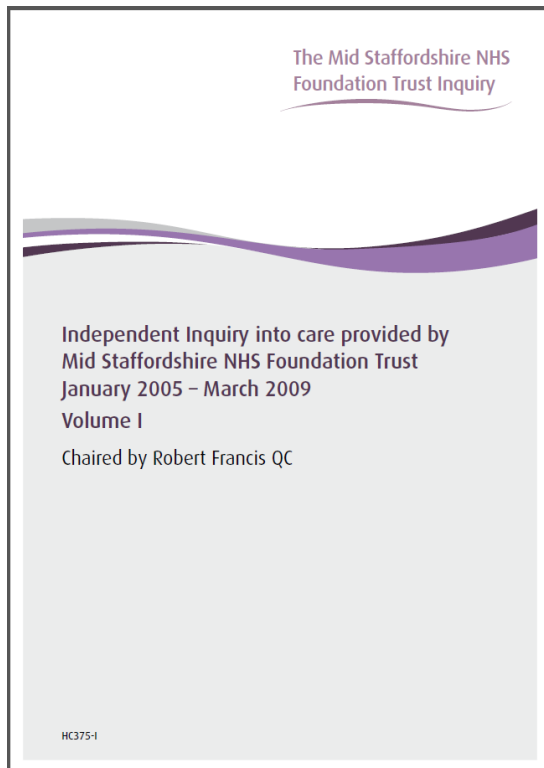# Using data to improve patient care

Prof Jim Briggs

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History: learning from mistakes

- Francis report

The Mid Staffordshire NHS Foundation Trust Inquiry

Independent Inquiry into care provided by Mid Staffordshire NHS Foundation Trust January 2005 – March 2009
Volume I

Chaired by Robert Francis QC

HC375-I

- And many others …
  - Kennedy on Bristol
  - Kennedy on c.diff
  - National Audit Office
  - Darzi
  - National Institute for Health and Clinical Excellence 2007
  - DH Comprehensive Critical Care 2000
  - National Confidential Enquiry into Patient Outcome and Death
  - National Patient Safety Agency
  - RCPL Acute Medicine Task Force 2002 and 2004

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Background

- People die in hospitals
  - study of 1000 adults who died in 10 English hospitals in 2009
    - Hogan et al, BMJ Quality and Safety, 2012
  - 5% preventable (>50% chance)
  - = 12,000 per year in England
- Causes:
  - a clinician (or team of) is less competent
  - someone of sufficient expertise sees patient too late
  - the supply of clinical activity is finite

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How can data and IT help?

- Use IT to collect data better

- Once we have collected data: analyse it

- Detect indications of deterioration that clinicians might not spot

- Better for patients:
  - prompt some action by a nurse or doctor
  - make that action easier to do

- Better for hospitals:
  - help managers monitor/compare patterns of activity
  - should lead to more effective and efficient care

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What makes data good quality?

Clinical data: quality (poor)

- Some data in hospitals is poor quality because it's not:
  - available or complete
    - much not stored electronically
  - accurate
    - some stored electronically has transcription errors
    - some is recorded crudely
  - timely
    - some not recorded until hours/days/weeks/months after the fact
  - consistent
    - some is a clinician's judgement (e.g. diagnosis)
    - some is an administrator's judgement

1 Availability
2 Completeness
3 Accuracy
4 Timeliness
5 Consistency

Clinical data: quality (better)

- Some data is much more reliable:
    - pathology (typically blood test) data
        - most is taken automatically from quality-controlled testing equipment
            - accurate
        - lab is regularly quality-assured
            - accurate
        - most test results available in an hour
            - timely
    - vital signs
        - collected regularly at the bedside using portable data entry devices
            - accurate and complete
        - very good user interface (reduces data entry error)
            - accurate
        - data available immediately
            - timely
- Best tends to be "operational" data
    - i.e. there is implicit incentive to record it accurately

Data we have used

Patient administrative data

for all in-patients

- age, gender
- date/time of admission and discharge
- whether admitted as an elective or emergency case
- whether discharged dead or alive
- which dept(s)/ward(s) the patient was in
- what disease(s)/condition(s) the patient was diagnosed with

Pathology data

most commonly performed blood tests

- albumin
- creatinine
- hemoglobin
- potassium
- sodium
- urea
- white cell count

Vital signs data

routinely measured physiological indicators

- heart rate (pulse)
- respiration rate
- temperature
- blood pressure (systolic)
- O_2 saturation
- supplemental oxygen
- AVPU score (alert or not)

Operating theatre data

for those undergoing surgery
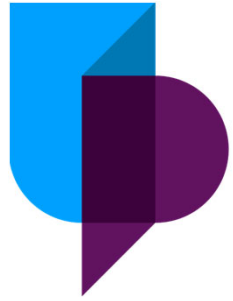
- procedure(s)
- surgical time
- operation time
- anaesthetic type
- anaesthetic time
- recovery time
- ward time

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Vitalpac and NEWS

Collecting vital signs at the bedside

- 2006-2008 KTP with *The Learning Clinic,* developers of Vitalpac
  - allows nurses to collect vital sign data at the patient's bedside
  - data immediately stored in hospit*al* systems
  - doctors use a tablet interface
- Now in use at Portsmouth and about 50 other hospitals

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Vital signs data

Routinely measured physiological indicators

heart rate (pulse)

respiration rate

temperature

blood pressure (systolic)
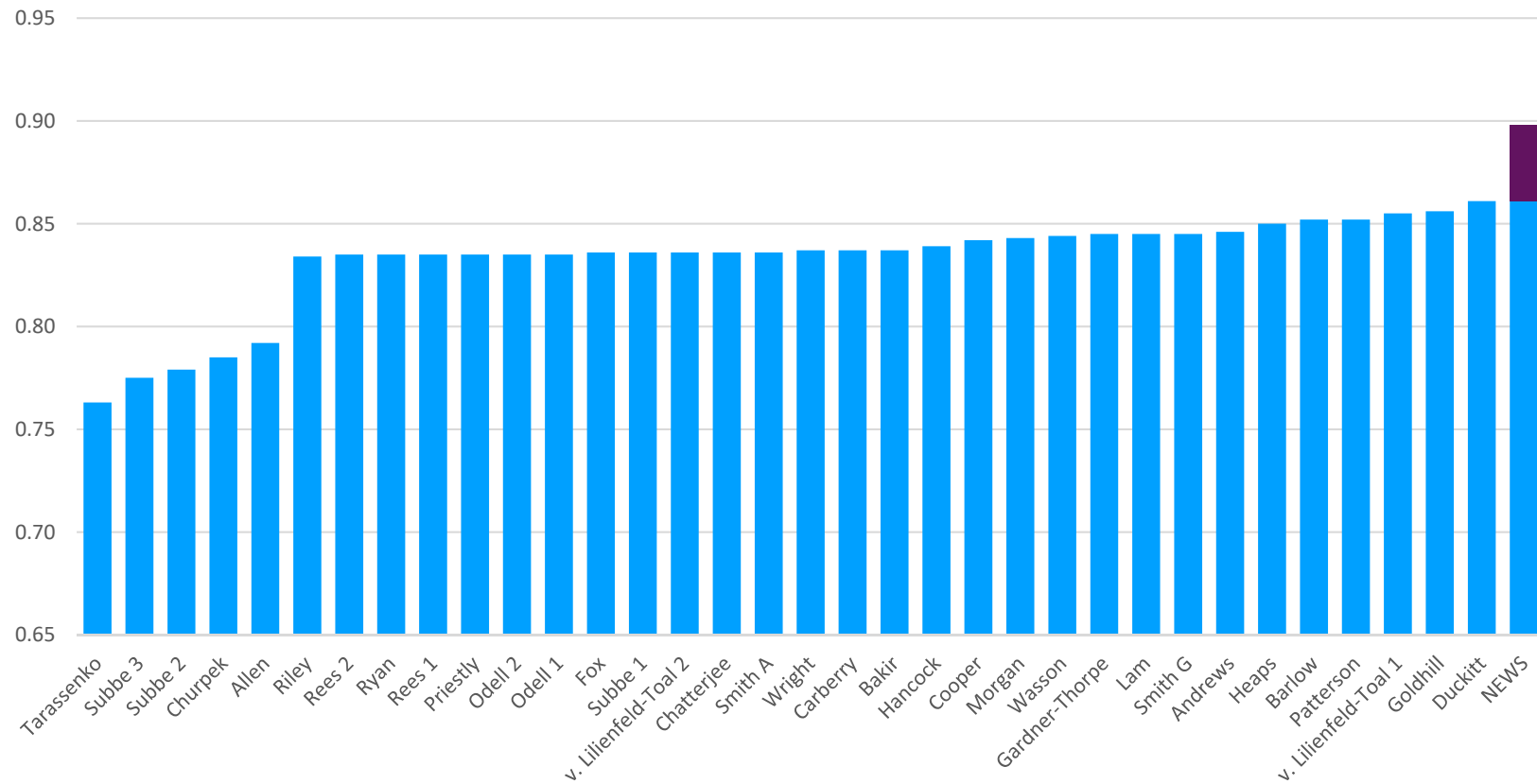
O_2 saturation

supplemental oxygen

AVPU score (alert or not)

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Using data to spot deterioration

- We used the data collected during the trial period to design a new "early warning score (EWS)"

- Derived from 198,755 observation sets from 35,585 acute medical admissions

- Outcome within 24 hours:
  - death
  - cardiac arrest
  - unanticipated transfer to intensive care

- Simple enough that a nurse can do it on paper

- Key paper:
  - David Prytherch, Gary Smith, Paul Schmidt and Peter Featherstone (2010) ViEWS - Towards a national early warning score for detecting adult inpatient deterioration. Resuscitation, 81 (8). pp. 932-937.

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The "big data" difference: superior to 33 other EWSs

Comparison of early warning score systems

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Adopted nationally (2012)

National Early Warning Score (NEWS)*

PHYSIOLOGICAL PARAMETERS	3	2	1	0	1	2	3
Respiration Rate	≤8		9 - 11	12 - 20		21 - 24	≥25
Oxygen Saturations	≤91	92 - 93	94 - 95	≥96			
Any Supplemental Oxygen		Yes		No			
Temperature	≤35.0		35.1 - 36.0	36.1 - 38.0	38.1 - 39.0	≥39.1	
Systolic BP	≤90	91 - 100	101 - 110	111 - 219			≥220
Heart Rate	≤40		41 - 50	51 - 90	91 - 110	111 - 130	≥131
Level of Consciousness				A			V, P, or U

*The NEWS initiative flowed from the Royal College of Physicians' NEWS Development and Implementation Group (NEWSDIG) report, and was jointly developed and funded in collaboration with the Royal College of Physicians, Royal College of Nursing, National Outreach Forum and NHS Training for Innovation

NEWS since 2012

- 2012
  - NEWS published by Royal College of Physicians
- 2014
  - evidence of adoption by many hospitals
- 2017 September
  - NICE recommended it for recognising signs of sepsis
- 2017 December
  - NEWS2 published by RCP
- 2018
  - NHS Improvement recommends its use
  - NHS England provides financial incentives for its use
    - by hospitals
    - by ambulance services
- 2020
  - WHO recommends it for care of COVID patients
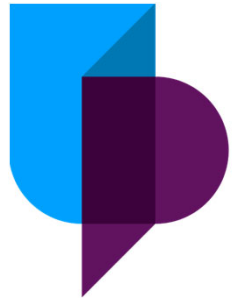
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More recent work

Questions we have answered

- Is NEWS applicable to surgery as well as general medicine?
  - PhD work (Caroline Kovacs)
- Can a better model be created by adding more variables?
  - the HAVEN project (with Oxford)
- What are the implications for nurse staffing?
  - the Missed Care project (with Southampton)
- How frequently does a patient need their vital signs taken?
  - the FOBS project (with Oxford and Southampton)
- How early can predictions be made on progress of ICU patients?
  - PhD work (Aya Awad)
- Can we do a better job of risk prediction for surgery patients?
  - P-POSSUM and its successor
- Does NEWS work for COVID-19 patients?
  - urgent work done with Portsmouth hospital

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Missed Care

- Collaborative project with Southampton

- How are patients affected by low nurse staffing levels?
    - Based on 3 years' of data

- Conclusions:
    - Patients who spent time on wards with fewer than the usual number of fully qualified nurses were more likely to die, or to stay in hospital for longer
    - When staffing was lower, more vital sign observations were missed, and this was related to higher death rates,
        - but low staffing could not explain why most observations were being missed

HAVEN

- Collaborative project with Oxford
  - Building on NEWS and work on blood test results
- Can we better identify hospitalised patients at risk of reversible deterioration?
  - Based on 230,415 patient admissions
- Devised model including:
  - vital signs
  - blood test results
  - how these have varied in the past 24 hours
  - patient age and sex
  - comorbidities (from previous admissions) and frailty risk
- Better than 7 other models

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FOBS

- Collaborative project with Oxford and Southampton

- How frequently should a patient's vital signs be measured?

- Royal College of Physicians recommend protocol based on patient's NEWS score
  - all patients should be monitored at least every 12 hours
  - higher the score -> the more frequently observations should be taken

- Our provisional results:
  - current protocol is not unsafe
  - shown how trade-offs between patient risk and frequency can be calculated

COVID-19 work

- NEWS is as good at detecting deteriorating COVID patients as deteriorating non-COVID patients

- COVID did not affect the pattern of patient observations

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Thank you

- https://www.port.ac.uk/research/research-centres-and-groups/centre-for-healthcare-modelling-and-informatics

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