Preoperative risk prediction tools that predict morbidity risk in adults undergoing surgery: An Evidence Review

EXECUTIVE SUMMARY

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What are Evidence Reviews?

This evidence review includes a Rapid Evidence Map (REM) and an in-depth summary. The REM describes the evidence base and the in-depth summary focusses on the validity of a sub-set of studies. It has utilised abbreviated systematic mapping and scoping review methods to provide a description of the nature, characteristics and volume of the available evidence for a particular policy domain or research question, and then a detailed summary of a subset of this evidence.

Who is this summary for?

Planned Care Wales

Background / Aim of Rapid Evidence Map

Risk prediction tools play a critical role in preoperative care by estimating the likelihood of adverse outcomes, including mortality, morbidity, and postoperative complications. In low-risk surgical settings such as surgical hubs, which typically focus on high-volume, low-complexity procedures, accurate risk prediction is particularly valuable. The aim of this review was to identify and map the evidence for 14 validated pre-operative surgical risk prediction tools currently used in Wales within any elective, or non-emergency surgical setting, and to provide a more in-depth look at the findings for a selection of tools deemed to be the most applicable on a population level to the context of surgical hubs. The initial list of prediction tools used in Wales was identified by the stakeholders, who also informed the selection of tools for a more-in depth summary based on the findings of the initial evidence map.

Results

Recency of the evidence base

- This review included evidence available up until December 2024. Included studies were published between 1999 and 2024.

Extent of the evidence base

- A total of 118 studies were identified across 12 risk prediction tools.
- No evidence was identified assessing the predictive ability of two of the tools: the Carlisle Risk Calculator and the NELA PRS.
- No evidence was found looking at the predictive ability of risk prediction tools for selecting patients suitable for surgical hubs.
- The tools were used across a range of surgical specialties including: general; mixed; orthopaedic; cardiothoracic; urology; vascular; neurosurgery; plastic; gynaecology; ENT; urogynaecology and oral and maxillofacial surgery.
- Risk prediction tools measured: Composite (grouped) complications (e.g. any complications, severe complications, morbidity), individual complications (e.g. pneumonia, surgical site infection), and healthcare utilisation and recovery measures (e.g. readmission, length of stay, return to the operating room).
- No risk prediction tool adequately predicted complications across all surgical specialties.
- There is considerable heterogeneity among the included studies in which surgical specialties the risk prediction tools are being used for, how complications are defined, and which measures are used to determine a tool's predictive ability. This makes direct comparisons very challenging.

- Four tools were selected as being potentially the most impactful at a population level for a more in-depth look at the findings: ACS NSQIP, P-POSSUM, RCRI, ASA classification system.
- A total of 76 studies were identified across the 4 risk prediction tools (ACS NSQIP n=40; RCRI n=16; ASA classification system n=13; P-POSSUM n=7).

Key findings for the four risk prediction tools of interest

- Overall, no one tool was identified that adequately predicted complications across all surgical specialties. The predictive ability of the tools varied across different surgical specialties. The findings for the different surgical specialities may be limited due to a very small evidence base available for each surgical type.
- **ACS NSQIP was found to have a poor predictive ability for composite complications** across studies. There is limited evidence to suggest that **ACS NSQIP had an excellent predictive ability** for complications after mixed surgery; **a fair predictive ability** after thoracic or plastic surgery; **a poor predictive ability** after neurosurgery, gynaecology or general surgery; **and a very poor predictive ability** after orthopaedic, urology or vascular surgery.
- **P-POSSUM was found to have a poor predictive ability for composite complications** across studies. There is very limited evidence to suggest that **P-POSSUM had a fair predictive ability** for complications after ENT surgery; **a poor predictive ability** after general surgery; **and a very poor predictive ability** after gynaecology surgery.
- **The RCRI was found to have a fair predictive ability for composite complications** across studies. There is very limited evidence to suggest that **the RCRI had a fair predictive ability** for complications after vascular, orthopaedic, or mixed surgery, and **a poor predictive ability** after urology surgery.
- **The ASA classification system was found to have a poor predictive ability for composite complications** across studies. There is very limited evidence to suggest **the ASA classification system had a fair predictive ability** for complications after mixed surgery; **a poor predictive ability** after general or orthopaedic surgery; and **a very poor predictive ability** for vascular surgery and urology surgery.
- The evidence directly comparing risk prediction tools appears to be mixed.

Summary of the evidence gaps

- No quality appraisal of included studies was conducted and therefore we cannot report the quality of the included studies.
- No evidence was found looking at the use of risk prediction tools for identifying patients suitable for treatment in surgical hubs.
- Further research using consistent methods is needed to better understand the predictive ability of risk prediction tools.

Implications and next steps

- No risk prediction tool adequately predicted complications across all surgical specialties, as such it may be likely that some tools are better suited for specific surgery types or that a combination of risk prediction tools may be needed to adequately assess an individual's level of risk.
- The heterogeneity among the included studies makes direct comparisons very challenging even when looking at the evidence available for each tool individually, further research should ensure consistent methods are used to assess the predictive ability of risk prediction tools and allow a robust evaluation.

Economic considerations

- Despite not being within the scope of this review, there is a recognised research gap regarding economic evaluations of risk prediction tools.
- Future research into risk prediction tools should incorporate health economic evaluations, considering not only individual risks but associated cost implications.