.5	185	187.5	190	192.5	195	
40	17.20	16.65	16.12	15.63	15.15	14.69	14.26	13.84	13.44	13.06	12.70	12.35	12.01	11.69	11.38	11.08	10.79	10.52	
42.5	18.27	17.69	17.13	16.60	16.09	15.61	15.15	14.71	14.28	13.88	13.49	13.12	12.76	12.42	12.09	11.77	11.47	11.18	
45	19.35	18.73	18.14	17.58	17.04	16.53	16.04	15.57	15.12	14.69	14.28	13.89	13.51	13.15	12.80	12.47	12.14	11.83	
47.5	20.42	19.77	19.15	18.55	17.99	17.45	16.93	16.44	15.96	15.51	15.08	14.66	14.26	13.88	13.51	13.16	12.82	12.49	
50	21.50	20.81	20.16	19.53	18.93	18.37	17.82	17.30	16.80	16.33	15.87	15.43	15.01	14.61	14.22	13.85	13.49	13.15	
52.5	22.57	21.85	21.16	20.51	19.88	19.28	18.71	18.17	17.64	17.14	16.66	16.20	15.76	15.34	14.93	14.54	14.17	13.81	
55	23.65	22.89	22.17	21.48	20.83	20.20	19.60	19.03	18.48	17.96	17.46	16.98	16.51	16.07	15.64	15.24	14.84	14.46	
57.5	24.72	23.93	23.18	22.46	21.78	21.12	20.49	19.90	19.32	18.78	18.25	17.75	17.26	16.80	16.36	15.93	15.52	15.12	
60	25.80	24.97	24.19	23.44	22.72	22.04	21.39	20.76	20.16	19.59	19.04	18.52	18.01	17.53	17.07	16.62	16.19	15.78	
62.5	26.87	26.01	25.20	24.41	23.67	22.96	22.28	21.63	21.00	20.41	19.84	19.29	18.77	18.26	17.78	17.31	16.87	16.44	
65	27.95	27.06	26.20	25.39	24.62	23.88	23.17	22.49	21.84	21.22	20.63	20.06	19.52	18.99	18.49	18.01	17.54	17.09	
67.5	29.02	28.10	27.21	26.37	25.56	24.79	24.06	23.36	22.68	22.04	21.42	20.83	20.27	19.72	19.20	18.70	18.22	17.75	
70	30.10	29.14	28.22	27.34	26.51	25.71	24.95	24.22	23.52	22.86	22.22	21.60	21.02	20.45	19.91	19.39	18.89	18.41	
72.5	31.17	30.18	29.23	28.32	27.46	26.63	25.84	25.09	24.36	23.67	23.01	22.38	21.77	21.18	20.62	20.08	19.56	19.07	
75	32.25	31.22	30.23	29.30	28.40	27.55	26.73	25.95	25.20	24.49	23.80	23.15	22.52	21.91	21.33	20.78	20.24	19.72	
77.5	33.32	32.26	31.24	30.27	29.35	28.47	27.62	26.82	26.04	25.31	24.60	23.92	23.27	22.64	22.04	21.47	20.91	20.38	
80	34.40	33.30	32.25	31.25	30.30	29.38	28.51	27.68	26.89	26.12	25.39	24.69	24.02	23.37	22.76	22.16	21.59	21.04	
82.5	35.47	34.34	33.26	32.23	31.24	30.30	29.41	28.55	27.73	26.94	26.19	25.46	24.77	24.11	23.47	22.85	22.26	21.70	
85	36.55	35.38	34.27	33.20	32.19	31.22	30.30	29.41	28.57	27.76	26.98	26.23	25.52	24.84	24.18	23.55	22.94	22.35	
87.5	37.62	36.42	35.27	34.18	33.14	32.14	31.19	30.28	29.41	28.57	27.77	27.01	26.27	25.57	24.89	24.24	23.61	23.01	
90	38.70	37.46	36.28	35.16	34.08	33.06	32.08	31.14	30.25	29.39	28.57	27.78	27.02	26.30	25.60	24.93	24.29	23.67	
92.5	39.77	38.50	37.29	36.13	35.03	33.98	32.97	32.01	31.09	30.20	29.36	28.55	27.77	27.03	26.31	25.62	24.96	24.33	
95	40.85	39.54	38.30	37.11	35.98	34.89	33.86	32.87	31.93	31.02	30.15	29.32	28.52	27.76	27.02	26.32	25.64	24.98	
97.5	41.92	40.58	39.30	38.09	36.92	35.81	34.75	33.74	32.77	31.84	30.95	30.09	29.27	28.49	27.73	27.01	26.31	25.64	
100	43.00	41.62	40.31	39.06	37.87	36.73	35.64	34.60	33.61	32.65	31.74	30.86	30.02	29.22	28.44	27.70	26.99	26.30	
102.5	44.07	42.66	41.32	40.04	38.82	37.65	36.53	35.47	34.45	33.47	32.53	31.64	30.78	29.95	29.16	28.39	27.66	26.96	
105	45.15	43.70	42.33	41.02	39.76	38.57	37.42	36.33	35.29	34.29	33.33	32.41	31.53	30.68	29.87	29.09	28.34	27.61	
107.5	46.22	44.75	43.34	41.99	40.71	39.49	38.32	37.20	36.13	35.10	34.12	33.18	32.28	31.41	30.58	29.78	29.01	28.27	
110	47.30	45.79	44.34	42.97	41.66	40.40	39.21	38.06	36.97	35.92	34.91	33.95	33.03	32.14	31.29	30.47	29.68	28.93	
112.5	48.37	46.83	45.35	43.95	42.60	41.32	40.10	38.93	37.81	36.73	35.71	34.72	33.78	32.87	32.00	31.16	30.36	29.59	
115	49.45	47.87	46.36	44.92	43.55	42.24	40.99	39.79	38.65	37.55	36.50	35.49	34.53	33.60	32.71	31.86	31.03	30.24	
117.5	50.52	48.91	47.37	45.90	44.50	43.16	41.88	40.66	39.49	38.37	37.29	36.27	35.28	34.33	33.42	32.55	31.71	30.90	
120	51.60	49.95	48.37	46.88	45.44	44.08	42.77	41.52	40.33	39.18	38.09	37.04	36.03	35.06	34.13	33.24	32.38	31.56	
122.5	52.67	50.99	49.38	47.85	46.39	45.00	43.66	42.39	41.17	40.00	38.88	37.81	36.78	35.79	34.84	33.93	33.06	32.22	
125	53.75	52.03	50.39	48.83	47.34	45.91	44.55	43.25	42.01	40.82	39.67	38.58	37.53	36.52	35.56	34.63	33.73	32.87	
127.5	54.82	53.07	51.40	49.80	48.28	46.83	45.44	44.12	42.85	41.63	40.47	39.35	38.28	37.25	36.27	35.32	34.41	33.53	
130	55.90	54.11	52.41	50.78	49.23	47.75	46.34	44.98	43.69	42.45	41.26	40.12	39.03	37.98	36.98	36.01	35.08	34.19	
132.5	56.97	55.15	53.41	51.76	50.18	48.67	47.23	45.85	44.53	43.27	42.06	40.90	39.78	38.71	37.69	36.70	35.76	34.85	
135	58.05	56.19	54.42	52.73	51.12	49.59	48.12	46.71	45.37	44.08	42.85	41.67	40.53	39.44	38.40	37.40	36.43	35.50	
137.5	59.12	57.23	55.43	53.71	52.07	50.51	49.01	47.58	46.21	44.90	43.64	42.44	41.28	40.18	39.11	38.09	37.11	36.16	
140	60.20	58.27	56.44	54.69	53.02	51.42	49.90	48.44	47.05	45.71	44.44	43.21	42.03	40.91	39.82	38.78	37.78	36.82	
142.5	61.27	59.31	57.45	55.66	53.96	52.34	50.79	49.31	47.89	46.53	45.23	43.98	42.78	41.64	40.53	39.47	38.46	37.48	
145	62.35	60.35	58.45	56.64	54.91	53.26	51.68	50.17	48.73	47.35	46.02	44.75	43.54	42.37	41.24	40.17	39.13	38.13	



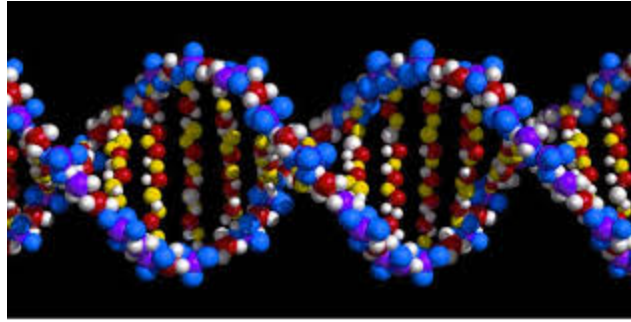
Genetic testing

- First sequencing of the human genome published in 2000
- Today a human genome can be sequenced for \$4,500 in a few days, and a genetic risk profile can be obtained for \$100 with a saliva sample, direct to customer, bypassing GPs and medical notes
- Eg 'health reports on 254 diseases and conditions, including categories such as
 - Carrier status
 - Health risks, eg macular degeneration, atrial fibrillation, coeliac disease, coronary heart disease, and breast cancer'
 - First step in prevention
 - Can target drug treatments



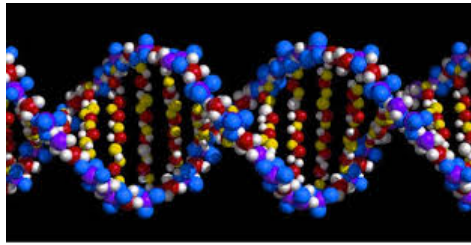
Industry position

- Industry agreement that we would not request genetic information, but could request and underwrite based on existing tests
- Some concern this could lead to an uneven playing field, and increased anti-selection



actual usefulness

- Much of the genetic sequence (exons) is not expressed
- Only 0.4% of the human genome differs between individuals
- Studies can identify variants associated with diseases, but often not whether they are causal
- Different companies use different SNPs to assess the same disease – results are often conflicting
- A Few diseases, such as Huntington's and Cystic Fibrosis are controlled by a single gene, and genetic testing is a powerful predictor



- Most common diseases, including heart diseases and many cancers, there is a complicated interplay between multiple genes, cumulative and interactive effects and the environment. Eg over 40 genes associated with diabetes
- The predictive power of complex genes is weak, and poorly understood. Only 7% of Australian genetic specialists feel confident interpreting DTC results



Conclusion

- Testing is accurate in identifying altered bases, but not yet in determining their predictive ability
- For all but a small number of conditions SNPs provide limited information on a customer's incremental risk'
- Significant research is continuing and the predictive ability is expected to grow.
- It is vital that the industry keeps up to date with these developments

Nanomedicine

- Nano technology is the manipulation of matter on an atomic scale
- Has the potential to change the prognosis for many conditions
- Major focus of research in applying to medicine, applications include:
 - Drugs can be delivered directly to appropriate cells, reducing side effects, eg for chemotherapy
 - Increased use of arthroscopic surgery
 - Tissue engineering, to help repair or reproduce damaged tissue

Information Revolution



Personal Statement 1988 and 2014

section 14 medical statement

If you answer 'yes' to any of the underlined conditions, complete the general medical questionnaire on page 7 even if you will have a medical examination.

If, however, you answer 'yes' to the conditions which are not underlined, please give details in the Additional information section at the bottom of this page.

Have you ever had or been told you had, or received advice or treatment for:

- A High blood pressure, chest pain, high cholesterol, stroke, rheumatic fever or any heart or vascular complaint? yes no
- B Mental disorder, such as anxiety, depression, nervous condition or stress? yes no
- C Strained back, sciatica, whiplash, spondylitis or any other form of back or spinal trouble? yes no
- D Arthritis, rheumatism, gout, tendonitis, repetitive strain injury or any disorder of the joints or muscles? yes no
- E Asthma, bronchitis, tuberculosis, pleurisy or other lung complaint? yes no
- F Neurological or nervous disorder such as epilepsy, fits, paralysis, migraine, persistent headaches, dizziness or neuritis? yes no
- G Indigestion, ulcer, hiatus hernia, bowel disorder, colitis or passing blood from the bowel? yes no
- H Hepatitis, cirrhosis or any liver or gall bladder disease? yes no
- I Diabetes, sugar in urine, thyroid trouble or pancreatic disease? yes no
- J Kidney or bladder disorder such as kidney stones, nephritis, cystitis or passing blood in the urine? yes no
- K Cancer, cyst or tumour of any kind? yes no
- L Skin conditions, defect in hearing or sight, varicose veins, haemorrhoids or rupture (hernia)? yes no
- M Blood disorder, such as anaemia, haemophilia or leukaemia or received a blood transfusion or treatment with human blood products? yes no
- N Has your weight varied by more than 5kg in the last 12 months? yes no
- O Have you within the last three years undergone any blood tests including HIV? yes no
- P Do you take, or have you ever taken, drugs, tablets or any medications on a regular basis? yes no
- Q Have you required medical treatment for any illness or injury not mentioned above including chronic fatigue syndrome? yes no
- R Do you contemplate seeking any medical advice, investigation or treatment (including surgery) for any current health problem(s)? yes no
- S Do you or any of your current or previous sexual partners have HIV/AIDS, or any sign of HIV infection? yes no
- T In the last 3 years, are you aware of any HIV risk situation to which you or any of your sexual partners may have been exposed? yes no

HIV risk situations include but are not limited to:
• sex with or as a prostitute;
• sex with an intravenous drug user;
• contact with someone else's blood eg through injection or scratch with a used needle;
• anal intercourse (except in a relationship between you and one other person only and neither of you have had sex with anyone else for at least 3 years.) yes no

U **Females only**
Have you ever had any gynaecological condition or any complications with past pregnancy or childbirth? yes no
If yes, provide details in Additional Information section below.

Are you currently pregnant? yes no
If yes, date due: / / Any complications with this pregnancy? / /

Have you ever had a pap smear? yes no
If yes, state latest test date and result: / /

Have you ever had or been advised to have a mammogram for any reason? yes no
If yes, state latest test date and result: / /

Have you ever had a breast lump (even if you have not seen a doctor about it)? yes no
If yes, provide details: / /

Additional information (required if 'yes' answered for conditions not underlined)

Question number	Condition name	Date first started	Time off work	Degree of recovery	Full details of treatment including date of last symptoms	Full name and address of doctor or hospital

8. Medical history

- 1 If you answer 'Yes' to any of the conditions in bold, complete the relevant Medical Questionnaire on pages 10 to 18. If you answer 'Yes' to conditions which are not bold, provide details in the Additional Information table on the following page.

Have you ever had symptoms of, been told you had, or received advice from any health professionals including but not limited to doctors, specialists, counsellors or chiropractors for any of the following:

- a. High blood pressure, chest pain, high cholesterol, stroke or any heart or vascular disorder? No Yes
- b. Asthma, bronchitis or any other lung disorder? No Yes
- c. Epilepsy, seizure disorder, multiple sclerosis, paralysis, migraine, dizziness, neuritis or any other neurological disorder? No Yes
- d. Kidney stones, nephritis, passing blood in the urine or any other kidney or bladder disorder? No Yes
- e. Hepatitis, cirrhosis or any liver or gall bladder disorder? No Yes
- f. Diabetes, sugar in urine, thyroid or pancreatic disorder? No Yes
- g. Indigestion, reflux, ulcer or hernia? No Yes
- h. Colitis, passing blood from the bowel or any other bowel disorder? No Yes
- i. Anaemia, leukaemia, haemophilia, received a blood transfusion or any other blood disorder? No Yes
- j. Cancer, tumour, lump, cyst or skin lesion of any kind? No Yes
- k. Back or neck pain, sciatica, whiplash or any other spinal disorder? No Yes
- l. Repetitive strain injury, chronic fatigue syndrome, fibromyalgia, or muscle strain? No Yes
- m. Arthritis, gout or any disorder of the joints? No Yes
- n. Depression, adjustment disorder, post-traumatic stress disorder, post natal depression, major depression or any other mood or depressive disorder? No Yes
- o. Anxiety, attention deficit disorder, eating disorder, obsessive compulsive disorder or any other anxiety disorder? No Yes
- p. Schizophrenia, psychotic or personality disorder, manic or bipolar disorder or any other mental health disorder? No Yes
- q. Stress, fatigue, insomnia or sleeplessness? No Yes
- r. Psoriasis, eczema, dermatitis or any other skin condition? No Yes
- s. Sleep apnoea or any other sleep disorder? No Yes
- t. Any impairment of sight not corrected by glasses or contact lenses? No Yes
- u. Any ear disorder such as hearing loss or tinnitus? No Yes
- v. Have you ever had an occupational needle stick injury? No Yes
- w. i. Have you, or do you intend to participate in any activity that increases your chances of contracting the HIV virus? This would include things such as working or engaging in sexual intercourse with a sex worker or intravenous drug user or someone you suspect or know to be HIV positive, or engaging in anal sexual intercourse. If you have answered 'Yes' to this question, AMP will contact you for further information. No Yes
- ii. Are you suffering from AIDS, or infected with HIV, or are you carrying antibodies to the HIV virus? If you have answered 'Yes' to this question, AMP will contact you for further information. No Yes
- x. Have you had any other disorder or impairment, taken any medication or undergone any medical tests or surgery either in Australia or overseas not mentioned above? No Yes
- y. Do you intend to seek any medical advice, undergo any tests or investigations or surgery either in Australia or overseas in the future? No Yes
- z. Have you ever had, are you currently waiting for a result of, or are you considering having a genetic test? No Yes

Note: You do not have to provide a result if you were or are taking part in a medical research project or trial and haven't been or will not be provided with your individual result.

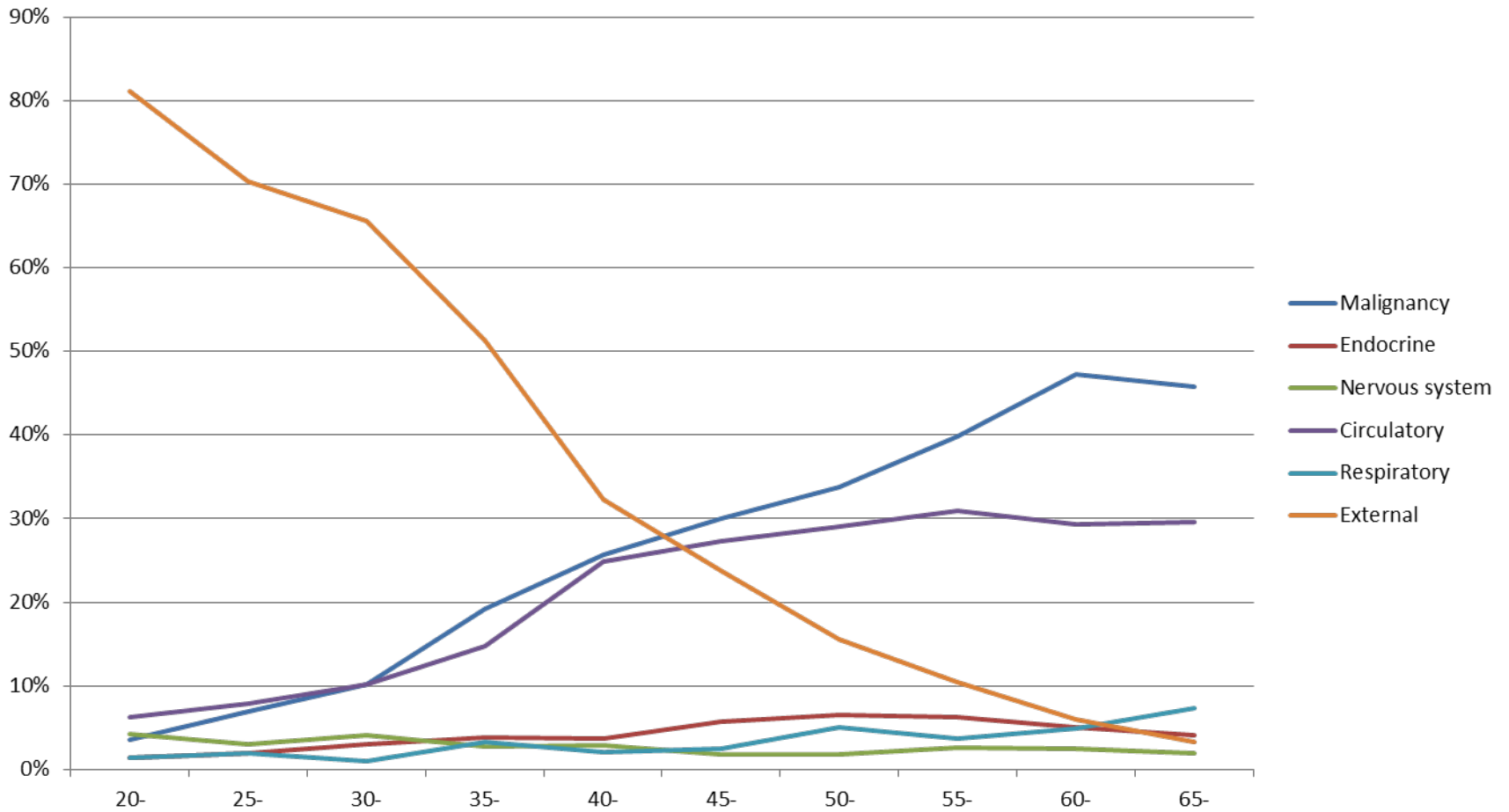
If 'Yes' to z, please provide full details:

Do modern advances open up new opportunities??

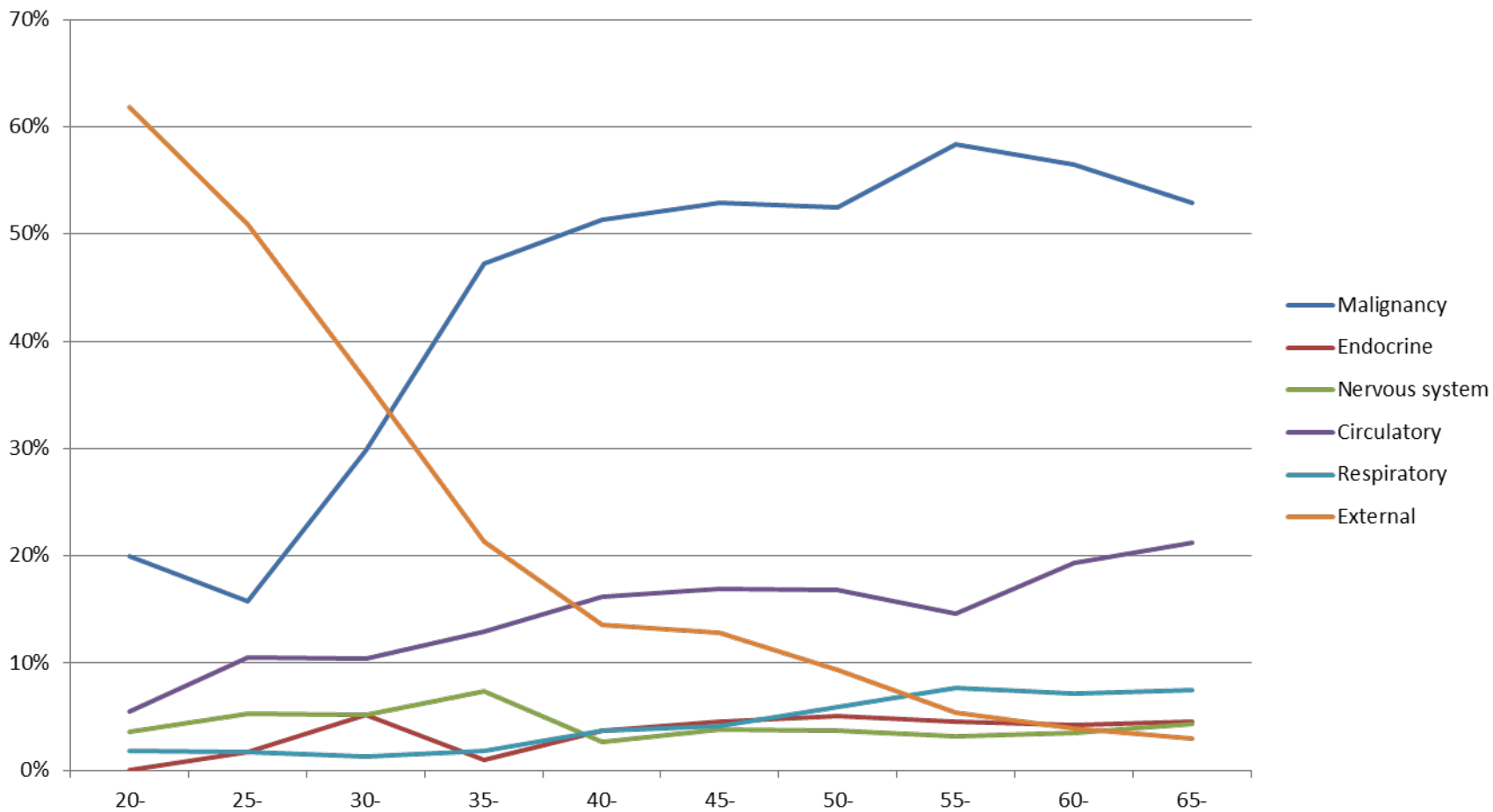
Underwriting barely changed, despite

- Data advancement
- Medical advancements
- Increased availability of information
- Our aim is to group applicants into categories of similar risk in the way that is easiest for the client, and affordable for the office
- What could we do differently ??

Male causes of death



Female causes of death



Customising underwriting by profile

- Risks vary greatly by age and gender
- Average duration of policies has shortened
- We now have the ability to tailor our questions to the profile of the applicant
- greater than 70% of deaths in lives under 30 are due to accident. The biggest category is MVA.
- Why not add question about driving record, and fewer about medical conditions that typically occur later in life??

Driving record as a predictor of Mortality

US studies have shown that driving record is a good predictor of mortality

- Differences are across all ages and genders, but most significant for young males.
- The predictive ability is greater than for many medical conditions
- Recent history of either severe violations had a mortality of 171% of population
- Applicants with 6 or more recent violations have mortality of 179% of the aggregate



Predictive modelling

- Is the use of modern statistical methods to identify and measure past associations for the sake of inferring associations in the future. It generally has a strong Bayesian flavour.
- Is a modern extension of what actuaries have been doing for centuries.
- Enables us to more accurately predict mortality with fewer questions for the applicant.
- Correlation need not assert causation to be useful for risk management
 - Eg cigarette smoking

Predictive modelling so far

- Now being used in customer profiling for general insurance and banking
- Still largely in developmental stages for life Insurance
- Banking and GI information held within the group can have interesting applications for mortality

Some interesting initial findings

- Time of withdrawing funds from ATMs
- Camping holidays
- Take away food



Social and psychological factors

- The applicants attitude beliefs and personality (psychological profile) and community resources and physical environment (social) also have a big impact on propensity to claim.
- Is especially true for income protection
- Use of sick leave is a key predictor of future IP claim, but rarely requested

Group Risk

Group risk provides the ideal environment for using social and behavioural models.

- Cultural and climate surveys
 - People far more likely to want to return to work if there is a high level of engagement
 - Stress claims likely to be higher in an authoritarian style culture
- Employee wellness programmes
- Sick leave records
- Physical environment and ACC records

HEALTH & WELLBEING



After Tara Bahrapour is shown here in a photo taken at her current age, 47, at left. The images at later ages were produced using computer technology developed by researchers at Face Aging Group.

Image: WASHINGTON POST

While it is not yet clear whether humans will one day live 150 years, as some have predicted, scientists are optimistic that the number of years of healthy life – or “health span” – of humans can be significantly increased.

reliable lifespan estimates in the next 12 to 18 months, Olshansky said.

Ethical and practical concerns might arise, said Leonard Fleck, a professor of philosophy and medical ethics at Michigan State University.

Even if it can predict life span, the analysis might not be able to predict a person’s need for long-term care, he said. And it could open the door for discrimination.

“If at age 40 if there were something about your face saying you’re not likely to make it past 60, an employer could say, ‘oh, I’m not willing to promote you to some position of importance because it’s not likely to be a good investment,’” Fleck said.

And people who looked younger than their years did not always last long, said Mark Collins, president of the California-based Glenn Foundation, which funds ageing research. “Sometimes people who look very healthy drop dead in the middle of the track, while others who look wrinkled are still running at age 80,” he said.

Olshansky conceded that even if face ageing was found to

submit a photo. The database they are developing, called Face My Age, is expected to deliver increasingly more accurate assessments and predictions as more people participate. The researchers are hoping for large numbers of people – at least 10,000 or 20,000, but preferably more – to submit photos and basic biographical information in exchange for feedback on how quickly they are ageing and what this means for their longevity prospects. The person in the photo

FACING MORTALITY

affect longevity prospects – it would analyse each section of cheek, eye, brow, mouth and jaw looking for shading variations that signal lines, dark spots, drooping and other age-related changes that might indicate how the person is doing compared with others of the same age and background.

The United States National Institutes of Health recently launched an unprecedented collaborative initiative across 20

that an underwriter in your house and, noting your blood pressure, photo of your face. Wrinkles, mottled spots, when fed could estimate live. tion technology, ch for criminals a missing child adult, may soon

Dominion Post 12/8/14

‘Imagine that an insurance underwriter comes to your house and along with noting your weight and blood pressure snaps a photo of your face. And that those wrinkles, mottled spots and saggy parts, when fed into a computer, could estimate how long you will live.’

Future

Continue as we are:

- Get more of the same
- Guidelines become increasingly inappropriate
- Businesses incur unnecessary expenses

Or embrace new potential opportunities

- Life company actuaries one again involved in underwriting policies and guidelines
- Constructive dialogue around both the theoretical position and practical reality
- Actuaries involved in developing innovative approaches to underwriting that are both financially sound and attractive in the market
- Much stronger more viable base for ongoing businesses.

Questions for Discussion

- What role should actuaries have in the development of underwriting strategy and guidelines?
- How should manuals and underwriting policy reflect the growing obesity epidemic?
- Is underwriting overly reliant on obtaining information on individual's health?
- How can we protect the office from adverse experience using other methodologies such as predictive modelling?
- How could underwriting look if we customised it for age and gender?
- How could we manage risk differently in the group space?
- What do we need to do to ensure the industry remains on top of developments in areas such as genetic testing, and nanotechnology?