DARAT: Domestic Abuse Risk Assessment Tool

- Why build an algorithmic tool in the first place?

- Choices we had to make along the way

- Will it improve on the status quo?

- Implementation decisions: how do we ensure human-centric decision making?

- Tough problems and tough decisions

- Can it be scaled: options for development of national models

Why Build a Tool?

DASH:
Domestic Abuse, Stalking and Honour Based Violence Risk Identification, Assessment and Management Model (DASH, 2009)

Rationale for design of a new tool

- Tens of thousands of domestic incidents each year

- Police officers are expected to grade risk of future domestic harm, and are expected to use DASH to do this

- Police forces allocate protective resources based on DASH scores, and this leads to:

  - High harm outcomes being missed if it is not accurate, and therefore people may suffer harm that could have been prevented

  - Resources being allocated to cases where there is actually no likelihood of harm
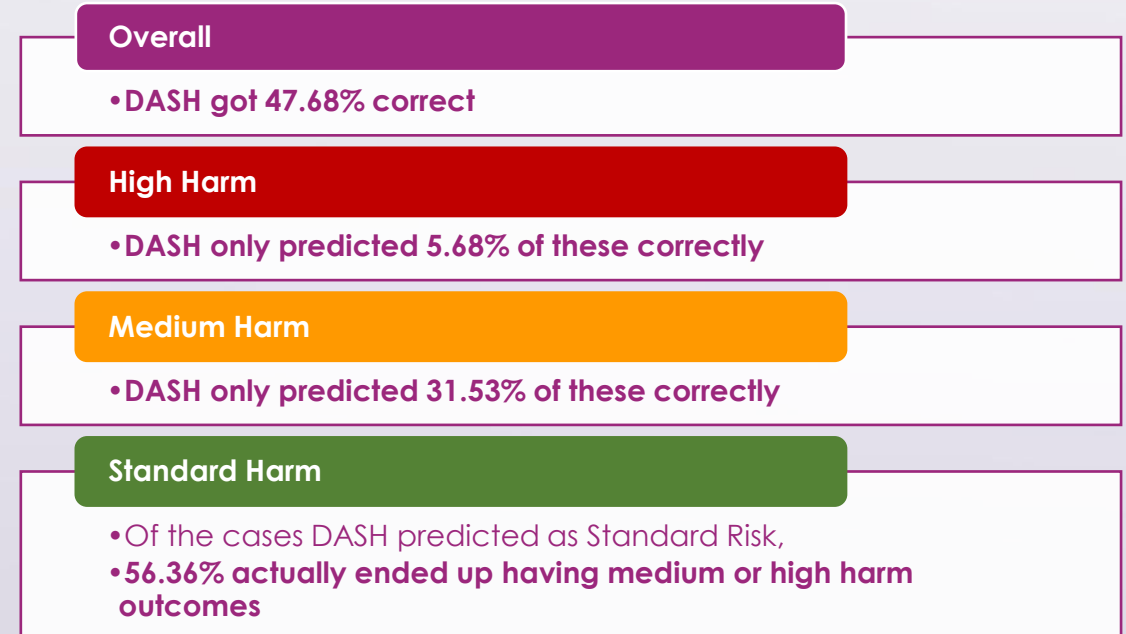
Why Build a Tool?

How accurate is DASH?

Testing

DASH scores were compared to the actual whole occurrence outcomes (divided into new risk gradings) in the 12 months following the triggering incident

Results:

Overall
- **DASH got 47.68% correct**

High Harm
- **DASH only predicted 5.68% of these correctly**

Medium Harm
- **DASH only predicted 31.53% of these correctly**

Standard Harm
- Of the cases DASH predicted as Standard Risk,
- **56.36% actually ended up having medium or high harm outcomes**

Caveats

No custodial data is currently available, so some high harm outcomes may have been prevented by custodial sentences

Unknown efficacy of treatment; some risk may have been reduced

Why Build a Tool?

- Machine Learning and AI are often not the right answer to many problems we have in the public sector

- In this case though, the alternative does not work well... and DASH is an algorithm

- Perfect storm
    - wasted resources at the same time as under-identifying cases that go on to suffer significant harm

- We need to tread carefully, but this problem can be reduced through use of a machine learning tool

AI-generated content may be incorrect
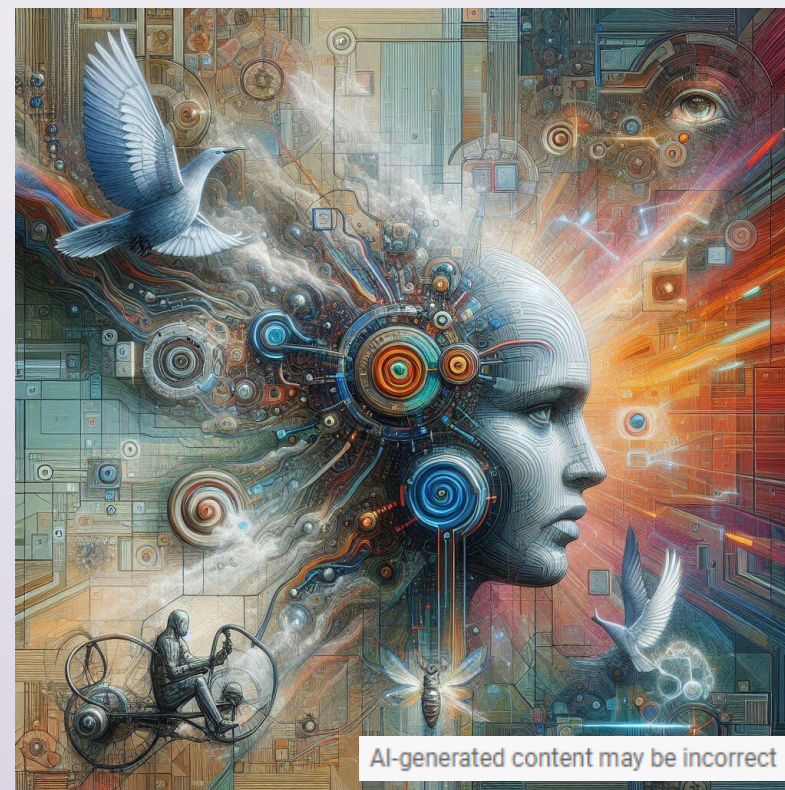
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Why build a tool?

Better allocation of resources

- Decisions are made in relation to risk at present, and resources are wasted if allocated incorrectly.
- Better decisions would mean **more effective allocation of resources** (which could in turn lead to safer victims)

Baseline to find out what works for reducing risk

- Clear risk predictions with known accuracy allows **testing of interventions**

Better decisions

Uses strengths of DASH

Clear risk grading and time frame aiding understanding for safeguarding

Combined with other information

Improves, but does not replace human decision making

Known accuracy, bias and trustworthiness

Takes account of complex interactions between risk factors

Designed with risk assessment in mind

Choices we made along the way

"No person should be a victim of domestic abuse"

- Standard risk should be that **nothing** happens

Choices we made along the way

- **Domain Knowledge**
  - Data cleaning to avoid garbage in... garbage out
  - Recoding... adding sensible new variables and in turn **new features**
  - Predicting the **right thing**, at the **right time**, knowing which information would be available to the model
  - Balancing the model in a way that **works for policing**, not just in principle
  - Not all errors are created equal

Choices we made along the way...

Two tools... not just one

Whole Occurrence Model

- Suspect or Victim -> Suspect or Victim again
- 12 months
- How serious

Offender Only Model

- Suspect -> Suspect again
- 12 months
- How serious

Choices we made along the way…

A place to start from

Algorithmic Approach with large high quality dataset

- Improved Data Cleaning and Nominal Matching
- Random Forest Modelling used to provide rigour around classification task
- Other options will be examined to test loss vs simplicity
- Tested on unseen data

Wide range of data put into the model:

triggering characteristics	historical circumstances for victim and offenders
flags and warnings for victims and suspects	missing persons reports
death by suicide as a harmful outcome	

Some Caveats...

- DARAT is being developed alongside our team building a cloud-based multi-agency data sharing platform
  - Development is ongoing, but we are not there yet
- These are early representations, but this project is in development stages and is subject to change
- Likely to be a good deal of improvement that can still be made
- No bias checking has currently been performed, but it will be
- With these caveats in mind...

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Will it improve on the status quo?

- Example Whole Occurrence Model... please remember caveats!

FORCE A: DARAT WHOLE OCCURRENCE					
	High	**Medium**	**Standard**	Sensitivity	Percentage
High	105	152	97	29.66%	5.56%
Medium	607	1351	1548	38.53%	55.04%
Standard	160	337	2013	80.20%	39.40%
Specificity	12.04%	73.42%	55.03%	54.46%	
Percentage	13.69%	28.89%	57.43%		

(ACTUAL OUTCOME)

DASH FINAL RISK ASSESSMENT					
	High	**Medium**	**Standard**	Sensitivity	Percentage
High	142	1004	1352	5.68%	5.74%
Medium	604	7475	15629	31.53%	54.44%
Standard	353	3845	13147	75.80%	39.83%
Specificity	12.92%	60.65%	43.64%	47.68%	
Percentage	2.52%	28.30%	69.18%		

(ACTUAL OUTCOME)

- Domain Knowledge again... everything is a tradeoff

- Balancing the model in a way that works for policing, not just in principle... *not all errors are created equal*

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Tough Problems and Tough Decisions

- **Data dependencies** on other tech projects

- **Everything is a tradeoff**, domain knowledge really helps
    - Definitions, features and timings need to be well considered

- Being transparent means making your project **look more risky** than other less transparent projects

- Explainability and performance can be at odds, but the human decision maker **needs to understand enough** to make the call
    - Also, how do you avoid inappropriate refusal or insistence on overriding?

- **Re-training paradox**… Some problems are easy, this one isn't!

- Avoiding **technical debt** due to interconnected machine learning or automated processes

Implementation decisions

- A human being needs to be the **ultimate decision maker**
  - House of Lords Guidance… but more importantly, they often know real world information that doesn't exist in data, so the model can't use it

- **Tools will help**
  - Presenting data at the right time for it to be used easily
  - Asking questions, framed to make officers think and evaluate
  - Providing feedback after a year so officers can learn
  - Data and Model Drift dashboards for data decision makers

- **Bias estimations** openly described and minimised

- **Open and transparent** use of the model, without facilitating tailored offences to avoid the classification of high risk

- **Don't overlap** with other models

- It needs to be **built by teams with intimate domain knowledge**

- Need to ensure we are **not damaging legitimacy** or self-trust of officers

Can it be scaled?

- Thames Valley Together blueprint has been recognised as something that should be taken wider (Common Data Platform)

- Opportunities as all tools built for DARAT would work in other forces using that architecture

- So **yes**, it would be possible… **but with caveats**:
  - Each force defines data differently and has different problem profiles for domestic abuse
  - Would need to rebuild the model part to ensure that it is not immediately affected by a data drift problem
  - But much easier than having to rebuild the model and all tools
  - A national model could also be developed, using wider data, but this would require collaboration, and may or may not work better than separate ones

Reflections…

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Please reach out to me on LinkedIn

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