



**DIGITAL  
PATHOLOGY**

**DPA**

**A S S O C I A T I O N**

# The Hidden Burden of Error in Surgical Pathology: What We Miss and Why It Matters

Amanda Katsma, MS, PA (ASCP)cm, PhD candidate

Thursday, May 14, 2026 | 4-5 PM ET

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# GENERAL INFORMATION



Participants will be in listen-only mode.



Submit questions via the **Q&A box**.

*Questions submitted via the chat box may not be captured.*



The session recording will be available soon.

# SPEAKER INTRODUCTION



**Amanda Katsma, MS, PA (ASCP)cm, PhD  
candidate**

University of Jamestown,  
Clinical Research PhD program  
Medical College of Wisconsin  
Vector Surgical

# Objectives

- Identify where digital pathology intersects with the Total Testing Process
- Recognize major upstream technical vulnerabilities
- Understand the gap between actively detected and formally reported errors
- Discuss how digital pathology and AI may improve quality surveillance

**What if...**

**Most technical errors are never formally reported?**

**And those errors occur before the slide is ever scanned?**

The logo for the Digital Pathology Association (DPA) features the letters 'DPA' in a large, bold, white sans-serif font, centered within a white rounded rectangular box. Above this box, the words 'DIGITAL' and 'PATHOLOGY' are stacked in a smaller, white, all-caps sans-serif font. Below the box, the word 'ASSOCIATION' is written in the same white, all-caps sans-serif font.

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How often do technical errors occur in your laboratory?

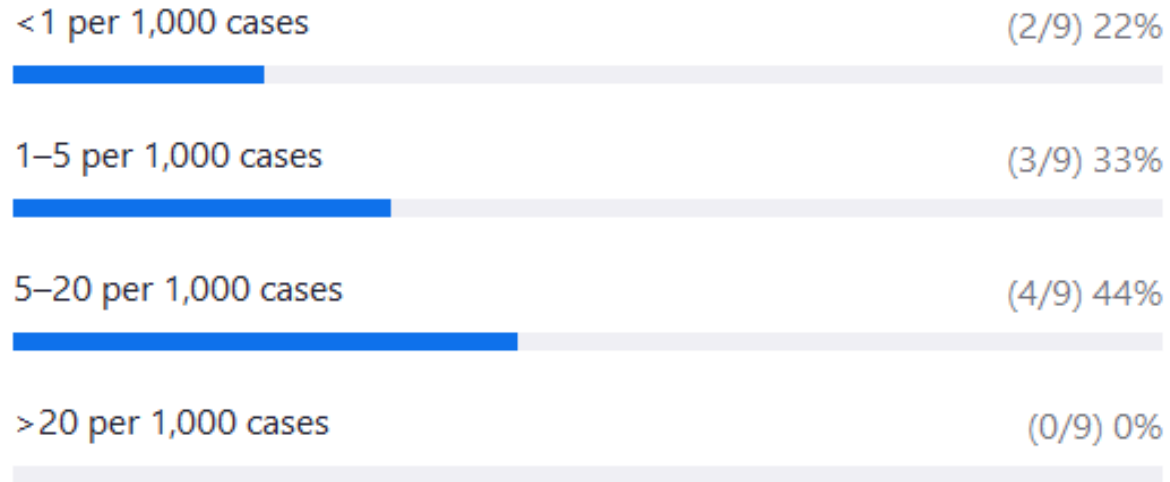
- A. <1 per 1,000 cases
- B. 1–5 per 1,000 cases
- C. 5–20 per 1,000 cases
- D. >20 per 1,000 cases

# Poll #1

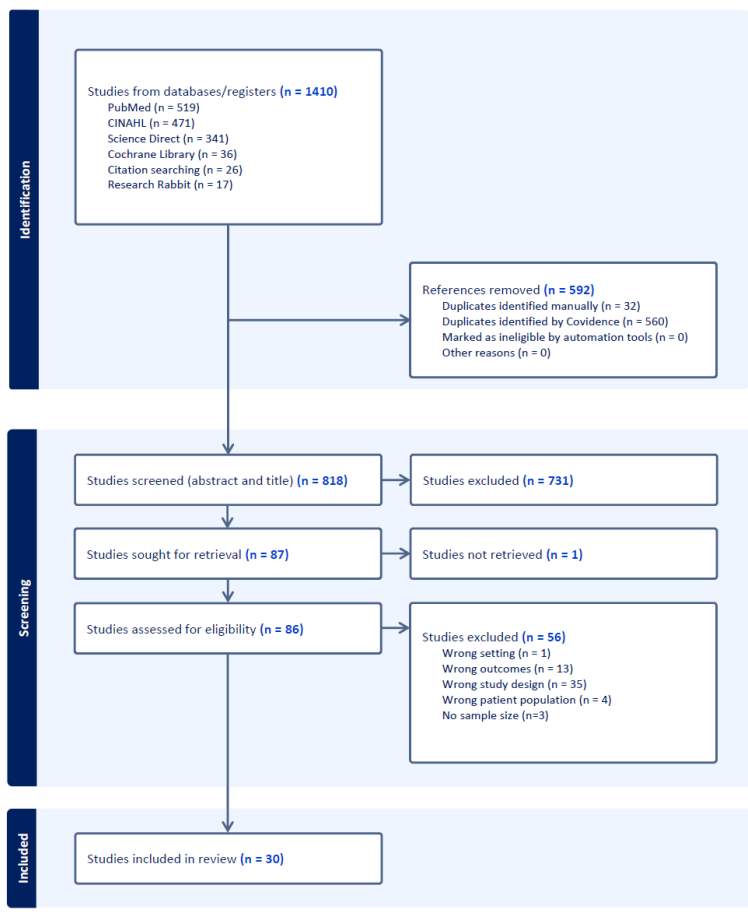
Webinar poll | 1 question | 9 of 14 (64%) participated

1. How often do technical errors occur in your laboratory? (Single choice)

9/9 (100%) answered



### Errors Prevalence in the Total Testing Process of Surgical Specimens



## A systematic Literature Review was performed to answer this question.

- 30 studies
- 2.8 million cases
- 10 countries
- 11 multi-institutional studies

# Most clinical decisions depend on pathology results

But:

- Pathology workflows are heavily manual
- Involve repeated specimen handling
- Contains numerous opportunities for error

Digital pathology improves interpretation.  
But specimen integrity is established upstream.



# What Counts as an Error?

Anything affecting specimens that could lead to an inaccurate diagnosis.

# Technical Error Examples:

- ✓ Misidentification
- ✓ Wrong source
- ✓ Typographical errors
- ✓ Contamination
- ✓ Tissue loss
- ✓ Wrong blocks/slides

The logo for the Digital Pathology Association (DPA) is located on the left side of the slide. It features the words "DIGITAL" and "PATHOLOGY" stacked vertically in a white, sans-serif font. Below this, the letters "DPA" are prominently displayed in a large, bold, white font within a white rounded rectangular box. Underneath the box, the word "ASSOCIATION" is written in a smaller, white, sans-serif font. The background of the slide is a dark blue-purple color with a network of white dots and lines, and several hexagonal shapes in shades of red and purple.

**DPA**

**ASSOCIATION**

Have you ever seen a specimen issue corrected before sign-out that was never formally documented?

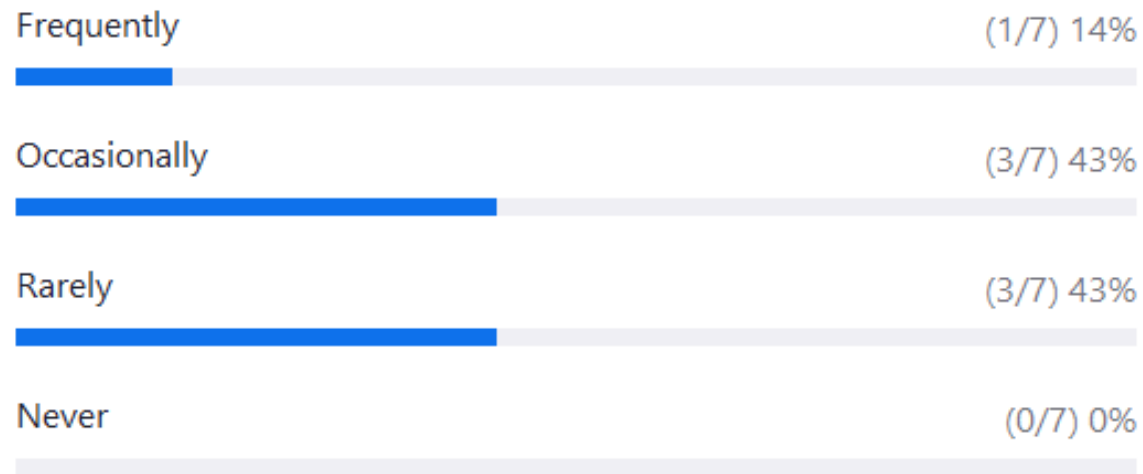
- A. Frequently
- B. Occasionally
- C. Rarely
- D. Never

## Poll #2

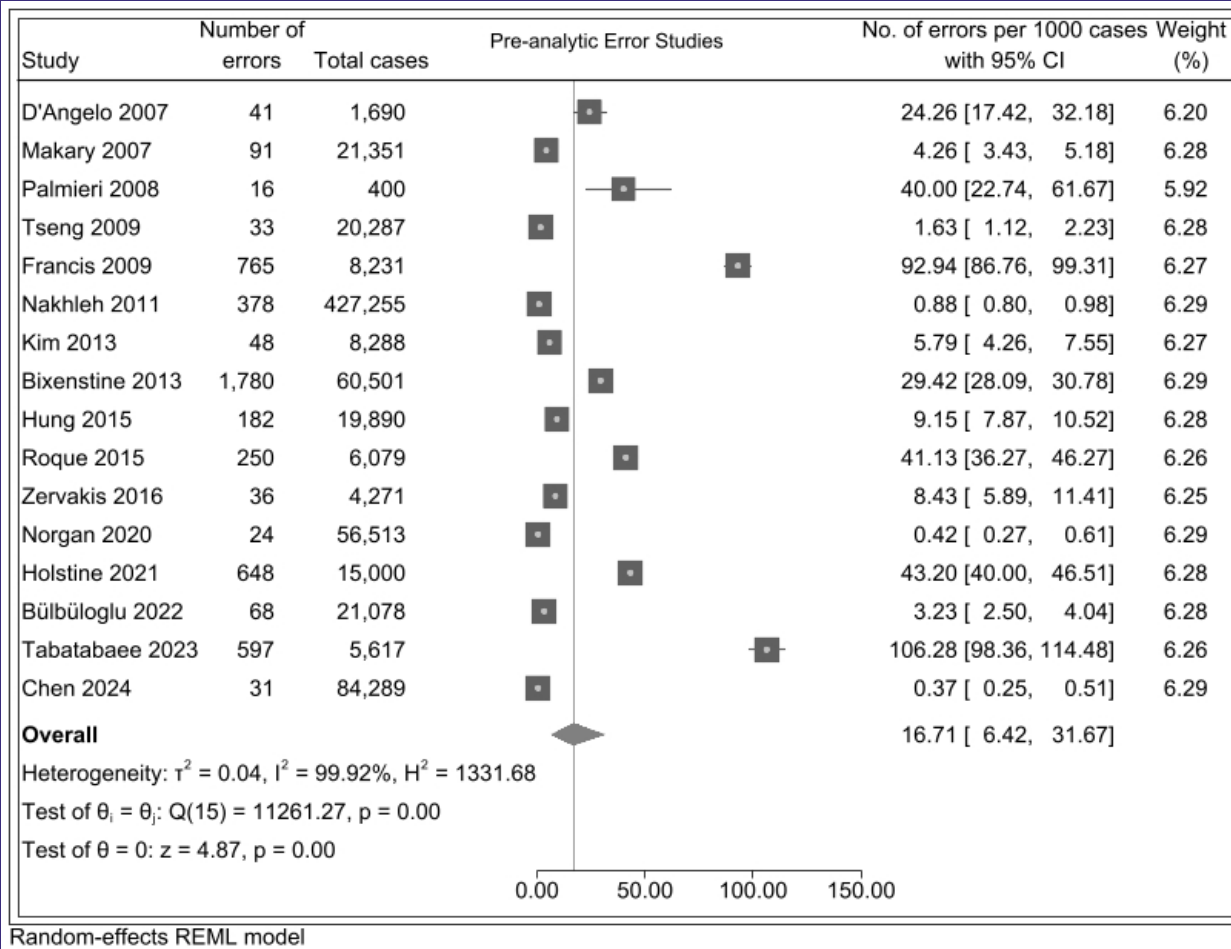
Webinar poll | 1 question | 7 of 15 (46%) participated

1. Have you ever seen a specimen issue corrected before sign-out that was never formally documented? (Single choice)

7/7 (100%) answered

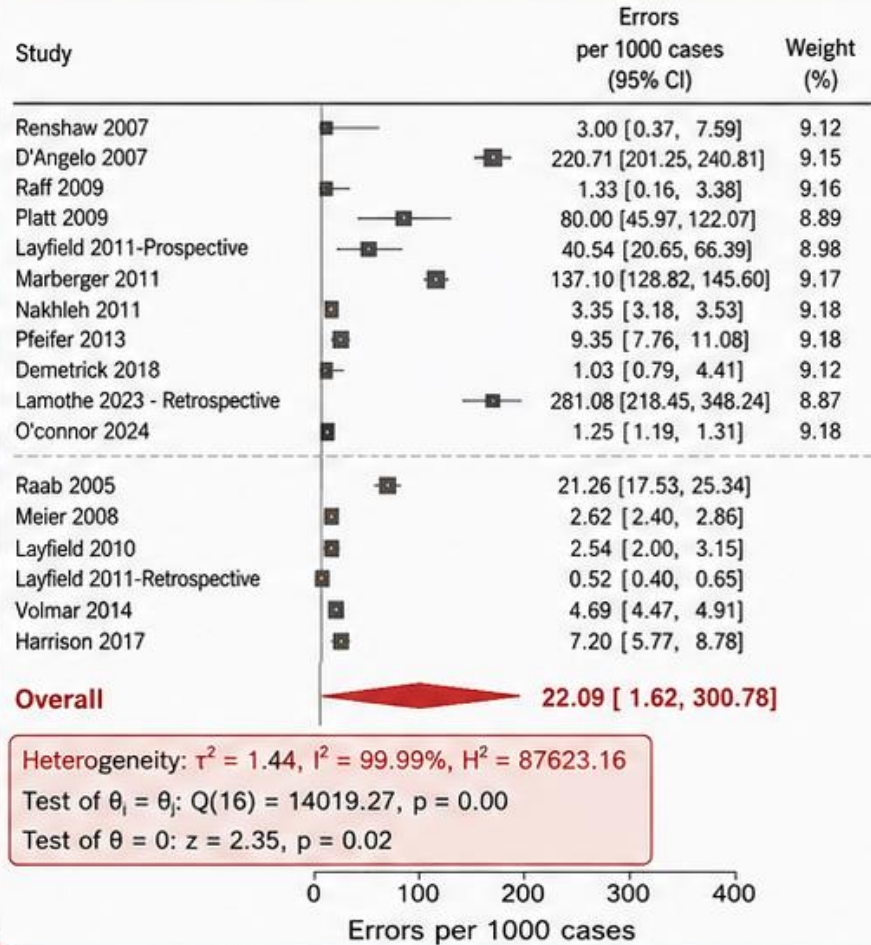


# Pre-analytic error studies



16.71 errors per 1,000 cases

# Laboratory Error Studies



Initial review of the results:  
 95% CI of **1.62 - 300.78**

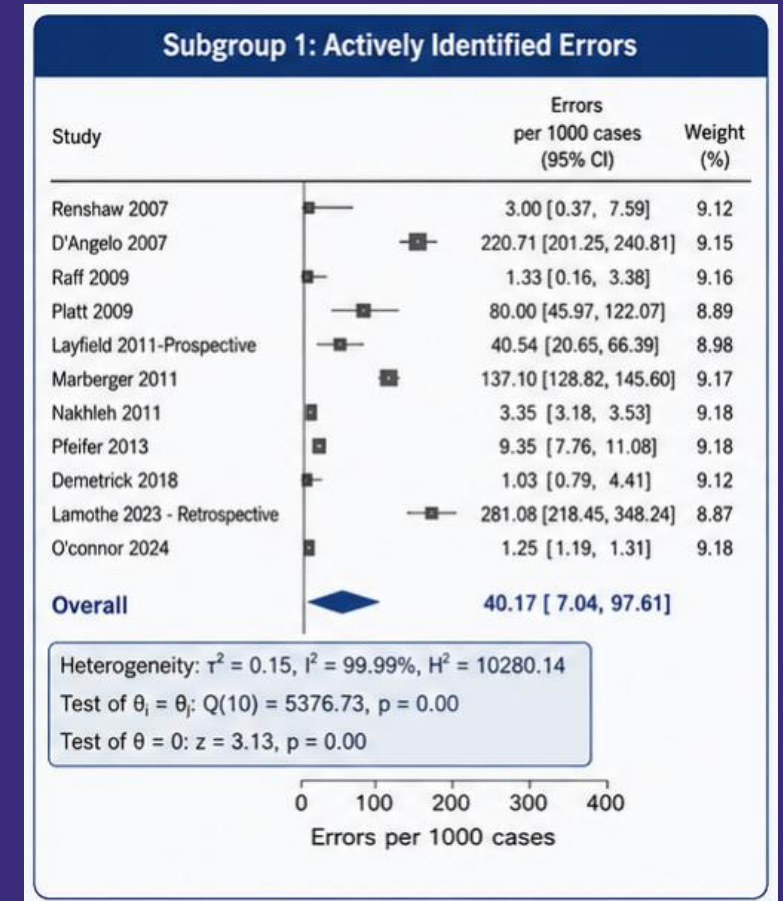
MASSIVE Heterogeneity

All Studies of Laboratory results could not be grouped together.

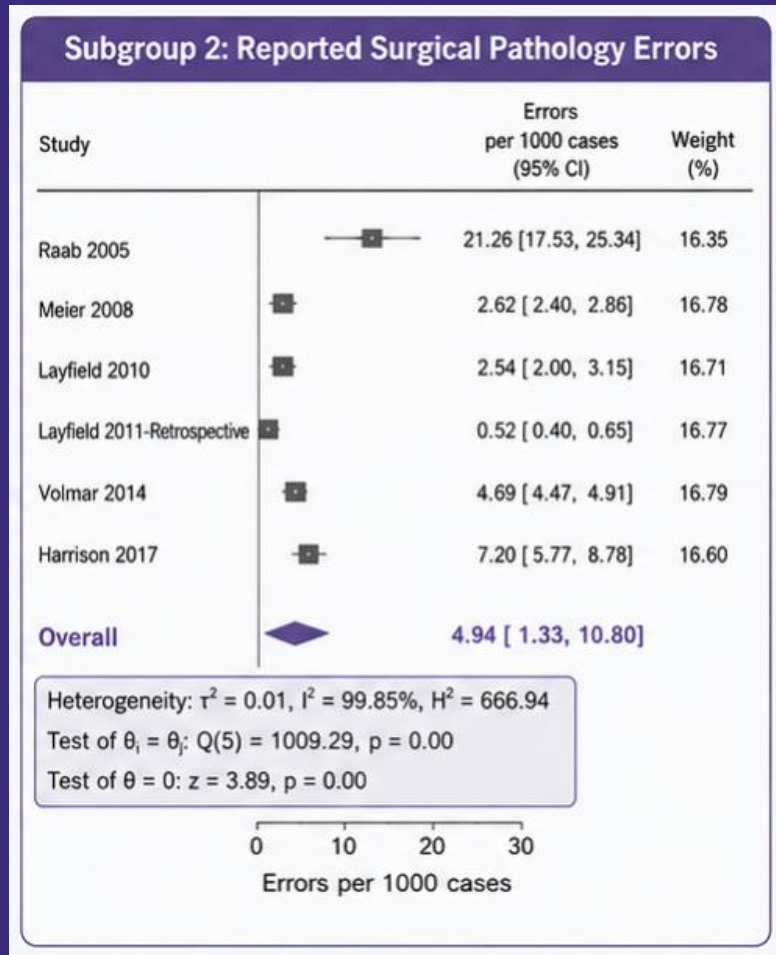
# Actively identified laboratory errors:

**40.17 per 1,000 cases**

- Direct observation
- Contamination tracking
- DNA Analysis
- Specimen color coding



# Formally Reported Laboratory errors:



**4.94 per 1,000 cases**

**-Retrospective Studies  
of Error Record**

# A CHASM BETWEEN ERROR RATES

The way we look for errors dramatically changes what we find.

## ACTIVELY IDENTIFIED ERRORS



Direct observation  
Contamination tracking  
DNA Analysis  
Specimen color coding

## FORMALLY REPORTED ERRORS



Errors are identified by reviewing existing records after care is complete.

**40.17**  
errors per  
1000 cases

[95% CI 7.04 – 97.61]

**~8x**  
HIGHER

Actively identified errors are ~8 times higher than formally reported errors.

**4.94**  
errors per  
1000 cases

[95% CI 1.33 – 10.80]

UNDERREPORTED  
& MISSED

# Why Does This Gap Exist?

## **Passive systems:**

- Rely on self-reporting,
- Miss near misses,
- Inconsistently define errors,
- Often only capture amended reports.

**Active surveillance detects far more events.**

# D'ANGELO Study 2007

414 observed laboratory errors → 12 amended reports  
= 97% underestimation

**Anatomic Pathology** / THE HENRY FORD PRODUCTION SYSTEM

## **The Henry Ford Production System**

Measures of Process Defects and Waste in Surgical Pathology  
as a Basis for Quality Improvement Initiatives

*Rita D'Angelo, MS, ASQ CQE, SSBB, and Richard J. Zarbo, MD, DMD*

**Key Words:** Quality improvement; Lean; Henry Ford; Toyota; Six Sigma; Measurement

DOI: 10.1309/X6N1Y3V2CB9HUL8G

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**Do you believe your  
laboratory captures MOST  
technical errors?**

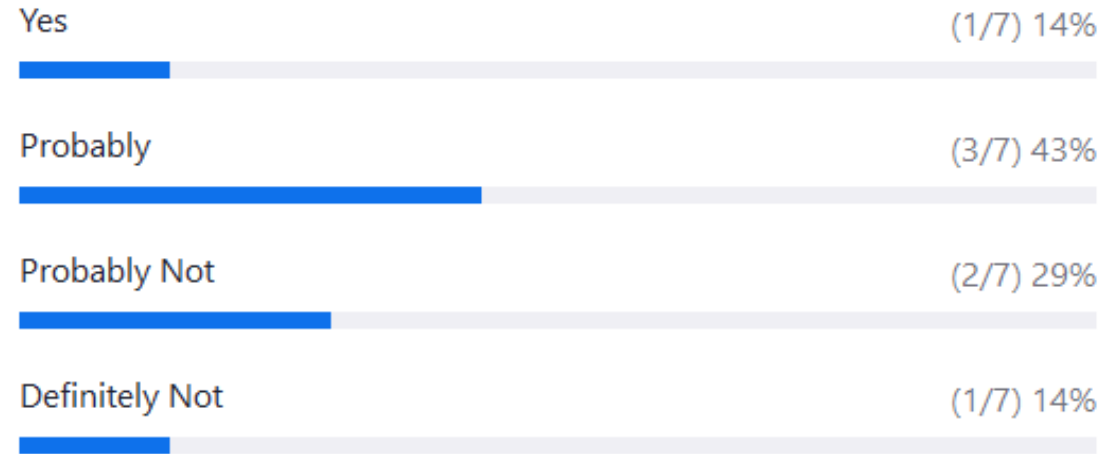
- A. Yes
- B. Probably
- C. Probably not
- D. Definitely not

# Poll #3

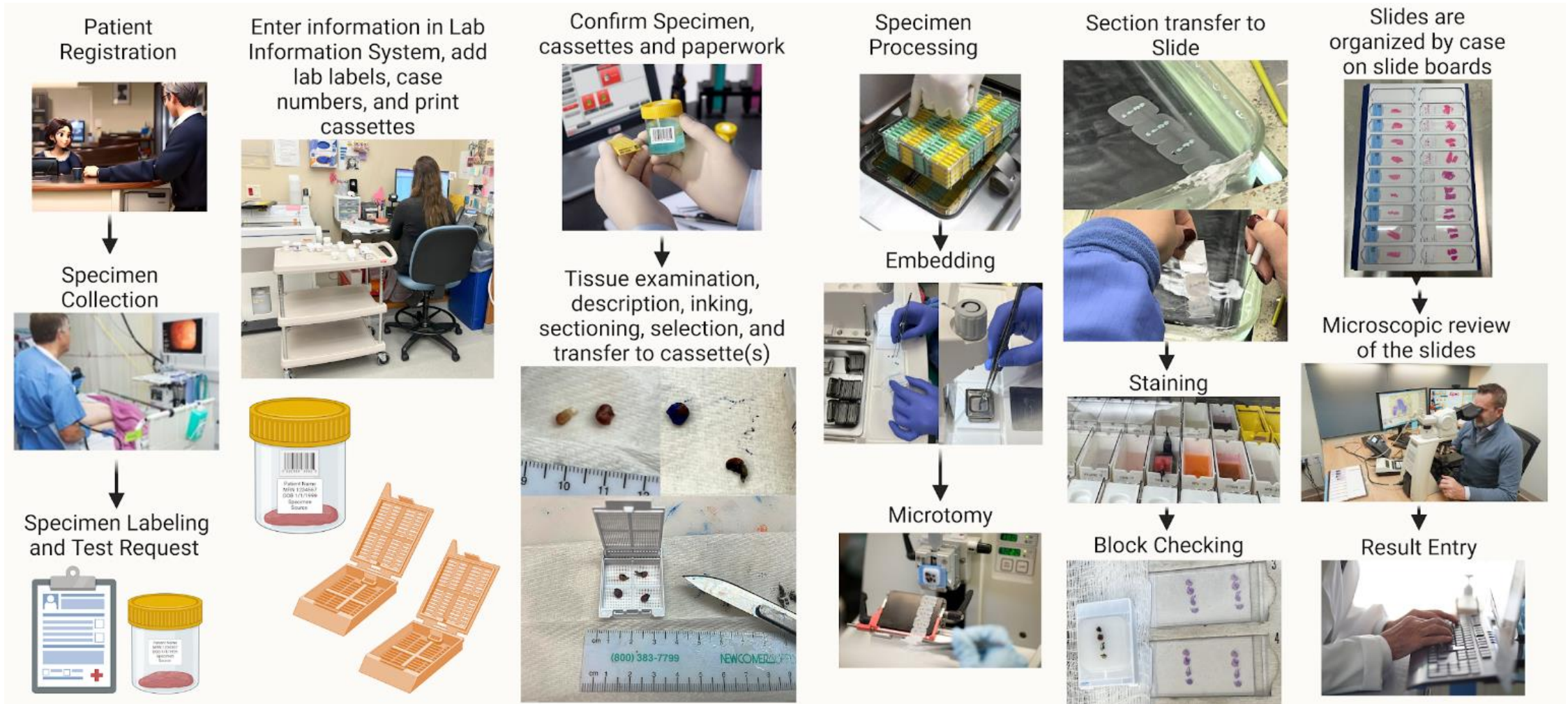
Webinar poll | 1 question | 7 of 15 (46%) participated

1. Do you believe your laboratory captures MOST technical errors? (Single choice)

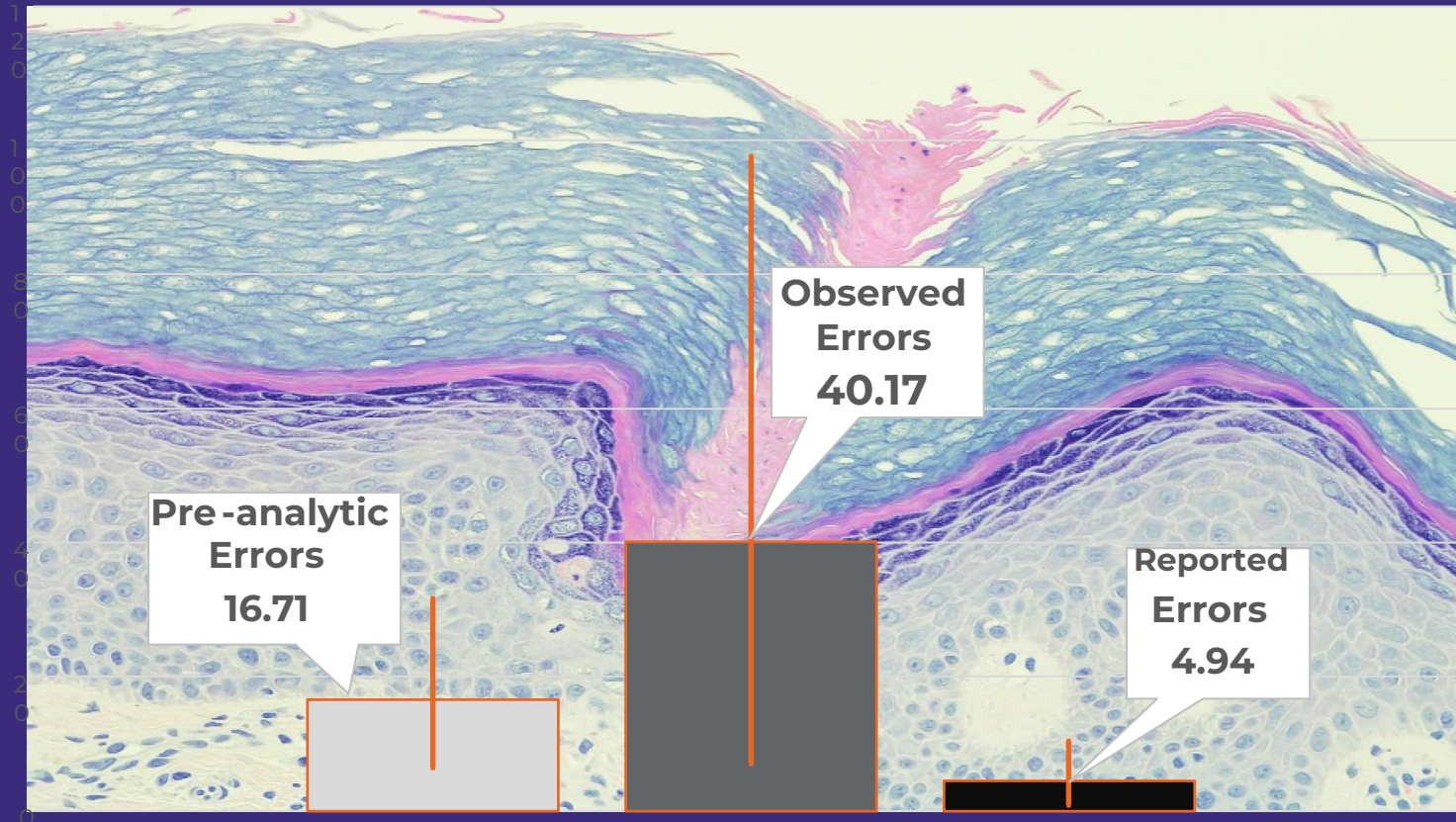
7/7 (100%) answered



# Relabeling, transfers, shared fluids, shared equipment

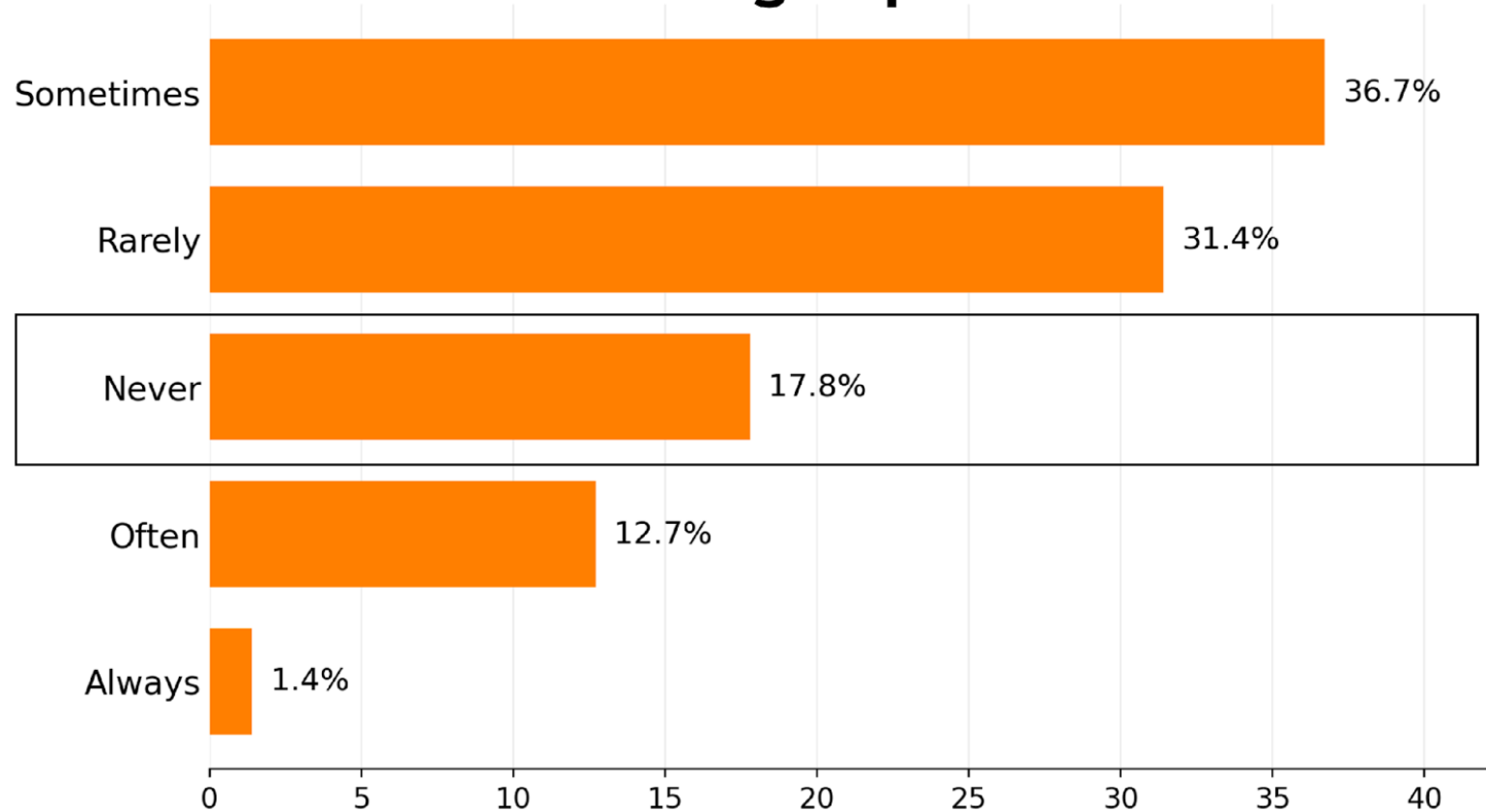


The laboratory is more vulnerable than popular belief.



# A poll of over 600 Healthcare Professionals

## Frequency of Observed Errors Not Being Reported



An iceberg floating in the ocean. The tip of the iceberg is above the water surface, and the much larger base is submerged. The sky is blue with some clouds. The water is a deep blue. On the left side of the image, there is a vertical bar with a pink-to-purple gradient and some geometric shapes.

**Reported  
Errors**

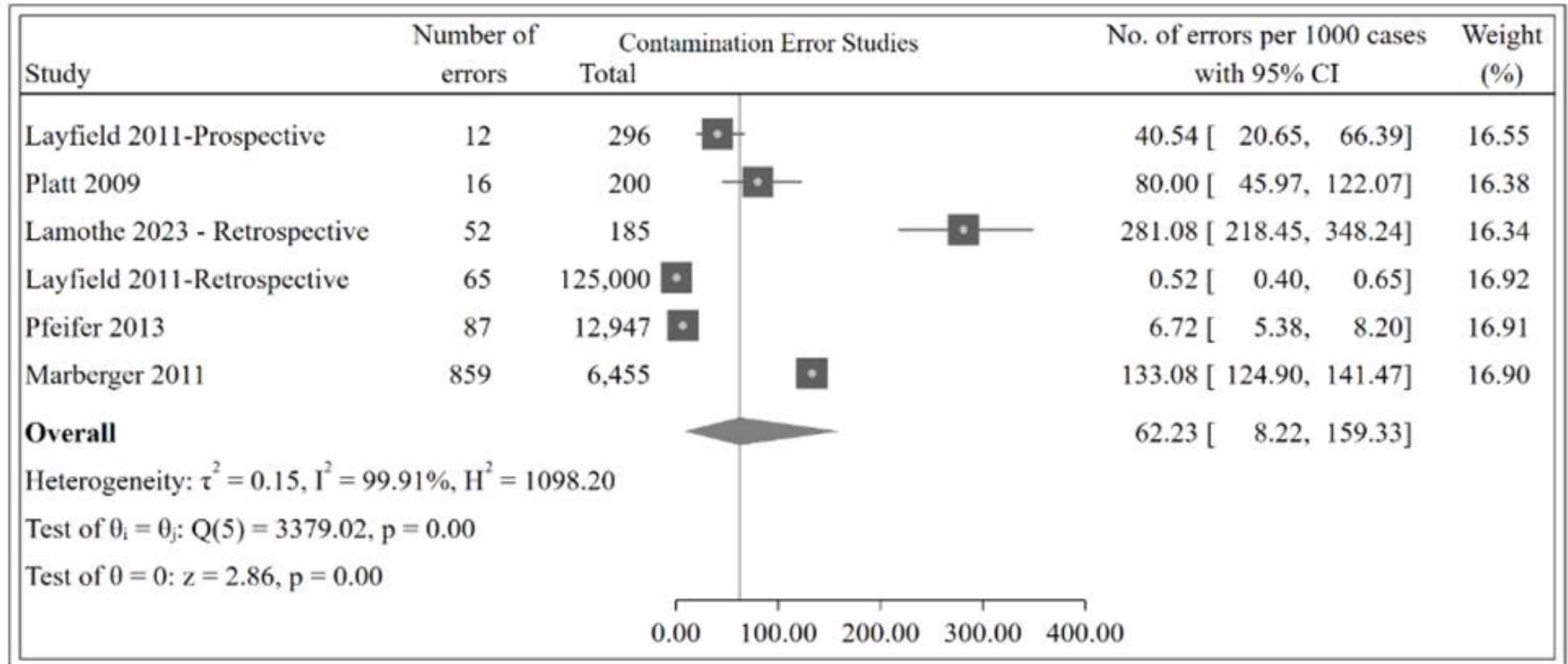
**contamination**

**corrected near misses**

**occult errors**



# Contamination Only Studies



Random-effects REML model

# Contamination is likely underestimated

- Contamination only studies: 62.23/1000 cases
- Shared equipment and chemicals
- Often:
  - Not Recognized
  - Not Reported
  - Not systematically tracked

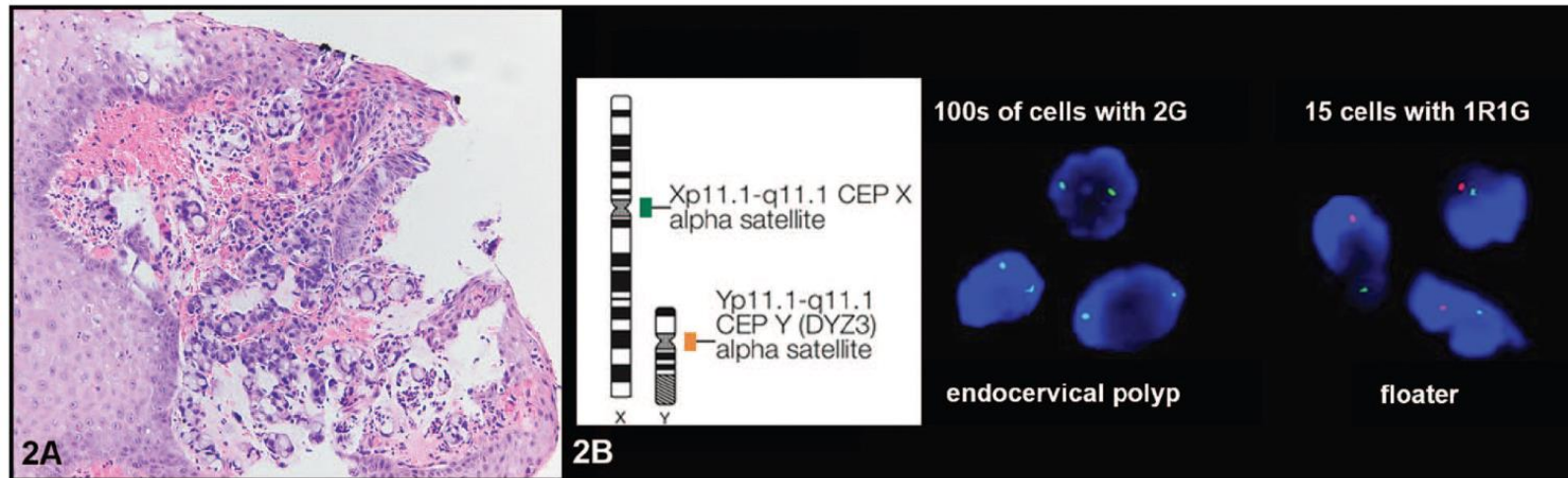


Figure 2. A, Malignant signet ring cells observed on an endocervical polyp. B, Fluorescence in situ hybridization analysis of X and Y chromosomes using CEPX (spectrum green) and DYZ3 (spectrum red) probes targeting specific regions of chromosomes X (Xp11.1-q11.1) and Y (Yp11.1-q11.1) was used to confirm the exogenous origin of the malignant signet ring cells as contaminants, with minimal tissue consumption (hematoxylin-eosin, original magnification 3100 [A]).

**How does this impact digital pathology?**

# AI models can learn contamination artifacts as a biological signal.

Human annotations can become inaccurate when contamination or artifacts affect interpretation.

## Examples:

- A contaminant is accidentally included in tumor annotations.
  - A tissue floater is labeled as a metastatic tumor.
  - Artifact regions are included inside ROI boundaries.

Result:

The model is trained on corrupted “ground truth.”

**AI assumes: contaminant = disease-associated feature**

“Tissue contaminants induce errors in modern ML models. The high level of attention given to contaminants indicates a failure to encode biological phenomena.”

**MODERN PATHOLOGY**



Journal homepage: <https://modernpathology.org/>

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**Research Article**

**Tissue Contamination Challenges the Credibility of Machine Learning Models in Real World Digital Pathology**

Ismail Irmakci, Ramin Nateghi, Rujoi Zhou, Mariavittoria Vescovo, Madeline Saft, Ashley E. Ross, Ximing J. Yang, Lee A.D. Cooper, Jeffery A. Goldstein\*

*Department of Pathology, Northwestern University, Feinberg School of Medicine, Chicago, Illinois*

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**ARTICLE INFO**

*Article history:*

Received 28 April 2023

Revised 13 November 2023

Machine learning (ML) models are poised to transform surgical pathology practice. The most successful use attention mechanisms to examine whole slides, identify which areas of tissue are diagnostic, and use them to guide diagnosis. Tissue contaminants, such as floaters, represent unexpected tissue. Although human pathologists are extensively trained to consider and detect tissue

## Digital Pathology Improves Visibility, Not specimen integrity

- Detects downstream artifacts
- Improves review access
- Enables retrospective audit
- Cannot inherently correct upstream defects.

# Digital pathology improves visibility, but also reveals hidden vulnerability.

## WHAT DIGITAL PATHOLOGY IMPROVES



### Improved visibility

Whole slide imaging enables detailed review and remote access.



### Computational analysis

AI and image analytics identify subtle patterns at scale.



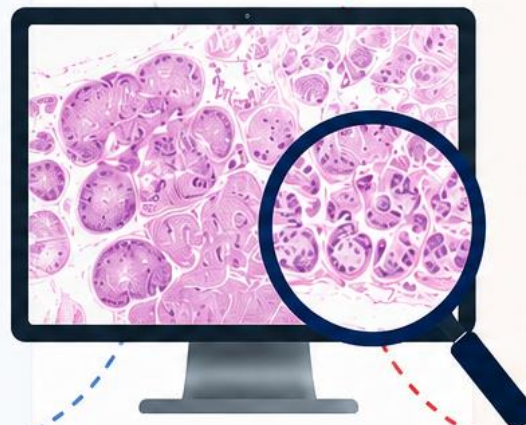
### Enhanced collaboration

Slides can be shared instantly across locations.



### Measurable workflows

Digital systems generate traceable data streams.



## WHAT DIGITAL PATHOLOGY REVEALS

Digital pathology may expose hidden workflow vulnerabilities previously difficult to measure.



Tissue contamination and floaters



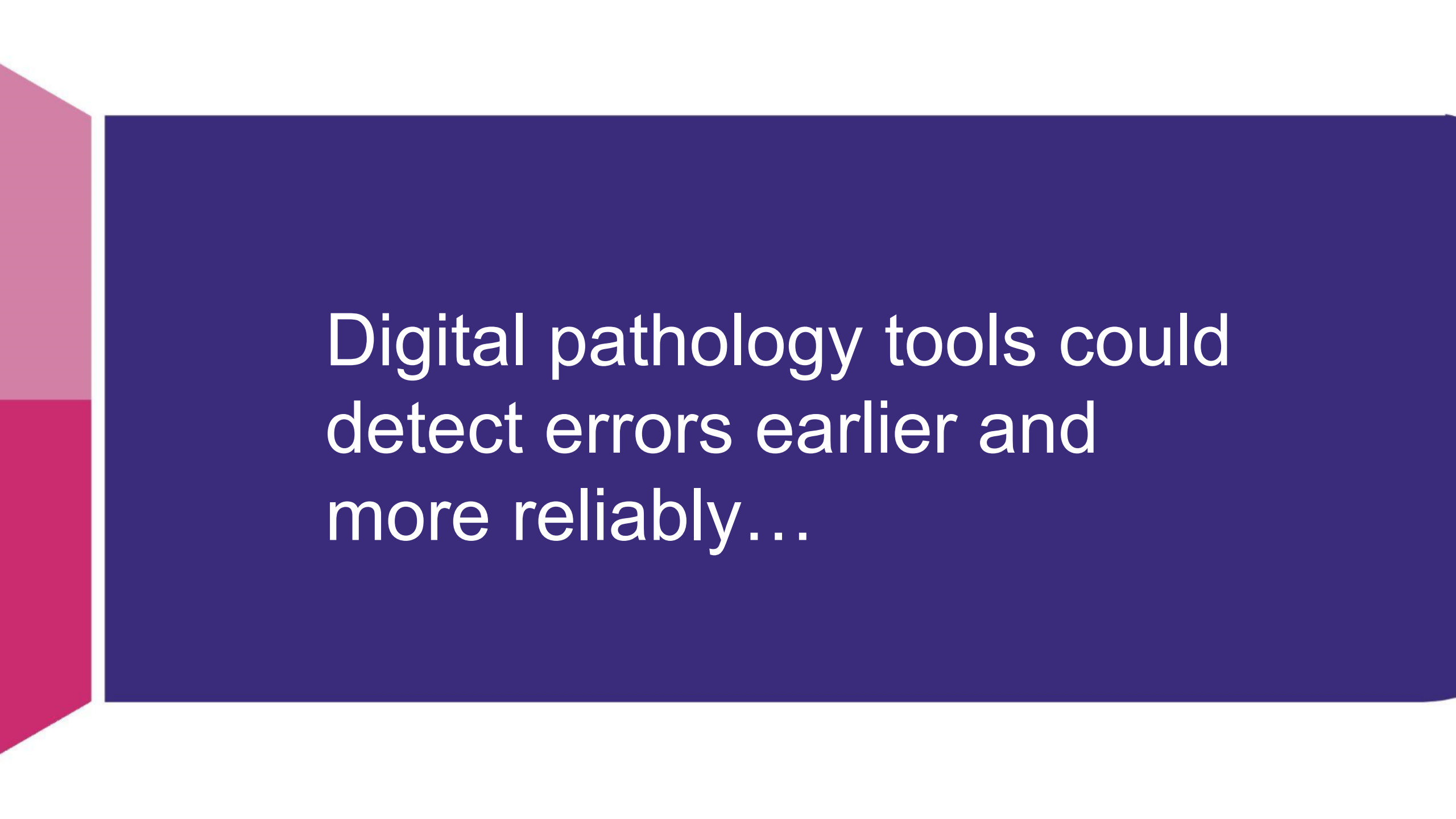
Labeling inconsistencies



Processing artifacts



Slide preparation defects



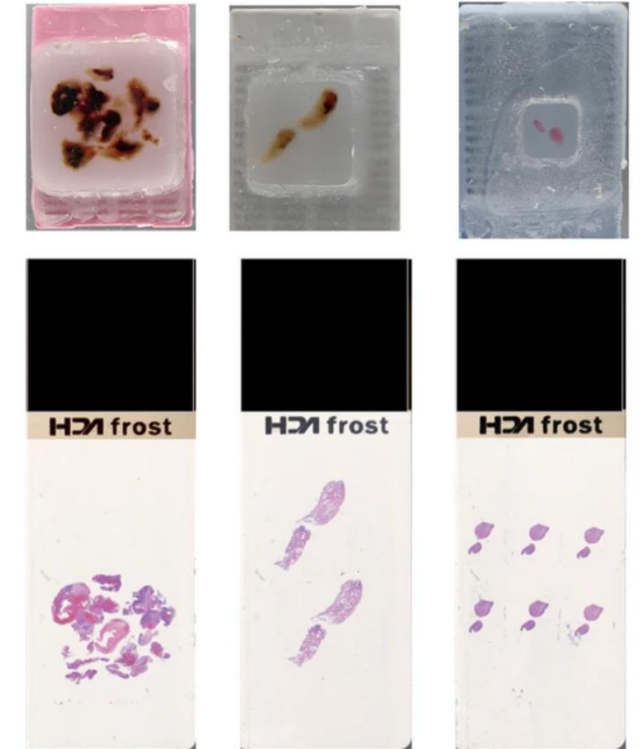
Digital pathology tools could  
detect errors earlier and  
more reliably...

# New Digital Pathology & AI in QC

## AI for Block–Slide Consistency

(Tang et al., 2026)


- AI compares **paraffin blocks** ↔ **histology slides**
- **95.0% accuracy vs 91.5% for human review**
- **~80X faster**
- Identified **mismatches missed by human reviewers**
- **Unbiased Error Reporting**



Virchows Archiv  
<https://doi.org/10.1007/s00428-026-04535-w>

ORIGINAL ARTICLE

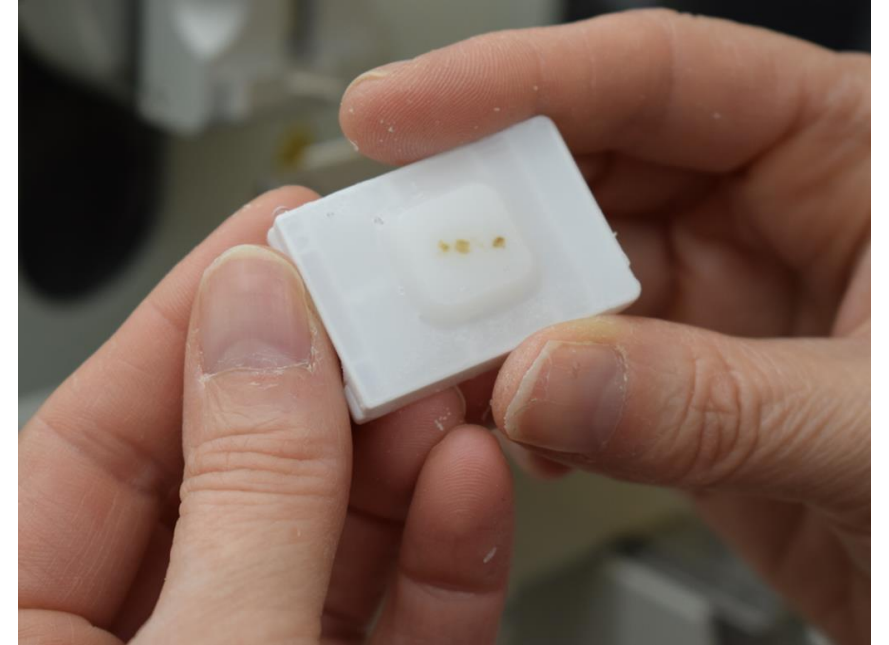
An AI framework for automated quality control of paraffin block and slide consistency: a clinical evaluation and human–machine comparison study

Linfeng Tang<sup>1</sup>  · Liwei Xie<sup>2</sup> · Xiaoling Yang<sup>3</sup> · Jinqiu Liu<sup>1</sup> · Xinru Zou<sup>1</sup> · Wei Xia<sup>1</sup>



Check for updates

# What this could mean?



## **Digital pathology + AI may enable:**

- continuous quality surveillance
- automated error detection
- standardized monitoring
- unbiased error detection



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In the past 6 months, how many minor specimen errors have you witnessed but not formally reported?

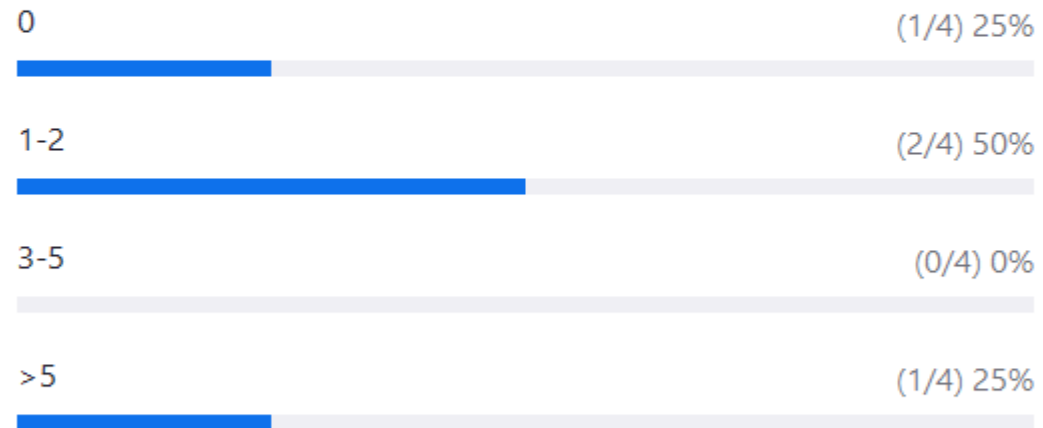
- A. 0
- B. 1–2
- C. 3–5
- D. >5

## Poll #4

Webinar poll | 1 question | 4 of 13 (30%) participated

1. In the past 6 months, how many minor specimen errors have you witnessed but not formally reported? (Single choice)

4/4 (100%) answered





## **Low reported error rates, safer systems or under-detection?**

### **What influences reported error rates?**

- Detection sensitivity
- Reporting culture
- Definitions of “reportable” error
- Near-miss tracking practices
- Surveillance methods

# WHAT INFLUENCES ERROR RATES?

**Current quality systems are heavily dependent on people.**

Error detection, quality surveillance, and reporting rely on:

- Individual training
- Manual observation
- Time and labor intensity of reporting
- Interpretation of policies
- Local quality culture

This creates variability, under detection, and reporting bias.

# DIGITAL PATHOLOGY and AI COULD DETECT ERRORS

AI-assisted tools may help detect:

- ✓ block-slide mismatches,
- ✓ contamination,
- ✓ labeling inconsistencies,
- ✓ processing artifacts,
- ✓ technical abnormalities

# References

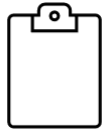
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5. Irmakci I, Nateghi R, Zhou R, Vescovo M, Saft M, Ross AE, Yang XJ, Cooper LAD, Goldstein JA. Tissue Contamination Challenges the Credibility of Machine Learning Models in Real World Digital Pathology. *Mod Pathol.* 2024 Mar;37(3):100422. doi: 10.1016/j.modpat.2024.100422. Epub 2024 Jan 6. PMID: 38185250; PMCID: PMC10960671.
6. OpenAI. *Image generated using ChatGPT (GPT-5 with DALL·E image generation).* Created May 9, 2026. <https://chat.openai.com/>

# AUDIENCE Q&A

Submit questions via the **Q&A box**.

*Questions submitted via the chat box may not be captured.*

# THANK YOU!



## **Share your feedback!**

*Check your email for a brief evaluation.*



The session recording will be available soon.

# PATHOLOGY VISIONS **26**

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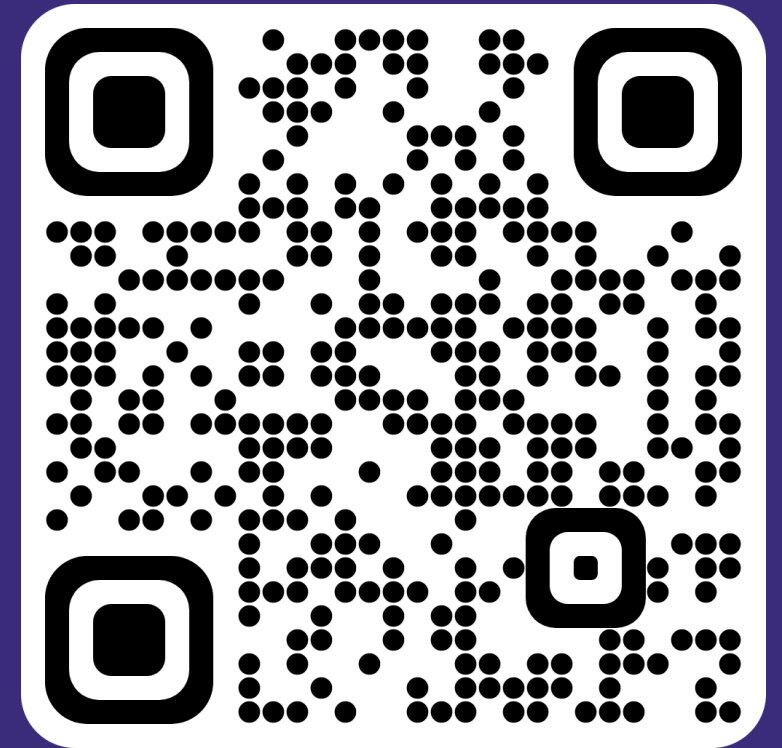
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