Artificiële intelligentie bij het opsporen van kankercellen

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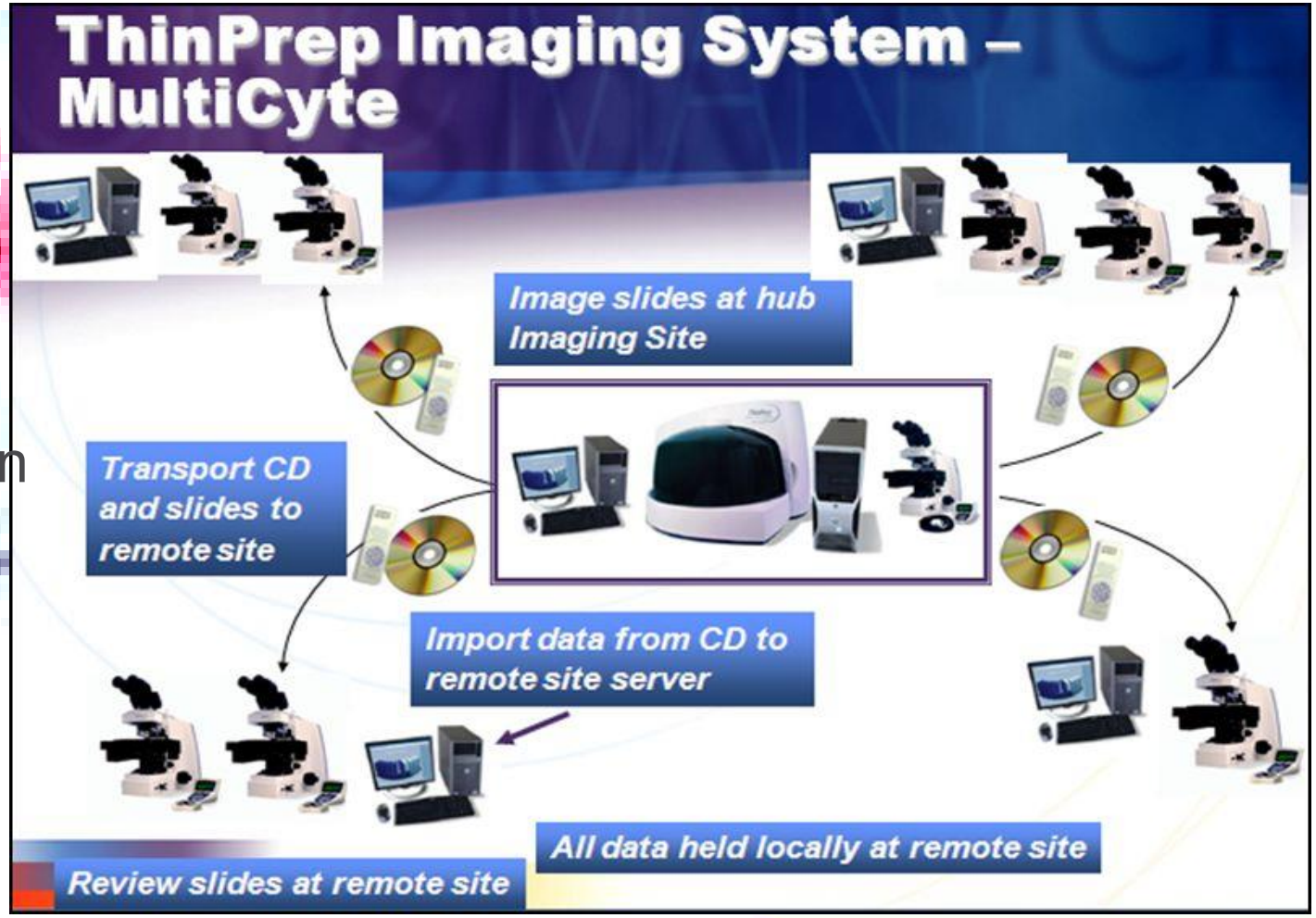
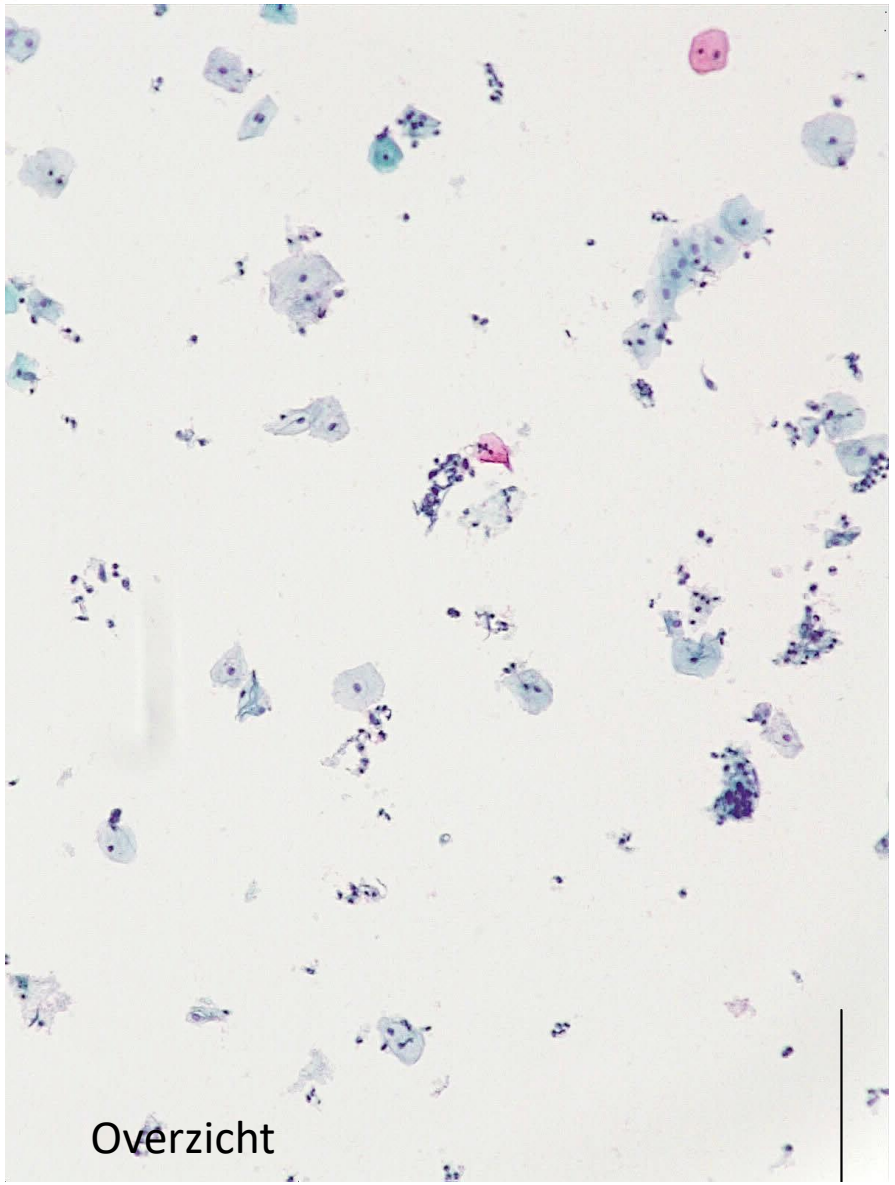
Cervixcytologie in Imelda 2011 (TIS)

Netwerk pathologielaboratoria

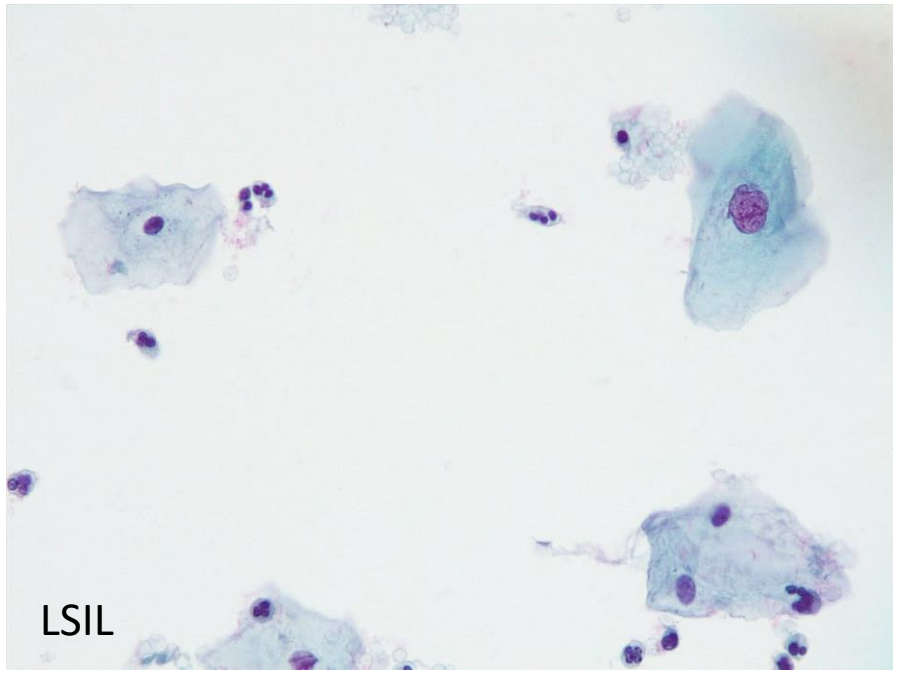
- Vloeibaar medium cytologie
- Stalen centraal gescand
- Aanduiding meest afwijkende cellen
- Stalen locaal gescreend
- Gebruik van microscoop



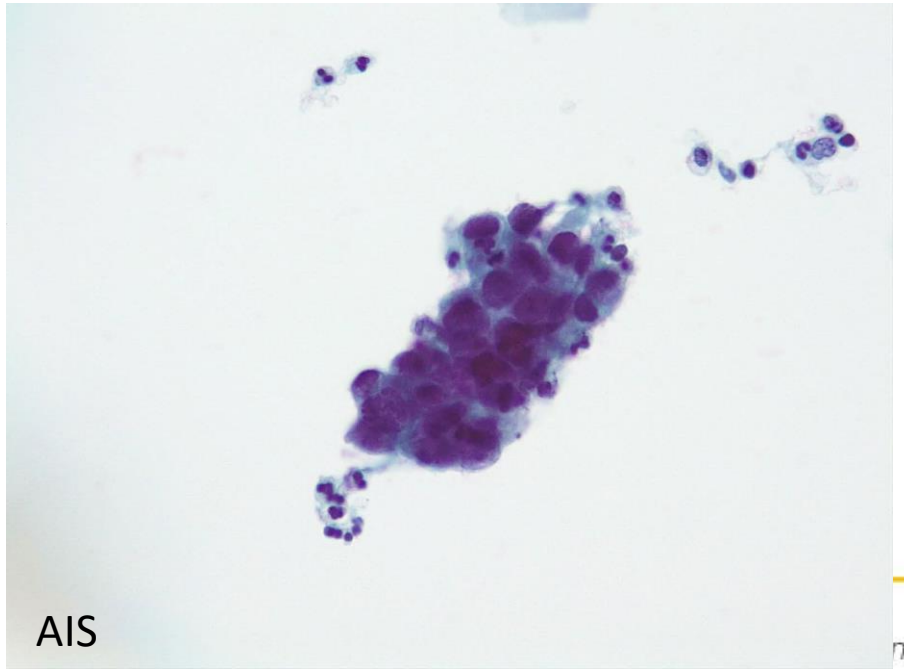
LBC preparaat



Overzicht



LSIL



AIS

Cervixcytologie Imelda 2023 (DC)

Digital Diagnostics System

Components

HOLOGIC

DIGITAL IMAGER

Exceptional image quality at high throughput

ThinPrep® Cervical AI Image Analysis

New AI assistive technology for diagnostic review

IMAGE MANAGEMENT SERVER

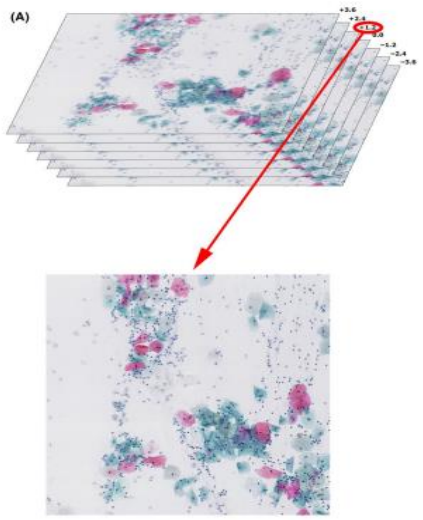
Central hub of digital diagnostics

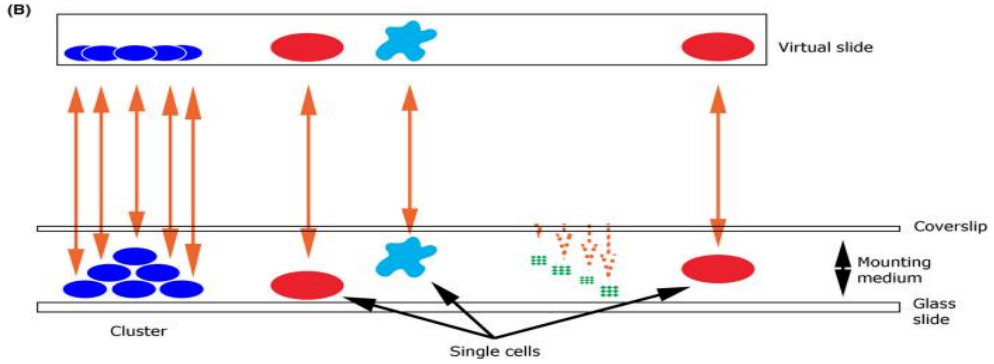
REVIEW STATION

The microscope reimagined.

Imaging Cytology

Cytology specimens contain 3D cell groups and objects are located at different depths between the coverslip and glass slide





Volumetric Scan

A single scan simultaneously acquires up to 14 focal planes, eliminating the need to scan each layer individually. The result is all cells are imaged without sacrificing throughput.

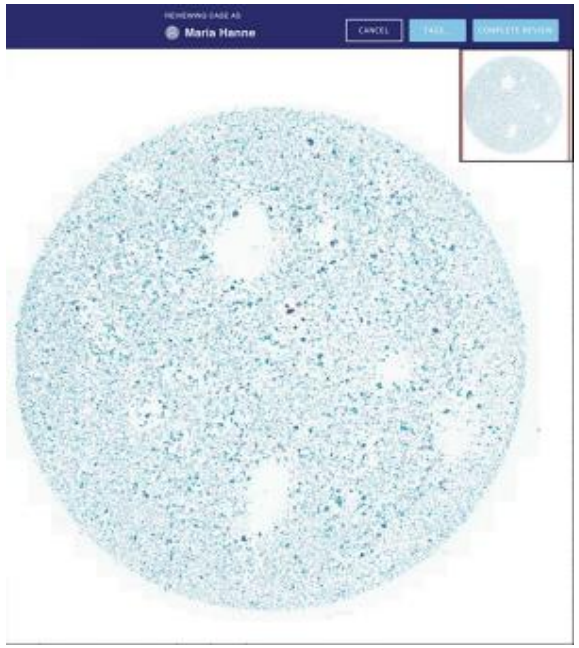
Adaptive Focus

Curve-following scanning method minimizes local focus errors, providing higher quality cytology images.

Focus Merge

Powerful image processing merges in-focus pixels from multiple planes into a single layer so you can clearly visualize the entire cytology image.

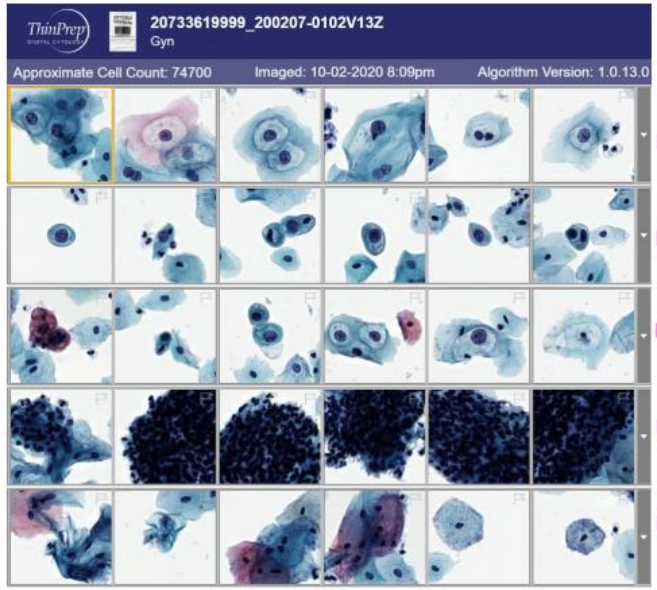
Peng, S and Mayer, S. How thin is a ThinPrep slide? Challenges of achieving high focus quality on a digital whole slide imaging system. Poster presented at: Pathology Visions 2019, 2019 Oct 6 – 8; Orlando, Fl.



Ikenberg et al, Cancer Cytopathology 2023

Gallery:

OBJECTS OF INTEREST (OOI): ORGANIZED BY ROWS



- **Row 1:** Low N/C ratio, enlarged nuclei, koilocytes (likely ASCUS, LSIL)
- **Row 2:** High N/C ratio, dark nuclei (likely HSIL, Sq Met, Parabasal)
- **Row 3:** Other – distorted cells, additional items from 1 or 2
- **Row 4:** Glandular and/or other clusters
- **Row 5:** Infections

…Rows 1-4 fill in with normal cells if nothing else is available

HOLOGIC

Diagnostic Solutions

Vergelijking TIS en DC

- Hogere sensitiviteit DC
- Hogere NPV DC
  - voor hooggradige letsels
  - ook histologisch bevestigd
- Geen verlies aan specificiteit
- Tijdswinst

TABLE 8 Clinical performance of digital cytology with combined histopathology results as the reference standard.

	Sensitivity, %	95% CI, %	Specificity, %	95% CI, %	PPV, %	95% CI, %	NPV, %	95% CI, %
CIN2+ threshold on histopathology								
HSIL+	84.1	79.8–87.8	71.2	64.5–77.2	82.9	78.5–86.7	72.9	66.2–78.9
ASC-H+	92.8	89.5–95.3	62.5	55.5–69.1	80.4	76.2–84.2	83.9	77.1–89.3
LSIL+	98.0	95.9–99.2	19.7	14.5–25.8	66.9	62.6–71.0	85.4	72.2–93.9
ASC-US+	99.4	97.9–99.9	6.7	3.7–11.0	63.9	59.7–67.9	87.5	61.7–98.5
CIN3+ threshold on histopathology								
HSIL+	87.9	83.2–91.7	56.7	51.0–62.4	62.3	57.0–67.4	85.2	79.6–89.8
ASC-H+	97.6	94.8–99.1	48.9	43.1–54.6	60.8	55.8–65.6	96.1	91.8–98.6
LSIL+	99.6	97.8–100.0	15.4	11.6–20.0	48.9	44.5–53.4	97.9	88.9–100.0
ASC-US+	100.0	98.5–100.0	5.2	3.0–8.4	46.2	41.9–50.5	100.0	79.4–100.0

Abbreviations: ASC-H, atypical squamous cells cannot exclude high grade; ASC-US, atypical squamous cells of undetermined significance; CI, confidence interval; CIN, cervical intraepithelial neoplasia; DC, Digital cytology; HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion; NPV, negative predictive value; PPV, positive predictive value.

TABLE 9 Clinical performance of the ThinPrep Imaging System with combined histopathology results as the reference standard.

	Sensitivity, %	95% CI, %	Specificity, %	95% CI, %	PPV, %	95% CI, %	NPV, %	95% CI, %
CIN2+ threshold on histopathology								
HSIL+	64.2	58.9–69.2	76.1	69.7–81.7	81.6	76.5–86.0	56.2	50.2–62.1
ASC-H+	79.5	74.8–83.6	64.6	57.7–71.1	78.8	74.1–83.0	65.5	58.6–72.0
LSIL+	96.8	94.4–98.4	12.0	7.9–17.2	64.5	60.3–68.7	69.4	51.9–83.7
ASC-US+	98.8	97.1–99.7	2.9	1.1–6.1	62.8	58.5–66.8	60.0	26.2–87.8
CIN3+ threshold on histopathology								
HSIL+	70.7	64.6–76.3	68.6	63.1–73.8	64.7	58.7–70.4	74.2	68.7–79.2
ASC-H+	87.1	82.3–91.0	56.9	51.1–62.5	62.2	56.9–67.3	84.5	78.8–89.1
LSIL+	96.8	93.8–98.6	9.2	6.2–13.0	46.4	42.1–50.8	77.8	60.9–89.9
ASC-US+	98.4	95.9–99.6	2.0	0.7–4.2	45.0	40.7–49.2	60.0	26.2–87.8

Abbreviations: ASC-H, atypical squamous cells cannot exclude high grade; ASC-US, atypical squamous cells of undetermined significance; CI, confidence interval; CIN, cervical intraepithelial neoplasia; HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion; NPV, negative predictive value; PPV, positive predictive value; TIS, The ThinPrep Imaging System.

Tijdswinst tussen TIS en DC

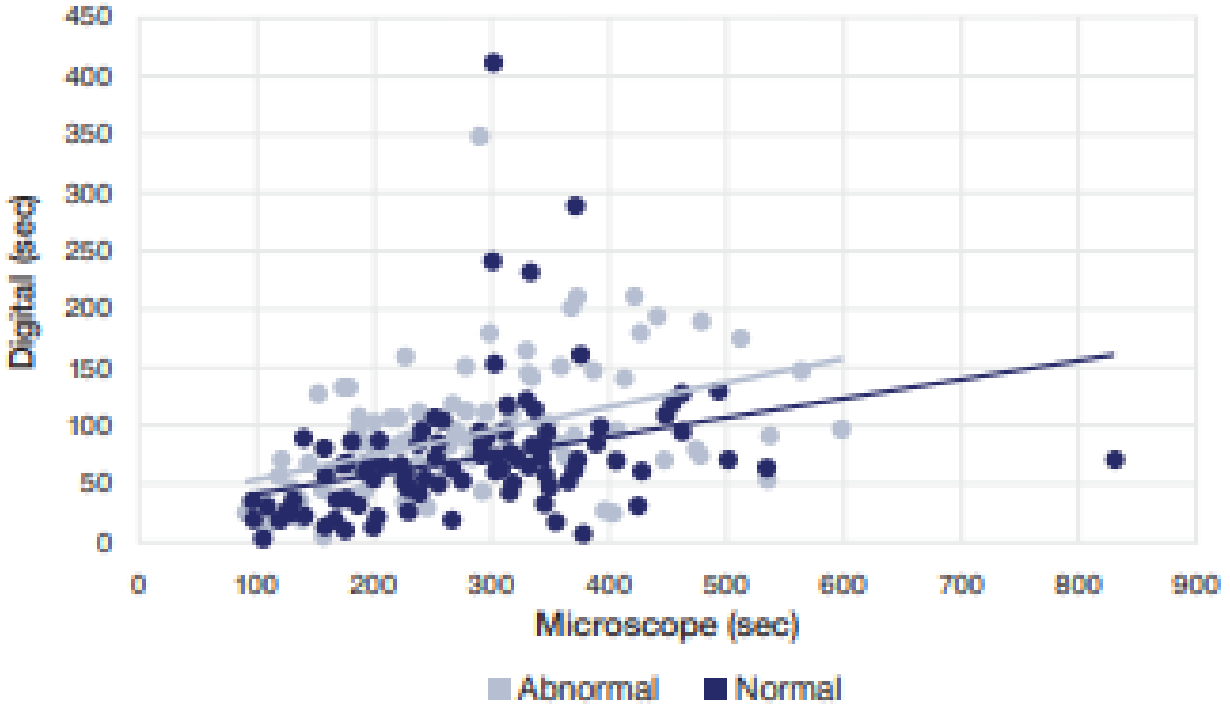


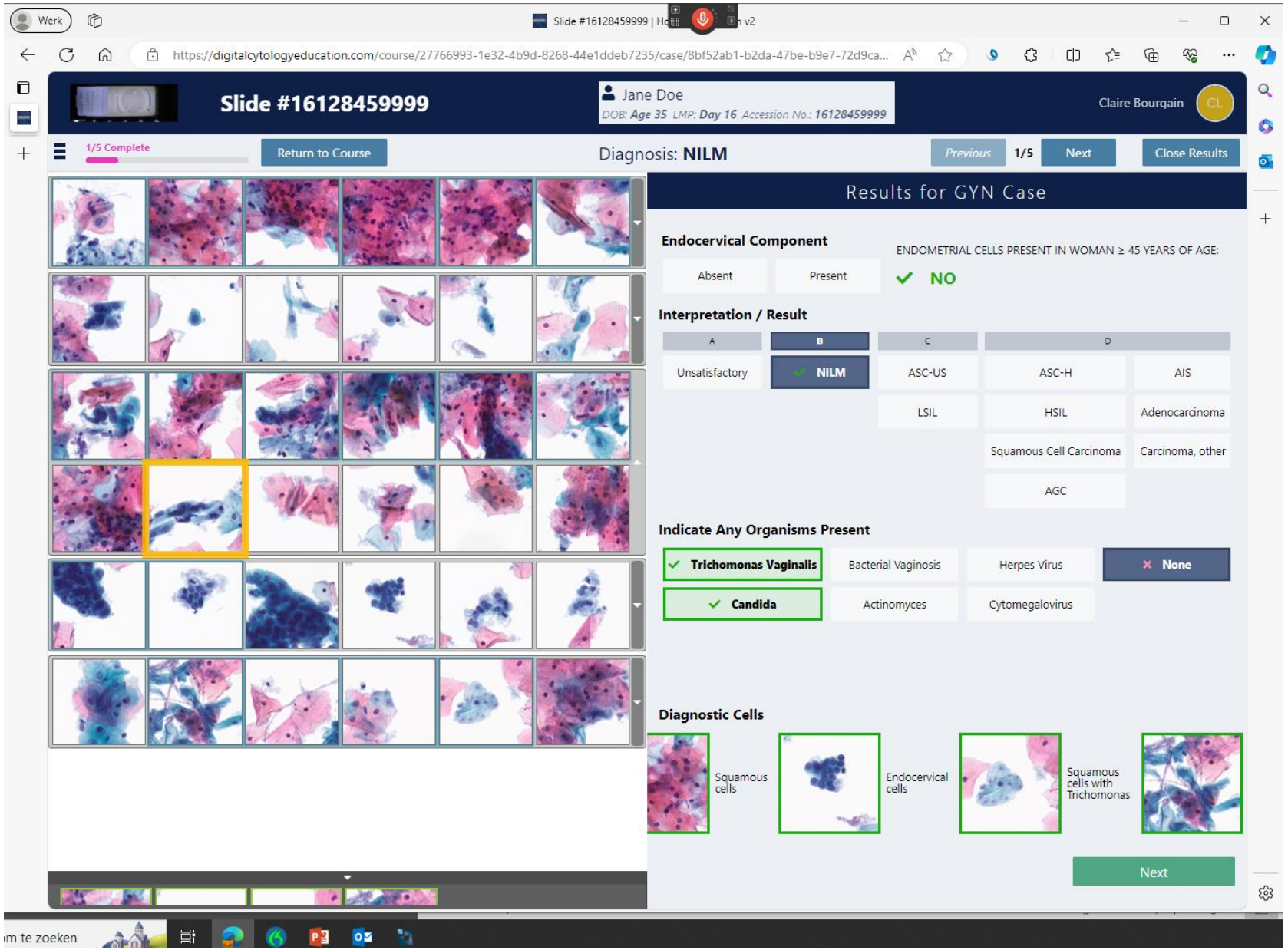
Figure 3. Scatterplot comparing time (in sec.) between microscope and digital arms for abnormal and normal slides

Externe QA

Maandelijks 5 testcasussen

Slagen bij 70%

Certificaat na 2 geslaagde testen



Cijfers Imelda TIS vs CD

3000 stalen in elke arm	TIS	CD
ASCUS	101 (3,4%)	171 (5,7%)
ASCH	12 (0,4%)	20 (0,6%)
LSIL	20 (0,6%)	40 (1,3%)
HSIL	2 (0,06%)	7 (0,2%)
AGC	0	0
Totaal	135 (4,5%)	238 (7,9%)

Tijdswinst per gescreende casus +/- 50%

Leercurve!!

Dank u!