



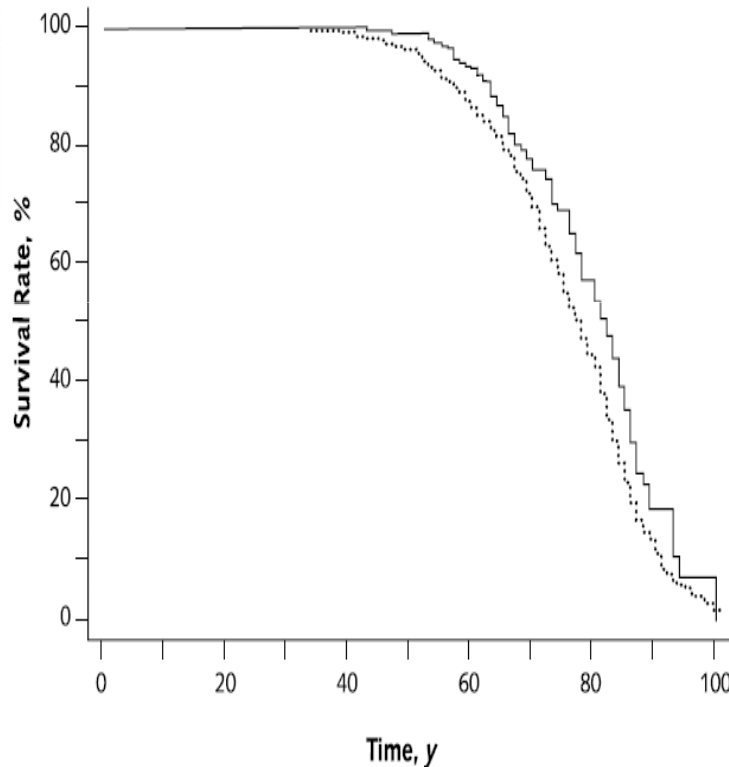
Risk Segmentation in Life Insurance – Unisex: A Step Backwards ?

Bernhard Geismann
Warsaw, 30th May 2012

Example: Status vs. Mortality



Survival in Academy Award–winning actors and actresses (solid line) and controls (performers who were never nominated) (dotted line), plotted by using the Kaplan–Meier technique



Analysis is based on log-rank test comparing 235 winners (99 deaths) with 887 controls (452 deaths). The total numbers of performers available for analysis were 1122 at 0 years, 1056 at 40 years, 762 at 60 years, and 240 at 80 years. $P = 0.003$ for winners vs. controls.

Analysis of Death Rates of Academy Award–Winning Actors and Actresses

Analysis	Relative Reduction in Mortality Rate (95% CI), %*
Winners compared with controls	
Basic analysis	28 (10–42)
Adjusted for birth year	27 (9–41)
Adjusted for sex	27 (10–42)
Adjusted for ethnicity	27 (10–42)
Adjusted for all 3 demographic factors	26 (8–40)
Adjusted for birth country	27 (10–42)
Adjusted for possible name change	27 (8–41)
Adjusted for age at first film	26 (7–40)
Adjusted for total films in career	27 (9–42)
Adjusted for all 4 professional factors	25 (5–40)
Adjusted for all 7 factors	23 (2–38)
Winners compared with nominees	
Basic analysis	25 (5–41)
Adjusted for birth year	24 (4–40)
Adjusted for sex	27 (7–42)
Adjusted for ethnicity	25 (5–41)
Adjusted for all 3 demographic factors	26 (6–42)
Adjusted for birth country	26 (6–41)
Adjusted for possible name change	26 (6–42)
Adjusted for age at first film	25 (5–41)
Adjusted for total films in career	23 (2–39)
Adjusted for all 4 professional factors	24 (3–40)
Adjusted for all 7 factors	22 (0–38)

Quelle: Redelmeier et al, Survival in Academy Award–Winning Actors and Actresses, Ann Intern Med. 2001;134:955-962.

Example: Status vs. Mortality



Table 2: Extra Years of Life from Winning (A Matching Test)

	Window (Years)	Matched Winners (#)	Conditional Test Diff. (Years)	Unconditional Test Diff. (Years)
USA*	3	30	2.08	4.64
Germany*	3	38	1.30	2.45
EU*	5	102	0.69	1.36
All	3	135	0.33	1.38
All * (controls are only of winner's nationality)	13	125	0.99	-
Physics*	3	77	0.04	0.83
Chemistry*	5	79	1.35	2.75

* Each winner is matched only with controls from the same nationality, continent or scientific discipline as specified.

- > Nobel Prize winners go on to have longer lives than scientists who are merely nominated:
 - USA: Nobel Prize winners live 2.08 years longer than matched American nominees

Quelle: Rablen et al, Mortality and Immortality, University of Warwick, January 2007

Example from the UK: Rabate for Vegetarians



Male Non-Smoker



you pay throughout the 20 year term.

Buying out £100,000 cover will pay £5.58/£5.85 per month throughout the term.
If you go up.

Amount of Cover	"No Meat" Discount Premium (Per Month)	Ordinary Premium (Per Month)
-----------------	--	------------------------------

Call on 0844 55 70 300 for your no-obligation Quote
security and protection for you and your loved ones

£100,000	£5.11	£5.42
£100,000	£5.16	£5.48
£100,000	£5.80	£6.16
£100,000	£7.23	£7.68

Source: http://www.animalfriends.org.uk/life_insurance_table_template.html March 2008

Example: Gen Re Special Rebate



- > Gen Re will offer discounts to Vegetarians
- > but only to vegetarians who have won both an Oscar and a Nobel prize

Risk Factors Ideally Are



- > Available at reasonable costs
- > Objective
- > Acceptable by distribution and policyholders
- > Verifiable (also in arrears)
- > Relevant (size of risk group)
- > Relevant (price difference)
- > Statistically significant (correlated with the risk)
- > Permanent (no or few or predictable changes)
- > Not slowing down the underwriting process
- > Legal (e.g. not indirectly discriminating)

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Summary of Advocate General's Opinion

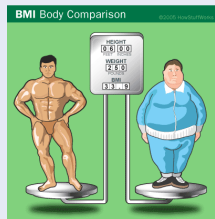


“... Thus, the **life expectancy** of insured persons **is** above all strongly **influenced by** the economic and social conditions of each individual, such as, for example, the kind and extent of the **professional activity** carried out, the **family and social environment**, **eating habits**, **consumption** of stimulants and/or drugs, **leisure activities** and **sporting activities...**”



Source: European Court of Justice Press Release

Risk Factors



- > (Smoking)
- > BMI
- > Blood Pressure, Cholesterol

Medical

- > Family Status
- > Real Estate Ownership
- > Education
- > Income
- > Profession
- > Postal Code

Socio-economic

- > Driving
- > Screening Programs

Risk behaviour

Example: Medical Risk Factors



- > Calculation of individual heart attack risk
- > Individual: Bernhard Geismann
- > Medical check-up dated 23rd March 2012

Herzinfarkttrisiko nach PROCAM

Bernhard Geismann

08.04.2008

Königswinter



Heart Attack Incidence Risk

Parameter	Zielwerte	8.4.08	27.9.05	Bemerkung
Gesamtcholesterin (mg/dl)	unter 200	232	185	Gesamtcholesterin ist die Messung der gesamten Menge des Cholesterins im Blut zu einer bestimmten Zeit. Cholesterin ist lebensnotwendig, doch überschüssiges Cholesterin kann der Körper nicht ohne weiteres ausscheiden. Es wird in bestimmter Form (s. LDL-Chol.) in den Gefäßwänden abgelagert und kann zu Arteriosklerose und damit zu Herzinfarkt oder Schlaganfall führen.
HDL-Cholesterin (mg/dl)	über 35	71,3	68,9	HDL-Cholesterin ist das „gute“ Cholesterin und hat einen hohen Eiweiß- und geringen Fettanteil. Es ist ein Transportprotein, lagert sich nicht in den Gefäßen ab, sondern transportiert den Fettanteil in die Leber.
LDL-Cholesterin (mg/dl)	unter 130	131,9	102,5	LDL-Cholesterin ist das sogenannte „schlechte“ Cholesterin. Das LDL enthält viel mehr Fett als Eiweiß und hat die Tendenz, sich in vorgeschädigten Arterienwänden abzulagern.
Quotient (Chol. / HDL)	kleiner als 4,5:1 beim Mann, 3,5:1 bei der Frau	3,25	2,69	Der sogenannte Arteriosklerose-Index hilft, das Verhältnis der Cholesterin-Unterfraktionen besser einzuschätzen. Hierbei wird das Gesamtcholesterin durch den HDL-Anteil geteilt (Chol/HDL). Um so kleiner der Quotient ist, um so besser, wobei die Höhe des Gesamtcholesterin-Wertes sekundär ist.
Triglyceride (mg/dl)	unter 150	144	68	Triglyceride setzen sich aus drei Fettsäuremolekülen und Glycerin zusammen. Genau wie das Cholesterin zirkulieren sie im Blut. Nach einer Mahlzeit steigen die Triglyceridwerte deutlich an, da sie unter anderem das Fett anzeigen, welches Sie zu sich genommen haben und welches noch nicht verstoffwechselt ist.
Blutdruck (mmHg)	unter 140/90	120/85	130/95	Von Bluthochdruck spricht man bei ≥ 140 mmHg beim oberen und/oder bei ≥ 90 mmHg beim unteren Wert. Ein erhöhter Blutdruck beschleunigt die Arteriosklerose-Entwicklung und schädigt das Herz.

Blood pressure

Cholestorol



Herzinfarkttrisiko nach PROCAM



Bernhard Geismann
08.04.2008
Königswinter

Heart Attack Incidence Risk

Parameter	Zielwerte	8.4.08	27.9.05	Bemerkung
Alter in Jahren <i>Age</i>		44	42	Alter ist ein wichtiger Risikoparameter, aber leider nicht zu beeinflussen. Männer vor dem 50. Lebensjahr und Frauen nach der Menopause weisen ein erhöhtes Risiko auf.
Raucher <i>Smoking</i>		nein	nein	Zigarettenrauchen verdoppelt das Risiko, einen Infarkt zu bekommen.
Diabetes mellitus (Zuckerkrankheit) <i>Diabetes</i>		nein	nein	Risikofaktoren für die Zuckerkrankheit sind: familiäre Vorbelastung, Übergewicht und Bewegungsmangel. Bei Messung des Blutzuckerspiegels im Blut wäre ein Idealwert: < 100 mg/dl (nüchtern).
Herzinfarkt in der Familie <i>Family History</i>		nein	nein	Eine familiäre Disposition für Herz-Kreislaufkrankungen liegt dann vor, wenn bei Eltern oder/und Geschwistern ein Herzinfarkt vor Vollendung des 60. Lebensjahres auftrat.
Angina pectoris		nein	nein	A.p. bezeichnet einen meist anfallsweise in der Herzgegend auftretenden Schmerz, mit einem typischen Beengungs- und Vernichtungsgefühl. Die Schmerzen können typischerweise vom Brustbereich in andere Körperpartien (Arm, Hals, Bauch etc.) ausstrahlen. Personen mit A.p.-Symptomen zählen zur Hochrisikogruppe.



Herzinfarkttrisiko nach PROCAM

Bernhard Geismann
08.04.2008
Königswinter

Heart Attack Incidence Risk



Infarkttrisiko nach PROCAM für die nächsten 10 Jahre

	8.4.08	27.9.05	Bemerkungen
Inzidenz in %	0,690	0,360	Mit der Infarkt-Inzidenz wird die Wahrscheinlichkeit in % berechnet, innerhalb der nächsten 10 Jahre einen Myokard-Infarkt zu erleiden.
Inzidenz / 1000 mit 65 Jahren	58,8	38,1	Blick in die Zukunft: Bei gleichen Risikoparametern würde das Infarkttrisiko mit 65 Jahren auf 58,8 pro 1000 ansteigen.
Herzinfarkttrisiko (Status/Entwicklung)	<p>aktuelles Risiko (8.4.08)</p> <p>Risiko 27.9.05</p>		

Incidence Rate for next 10y

Per 1,000



Herzinfarkttrisiko nach PROCAM

Bernhard Geismann
08.04.2008
Königswinter



Heart Attack Incidence Risk

12/2008

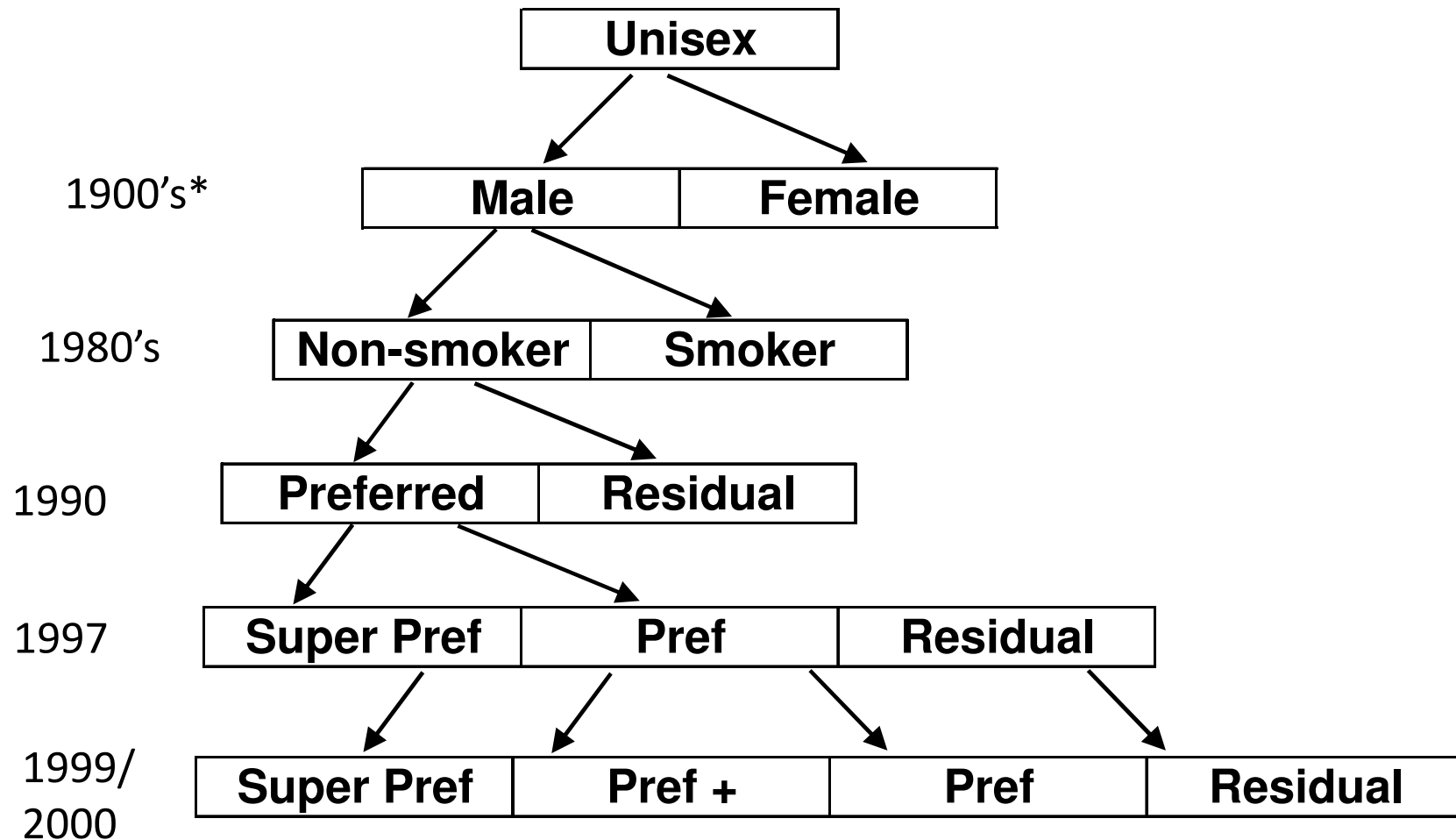
Relatives Risiko (Multiplikator und kardiovaskuläres Alter) nach PROCAM

	8.4.08	27.9.05	Bemerkung
Multiplikator	0,16	0,10	Ihr Herzinfarkttrisiko für die nächsten 10 Jahre ist 0,16 mal so hoch wie beim Durchschnitt der Altersgruppe. Der Durchschnitt der deutschen Bevölkerungsgruppe ist PROCAM bei Multiplikator = 1. Ein Wert von 0 - 1 als gut bezeichnet werden.
kardiovaskuläres Alter	< 35	< 35	Das kardiovaskuläre Alter ist definiert als das Alter, dem ein durchschnittlicher Teilnehmer der Studie ein vergleichbares Herzinfarkttrisiko hat. Somit entspricht Ihr Herzinfarkttrisiko dem eines Durchschnittsbürgers, jünger als 35 Jahre.

Relative Risk

Cardiovascular Age

Preferred Lives Term Insurance In USA



*Exception: Montana!

USA – Term Ins., Male, Age 40, US\$ 500.000



Breakdown of Number of Risk Classes Offered

Number of Classes	Non-Smoker		Smoker	
	Products	Companies	Products	Companies
1	2	2	17	13
2	7	5	62	53
3	30	28	3	3
4	35	31		
5	7	4		
Total	81	70	82	69

2 smoker classes and 3 or 4 non-smoker classes is typical in the U.S.
Survey August 2008

„Preferred Lives“ in USA



- > Scoring Modell
- > In/Out- Modell
- > Significant correlation of various risk factors
- > „Preferred Underwriting“ Activities of SOA

„Preferred Lives“ in USA: Example



- | > Nonsmoker Classes: | Diamond plus | Platinum | Gold |
|-----------------------|---------------------|-----------------|-------------|
| > No tobacco | for 5 years | 3 years | 1 year |
| > Blood pressure | very strict | strict | - |
| > Cholesterol | strict | medium | - |
| > BMI | medium | relaxed | - |
| > Additional Criteria | all | all | - |
- > AC: never a severe illness, no sport risks (2 year), no flight risk (5 years), no treatment for alcohol or drug abuse, no marihuana (5 years), no severe injuries (3 years), no foreign travel risk

Risk Factor „Smoking Status“

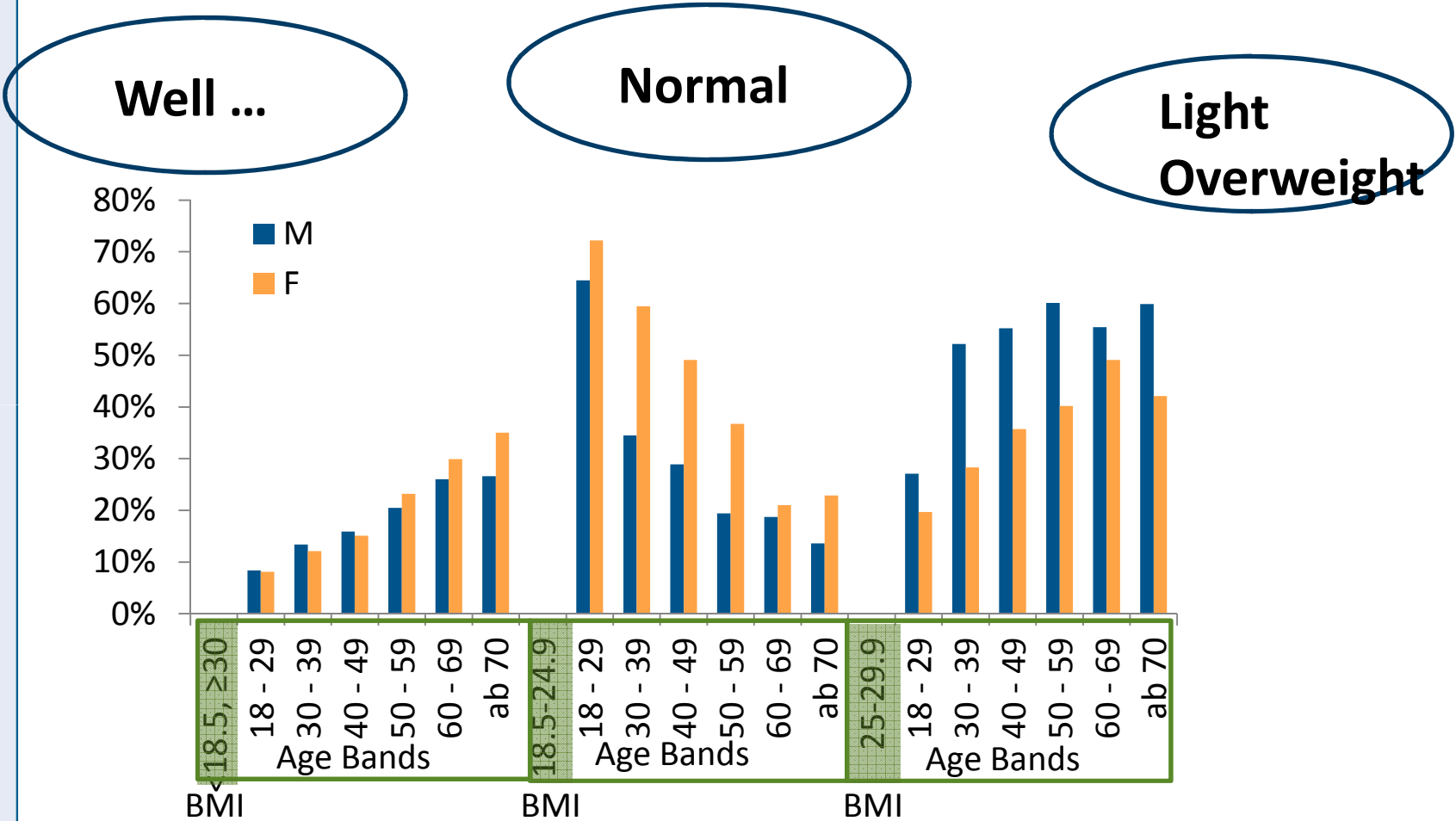


- > Significant price difference
- > Strongly correlated with mortality
- > **Fits well into the Unisex-world**
- > Competition / anti-selection
- > Risk of change: correlation with mortality improvements

BMI – Prevalences in Population



Source: Telefonischer Gesundheitssurvey 2003/04

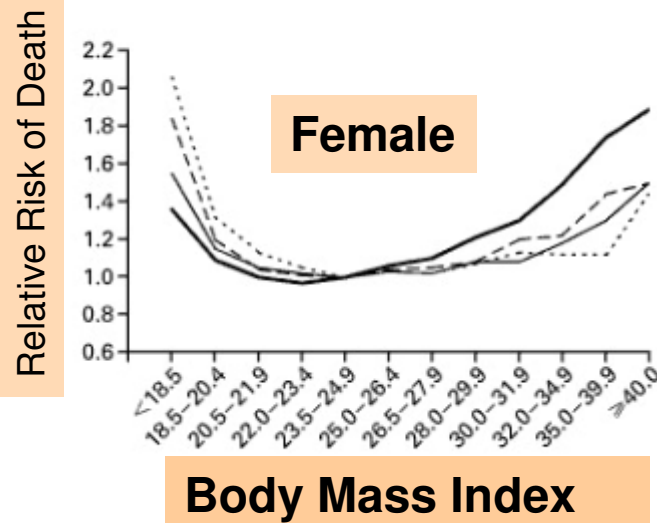
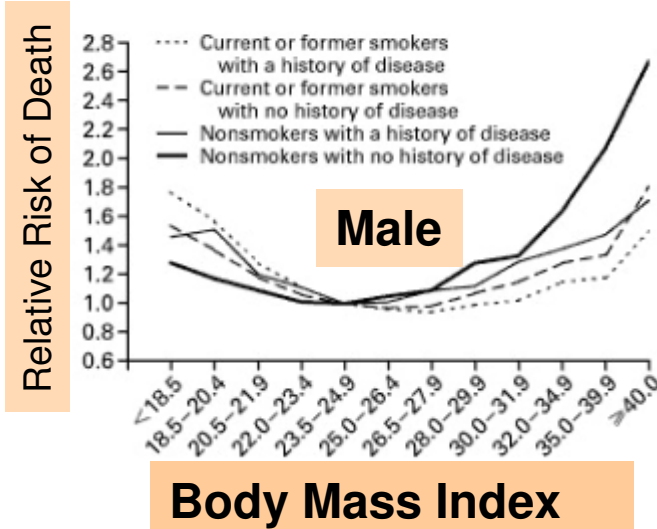


BMI – Excess Mortality

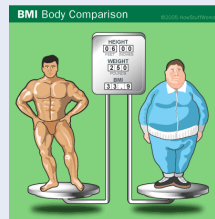


Source: Berrington de Gonzalez et al. BMI and Mortality among 1.46 Million White Adults. N Engl J Med 2010;363:2211-9.

- > Increased mortality for both genders (in „J-shape“)
- > Less significant for smokers



Risk Factors



- > (Smoking)
- > BMI
- > Blood Pressure, Cholesterol

Medical

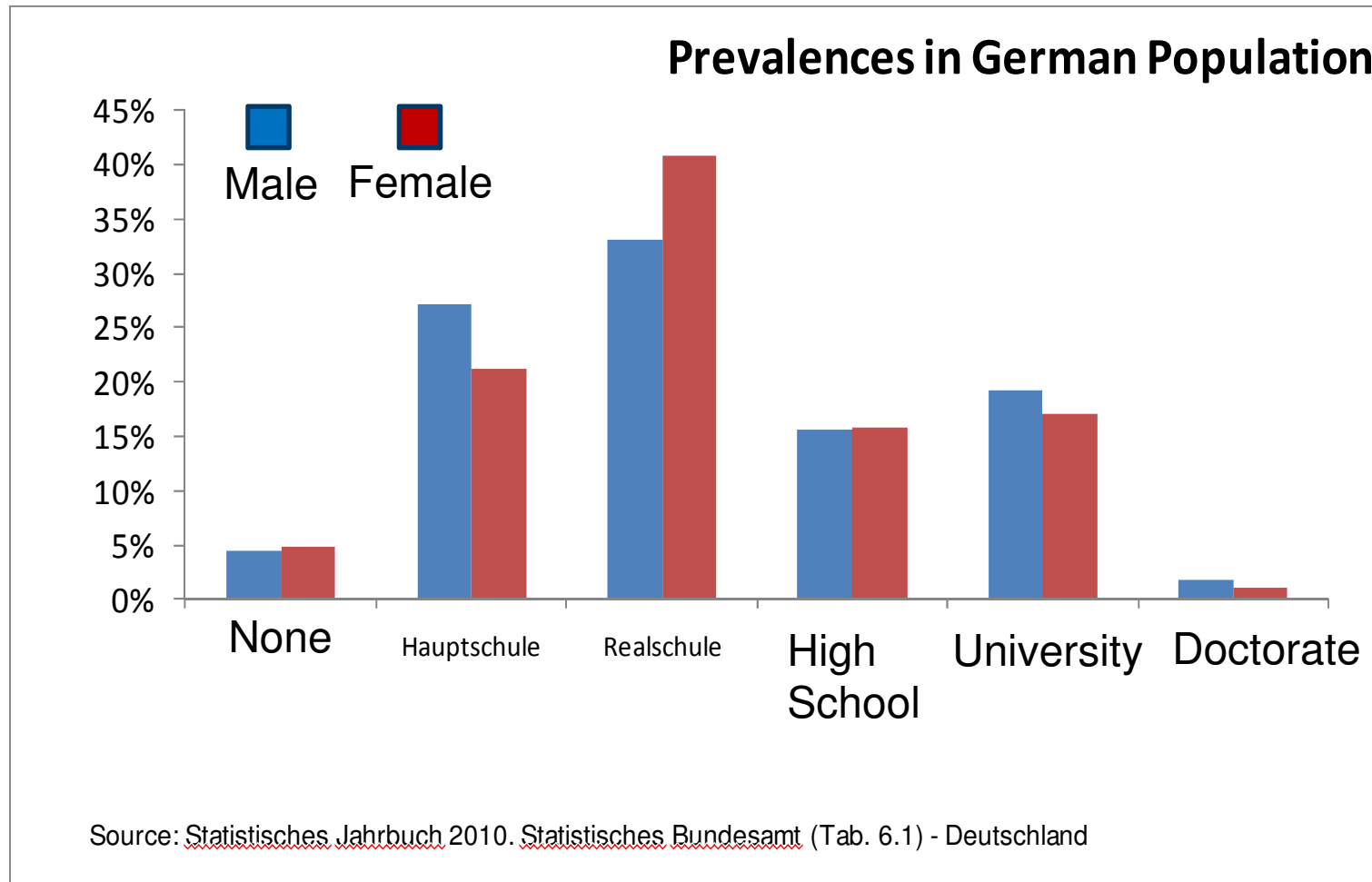
- > Family Status
- > Real Estate Ownership
- > Education
- > Income
- > Profession
- > Postal Code

Socio-economic

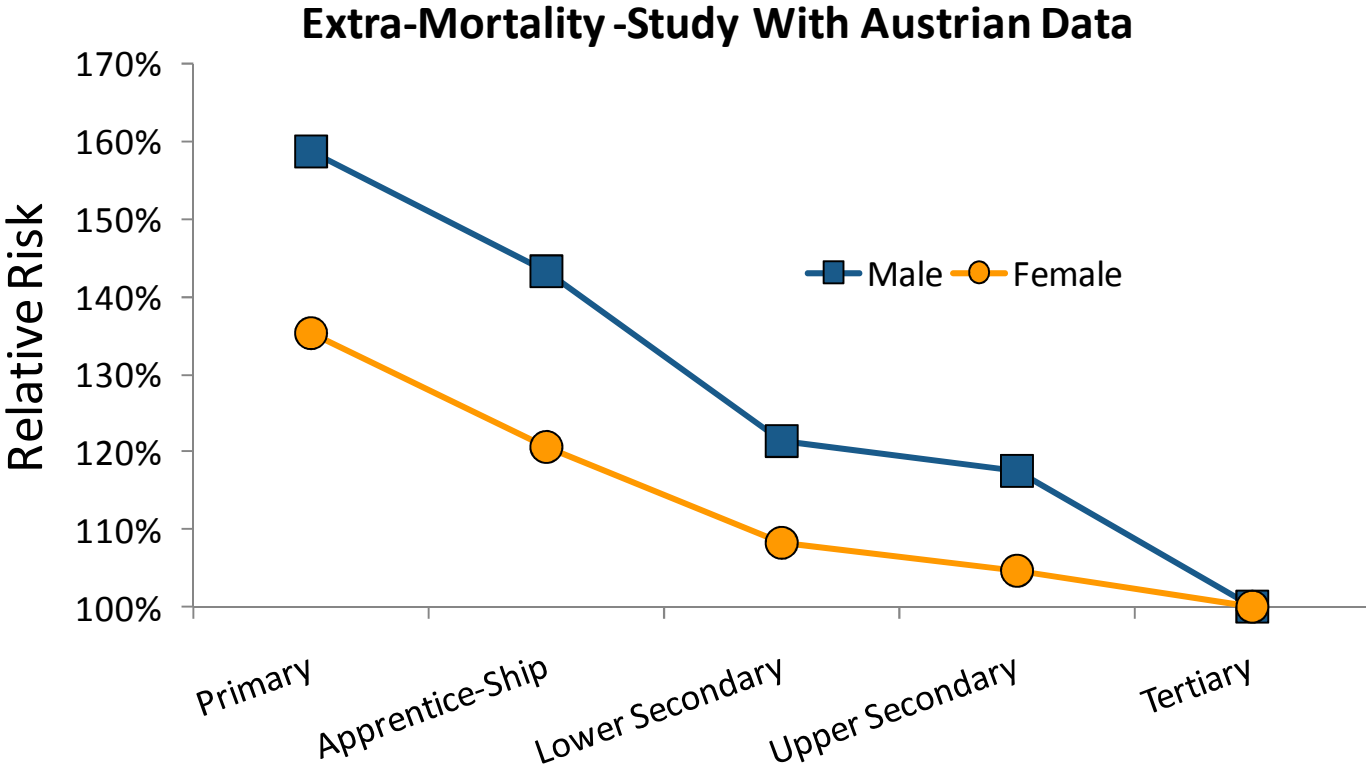
- > Driving
- > Screening Programs

Risk behaviour

Risk Factor Education



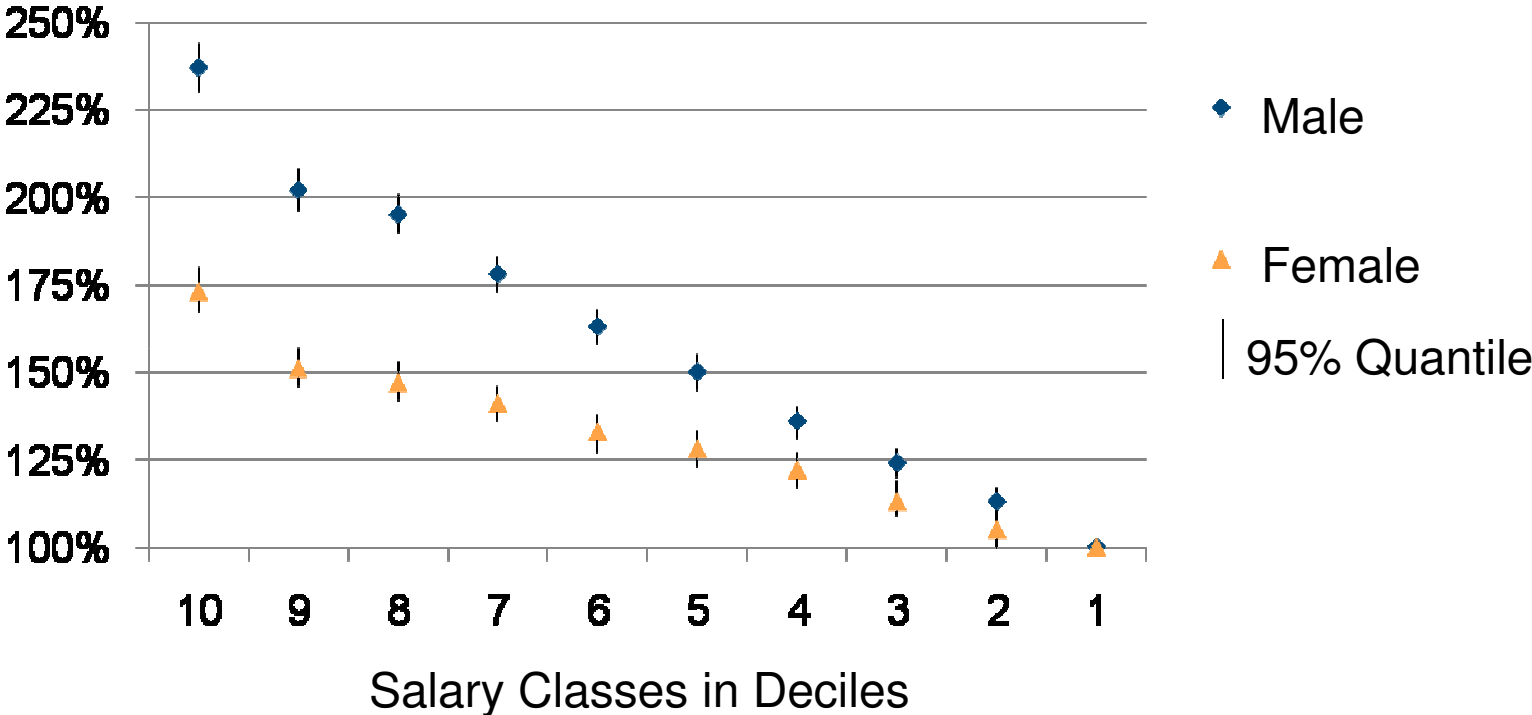
Risk Factor Education



Source: Klotz, Dolhammer. Trends in educational mortality differentials in Austria between 1981/82 and 2001/2002: A study based on a linkage of census data and death certificates



> Mortality (Study from Finland)

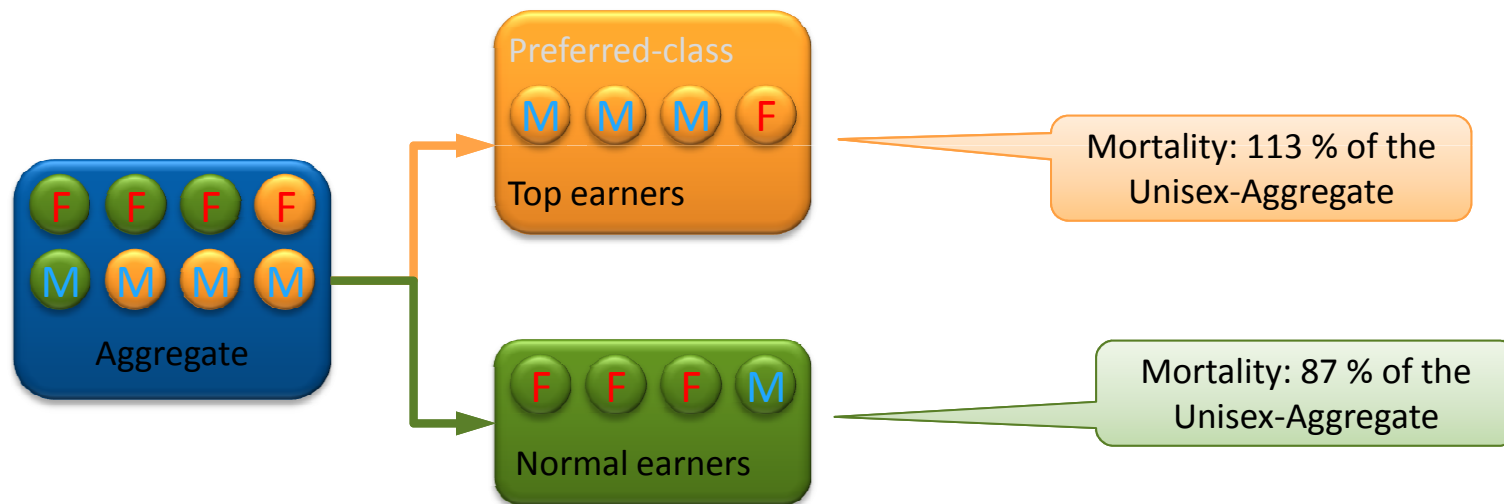


Source: Income differences in mortality: a register-based follow-up study of three million men and women, Pekka Martikainen, Pia Mäkelä, Seppo Koskinen and Tapani Valkonen

Gender Mix and Risk Factor - Unisex



- > Let us assume a portfolio with:
 - Male ratio: 50 %, male mortality: $q_x = 2 * q_y$ (female mortality)
 - Income distribution: $\frac{3}{4}(\frac{1}{4})$ of all men (women) are **top earners**
 - Mortality of **normal earners** relative to top earners is **110 %** for both genders



> Gender mix outplays risk segmentation !

Risk Factors Ideally Are



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- > Life Expectancy in Germany
Cohorts with birth years 1934-1952

	e₆₅	L₄₅/L₆₅
Total	12,6	78%
“Workers”	11,3	70%
Self-Employed	13,7	83%
“Employed”	13,5	82%
Civil Servants	14,6	86%

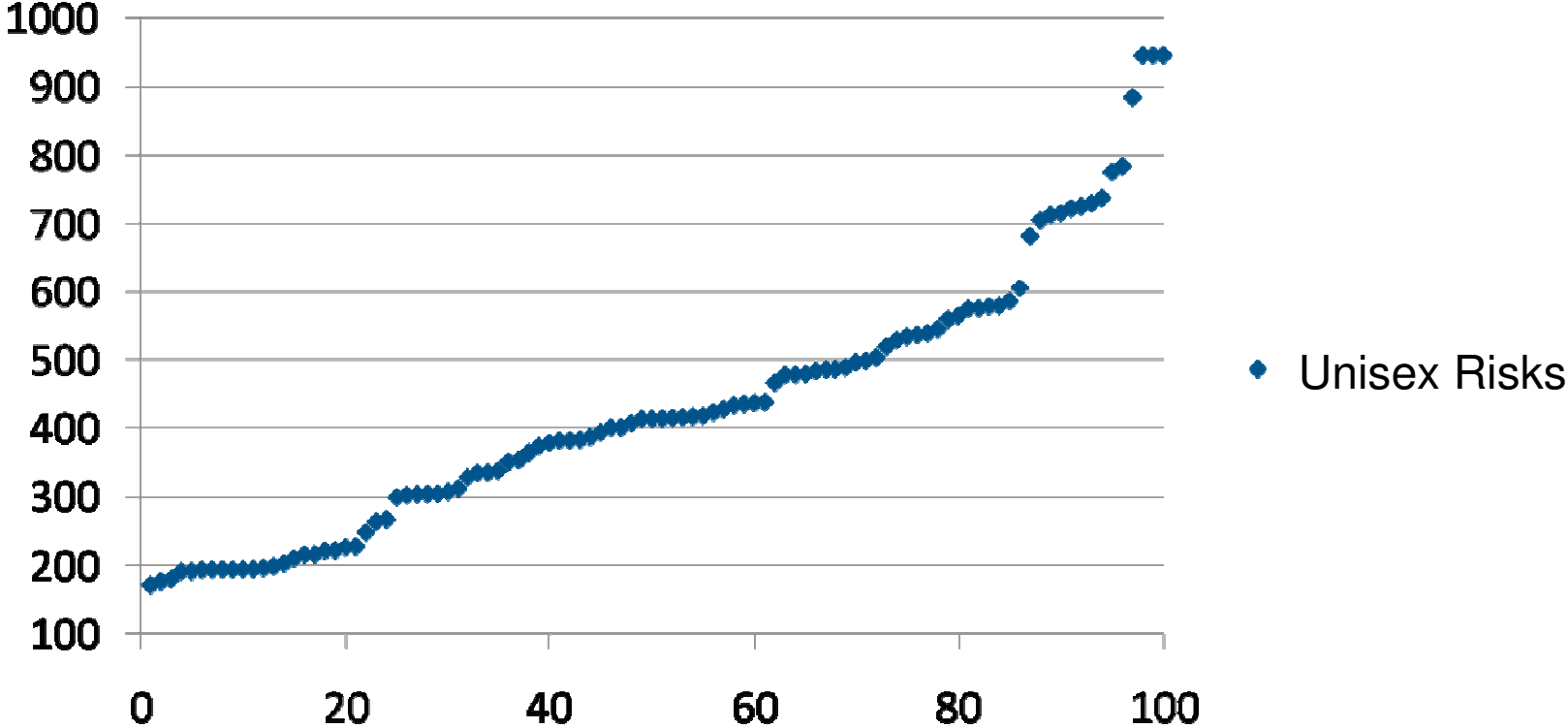
Source: Differentielle Sterblichkeit: Die ungleiche Verteilung der Lebenserwartung in Deutschland, Marc Luy, 2006, Rostocker Zentrum zur Erforschung des Demografischen Wandels

- > Unisex: female occupations become a preferred class

Disability: Occupation is a Suitable Risk Factor



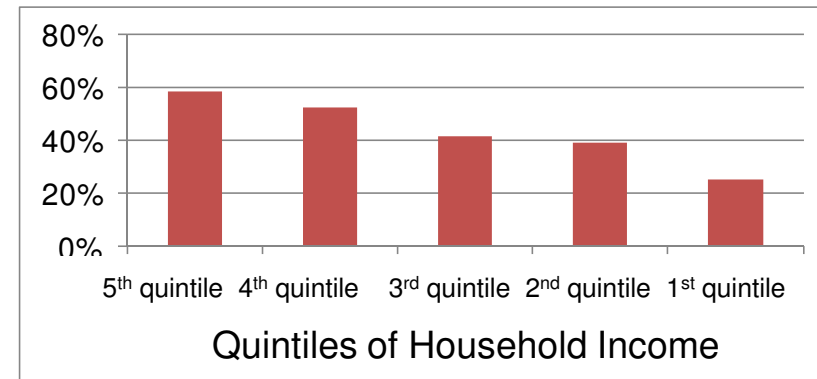
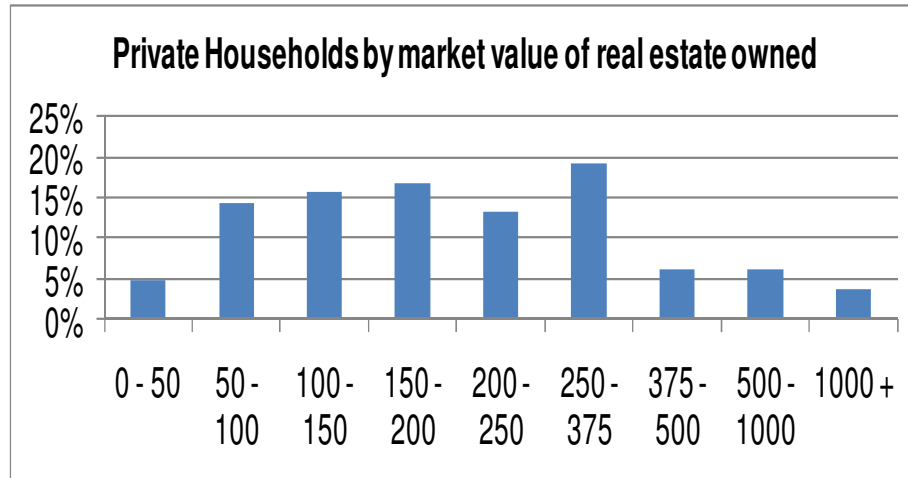
Occupational Risks in Disability Insurance



Gen Re's German Disability Pool *(since 1996)*

- **Approx. 40 m risk years / 77,000 claims**
- **22 insurance companies / >30% market share**

Real Estate Ownership



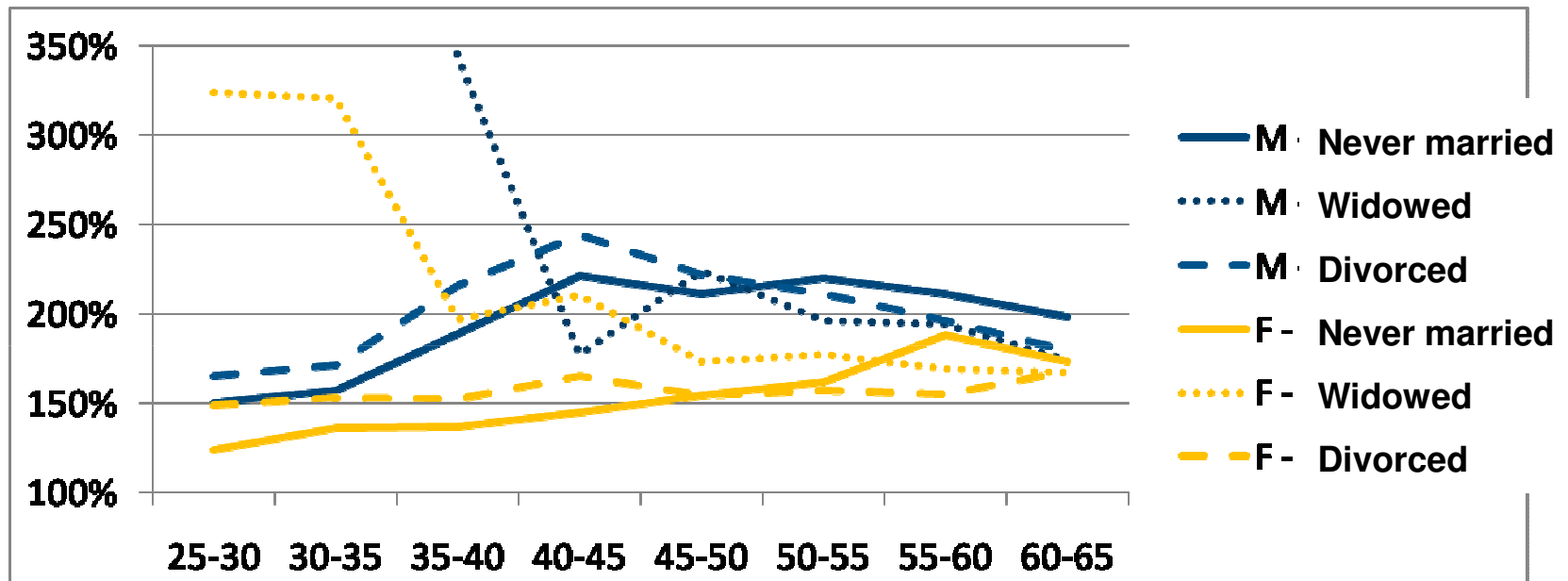
- Correlation with other factors
- Mortality vs. value of real estate
- Indirectly observable through household income

Sources: SOEP 2006 and Statistisches Bundesamt (Wirtschaft und Statistik 10/2009)

Family Status – Mortality in Germany



> 100 % = mortality of married



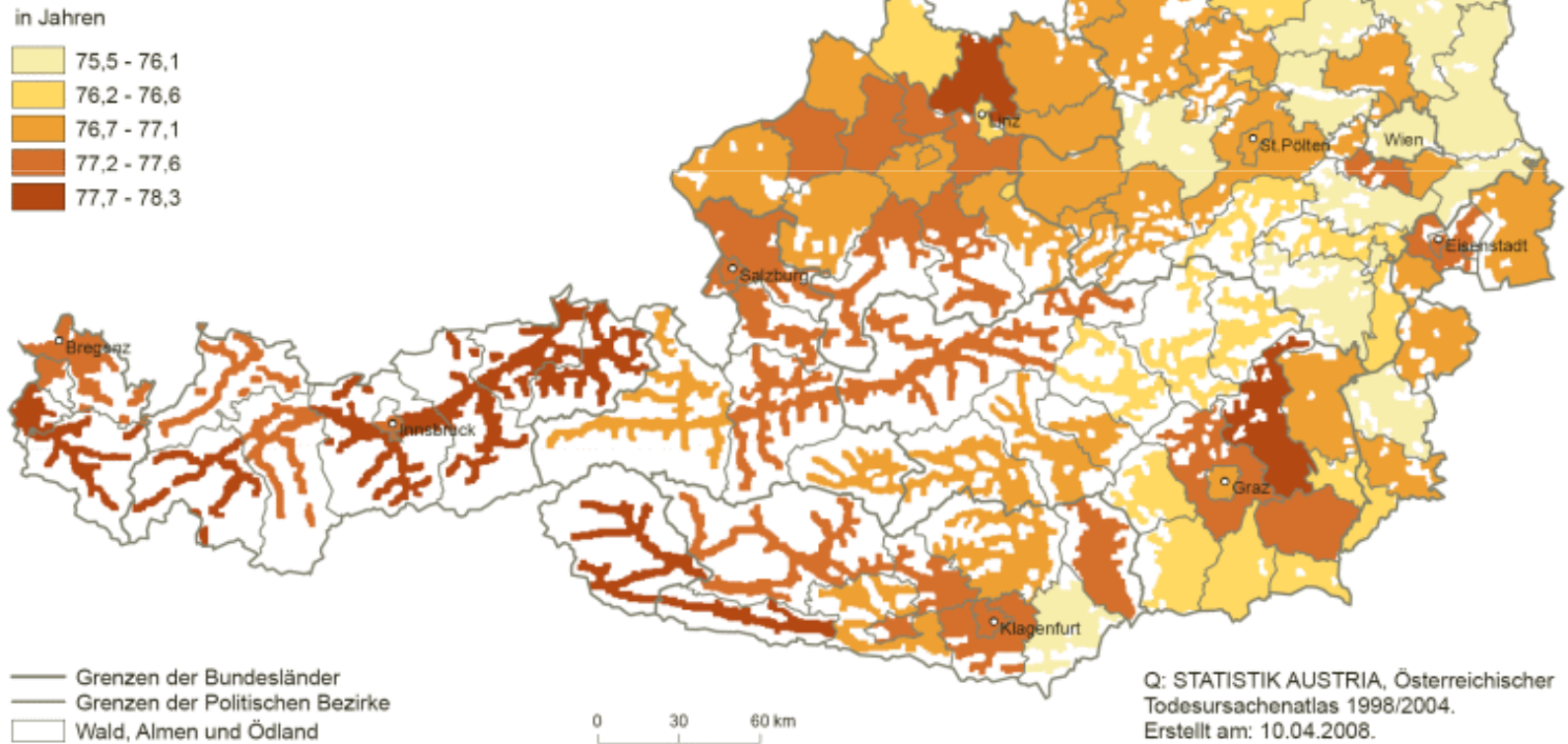
- > Effects for insured lives are smaller
- > Risk of change
- > High portion of term policy holders is married

Risk Factor Postal Code

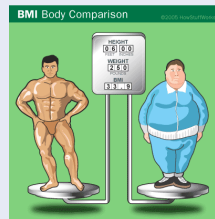


- > Used in the UK
- > Suitable for Unisex ?

Life Expectancy at Birth in Austria



Risk Factors



- > (Smoking)
- > BMI
- > Blood Pressure, Cholesterol



- > Family Status
- > Real Estate Ownership
- > Education
- > Income
- > Profession
- > Postal Code



- > Driving
- > Screening Programs



Driving Behaviour – Example from Germany



- > Central Registry in Flensburg
- > Entries for 14 % of population
- > 78 % of people with entries are men

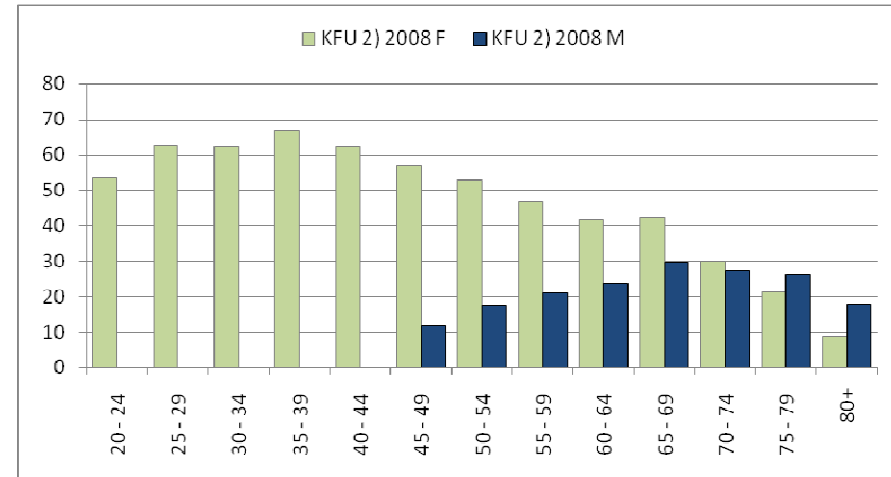
- > Insurance: assume male /female ratio to be 65% / 35%
- > Difference in Premium „with Flensburg“ vs „without“ is just 1%

- > Based on gender mix, overmortality statistics are not available

Cancer Screening Programs



- > Proposed application question:
- > Do you participate in a cancer screening program?



German Cancer Screening Programs (EBM 01730 (F), 01731 (M))

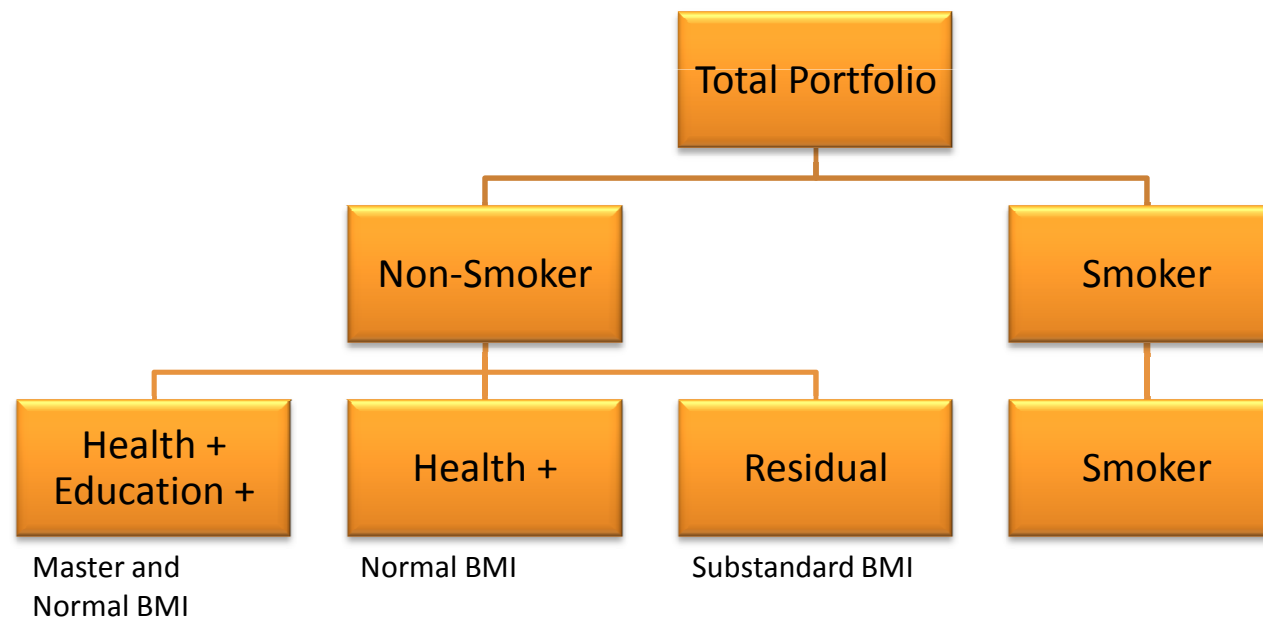
Females	Males and Females
<ul style="list-style-type: none"> • Cervical Cancer • Breast Cancer 	<ul style="list-style-type: none"> • New since 2008: Skin Cancer • Colon Cancer
Males	
<ul style="list-style-type: none"> • Prostate Cancer 	

Sample Product for the Unisex World



> Segmentation Criteria:

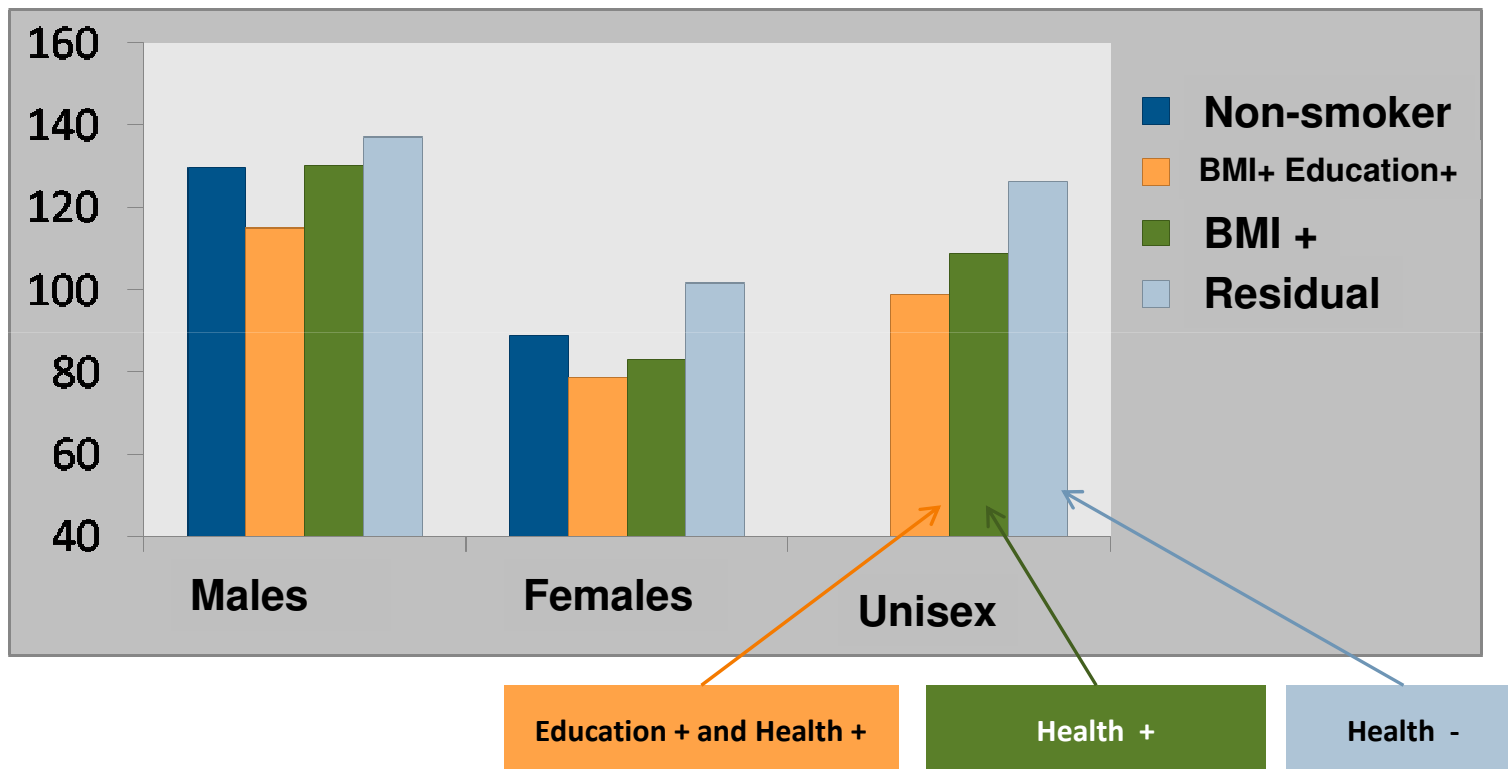
- Smoking
- Health+ : normal BMI, e..g. between 19 and 25
- Education +: High School Diploma or Master Craftsman



Example for a Unisex Term Product



- > Indicative calculation; Non-smoker
- > FA = 100k PLN, ARoI 1,75 %, $x=35$, $n=15$, no MEX, best estimate



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