External validation of the Hidradenitis Suppurativa Cutaneous Abscess Prediction Score-1 (HSCAPS-1): a prediction model for diagnosis of hidradenitis suppurativa over site-specific cutaneous abscess

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Disclosures

- Mr. Koptyev has nothing to disclose.
- Mr. Strunk has nothing to disclose.
- Ms. Butt has nothing to disclose.
- Dr. Kirby reports receiving personal fees from AbbVie, ChemoCentryx, Incyte, Janssen, Novartis, and UCB Pharma outside the submitted work.
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Gap in Care

- **HS has poor disease recognition:**
  - General lack of awareness in the medical community
  - Heterogeneity in clinical presentation makes recognition difficult

- **Patients with HS experience delays in diagnosis for up to 10 years after initial symptoms.**
  - Hospital admissions/readmissions for prolonged Abx courses directed at infections
  - Disease progression and morbidity related to fragmented care and suboptimal management
  - Accumulation of comorbid conditions
  - Impact on general health-related and skin-specific quality of life

Garg et al. Evaluating patients' unmet needs in hidradenitis suppurativa: results from the Global VOICE project J Am Acad Dermatol. 2020;82(2):366-376.
Reddy et al. Comparative Overall Comorbidity Burden Among Patients With Hidradenitis Suppurativa. JAMA Dermatol. 2019 Jul 1;155(7):797-802.

Background and Objective

- Can we build a clinical decision support tool that:
  - Provides a predicted probability for diagnosis of HS
  - Distinguishes HS from cutaneous abscess, its most common mimic
  - Does so without reliance on the expert exam by a dermatologist
  - Can be utilized at the point of care for real time decision making and appropriate management

- We have previously developed and initially validated HSCAPS-1 using ‘big data’.
  - Hidradenitis Suppurativa Cutaneous Abscess Prediction Score-1 (HSCAPS-1)

- Our objective was to assess discrimination and calibration of HSCAPS-1 in an external population.

Garg A, Reddy S, Kirby J, Strunk A. Development and Validation of HSCAPS-1: A Clinical Decision Support Tool for Diagnosis of Hidradenitis Suppurativa over Cutaneous Abscess. Dermatology. 2021;237(5):719-726

Methods

- **Study design:** Cross-sectional
- **Study population:** patients aged > 18 years diagnosed with HS (n=1,131) or cutaneous abscess (n=1,186) specified to axilla, groin, perineum, or buttock
- **Setting:** Outpatient and emergency encounters at Penn State Health, Hershey, PA
- **Time frame:** January 1, 2012 – February 20, 2020

Methods

- **Case identification:** Diagnosis code applied during the visit for HS or abscess was the gold standard reference, and a subset of charts were manually validated.

- **Statistical Analysis:** Patients' estimated probability of HS was calculated from the HSCAPS-1 equation based on comorbidity and demographic data in the electronic record.

- **Model performance:** discrimination and calibration were measured by the c-statistic and a flexible calibration curve

- **Missing data:** handled via multiple imputation by chained equations

HSCAPS-1 Variables

- Variables in simplified model
  - Age
  - Sex
  - Race
  - BMI
  - Smoker (ever)
  - Type II Diabetes
  - Acne
  - Substance use disorder
  - Down syndrome
  - Opioid prescriptions
  - Obstructive sleep apnea
  - Myocardial infarction
  - Liver Disease
  - Ulcerative colitis
  - Spondyloarthritis
  - PCOS
  - Depression

Case 1: ‘boils’ in the axillae, suspected by ED to be abscess

Sex	Race	Age	BMI	TIIDM	Acne	SUD	Down syndrome	Ever Tobacco Smoker	Opioid prescriptions	Predicted probability of HS diagnosis
Female	African American	25	33	No	Yes	No	No	Yes	0	83.7%

- Assign score of 1 to pertinent variable if present
- Assign score of 0 if not present

ED Physical exam: tender fluctuant nodules, one of which drains, in the axillae

Unpublished equation removed

Case 2: ‘boil in groin’, suspected by ED to be abscess

Sex	Race	Age	BMI	TIIDM	Acne	SUD	Down syndrome	Ever Tobacco Smoker	Opioid prescriptions	Predicted probability of HS diagnosis
Male	Other race	40	34	Yes	No	No	No	Yes	0	31.4%

- Assign score of 1 to pertinent variable if present
- Assign score of 0 if not present

ED Physical exam: fluctuant red erythematous warm nodule on the left inner thigh

Unpublished equation removed

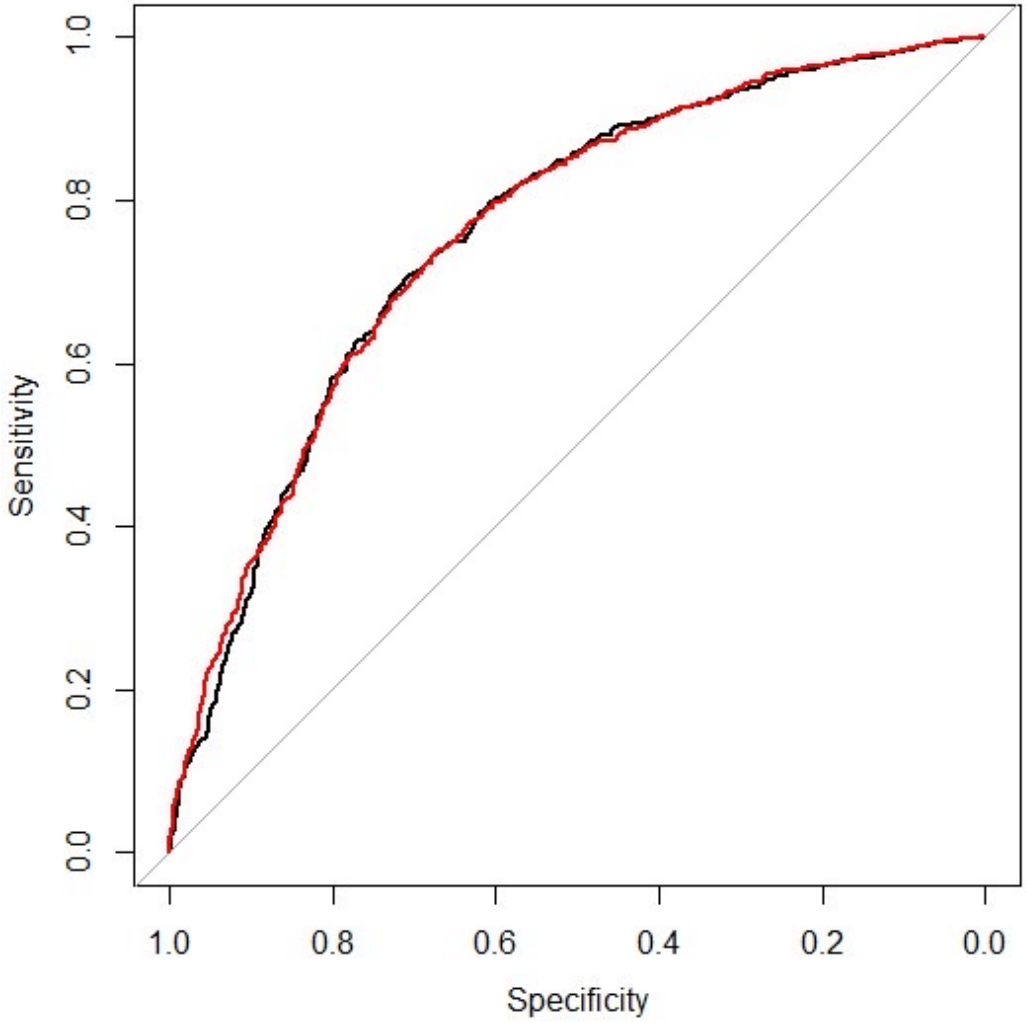
Patient characteristics and outcome frequency were similar in development and validation samples

- Development set
  - 4,060 HS patients (51%) and 3,914 abscess patients (49%)
  - Mean age: 40 and 43 in HS and abscess
  - % Female: 77% in HS and 56% in abscess
  - Patient race:
    - 65% White
    - 26% African American
    - 9% Other race

- Validation set
  - 1,131 HS patients (49%) and 1,186 abscess patients (51%)
  - Mean age: 37 and 45 in HS and abscess
  - % Female: 81% in HS and 48% in abscess
  - Patient race
    - 77% White
    - 13% African American
    - 11% Other race

Model Performance: Discrimination

ROC Curve for Full and Simplified Model: Imputation 1

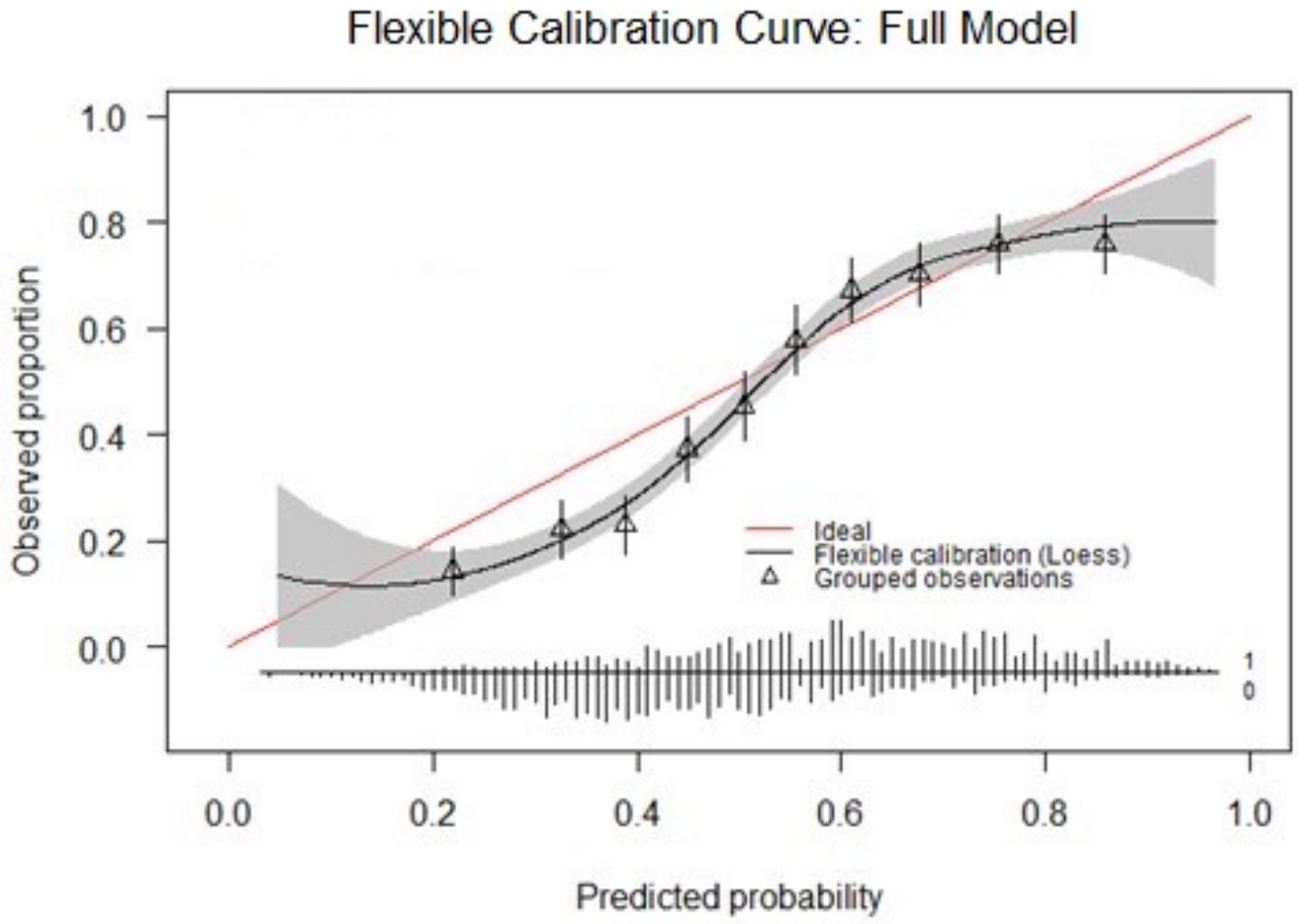


<u>C-statistic (95% CI)</u>

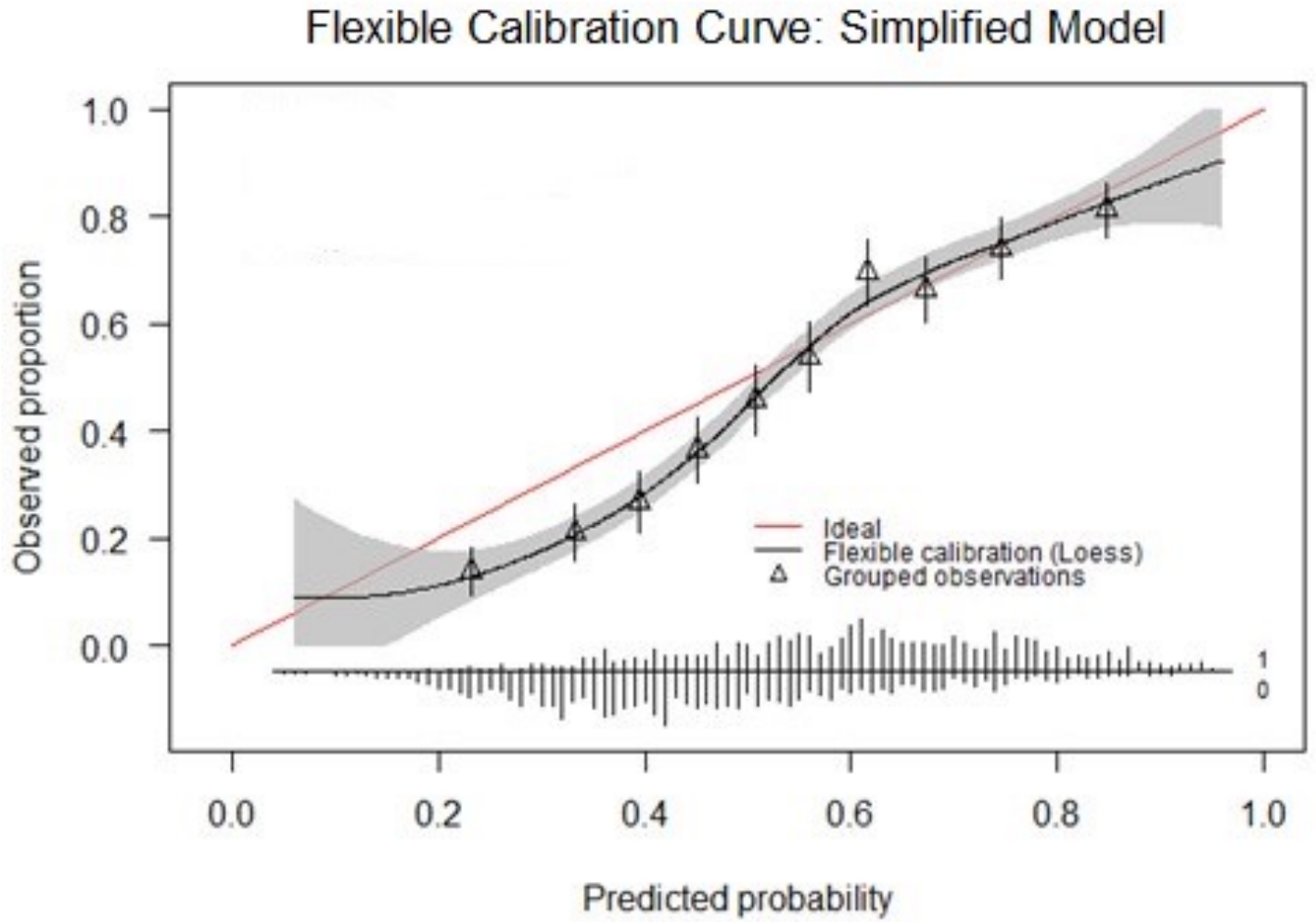
- Full model: 0.757 (0.737, 0.777)

- Simplified model: 0.759 (0.739, 0.779)

Model Performance: Calibration



Model Performance: Calibration



Future Directions

- Evaluation of models which remove potentially stigmatizing demographic (ie, race) and comorbid variables (ie, substance use disorder and opioid prescriptions)

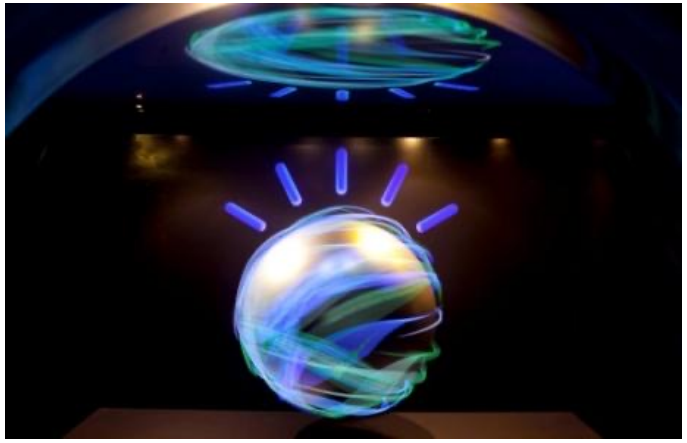
- Assessing transportability of the model by altering data collection methods (e.g., patient-reported)

Conclusions

- Both full and simplified models showed good discrimination and moderate calibration
- Updating the model can provide more accurate predictions when it is applied in settings with different HS prevalence
- This algorithm may be applied within EMRs to identify HS patients at the point of care, filling an important gap in HS care related to diagnosis

Big Data Science

- Power: observations for uncommon diseases, and rare events within diseases
- Granularity: robust clinical data
- Absence of qualitative information: i.e., disease severity



IBM Watson Health Research Platform

- Applications:
  - Prevalence/Incidence for rare diseases
  - Disease associations (ie, comorbidities)
  - Utilization patterns (ie, encounters, prescriptions patterns, procedures)
  - Clinical decision aids
    - Diagnostic aid
    - Prediction modeling

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