Predictive Performance of the Clinicopathologic Gene Expression Profile (CP-GEP) in Identifying Cutaneous Melanoma Patients for Whom Sentinel Lymph Node Biopsy is Unnecessary: A Systematic Review and Meta-Analysis

Terence Wong[1], Sydney Ch'ng[1,2,3], Peter Ferguson[1,2,3,4], Linda Martin[1,2], Alexander M Menzies[1,2,6,7], Anne Cust[1,5], Inês Pires da Silva[1,2,8,9], Georgina V Long[1,2,6,7], Richard A Scolyer[1,2,3,9], Alexander van Akkooi[1,2,3*], Serigne N Lo[1,2,9*]

1. Melanoma Institute Australia, 2. The University of Sydney, 3. Royal Prince Alfred Hospital, 4. NSW Health Pathology, 5. The Daffodil Centre, 6. The Mater Hospital, 7. Royal North Shore Hospital, 8. Blacktown and Westmead Hospitals, 9. Charles Perkin Centre

Background

- Sentinel lymph node biopsy (SLNB) is an invasive procedure used for accurate staging and optimal management[1,2]
- SLNB is recommended for melanomas with Breslow thickness >1.0 mm and should be discussed for patients with thin melanomas[2]
- Overall rate of positive SLNBs is low, ranging from 15% to 20%[3]
- CP-GEP model serves as a deselection tool by identifying patients that do not have nodal metastasis and can therefore forgo SLNB

Objectives

To summarise the findings of multiple external validation studies across various countries to **assess the overall predictive performance** of the CP-GEP model and **examine potential heterogeneity** between validation cohorts

Methods

- External validation studies assessing the CP-GEP model from 2020-2024
- True positive (TP), false positive (FP), true negative (TN), false negative (FN) values were extracted from each study to measure the predictive utility of the model (sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV) and SLNB reduction rate (RR)
- Pooled estimates were derived using a random-effects (RE) model
- Risk of bias: Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool
- SLNB reduction rate represents the proportion of patients that received a low-risk CP-GEP result and could therefore safely forgo SLNB[4]

$$SLNB\ reduction\ rate = \frac{CP-GEP\ Low\ risk\ (TN+FN)}{All\ patients\ (TN+TP+FP+FN)}$$

Results

- The overall pooled sensitivity was 93% and NPV was 95% across all primary tumour classification groups
- Subgroup analysis revealed that the model performed best for pT2 melanomas
- Results for pT1 melanomas could not be reliably interpreted as substantial heterogeneity was observed
- pT3 and pT4 melanomas are unlikely to benefit from the model as they have high risk for nodal metastasis and would usually be recommended to undergo SLNB

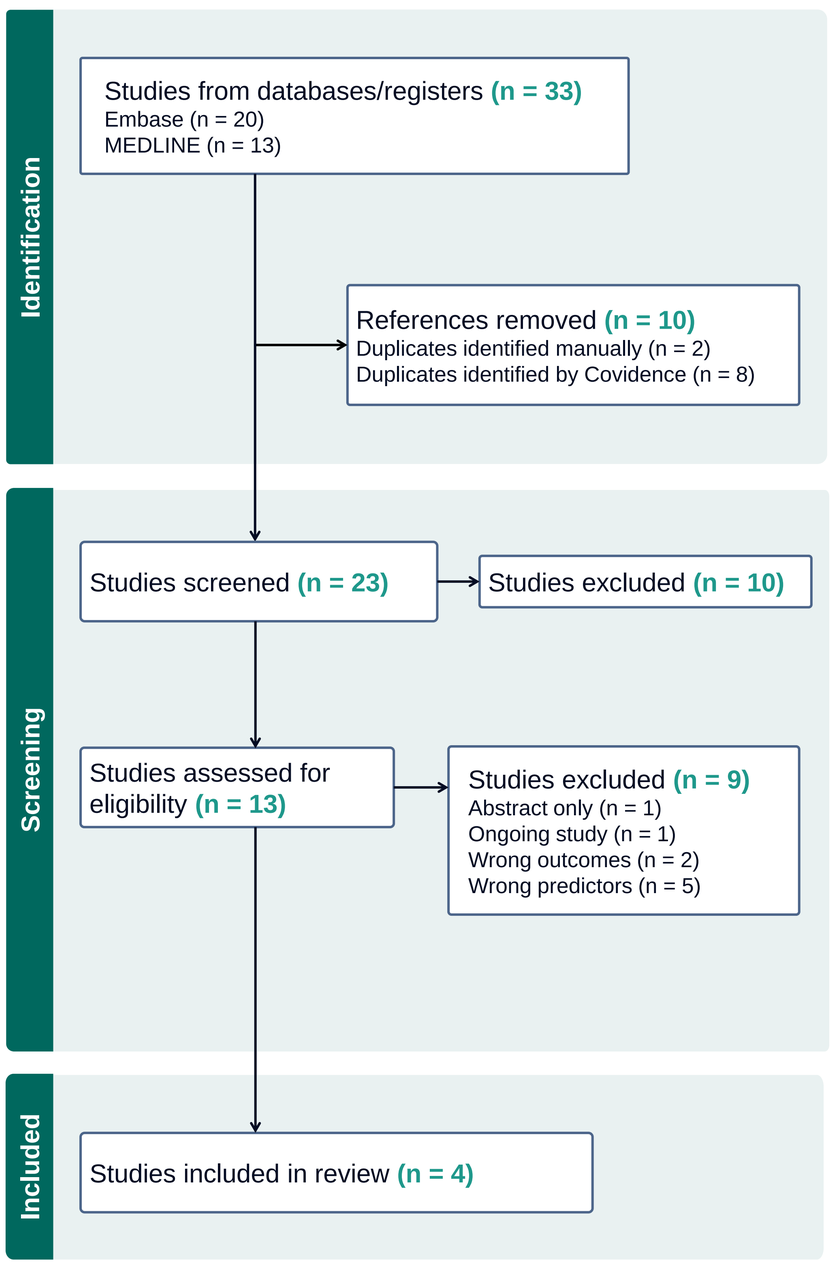

Figure 1. PRISMA flowchart of search results and inclusion of external validation studies assessing the predictive utility of the CP-GEP model.

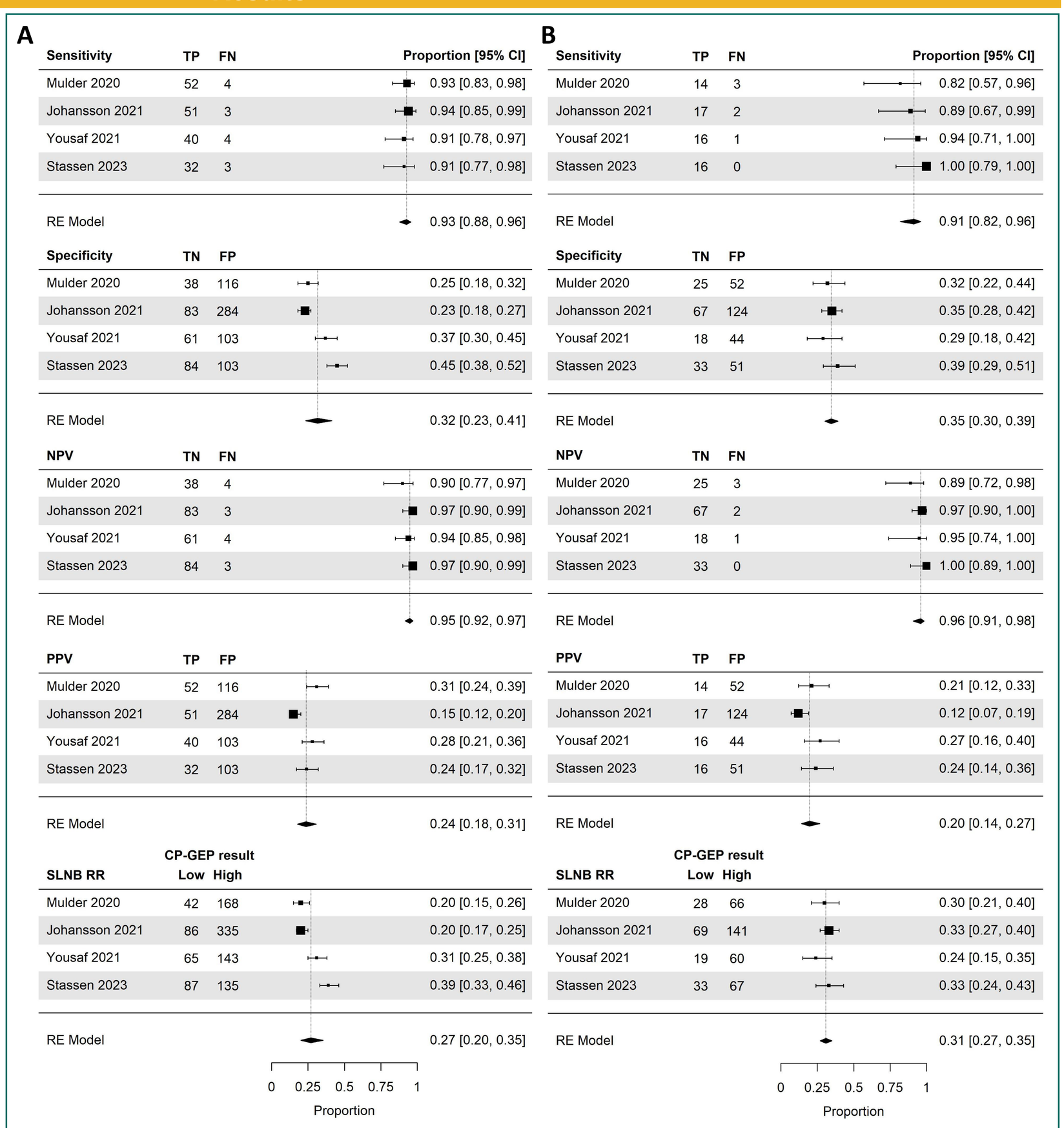

Figure 2. Pooled predictive performance metrics of the CP-GEP model for **(A)** all tumour thicknesses and **(B)** pT2 melanomas subgroup.

Conclusions

- **The CP-GEP model demonstrated the hallmarks of an effective deselection tool for SLNB, particularly in patients with pT2 melanomas**
- **Additional research into pT1 melanomas with greater sample sizes will be crucial in determining the true predictive utility of the model for this subgroup**

References

1. Nakamura, Y. (2019). *Front Med (Lausanne)*, 6 The Role and Necessity of Sentinel Lymph Node Biopsy for Invasive Melanoma. Front Med (Lausanne). 2019;6:231.
2. Wong SL, et al. Sentinel Lymph Node Biopsy and Management of Regional Lymph Nodes in Melanoma: American Society of Clinical Oncology and Society of Surgical Oncology Clinical Practice Guideline Update. Journal of Clinical Oncology. 2018;36(4):399-413.
3. Stetkevich SA, Simman R. Redesigning Sentinel Lymph Node Biopsy Guidelines in Melanoma Cases. Eplasty. 2023;23:e8.
4. Mocellin S, et al. Sentinel node status prediction by four statistical models: results from a large bi-institutional series (n = 1132). Ann Surg. 2009;250(6):964-9.

Acknowledgements

Melanoma Institute Australia
THE UNIVERSITY OF SYDNEY

terence.wong@melanoma.org.au