SOCIETY OF ACTUARIES

A World of Mortality Issues and Insights Seminar
May 23, 2012

Session 2 – Update on Underwriting Criteria Scoring (USC) Algorithm

Presenter
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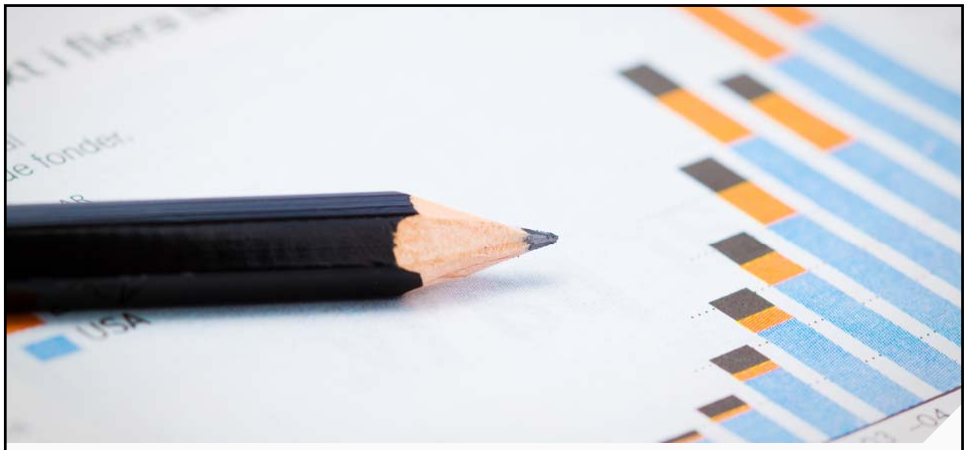

UNDERWRITING CRITERIA SCORING

Dieter Gaubatz
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SOA - A World of Mortality Issues and Insights Conference – May 23, 2012

Agenda

1. SOA mortality support to the industry
2. Adding preferred criteria to the mix
3. UCS role
4. Inputs into UCS
5. Assumptions
6. Calculations
7. What's left to do

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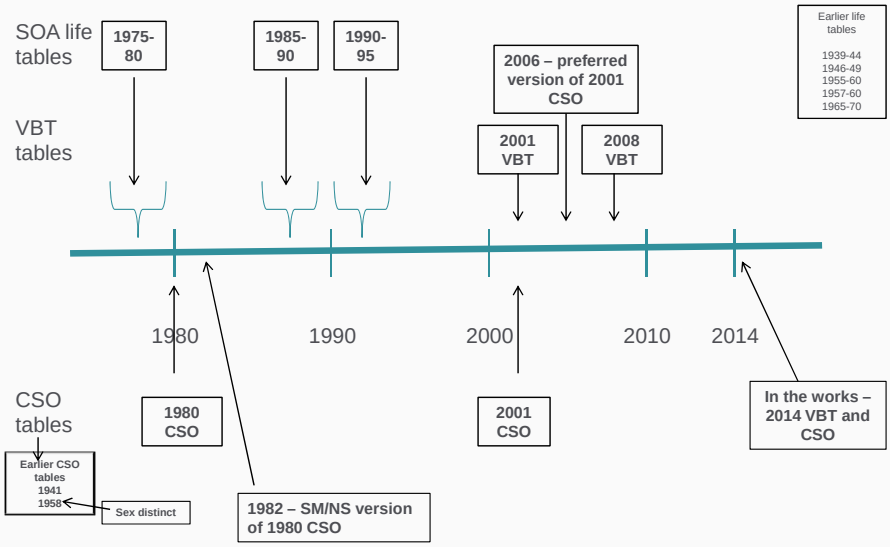
Timeline of industry individual life mortality tables

Society of Actuaries



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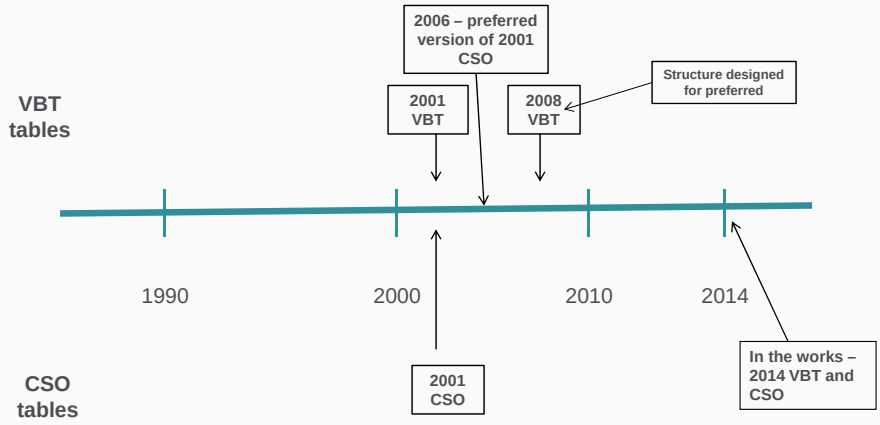
Preferred mortality



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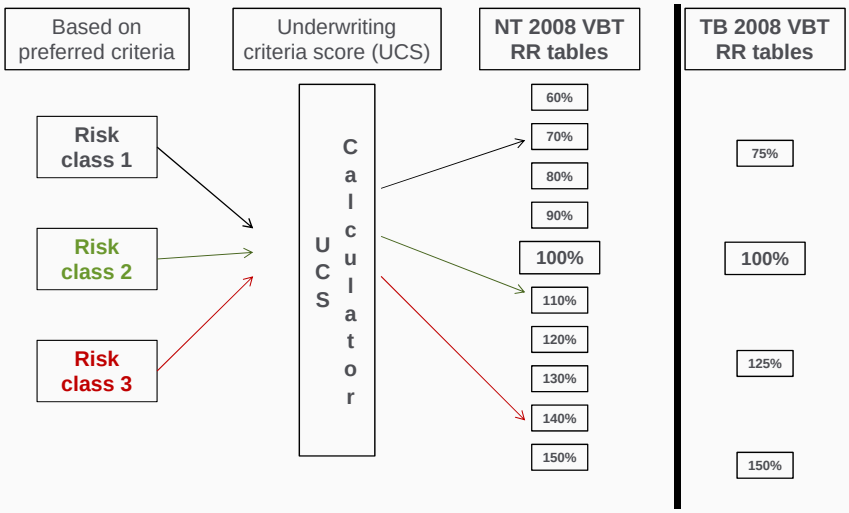
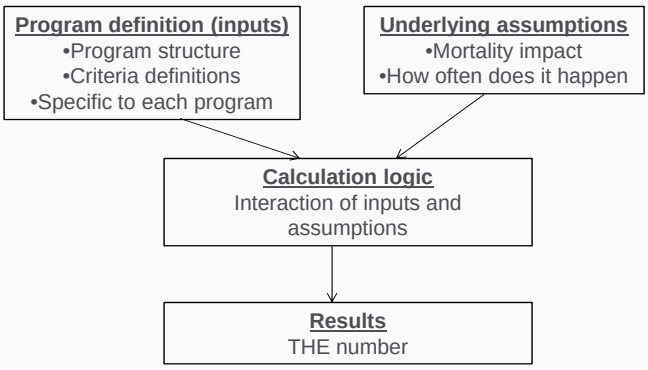
2008 VBT table calculation structure



UCS Calculator basics

4 key elements



YOUR program
what does it look like

How many risk classes?
Which criteria?
What are the qualifications to be allowed into each criteria?
How do the various criteria interact to come up with a final qualification?

•Meet all criteria
•Apply points

Function of

# of risk classes
3-4 non-tobacco
1-2 tobacco

Criteria values for Blood Pressure
Diastolic level
Systolic level
What if applicant is being treated for high BP

Risk factors
Blood pressure
Cholesterol
Build
Family medical history
Personal medical history
Avocation
Substance abuse
Driving record
Miscellaneous

= **UCS**

Inputs
age splits

UCS 1.0/2.0

BP recognizes difference between ages 45 and 65

Blood Pressure (KO, DC, Excl)

I. Systolic Limit - Age 45
Diastolic Limit - Age 45
Treated Allowed (Y/N)
II. Systolic Limit - Age 65
Diastolic Limit - Age 65
Treated Allowed (Y/N)

But what about build, etc.

Build (KO, DC, Excl)
Enter A or B.
A. Male Weight Limit at 5'6" in lbs
Male Weight Limit at 5'10" in lbs
Male Weight Limit at 6'2" in lbs
Female Weight Lmt at 5'2" in lbs
Female Weight Lmt at 5'6" in lbs
Female Weight Lmt at 5'10" in lbs
B. Male BMI Limit (##.#)
Female BMI Limit (##.#)

UCS 3.0 (Build)

Ages 18 - 32

Build - BMI for Males for Alt 1		
		Maximum
Risk Class	DC Points	35.9
Std		21.9
Super Pref		29.9
Pref		32.9
Std		35.9

Ages 33 - 59

Build - BMI for Males for Alt 1		
		Maximum
Risk Class	DC Points	35.9
Pref		22.0
Super pref		31.0
Std		35.9

Ages 60 - 90

Build - BMI for Males for Alt 1		
		Maximum
Risk Class	DC Points	35.9
Pref		25.0
Super pref		35.0
Std		35.9

Inputs
Combo inputs

UCS 1.0/2.0

BP recognizes difference between ages 45 and 65

Blood Pressure (KO, DC, Excl)	Risk class 1	Risk class 2
I. Systolic Limit - Age 45		
Diastolic Limit - Age 45		
Treated Allowed (Y/N)		
II. Systolic Limit - Age 65		
Diastolic Limit - Age 65		
Treated Allowed (Y/N)		

Treated / Untreated
Different values can be inserted
Note: untreated is shown here, but there are separate boxes for treated and untreated.

UCS 3.0

Input alternative 1

Blood Pressure – Systolic Untreated		
		Maximum
Risk Class	DC Points	154
Super Pref		
Pref		
Std		

Blood Pressure – Diastolic Untreated		
		Maximum
Risk Class	DC Points	104
Super Pref		
Pref		
Std		

Input alternative 2

Blood Pressure - Combo Systolic/Diastolic - Untreated				
		Systolic		Diastolic
		Minimum	Maximum	Maximum
Risk Class	DC Points	90	154	104
Super Pref		90	125	75
Pref		90	135	85
Std			154	104

Inputs
Other features of UCS 3.0

- Flexible age banding possible for all criteria
- Multiple input structures for blood pressure, cholesterol, build

- Knock–out and debit-credit entry locations combined
- Better definition for allowing flat extras
- Family history
  - Cardio → Coronary, cerebro
- Personal history
  - Cardio → Coronary, cerebro
  - Mental / nervous added
- Separate NT/TB input worksheets

Assumptions – relative risk and prevalence

Blood pressure as the example

UCS 1.0/2.0

GENERAL PARAMETERS Table

Age 45 / Age 65 Weighing (each)	50%
Diastolic Weight Relative to Systolic	2
Add to Diastolic Pressure reading value if Treated	2.5
Add to Systolic Pressure reading value if Treated	5

SYSTOLIC VALUES - AGE 45 Table

Slope to minimum	1
Slope to maximum	2

	SBP Value	Min Score	Slope
Min	120	-33.0	6.60
	125	0.0	6.60
	130	33.0	3.40
	140	67.0	3.30
	150	100.0	13.50
Max	152	127.0	0.00

SYSTOLIC VALUES - AGE 65 Table

Slope to minimum	1
Slope to maximum	2

	SBP Value	Min Score	Slope
Min	120	-33.0	6.60
	125	0.0	6.60
	130	33.0	3.40
	140	67.0	3.30
	150	100.0	13.50
Max	152	127.0	0.00

DIASTOLIC VALUES AGE - 45 Table

Slope to minimum	1
Slope to maximum	2

	DBP Value	Min Score	Slope
Min	72	-19.8	6.60
	75	0.0	6.60
	80	33.0	6.80
	85	67.0	6.60
	90	100.0	13.50
Max	92	127.0	0.00

DIASTOLIC VALUES - AGE 65 Table

Slope to minimum	1
Slope to maximum	2

	DBP Value	Min Score	Slope
Min	77	-30.0	10.00
	80	0.0	10.00
	83.3	33.0	10.00
	86.7	67.0	10.00
	90	100.0	13.50
Max	92	127.0	0.00

Note: Score is the interpolated value for the specified Blood Pressures

Result is the BP component of the score

UCS 1.0/2.0 calculation example
Blood pressure

BP Criteria (program specific example)

- 2 risk classes
- BP requirement for preferred

Age	SBP/DBP
45	140/80
65	140/80

Final BP UCS factor

Preferred	33.3
Std/residual	127.0

Preferred

Age	Factor	Wgt
45	44.3	50%
65	22.3	50%

Age 45 calculation

		Value	Wgt	
Preferred				
Score	SBP	140	1	67
	DBP	80	2	33
	Combined		3	**44.3**
Standard/Residual				
Score	SBP	152	1	127
	DBP	92	2	127
	Combined	3	**127**	

Age 65 calculation

		Value	Wgt	
Preferred				
Score	SBP	140	1	67
	DBP	80	2	0
	Combined		3	22.3
Standard/Residual				
Score	SBP	152	1	127
	DBP	92	2	127
	Combined		3	**127**

Calculation

Munich RE

UCS 1.0/2.0

2008 VBT RR table

	Wgt	Risk Class 1	Risk Class 2
UNDERWRITING CRITERIA SCORE	19	33.3	148
Alcohol & Drug Abuse	1	33.3	133
Blood Pressure	3	**33.3**	**127**
Build	2	33.3	166
Cholesterol	3	33.3	188
Family History	3	33.3	133
Motor Vehicle Report	2	33.3	150
Personal History	2	33.3	153
Tobacco Definition	2	33.3	148
Miscellaneous	1	33.3	133
Adj			

BP component

Overall Table			Individual Criteria								
	Cumulative		Alcohol / Drug Abuse	Blood Pressure	Build	Chol	Family History	Motor Vehicle Report	Personal Medical	Tobacco Definition	Misc
UCS	RRR	Proportion	UCS	UCS	UCS	UCS	UCS	UCS	UCS	UCS	UCS
-1	0.0%	0.000%	17.1	-12.4	-7.4	-4.6	-11.6	-9.5	17.1	19.0	17.1
0	0.0%	0.000%	17.9	-11.5	-6.2	-3.3	-10.7	-8.4	17.9	19.9	17.9
1	52.1%	0.164%	18.7	-10.5	-5.1	-2.0	-9.7	-7.3	18.7	20.8	18.7
2	52.3%	0.335%	19.4	-9.6	-3.9	-0.7	-8.7	-6.2	19.4	21.6	19.4
3	52.5%	0.512%	20.2	-8.7	-2.7	0.6	-7.8	-5.2	20.2	22.5	20.2
4	52.7%	0.697%	21.0	-7.7	-1.6	1.9	-6.8	-4.1	21.0	23.4	21.0
5	52.9%	0.889%	21.8	-6.8	-0.4	3.2	-5.8	-3.0	21.8	24.2	21.8
6	53.2%	1.088%	22.6	-5.9	0.7	4.5	-4.8	-2.0	22.6	25.1	22.6
7	53.4%	1.296%	23.3	-4.9	1.9	5.8	-3.9	-0.9	23.3	26.0	23.3
8	53.6%	1.511%	24.1	-4.0	3.1	7.1	-2.9	0.2	24.1	26.8	24.1
9	53.9%	1.735%	24.9	-3.1	4.2	8.4	-1.9	1.2	24.9	27.7	24.9
10	54.1%	1.967%	25.7	-2.1	5.4	9.7	-0.9	2.3	25.7	28.6	25.7
11	54.4%	2.209%	26.4	-1.2	6.6	10.9	0.0	3.4	26.4	29.4	26.4
12	54.6%	2.459%	27.2	-0.3	7.7	12.2	1.0	4.5	27.2	30.3	27.2
13	54.9%	2.720%	28.0	0.7	8.9	13.5	1.9	5.5	28.0	31.2	28.0
14	55.2%	2.990%	28.8	1.6	10.1	14.8	2.9	6.6	28.8	32.0	28.8
15	55.5%	3.271%	29.6	2.6	11.2	16.1	3.9	7.7	29.6	32.9	29.6
16	55.7%	3.562%	30.3	3.5	12.4	17.4	4.9	8.7	30.3	33.8	30.3
138	98.2%	98.691%	125.2	117.6	154.4	175.1	123.3	139.3	125.2	139.3	125.2
139	98.4%	98.837%	126.0	118.6	155.5	176.4	124.3	140.4	126.0	140.2	126.0
140	98.5%	98.979%	126.8	119.5	156.7	177.7	125.2	141.4	126.8	141.1	126.8
141	98.7%	99.117%	127.6	120.5	157.9	179.0	126.2	142.5	127.6	141.9	127.6
142	98.9%	99.252%	128.3	121.4	159.0	180.2	127.2	143.6	128.3	142.8	128.3
143	99.1%	99.384%	129.1	122.3	160.2	181.5	128.1	144.6	129.1	143.7	129.1
144	99.3%	99.513%	129.9	123.3	161.3	182.8	129.1	145.7	129.9	144.5	129.9
145	99.4%	99.638%	130.7	124.2	162.5	184.1	130.1	146.8	130.7	145.4	130.7
146	99.6%	99.761%	131.4	125.1	163.7	185.4	131.1	147.9	131.4	146.3	131.4
147	99.8%	99.882%	132.2	126.1	164.8	186.7	132.0	148.9	132.2	147.1	132.2
148	100.0%	100.000%	133.0	127.0	166.0	188.0	133.0	150.0	133.0	148.0	133.0

UCS 2.0 addition
For debit-credit

Final RR
UCS 1.0/2.0

Munich RE

Cumulative

Risk class	UCS	RR	Prev
Preferred	33.3	61.5%	10.72%
Std	148	100%	100%

Risk class values (range)

Risk class	UCS	RR	Prev
Preferred	33.3	61.5%	10.72%
Std	148	104.6%	89.28%

Assumptions – UCS 3.0
Diastolic blood pressure (sample)

Testing values only, not final assumptions

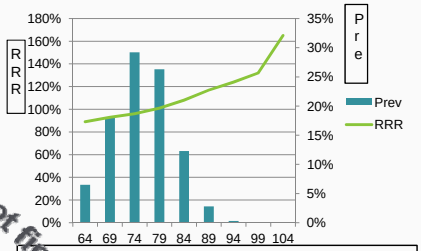
1. Blood pressure diastolic - Untreated

Table ranges		Min Value	60	65	70	75	80	85	90	95	100
		Max Value	64	69	74	79	84	89	94	99	104
Table values		Key	64	69	74	79	84	89	94	99	104
Range	RRR	98.6%	89%	93%	96%	101%	108%	117%	124%	132%	165%
	Prev	95.5%	6.5%	18.0%	29.2%	26.3%	12.3%	2.8%	0.3%	0.4%	0.0%
Cumulative	RRR		89.0%	91.9%	94.1%	96.4%	97.9%	98.5%	98.6%	98.6%	98.6%
	Prev		6.5%	24.5%	53.7%	80.0%	92.3%	95.1%	95.4%	95.5%	95.5%

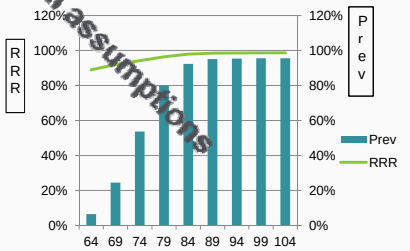
2. Blood pressure diastolic - Treated

Table ranges		Min Value	60	65	70	75	80	85	90	95	100
		Max Value	64	69	74	79	84	89	94	99	104
Table values		Key	64	69	74	79	84	89	94	99	104
Range	RRR	129.3%	120%	123%	126%	129%	135%	143%	148%	153%	186%
	Prev	4.5%	0.1%	0.6%	1.2%	1.4%	0.8%	0.2%	0.0%	0.0%	0.0%
Cumulative	RRR		120.0%	122.4%	124.7%	126.6%	128.2%	129.0%	129.1%	129.2%	129.3%
	Prev		0.1%	0.7%	1.9%	3.4%	4.2%	4.4%	4.5%	4.5%	4.5%

Diastolic blood pressure (untreated) - **range** values



Diastolic blood pressure (untreated) - **cumulative** values



Assumptions – UCS 3.0
Build (sample)

Testing values only, not final assumptions

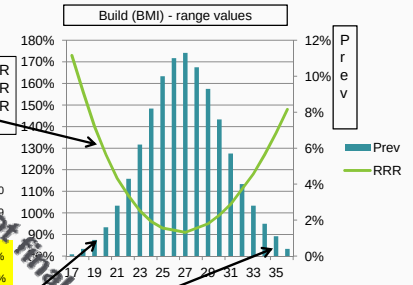
J/U curve assumption

5. Build - BMI

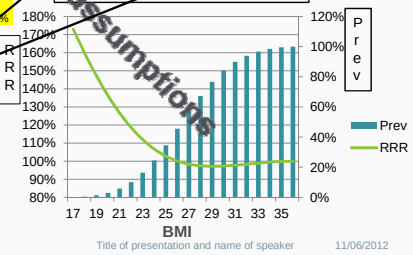
Table ranges		Min Value	16.0	17.0	18.0	19.0	24.0	25.0	26.0	27.0	28.0
		Max Value	16.9	17.9	18.9	19.9	24.9	25.9	26.9	27.9	29.9
Table values											
Range	RRR	100.0%	173%	156%	140%	127%	93%	92%	91%	93%	95%
	Prev	100.0%	0.1%	0.4%	0.9%	1.6%	10.0%	11.0%	11.3%	10.5%	9.3%
Cumulative	RRR		173%	159%	147%	136%	103%	100%	98%	97%	97%
	Prev		0.1%	0.5%	1.4%	3.0%	34.5%	45.5%	56.8%	67.3%	76.6%

Prevalence – standard issues only, substandard have been eliminated by underwriting process

Build (BMI) - range values



Build (BMI) - cumulative values



Assumptions – UCS 3.0
Build – full table

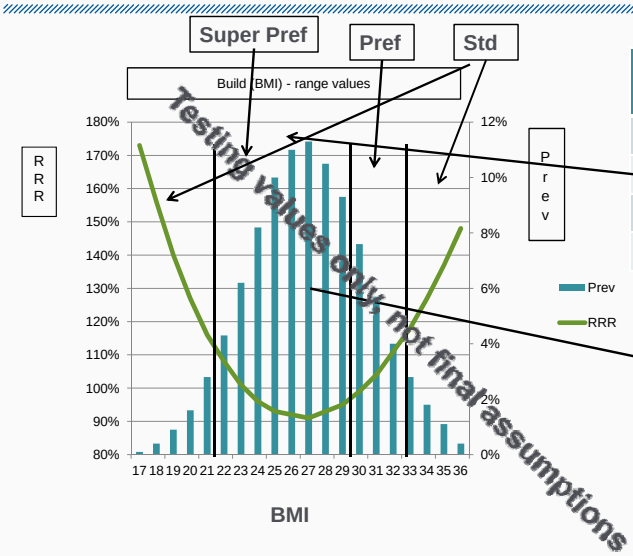
Testing values only not final assumptions

5. Build - BMI

Table ranges	Min Value		16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0
	Max Value		16.9	17.9	18.9	19.9	20.9	21.9	22.9	23.9	24.9	25.9	26.9	27.9	28.9	29.9	30.9	31.9	32.9	33.9	34.9	35.9
Table values	Key		*169*	*179*	*189*	*199*	*209*	*219*	*229*	*239*	*249*	*259*	*269*	*279*	*289*	*299*	*309*	*319*	*329*	*339*	*349*	*359*
Range	RRR	100.0%	173%	156%	140%	127%	116%	108%	101%	96%	93%	92%	91%	93%	95%	99%	104%	111%	118%	127%	137%	148%
	Prev	100.0%	0.1%	0.4%	0.9%	1.6%	2.8%	4.3%	6.2%	8.2%	10.0%	11.0%	[illegible]	10.5%	9.3%	7.6%	5.7%	4.0%	2.8%	1.8%	1.1%	0.4%
Cumulative	RRR		173%	159%	147%	136%	127%	119%	112%	107%	103%	100%	98%	[illegible]	97%	97%	98%	98%	99%	99%	100%	100%
	Prev		0.1%	0.5%	1.4%	3.0%	5.8%	10.1%	16.3%	24.5%	34.5%	45.5%	56.8%	67.3%	76.6%	84.2%	89.9%	93.9%	96.7%	98.5%	99.6%	100.0%

Calculation
Build – Knock-out

Testing values only not final assumptions



Risk class	Min value	Max value
3	16.0	21.9
1	22.0	29.9
2	30.0	32.9
3	33.0	35.9

Risk class	RRR	Prev
3	119%	10.1%
1	94%	74.1%
2	109%	12.5%
3	133%	3.3%

	RRR	Prev
1	94%	74.1%
2	109%	12.5%
3	122%	13.4%

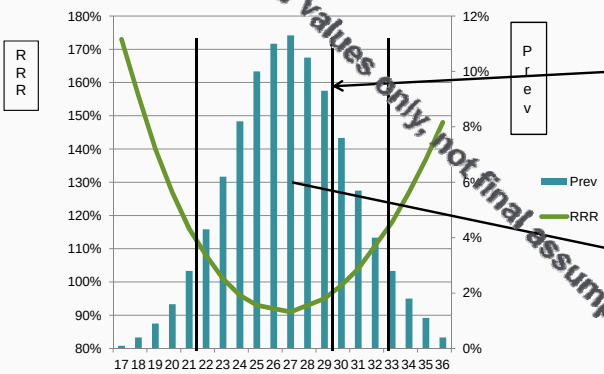
Calculation
Build

Munich RE

Debit-credit calculation

Testing values only, not final assumptions

Build - range values



BMI

KO and DC calculations are exactly the same

DC pts	Min value	Max value
7	16.0	21.9
0	22.0	29.9
2	30.0	32.9
7	33.0	35.9

DC pts	RRR	Prev
7	119%	10.1%
0	94%	74.1%
2	109%	12.5%
7	133%	3.3%

	RRR	Prev
0	94%	74.1%
2	109%	12.5%
7	122%	13.4%

Calculation – combining criteria
Knock-out

Munich RE

Build

Risk Class	RRR	Prev
1	94%	74.1%
2	109%	12.5%
3	122%	13.4%

Diastolic BP

Risk Class	RRR	Prev
1	90%	60.0%
2	105%	30.0%
3	145%	10.0%

Assumes independence

Risk Class Build	DBP	RC	Prev Build	DBP	Final		RRR Build	DBP	Final
1	1	1	74.1%	60.0%	44.5%		94.4%	90.0%	85.0%
1	2	2	74.1%	30.0%	22.2%		94.4%	105.0%	99.1%
1	3	3	74.1%	10.0%	7.4%		94.4%	145.0%	136.9%
2	1	2	12.5%	x 60.0%	= 7.5%		109.4%	x 90.0%	= 98.4%
2	2	2	12.5%	30.0%	3.8%		109.4%	105.0%	114.8%
2	3	3	12.5%	10.0%	1.3%		109.4%	145.0%	158.6%
3	1	3	13.4%	60.0%	8.0%		122.1%	90.0%	109.9%
3	2	3	13.4%	30.0%	4.0%		122.1%	105.0%	128.2%
3	3	3	13.4%	10.0%	1.3%		122.1%	145.0%	177.1%

sum

sumproduct

RC	Prev	RRR
1	44.5%	85.0%
2	33.5%	100.7%
3	22.1%	129.2%

Calculation – combining criteria

Debit - credit

Munich RE

Build

DC Pts	RRR	Prev
0	94%	74.1%
2	109%	12.5%
7	122%	13.4%

Diastolic BP

DC Pts	RRR	Prev
0	90%	60.0%
1	105%	30.0%
8	145%	10.0%

Assumes independence

DC Points			Prev				RRR			
Build	DBP	Pts	Build	DBP		Final	Build	DBP		Final
0	0	0	74.1%	60.0%		44.5%	94.4%	90.0%		85.0%
0	1	1	74.1%	30.0%		22.2%	94.4%	105.0%		99.1%
0	8	8	74.1%	10.0%		7.4%	94.4%	145.0%		136.9%
2	0	2	12.5%	60.0%	=	7.5%	109.4%	90.0%	=	98.4%
2	1	3	12.5%	30.0%		3.8%	109.4%	105.0%		114.8%
2	8	10	12.5%	10.0%		1.3%	109.4%	145.0%		158.6%
7	0	7	13.4%	60.0%		8.0%	122.1%	90.0%		109.9%
7	1	8	13.4%	30.0%		4.0%	122.1%	105.0%		128.2%
7	8	15	13.4%	10.0%		1.3%	122.1%	145.0%		177.1%

Only difference is "+", instead of "greatest of"

sum

sumproduct

DC Pts	Prev	RRR
0	44.5%	85.0%
1	22.2%	99.1%
2	7.5%	98.4%
3	3.8%	114.8%
7	8.0%	109.9%
8	11.4%	133.9%
15	1.3%	177.1%

Converting D/C to risk class

Munich RE

Debit Credit Point Qualifications for non-tobacco risks			
	Non-tobacco		
Risk Class #		Min DC Pts	Max DC Pts
1	Super Pref	0	0
2	Pref +	1	2
3	Pref	3	8
4	Std	9	15

This box defines the D/C structure of a company's program. It would be inserted in the "Input" worksheets.

DC Pts	Prev	RRR	Risk class
0	44.5%	85.0%	1
1	22.2%	99.1%	2
2	7.5%	98.4%	2
3	3.8%	114.8%	3
7	8.0%	109.9%	3
8	11.4%	133.9%	3
15	1.3%	177.1%	4

RC	Prev	RRR
1	44.5%	85.0%
2	29.7%	99.0%
3	23.2%	122.5%
4	1.3%	177.1%

From prior slide

Time to get excited

Highlights of version 3.0

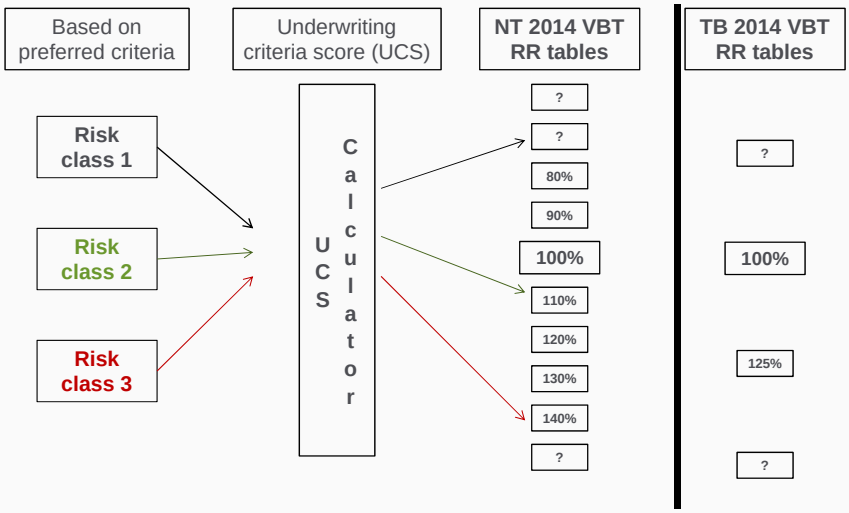
- More experience based assumptions (special thanks to drug lab and a few insurers)
  - Ability to recognize J/U curve assumptions where appropriate
  - Ability to recognize min/max criteria definitions
- Improved knock-out vs. debit-credit logic
- Flexible criteria definitions by age range
- Improved recognition of various criteria definitions

But there's more

- . Not a pricing tool
  - Not intended to be a pricing tool
  - No assumption granularity by gender, smoking status, issue age
  - More granular assumptions would have greater "correlations" among criteria
- Excel only tool
  - ".xls" version (as opposed to ".xlsx")
  - No macros
  - SOA requirements
- Committee still has a few open issues
  - Agreeing upon assumptions
  - Reflect TB definition
  - Company specific definition of "standard"
  - Input/output structures
- The standard disclaimer
  - UCS 3.0 is a work in progress
  - Nothing has been approved by anyone

2014 VBT table calculation structure

So how is the RRR going to be used????



Thanks to:
Underwriting Criteria Team members

Jaron Arboleda (MIB representative)
Jean-Marc Fix (actuary)
Dieter Gaubatz – chair (actuary)
Kim Genik (underwriter)
Anna Hart (underwriter)
Carl Holowaty (MD)
Doug Ingle (underwriter)
Al Klein (actuary)
Peter Komsthoeft (underwriter)
Ev Kunzelman (underwriter)
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