

MITIGATING BIAS IN PEDIATRIC MENTAL HEALTH NOTES VIA REWRITING

VISHAL YADAV¹; MARIIA IGNASHINA¹; DAN SANTEL²; JEFFREY R. STRAWN², MD; ROBERT T AMMERMAN², PHD; TRACY GLAUSER²; JOHN PESTIAN²; JULIA IVE¹

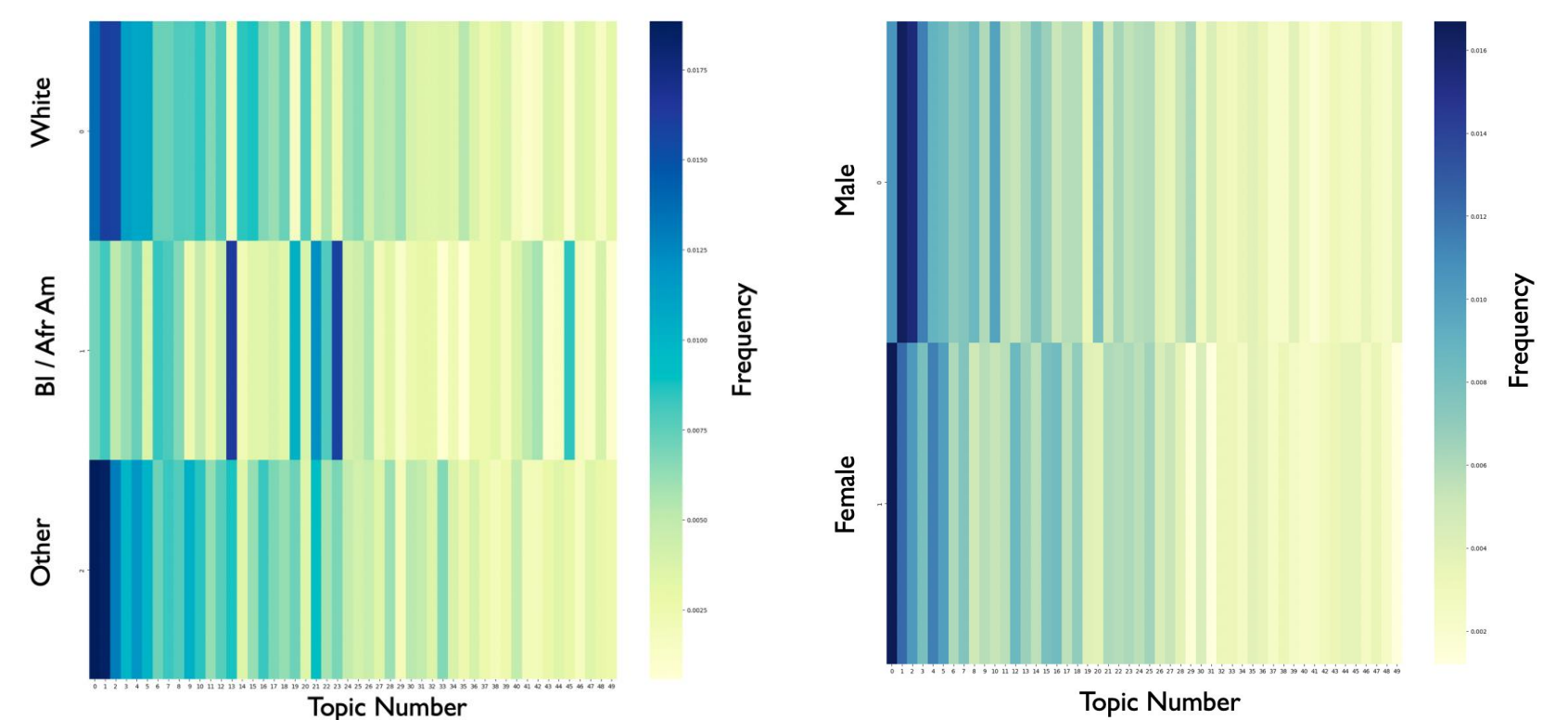
¹ QUEEN MARY UNIVERSITY OF LONDON
² CINCINNATI CHILDREN'S HOSPITAL MEDICAL CENTER, UNIVERSITY OF CINCINNATI

We focus on mitigating predictive bias in incoming textual data (progress notes, telephone encounters, etc.) to an automatic predictor for pediatric anxiety.

Data

- 4-5K anxiety patients Ages 4-6
- 50% match / 50% case
- For example, Age 4: ~56 notes per patient; 1,650 clinicians; ~400 care sites; 62% white; 60% males

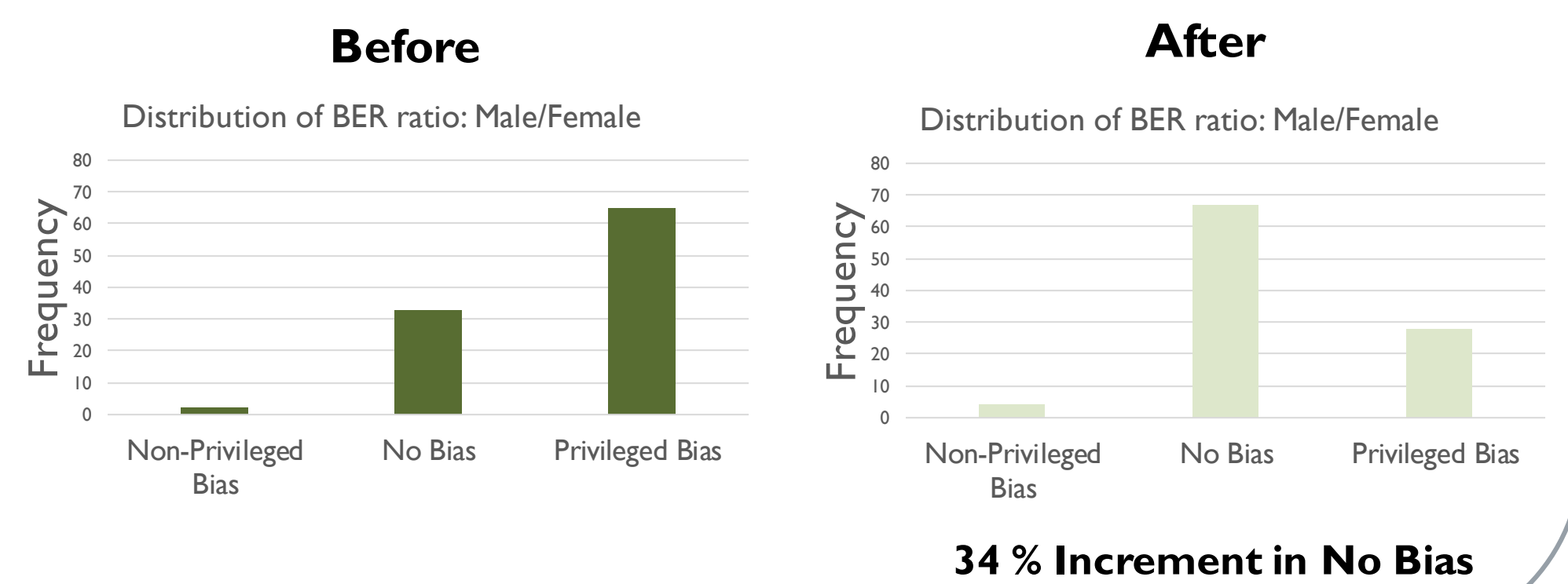
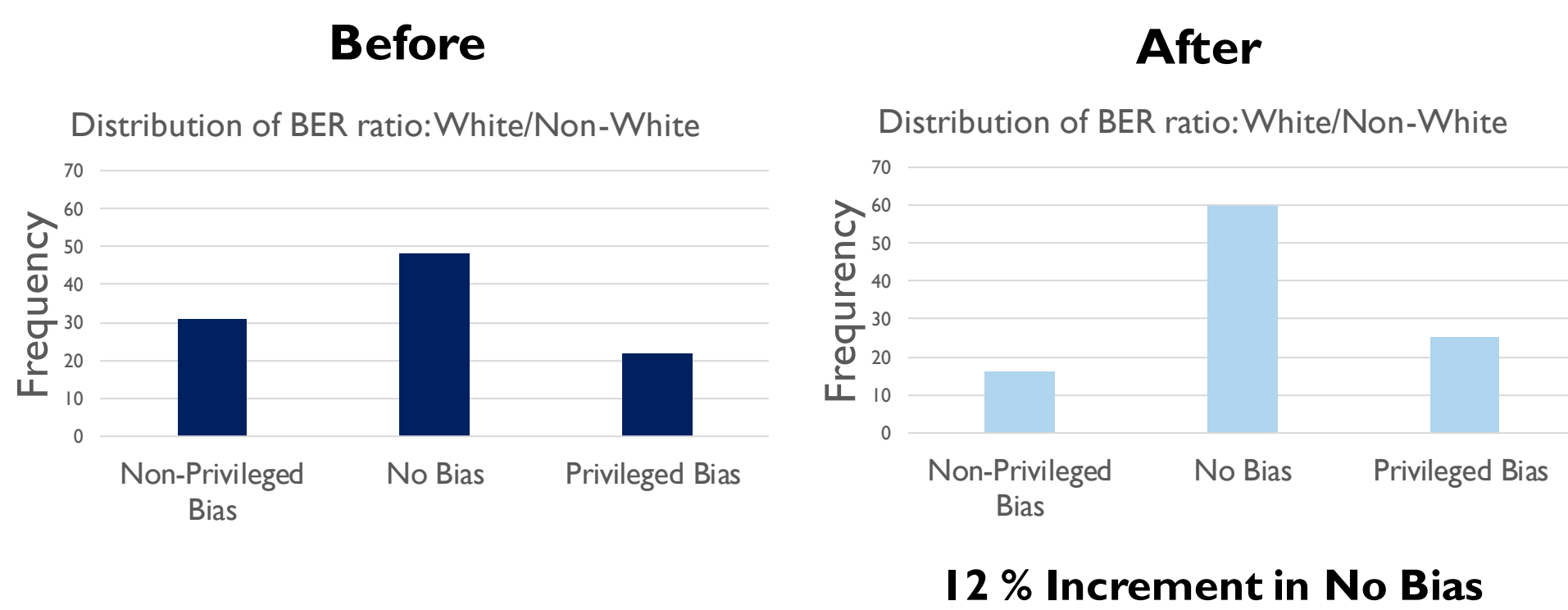
BERTopics (Grootendorst, 2022) for Age 5



Bias Mitigation via Rewriting

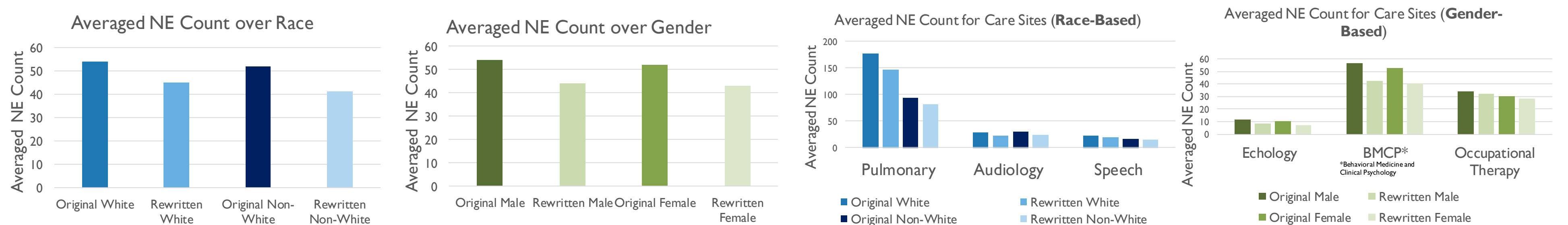
- Rewriting by the Pegasus Seq2Seq model (Zhang et al., 2019), which paraphrased free-text fields
- Clinical-BigBird (Li et al., 2022): trained on Age 4; 100 random tests Age 6; F-measure for Anxiety ~0.6
- Predictive bias measured using Balanced Error Rate (BER) ratio

$$BER = \frac{\frac{FP}{FP + TN}}{2} + \frac{\frac{FN}{FN + TP}}{2}$$



Information Preservation: Automatic Evaluation

- Informativeness Measure: count of Clinical Named Entities (NE) per note
- We extract NE using Stanford Stanza (Zhang et al., 2021), e.g., Treatment, Anatomy, Procedure, etc.



Information Preservation: Human Evaluation

- 3 clinical experts annotated the rewritten texts, assessing missing data, closeness to original notes and whether the rewritten notes were coherent
- Paraphrased texts maintain fidelity to the original content in 76% of cases, showcasing the effectiveness of the paraphrasing process, despite information from the source text missing in ~47% of cases
- Coherence of paraphrased text is preserved in 89% of cases
- For closeness to original notes, moderate agreement between annotators was observed using the Fleiss' kappa measure

Conclusion

Natural variation in mental health text may cause predictive bias. Rewriting techniques can reduce up to 34% for our case of those differences while preserving the original content.