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CASE STUDY · MARLUC SYNOPSIS

Gloucestershire Hospitals long-stay risk prediction

IMPLEMENTED 2021–2023 · HEALTH AND LIFE SCIENCES · UNITED KINGDOM · BAND E · CLAIMED ONLY

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Gloucestershire Hospitals and Polygeist built a machine learning model, funded by the NHS AI Lab Skunkworks, that scores each new patient's risk of staying more than 21 days. By NHS England's account it detected two-thirds of long stayers on historical data. The trust planned to test it with clinicians in its electronic patient record; no results of that use have been published.

ABOUT THIS SYNOPSIS

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Facts and figures are as reported by the sources listed below, which may be incomplete, self-reported or out of date. Check the original source before relying on any figure.

The impact band, proof marker and SEAM view are MarLuc's opinion. The organisation is not a MarLuc client and has not reviewed or endorsed this synopsis. Names and trademarks belong to their owners.

NOTICE WORDING LAST UPDATED 16 NOVEMBER 2026

AT A GLANCE

No measurable effect: no results reported.

AI used: Machine learning risk prediction (generative adversarial network with a risk model).

Implemented: 2021–2023. Grade: band E, No measurable effect, Claimed only.

Headline result, as reported: Model detected two-thirds of long stayers on historical data, by NHS England's account; no results from clinical use published

1 · The case

The facts, as reported by the 5 sources listed at the end. Where a source is silent, the field says "Not reported".

Organisation

Gloucestershire Hospitals NHS Foundation Trust. NHS acute hospital trust in Gloucestershire, England. Staff numbers: Not reported in the sources used. Canvas block: 4. Operations and process. Also 6. Data and technology.

Business challenge

The challenge. More than 30% of bed days in the trust's acute hospitals were used by patients staying over 21 days, by the trust's account. Long stayers had an 11% mortality rate in hospital, against 5% for all admissions, and 23% became unwell after being declared medically fit for discharge, against 1% overall.

How it was addressed. The trust's business intelligence team proposed the idea and was picked as an AI Skunkworks pilot in April 2021. After a data protection impact assessment, Polygeist built a deep-convolutional generative adversarial network (DC-GAN) that estimates length of stay, fed into a risk model scoring each patient from 1 to 5. The trust said it would take the model's outputs, refreshed every 15 minutes, into its electronic patient record to test and evaluate with clinicians. The code was released as open source. [1] [2] [3] [4] [5]

Who implemented it

Polygeist (Software vendor): Software company that built the model and system.
In-house (In-house): Gloucestershire Hospitals business intelligence team: proposed the project and supplied and joined the data.
Funded and supported by the NHS AI Lab Skunkworks, with Polygeist engaged through the Home Office's Accelerated Capability Environment.

Technology (SEAM pillar E)

SEAM types: T8 Predictive / ML models. Deployment: Not reported. Vendors and products: Polygeist, Long-stay risk model (open source).

Where it was built in: Model outputs refreshed every 15 minutes, planned to be shown in the trust's electronic patient record; Polygeist says they were visible there within 12 weeks.

What changed

Not reported in practice. The intended change: a risk score on each patient's record from arrival, so staff can consider earlier action for patients likely to stay long. [1] [2] [3] [4] [5]

What it cost

Not reported

What it saved

Not reported. HLTH, summarising Digital Health, says a one-day cut in average stay could save the trust £1.7 million; this is a potential figure, and no result is reported. [1] [2] [3] [4] [5]

Governance and control

Data was used after a data protection impact assessment and agreement, per NHS England. The trust's deputy CIO said senior clinical involvement was part of its pitch and advised having a clinical sponsor. No monitoring, validation in live use or clinical safety assessment is reported.

S2 · Accountable owner · Claimed
The trust's business intelligence team led the idea with support from its chief information officer and senior clinical leaders. [2] [5]

A1 · Safe use · Claimed
Data was used after a data protection impact assessment and a data protection agreement, per NHS

A2 · Human in the loop · Claimed
The score is meant to help staff decide on earlier interventions; the trust's deputy CIO stressed a clinical sponsor. No decision rule is described. [1] [3]

A3 · Monitoring and assurance · Not reported
Not reported beyond the planned evaluation with clinicians.

A4 · Vendor AI · Not reported
Not reported.

A5 · Agent controls · Not reported
Not reported.

A6 · Standards and regulation · Not reported
Not reported.

What worked, what did not, what is unproven

WORKED

– The model detected two-thirds of long stayers at or soon after arrival on historical data, by NHS England's account.

– Performance held within 1% on unseen data across the 2020 COVID waves, by NHS England's account.

– Polygeist says the system was integrated with the trust's IT within 12 weeks and showed results in the electronic patient record, per HTN.

DID NOT

– No published results show the score changed care or length of stay.

UNPROVEN

– Whether clinicians used the score and whether it reduced long stays, deterioration or mortality.

– Whether the model was adopted into wider hospital use, which NHS England said the Skunkworks team would support.

Timeline

Apr 2021 Long-stay risk project picked as an AI Skunkworks pilot [2]

Nov 2021 Trade press reports the trust's business intelligence team applied for a proof of concept [5]

May 2023 Trust and Polygeist describe the project at HTN; Polygeist says it was integrated with the electronic patient record [3]

Oct 2023 Trade press reports integration with the record system through APIs [4]

2 · Grade and SEAM assessment

MarLuc's opinion, made on the evidence above. How cases are graded: marluc.co.uk/case-studies/how-we-rate

Level of change and impact

Claimed: Not applicable. Grade: E, No measurable effect. Proof: Claimed only. Level of change: Not graded.

No level assessed: band E, a tested model with no reported results from use.

The SEAM view and lessons learnt

The trust picked a problem with a clear cost and clear harm, owned the data, and got a model into its patient record quickly. The evidence stops there: the promised test with clinicians has no published outcome. For a larger organisation, the transferable point is to plan the clinical evaluation, and what staff will do differently for a high-risk patient, at the same time as the model.

1. Define the action staff take on a high score before building it.
2. Plan and publish a clinical evaluation alongside model accuracy.
3. Name a clinical sponsor from the start.

Evidence

Score 2 of 4. Self-reported: model test results from NHS England's write-up of work it funded, and statements by the trust and Polygeist at a trade event. Not independently checked.

Evaluation method. Model tested on unseen historical data. No live trial, comparison group or published clinical evaluation.

Sources disagree. NHS England says data from more than 1 million admissions was used; HLTH, summarising Digital Health, says the model was trained on 460,000 anonymised records. NHS England says the trust would 'soon begin' testing outputs in the electronic patient record; Polygeist told HTN the system was already integrated within 12 weeks.

Status. Unclear. No source found reports clinical evaluation results or routine use after 2023.

3 · Original sources

Read these in full. To challenge a fact or a grade, use the contact form at marluc.co.uk or the link on https://marluc.co.uk/case-studies/gloucestershire-hospitals-long-stay-prediction

[1] NHS England AI Knowledge Repository: Using machine learning to identify patients at risk of long term hospital stays
https://digital.nhs.uk/services/ai-knowledge-repository/case-studies/using-machine-learning-to-identify-patients-at-risk-of-long-term-hospital-stays

[2] NHS England Data Science: Long Stayer Risk Stratification
https://nhsengland.github.io/datascience/our_work/long-stay

[3] HTN: NHS blueprinting team, Gloucestershire Hospitals and Polygeist on using AI to tackle length of stay (May 2023)
https://htn.co.uk/2023/05/23/nhs-blueprinting-team-ai-lab-gloucestershire-hospitals-nft-and-polygeist-on-using-ai-to-tackle-length-of-stay/

[4] HLTH: ACE and NHS AI Lab develop AI tool to improve hospital outcomes (October 2023, summarising Digital Health)
https://hlth.com/insights/news/ace-and-nhs-ai-lab-develop-ai-tool-to-improve-hospital-outcomes-2023-10-02

[5] Hospital Times: NHS AI Lab Skunkworks, the cautious early adopters (November 2021)
https://hospitaltimes.co.uk/nhs-ai-lab-skunkworks-the-cautious-early-adopters

Gloucestershire Hospitals NHS Foundation Trust website: https://www.gloshospitals.nhs.uk

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