



Decision Analytic Products in US Life Insurance Underwriting

Thomas Ashley, MD, FACP
Vice President and Chief Medical Director

Decision Analytics Products



Industry Lab Vendors

- CRL SmartScore, ExamOne Risk IQ
- Mine historical customer results of medical exam, blood, urine

BioSignia

- Synthesize results across many clinical literature studies into unified mortality risk equation

Deloitte

- Generate risk prediction from consumer behavior data



- Dataset of all lab customers who applied for insurance in past 15 years
- Many millions of records with height, weight, blood pressure plus results of blood and urine tests
- Social Security Death Master File to infer mortality outcome
- Construct integrated mortality risk prediction model

SmartScore and Risk IQ Differences



	Risk IQ	SmartScore
Method	<ul style="list-style-type: none">• Generalized linear model• Created synthetic variables such as ratio of test results• Excluded special selective tests	<ul style="list-style-type: none">• Univariate relationship for each test• Assigned relative risk along each curve• Adjusted for age/sex• Summed variables• Added score for special tests PSA, NT-proBNP, HCV
Output	<ul style="list-style-type: none">• Integer score, 0-99• Approximates %ile mortality risk by age/sex	<ul style="list-style-type: none">• Score normed to approximate credits (better than standard) or debits (substandard)
Explanation	<ul style="list-style-type: none">• Both vendors report subscores that estimate contribution of single tests to total score	



- Applicants only, no knowledge of underwriting result, medical history
- Model inaccurate to extent that lab data duplicates known medical risk (unless use model as substitute for other underwriting)
- SSDMF incomplete
- Thus, each algorithm would look different if derived from issued cases, adjusted for underwriting risk class, claims



- Mortality of unplaced cases is invisible
- Use SSDMF to infer deaths
- Comparison to in-force mortality experience

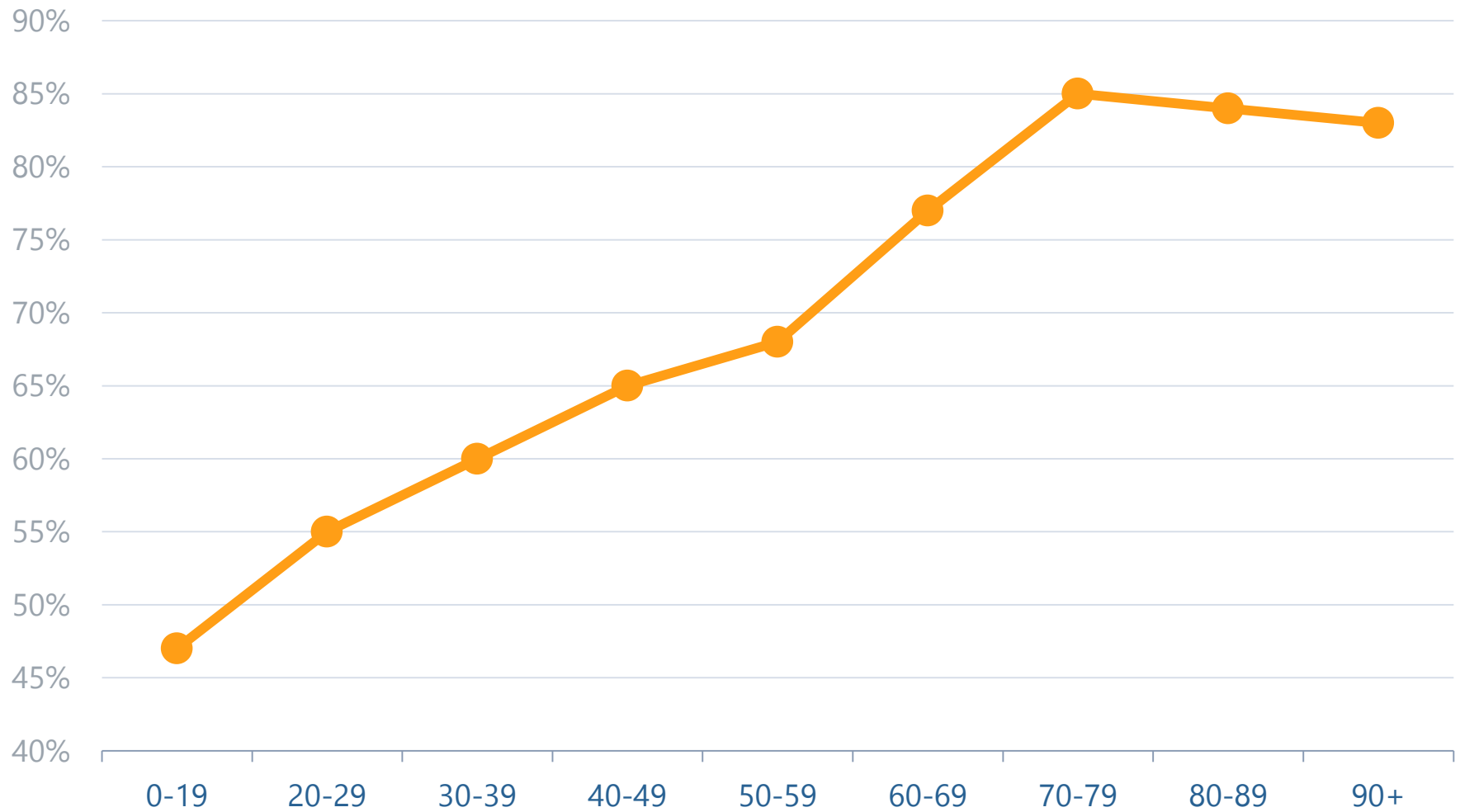
In-force	All deaths observed
Unplaced	Incomplete reporting, but by how much?

- Measure accuracy of SSDMF against Gen Re claims

SSDMF Accuracy



Age at Death





- Claim analysis allows us to adjust for undetected deaths in Facultative unplaced analysis
- Unclaimed property application of SSDMF
- Annuity surveillance



BioSignia

- Goal is to integrate typical preferred underwriting criteria (ht, wt, bp, family history, cholesterol, MVR, occupation)
- Appended select lab tests (glucose, liver enzymes)
- Meta-analysis: digest clinical literature to derive relationship between each parameter and mortality risk
- Synthesize results across many studies into unified mortality risk equation
- Output normed to approximate mortality % 2001VBT



- Deloitte Consulting
- Ignore conventional underwriting evidence
- Mine electronic databases of consumer history
 - Credit card purchases
 - Warranty registration
 - Survey responses
- Relate this profile to risk of disease and mortality
- Hundreds of parameters available for inclusion in model
- Construct unique model for each client company
 - Choice of parameters to include / exclude
 - Tune to customers of each company



Biomedical

- Multiple criteria for preferred considered separately distorts overall measure of risk
- Prediction from integrated model might outperform conventional underwriting of each variable separately
 - More efficient risk classification
 - Less overlap among risk classes
 - Recognition of interactions that represent different risk than sum of the parts

Deloitte

- Faster, cheaper, automated underwriting without need for blood, urine, exam



Industry Labs, BioSignia

- Demonstrate that score corresponds to mortality experience
- Industry labs
 - Published performance on own data
 - Unpublished trials for individual customers
- BioSignia
 - Obtained large experience study data with underwriting evidence





Deloitte

- Demonstrate that score corresponds to risk class assignment from existing underwriting process
- Replication of underwriting action immediate – no need for experience to develop or retrospective study

Conventional UW Class

	1	2	3
1	Yellow	Green	Green
2	Red	Yellow	Green
3	Red	Red	Yellow



- Hypothesis
 - Refine preferred / STD risk and reclassify more consistently
 - Qualify more applicants or adjust prices for risk classes
- Demonstrate efficacy
 - Direct company could implement it
 - Reinsurer could reflect it in pricing
 - Regulator / producer could accept it
- Lab vendors derived model from insurance applicants / SSDMF
- How does it perform on underwritten population?
- Single company study lacks power to measure low risk groups

Laboratory Mortality Risk Score Validation



- Goal**
- Measure performance of SmartScore and RiskIQ on issued policies

- Rationale**
- Risk score construction used applicants and SSDMF
 - Performance on issued lives and observed deaths will differ
 - Decision on effective use of a score needs inforce experience

- Process**
- Assemble underwriting evidence
 - Obtain RiskIQ and SmartScore
 - Assemble mortality experience
 - Compare mortality risk prediction to mortality experience

Study Population Statistics



Lives

1,211,741

Claims

2,348

Maximum Duration

8
Year

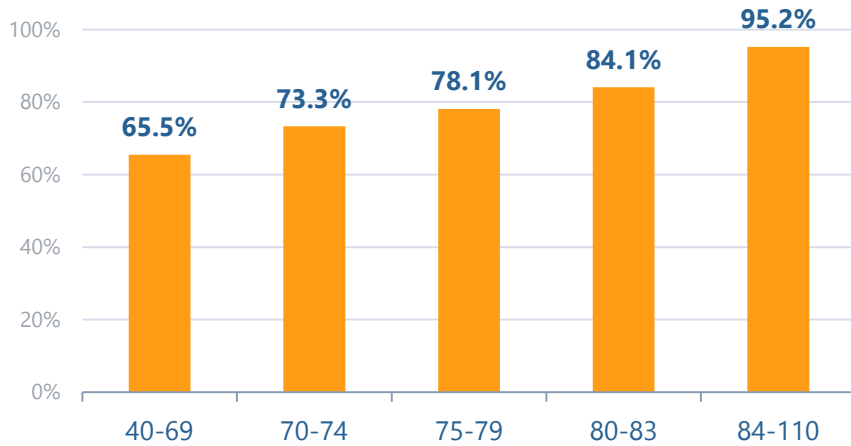
Average Duration

1.9
Year

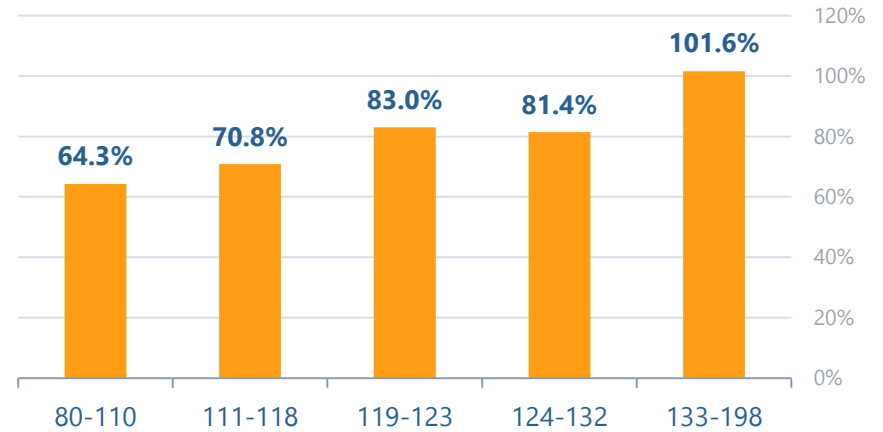
Conventional Underwriting Criteria



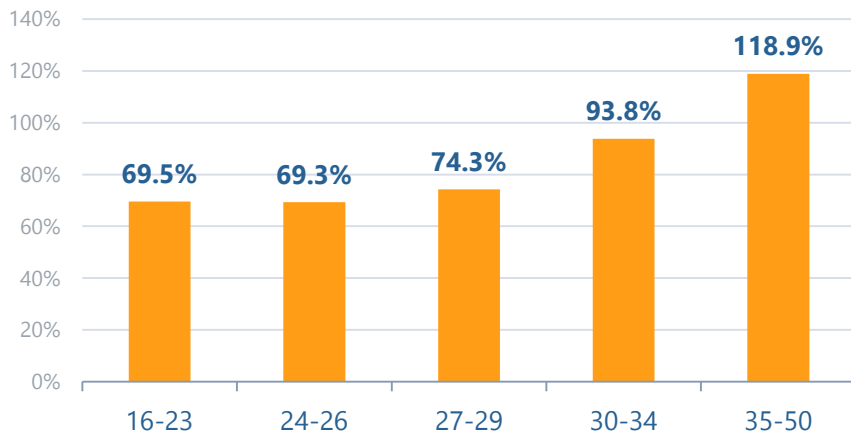
Diastolic Blood Pressure



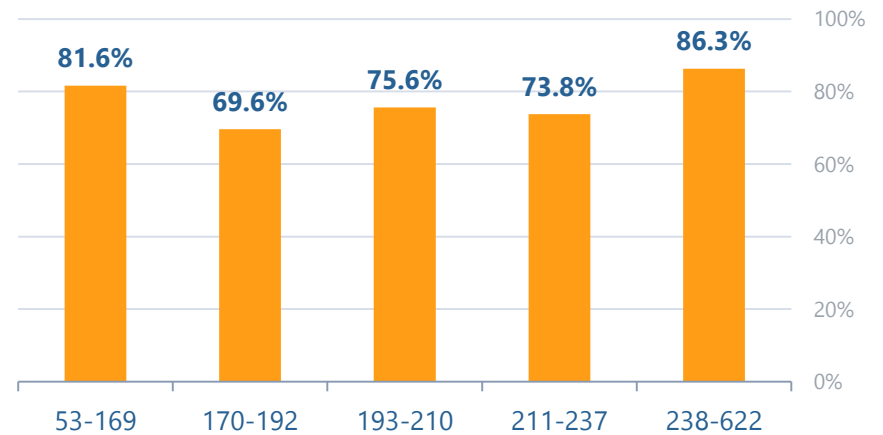
Systolic Blood Pressure



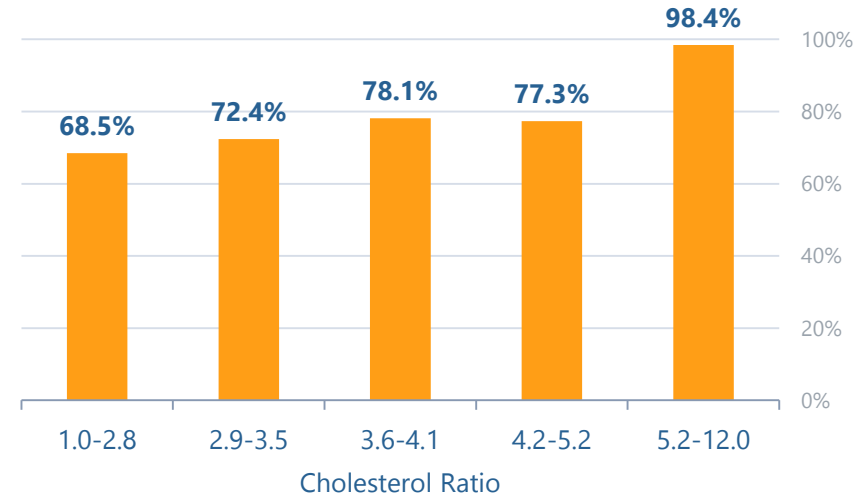
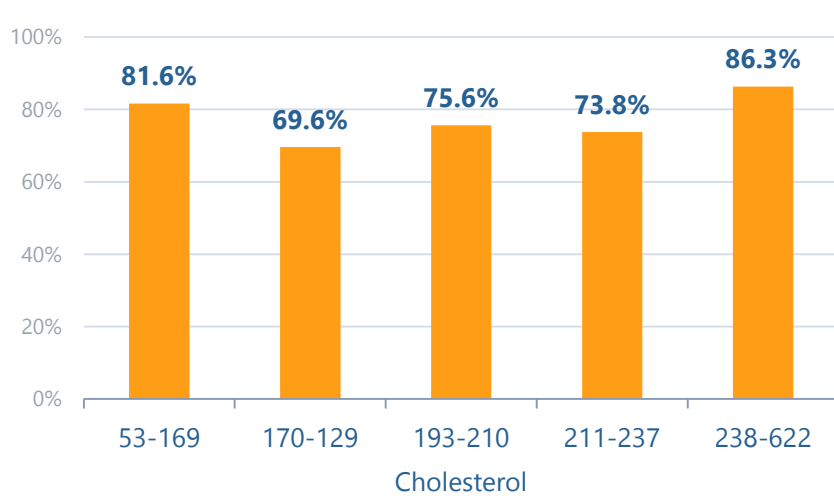
BMI



Cholesterol



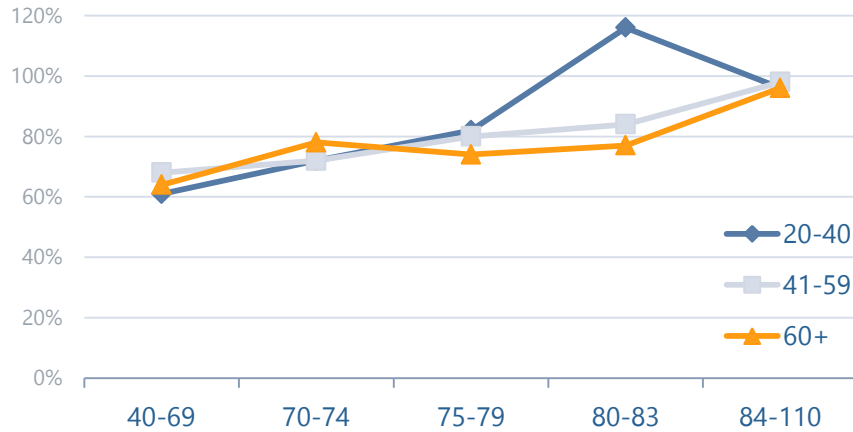
Cholesterol



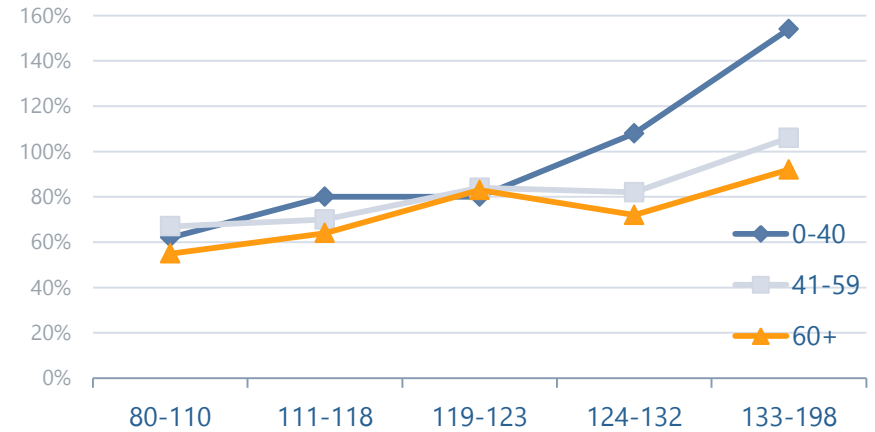
Age Bands



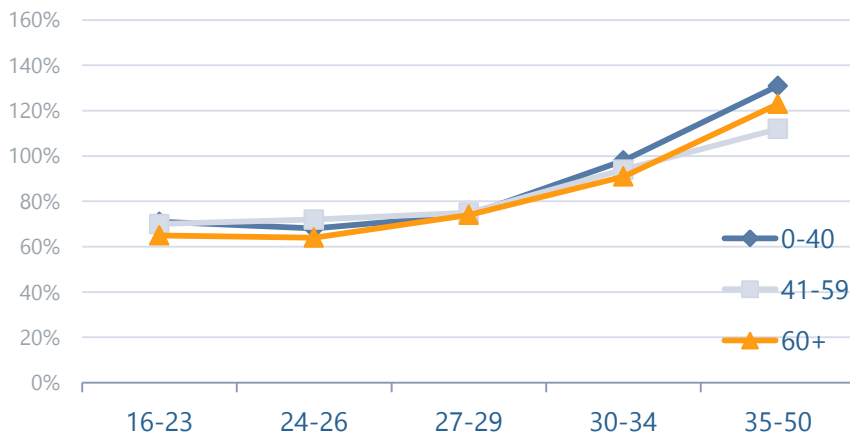
Diastolic Blood Pressure



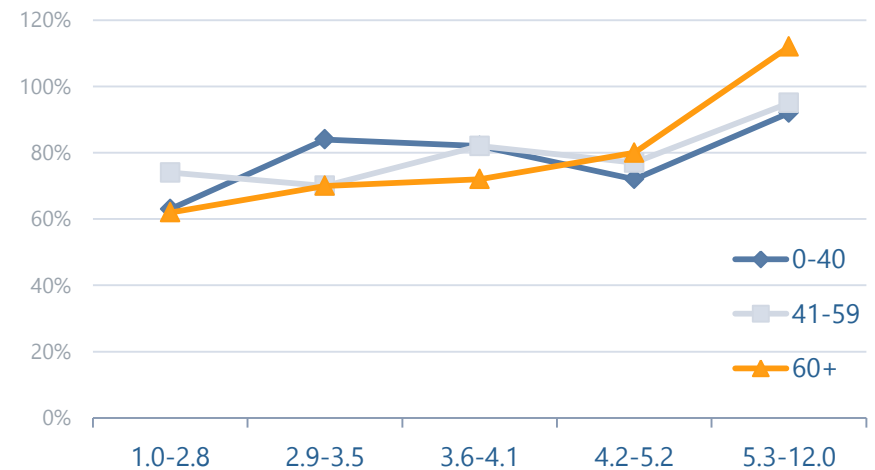
Systolic Blood Pressure



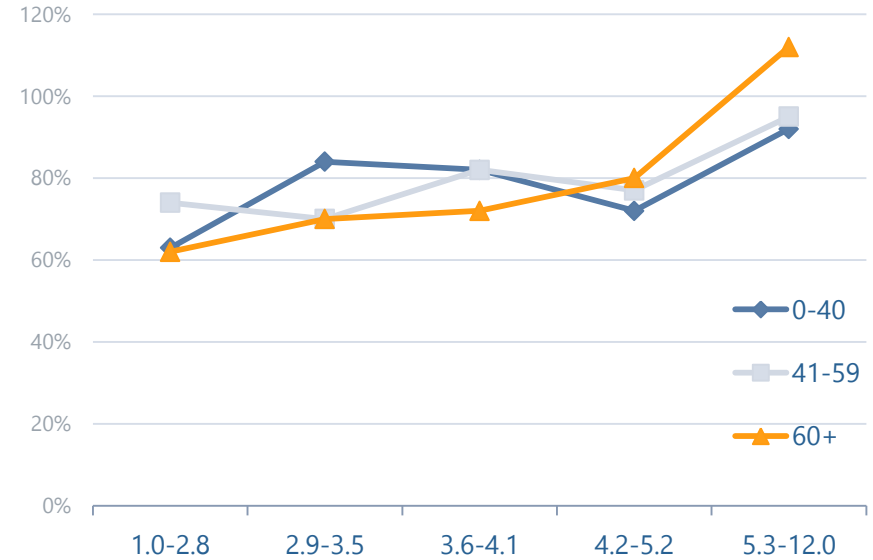
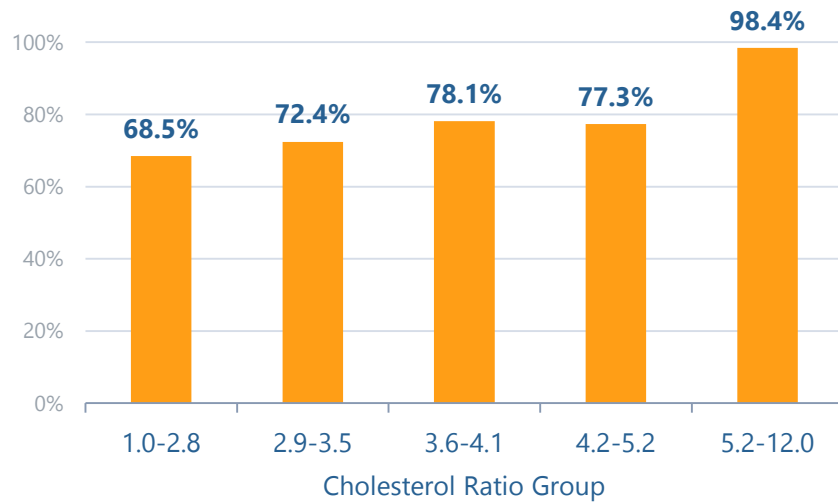
BMI



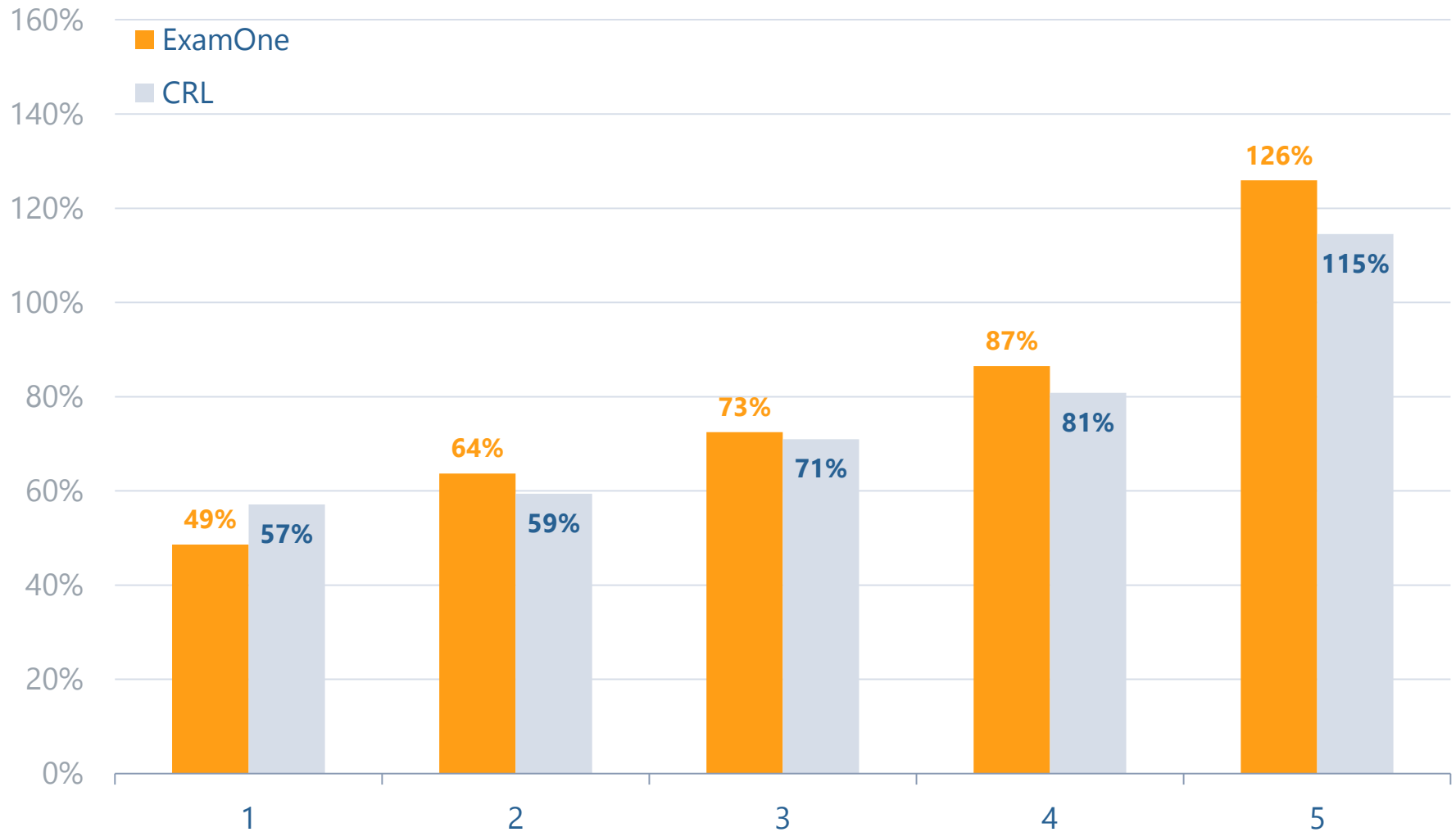
Cholesterol Ratio



Cholesterol Ratio Charts



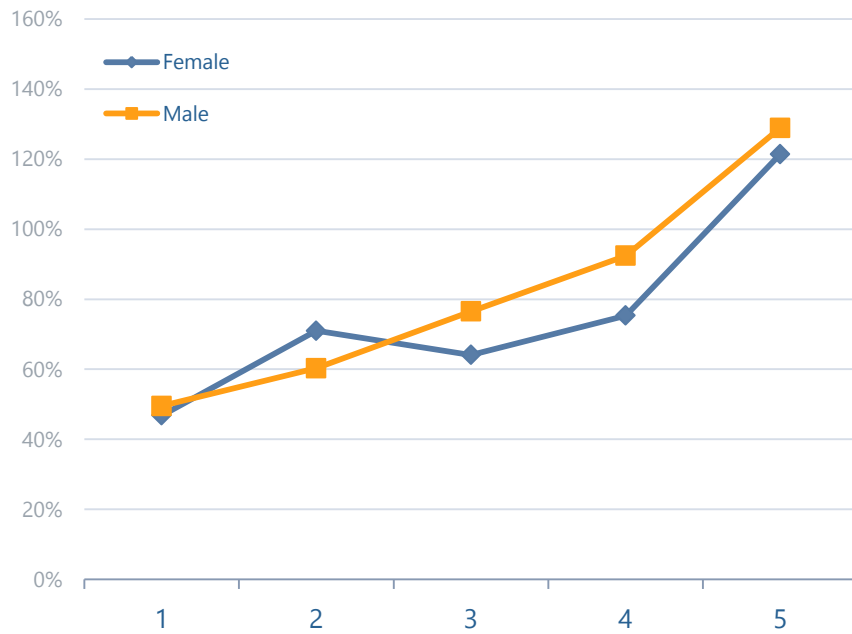
Lab Score Mortality Correlation



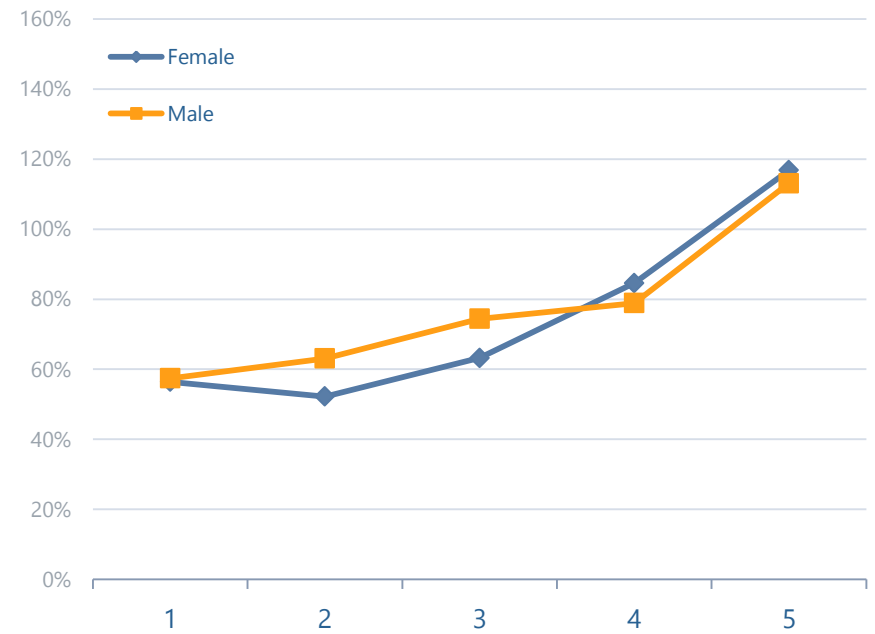
Comparison – Gender



ExamOne



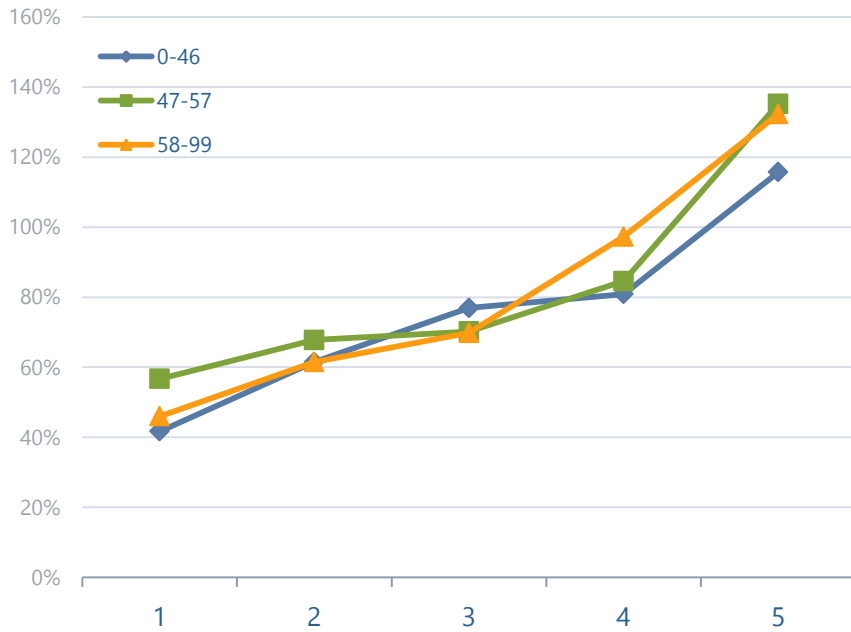
CRL



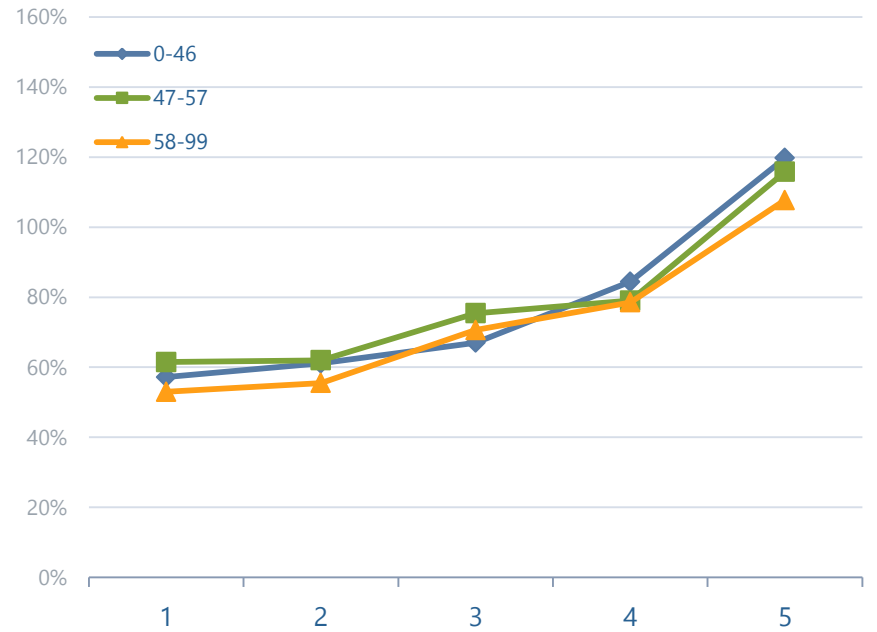
Comparison – Age



ExamOne



CRL





- Multivariate score superior to single criteria
- Risk IQ and SmartScore identify highest risk
- High mortality rate sufficient to see at individual company level
- Performance in low risk segments less striking but meaningful
- Additional analysis—for participants only
 - Greater detail, especially on low risk
 - Additional stratification by gender, tobacco, duration, underwriting risk class



Thank you

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