AI Enabled Next Generation LTC and Life Insurance Underwiring Using Facial Score Model

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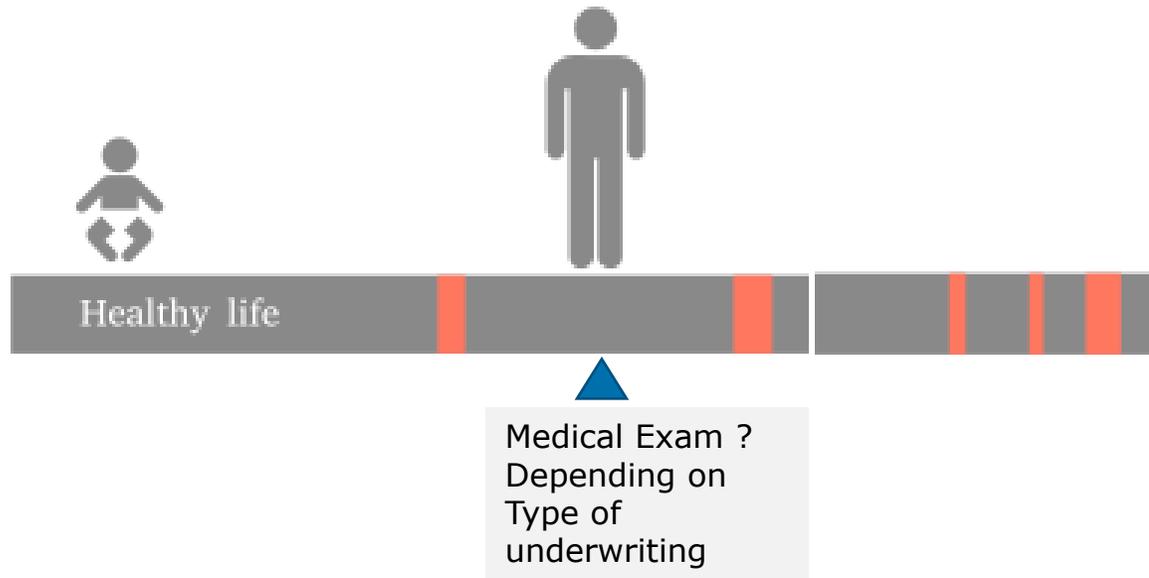Financial Services | Insurance | Transformation Consulting

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Agenda

1. Challenge

2. Computational Neuroscience Pathway to AI
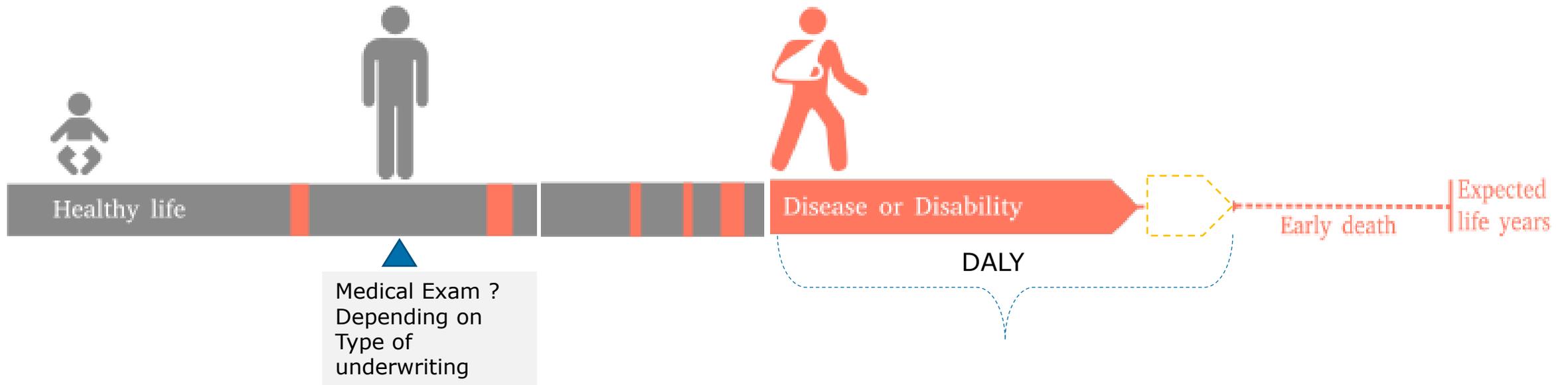
3. How it works ?

4.Way Forward

Some Insurance Contracts – Long Term

Healthy life

Medical Exam ?
Depending on
Type of
underwriting

Some Insurance Contracts – Long Term

Healthy life

Medical Exam ?
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Disease or Disability

Early death

Expected
life years

Some Insurance Contracts – Long Term

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Disease or Disability

DALY

Early death

Expected life years

Life Insurance: Underwriting assumption at the time of 'policy bind' are not revisited with insured
Long Term Care : Underwriting assumption and insured health disparity because of DALY
Health Insurance: Underwriting parameters / characteristics monitoring, and controls are essentials
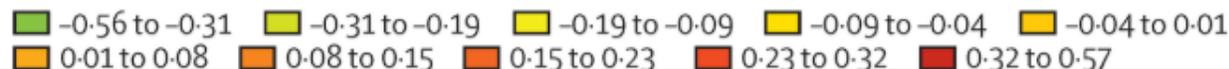**Supplemental:** Behavioural health , Mental Health Impact

Can AI –ML Help in Controls, Monitoring and Next Generation Underwriting?

Ref: Leading Ten Level 3 causes of global age-specific DALYs

	1	2	3	4	5	6	7	8	9	10
Early neonatal (0–6 days)	NN Preterm	NN Enceph	NN Sepsis	Congenital	Other NN	LRI	NN Haemol	STD	Diarrhoea	Meningitis
Late neonatal (7–27 days)	NN Sepsis	NN Preterm	NN Enceph	Congenital	LRI	Other NN	Diarrhoea	Meningitis	Malaria	NN Haemol
Post-neonatal (28–364 days)	LRI	Diarrhoea	Congenital	Malaria	PEM	Meningitis	HIV	Haemog	Iron	NN Preterm
1–4 years	Malaria	Diarrhoea	LRI	PEM	Iron	Congenital	Meningitis	Drowning	Skin	Haemog
5–9 years	Iron	Skin	LRI	Diarrhoea	Intest inf	Malaria	HIV	Asthma	Road injuries	Congenital
10–14 years	Iron	Skin	HIV	Conduct	Asthma	Road injuries	Anxiety	Intest inf	Migraine	Haemog
15–19 years	Road injuries	Skin	Depression	Iron	Back & neck	Self-harm	Migraine	Anxiety	Violence	HIV
20–24 years	Road injuries	Depression	Self-harm	Back & neck	Skin	Violence	HIV	Migraine	Iron	Other MSK
25–29 years	Road injuries	HIV	Back & neck	Depression	Self-harm	Migraine	Skin	Violence	TB	Drugs
30–34 years	HIV	Back & neck	Road injuries	Depression	Self-harm	Migraine	IHD	TB	Skin	Violence
35–39 years	HIV	Back & neck	Road injuries	Depression	IHD	Migraine	TB	Self-harm	Stroke	Other MSK
40–44 years	Back & neck	HIV	IHD	Road injuries	Depression	Stroke	Diabetes	Sense	TB	Migraine
45–49 years	IHD	Back & neck	Stroke	Diabetes	HIV	Depression	Road injuries	Sense	TB	Other MSK
50–54 years	IHD	Stroke	Back & neck	Diabetes	Sense	Depression	Lung C	COPD	Road injuries	TB
55–59 years	IHD	Stroke	Back & neck	Diabetes	Sense	COPD	Lung C	Depression	TB	CKD
60–64 years	IHD	Stroke	Diabetes	Back & neck	COPD	Sense	Lung C	CKD	LRI	Depression
65–69 years	IHD	Stroke	COPD	Diabetes	Sense	Back & neck	Lung C	CKD	LRI	Stomach C
70–74 years	IHD	Stroke	COPD	Sense	Diabetes	Back & neck	Lung C	LRI	Alzheimer's	CKD
75–79 years	IHD	Stroke	COPD	Sense	Diabetes	Alzheimer's	Back & neck	LRI	Lung C	CKD
≥80 years	IHD	Stroke	Alzheimer's	COPD	Sense	LRI	Diabetes	CKD	Back & neck	HTN HD

Rate of change 2005–15 (%)

- –0·56 to –0·31
- –0·31 to –0·19
- –0·19 to –0·09
- –0·09 to –0·04
- –0·04 to 0·01
- 0·01 to 0·08
- 0·08 to 0·15
- 0·15 to 0·23
- 0·23 to 0·32
- 0·32 to 0·57

Leading causes 1990	Leading causes 2005	% change, number of DALYs 1990–2005	% change, all-age DALY rate 1990–2005	% change, age-standardised DALY rate 1990–2005	Leading causes 2015	% change, number of DALYs 2005-15	% change, all-age DALY rate 2005-15	% change, age-standardised DALY rate 2005-15
1 Lower respiratory infection	1 Ischaemic heart disease	26·3	2·7	−12·2	1 Ischaemic heart disease	11·0	−1·8	−14·2
2 Neonatal preterm birth	2 Lower respiratory infection	−37·2	−49·0	−37·5	2 Cerebrovascular disease	0·1	−11·3	−22·2
3 Diarrhoeal diseases	3 Cerebrovascular disease	21·6	−1·0	−13·0	3 Lower respiratory infection	−23·8	−32·6	−31·0
4 Ischaemic heart disease	4 Neonatal preterm birth	−37·9	−49·4	−36·1	4 Low back and neck pain	18·6	4·9	−2·1
5 Cerebrovascular disease	5 HIV/AIDS	584·8	445·2	446·8	5 Neonatal preterm birth	−24·4	−33·1	−28·6
6 Neonatal encephalopathy	6 Diarrhoeal diseases	−37·3	−49·0	−39·3	6 Diarrhoeal diseases	−27·2	−35·7	−34·0
7 Malaria	7 Malaria	20·7	−1·4	18·3	7 Sense organ diseases	25·2	9·9	0·6
8 Measles	8 Low back and neck pain	34·5	9·4	−1·8	8 Neonatal encephalopathy	−14·6	−24·2	−19·2
9 Congenital anomalies	9 Neonatal encephalopathy	−2·4	−20·4	0·3	9 Road injuries	−6·5	−17·1	−17·6
10 COPD	10 Road injuries	11·8	−9·0	−7·9	10 HIV/AIDS	−32·6	−40·4	−40·3
11 Road injuries	11 COPD	−1·1	−19·6	−27·7	11 Diabetes	29·0	14·6	1·6
12 Low back and neck pain	12 Congenital anomalies	−13·1	−28·3	−13·4	12 COPD	0·1	−11·5	−22·1
13 Tuberculosis	13 Sense organ diseases	39·4	11·7	2·1	13 Congenital anomalies	1·3	−9·4	−5·5
14 Iron-deficiency anaemia	14 Iron-deficiency anaemia	13·8	−10·0	−1·3	14 Malaria	−38·3	−45·0	−43·1
15 Protein-energy malnutrition	15 Tuberculosis	−15·0	−30·5	−35·8	15 Depressive disorders	18·2	4·5	1·0
16 Sense organ diseases	16 Diabetes	65·1	34·4	18·3	16 Iron-deficiency anaemia	−3·3	−17·2	−11·3
17 Drowning	17 Depressive disorders	32·9	8·1	0·6	17 Skin diseases	12·3	−0·7	0·6
18 Meningitis	18 Skin diseases	22·7	−0·2	1·2	18 Tuberculosis	−19·0	−28·2	−32·4
19 Depressive disorders	19 Self-harm	14·8	−6·8	−10·9	19 Lung cancer	14·5	1·1	−11·3
20 Skin diseases	20 Lung cancer	31·7	7·4	−6·1	20 Chronic kidney disease	19·6	4·8	−3·0
21 Self-harm	21 Neonatal sepsis	7·0	−12·9	10·5	21 Self-harm	−4·4	−15·4	−17·0
22 Other neonatal	22 Chronic kidney disease	36·6	10·0	3·5	22 Other musculoskeletal	19·9	6·0	0·8
23 Asthma	23 Migraine	29·7	5·6	−0·3	23 Migraine	15·3	2·0	0·8
24 Diabetes	24 Meningitis	−23·9	−38·3	−26·8	24 Neonatal sepsis	−0·2	−11·7	−5·5
25 Neonatal sepsis	25 Other musculoskeletal	51·5	23·3	13·4	25 Asthma	−2·6	−13·9	−16·9
26 Tetanus	26 Asthma	−12·3	−28·7	−31·2	26 Falls	9·2	−3·3	−8·7
27 Lung cancer	27 Protein-energy malnutrition	−36·1	−48·0	−36·2	27 Meningitis	−10·6	−21·4	−17·8
28 Falls	28 Measles	−65·1	−71·8	−64·6	28 Anxiety disorders	14·8	1·5	1·0
29 Migraine	29 Drowning	−38·0	−49·6	−42·8	29 Alzheimer's disease	32·8	17·4	−3·4
30 Chronic kidney disease	30 Falls	6·0	−13·7	−15·4	30 Interpersonal violence	−5·9	−16·8	−16·1
31 Interpersonal violence	31 Other neonatal				31 Protein-energy malnutrition			
34 Other musculoskeletal	32 Interpersonal violence				34 Other neonatal			
37 Anxiety disorders	33 Anxiety disorders				35 Drowning			
42 HIV/AIDS	37 Alzheimer's disease				81 Measles			
49 Alzheimer's disease	72 Tetanus				100 Tetanus			

Communicable, maternal, neonatal, and nutritional
Non-communicable
Injuries

Ref: Lancet : Volume 388, Issue 10053, 8–14 October 2016, Pages 1603-1658
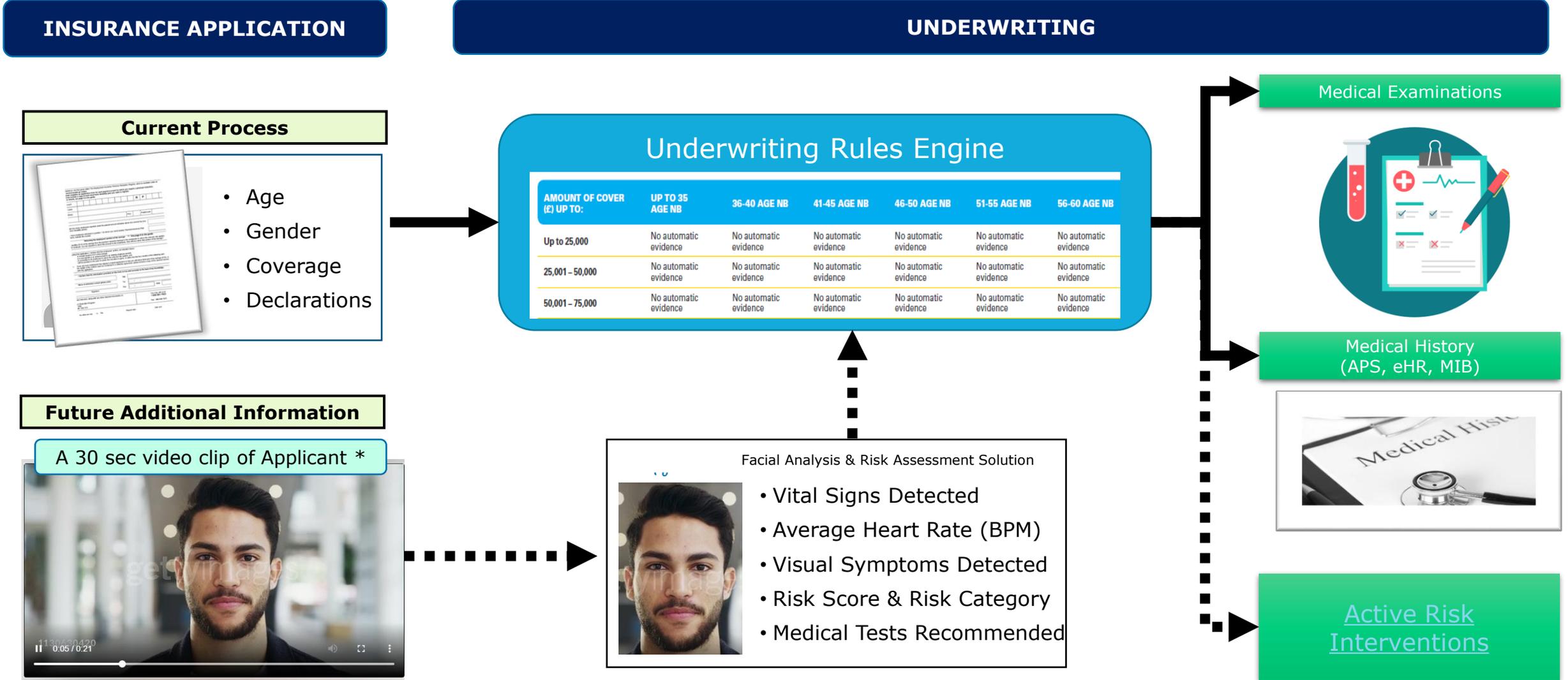
1. Challenge

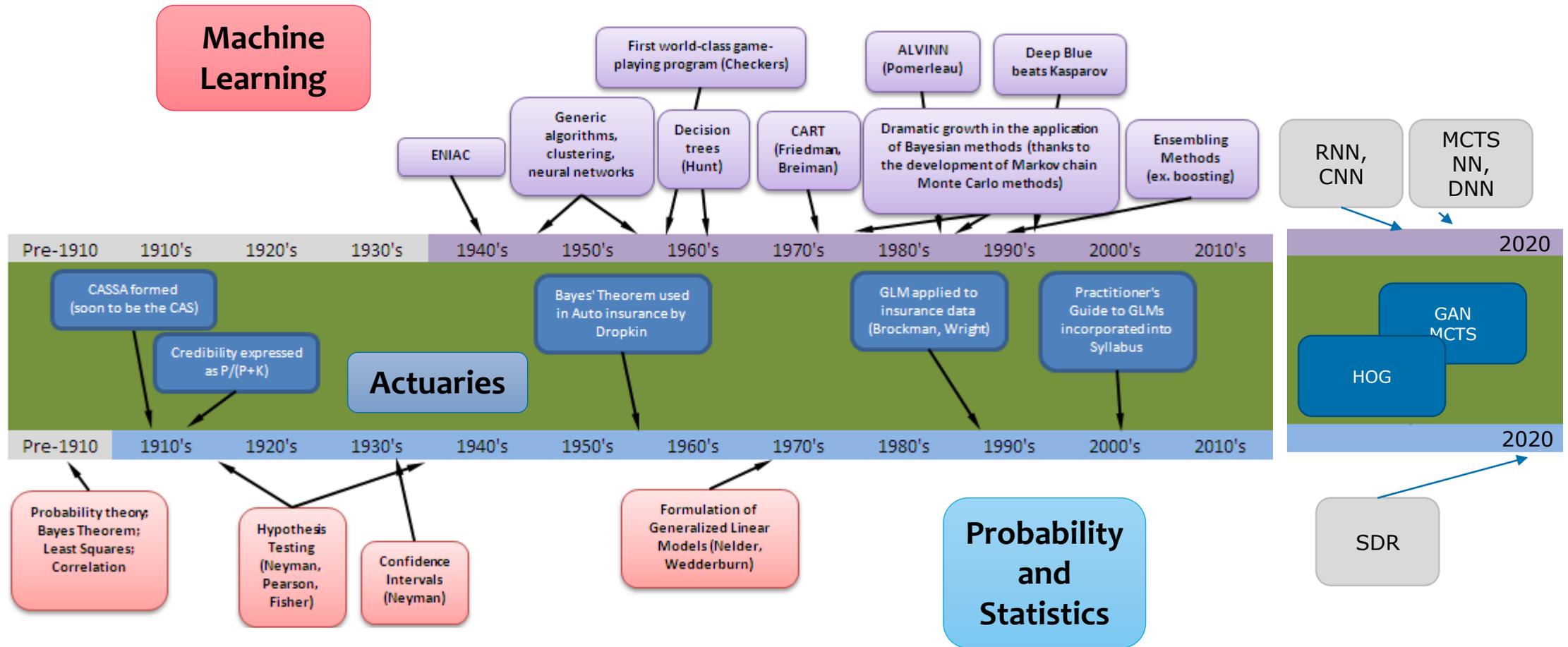2. Computational Neuroscience Pathway to AI

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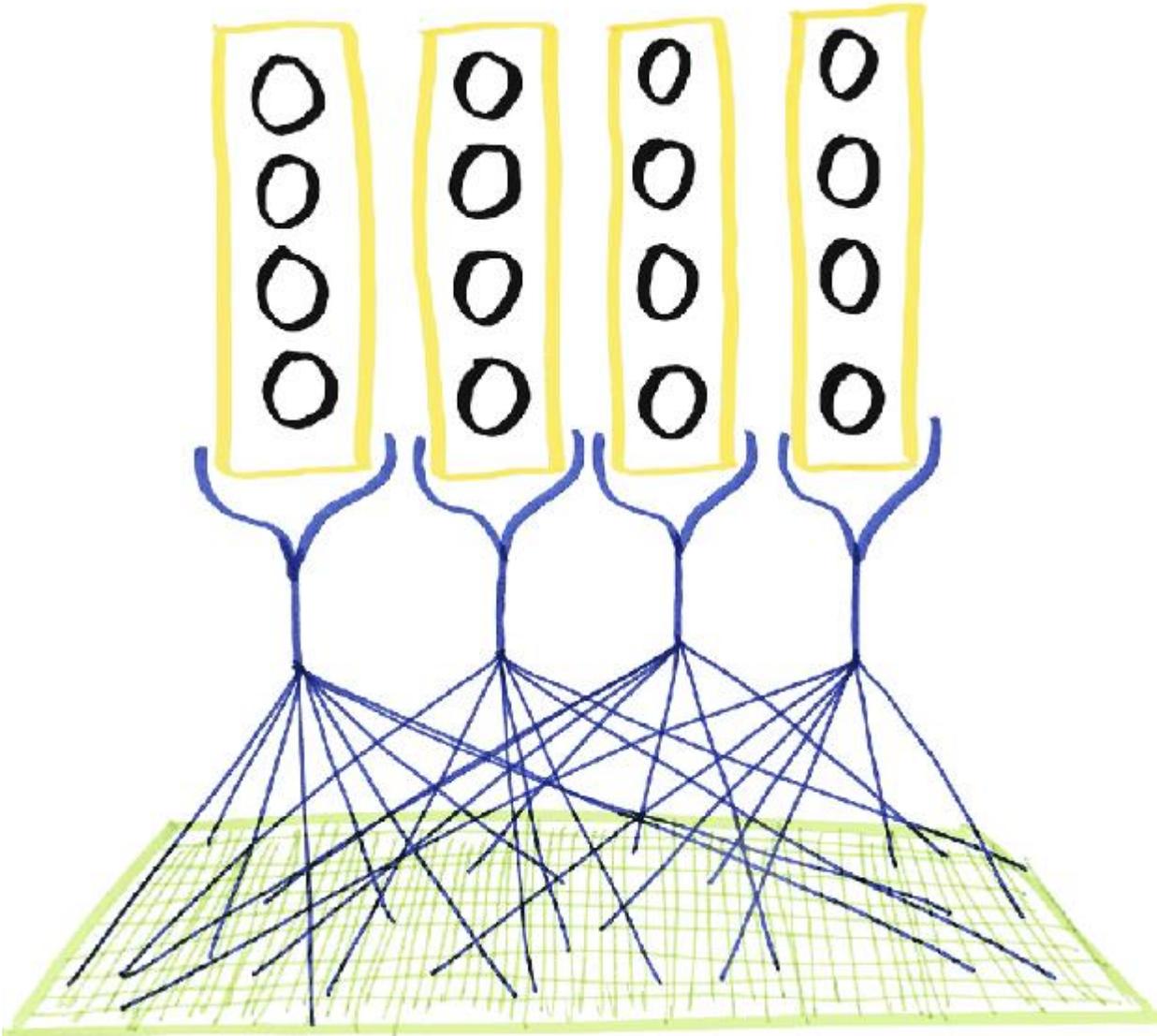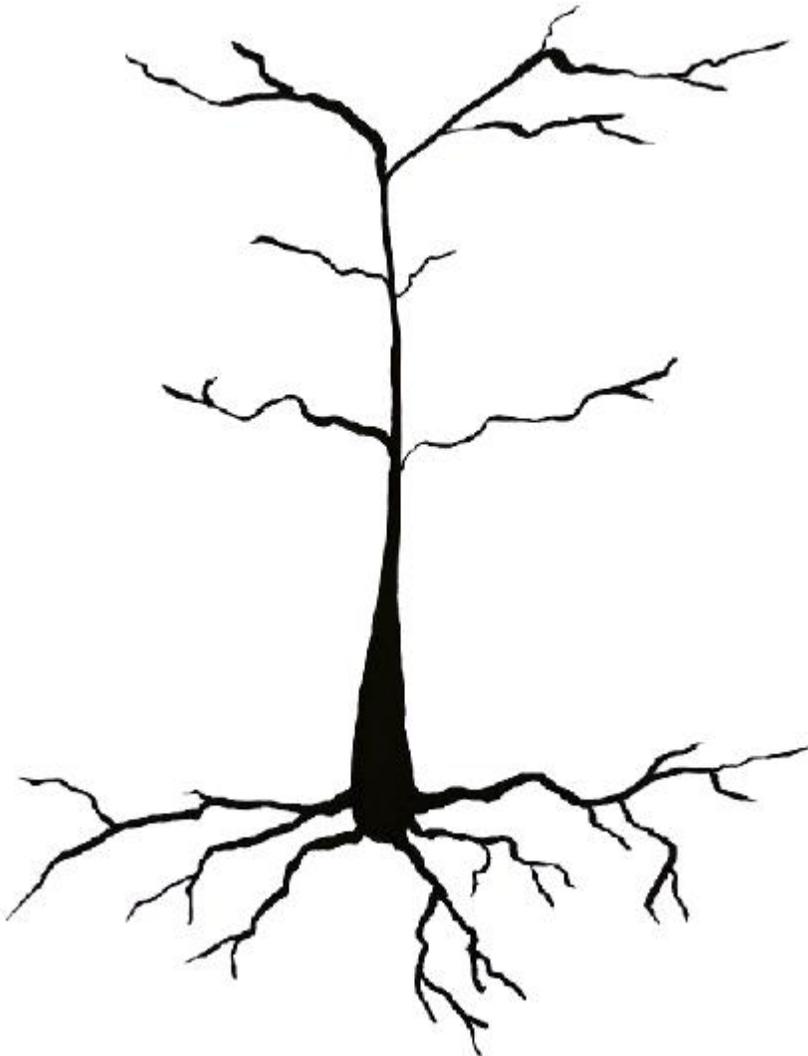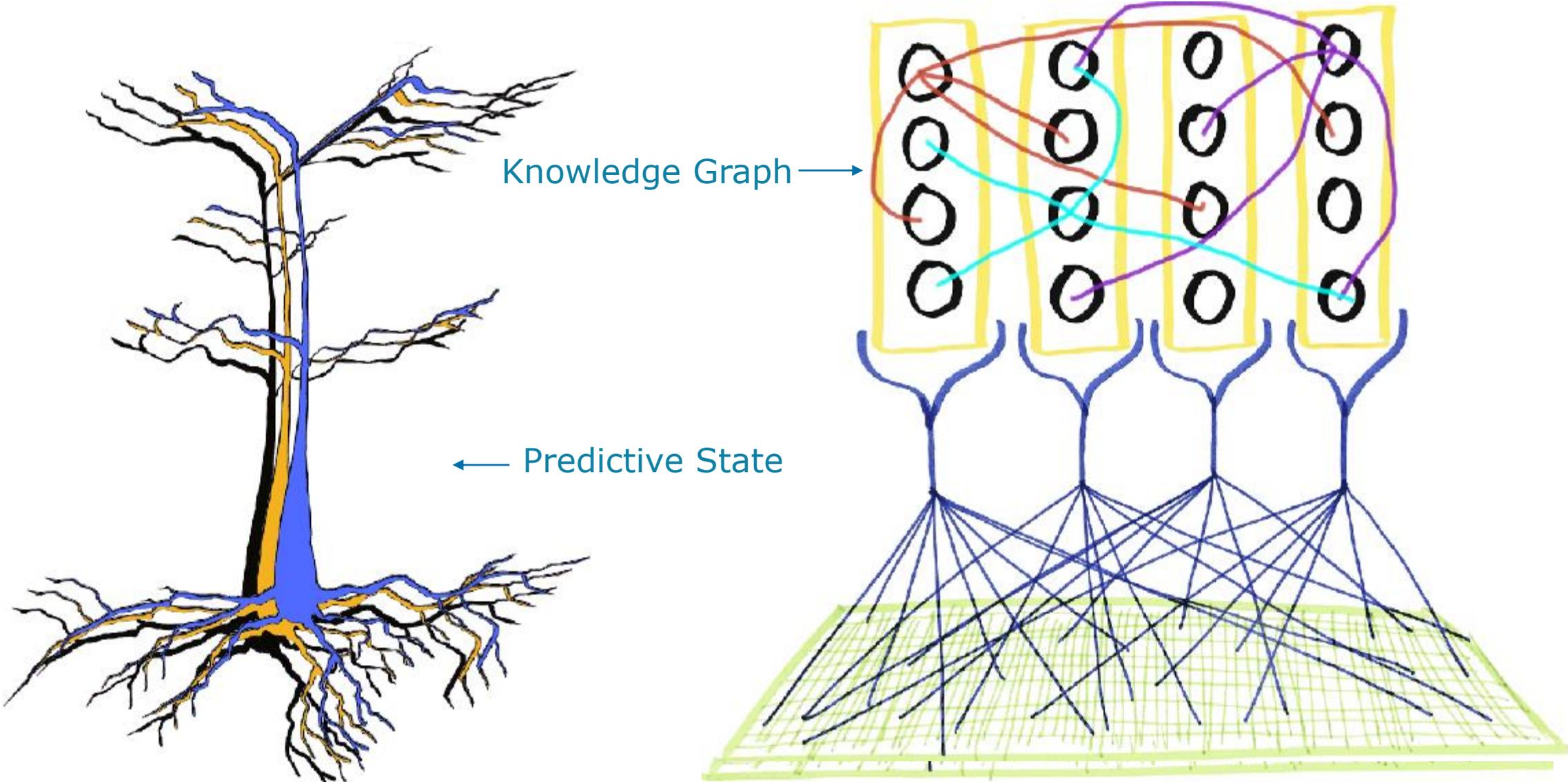# Next Generation Underwriting – Augmentation with Facial Score

Current Process

- Age
- Gender
- Coverage
- Declarations

Underwriting Rules Engine

AMOUNT OF COVER (£) UP TO:	UP TO 35 AGE NB	36-40 AGE NB	41-45 AGE NB	46-50 AGE NB	51-55 AGE NB	56-60 AGE NB
Up to 25,000	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence
25,001 – 50,000	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence
50,001 – 75,000	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence	No automatic evidence

Future Additional Information

A 30 sec video clip of Applicant *

Facial Analysis & Risk Assessment Solution

- Vital Signs Detected
- Average Heart Rate (BPM)
- Visual Symptoms Detected
- Risk Score & Risk Category
- Medical Tests Recommended

Medical Examinations

Medical History (APS, eHR, MIB)

Active Risk Interventions

Machine Learning and Insurance

Facial Features Correlations to Probable Health Conditions

Knowledge Graph

Predictive State

How This Works

The Fundamentals - Facial Analysis (Representative)

What can the human face say about the health of an individual

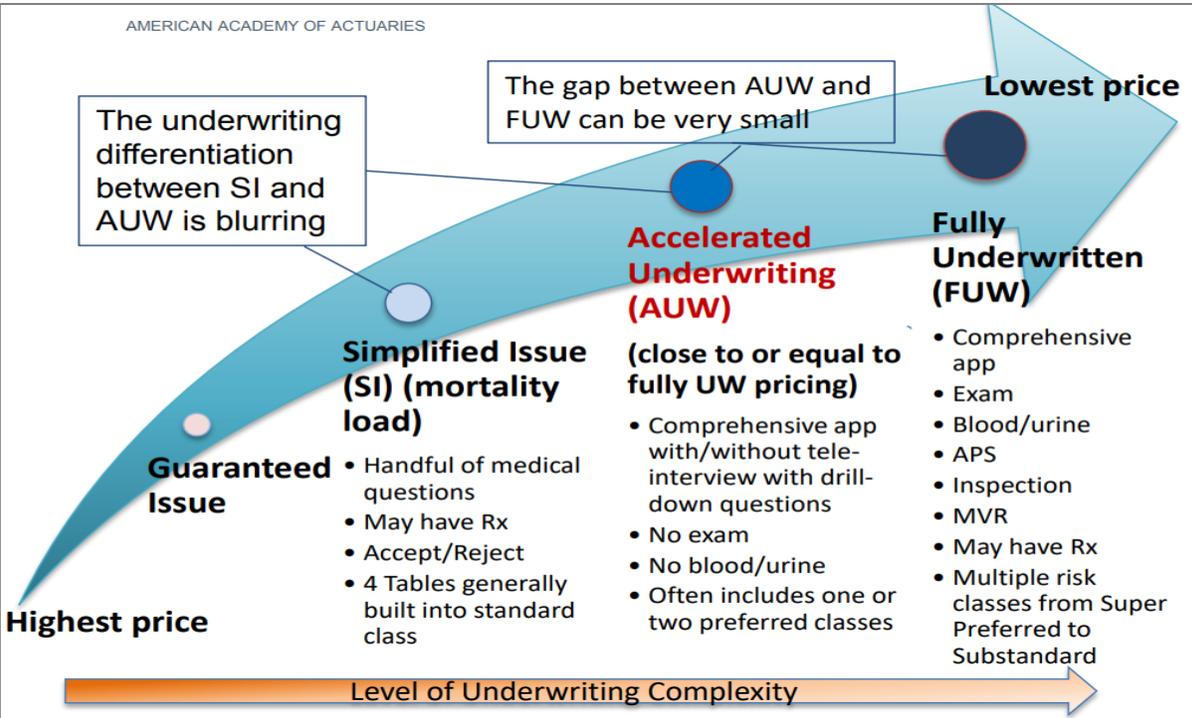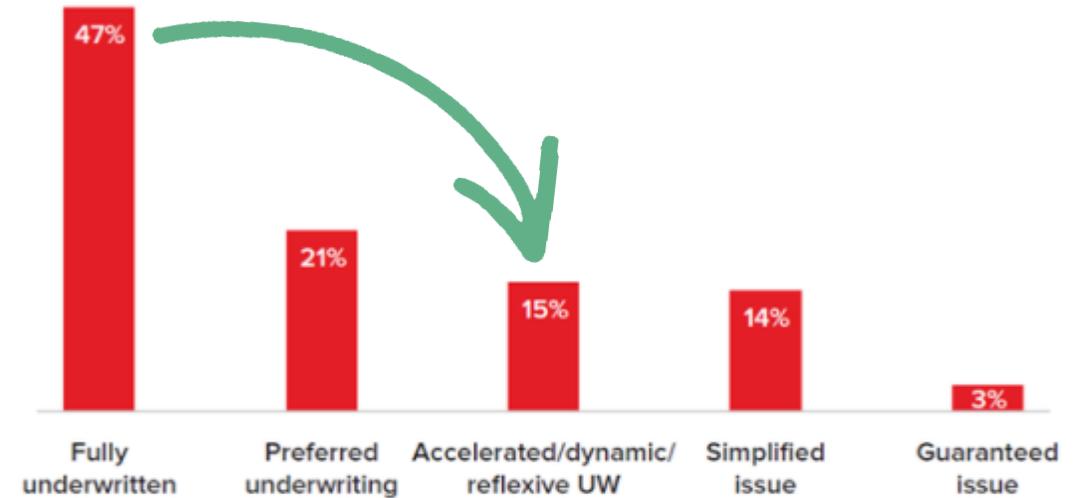| Visual Symptoms	Probable Conditions
Facial Morphology – Abnormal Characteristics	▪ Down syndrome ▪ Acromegaly ▪ Craniofacial deformations ▪ Fetal alcohol exposure ▪ Cornelia de Lange syndrome ▪ Cushing's Syndrome
Facial asymmetry	▪ Facial paralysis
Abnormal skin color	▪ Bronchial asthma
Yellowish face or eye color	▪ Hepatitis (Jaundice)
Abnormal Eye Movement Or Disturbances in Facial Expressions	▪ ADHD ▪ Dyslexia ▪ Parkinson ▪ Autism ▪ Schizophrenia
Abnormal Muscular Response	▪ Bell's palsy and facial paralysis
Abnormal Head Pose	▪ Pain

Market Trend in Life and Health Insurance

"Shift from Fully Underwritten to Accelerated Underwriting "

AMERICAN ACADEMY OF ACTUARIES

The underwriting differentiation between SI and AUW is blurring

The gap between AUW and FUW can be very small

Lowest price

Accelerated Underwritten (AUW)

Fully Underwritten (FUW)

Simplified Issue (SI) (mortality load)

(close to or equal to fully UW pricing)

- Comprehensive app
- Exam
- Blood/urine
- APS
- Inspection
- MVR
- May have Rx
- Multiple risk classes from Super Preferred to Substandard

- Comprehensive app with/without tele-interview with drill-down questions
- No exam
- No blood/urine
- Often includes one or two preferred classes

Guaranteed Issue

- Handful of medical questions
- May have Rx
- Accept/Reject
- 4 Tables generally built into standard class

Highest price

Level of Underwriting Complexity

Proportion of Business Revenue in 2018 by Underwriting Methods

47% — Fully underwritten
21% — Preferred underwriting
15% — Accelerated/dynamic/reflexive UW
14% — Simplified issue
3% — Guaranteed issue

RGA Global Life and Health Underwriting Survey - 2020

On a forward-looking basis, however, 65% of participants expect the percentage of new business that is fully underwritten to decrease over the next 3-5 years. Participants cited customer experience enhancement and the ability to increase use of predictive analytics as top factors driving the shift. Insurers are seeking alternative underwriting models that do not compromise mortality/morbidity outcomes. Rather than seeing fully underwritten approaches disappear, insurers are trying to replicate the same performance through alternative means, while achieving a better customer experience. For example, there is growing interest in the predictive power of credit data and digital health data.

https://www.rgare.com/knowledge-center/media/research/rga-global-life-and-health-underwriting-survey-entering-the-new-normal

Benefits

Enhance Customer Experience

Enhance customer experience by using simpler questions and faster processing. improve efficiency of the medical underwriting process

Reduce Cost

Reduce cost of fully underwritten policies by automating the derivation of key underwriting metrics

Active Risk Management

Provide an effective means to transition from **Passive** to **Active Risk Management** for the insured population

NextGen Business Model
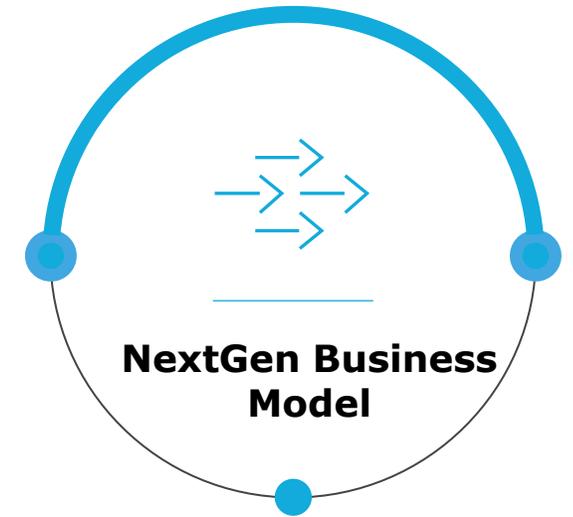
Build the foundations of the next generation **Business Model and Next Generation Underwrting**

The way forward

Biosensors * (Work in Progress)
- Biosensor inputs based vital signs

✓ **Audio Based Analysis**
- Cough Sound Analysis ,
- Sentiment Analysis to detect signs of depression

✓ **Video Based Analysis**
- Heart Rate
- Abnormal eye movement
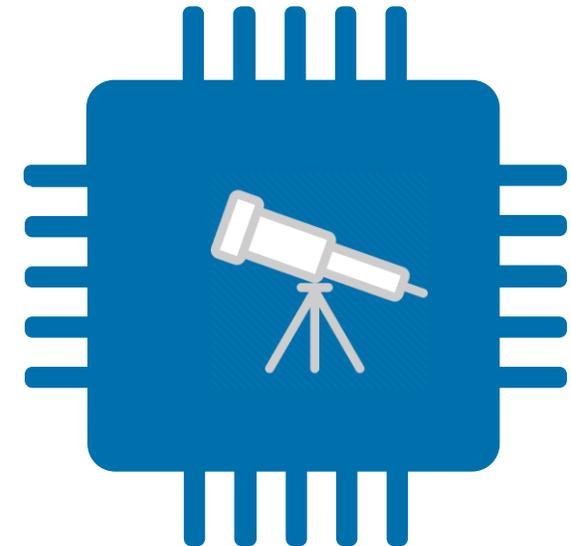- Disturbances in facial expressions indicative of ADHD, Parkinson's etc.

✓ **Image Based Analysis**
- Gender
- Jaundice/Hepatitis
- Facial Paralysis/Palsy
- Down's Syndrome

✓ **Integration & Compliance**
- Integration with existing UW systems
- HIPPA and GDPR compliance

Academic research ---in Uni

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People matter, results count.

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