PROMS-G
Project Management
Specialist Group

Transforming Healthcare with AI

Reality versus the Hype

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President and Chief Strategy Officer

C2-Ai Precision Healthcare – Ai

Driven | Saving Lives – Reducing Harm and Variation

BCS PROMS-G Event | 23 November 2023

Some problems are harder than others…

At an airport last week…a mum and her daughter were scanned by facial recognition software…

Healthcare is unsustainable

$2tn
waste/variation in healthcare globally

90%
of cost/clinical variation not detected by existing systems but found and resolved by C2-Ai

80%
of healthcare spending is on chronic conditions

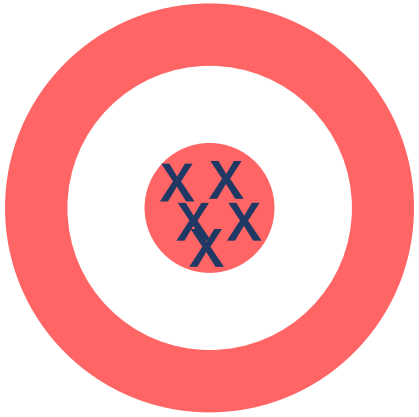
$3.2tn
Financial impact of chronic conditions in US alone

$300bn
potential savings across Medicare/Medicaid

15%
of hospital spending is on adverse events

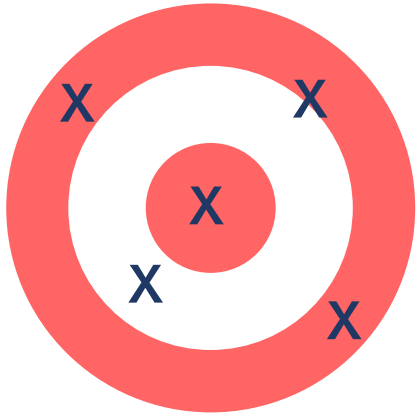
AI will put every industry back two years

‘CLASSIC’ CHALLENGES AI SOLUTIONS HAVE TO OVERCOME

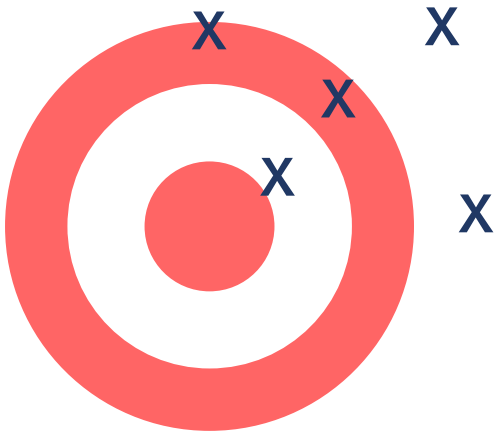


ON TARGET – This is what you want. Can you prove it?

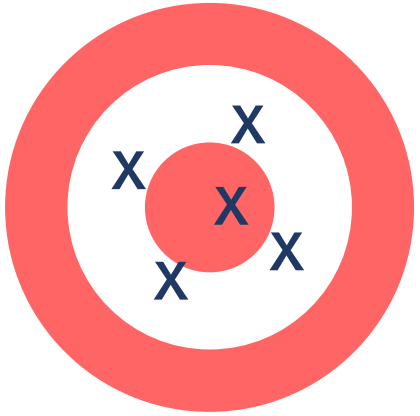
BIASED – Low accuracy, high precision. Do you know if you have this problem?



NOISY – How do you know if you have this problem?



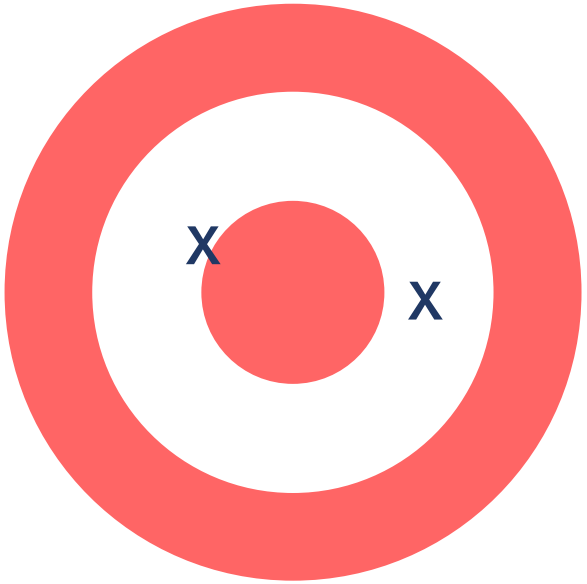
NOISY AND BIASED –



GETTING THERE High Accuracy, Low Precision

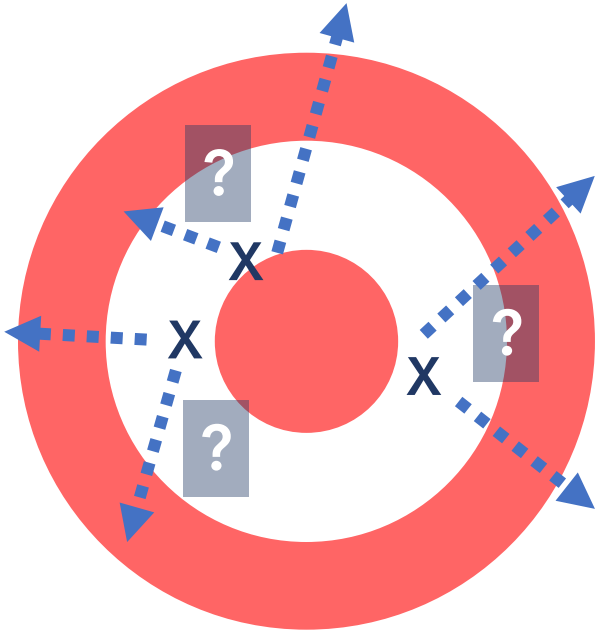
NO DATA - How do you know if you have this problem?

3 New Challenges in the Era of AI



AI – INSUFFICIENT DATA POINTS FOR PROPER CONCLUSIONS

AI – CAN'T JUDGE THE OUTCOMES IF YOU CAN'T SEE THE DECISIONS



AI – CAN'T TRACK WHAT IS HAPPENING OVER TIME

Source - Richard A D Jones - Built on the four concepts in Noise by Kahnman et al (2021)

Part of the project team is acting against the team!

- Changes their mind
- Won’t share their working
- Might kill someone unprovoked
- Has no empathy
- Has no remorse

AI can be viewed a bit like a psychopath

Are the expectations realistic and fair?

The aim of Tesla is not to get to zero deaths

One conversation reported to me said the target was 500 a year, instead of 38,000 in the US

So as in every country, there are deaths caused by stupidity, bad luck, alcohol, arguments, drugs, poor skill levels…. But when a machine makes a rare mistake, it needs investigating

To err is human.. but a machine needs to be better than human

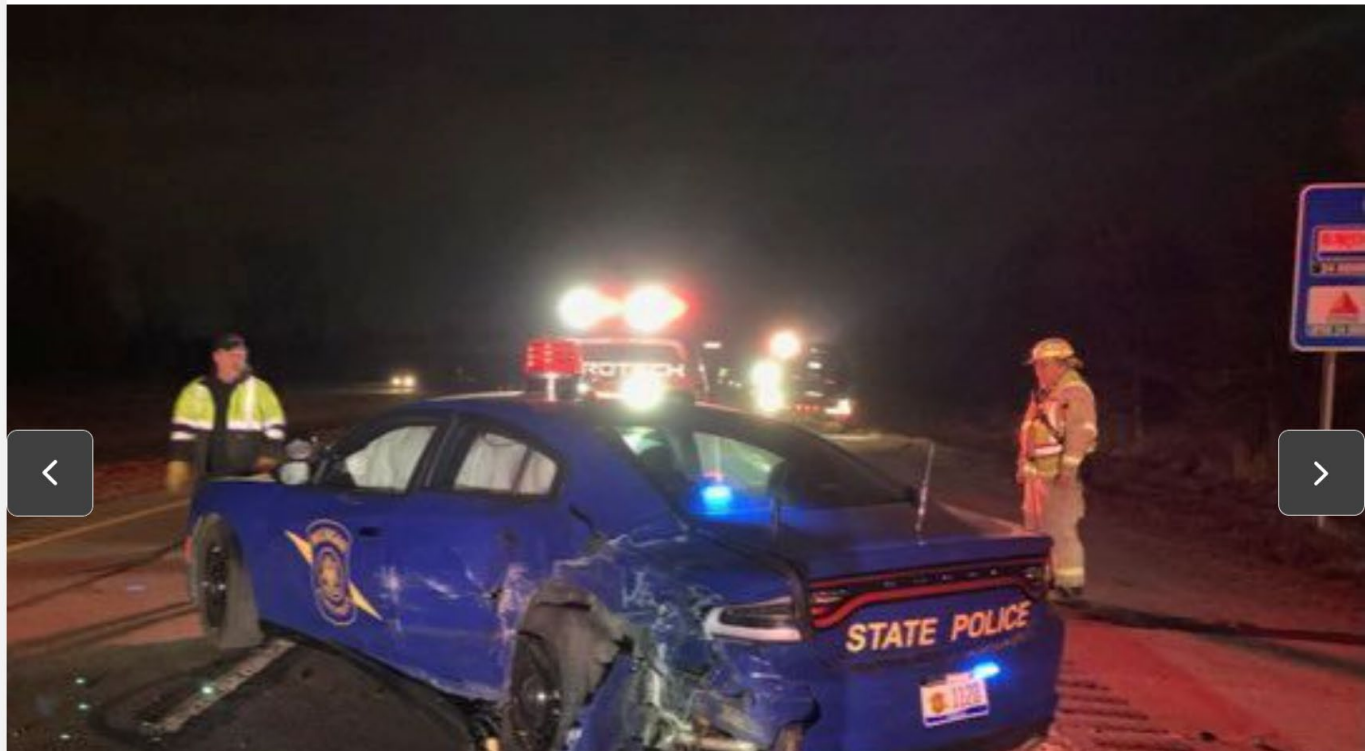
September 21, 2021
10:20 PM BST
Last Updated 4 days ago

Disrupted

A life and death question for regulators: Is Tesla's Autopilot safe?

7 minute read

By Hyunjoo Jin and Mike Spector, David Shepardson



HOW AI WILL SET HEALTHCARE BACK 2 YEARS

1. 

Innovation pipelines and teams in providers/payers will rapidly become overwhelmed by new/unproven concepts

2. 

The need for careful evaluation is now going to be amplified in the face of the 'Wild West' end of AI (AI that can rewrite itself and change its mind)

3. 

The challenges related to regulating and ensuring the accuracy of untested and potentially biased medical applications will further erode the trust of risk-averse clinicians

4. 

A breed of applications will appear from companies blind to the fact these are 'medical devices'. Regulatory push back needs to be overwhelming or we will see 'snake oil AI' applications doing real harm

5. 

The existing barriers to adoption of innovation, such as risk-aversion, decision-making, bandwidth, focus etc. will not change fast

6. 

Point solutions that address only a small part of care will fail to gain traction with time-pressed, stressed and 'screened out' clinicians.

7. 

The challenge of trusting data into generative AI platforms, that may then take that data or even IP and apply it elsewhere (or expose it) will remain a stumbling block

8. 

Doctors don't want to have to log in to multiple solutions that provide only one piece in the jigsaw of care.

	Maturity Level (work from left to right to last category that applies to the innovation/solution)				
	INNOCENCE	**CRAWL**	**WALK**	**RUN**	**EXCELLENCE**
Data	A concept but no data	Mid-size data set but uncertainty on bias	Larger data set with some aspects to reduce impact of bias	Large data set in one country only - designed to avoid bias	Data sets from all target territories - big enough to avoid potential issues of bias
Credibility	Clear concerns on use and security of data and/or ability to deliver in healthcare	Credible team in new organisation	No data security and usage issues perceived and some track record in the space	Good reputation in industry and working on overlapping area to current solutions	As left but solution provider seen as longstanding industry expert in the topic area
Impact	Niche problem Low down the pecking order of 'hot topics'	Clear benefit over existing approach in niche application	Significant leap forward in niche application	Game changer in one important area of healthcare	Addressing the biggest problems in healthcare
ROI	Marginal clinical advantage only but cost is multiple of existing approach	Clear clinical advantage but cost up to twice that of existing approach	Similar cost to current solutions and better than today's solutions	Business case with marginal ROI for deployment of the solution	Clear ROI including in US reimbursable models and public health systems (UK, Canada etc.)
Standards	Uncertainty on standards/regulation	In process on getting necessary standards	Essential standards met to deliver solutions legally	Essential standards and some 'confidence' ones that will reassure potential clients	Full ISO, DTAC, FDA, IMA, MHRA, MD SAP as necessary
Clinical Buy-in	Seen as IT solution with limited clinician support and/or clinical workflows impacted and/or 'yet another dashboard' to try to make inferences from	Solution champions in clinical community developing but still seen as in 'early adoption' phase	Local champions for the solution established among thought leaders	As left but developing international champions and references	Championed by clinicians and leading institutions in multiple countries
Uniqueness	'Me too' product with obvious competitive approaches already in the market	Strong overlap to existing solutions	Partial overlap some but not all functionality areas	Minor overlap of full functionality to existing approaches	Globally unique approach deployable at scale
Advantage	Lower performance than current approaches and/or more expensive	Similar performance to solutions/ approaches in the market	Clear differentiation in some but not all aspects	Significant differentiation	Delivers 10-100X benefits in clinical and financial terms
Onramp	Requires integration into multiple different systems (e.g. EHR) and/or Creation of new bespoke interface and and/or Multiple data source integration required	API link needed (have to await IT time which could be 2 years in one NY system)	Some interfaces in place but still rely on client IT team		No integration required or plus and play interface already defined
Workforce	Requires retraining and adds to burden of doctors/nurses	Neutral impact in deployment on workforce time but training overhead significant	Neutral impact on workforce time and easy onramp to switchover to this 'new way'	Reduction in workforce stress and/or workload for given case mix	As left but also no clinical workflows impacted in derivation of analytics and/or reduces workload through targeting of solutions and/or reduces workload through reduction of complications, faster throughput etc.

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AI alone is not enough

Past vs Future

AI/BI vs Sophisticated algorithms deriving actionable insights that go far beyond today's systems

AWFULLY
INCONVENIENT
BAD INFORMATION
CLINICALLY IRRATIONAL

AI
AI/ACTIONABLE INSIGHTS
Driving improvements based on identifying/resolving previously hidden issues

BI
BUSINESS INTELLIGENCE
Unique metrics on where to pay attention and improve costs/outcomes

CI
COST IMPROVEMENT
900% more issues identified/resolved in hospital settings compared to typical systems

DI
DATA INTEGRITY
Highest standards of IG and data security across huge dataset processed (450m patient episodes)

EI
ETHICAL INTEGRITY
Transparency, fairness, integrating Social Determinants of Health

FI
FINANCIAL IMPACT
Otherwise unobtainable cost reduction/avoidance, margin improvement

GI
GOVERNANCE INTEGRITY
Avoid scandals, protect, reputation, demonstrably improve quality/safety

HI
HOSPITAL IMPROVEMENT
Tens of millions of dollars saved across otherwise invisible issues, Medicare/ Medicaid moved to break even

II
INVESTMENT IMPROVEMENT
Strategic transformation, capacity planning, M&A valuation and synergy capture

++

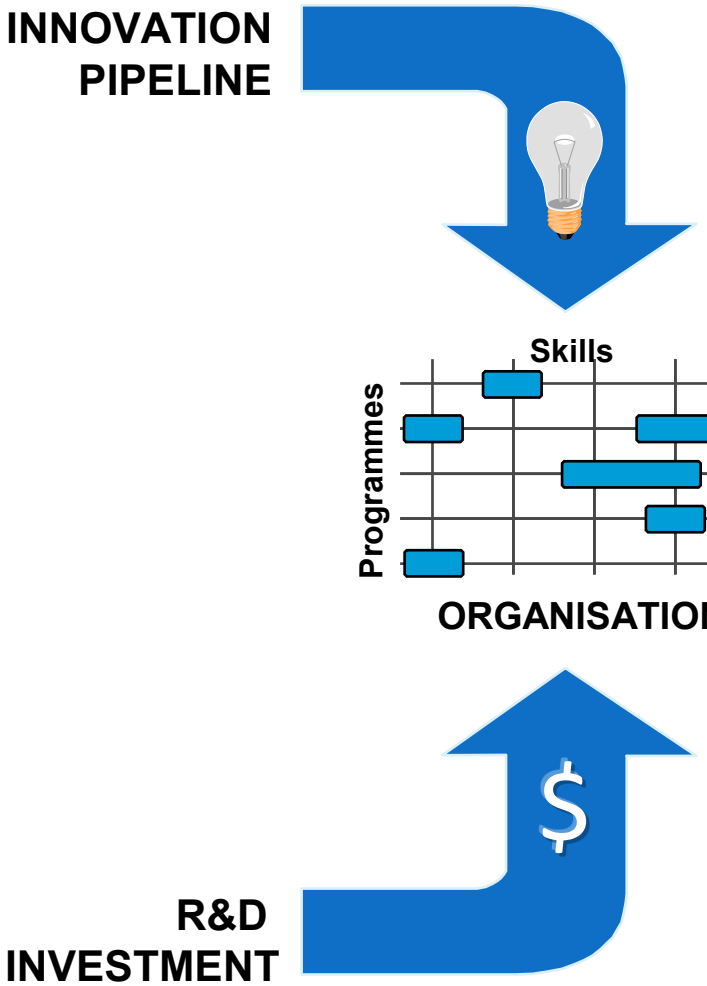
QI
QUALITY IMPROVEMENT
Significant improvements in quality, safety, reputation, STARS rating etc.

RI
RATINGS/REPUTATION IMPROVEMENT
Significant improvements in quality, safety, reputation, STARS rating etc.

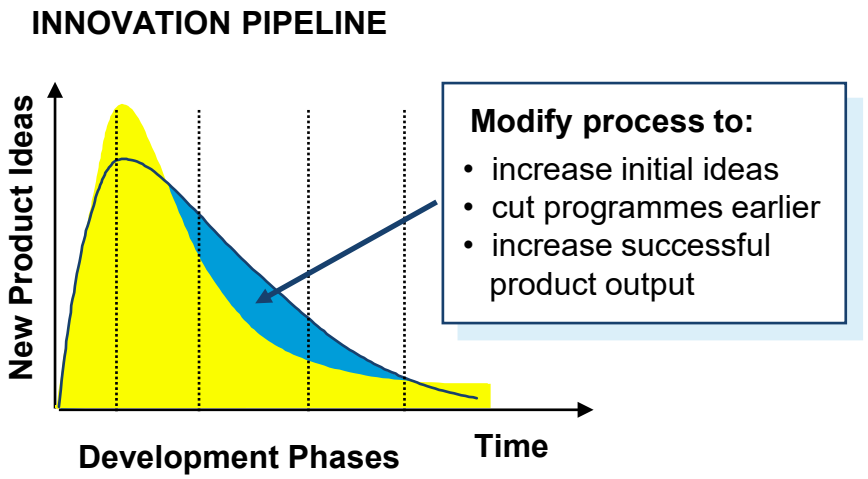
= ROI

You don’t necessarily understand the questions to evaluate a project

The Need for Effective Use of Resources

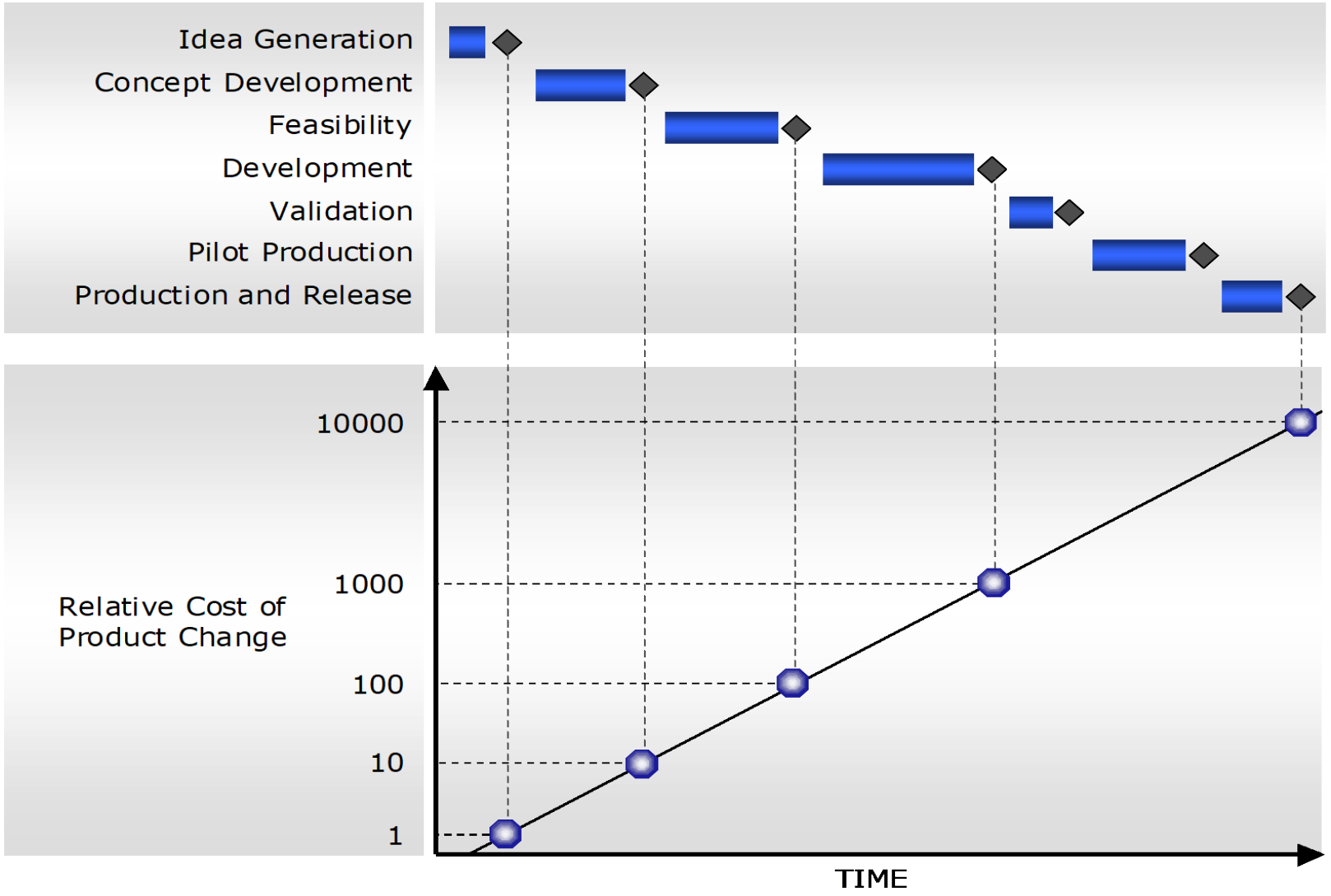


Only **10%** of programmes lead to product **"success"**



Only **46%** of total spend is on **successful products**

Classic thinking - Get it right early on – it's cheaper



Milestones are no longer milestones…

To write a good milestone statement, you can use the following structure: “The milestone is complete when” <**state of achievement**> and <**measure of quality**>.

State of Achievement	**and**	**Quality Statement**
The draft specification is complete	and	been signed off by the Director of Engineering
The fees estimate is complete	and	signed off by the Head of Department
All affected households have been sent letters	and	proof of delivery has been received for every one


The AI just rewrote itself. Evaluation now goes backwards as well as forwards.

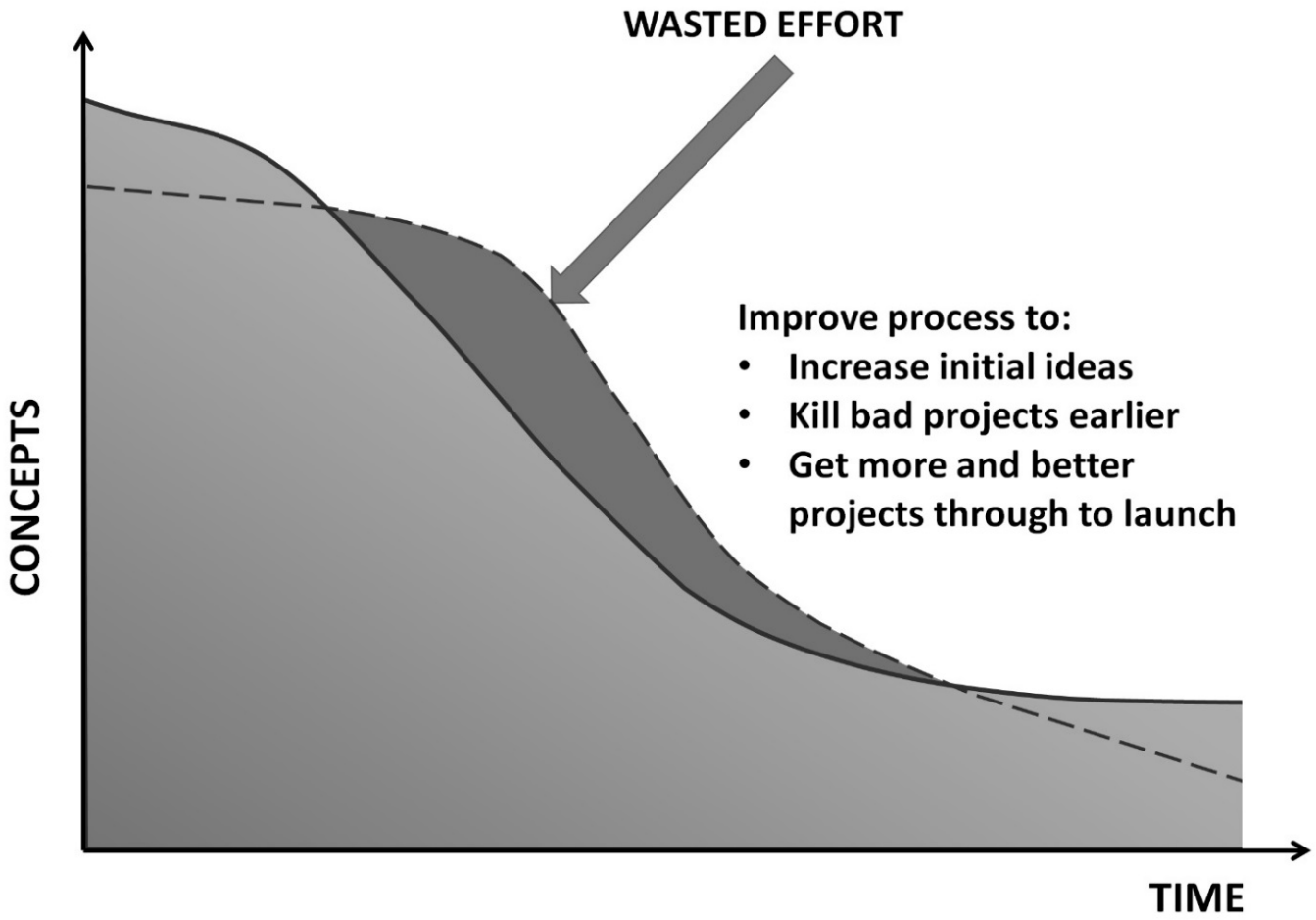

JOHN DAVID WASHINGTON
ROBERT PATTINSON
ELIZABETH DEBICKI
MICHAEL CAINE
KENNETH BRANAGH
TENET
A FILM BY CHRISTOPHER NOLAN
IN CINEMAS
AUGUST 26
BOOK TICKETS NOW

Developing products/services means sorting ideas

To ensure a stream of good products or services, a company will need to start with a larger number of concepts and then cull these over time.

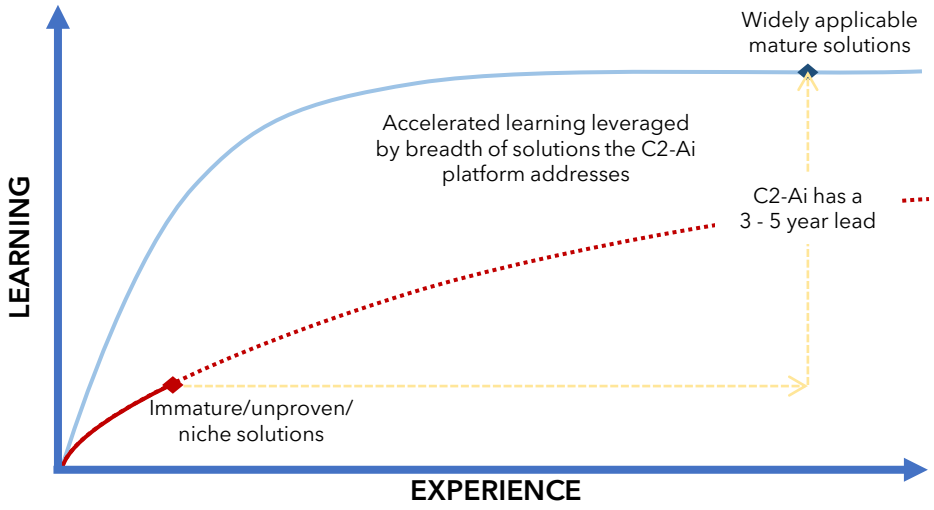
The dotted line shows a less effective portfolio.

AI WILL CREATE FAR TOO MANY OPPORTUNITIES – THAT CAN'T BE EVALUATED EFFECTIVELY

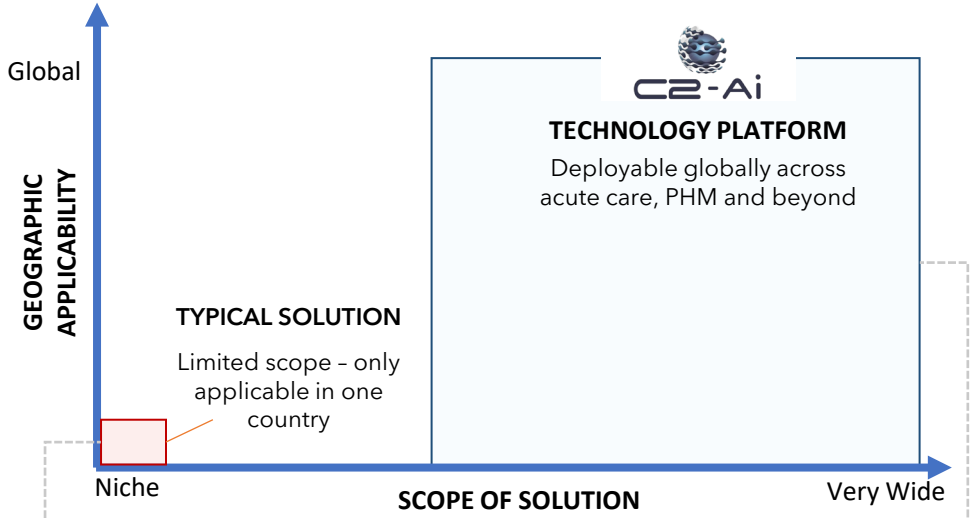


Experience and scope matter in selecting projects

EXPERIENCE NEEDS TIME AND BREADTH OF PROBLEMS ADDRESSED

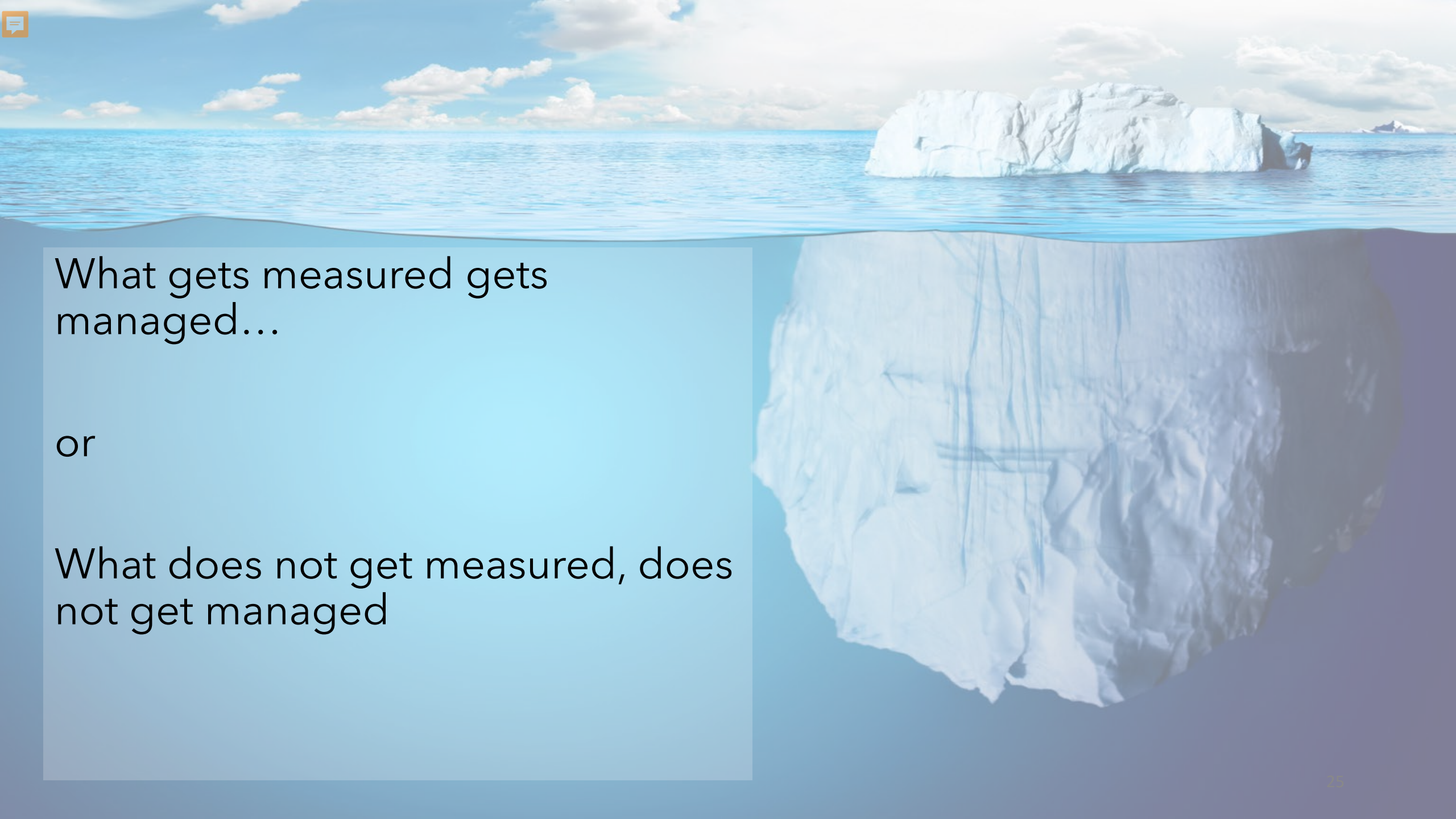


SCOPE MATTERS



New solutions focus on niche applications (e.g. radiology) and build on only one country's data.

C2-Ai's technology platform is deployable globally, based on learning from 47 countries including the US, UK and Canada.

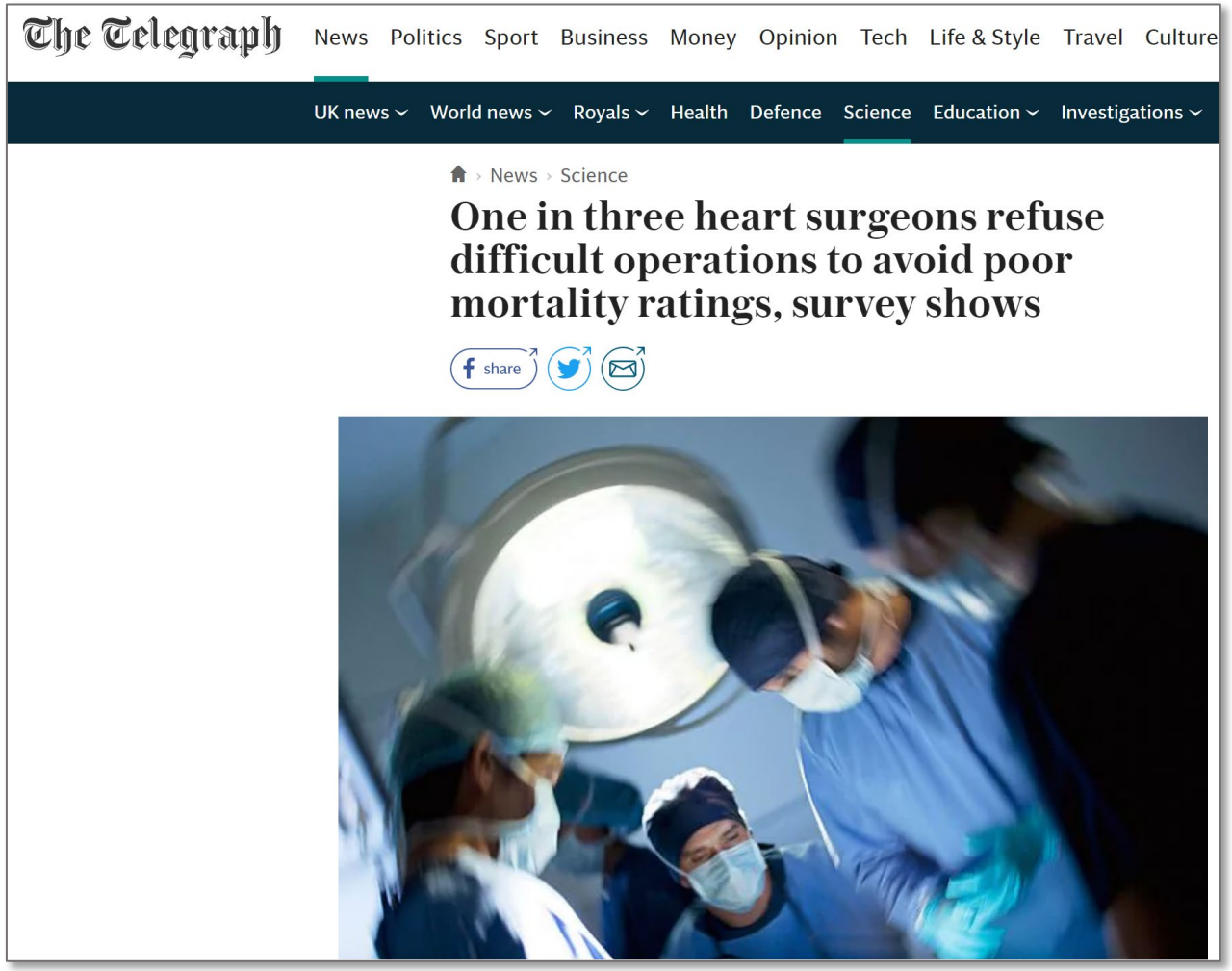


What gets measured gets managed…

or

What does not get measured, does not get managed

Hidden Costs and Impacts – Bad metrics driving fear and costing lives



This underlines:

- the weakness of simple mortality comparisons to national averages (other systems)
- how by using our risk-adjusted for each patient system, surgeons can feel confident that they will be fairly judged on their performance for each patient presented to them

26

C2-Ai provides this capability now - things others are only thinking of today

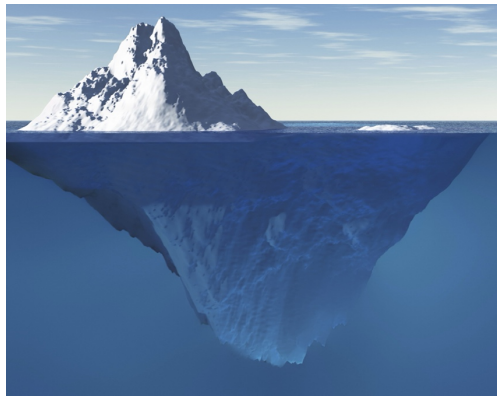
Example Solution – Patient Level Risk-Adjustment Optimising Hospitals

Individual clinical risk assessment at scale…

Up to **9×10^{453}**

Permutations per patient based on physiology, procedures, harm triggers etc.

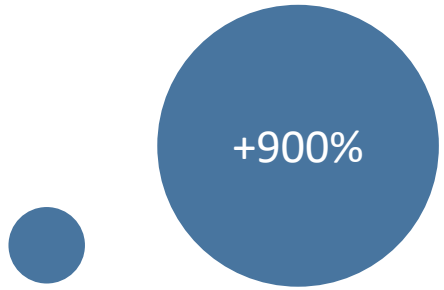
…drives deeper insights…



Up to **25x**

detection/resolution of harm

…delivering greater improvements…



Issues found by typical hospital monitoring

Issues with root causes found and resolved with C2-Ai

…even in the ‘best’ hospitals with the best EMRs

Signature hospital with vision
“to be the safest healthcare group”

56.4%

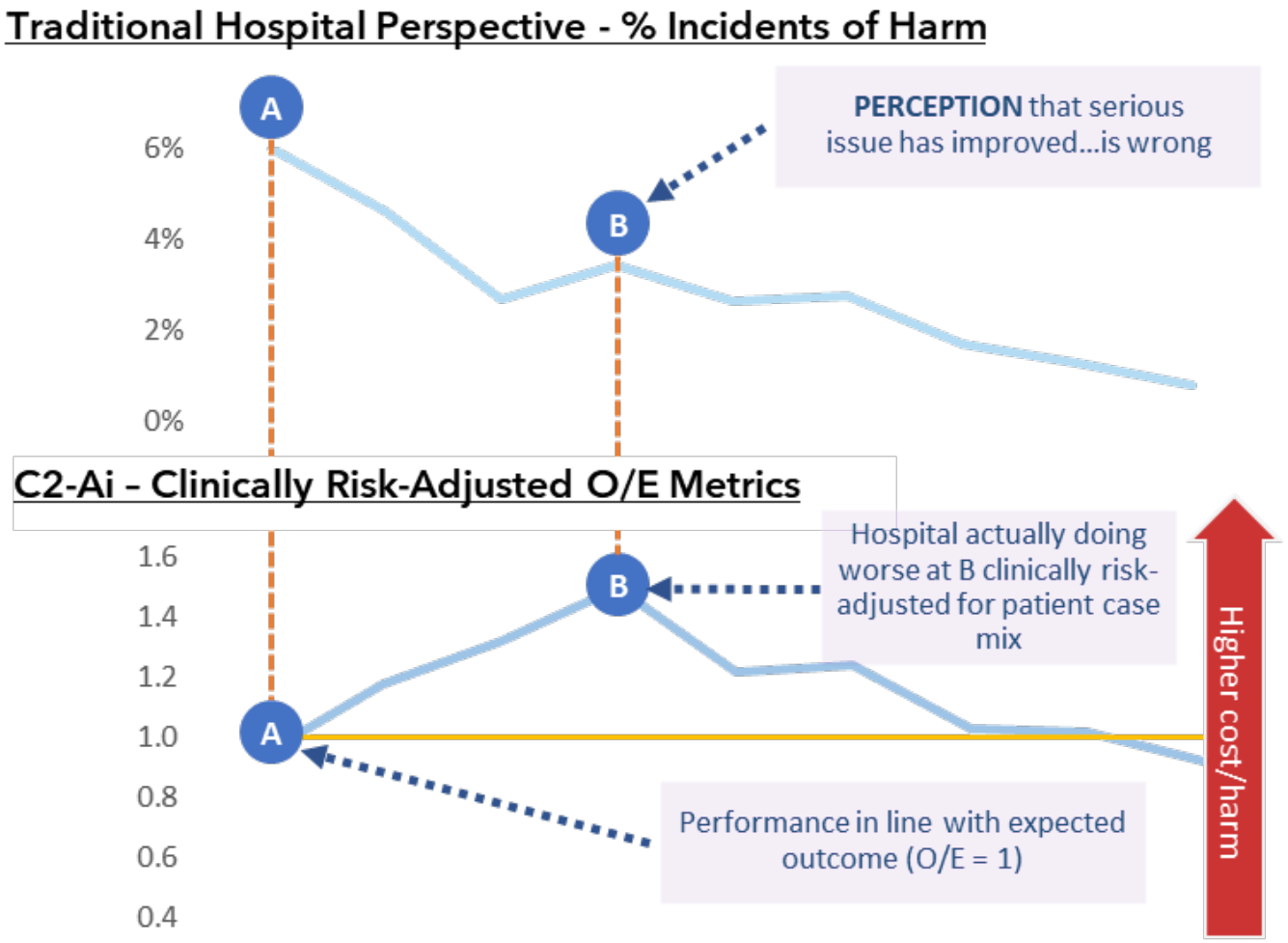
reduction in surgical complications

83%

average reduction in triggers of avoidable harm

Hospital Optimisation

Uncovers the Real Quality and Cost Issues…

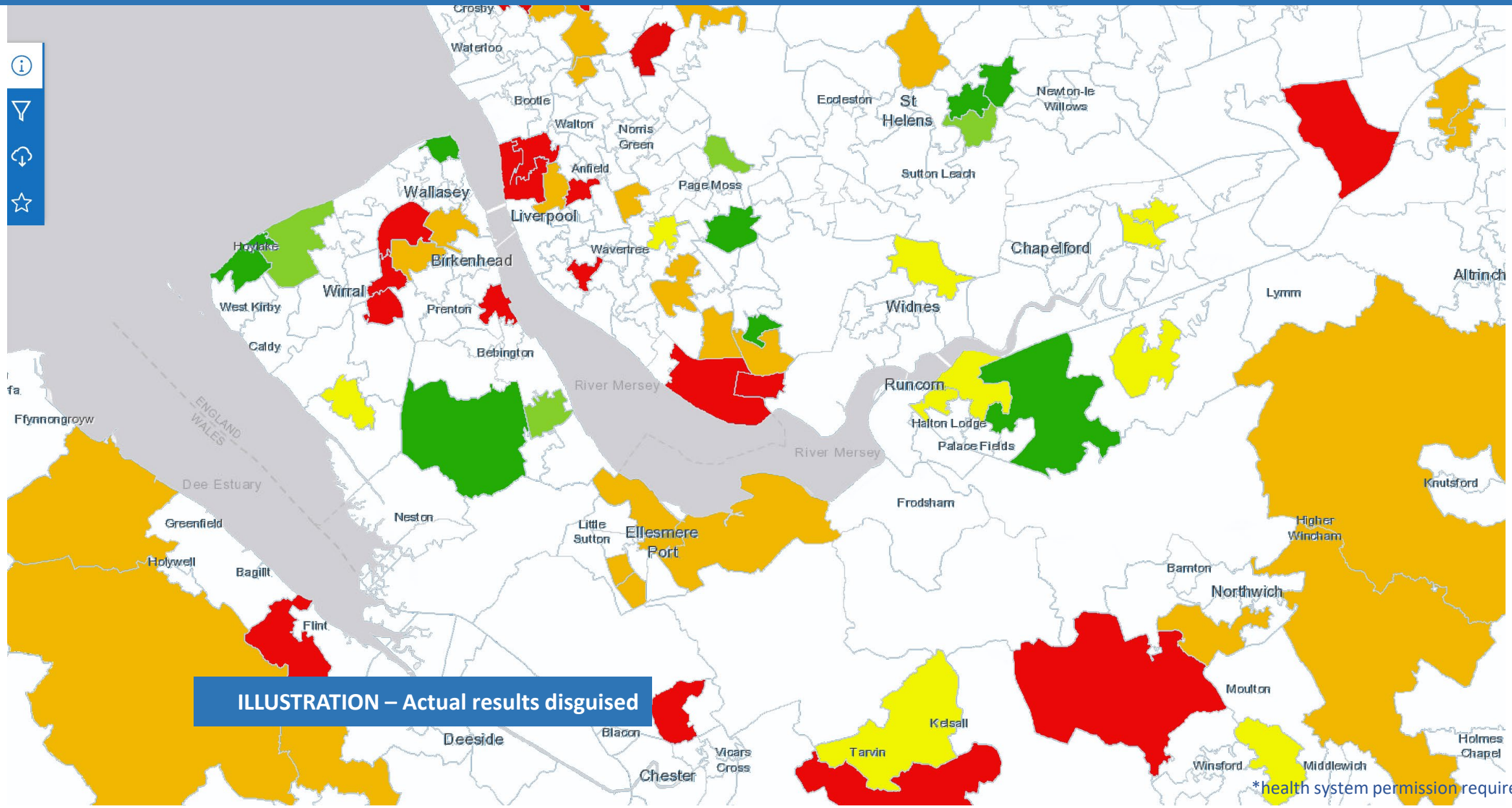


A C2-Ai's case-mix adjusted analysis showed that performance at point A was actually acceptable given the clinical case mix. Performance deteriorated over time

B Point B was where executives needed to focus their attention

Clinical Risk Stratification/Prioritisation by Area

Supporting targeted location or individual* patient interventions built around patient-level, clinical risk assessment



*health system permission required

Clinical considerations:

- Clinicians will need to be confident that decision support tools are valid for the patient in front of them, not just the specific group that made up the training data
- Algorithms can lead to wrong assumptions based on incomplete data, for example suggesting having asthma lowers a patient's risk of death from pneumonia
- Doctors learn from errors through reflection and changing future practice. How can we stop algorithms from reinforcing their own behaviour when they make mistakes?

Source – Artificial Intelligence in Healthcare - 2019

Ethical issues:

- Is it acceptable to stratify patients by factors such as age, race, postcode or socioeconomic group if this can improve outcomes, or would this negatively impact those patients? This is a big question for society and ethicists
- Do we have an ethical duty to encourage under-represented groups to provide more of their data to be used to train algorithms?
- Artificial intelligence has the potential to use the wide range of differences between us to provide truly individualised care – though this might be better for some people than others

Source – Artificial Intelligence in Healthcare - 2019

Impact on equity of new approach to waiting list triage

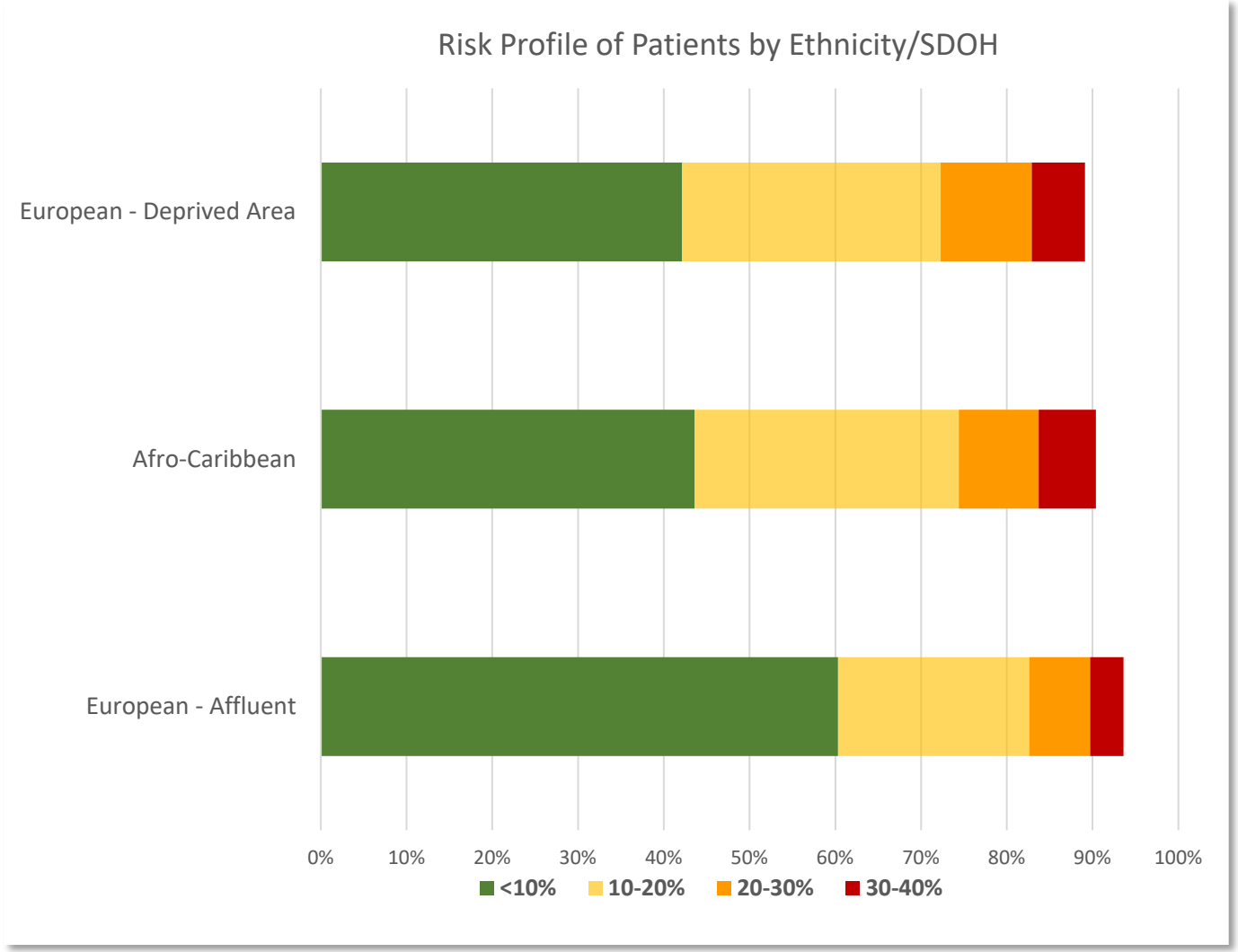
Social Determinants of Health are exactly that - they impact an individual's health and health needs.

C2-Ai's Elective Waiting List system:

- assesses each individual's clinical needs and prioritizes them accordingly
- does not artificially include SDOH as a separate assessment

Our research shows that **those impacted by SDOH naturally placed higher up the Patient Tracking List** - not because they were artificially boosted, but based scientifically on their poorer health status and increased clinical needs.

Predicted overall complication risk



Practical challenges:

- If training data is only obtained by those who specifically volunteer and consent for their data to be used, algorithms will learn from unrepresentative datasets
- Algorithms could be ‘loaded’ with hidden preferences, such as favouring a particular drug manufacturer over another
- Artificial intelligence will need high quality labelled data from electronic health records. Is it clinicians’ responsibility to make sure all data is recorded in a standardised machine readable way?

Source – Artificial Intelligence in Healthcare - 2019

450m records processed

47 countries providing data

What innovations will win?

As a generalisation:

- Broad solutions that address multiple care pathways will beat (get more attention) than solutions focused on niche problems.
- 10X solutions will trump solutions delivering 2% improvements. The pain of adopting the latter will not be worth it.
- Solutions that hit ‘hot buttons’ in healthcare will get attention. Those that don’t will struggle.
- Approaches that increase clinician screen time significantly are unlikely to take hold.
- Avoid disrupting clinicians (given the mass resignation, high stress levels and overload) as this will not be met favourably.
- Design the use and/or integration to minimize IT teams' time (they haven't got any spare - ever).
- Be up and running and delivering benefits in days.

Introduction

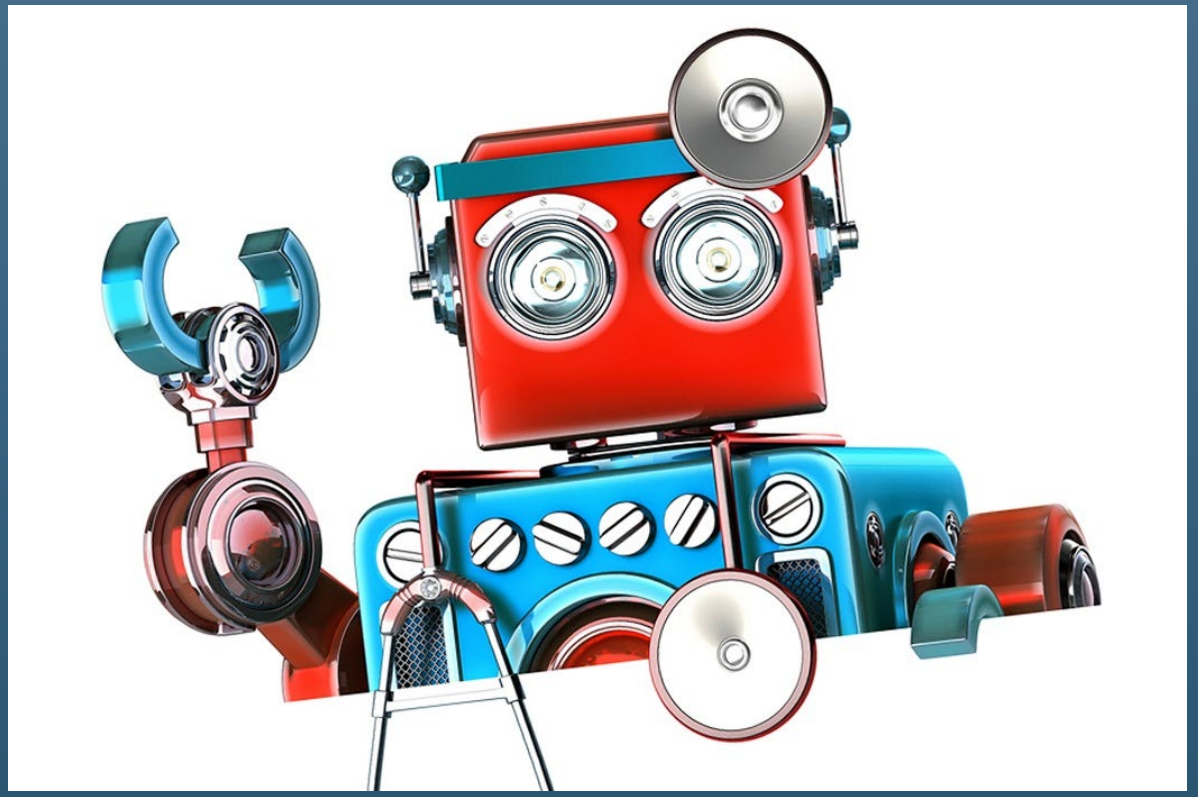
WILL VIEW FROM THE PORTFOLIO MANAGEMENT ANGLE

THEN A BIT OF FUN ABOUT PROJECT MANAGEMENT IN THIS CONTEXT

HOW DO YOU EVALUATE IDEAS?

Challenges of AI in healthcare for the implementation and use

- Human interactions are hard to digitise and machines struggle to negotiate between medical advice and patient wishes
- Clinicians understanding the AI system use to make decisions. This leads to an implied level of trust between user and system
- The holistic view of the patient can often be skewed by optimising the system based on purely health parameters
- Clinicians become increasingly dependent on technology. Is this technology safe and secure?
- Human factors and ergonomics risk being overlooked – lack of coproduction and patient inclusion in design



Source - Stuart Harrison - Ethos

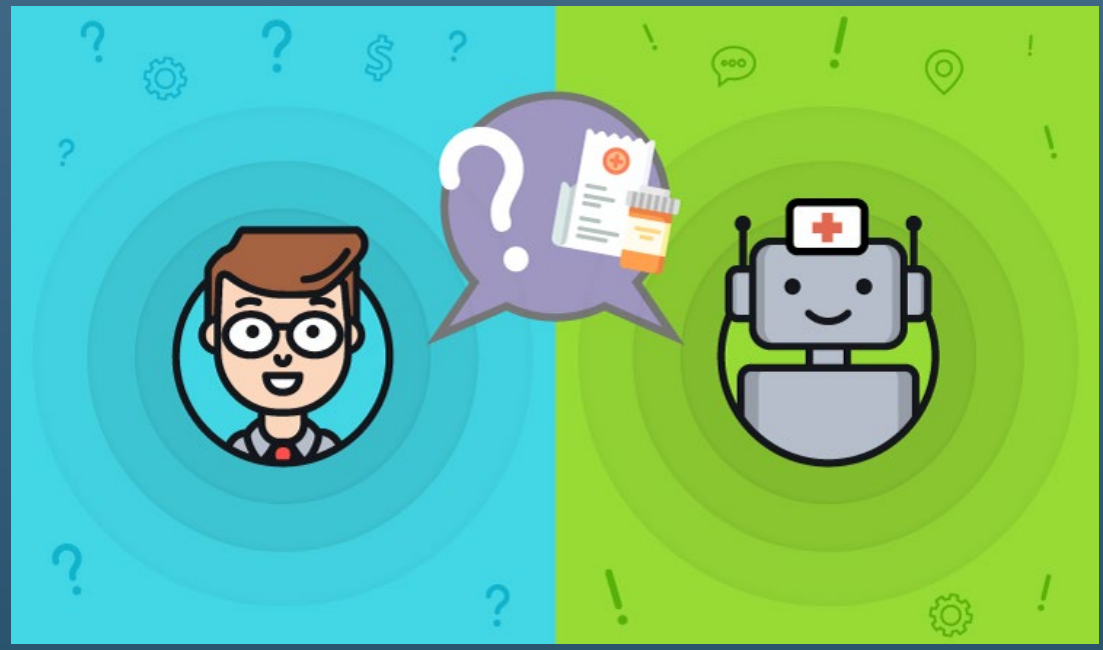
Clinical Safety & AI

Advantages

- AI has the ability to standardise assessment and treatment according to up-to-date guidelines
  - raising minimum standards and reducing unwarranted variation
- Improving access to healthcare, providing advice locally, in real-time and providing alerting functionality for complex conditions

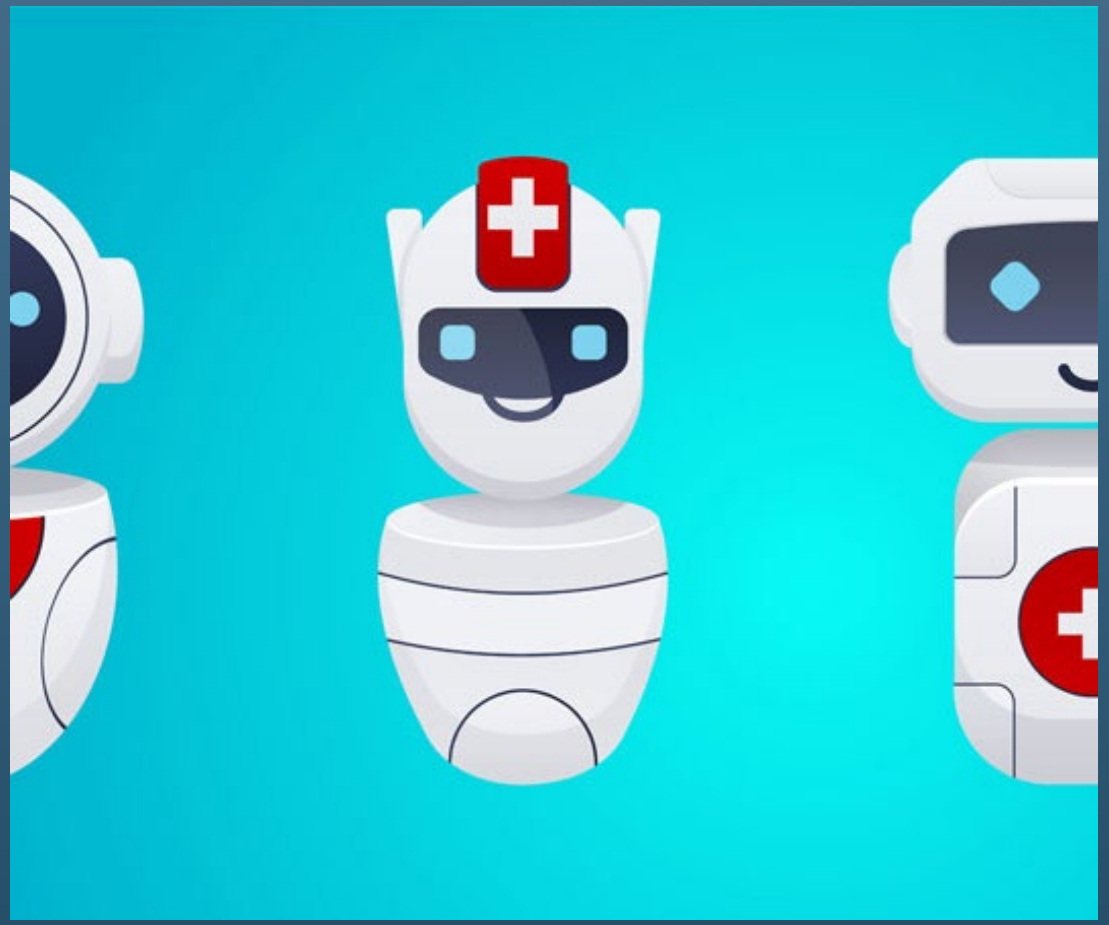
Disadvantages

- Decision support tools could be confidently wrong and misleading algorithms hard to identify
- Unsafe AI could harm patients across the healthcare system at scale
- Holistic clinical consultations potentially devalued or difficult to replicate
- Unfamiliarity may lead to misinterpretation of decisions made



Source - Stuart Harrison - Ethos

Medical Devices & AI



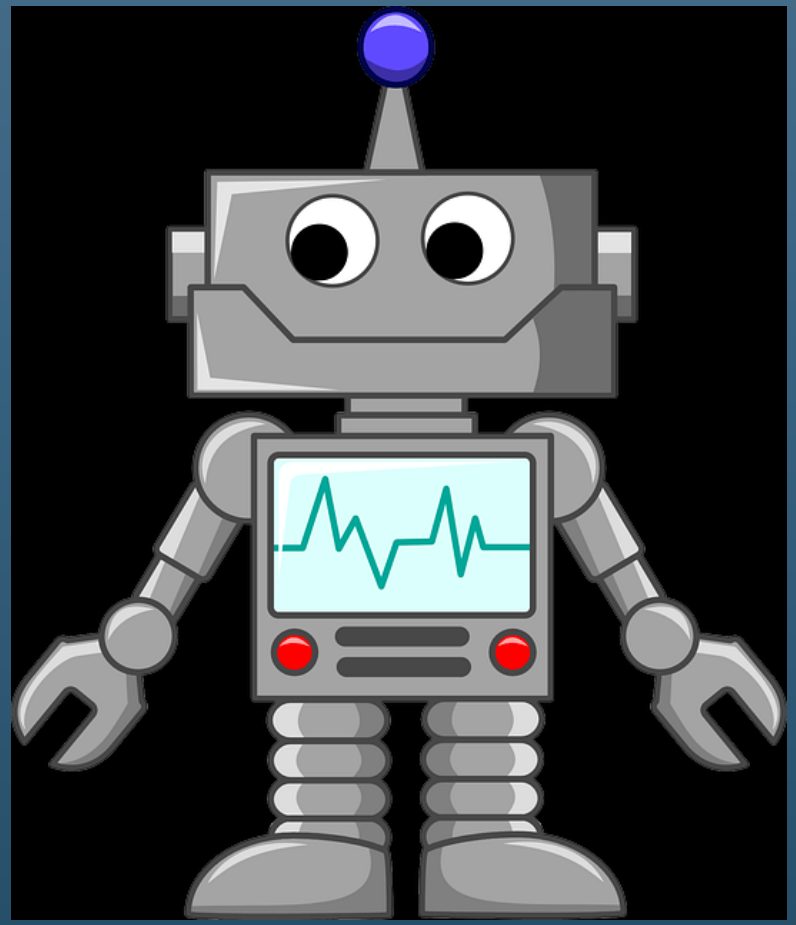
Challenges and summary for Medical Device Regulation of AI:

- Lifecycle approaches to regulation and compliance
- General Safety Requirements
  - Risk Mitigation measures
  - Clinical Evaluation and sometimes Performance Evaluation (IVDR)
- State of the Art – use of best practise in the absence of any formal standards (harmonised to the MDR or not)
- No general requirement from the MDR/IVDR or harmonised standards that machine learning be human interpretable
- IVDR performance evaluation method may be better equipped than the MDR clinical evaluation method to assessing the safety of AI
- Neither the verification, validation, nor the risk management elements of the harmonised standards appear to be a good fit for some machine learning models

Source - Stuart Harrison - Ethos

Challenges for the risk management, compliance and regulation of AI in health

- Regulatory bodies (MHRA and others) may not have sufficient expertise to manage the growth and issues presented by borderline devices and new use cases
- Complete lack of regulatory guidance on Software as a Medical Device & AI – the sector needs more guidance beyond traditional MEDDEV publications that do not change often
- Lifecycle requirements do not deal with “black box” technology solutions very well
- Considerable effort needs to be input into existing standards starting with risk management and lifecycle quality
- Regulatory requirements need to be more dynamic and efficient rather than static and reactive



Source - Stuart Harrison - Ethos

Project Killers

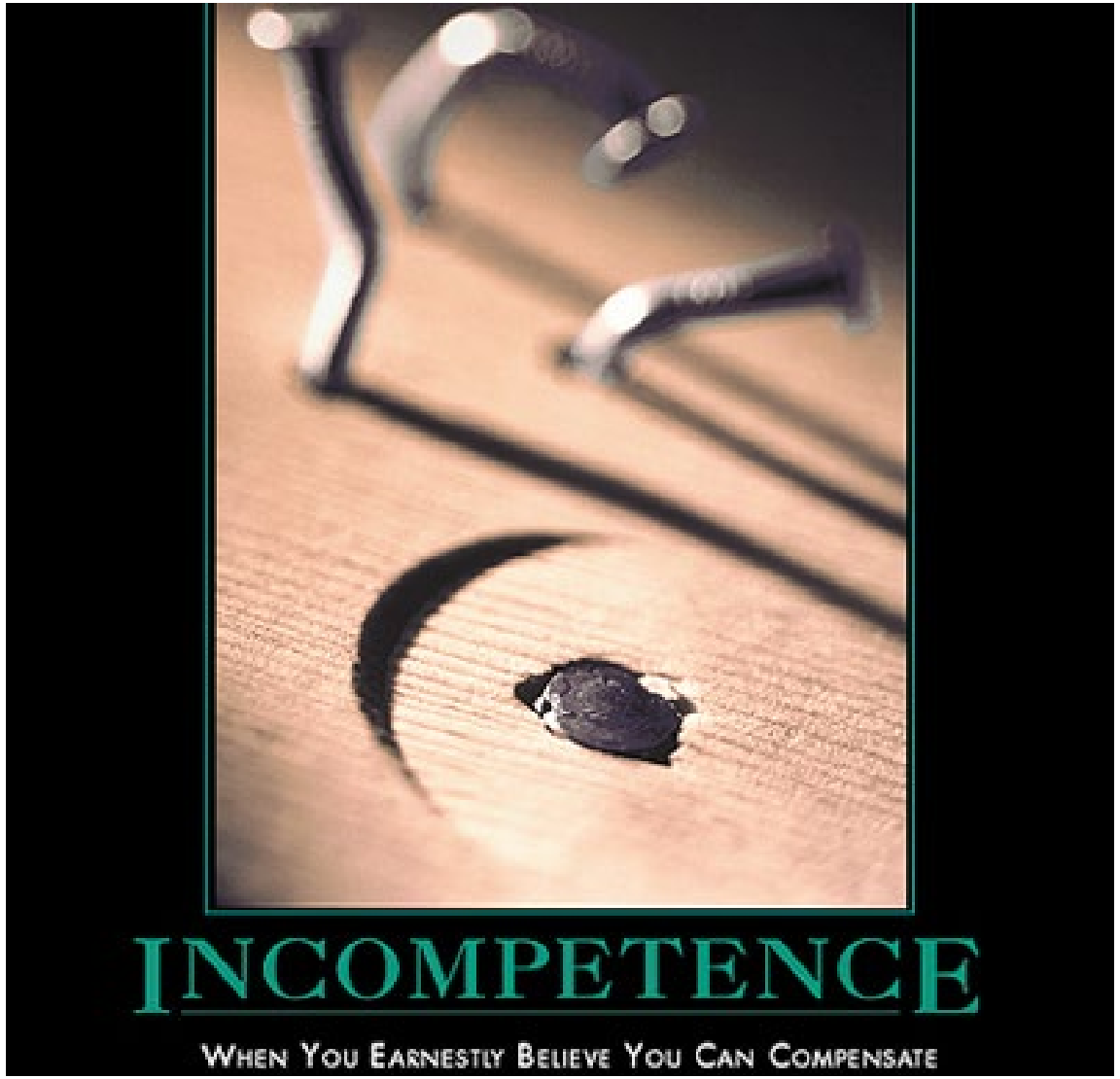
The Scared Team (Don’t Shoot the Messenger)

- The Scared Team knows it is in trouble but it’s not letting on!

Project Killers

The Incompetent Team

- Can’t warn you the project is going badly but even worse, they might tell you things are going well when they’re not!



Project Killers

The Ignored Team

- Target completion dates are imposed with little or no concern for what the team is saying about whether they are achievable.

Project Killers

The Relaxed Team

Project Killers

The Doomed Team

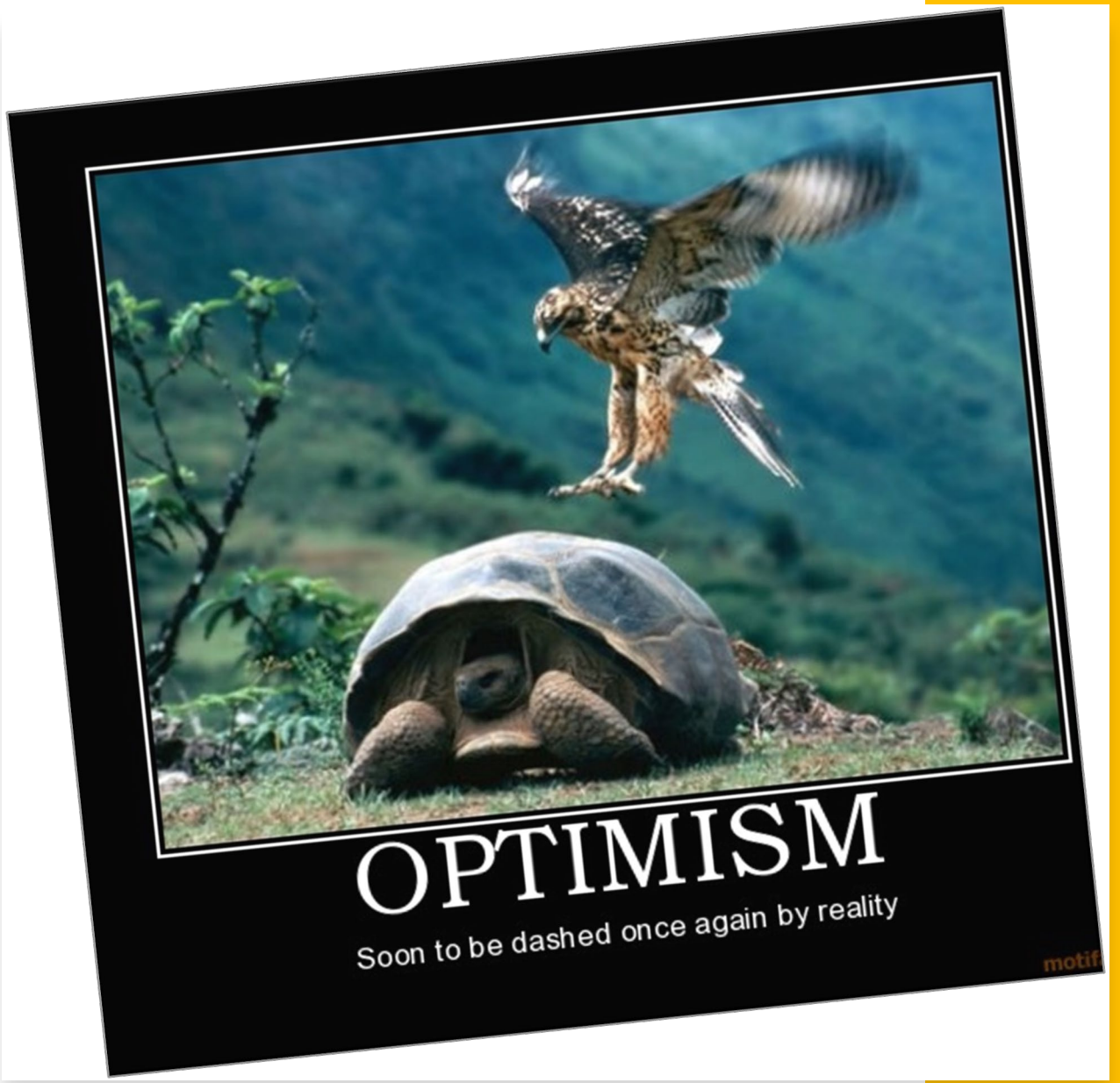
- Lost faith in the ability to complete the project on time even if the project is perfectly achievable.

Project Killers

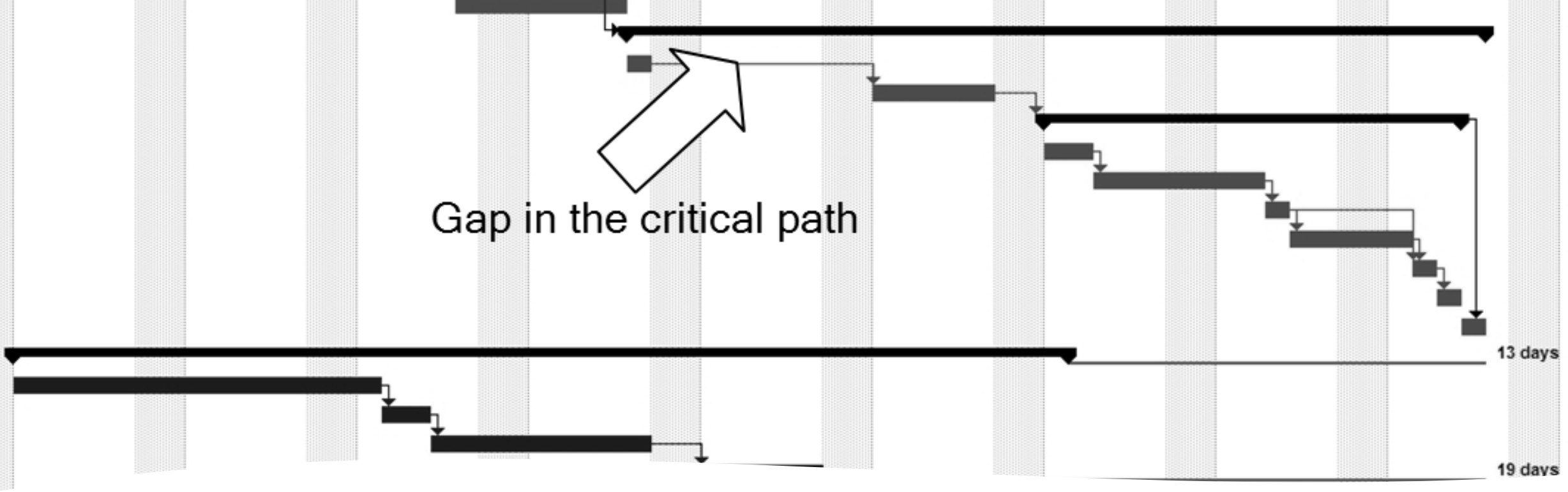
Death by Content

Project Killers

‘Everything Goes Right’ Plans



Attitudes have changed too – requiring better planning



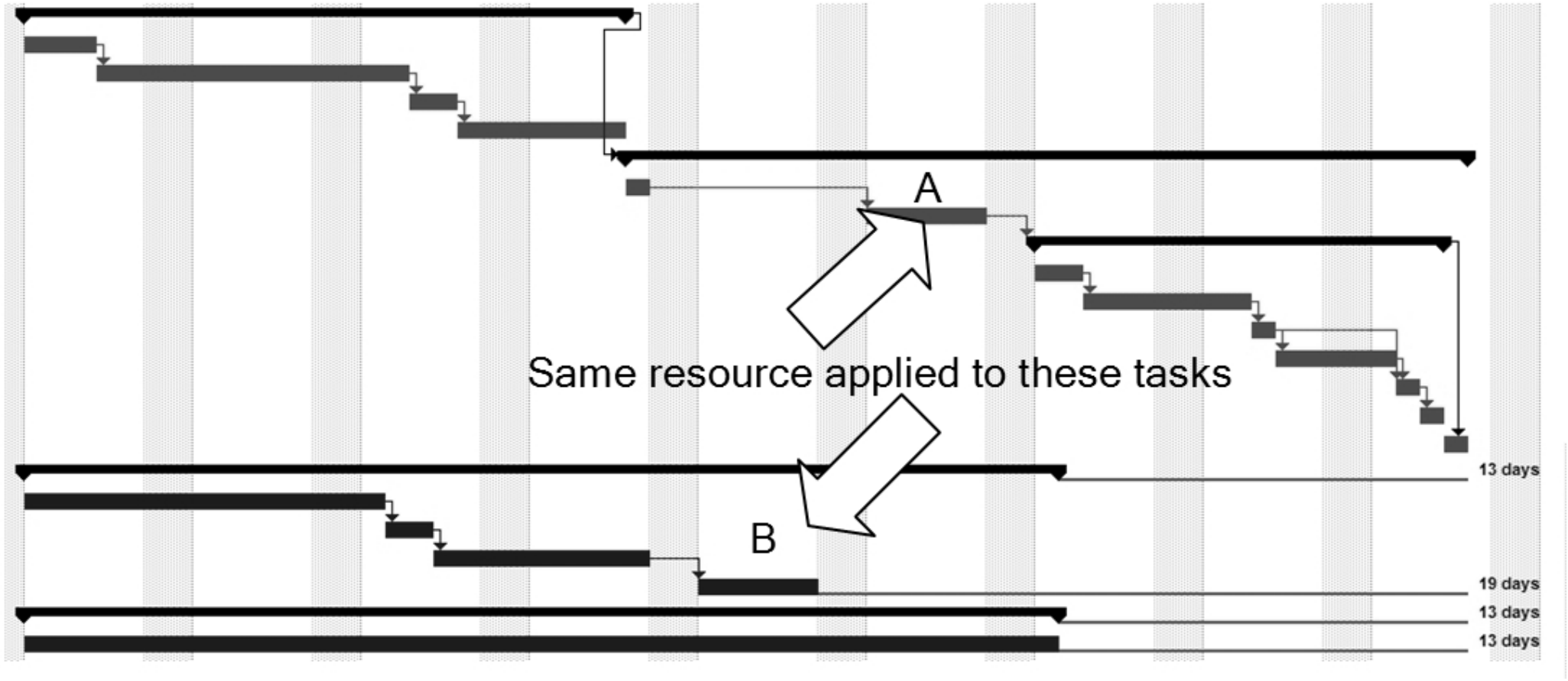
Shortening the plan

- The first thing to do is to **level** the project plan.

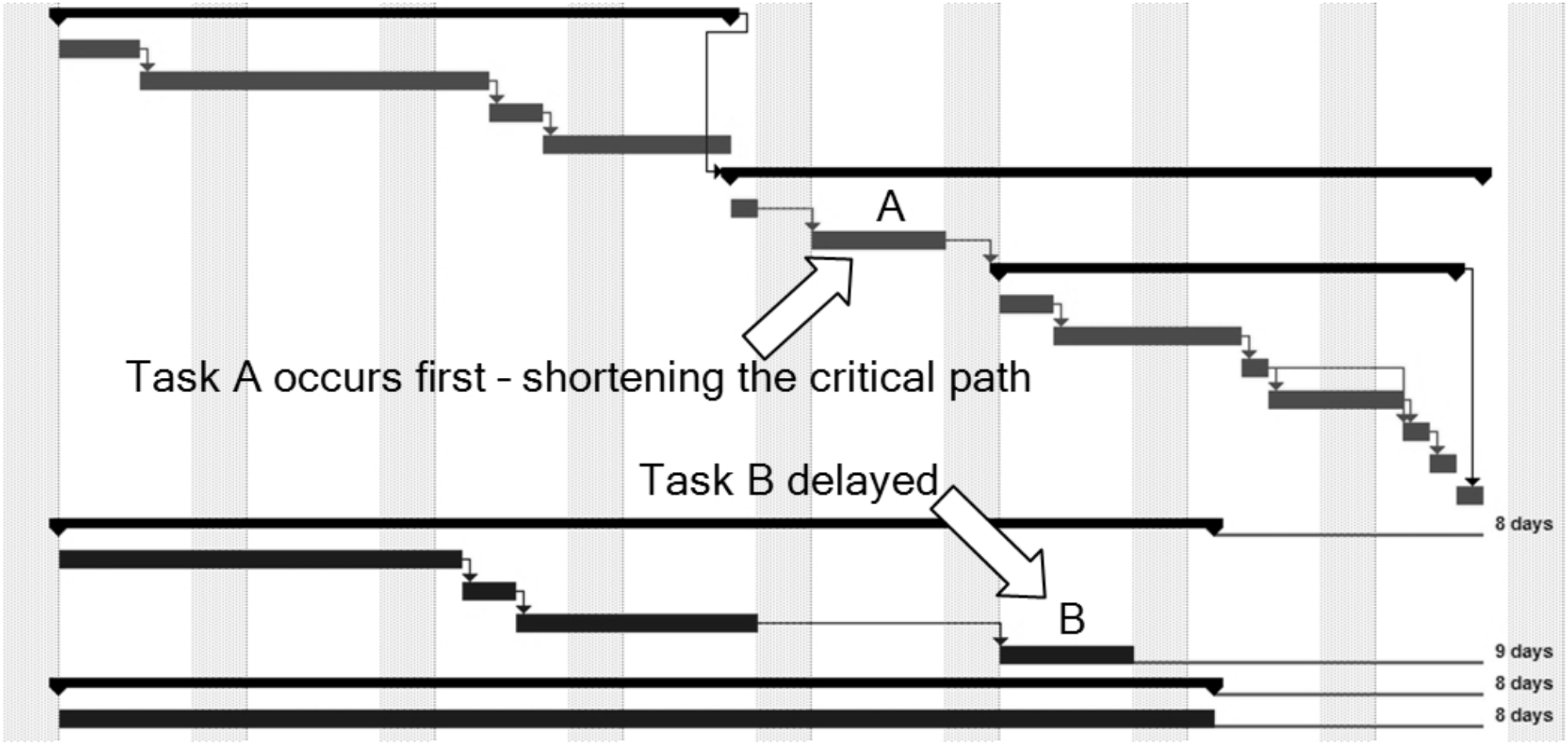
- This is a feature in the software that will delay tasks where a resource is trying to do two (or more things at once).

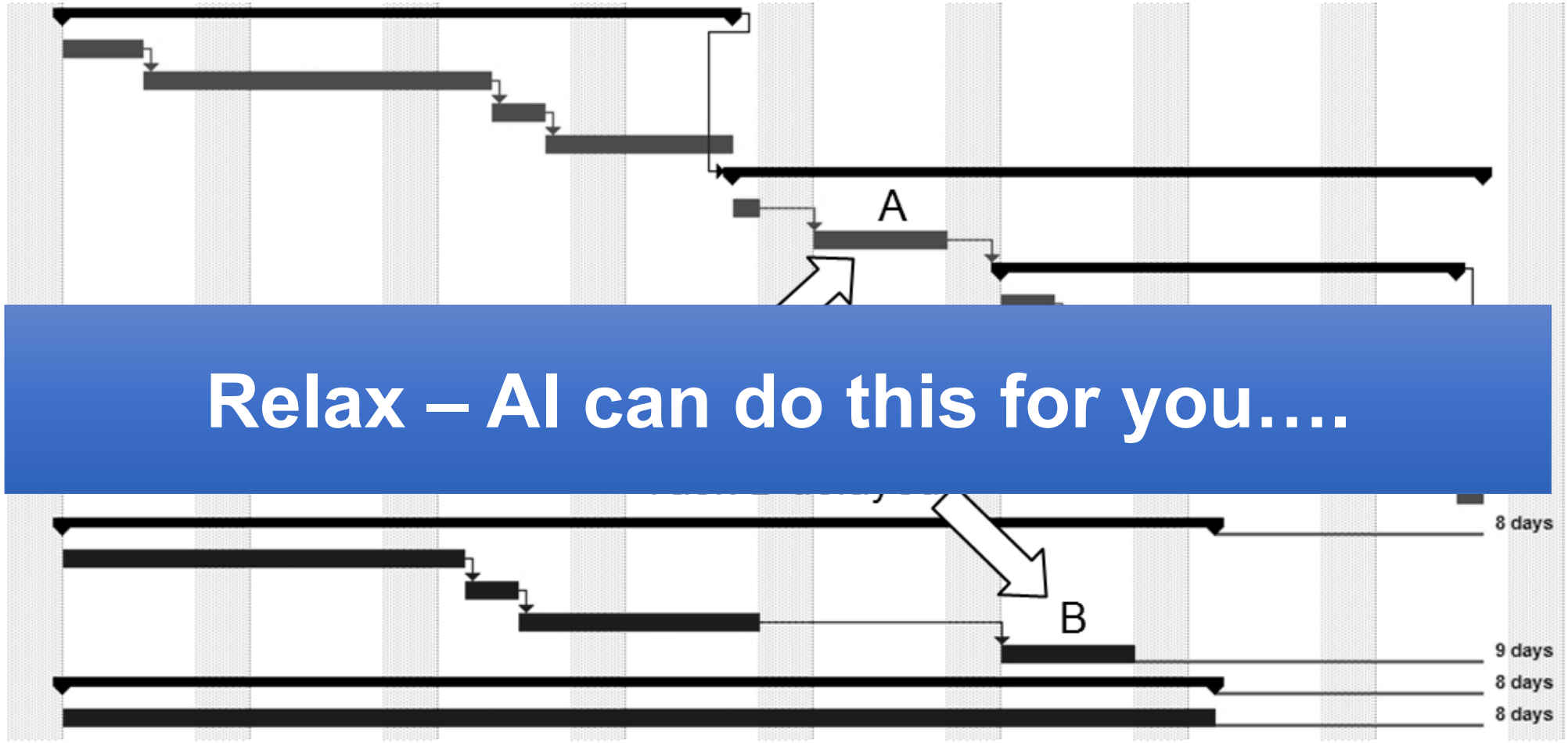
- These tasks might look fine drawn in parallel in the plan but when you realise that a given resource is actually down to do 48 hours work on a given day, and is only available for three hours, then you know the plan is completely unrealistic.

Shortening the plan – resources might be doing the ‘wrong’ thing first



Shortening the plan – prioritise what they do





Relax – AI can do this for you….