

Supplementary Data S1. Survey questionnaire and responses

Section 1. General information

Q1. What is your current status?

- 1) Resident trainee: 24.2% (32 responses)
- 2) Board certified pathologist: 75.8% (100 responses)

Q2. What kind of institution do you working in?

- 1) University hospital: 80.3% (106 responses)
- 2) General hospital: 12.1% (16 responses)
- 3) Commercial laboratory: 7.6% (10 responses)

Q3. What is your current position? (for board-certified pathologist only, duplicate response allowed)

- 1) Head of department: 25.0% (25 responses)
- 2) Instructing cytopathologist (fellow of Korean Society of Cytopathology): 36.0% (36 responses)
- 3) Board-certified pathologist: 78.0% (78 responses)

Q4. How long have you been practicing as a board-certified pathologist? (for board-certified pathologists only)

- 1) 1 to 5 years: 13.0% (13 responses)
- 2) 6 to 10 years: 21.0% (21 responses)
- 3) 11 to 15 years: 9.0% (9 responses)
- 4) >15 years: 57.0% (57 responses)

Q5. Do you have a training resident in your institution? (for board-certified pathologists only)

- 1) Yes: 29.0% (29 responses)
- 2) No: 71.0% (71 responses)

Section 2. Current resident cytopathology training curriculum

(section for residents and pathologists who have a resident in their institution)

Q1. What is the training duration only for cytopathology during the residency training program?

- 1) No time period for training in only cytopathology (next question Q2): 52.5% (32 responses)

- 2) <1 month: 1.6% (1 response)
- 3) 1 to <3 months: 9.8% (6 responses)
- 4) ≥3 months: 36.1% (22 responses)

Q2. What is the proportion of training time allocated related to cytopathology when residents' schedule is combined with other non-cytopathology diagnostic tasks?
(answered by respondents who chose option 1 for Q1)

- 1) ≥50%: 6.6% (4 responses)
- 2) 25 to <50%: 4.9% (3 responses)
- 3) 10 to <25%: 49.2% (30 responses)
- 4) <10%: 39.3% (24 responses)

Q3. When do you start cytopathology training at your institution?

- 1) 1st year of residency: 31.1% (19 responses)
- 2) 2nd year of residency: 59.0% (36 responses)
- 3) 3rd year of residency: 9.8% (6 responses)
- 4) 4th year of residency: 0.0% (0 responses)

Q4. Is cytopathology training divided into sub-fields? (e.g., gynecologic vs non-gynecologic, gynecologic vs respiratory vs endocrine, etc.)

- 1) Yes: 36.1% (22 responses)
- 2) No: 63.9% (39 responses)

Q5. How often do residents sign out reports with the pathologists at a defined time?

- 1) None: 4.9% (3 responses)
- 2) Once per month: 18.0% (11 responses)
- 3) 4 times per month: 27.9% (17 responses)

- 4) 5 to 8 times per month: 16.4% (10 responses)
- 5) ≥ 9 times per month: 32.8% (20 responses)

Q6. Training curriculum includes these practices (duplicate choice available)

- 1) Screening of marked cytopathology slides: 85.2% (52 responses)
- 2) Screening of unmarked cytopathology slides: 41.0% (25 responses)
- 3) Preparation of draft reports: 80.3% (49 responses)
- 4) Attendance of onsite rapid assessment of fine needle aspiration or endobronchial ultrasound fine needle aspiration: 44.3% (27 responses)
- 5) Perform fine needle aspiration: 1.6% (1 response)

Q7. Is there a separate conference time for cytopathology during intradepartmental conference or meeting?

- 1) Yes: 21.3% (13 responses)
- 2) No: 78.7% (48 responses)

Q8. How often is the cytopathology education or conference time during the training?

- 1) None: 31.1% (19 responses)
- 2) 1 to <3 times per year: 47.5% (29 responses)
- 3) 3 to <6 times per year: 11.5% (7 responses)
- 4) 6 to <12 times per year: 8.2% (5 responses)
- 5) ≥ 12 times per year: 1.6% (1 response)

Q9. How often do residents participate in cytopathology conferences, slide seminars, and education courses held by other external organizations?

- 1) <2 times per year: 26.2% (16 responses)
- 2) 2 to <6 times per year: 67.2% (41 responses)
- 3) ≥ 6 times per year: 6.6% (4 responses)

Q10. Would you like to comment freely on the cytopathology residency training?

(some excerpts from the responses provided by participants)

“Insufficient educational programs; more online programs and education sessions need to be conducted.”

“A systematic training program for residents is needed.”

“I do feel like I had professional cytopathology training.”

“We need education on quality control.”

“The Korean Society for Cytopathology (KSC) needs to develop standardized residency training manual.”

“We need regular educational sessions for cytopathology during slide seminars.”

Section 3. Degree of resident satisfaction with the cytopathology training curriculum (for residents only)

3-1. Overall satisfaction rating

Questionnaire items	Frequencies of satisfaction scores ^a					Average of satisfaction scores	Percentage of satisfaction
	1, strongly disagree	2, disagree	3, neutral	4, agree	5, strongly agree		
Q1. I am satisfied with the current overall cytopathology training	4	5	10	9	3	3.1	71.0
Q2. I am satisfied with the current overall gynecologic cytopathology training	6	7	7	7	4	2.9	58.1
Q3. I am satisfied with the current overall non-gynecologic cytopathology training	5	6	6	10	4	3.1	64.5
Q4. I am satisfied with the training hours occupied by the cytopathology during pathology resident training period	6	3	10	9	3	3.0	71.0

^a31 responders answered.

3-2. Satisfaction with cytopathology training practices and specific training fields

Questionnaire items	Frequencies of satisfaction scores ^a					Average of satisfaction scores	Percentage of satisfaction
	1, strongly disagree	2, disagree	3, neutral	4, agree	5, strongly agree		
Q1. I am satisfied with the training practice - slide screening and preparing draft reports	3	4	11	8	5	3.3	77.4
Q2. I am satisfied with the training practice - sign out reports to diagnose with pathologist	2	2	12	8	7	3.5	87.1
Q3. I am satisfied with the training practice - institutional education sessions (e.g., lecture)	6	6	10	6	3	2.8	61.3
Q4. I am satisfied with the education on criteria and guidelines	5	4	12	7	3	3.0	71.0%
Q5. I am satisfied with the case conferences	5	5	12	6	3	2.9	67.7%
Q6. I am satisfied with the education and conferences provided by society or other institutions	4	3	11	9	4	3.2	77.4%
Q7. I am satisfied with the training on FNA and on-site rapid assessment	8	4	11	5	3	2.7	61.3%

Q8. I am satisfied with the training on quality control and laboratory management	6	1	14	6	4	3.0	77.4%
Q9. I am satisfied with the training on digital pathology and automated screening system	8	3	10	7	3	2.8	64.5%
Q10. I am satisfied with cytopathology research participation	8	3	10	6	4	2.8	64.5%

KSC, Korean Society Cytopathology; FNA, fine needle aspiration.

^a31 responders answered.

3-3. Satisfaction with the training environment

Questionnaire items	Frequencies of satisfaction scores ^a					Average of satisfaction scores	Percentage of satisfaction
	1, strongly disagree	2, disagree	3, neutral	4, agree	5, strongly agree		
Q1. There are enough pathologists who direct or teach cytopathology	5	5	6	8	7	3.2	67.7
Q2. There are sufficient cytopathology references and book	3	5	7	11	5	3.3	74.2
Q3. There are sufficient educational or reference slides	4	5	9	7	6	3.2	71.0

^a31 responders answered.

Q4. Please comment freely

“We need educational conferences or training education.”

“Our hospital barely has a chance to experience a gynecologic cytopathology.”

“We need more cytopathology education.”

Section 4. Performance prediction and direction for the improvement (section for all respondents)

4-1. Do you know about the “Resident training goals and specifications” suggested by the Korean Society of Cytopathology? (Link: https://www.cytopathol.or.kr/resident_01.asp)

- 1) Strongly disagree: 22.0% (29 responses)
- 2) Disagree: 24.2% (32 responses)
- 3) Neutral: 41.7% (55 responses)
- 4) Agree: 9.1% (12 responses)
- 5) Strongly agree: 3.0% (4 responses)

4-2. Do you think that the current education and training system could help the residents accomplish the training goal suggested by the KSC guidelines?

- 1) Strongly disagree: 4.5% (6 responses)
- 2) Disagree: 18.2% (24 responses)
- 3) Neutral: 44.7% (59 responses)
- 4) Agree: 28.0% (37 responses)
- 5) Strongly agree: 4.5% (6 responses)

4-3. If you do not expect that the residents will not have the ability to independently and competently make a cytopathology diagnosis upon completion of training, what is the reason?

(42 responders answered)

- 1) Lack of specific curriculum or training time for cytopathology during the training period: 57.1% (24 responses)
- 2) Lack of diversity of cytopathology cases or specimen in specific fields: 23.8% (10 responses)
- 3) Lack of time for face-to-face instruction by board certified pathologists: 11.9% (5 responses)
- 4) Lack of diverse training modalities: 2.4% (1 response)
- 5) Lack of number of cytopathology cases: 2.4% (1 response)
- 6) Lack of adequate facility, study and training materials: 2.4% (1 response)

4-4. Areas of cytopathology training that should be strengthened

Questionnaire items	Frequency ^a					Average of agreement
	1, strongly disagree	2, disagree	3, neutral	4, agree	5, strongly agree	
Q1. Gynecologic cytopathology training should be strengthened	0	9	49	38	36	3.8
Q2. Non-gynecologic: respiratory cytopathology training should be strengthened	0	9	53	42	28	3.7
Q3. Non-gynecologic: urine cytopathology training should be strengthened	1	7	49	47	28	3.7
Q4. Non-gynecologic: salivary gland, lymph node, and pancreaticobiliary cytopathology training should be strengthened	1	8	44	51	28	3.7
Q5. Non-gynecologic: thyroid gland cytopathology training should be strengthened	1	6	45	41	39	3.8
Q6. Non-gynecologic: other areas (e.g., cerebrospinal fluid and breast) of cytopathology training should be strengthened	6	8	64	35	19	3.4

^a132 responders answered

4-5. Performance prediction

Questionnaire items	Frequency ^a					Average of agreement
	1, strongly disagree	2, disagree	3, neutral	4, agree	5, strongly agree	
Q1. Current cytopathology training will improve cytopathology diagnostic skills	6	10	56	48	12	3.4
Q2. Current cytopathology training will improve the ability to analyze differences between histologic and cytopathologic findings	7	10	60	45	10	3.3
Q3. Current cytopathology training will improve communication skills with colleagues, including clinicians	8	12	62	42	8	3.2
Q4. Current cytopathology training will improve the ability to apply ancillary staining methods in cytopathology	6	16	55	45	10	3.3

Q5. Current cytopathology training will improve the understanding of pre-analytical conditions	7	21	60	38	6	3.1
Q6. Current cytopathology training will improve basic knowledge on cytopathology	6	17	54	46	9	3.3
Q7. Current cytopathology training will improve research ability in cytopathology	12	27	50	37	6	3.0
Q8. Current cytopathology training will improve quality control and laboratory management abilities	7	21	53	43	8	3.2
Q9. Current cytopathology training will improve understanding and use of diagnostic systems, such as, the cervical pap smear Bethesda system	7	10	47	52	16	3.5
Q10. Current cytopathology training will improve understanding and use of diagnostic systems, such as, the thyroid Bethesda, salivary Milan, and urine Paris systems	5	9	53	56	9	3.4
Q11. Current cytopathology training will improve understanding and use of digital pathology and automated screening system	20	27	50	30	5	2.8
Q12. Current cytopathology training will improve the use of molecular cytopathology	16	28	50	34	4	2.9
Q13. Upon completion of a four-year training, the residents will have the ability to independently and competently make a cytopathology diagnosis	14	28	46	38	6	3.0

^a132 responders answered

Q14. Please comment freely about the cytopathology training improvement or on the achievement.

“Need to train with more diverse set of specimens.”

“Cytopathology is very important part of work in the commercial laboratories. Residents should be more prepared and be capable of cytopathologic diagnosis in the non-academic settings.”

“Training curriculum needs to be divided into subcategories, e.g., general area and subspecialized areas.”

“Workload is too huge for pathologist to focus on resident training.”

“Board-certified pathologist who are not specialized in cytopathology should be educated first.”

“Need interim test after setting of specific training goals.”

“Wish to have more opportunities to experience difficult cases.”

“Right now, it is even hard to even call it a training.”

Section 5. Training transfer

Questionnaire items	Frequency ^a					Average of agreement
	1, strongly disagree	2, disagree	3, neutral	4, agree	5, strongly agree	
Q1. I am using what I learned in cytopathology training in real-time work	3	7	40	55	27	3.7
Q2. What I learned during cytopathology training has improved my performance	4	5	43	57	23	3.7
Q3. I am applying what I have learned in the cytopathology training to real work	5	2	35	61	29	3.8
Q4. After the cytopathology training, I receive positive evaluation from the seniors or colleagues about my improved work performance	5	10	65	40	12	3.3
Q5. What I learned during the cytopathology training helped me solve problems in real-time work that deals with patients	4	6	54	52	16	3.5
Q6. Cytopathology training has improved my job expertise	4	3	47	58	20	3.7
Q7. Cytopathology training has improved my communication skills with the patients and clinicians	7	8	52	52	13	3.4

^a132 responders answered

Q8. Please comment freely about the cytopathology resident training.

“We need more cytopathology education organized by the KCP, e.g., activation of online educations, development of typical or unusual case gallery, and clinically oriented

practical educational sessions.” (11 comments)

“We need systematic training curriculum – interim evaluations, reinforcement of training curriculum standards, incentives on cytopathology training, linking with resident training guidelines by Korean Society of Pathologists, and broaden experience through dispatch to other institutions.”

“We need slide seminars not only for residents but also for the board-certified pathologists.”

“Enforce the role of instructing cytopathologists in each institution.”

“We need education that reflects current reality.”

“We need more education on cytopathology-histology correlation.”

“There is a need to enhance the cytopathology diagnostic ability of the residents.”

“There is a need to set obligatory primary slide screening training period or case numbers.”