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Editor-in-Chief
AERA Open
American Educational Research Association

Dear Editor,

We are pleased to submit our manuscript, “Algorithmic Fairness and Temporal Generalization in Early Childhood Risk Prediction: A Multi-Dimensional Audit Using the ECLS-K:2011 Longitudinal Study,” for consideration as a regular article in *AERA Open*.

Summary. This study conducts a comprehensive, multi-dimensional fairness audit of machine learning models that use early childhood data to predict 5th-grade academic risk. Using the nationally representative ECLS-K:2011 public-use data ($N = 9,104$), we trained seven algorithms—including three state-of-the-art gradient boosting methods—and evaluated them across group fairness, calibration fairness, intersectional fairness, and temporal generalization.

Key findings and contributions. Three results are especially noteworthy:

1. *The “poverty detector” problem.* Intersectional analysis (race \times SES) revealed that high-SES Black students were completely invisible to the model (TPR = 0%), despite a 14% at-risk prevalence in this subgroup. The model identifies risk primarily through socioeconomic signals, systematically missing minority students whose difficulties arise from non-poverty-related factors. This finding would not emerge from standard single-attribute fairness audits.
2. *The temporal paradox.* Additional longitudinal data (kindergarten through 3rd grade) improved overall accuracy but failed to resolve—and in some cases worsened—fairness disparities across racial/ethnic groups. This challenges the common assumption that more data naturally produces fairer predictions.
3. *Threshold fragility.* Fairness compliance was achieved at only one of four tested at-risk thresholds, demonstrating that fairness claims are contingent on specific analytical choices rather than inherent model properties.

Significance for AERA Open’s readership. As predictive analytics become increasingly prevalent in K–12 settings, this work provides both a methodological framework and empirical evidence for why comprehensive fairness auditing—spanning group metrics with uncertainty quantification, calibration analysis, intersectional subgroup assessment, and temporal stability—should be a prerequisite for deployment. The finding that classical regularized models match state-of-the-art methods also carries practical implications:

schools need not adopt complex algorithms to achieve competitive prediction, but no algorithm resolves the underlying equity challenges.

Fit with AERA Open. This manuscript addresses a timely intersection of educational research, quantitative methods, and equity—core concerns for AERA’s readership. The work is empirical, uses rigorous methods on nationally representative data, and yields actionable implications for researchers, practitioners, and policymakers considering algorithmic tools in education.

Manuscript details. The manuscript is approximately 8,000 words with 11 figures and 10 tables in the main text, plus an Online Supplementary Materials document with 6 additional figures and 8 tables. All analyses use freely available public-use data and fully reproducible open-source code. This manuscript has not been published or submitted elsewhere.

We appreciate your consideration and look forward to your response.

Sincerely,

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