

# **Automating Hospital Mortality Analytics: A Case Study in Reproducible Reporting at Public Health Scotland**

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# What is Hospital Standardised Mortality Ratio (HSMR)?

- A globally recognised measure of hospital mortality and patient safety
- Adjusts for risk factors like age, comorbidities, and illness severity
- Includes all acute inpatient and daycase admissions across Scotland
- Only includes deaths within 30 days of admission, both in-hospital and in the community

$$\text{HSMR} = \text{Observed Deaths} / \text{Predicted Deaths}$$



# Uses of HSMR

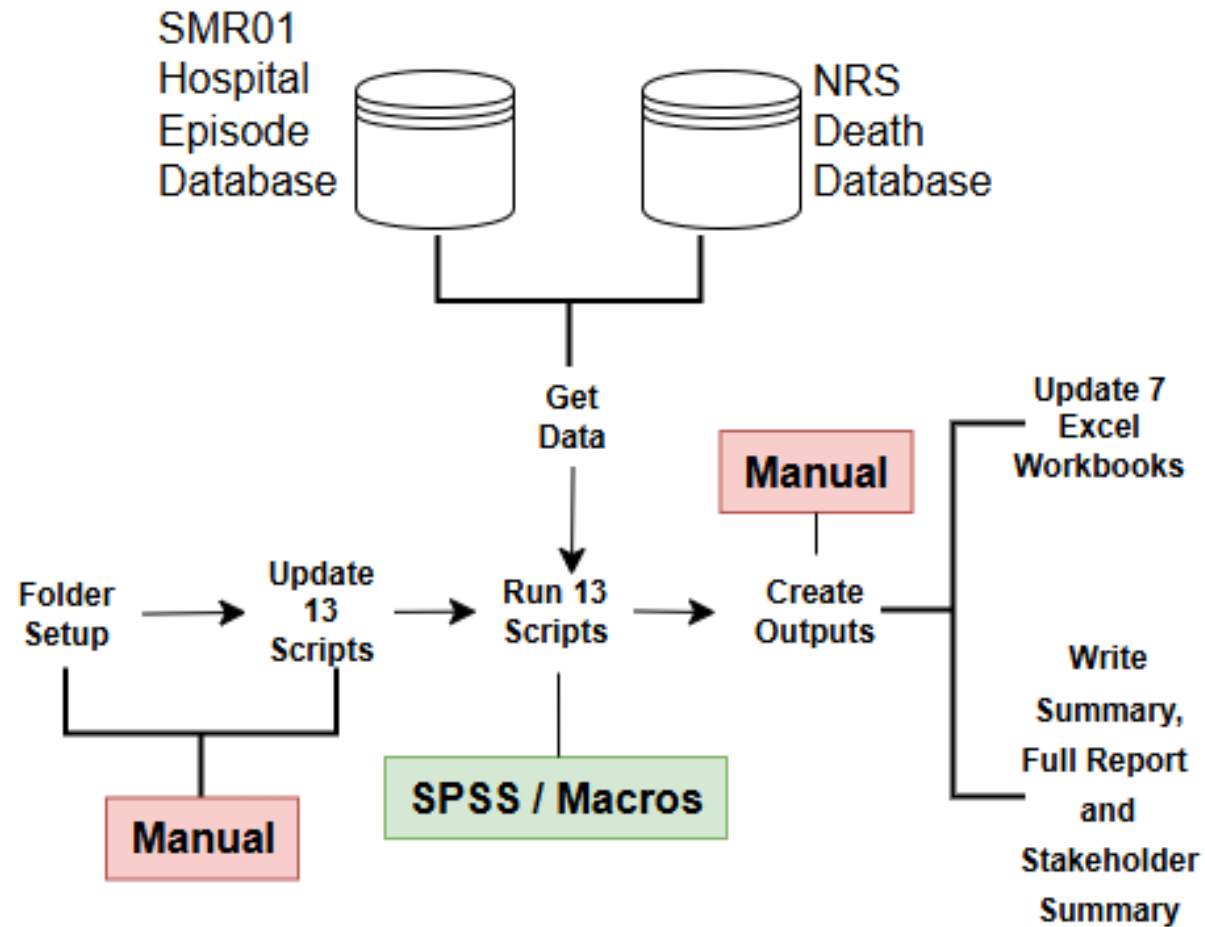
- **NHS Boards:** Reflect on patient safety, monitor mortality, and guide service improvements
- **Healthcare Improvement Scotland (HIS):** Uses HSMR with other indicators to support NHS Boards and explore care quality
- **Scottish Government:** Monitors trends, informs policy, and responds to public/parliamentary inquiries



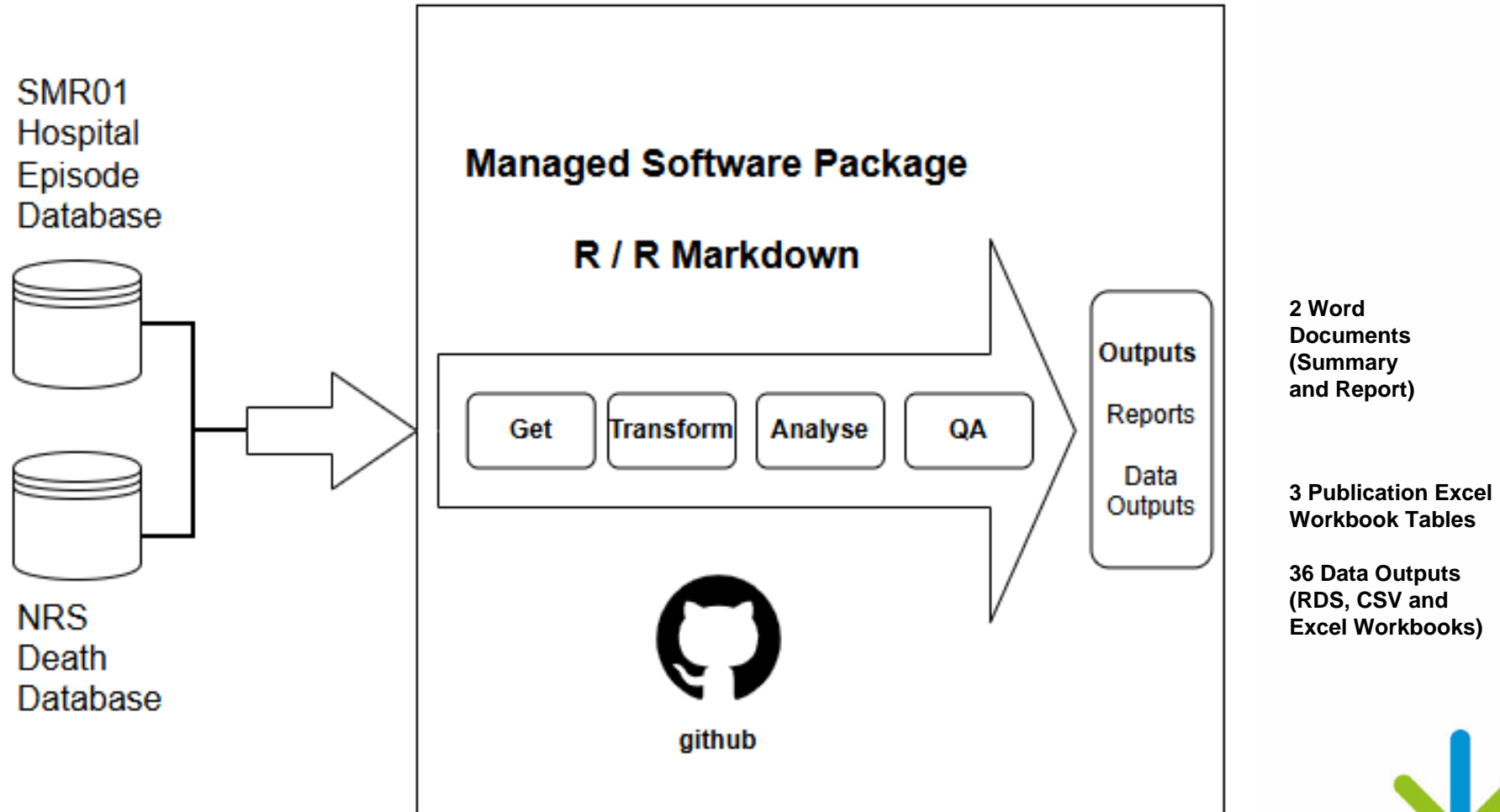
Scottish Government  
Riaghaltas na h-Alba



# Historically how we published the HSMR Report?



# Current HSMR Publishing Process - RAP





# Hospital Standardised Mortality Ratios



April 2024 to March 2025

An Accredited official statistics release for Scotland

Publication date: 12 August 2025

## About this release

This release by Public Health Scotland (PHS) provides information on Hospital Standardised Mortality Ratios (HSMRs) which are updated on a quarterly basis and reflect the HSMR for the latest 12-month reporting period April 2024 to March 2025. The associated crude mortality data is also presented by quarter and month to show trends from April 2020 to March 2025.

HSMR is a measure that compares the actual number of patient deaths in a hospital to the number predicted, after adjusting for the case-mix of patients. This adjustment accounts for factors (i.e. age, underlying conditions, illness severity) known to influence an individual's risk of death, allowing hospitals to be compared against the Scottish average.

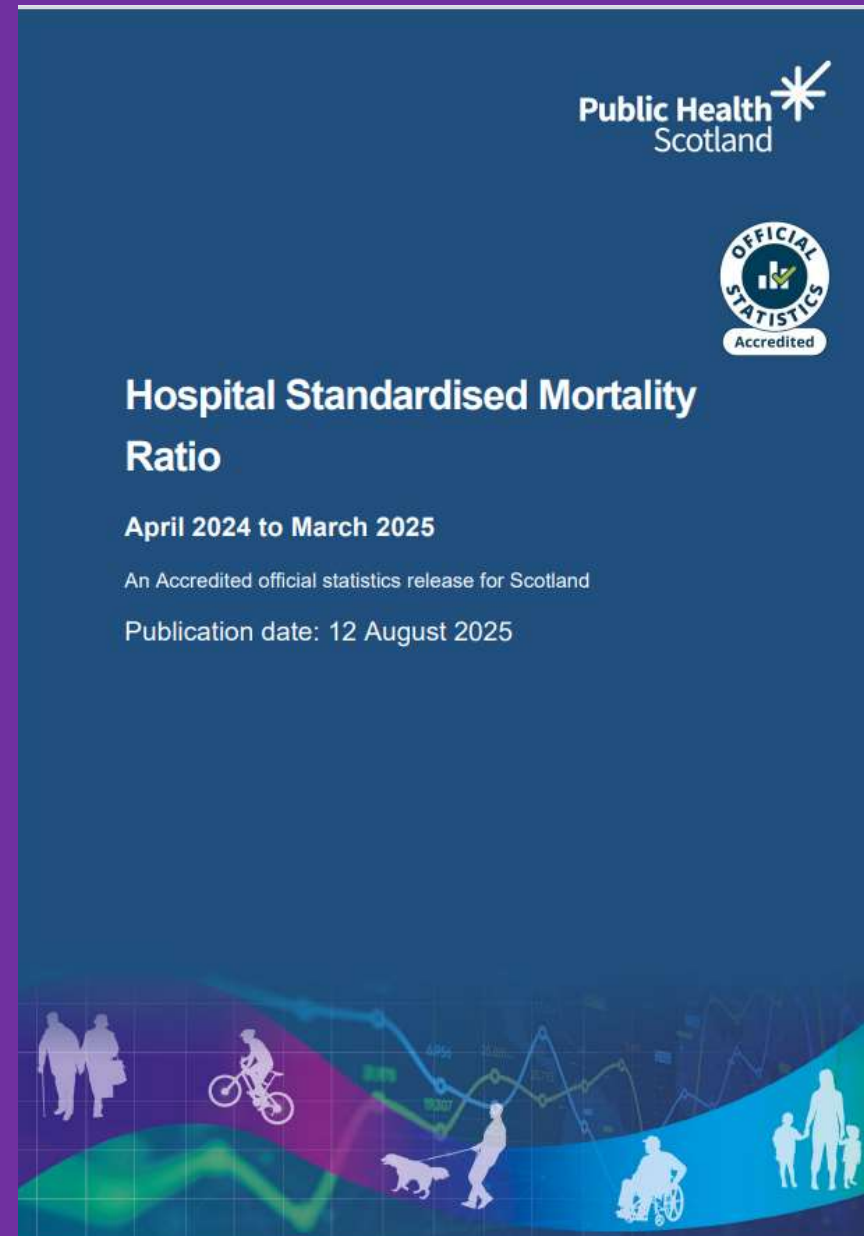
Alongside this publication, there is a supplementary report which is also being released:

- A technical report on the 2025 HSMR Model review, examining its performance and identifying opportunities for refinement. The HSMR model is a statistical framework based on logistic regression methodology designed to compute the risk-adjusted predicted mortality.

## Main points

For the period April 2024 to March 2025:

- No hospitals had a significantly higher standardised mortality ratio than the national average.
- One hospital had an SMR below the lower warning limit: Western General Hospital, NHS Lothian (0.81).



# Hospital Standardised Mortality Ratio

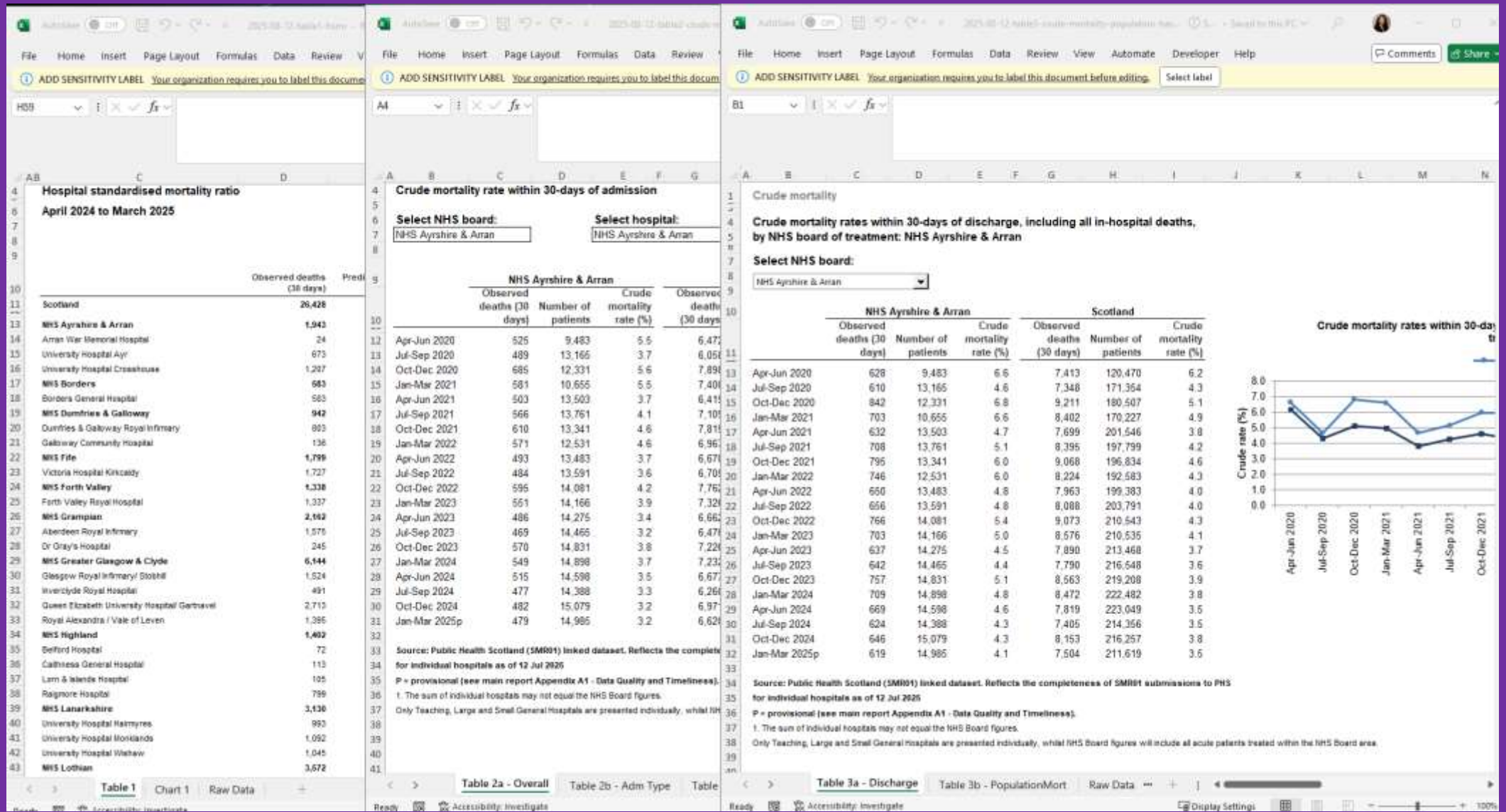
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# Summary & Report

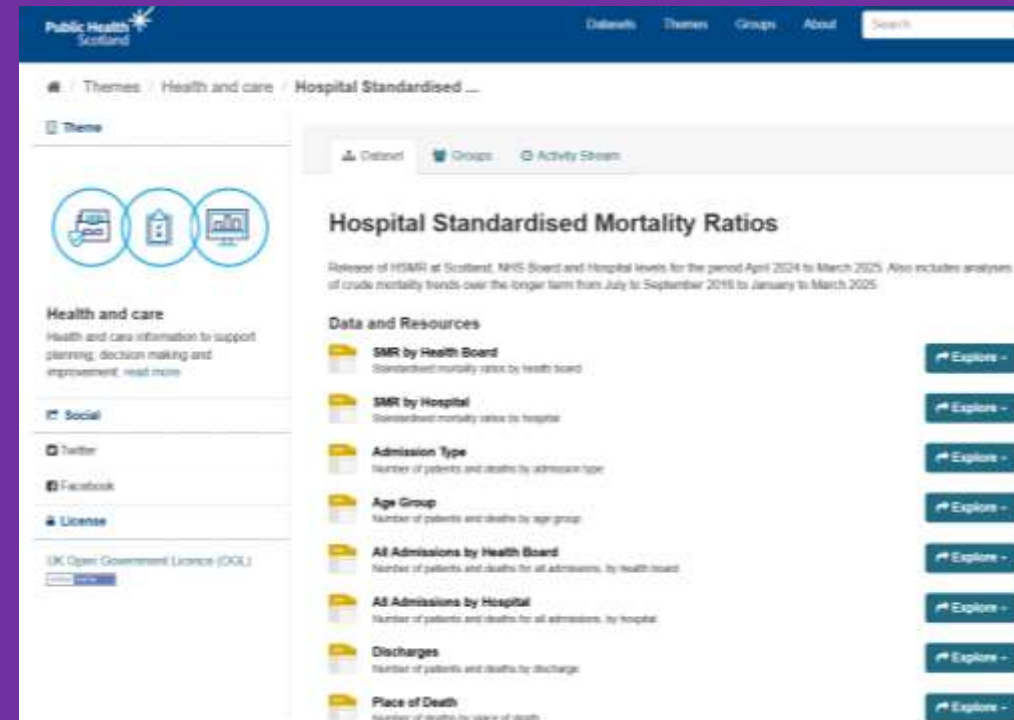
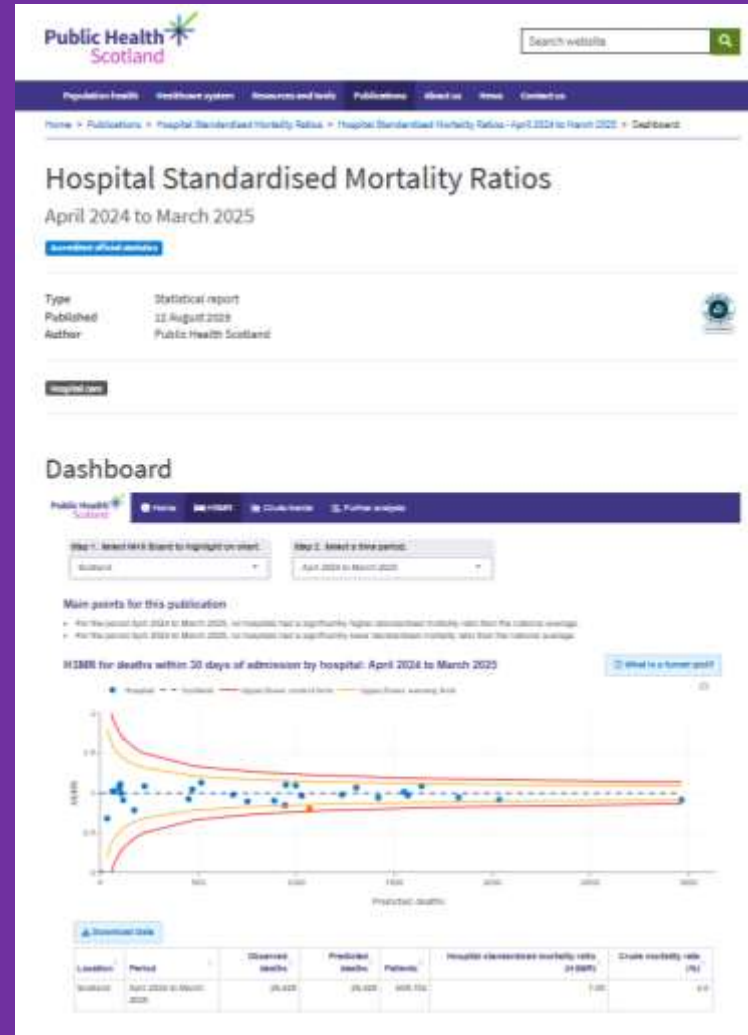




# Publication Tables



# RAP Data Outputs





# Strategic Impact

- Enhances **reproducibility**, **auditability**, and **collaboration**
- Aligns with PHS's goals of delivering **timely**, **trustworthy**, and **accessible** health intelligence
- Empowers analysts with modern tools and fosters a culture of **continuous improvement**



# Challenges, Advantages & Future Directions of RAP (inc. HSMR)

## Key Challenges

- High initial time/resource demand
- Legacy system integration hurdles
- Steep GitHub learning curve
- Debugging nested functions
- Package updates

## Advantages

- Boosts quality and reproducibility
- Enables collaboration and transparency
- Empowers analysts with modern tools
- Aligns with strategic goals

## Future Directions

- Expand RAP across NHS teams
- Develop training and peer support
- Improve documentation and modularity
- Enhance quarterly QA process



# Conclusions

- The HSMR publication is the **first RAP implementation** at Public Health Scotland
- Marked a shift from manual workflows to **automated, reproducible analytics**
- Improved **efficiency, data quality, and auditability**
- Enabled **interactive dashboards** for internal and public use
- Supports strategic goals of **transparency, timeliness, and innovation**
- Sets a **precedent** for future RAP adoption across public health domains

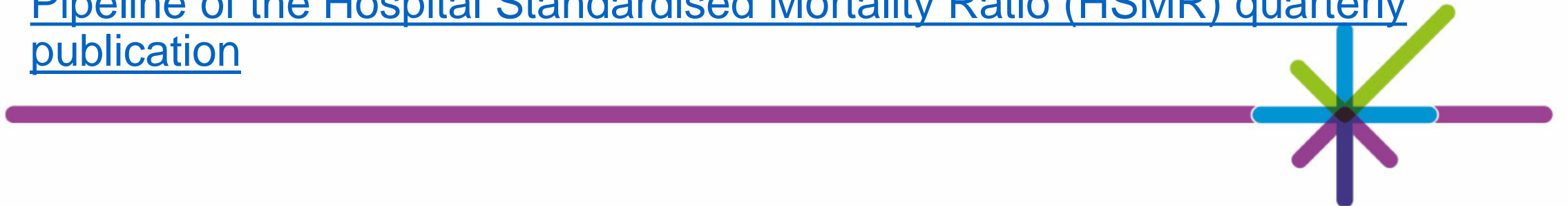


# HSMR Links

HSMR Publication - [Hospital Standardised Mortality Ratios - April 2024 to March 2025 - Hospital Standardised Mortality Ratios - Publications - Public Health Scotland](#)

HSMR R-Shiny Dashboard- [Dashboard - Hospital Standardised Mortality Ratios - April 2024 to March 2025 - Hospital Standardised Mortality Ratios - Publications - Public Health Scotland](#)

GitHub Repository- [Public-Health-Scotland/hsmr: Reproducible Analytical Pipeline of the Hospital Standardised Mortality Ratio \(HSMR\) quarterly publication](#)



# Thank you for listening!

## Contact Us

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