



Medical advances and their impact on Life insurance

Dr Bill Monday- CMO Munich Re Australia
2016 SLF International HNW Wealth Forum, Sydney

1. Setting the scene
2. Screening
3. Diabetes
4. Cancer
5. Cardiology
6. Hepatitis
7. Conclusion

A long, long time ago.....

1983



1983

Discovery: First Disease Gene Mapped

A genetic marker for Huntington's disease is found on chromosome 4.

Crusader life in Johannesburg sell a "Dread disease" accelerator rider benefit to cover heart attack, cancer, stroke and CABG to maximum cover of the equivalent of \$30,000

- From diagnose and treat to predict and prevent. **Predictive Medicine**
- Lifestyle change, controlling risk factors, **wearable medical devices**
- Enhanced diagnostics and imaging
- Targeted therapy, polypills, vaccines, nanomedicine
- Genetics, genomics and **personalised medicine**
- **Big data**, electronic records, tele-medicine,
- Longevity, compression of ill health
- New surgical techniques (i.e Minimally invasive and Transcatheter surgery)
- Don't forget the old enemies still hiding in the wings-epidemics, emerging infectious diseases, **antibiotic resistance**

Interventional

- Bare metal stent
- Rotablation
- Clopidogrel/GPIIB
- IABP
- FFR
- IVUS
- **PFO/ASD closure**
- **Drug eluting stent**
- Stem cell therapy
- **Bioabsorbable stent**
- **TAVI**

Heart failure

- ICD
- **Beta-blocker therapy**
- Biventricular PM
- Biventricular ICD
- Aldosterone therapy
- Telemedicine
- **Takotsubo Cardiomyopathy**

Electrophysiology

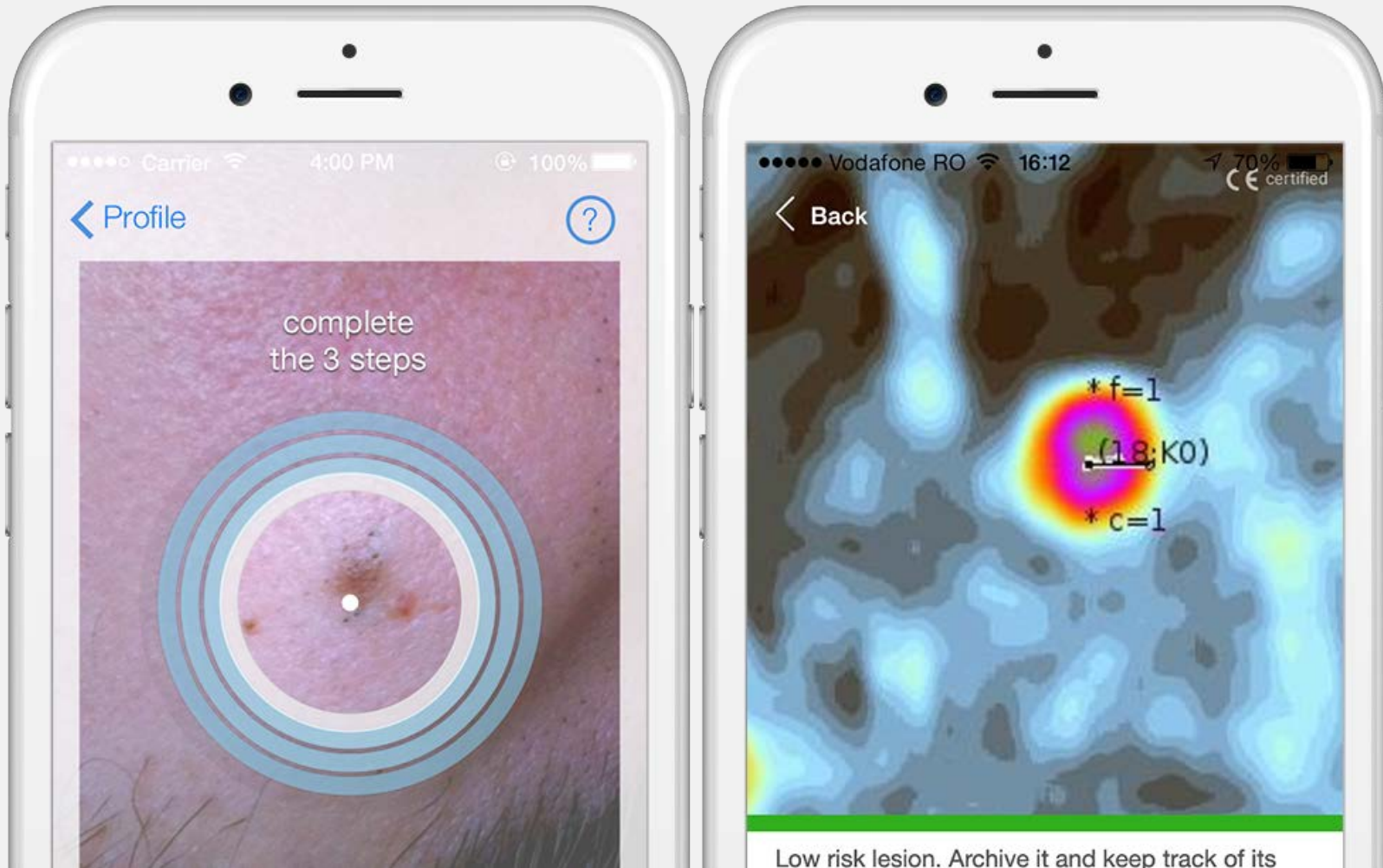
- ICD
- Mapping
- AVNRT ablation
- VT ablation
- Pulmonary vein isolation
- Genetic diagnosis of primary arrhythmias
- Subcutaneous ICD
- Dabigatran in AF

Imaging

- Cardiac ultrasound/TEE
- Stress echo
- Contrast echo
- 3D echo
- 3D TEE
- CT angiography
- Cardiac MRI

Screening is advancing...Here is an example

This app analyses your skin moles and tells you whether your mole is a low or high risk for cancer



Australia

2010 total population: 22 268 384

Income group: High

NCD mortality

2008 estimates	males	females
Total NCD deaths (000s)	63.4	63.2
NCD deaths under age 60 (percent of all NCD deaths)	13.4	9.2
<i>Age-standardized death rate per 100 000</i>		
All NCDs	364.8	246.3
Cancers	140.8	92.9
Chronic respiratory diseases	25.6	15.5
Cardiovascular diseases and diabetes	136.3	88.6

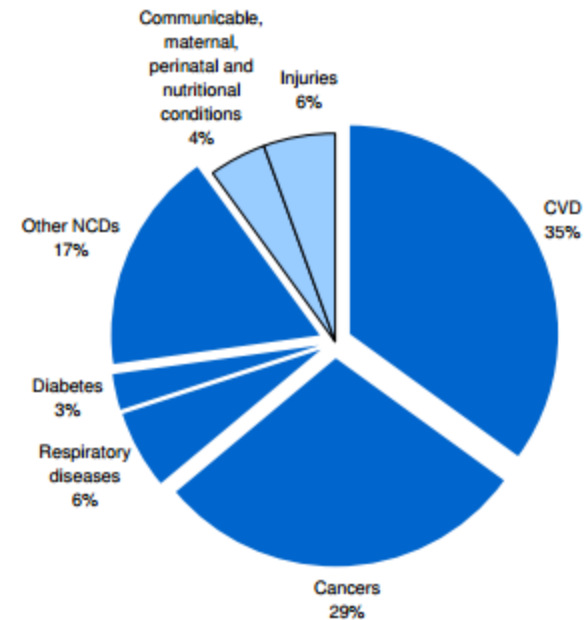
Behavioural risk factors

2008 estimated prevalence (%)	males	females	total
Current daily tobacco smoking	18.3	15.4	16.8
Physical inactivity	38.0	42.5	40.3

Metabolic risk factors

2008 estimated prevalence (%)	males	females	total
Raised blood pressure	41.1	32.0	36.4
Raised blood glucose	10.8	8.0	9.4
Overweight	68.2	59.3	63.7
Obesity	26.4	27.1	26.8
Raised cholesterol	55.9	58.9	57.4

Proportional mortality (% of total deaths, all ages)



NCDs are estimated to account for 90% of all deaths.

China

2010 total population: 1 341 335 152

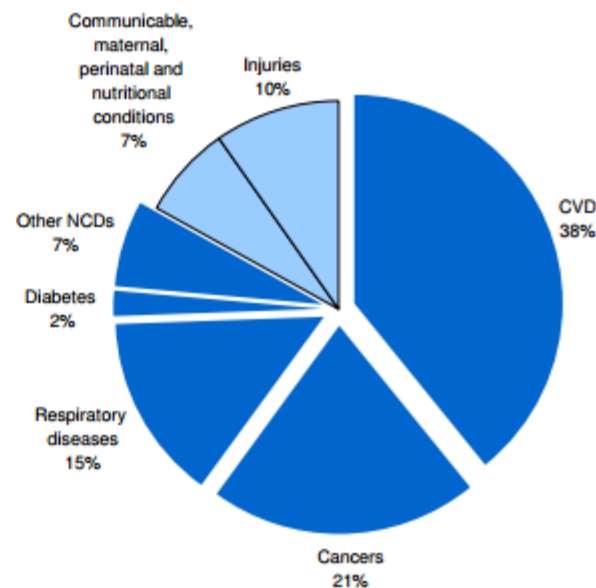
Income group: Lower middle

NCD mortality			
2008 estimates			
	males	females	
Total NCD deaths (000s)	4323.3	3675.5	
NCD deaths under age 60 (percent of all NCD deaths)	22.8	17.4	
Age-standardized death rate per 100 000			
All NCDs	665.2	495.2	
Cancers	182.3	105.0	
Chronic respiratory diseases	118.4	88.7	
Cardiovascular diseases and diabetes	311.5	259.6	

Behavioural risk factors			
2008 estimated prevalence (%)			
	males	females	total
Current daily tobacco smoking	49.3	2.1	26.3
Physical inactivity	29.3	32.0	30.6

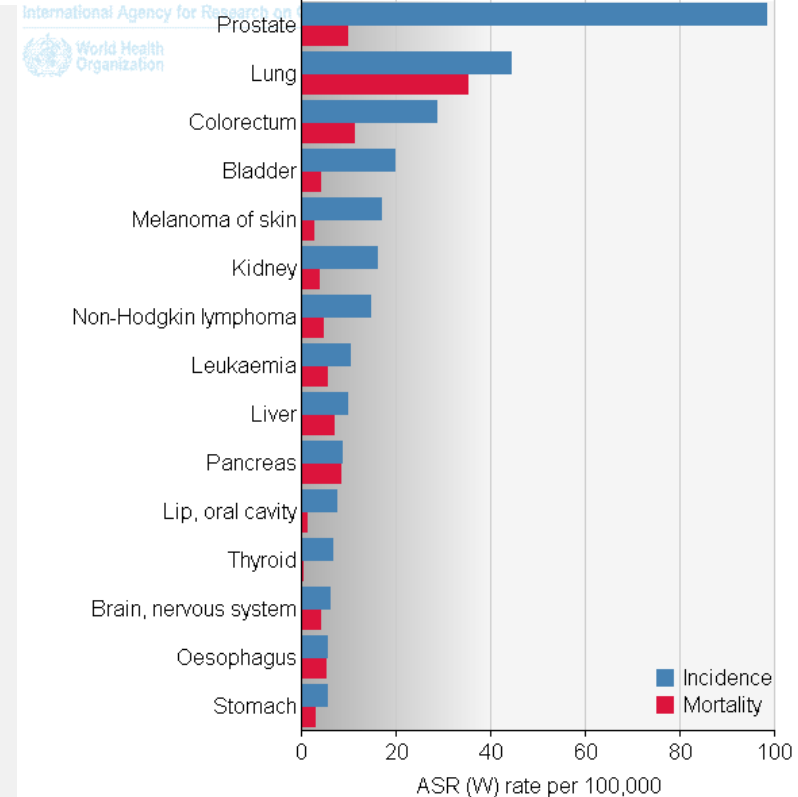
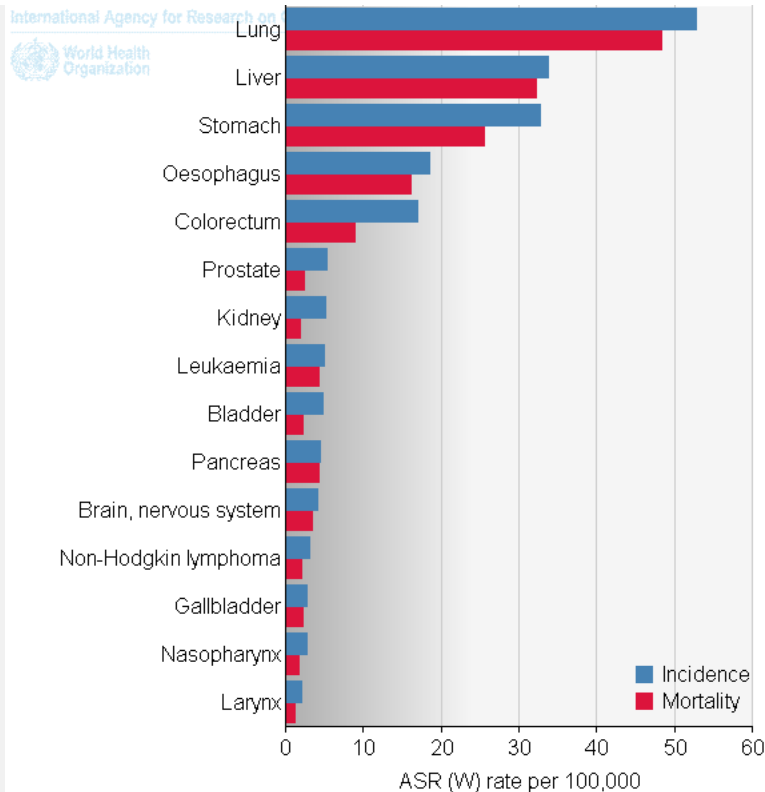
Metabolic risk factors			
2008 estimated prevalence (%)			
	males	females	total
Raised blood pressure	40.1	36.2	38.2
Raised blood glucose	9.5	9.3	9.4
Overweight	25.5	25.4	25.4
Obesity	4.7	6.7	5.7
Raised cholesterol	31.8	35.3	33.5

Proportional mortality (% of total deaths, all ages)

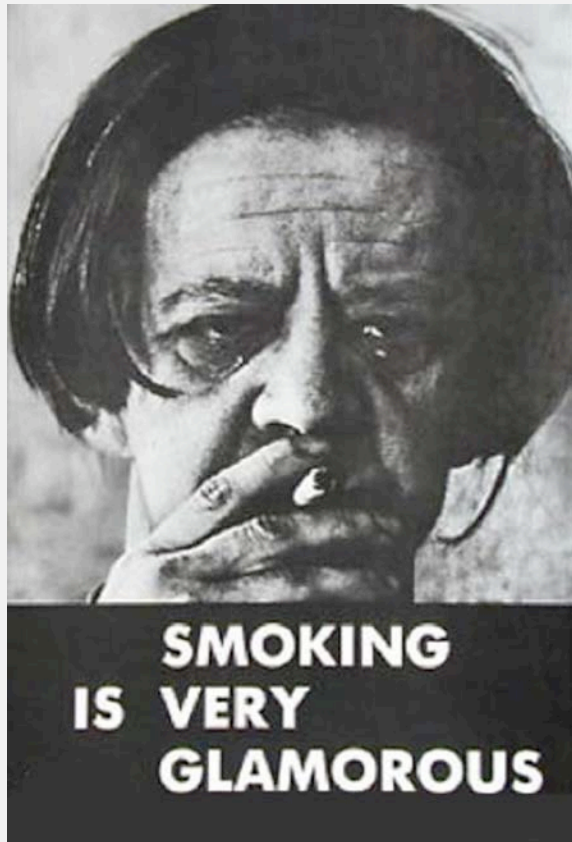


NCDs are estimated to account for 83% of all deaths.

Setting the scene- Cancer in China vs USA in men



Cardiac Risk factors



According to repeated nationwide surveys,

More Doctors Smoke **CAMELS** than any other cigarette!

Doctors in every branch of medicine were asked, "What cigarette do you smoke?" The brand named most was Camel!

You'll enjoy Camels for the same reasons so many doctors enjoy them. Camels have that cool, moist milkyway pack when you pull, and a flavor unmatched by any other cigarette. Makes this cigarette just another one. Camels for 30 days and you know what Camels please your taste, how well they suit your throat on your steady smoke. You'll see how enjoyable a cigarette can be!

THE DOCTORS' CHOICE IS AMERICA'S CHOICE!



For 30 days, test Camels in your "V-Zone" (V for Throat, T for Taste).

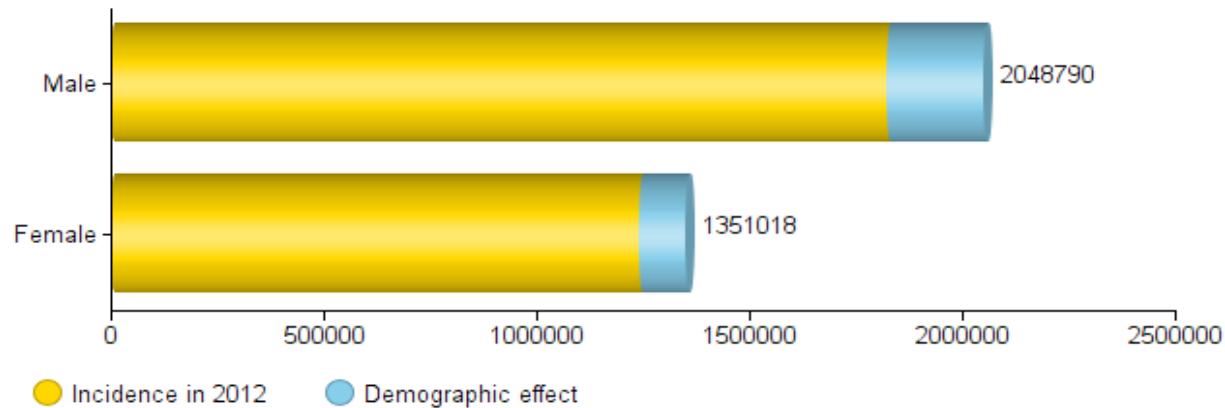
Setting the scene- Cancer in China

International Agency for Research on Cancer



China

All cancers excl. non-melanoma skin cancer
Number of new cancers in 2015 (all ages)

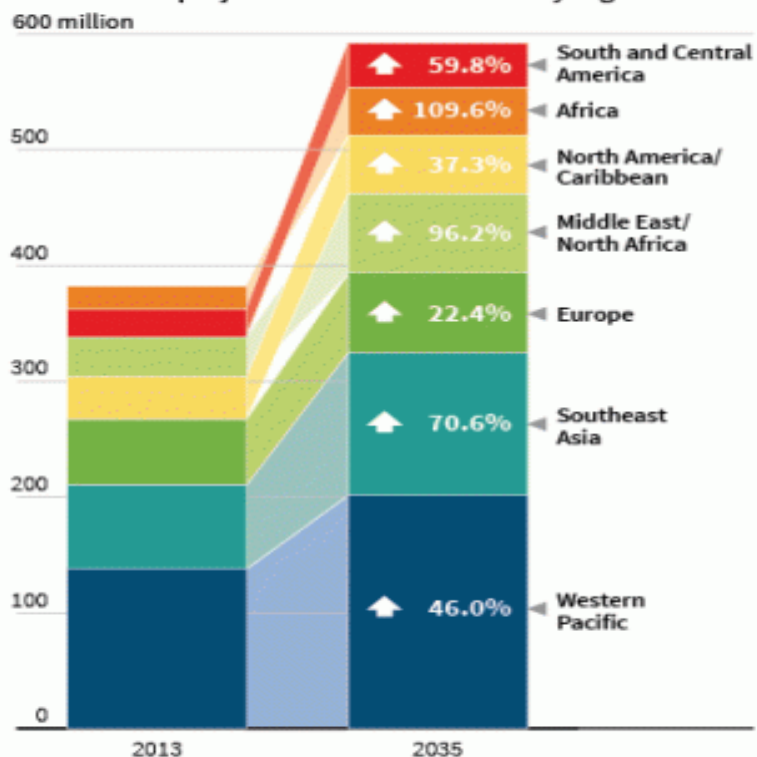


GLOBOCAN 2012 (IARC) (26.8.2015)

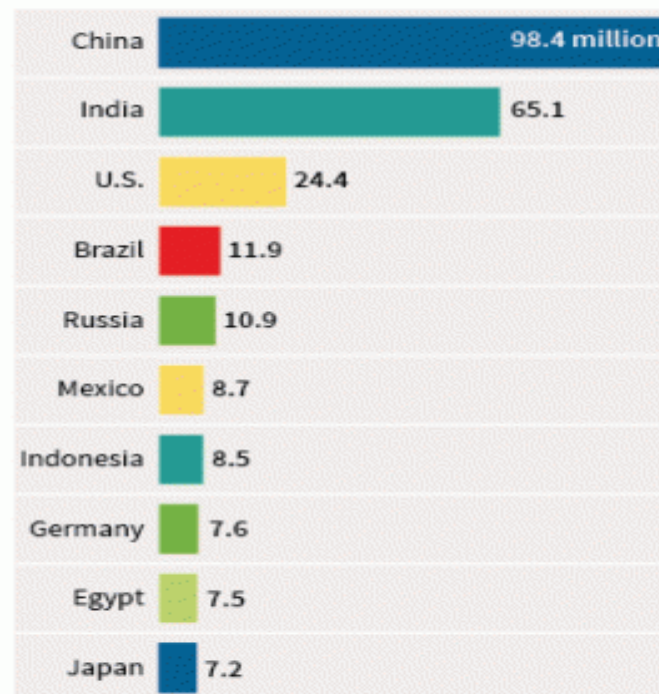
“The growth of cancer in China is ferocious”- WHO China representative DR Bernard Schwartlander said

World diabetes cases expected to jump 55 percent by 2035

Current and projected cases of diabetes by region



Top 10 countries by number of people with diabetes in 2013, ages 20 to 79



Source: International Diabetes Federation

S. Culp, 12/11/2013

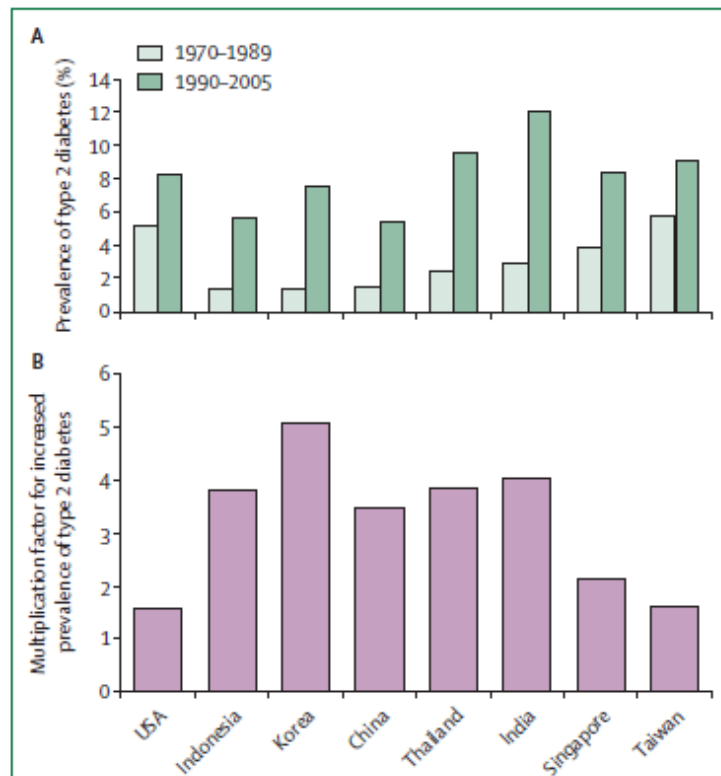


Figure 1: Comparison of prevalence rates of diabetes in selected countries between 1970-1989 and 1990-2005
(A) Prevalence of diabetes in selected nations. (B) Multiplication factor for change in prevalence of diabetes in selected nations between 1970-1989 and 1990-2005.

In the Asian population a tendency towards greater abdominal obesity and less muscle mass results in increased propensity for insulin resistance.

Urbanisation and Westernised diet

Physical inactivity: In the Nurses Health Study each 2h/day increment of time spent watching television was associated with a 14% increase in diabetes risk!





- Reminder to take meds- Compliance
- Dietary advice
- Monitoring of glucose
- Remote monitoring and dose adjustment
- Remote BP checking
- Remote ECG
- Microchips continuously checking glucose and adjusting insulin pump and sending data remotely



MyNetDiary Diabetes Tracker

The winning formula:

MyNetDiary Pro, the #1 diet app in the world

+

Comprehensive diabetes tracking
(blood glucose, insulin, carbs, meds, charts, reports and more)

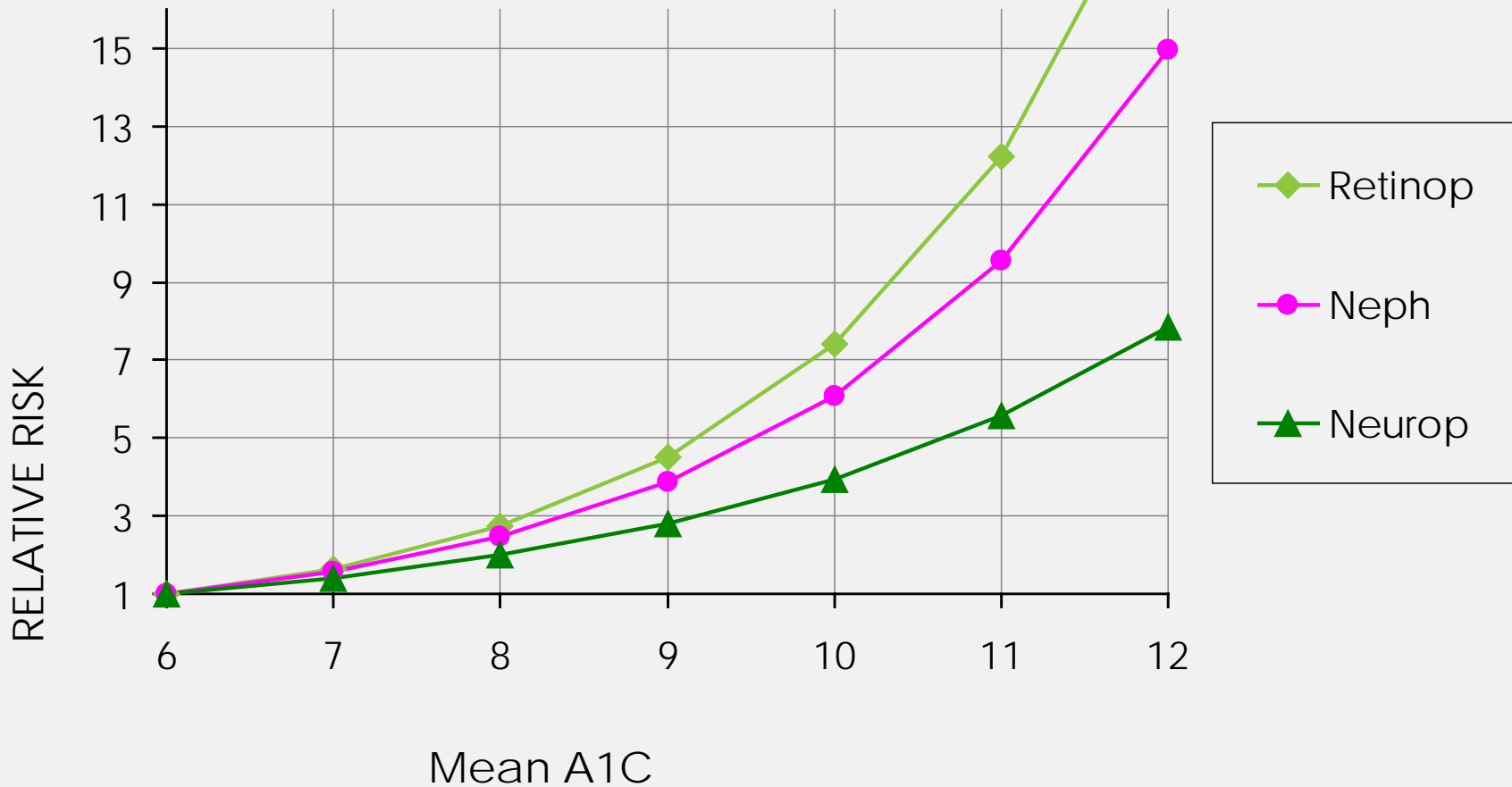
1. BMI < 25, active = 1
2. BMI < 25, inactive = 2,08
3. BMI > 30, active = 10,74
4. BMI > 30, inactive = 16,75



Conversion of HbA1c to mean glucose level

Hb-A1c	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
mg/dl	65	69	72	76	79	83	86	90	93	97
mmol/l	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4
Hb-A1c	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
mg/dl	101	104	108	111	115	118	122	126	129	133
mmol/l	5.6	5.8	6.0	6.2	6.4	6.6	6.8	7.0	7.2	7.4
Hb-A1c	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
mg/dl	136	140	143	147	151	154	158	161	165	168
mmol/l	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4
Hb-A1c	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
mg/dl	172	176	180	183	186	190	193	197	200	204
mmol/l	9.6	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.2	11.4
Hb-A1c	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
mg/dl	207	211	215	218	222	225	229	232	236	240
mmol/l	11.6	11.8	12.0	12.2	12.4	12.6	12.8	13.0	13.2	13.4
Hb-A1c	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5
mg/dl	243	261	279	297	314	332	350	368	386	403
mmol/l	13.6	14.6	15.6	16.6	17.5	18.5	19.5	20.4	21.4	22.4
Color Key:	Optimal	Good	High	Bad	Terrible	Horrible	Deathly	Suicidal	Suicidal	Suicidal

Relative Risk of Progression of Diabetic Complications



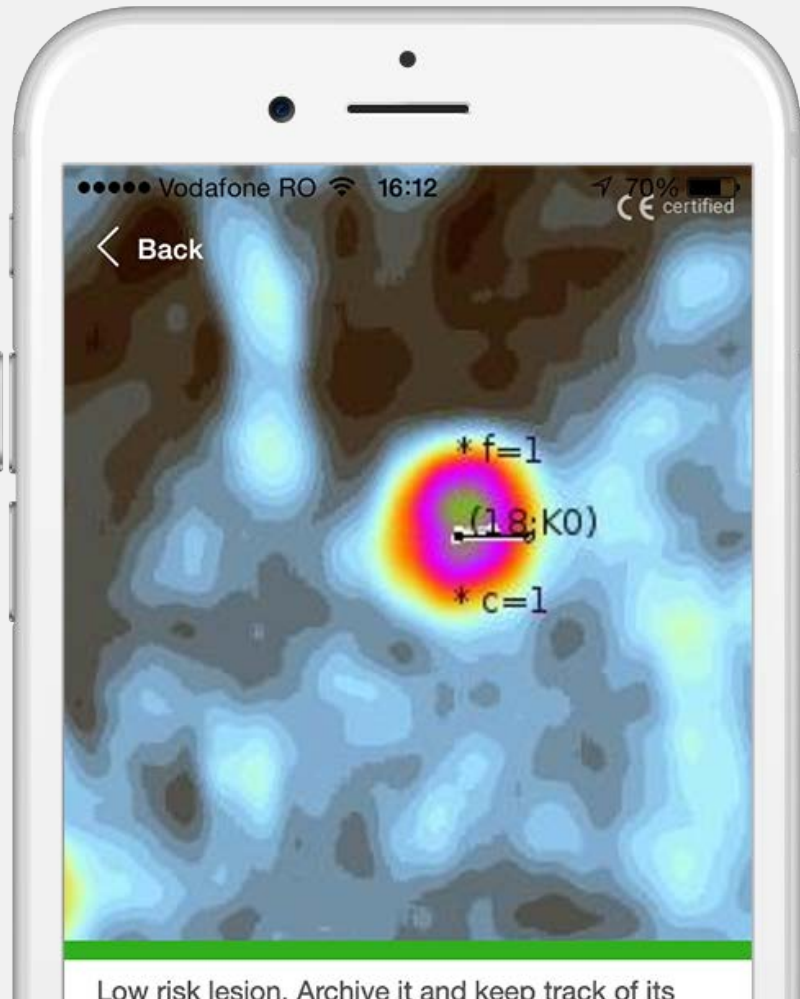
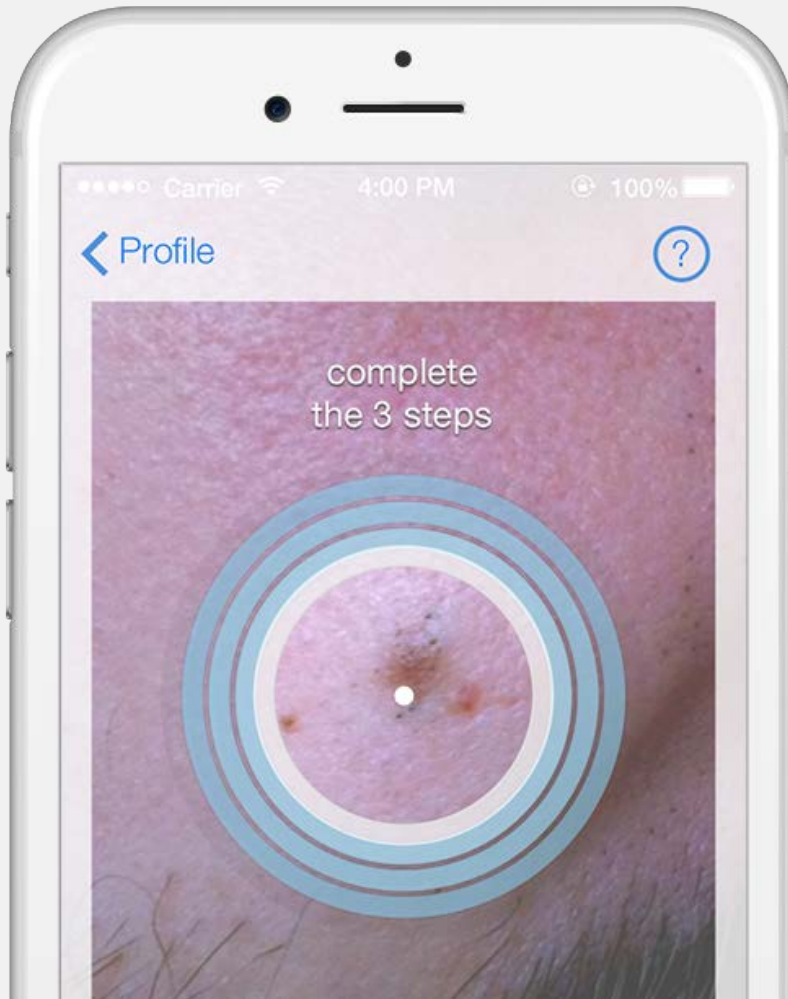
DCCT Research Group, *N Engl J Med* 1993, 329:977-986.

The Big 4 contribute to the big 5!

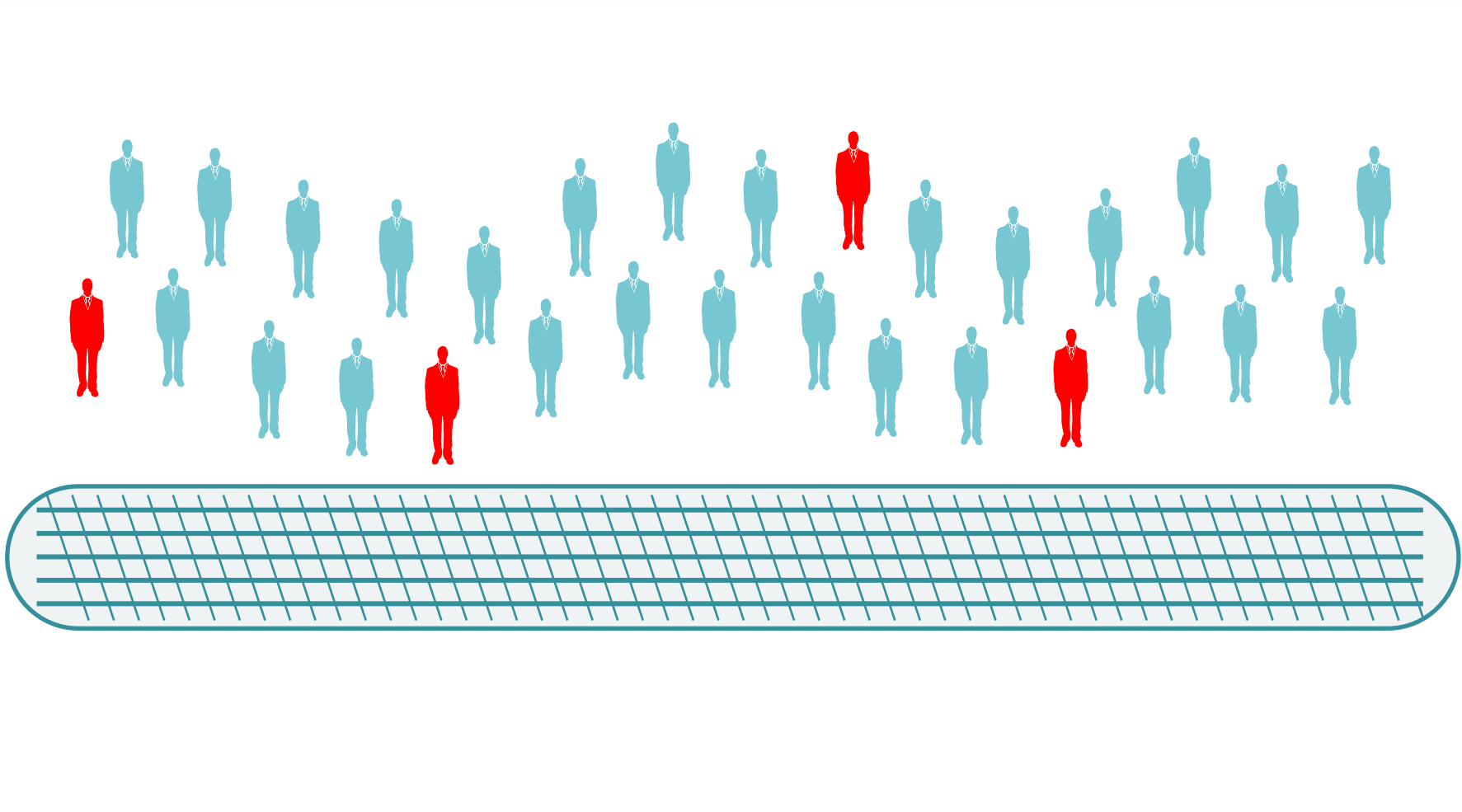


Screening is advancing...Here is an example

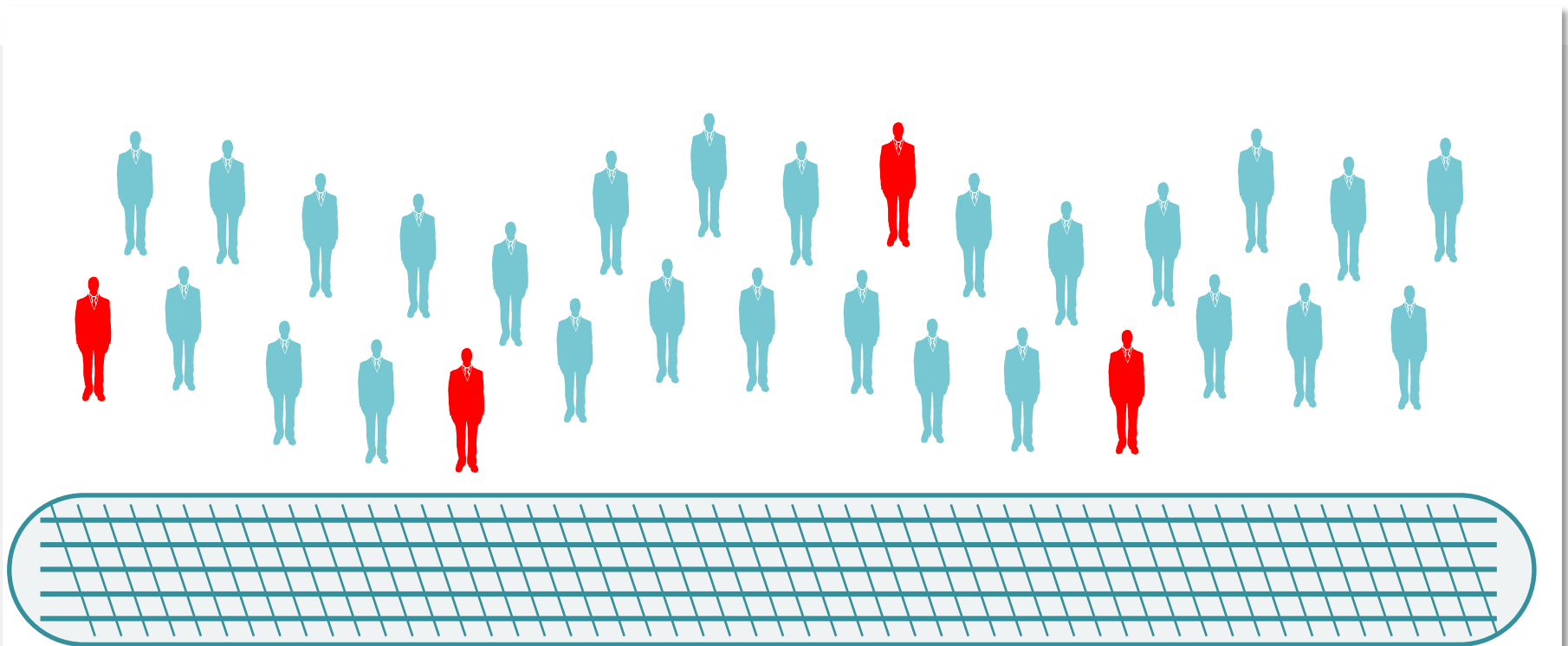
This app analyses your skin moles and tells you whether your mole is a low or high risk for cancer



The Perfect Screening Test.....



Unfortunately.....



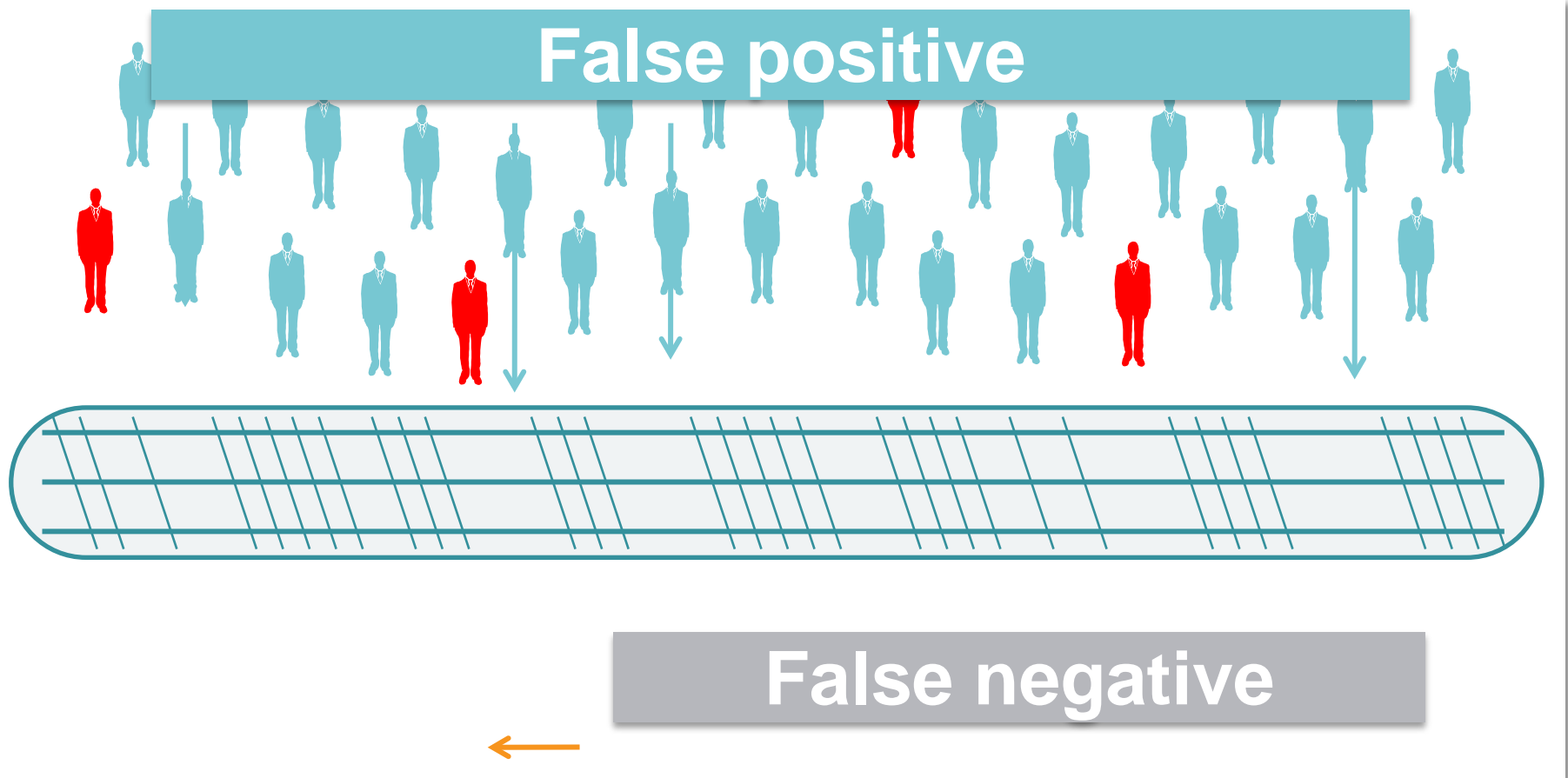
...there is no screening test with a 100% accuracy.

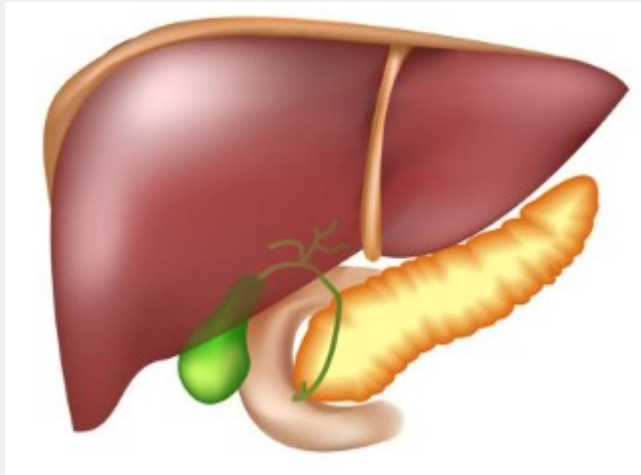
Most tests have a sensitivity and specificity between 70-90%.

As a consequence, some test results are incorrect !!!!

Unfortunately.....

False positive





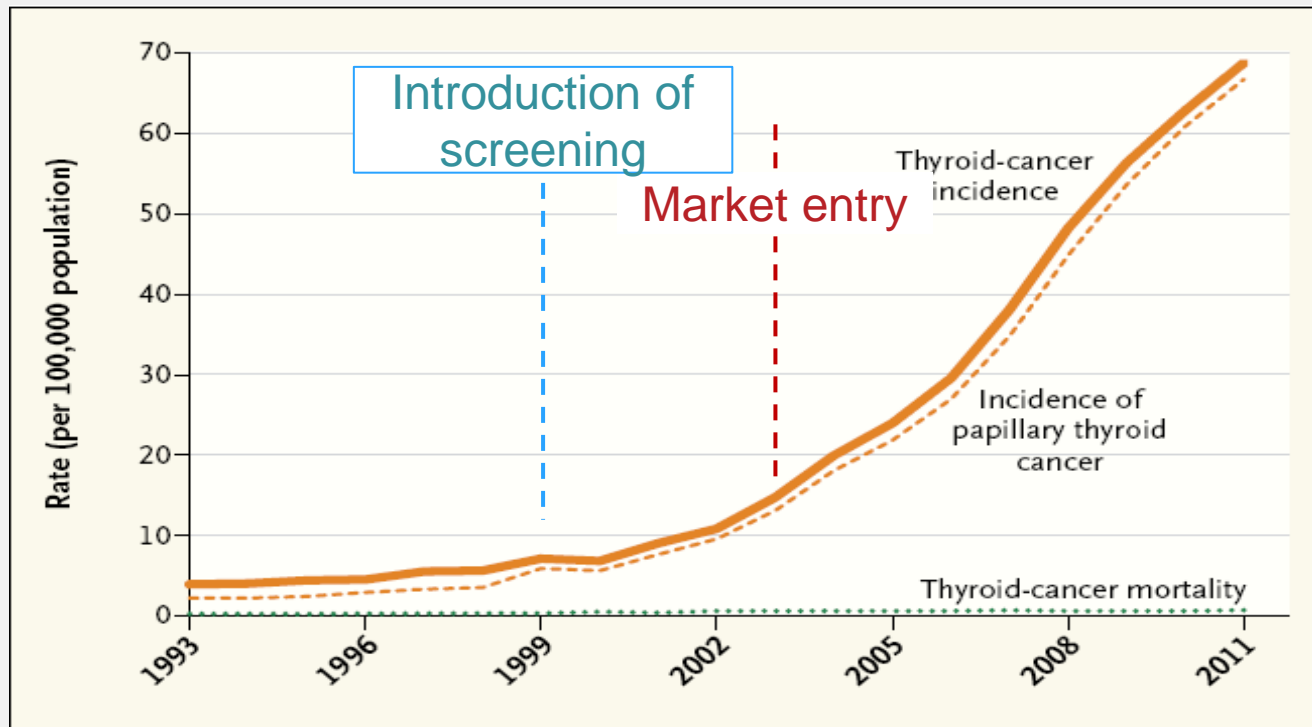
- High levels are seen in Hepatocellular carcinoma, Germ cells tumours of the testes and ovary and a condition called ataxia telangiectasia.
- Use in specific cases where there is an increased risk of liver cancer such as Hepatitis B, C or haemochromatosis.
- In these cases when the AFP is raised the sensitivity for hepatocellular cancer is 60% That leaves 40% who can have cancer but have a normal AFP level.

Recommendations for tumour marker testing in common malignancies*

Malignancy	Sample	Screening	Assisting diagnosis	Prognosis, monitoring, surveillance
Liver	Serum	Alpha-fetoprotein (High risk pts)	AFP	AFP
Bladder	Serum	None	None	None
Cervical	Serum	None	None	None
Gastric	Serum	None	None	CEA, CA 19
Testicular	Serum	AFP, B-HCG,LDH	AFP, B-HCG,LDH	AFP, B-HCG,LDH
Prostate	Serum	None	PSA	PSA
Colorectal	Faeces	FOBT	None	CEA
Breast	Serum	None	None	? CA -15
Ovarian	Serum	None	CA 125	CA 125
Multiple Myeloma	Serum, Urine	Paraprotein	Paraprotein	Paraprotein

(National Academy of Clinical Biochemistry USA)

Critical Illness - Risk of change -



From: Hyeong Sik Ahn et al: „Korea’s Thyroid-Cancer “Epidemic” — Screening and Overdiagnosis“, N Engl J Med 371;19 November 6, 2014

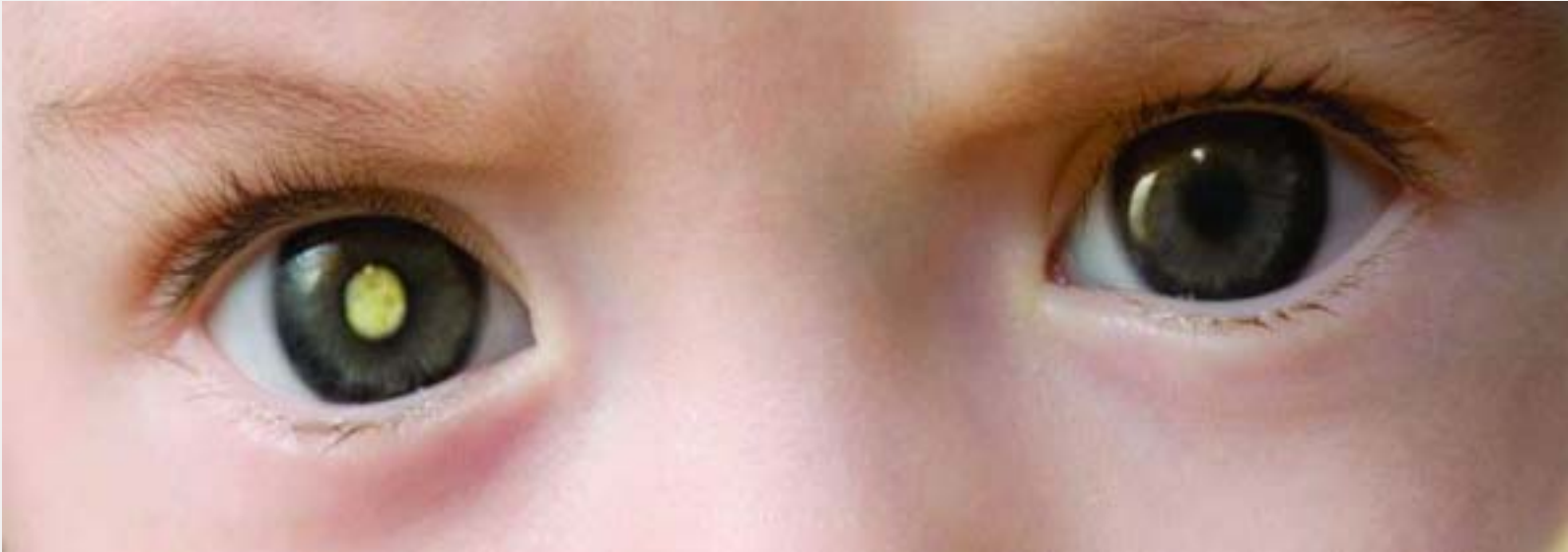
One third of all claims in women and 10% of all claims in men were due to early stage thyroid cancer!

Pricing was based on pre-screening numbers ...

... and insurance companies were facing losses.

Survival in early stage thyroid cancer is 100%





Not common

Usually relate to a defective Tumour suppressor gene or defective proto-oncogene

Retinoblastoma is a example

Image taken from Slideshare, Dr Amina Rahman, Calicut

Syndrome	Tumours
Familial Adenomatous Polyposis	Colorectal cancer
Hereditary Ovarian/Breast cancer	Breast, Ovarian, Colon, Prostate Ca
Hereditary Prostate cancer	Prostate Cancer
Hereditary Nonpolyposis Colon Cancer	Colon, Endometrial, Ovarian, Stomach, Small bowel, Ureter
Li- Fraumeni	Sarcoma, Breast Cancer
Multiple Endocrine Neoplasia Type 1	Parathyroid, Pancreas, Pituitary Ca
Multiple Endocrine Neoplasia Type 2	Thyroid cancer, Pheochromocytoma
Neurofibromatosis Type 1	Neurofibroma, Neurofibrosarcoma, Brain Tumour
Von Hippel Lindau	Kidney, Cerebellum, Pheochromocytoma

Medscape Medical News from the [2014 Breast Cancer Symposium \(BCS\)](#)

'Angelina Jolie Effect': BRCA Testing Doubles

Zosia Chustecka

September 03, 2014

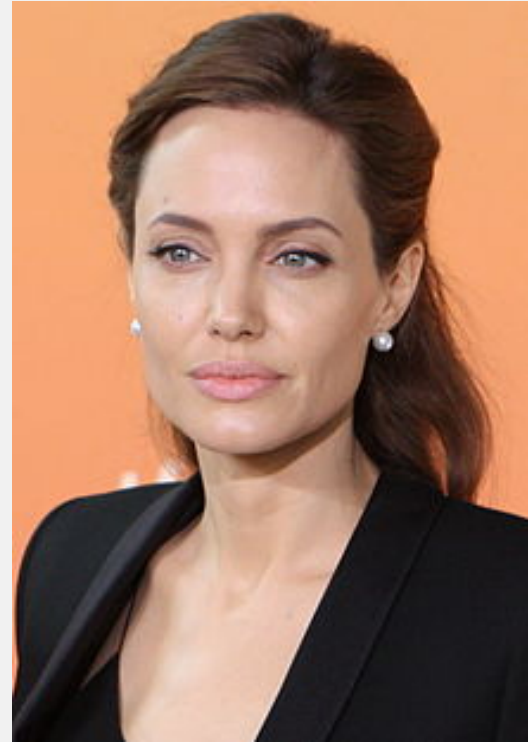


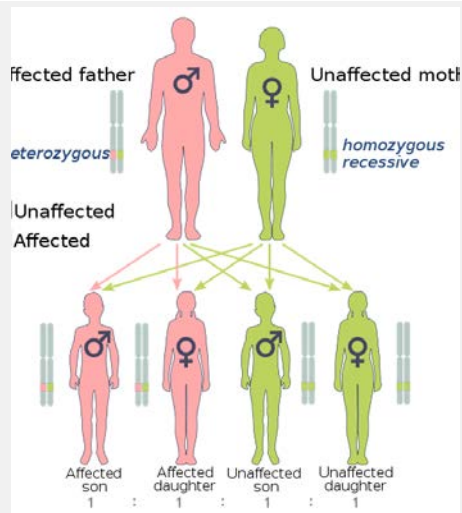
Image from Wikipedia

**Myriad Labs performed 250 000 BRCA gene tests
in 2014**

- Tumour Suppressor Genes
- Proto-Oncogenes
- RB, p53, BRCA1, BRCA 2
- Ras, c-ABL, c-MYC, HER2



Enablers of Predictive Medicine - The “Omics”



Genetics:

The investigation of the roles, functions and patterns of inheritance of single genes

Genomics:

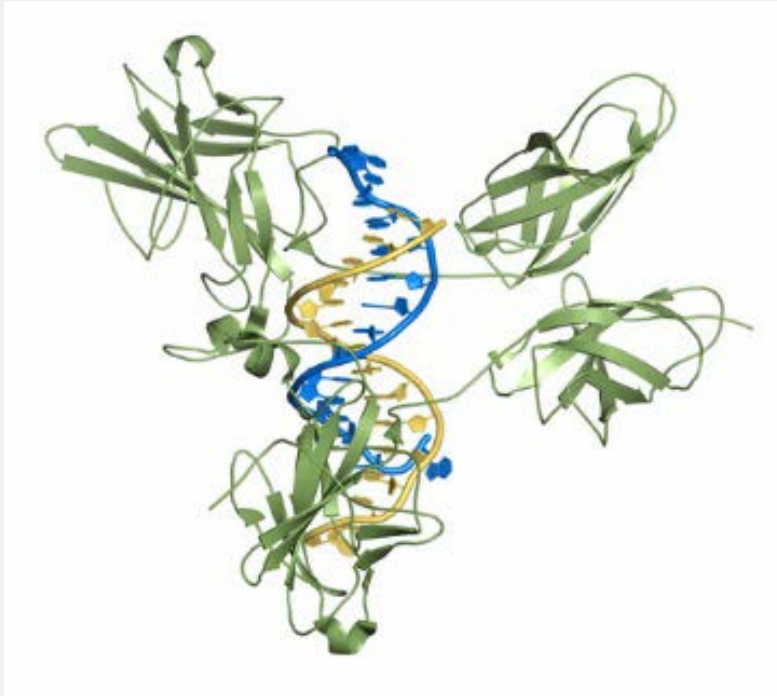
The investigation of the function and structure of an entire genome and its interaction with environmental or lifestyle factors

Proteomics

The study of proteins for the diagnosis, prognosis and therapeutic prediction of disease

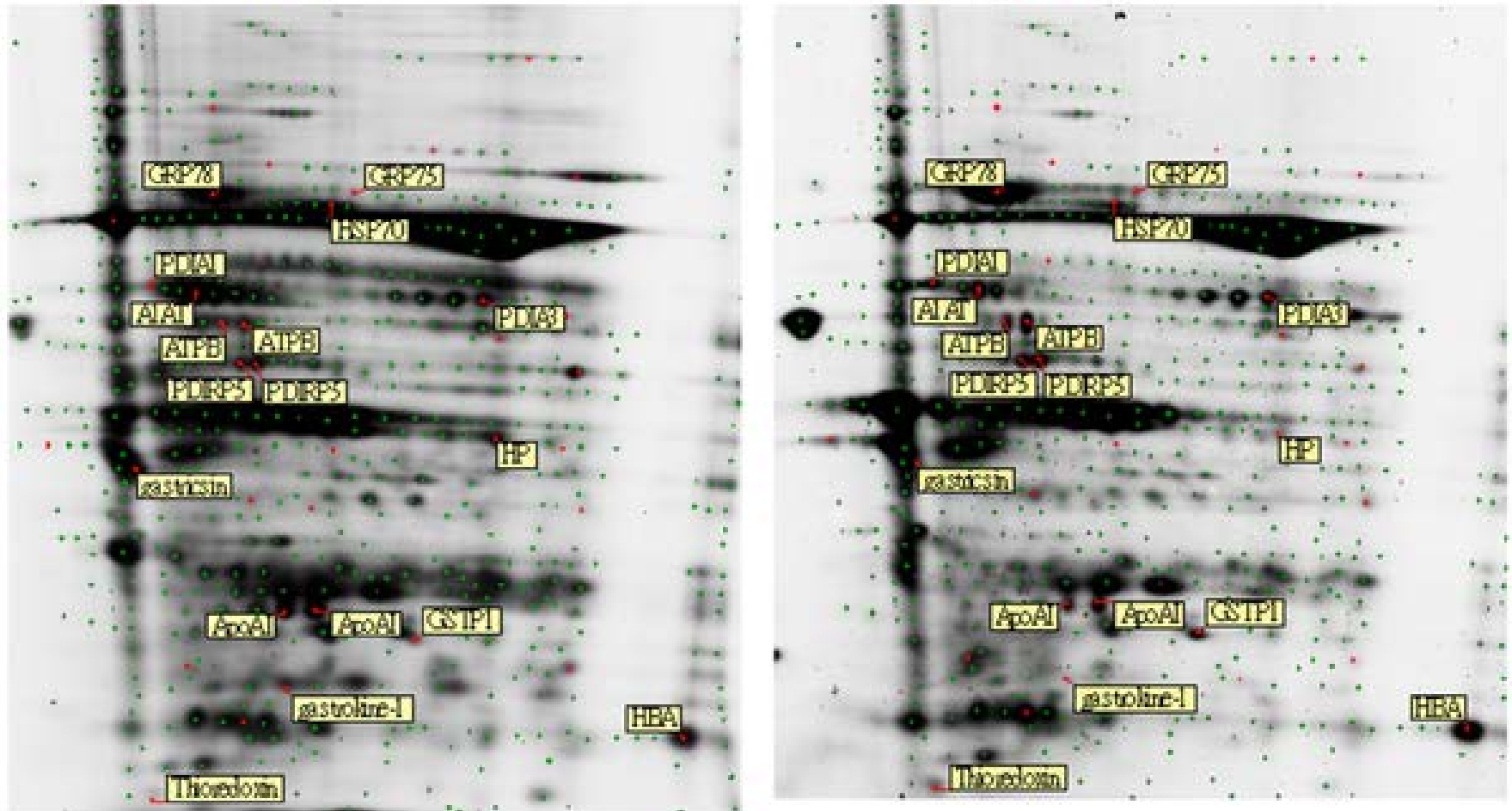
Metabolomics

The study of unique chemical fingerprint that specific cellular processes leave behind



- Human Proteome project was officially initiated in 2008.
- Cancer proteomics one of the fastest growing research fields
- Systematic searches for cancer biomarkers are underway
- The expected outcome is the development of panels of biomarkers for early detection of cancer and prediction of the probable response to therapy

Figure 1. The 2D-DIGE results paired tissue samples.



Wu JY, Cheng CC, Wang JY, Wu DC, Hsieh JS, et al. (2014) Discovery of Tumor Markers for Gastric Cancer by Proteomics. PLoS ONE 9(1): e84158. doi:10.1371/journal.pone.0084158
<http://127.0.0.1:8081/plosone/article?id=info:doi/10.1371/journal.pone.0084158>



Saliva used for biomarker development and personalized medicine

Potential to detect oral cancer, pancreatic cancer, lung cancer, ovarian cancer and breast cancer

*The Landscape of MicroRNA, PIWI-Interacting RNA and Circular RNA in Human Saliva Jae Hood Bahn et al
Clinical Chemistry 61:1 221-230 (2015)



- Mips test for prostate cancer
- A test for a specific gene fusion. A prostate cancer antigen and a PSA



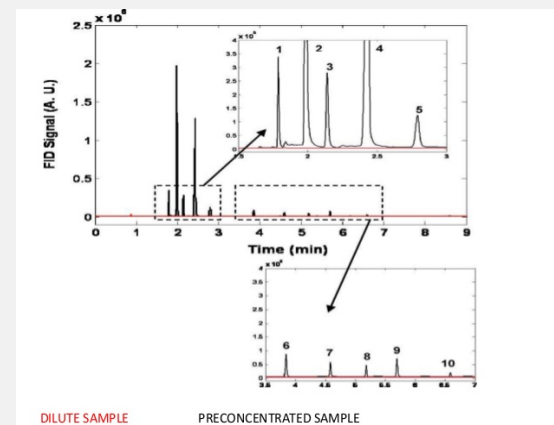
Frankie the dog sniffs out cancer

BBC News March 18th 2015



VOC's- Examples

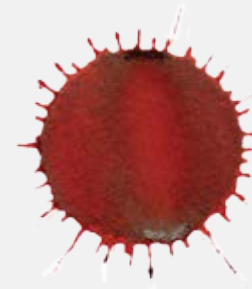
Pentane, benzene, heptane, toluene, octane, nonane, decane, undecane, dodacene, tetracane, nitic oxide, haem oxygenase



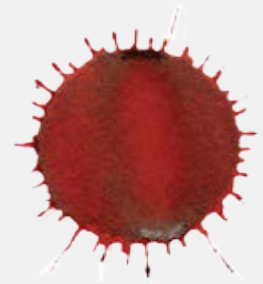
Chinese Researchers have developed a simple rapid device for detecting volatile organic compounds on the breath, demonstrating potential for early cancer detection. Washington DC. Feb 17 2015

From the Journal: Review of Scientific instruments

- Liquid biopsies are non invasive blood tests that detect circulating tumour cells and fragments of tumour DNA.
- Emerging technology that might replace costly, painful and risky tumour biopsies
- Will be useful for monitoring treatment and to assess for metastatic disease
- Envisaged that this process will be used in the future for cancer detection
- Needs standardization of assays and cost reduction before it can be used in mainstream medicine



- For the first time, Hopkins researchers say, they are within reach of a general screening tool that could be used to scan broadly—perhaps at an annual physical—for molecular traces of cancer in people with no symptoms.
- Companies performing Liquid biopsies:
 - Personal Genome Diagnostics
 - Guardant Health
 - Boreal Genomics



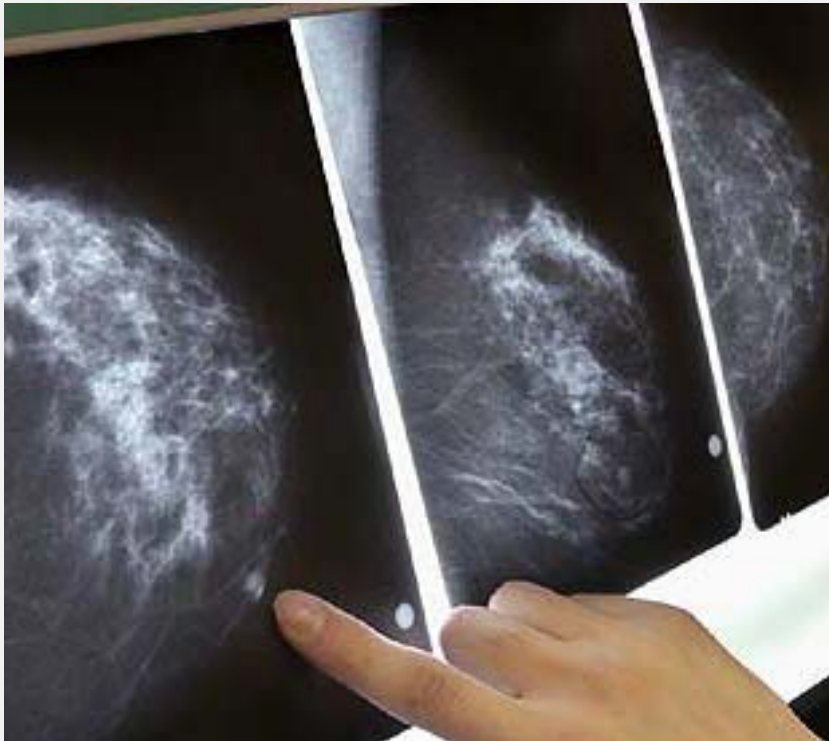
Changes in chromosomes years before cancer diagnosis could yield biomarker to predict cancer.



A distinct pattern in the changing length of blood telomeres, the protective end caps on our DNA strands, can predict cancer many years before actual diagnosis, according to a new study from Northwestern Medicine in collaboration with Harvard University*.

* Oncology news Australia May 5th 2015

Multigene assays used to predict chemotherapy benefit



- A test called Oncotype DX searches for the presence of 21 breast cancer related genes in breast tissue and produces a score that predicts the risk of breast cancer recurrence.
- 10,273 women tested who had early stage hormone receptor + breast cancer
- 16% of women scored a low score below 10 (out of a possible 100)and were treated with hormone therapy alone and no chemotherapy
- 99% of these women treated with hormone therapy alone did not experience a recurrence within 5 years

Prospective validation of a 21-Gene Expression Assay in Breast cancer. J.A. Sparano et al NEJM Sept 28th 2015



- DTC genetic testing- public awareness has increased from 29% to 37% in a study from the US.
- Awareness higher in those aged 50-64 and 65-74, college graduates, those with healthcare, those with a prior cancer diagnosis, internet use and living in urban areas

Cancer treatment- Times are changing

Surgery

Slash



Radiotherapy

Burn



Chemotherapy

Poison





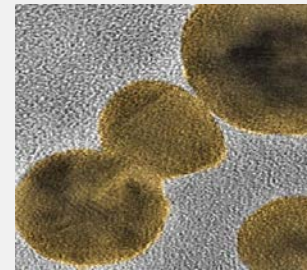
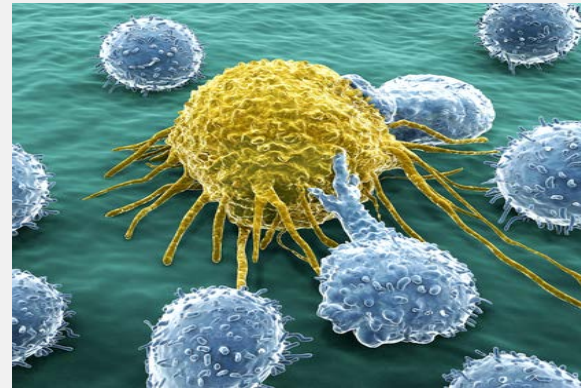
You can have normal genes but they can be switched on or off or down regulated or upregulated and this could be one of the steps to developing cancer .This in a nutshell is the science of epigenetics and epigenetic abnormalities are far more common than mutations

Enormous research is being done here to look at drug treatments here as cancer treatment



- Epigenetic dysregulation changes the pattern of gene expression so that tumour-promoting genes (Proto-oncogenes) are activated, while tumour-suppressor genes are silenced.
- An example: Trametinib targets a BRAF oncogene which signals melanoma cells to divide more regularly
- Cost \$131000 per patient!

Targeted therapy- Smart bombs have arrived

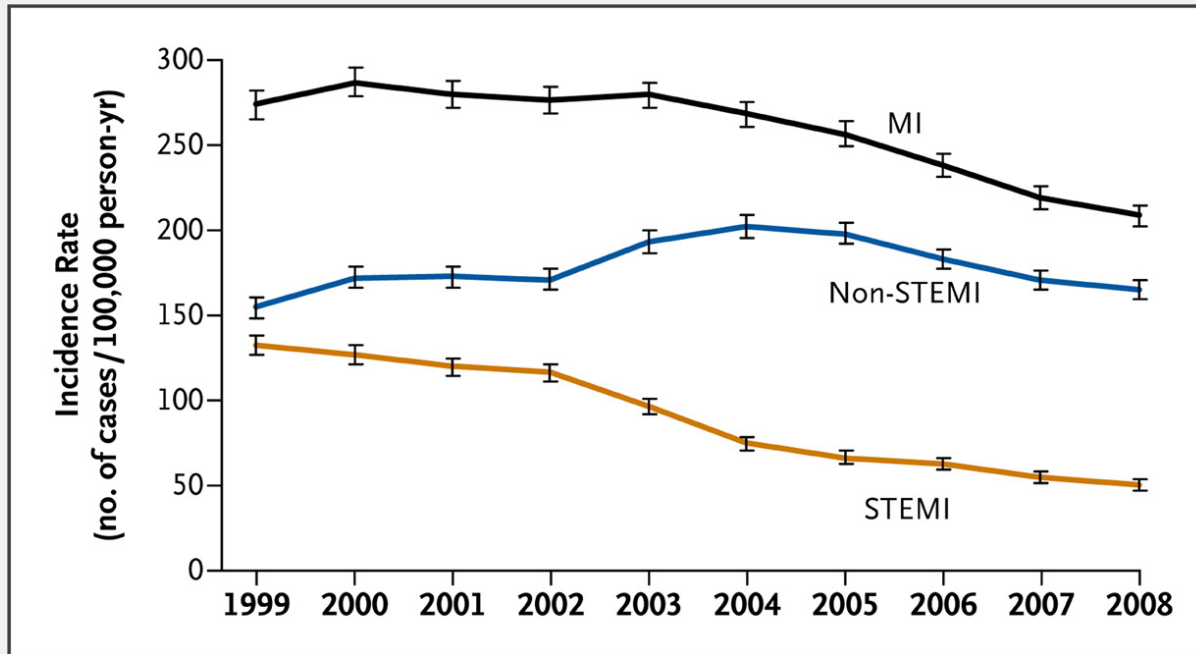




- Training the immune system to fight cancer.
- Teaches the immune system to identify and destroy tumour cells by identifying unique proteins produced by the mutated cancer cells
- A trial began in 2013 on patients with advanced melanoma.
- By looking at your genetic make up you could one day receive a personalised vaccine based on your own genetic susceptibility to cancer

Cardiac component



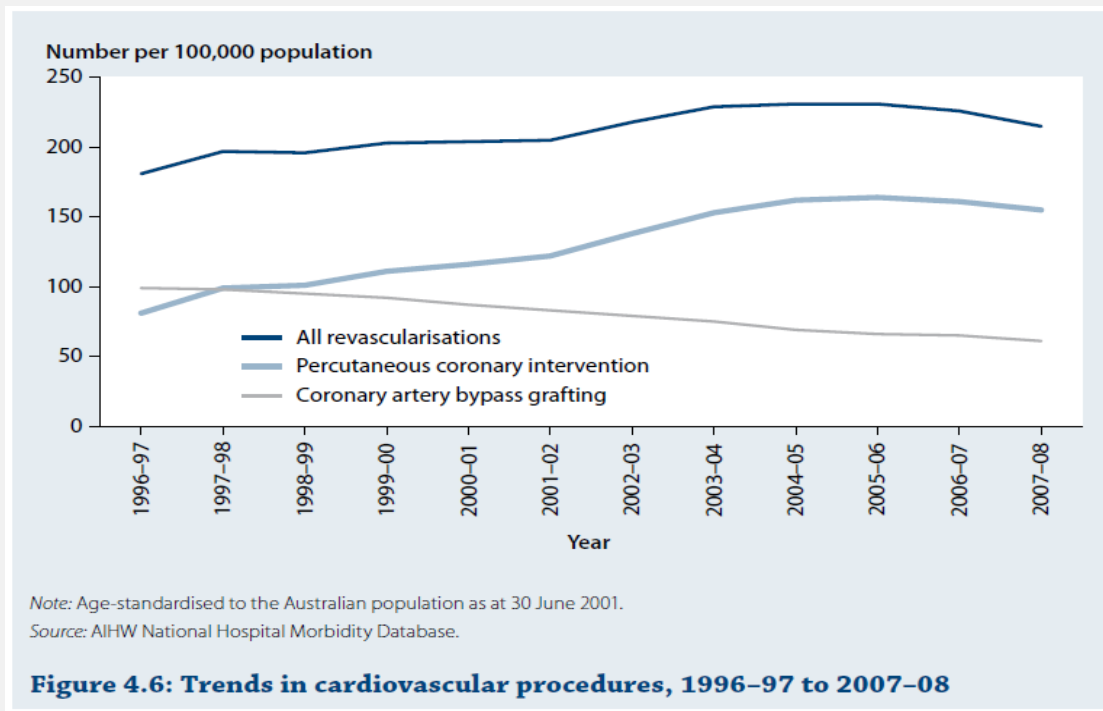


Age- and sex-adjusted incidence rates of acute MI, 1999 to 2008. I bars represent 95% confidence intervals.

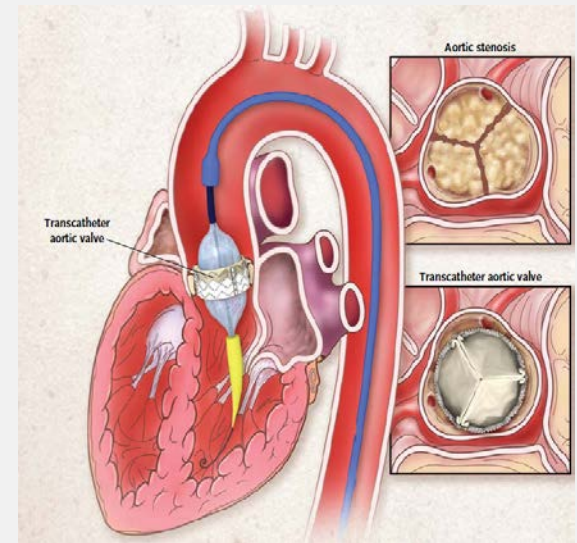
MI indicates myocardial infarction; STEMI, ST-elevation myocardial infarction.

Yeh et al; Population trends in the incidence and outcomes of acute myocardial infarction. N Engl J Med 2010

- Sensitivity increase of more **100x** from 1995 to 2007
- Sensitivity increase only **5x** from 2007 to date
- Since the 1990 no increase myocardial infarction diagnosis numbers
- Since the 1990 no increase in claims numbers



- CABG's decreasing
- Stenting increasing
- Multiple stenting increasing at 6% per annum

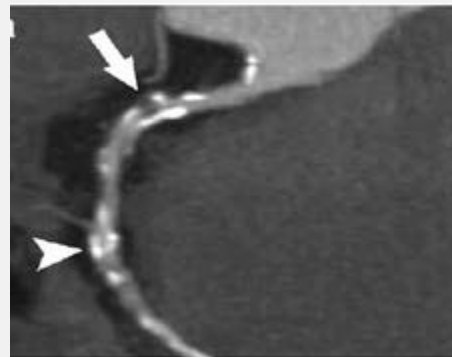




MIRA Calcium score rating example

CAC score Age 35-50

	Life	CI	TPD
<10	0	0	0
11-100	25	50	50
101-400	75	Dec	Dec
>400	RMO	RMO	RMO



Stress Echo- preferable to Stress ECG





Prevalence of Hep C in blood donors in Singapore is 0-4-1%



- High viral replicative
- (immune tolerant)
- Usually in Pts less than 20. Virus active making copies of itself but the person has no symptoms



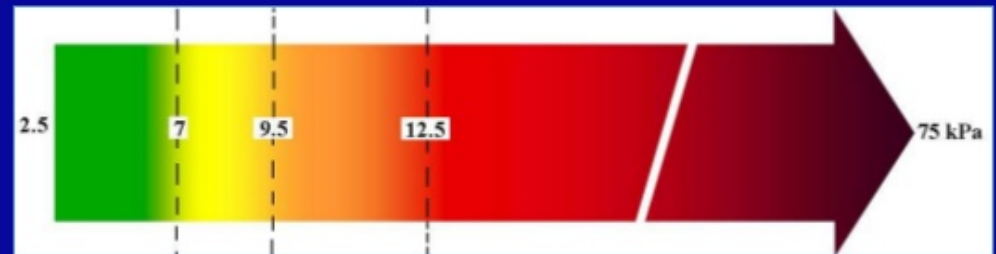
- Low viral replicative
- (Immune elimination)
- Occurs in patients 20-40. Here the immune system is trying very hard to get rid of the Hep B. LFT's may be raised and client can be symptomatic



- Non replicative
- (latent infection)
- Usually occurs over the age of 40. Hepatitis virus is present but not replicating strongly. There may be liver damage and the risk of progression to cirrhosis and cancer



Liver stiffness cut-offs in chronic liver diseases



Matavir

F0-F1

F2

F3

F4

Fibrosis

Mild

Sign

Severe

Cirrhosis

LSM 2.5 – 7 kPa → Mild or absent fibrosis is likely

LSM > 12.5 kPa → Cirrhosis is likely

Castéra L et al. J Hepatol 2008 ; 48 : 835 – 847.

- Medicine is rapidly advancing and impacting insurance medicine.
- The ability to obtain medical info, risk stratify , monitor and acknowledge lifestyle improvement is becoming a reality.
- Novel disease screening will enter insurance medicine and alter product design
- Specialized treatment is more effective with improved mortality and morbidity but someone has to pay for it.
- Exciting times- important to stay informed

Thank you

Questions?

