Evaluating Quality of Anesthesiologists' Supervision

- This talk includes many similar slides
  - Paging through produces animation
  - View with Adobe Reader for **mobile**: iPad, iPhone, Android
- Slides were tested using Adobe Acrobat
  - You can select View and then Full Screen
    - First optimize your settings
    - Select Edit, then Preferences, then Full Screen, and then No Transition
- Other PDF readers suitable if scrolling can be disabled
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Evaluating Quality of Anesthesiologists' Supervision of Anesthesia Residents and Nurse Anesthetists

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Financial Disclosure

- I am employed by the University of Iowa, in part, to consult and analyze data for hospitals, anesthesia groups, and companies
- Department of Anesthesia bills for my time, and the income is used to fund our research
  - I receive no funds personally other than my salary and allowable expense reimbursements from the University of Iowa, and have tenure with no incentive program
  - I own no healthcare stocks (other than indirectly through mutual funds)

Ongoing Professional Practice Evaluation and Supervision

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  - Information collected about every practitioner
  - Used semi-annually to decide whether to continue, limit, or revoke hospital privileges

"Current competence in performing the requested privilege(s) is verified by peers knowledgeable about the applicant's professional performance"

TJC Standard MS.06.01.03

Ongoing Professional Practice Evaluation and Supervision

- Monitoring supervision relies on anesthesia residents, nurse anesthetists, and other anesthesia practitioners' review
  - Paired daily in actual (*in situ*) clinical practice
  - Frequent ongoing sampling from many independent raters
  - Psychometrically reliable and valid

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Alternatives to Monitoring Supervision for OPPE

- Low incidence clinical outcomes
  - Mortality
  - Post-anesthesia care unit reintubation
  - Wrong-side regional nerve block placement
- Low sensitivity to detect differences among anesthesiologists once apply appropriate statistical methods to avoid false detection

Glance LG et al. Anesth Analg 2016
Glance LG et al. Anesthesiology 2016
Dexter F, Hindman BJ. Anesthesiology 2016

Alternatives to Monitoring Supervision for OPPE

- Relatively high incidence clinical outcomes
  - Postoperative patient satisfaction
  - Post-anesthesia care unit arrival pain scores
  - Prolonged times to tracheal extubation
  - Hypotension during induction of anesthesia

Kynes JM et al. Anesth Analg 2013
Wanderer JP et al. Anesth Analg 2015
Chen Y et al. Anesth Analg 2016
Bayman EO et al. Anesthesiology 2016
Epstein RH et al. Br J Anaesth 2017

Alternatives to Monitoring Supervision for OPPE

- Relatively high incidence clinical outcomes
  - Postoperative patient satisfaction
  - Post-anesthesia care unit arrival pain scores
  - Prolonged times to tracheal extubation
  - Hypotension during induction of anesthesia
- ➢ Risk adjusted scores fail to discriminate among anesthesiologists and/or lack validity

Alternatives to Monitoring Supervision for OPPE

- Process metrics (examples)
  - Perioperative temperature management
  - Surgical Care Improvement Project (SCIP) antibiotic guidelines
- Not designed to differentiate reliably among anesthesiologists as compared with being systems-based practice measures
- Limited validity as measures of individual anesthesiologists' quality of care

Schonberger RB et al. Anesth Analg 2015

Epstein RH et al. Anesth Analg 2018

Attributes of Supervision

Attributes of Supervision

- Supervision
  - Our department's functional definition for purposes of evaluating anesthesiologists
    - All anesthetic activities contributing to patient care, when the anesthesiologist being evaluated is not the provider continually present with the patient

Attributes of Supervision

- Supervision incorporates several attributes
  - Each attribute is included in de Oliveira Filho et al.'s scale for measuring anesthesiologists' supervision of anesthesia residents during clinical operating room care

de Oliveira Filho GR et al. Anesth Analg 2008

Attributes of Supervision

1) The faculty provided me timely, informal, non-threatening comments on my performance and showed me ways to improve
2) The faculty was promptly available to help me solve problems with patients and procedures
3) The faculty used real clinical scenarios to stimulate my clinical reasoning, critical thinking and theoretical learning

Attributes of Supervision

4) The faculty demonstrated theoretical knowledge, proficiency at procedures, ethical behavior, and interest/compassion/respect for patients
5) The faculty was present during the critical moments of the anesthetic procedure (e.g., anesthesia induction, critical events, complications)
6) The faculty discussed with me the perianesthesia management of patients prior to starting an anesthetic procedure and accepted my suggestions, when appropriate

Attributes of Supervision

7) The faculty taught and demanded the implementation of safety measures during the perioperative period (e.g., anesthesia machine checkout, universal precautions, prevention of medication errors, etc.)
8) The faculty treated me respectfully, and strived to create and maintain a pleasant environment during my clinical activities
9) The faculty gave me opportunities to perform procedures and encouraged my professional autonomy

Answering the 9 Questions

Answering the 9 Questions

- Choices beneath each question
  1. never
  2. rarely
  3. frequently
  4. always
- Questions presented daily in same sequence
- Generally takes < 90 seconds per evaluation
  - End of workday after patient care completed

Hindman BJ et al. Anesth Analg 2013
Dexter F et al. Anesth Analg 2014

Answering the 9 Questions

- Examples
  - The faculty was promptly available to help me solve problems with patients and procedures
    - Always gives greatest supervision score
  - The faculty was present during the critical moments of the anesthetic procedure
    - Always gives greatest supervision score

Answering the 9 Questions

- Score = mean of answers to the 9 questions
- For each combination of rater (e.g., resident) and ratee (e.g., anesthesiologist), calculate mean of the scores
- For each ratee, calculate average of the means among all raters
  - Equally weighting each rater

Dexter F et al. Anesth Analg 2014a,b

Indications that Supervision is Single Dimension Construct

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- Scale designed to include all attributes
- Scale includes each attribute in residents' written comments made when providing a score below the overall average among anesthesiologists in the department
- Cronbach α in routine use 0.948 (SE 0.001)

de Oliveira Filho GR et al. Anesth Analg 2008

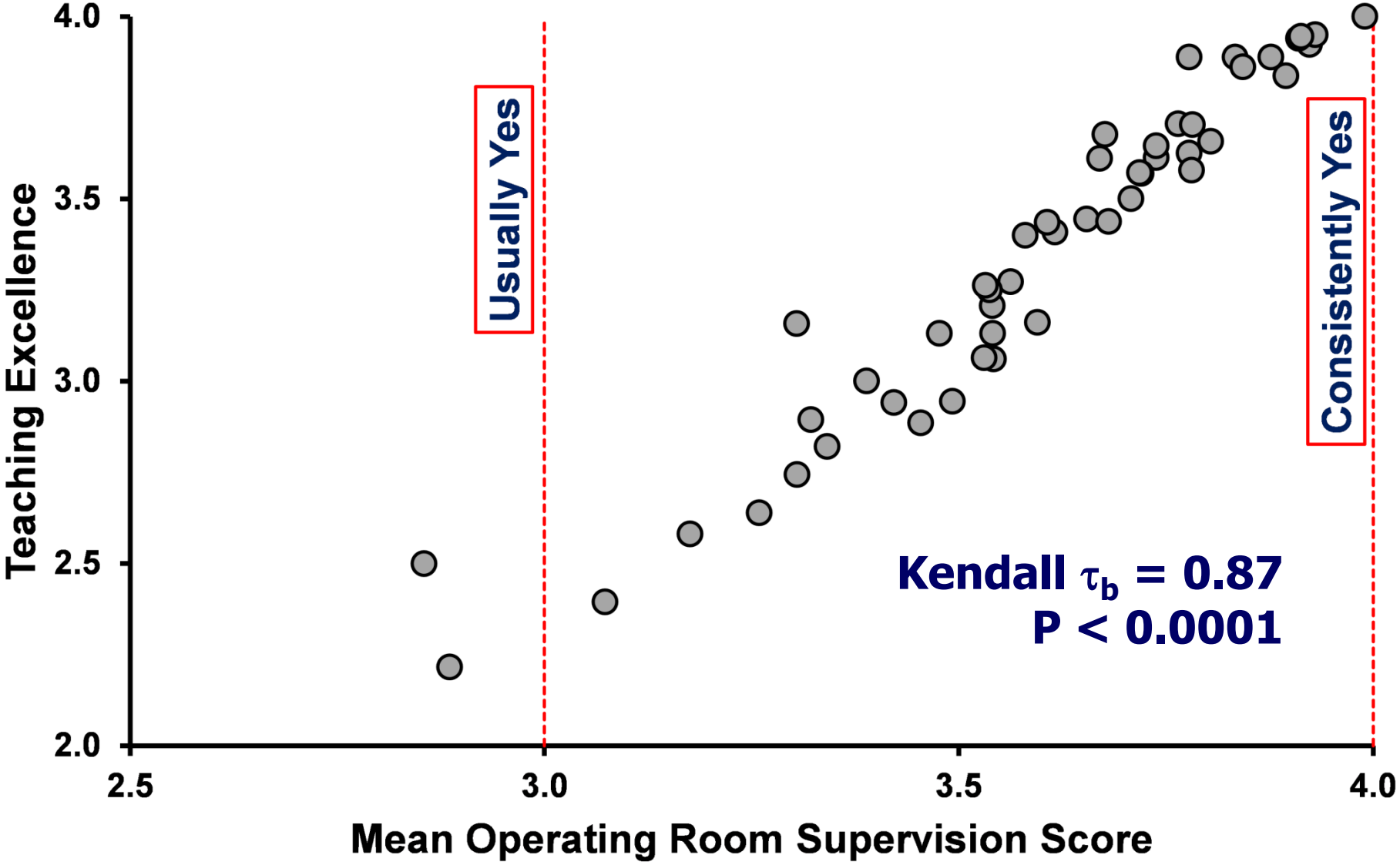
Dexter F et al. Anesth Analg 2016

Indications that Supervision is Single Dimension Construct

- Teaching is attribute important to the supervision of residents (trainees)

Hindman BJ et al. Anesth Analg 2013

Concordance between Teaching Evaluations and Supervision Score



Indications that Supervision is Single Dimension Construct

- Teaching is attribute important to the supervision of residents (trainees)
- Each anesthesiologist evaluated not only by residents (trainees) but also by nurse anesthetists (experienced providers)
  - Averages were correlated, $P < 0.0001$
  - Cronbach $\alpha = 0.895$ (SE 0.003)
  - Most common score = 4.00 for both groups, $P < 0.0001$

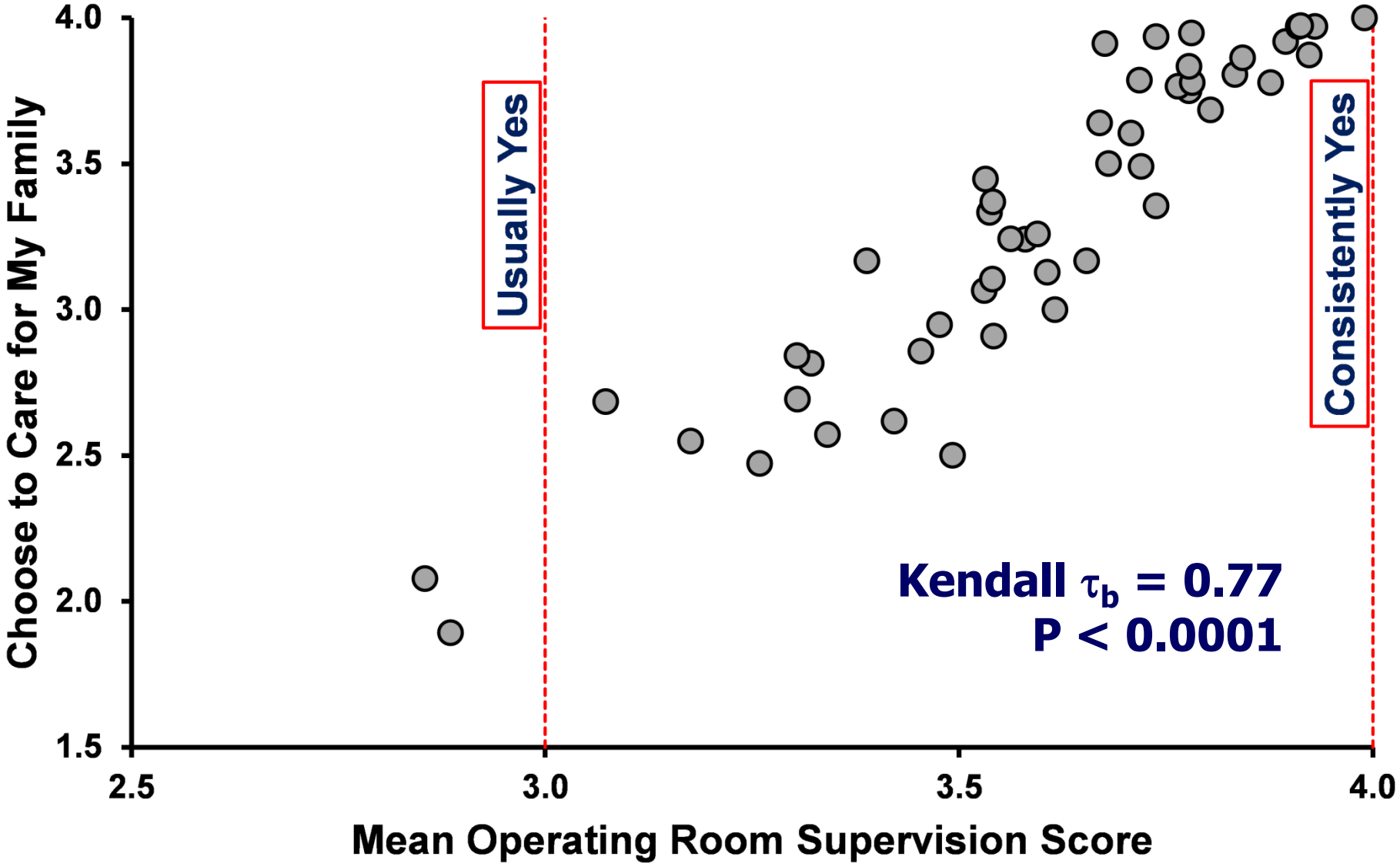
Dexter F et al. Anesth Analg 2014

Dexter F et al. Anesth Analg 2015

Indications that Quality of Supervision Matters

Hindman BJ et al. Anesth Analg 2013

"I would choose this instructor to care for … my family"



Indications that Quality of Supervision Matters

- Residents reporting overall supervision of department < 3.00 ("frequent") reported making more "mistakes that had negative consequences for the patient"
  - Accuracy (area under the curve) of 89% (99% confidence interval, 77% to 95%)
- Supervision < 3.00 predicted "medication errors (dose or incorrect drug) in" last year
  - Accuracy of 93% (99% CI 77% to 98%)

De Oliveira GS Jr et al. Anesth Analg 2013

Indications that Quality of Supervision Matters

- Residents reporting overall supervision during current rotation < 3.00 ("frequent") reported 3 (75th percentile) and 6 (95th) errors in past year with negative consequences for patients
  - Residents reporting supervision ≥3.00 reported fewer errors (2 and 4; P < 0.0001)
- Resident burnout not correlated (all P > 0.134) with numbers of reported errors while controlling for quality of supervision

De Oliveira GS Jr et al. Anesth Analg 2015

Indications that Quality of Supervision Matters

- Positive correlations between residents' evaluation of overall departmental supervision and safety culture (all $P < 0.0001$)
  - Overall perceptions of patient safety
  - Non-punitive response to errors
  - Handoffs and transitions
  - Feedback and communication about errors
  - Communication openness
  - Teamwork within the unit

De Oliveira GS Jr et al. Anesth Analg 2015

Indications that Quality of Supervision Matters

- Among the dozens of variables studied in national survey of residents' perceptions of their current rotation, supervision score most closely predicted by same one variable using multiple types of regression trees
  - Teamwork within the unit

De Oliveira GS Jr et al. Anesth Analg 2015

Indications that Quality of Supervision Matters

- Nurse anesthetists' written comments' theme "I did not see the anesthesiologist during the case(s) together" increased odds (48.2) of supervision score < 3.00 ($P < 0.0001$)
- Resident comments of insufficient presence associated with scores less than those of other evaluations with comments ($P < 0.0001$)
  - Anesthesiologists with ≥ 1 such comment had lower average scores than others ($P = 0.0071$)

Dexter F et al. Anesth Analg 2015

Dexter F et al. Anesth Analg 2016

Advice to Anesthesiologists When Present (Team Work)

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- Each increase in the anesthesiologist's number of resident comments of the anesthesiologist being disrespectful was associated with a lower average score (P = 0.0002)
- A supervision score < 3.00 ("frequent") had odds ratio of 85 for resident written comment of disrespectful faculty behavior (P < 0.0001)

Dexter F et al. Anesth Analg 2016

Advice to Anesthesiologists When Present (Team Work)

- Each increase in the anesthesiologist's number of resident comments of the anesthesiologist teaching poorly was associated with a lower average score ($P = 0.0002$)
- Evaluations with comments related to teaching poorly had lower scores than other evaluations with comments ($P < 0.0001$)

Dexter F et al. Anesth Analg 2016

Influence of Feedback on Supervision Scores

Influence of Feedback on Supervision Scores

- Monitoring anesthesiologists' supervision and providing feedback resulted in greater scores for both residents and nurse anesthetists
  - Multiple comparisons, all $P \leq 0.0011$
- Among nurse anesthetists, increase due mostly to questions associated with teaching (e.g., "stimulate my clinical reasoning, critical thinking, and theoretical learning")

Dexter F, Hindman BJ. Anesth Analg 2015

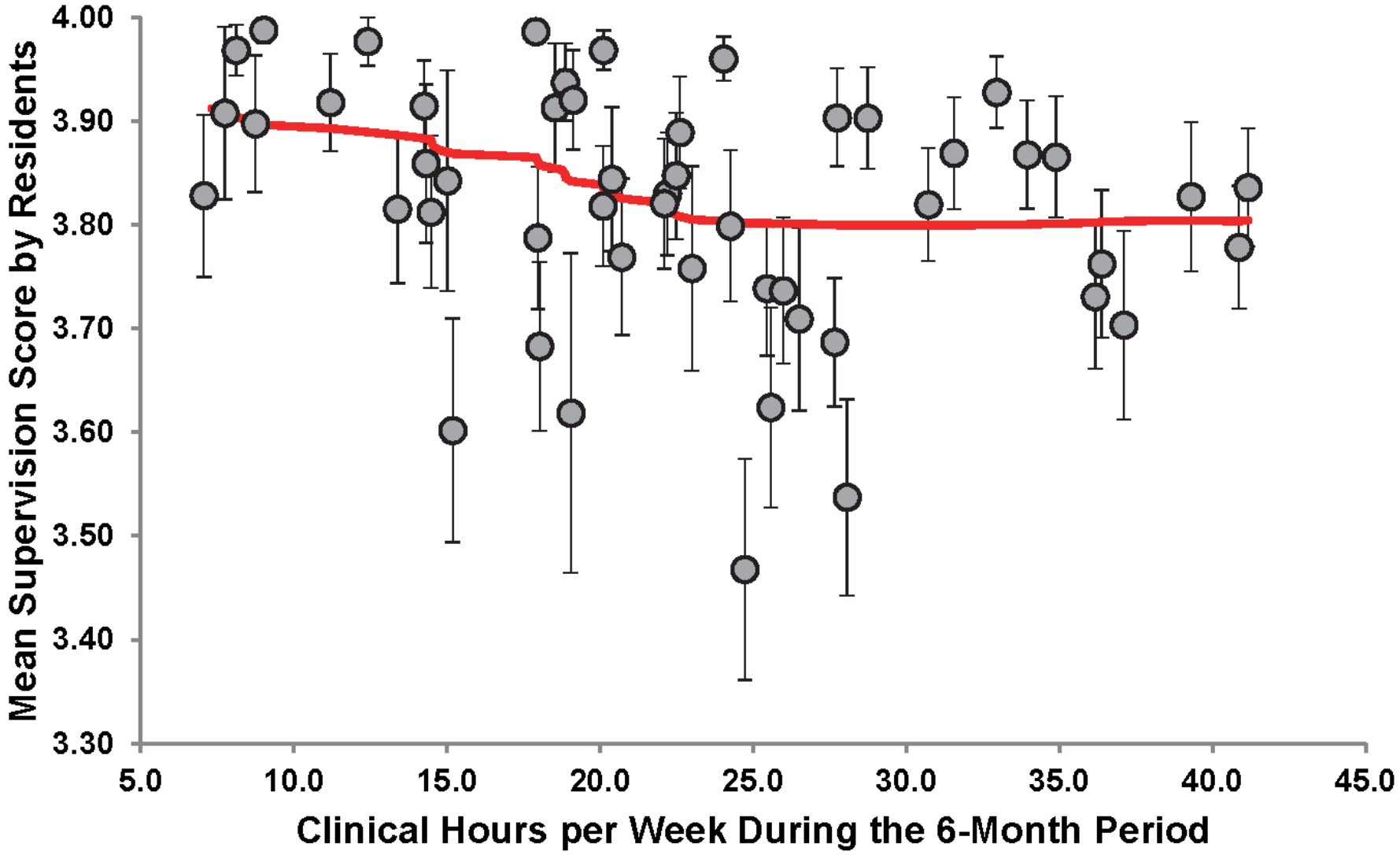
Value of Evaluating Supervision Scores for Anesthesiologists

Value of Evaluating Supervision Scores for Anesthesiologists

- Anesthesiologists' mean supervision scores provided both by residents and nurse anesthetists were not positively correlated with hours of faculty clinical activity
  - Multiple comparisons, all $P > 0.65$

Dexter F, Hindman BJ. Anesth Analg 2015

Value of Evaluating Supervision Scores for Anesthesiologists



Value of Evaluating Supervision Scores for Anesthesiologists

- Active anesthesiologist can provide ineffective supervision and a less frequent anesthesiologist can be very effective
  - Evaluating quality of supervision serves as independent measure of the value each anesthesiologist adds to care of the patients

Dexter F, Hindman BJ. Anesth Analg 2015

Value of Evaluating Supervision Scores for Department

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- Anesthesiologists' supervision of residents is mandatory and evaluated for reaccreditation
- Residents' mean ± SD of daily supervision score meeting expectations is 3.40 ± 0.30
- Evaluations of department and of individual anesthesiologists using their averages are correlated (Kendall τ_b = 0.35, P = 0.0032)
  - Median ratio 86% (SE 1%)

Dexter F et al. Anesth Analg 2013

Hindman BJ et al. Anesth Analg 2015

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➢ Achieve departmental score ≥ 3.00 by achieving individual average ≥ 3.40

Value of Evaluating Supervision Scores for Department

- Departments required to provide hospitals with physician-specific metrics demonstrating competence in professional practice
  - How anesthesiologists maintain privileges
  - Preceding section of lecture on Ongoing Professional Practice Evaluation (OPPE)
- Such assessments include the core competency of professionalism

Value of Evaluating Supervision Scores for Department

- Supervision scale includes 8 phrases pertaining to professionalism
- Multiple written comments provided by residents with below average supervision scores pertained to professionalism

Dexter F et al. Can J Anesth 2017

Value of Evaluating Supervision Scores for Department

- Supervision scale includes 8 phrases pertaining to professionalism
- Multiple written comments provided by residents with below average supervision scores pertained to professionalism
- ➢ Clinical supervision scores assess anesthesiologists' professionalism

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Covariates

Covariates Not Important

- Residency class
  - No association between residents' perception of supervision by anesthesiologists that meets expectations and years since start of training (P = 0.77)
  - Small differences among classes in scores
    - Mean differences ≤ 0.07 units

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Covariates Not Important

- Negligible differences in residents' scores when
  - Resident had more units of work that day with the anesthesiologist (τ_b = +0.083 [SE 0.014])
  - Anesthesiologist had more units of work that day with other providers (τ_b = −0.057 [SE 0.014])
- No association between residents' scores and
  - Patients cared for together (τ_b = +0.01, P=0.71)
  - Days worked together (τ_b = −0.01, P=0.46)

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Covariates Not Important

- Absence (P > 0.10) of correlation between residents' ratings of their rotations and:
  - Residents' age
    hours worked per week
    gender
  - Program size (number of residents)
    rotation (specialty)

De Oliveira GS Jr et al. Anesth Analg 2013

Covariates Not Important

- Specialization of anesthesiologist
  - Calculate Herfindahl of distribution of each anesthesiologist's anesthesia CPT codes
  - Herfindahl^{-1} = number of common procedures
  - No association between specialization and quality of supervision of residents (P = 0.31)
  - Specialization is associated with lesser quality scores among nurse anesthetists (P = 0.0001), but differences are small

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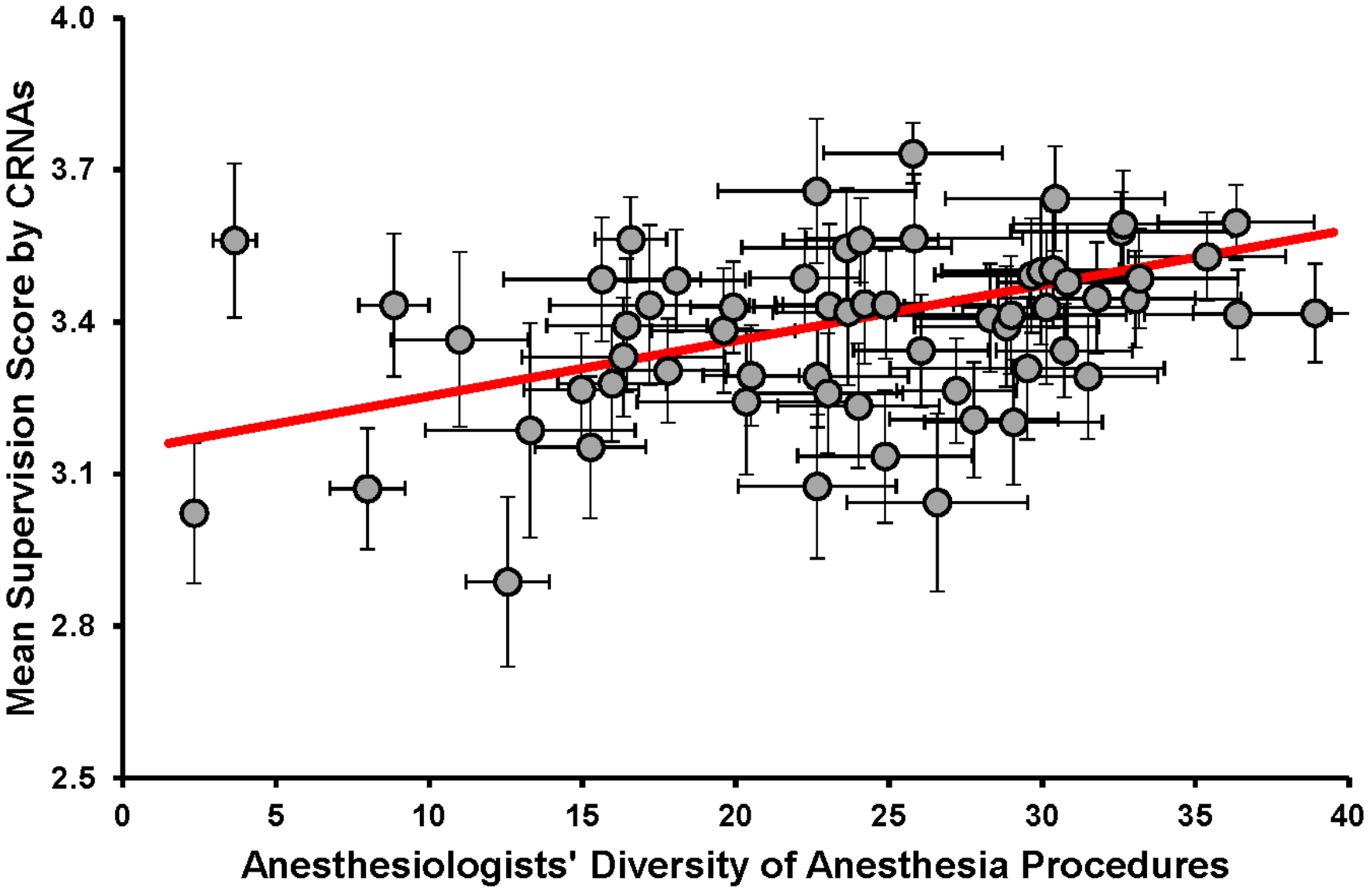
Covariates Not Important



Covariates to Include

- Control for resident vs. nurse anesthetist
  - Scores provided by residents greater than by nurse anesthetists ($P < 0.0001$)
  - Pairwise differences by anesthesiologist greater than zero too ($P < 0.0001$)

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Dexter F et al. Anesth Analg 2015

Covariates to Include

- Leniency of the resident (or nurse anesthetist)
  - Scientific term for heterogeneity among raters
  - From cumulative effect of all questions
    - For each rater, calculate mean answer to each of the 9 questions among all ratees
    - Cronbach α = 0.98, very large

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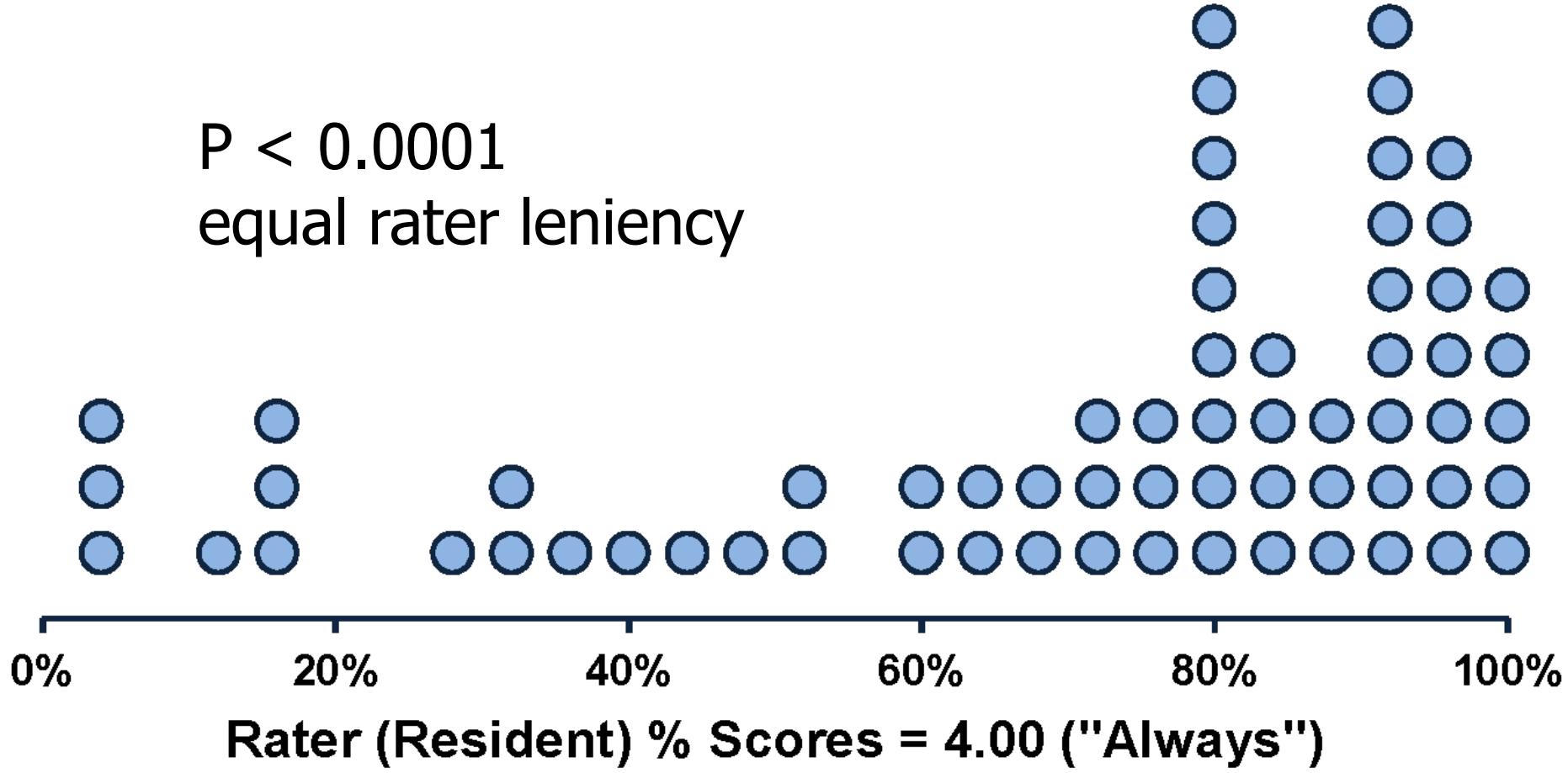
Covariates to Include



Covariates to Include

- For external reporting, since raters are mostly from just one department, comparisons use average scores equally weighting each rater
  - As used in preceding slides
  - Statistically Student's t-tests
- For assessment and progressive quality improvement within a department, use logistic regression of % scores = 4.00, treating the rater as a covariate

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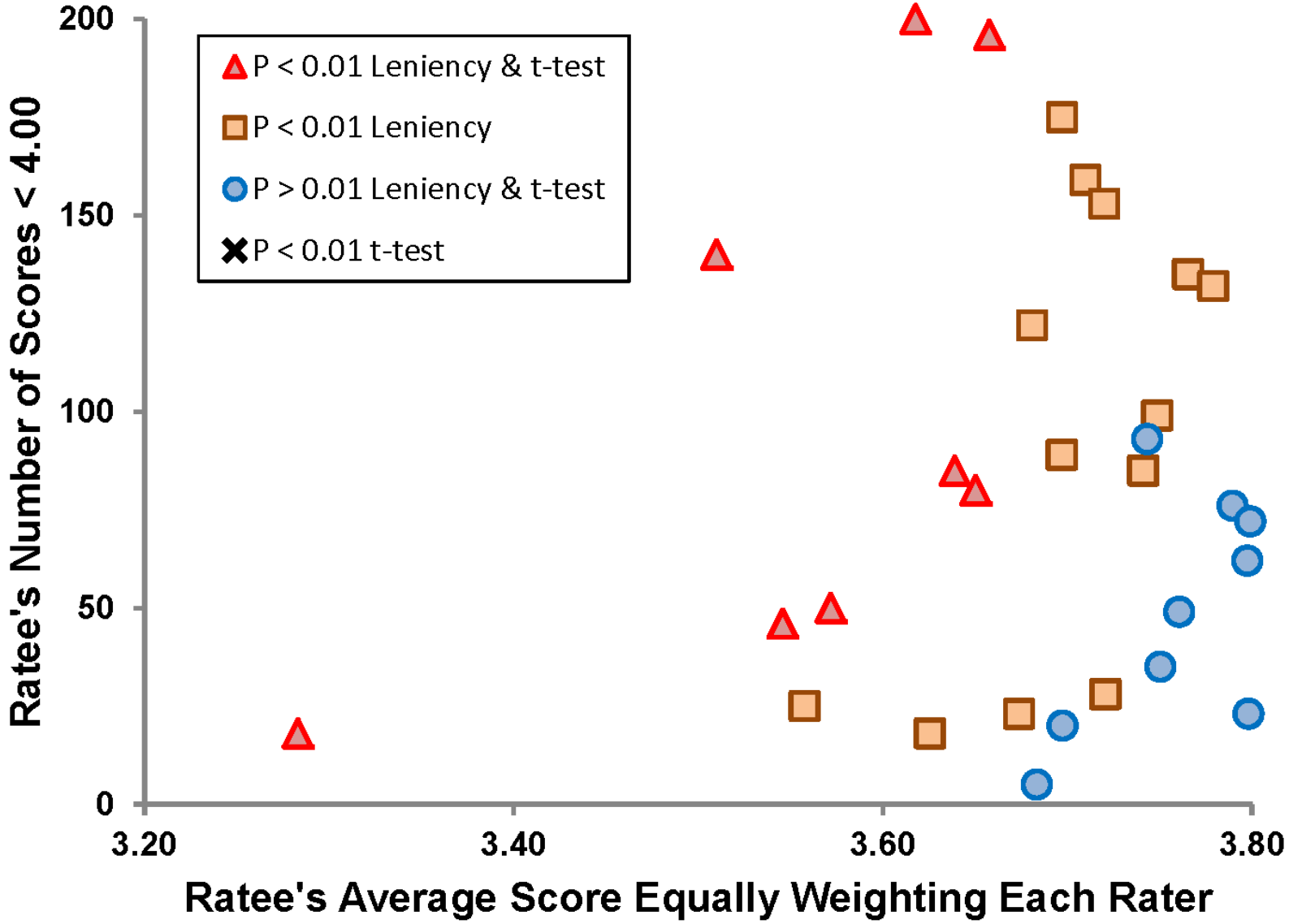
Covariates to Include



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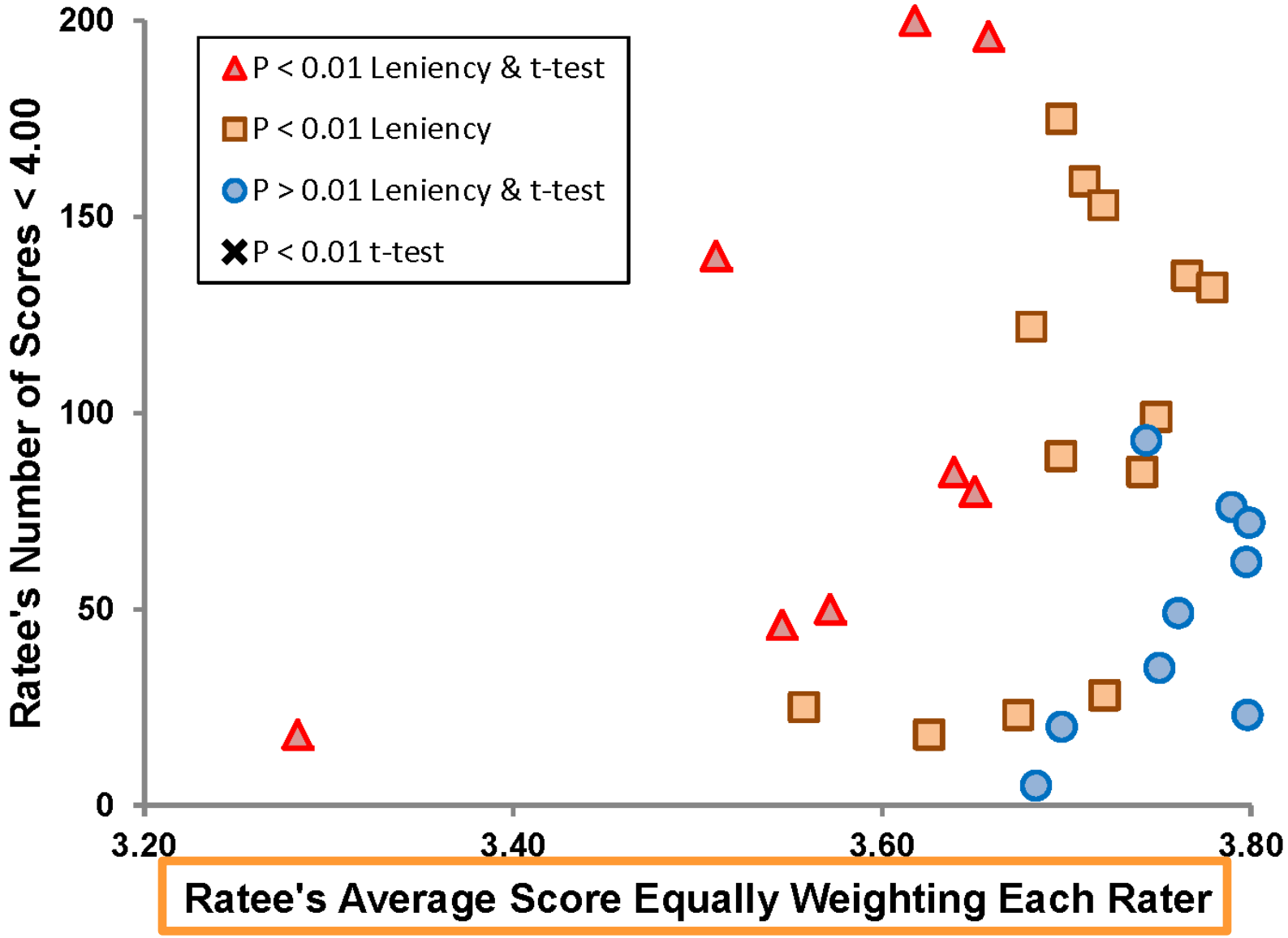

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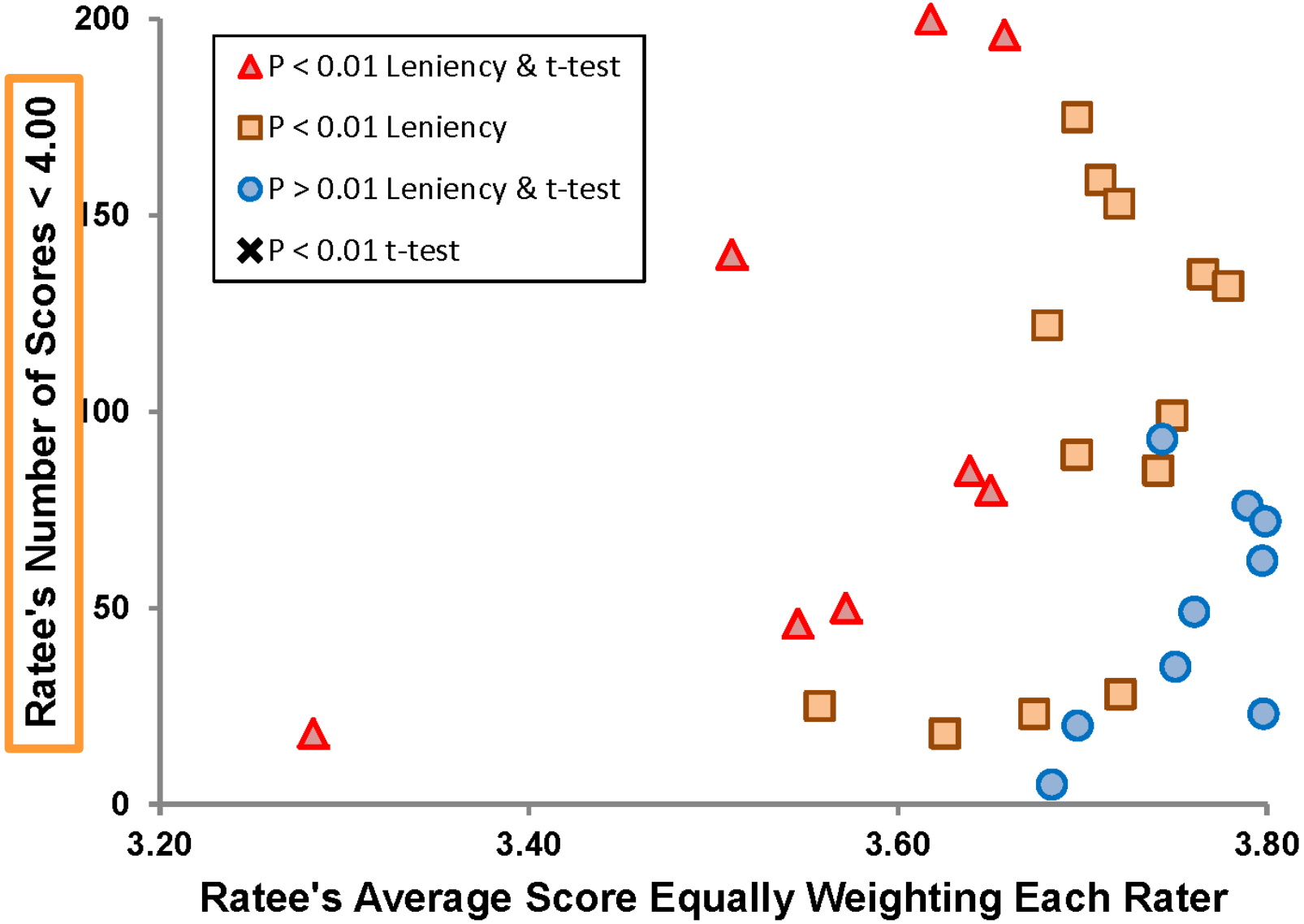

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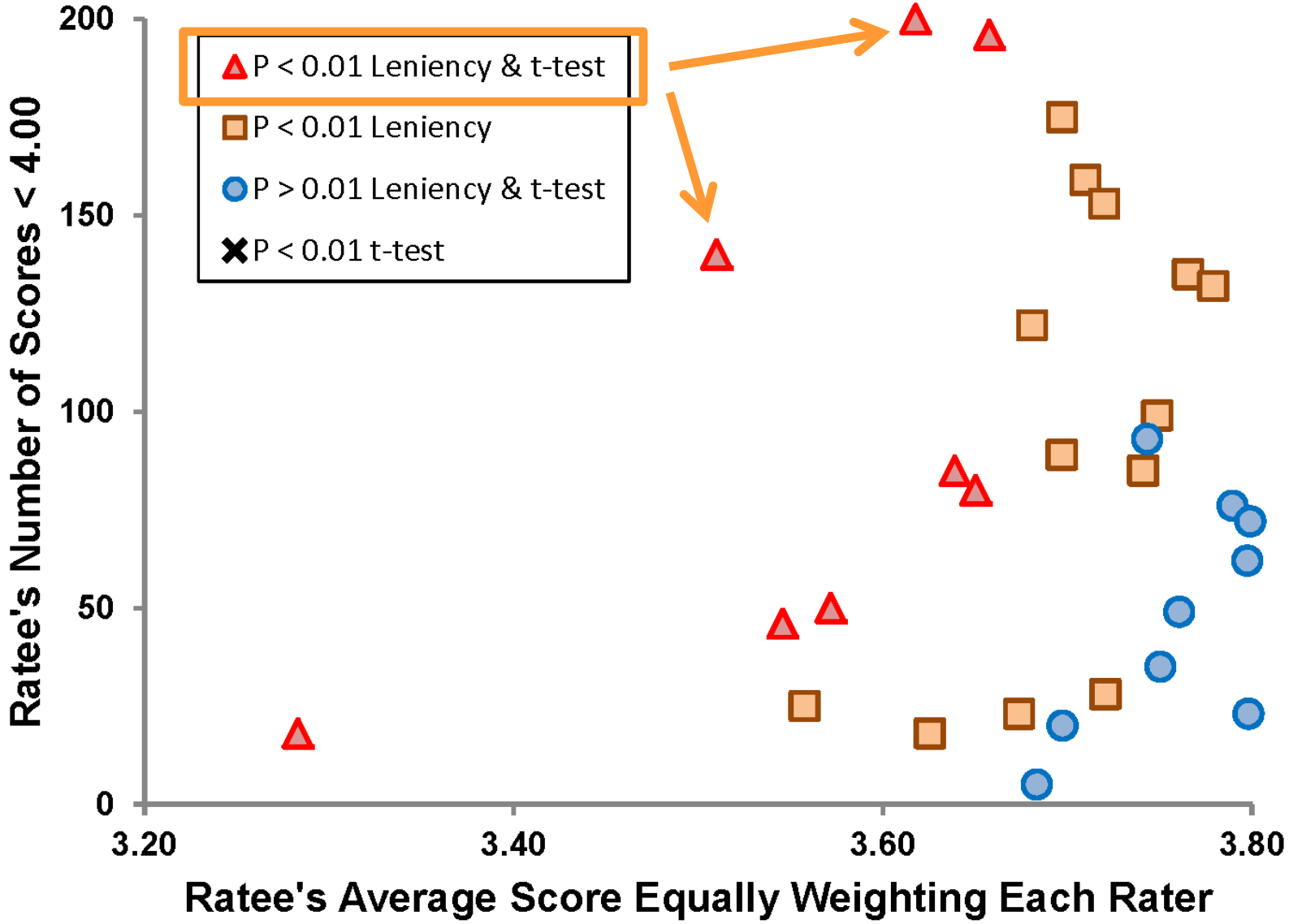

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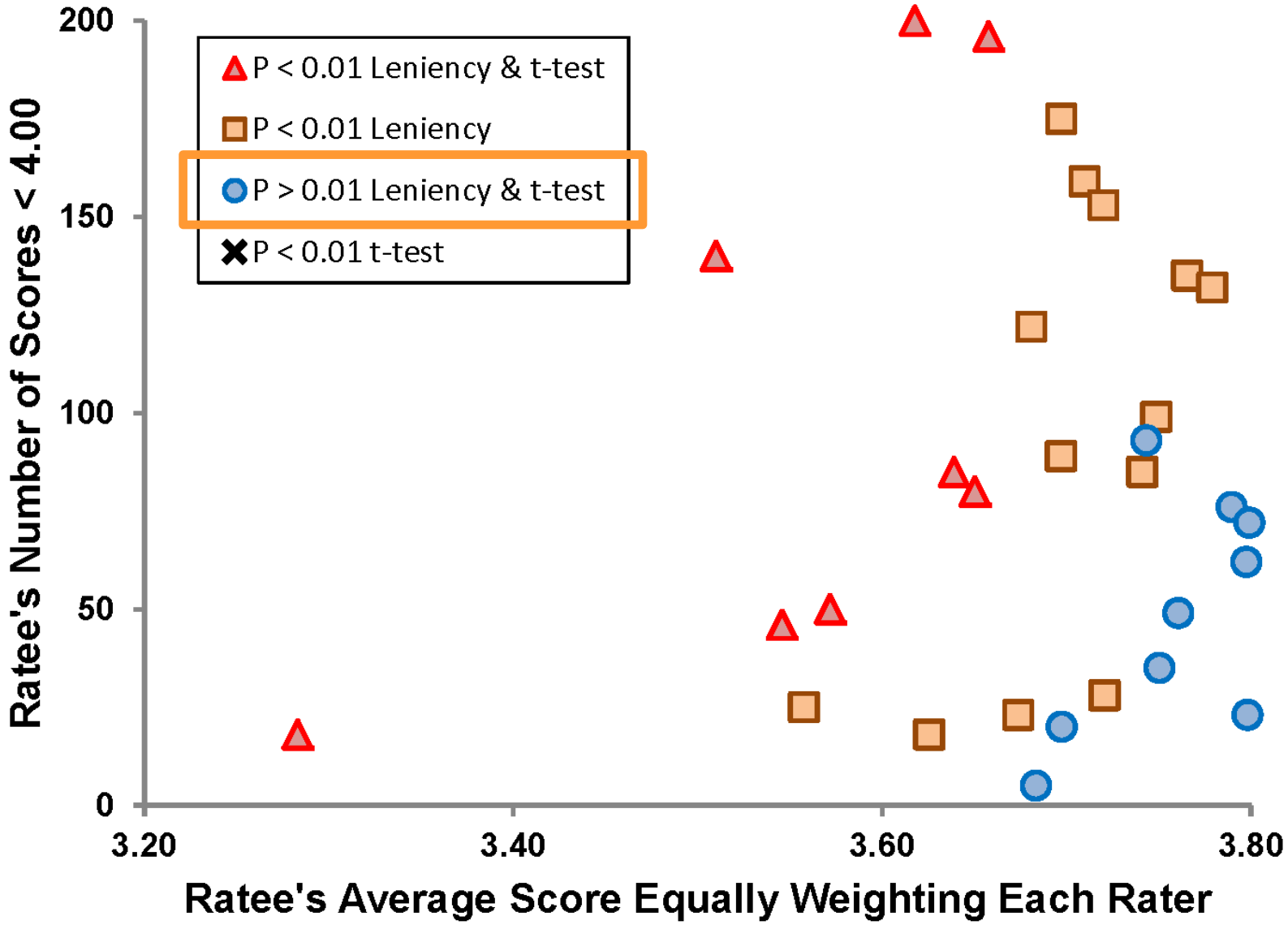

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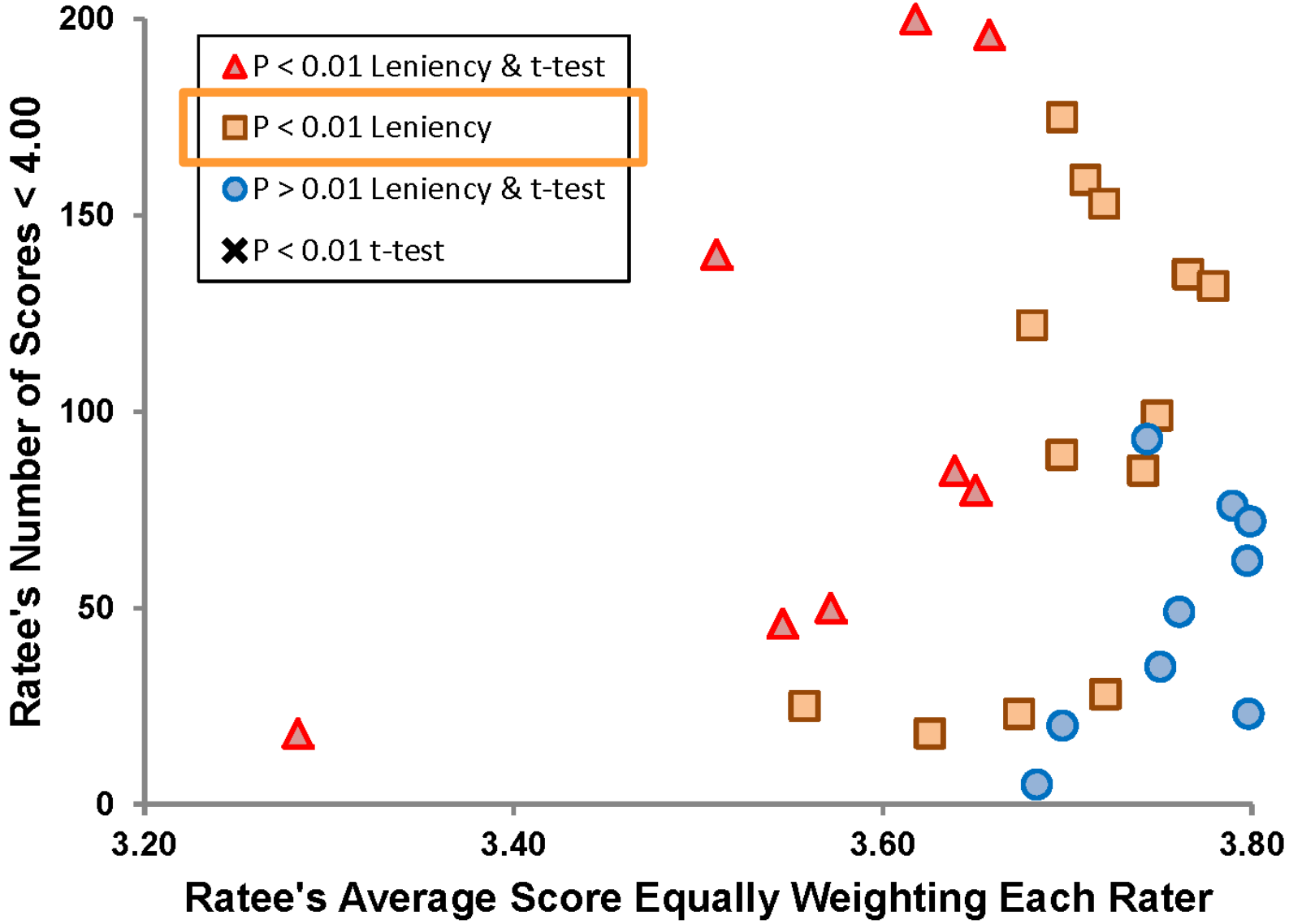

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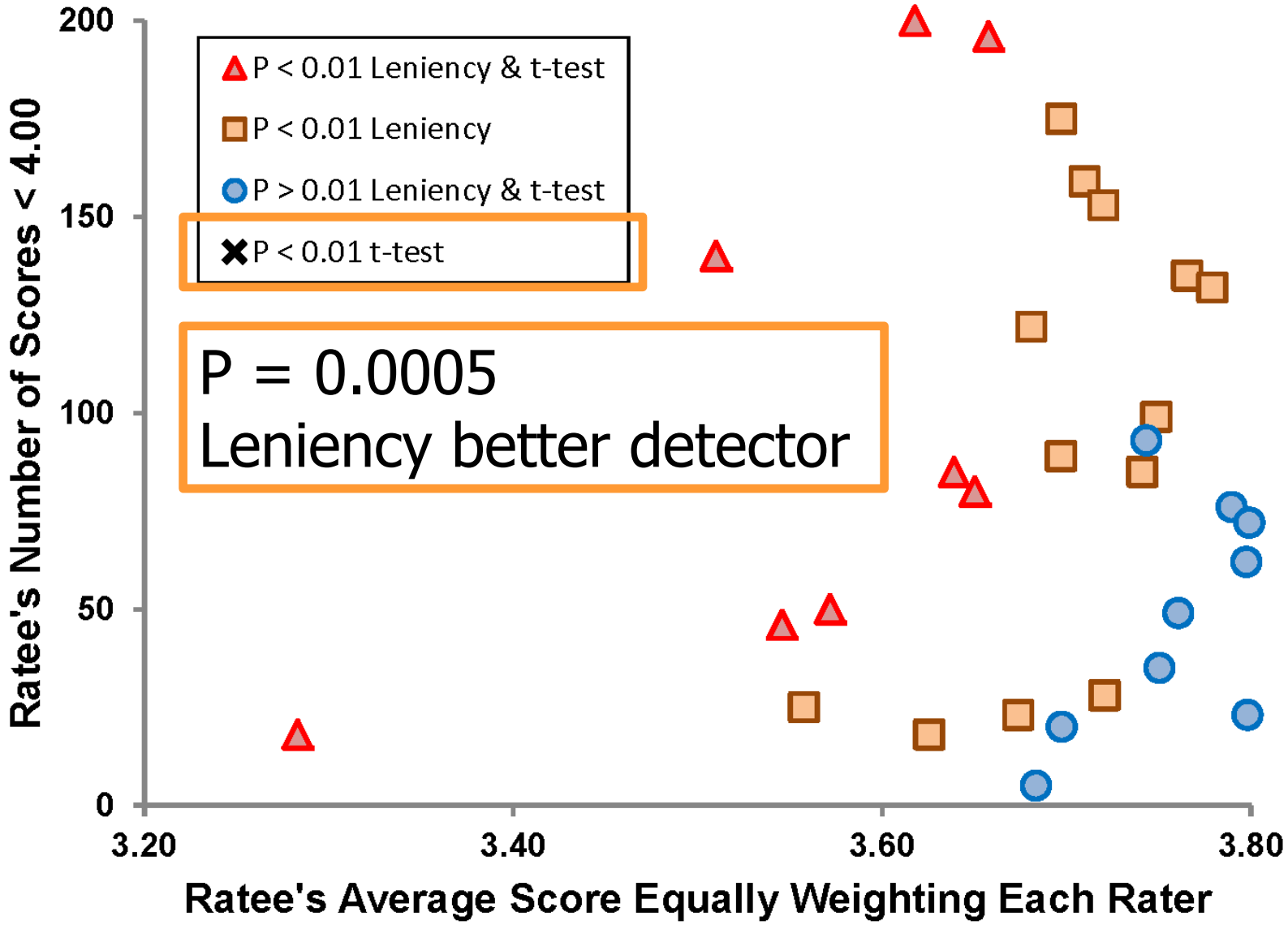

Bernoulli CUSUM Monitoring for Prompt Recognition Low Scores

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- Daily monitoring by server to detect changes in supervision scores promptly

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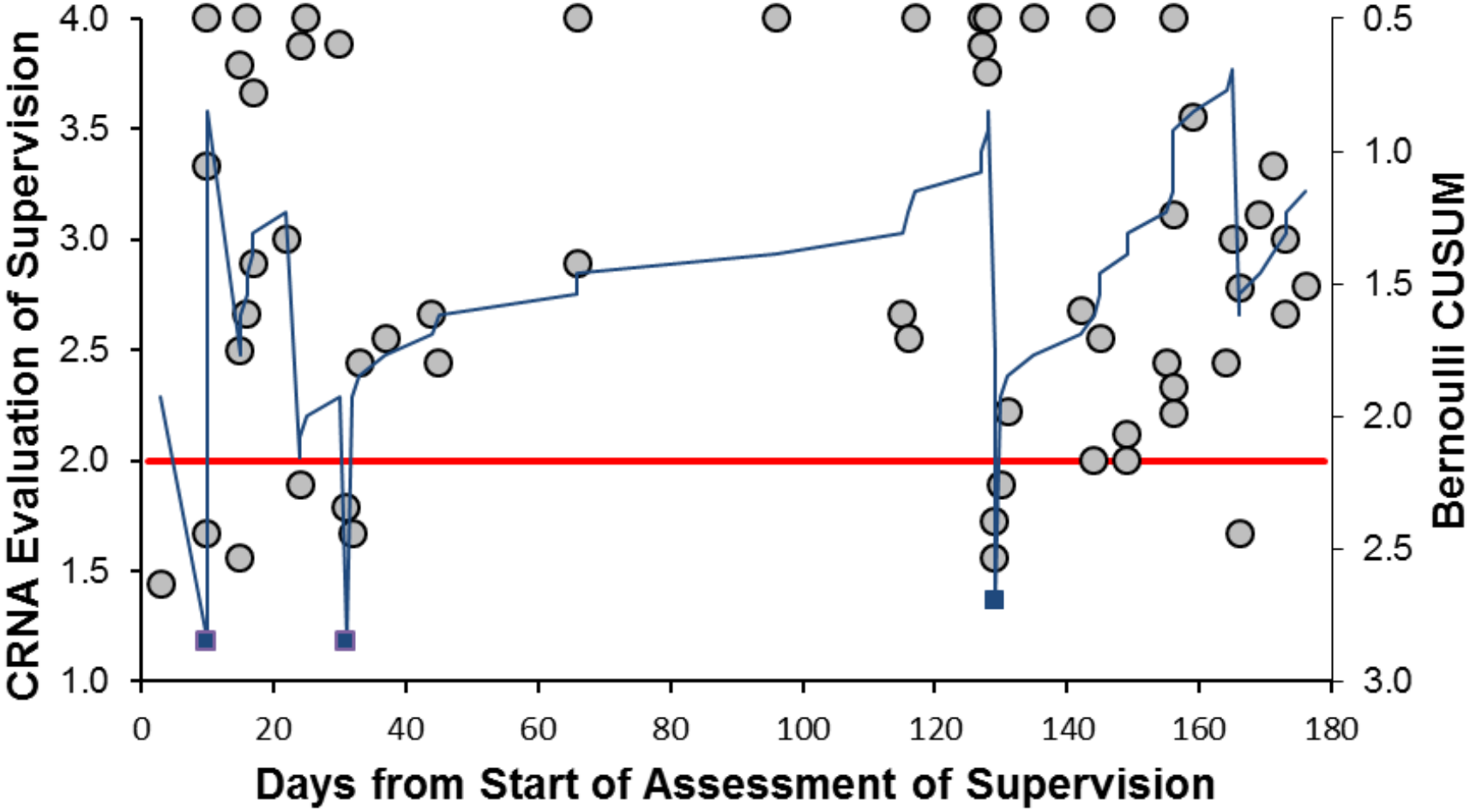
Dexter F et al. Can J Anesth 2017

Bernoulli CUSUM Monitoring for Prompt Recognition Low Scores

- Example for nurse anesthetists
  - Bernoulli CUSUM starting value = 1 – 1/13
  - Add (1 – 1/13) if score < 2.00 (“rarely”) or subtract (1/13) otherwise
  - Bernoulli CUSUM alert when > 2.32 and restart

Dexter F et al. Anesth Analg 2014

Bernoulli CUSUM Monitoring for Prompt Recognition Low Scores



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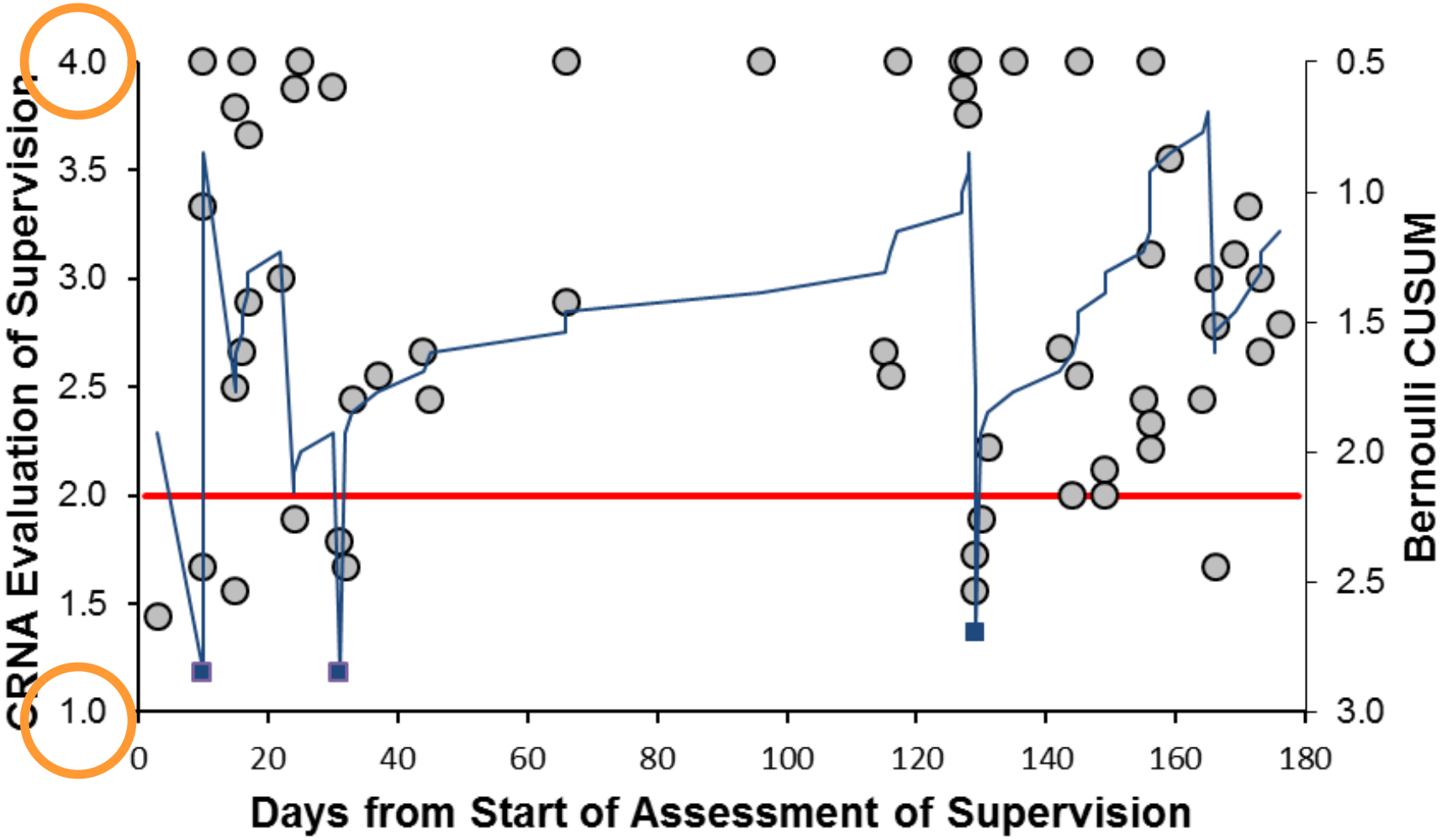

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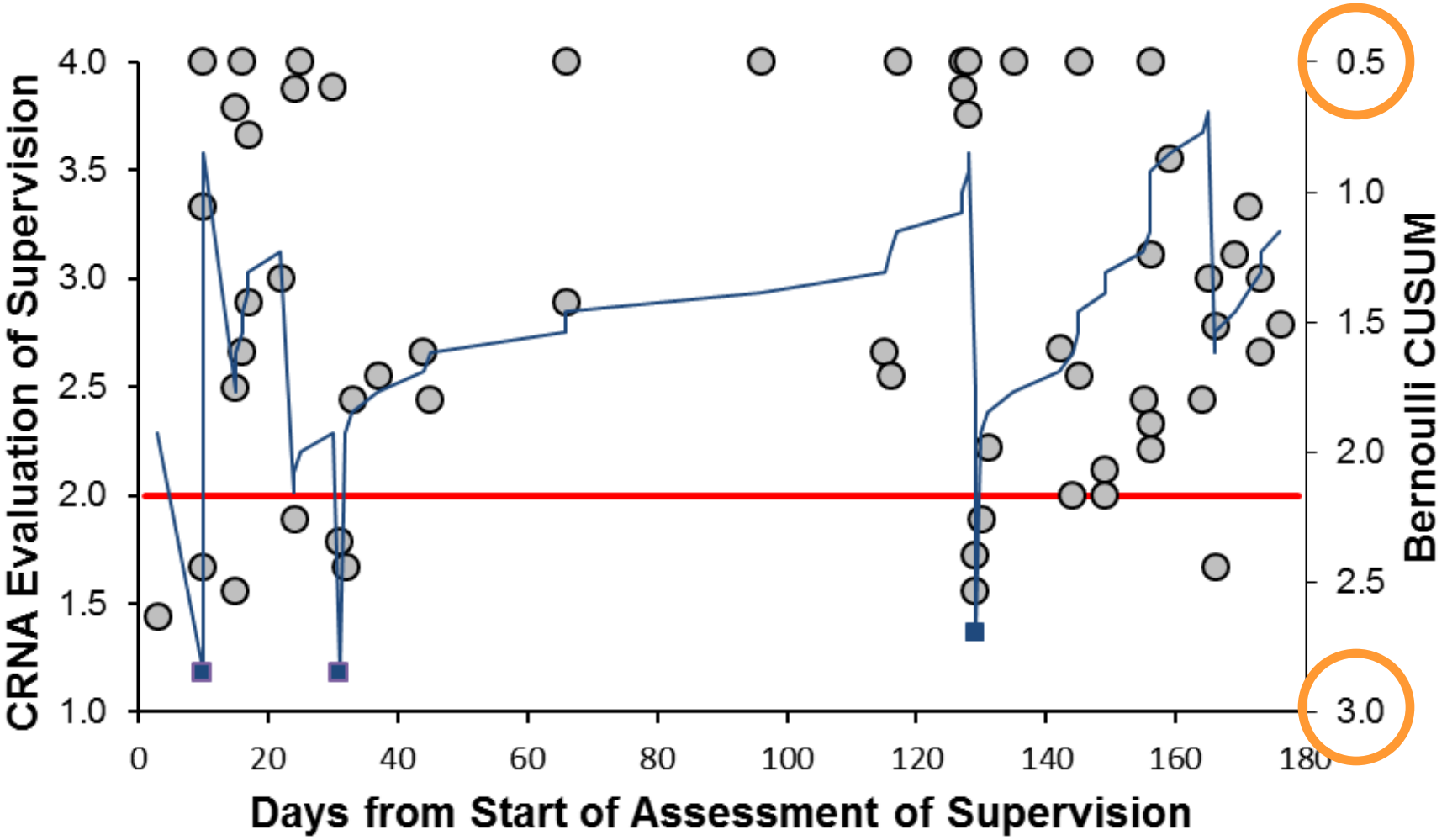

Bernoulli CUSUM Monitoring for Prompt Recognition Low Scores

- Evaluation by anesthesia residents
  - Among upper half of anesthesiologists (27/55), based on their average scores, zero of 27 was detected (flagged) during the 6 months by the Bernoulli CUSUM
  - Among the lower quartile of anesthesiologists (13/55), 12 of 13 were detected

Dexter F et al. Anesth Analg 2014

Bernoulli CUSUM Monitoring for Prompt Recognition Low Scores

- Evaluation by nurse anesthetists
  - Among upper half of anesthesiologists (29/58) based on their average scores, only 1 of 29 was detected (flagged) during the 6 months by the Bernoulli CUSUM
  - Among the lower quartile of anesthesiologists (14/58), 13 of 14 were detected

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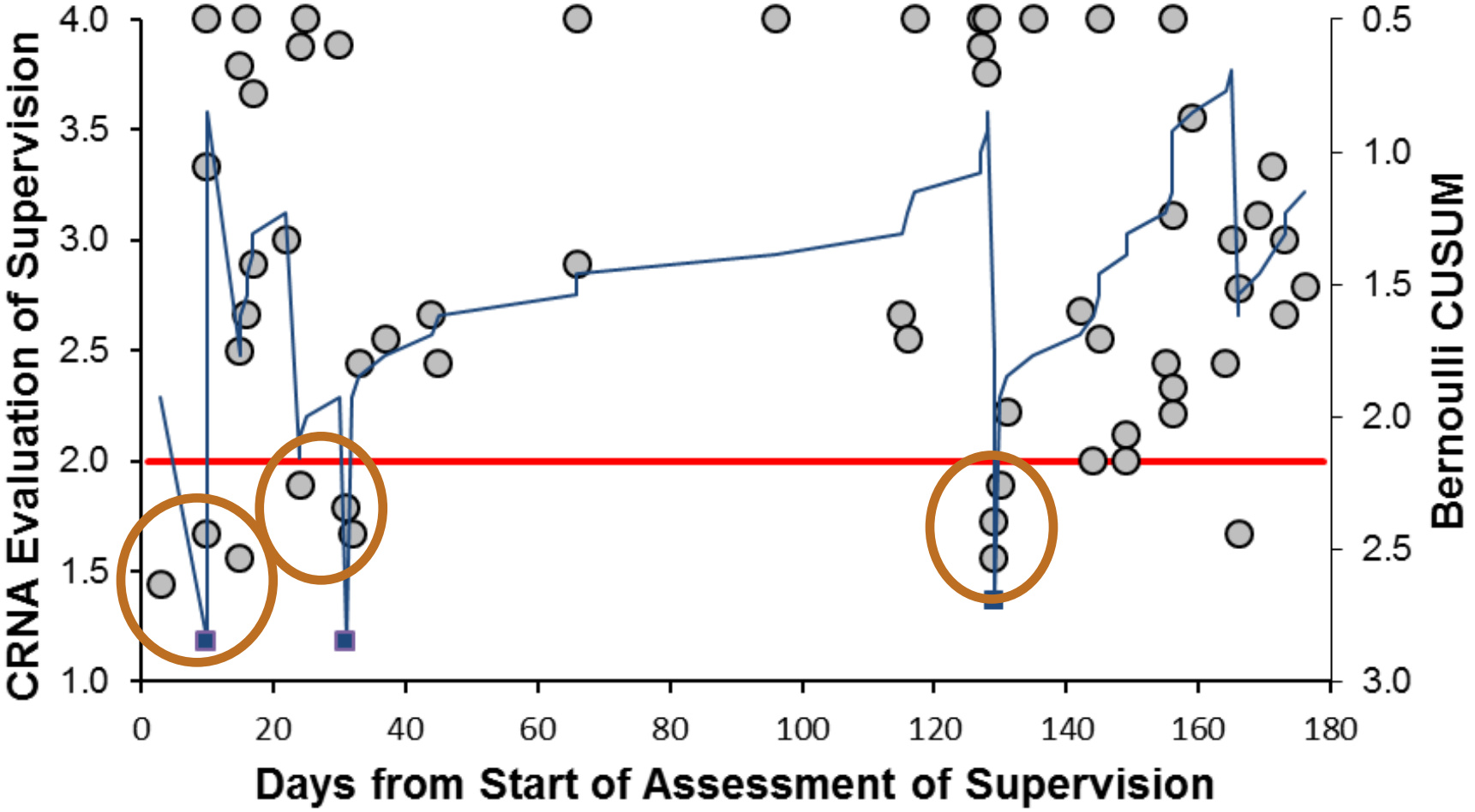
Do Need to Use Mathematics



<u>Do</u> Need to Use Mathematics

- Assumption of statistical independence
  - If no correlation among evaluations, and with p representing pooled estimate for low score, then among days with 2 evaluations, p^2 would be probability both scores are low
  - Among the nurse anesthetists' 1182 evaluations on days with 2 evaluations by nurse anesthetists, p = 5.92%
  - There were 4.34-fold more days with 2 low scores than expected at random ($P < 0.0001$)

Do Not Spend Substantial Time Maintaining Process: 1/Month

Date	Count of Scores	Mean of all Scores	% Scores < 3.00	Count CUSUM alerts
2014 Jan-Jun	4108	3.79	2.35%	13
2014 Jul-Dec	3777	3.82	1.53%	17
2015 Jan-Jun	4003	3.85	1.45%	10
2015 Jul-Dec	4492	3.86	0.70%	7
2016 Jan-Jun	3975	3.90	0.68%	3
2016 Jul-Dec	4356	3.91	0.89%	6
2017 Jan-Jun	4078	3.93	0.37%	1
2017 Jul-Dec	4334	3.94	0.84%	6

Bernoulli CUSUM Workflow for Who Receives the E-mail

Bernoulli CUSUM Workflow for Who Receives the E-mail

- If anesthesiologist works today with a resident, and this evening Bernoulli CUSUM alerts, likely the resident's evaluation indicated less than desirable supervision
- E-mail directly to the rated anesthesiologist would result in loss of confidentiality of the resident's evaluation

Dexter F et al. Anesth Analg 2014

Bernoulli CUSUM Workflow for Who Receives the E-mail

- Bernoulli CUSUM is process for detection
- Detection prompts e-mail notification of the relevant human resources professional, not the rated anesthesiologist
- Vice Chair for Faculty Development receives e-mail with hyperlink but without identifiers
  - Logs in
  - Sees name of anesthesiologist and evaluations from past 9 different raters

Additional Information on Anesthesia Group Management

Additional Information on Anesthesia Group Management

- www.FranklinDexter.net/education.htm
  - Example reports with calculations
  - Lectures on preoperative evaluation clinics, day of surgery decision making, PACU staffing, OR allocation and staffing, anesthesia staffing, financial analysis, comparing surgical services among hospitals, and strategic decision making
- www.FranklinDexter.net
  - Comprehensive bibliography of peer reviewed articles in operating room and anesthesia group management