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ORIGINAL ARTICLE

Results from the 2019 American Society of Cytopathology survey on rapid on-site evaluation—Part 1: objective practice patterns

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Introduction Rapid on-site evaluation (ROSE) is a service provided by cytologists that helps ensure specimen adequacy and appropriate triage for ancillary testing. However, data on the current usage patterns across different practice settings have been lacking.

Materials and methods To obtain an accurate and timely assessment of the current state of practice of ROSE, a 14-question online survey was constructed by the Clinical Practice Committee of the American Society for Cytopathology. The survey was available to the membership of the American Society for Cytopathology for a 3-week period in early 2019.

Results A total of 541 responses were received, including from 255 cytopathologists/pathologists, 261 cytotechnologists, 19 cytology resident/fellow trainees, and 6 others. ROSE was offered as a clinical service by 95.4% of the respondents, with telecytology for ROSE used in 21.9% of the practices. Endobronchial ultrasound-guided transbronchial needle aspiration was the procedure most frequently reported to use ROSE (mean, 59.1%; median, 70%). Cytotechnologists were involved in ROSE in most practices. The number of daily ROSE procedures correlated with the annual nongynecologic cytology volumes. Approximately 70% of ROSE procedures were reported to require >30 minutes, on average, for the cytologist.

Conclusions The results from our survey of cytologists have shown that the reported practice patterns for the usage of ROSE vary considerably. The presented data can help inform future guideline recommendations and the implementation of ROSE in different clinical settings.

Introduction

Rapid on-site evaluation (ROSE) is an often used service provided by cytologists to help ensure diagnostic specimens in the setting of minimally invasive procedures, including fine needle aspiration (FNA) and core biopsies, frequently performed with radiologic guidance. By providing real-time feedback, the cytologist can help ensure adequate sampling of the targeted lesion and appropriate specimen triage for any necessary ancillary studies.[1-3] Thus, the use of ROSE allows for bidirectional communication between the cytologist and the clinician during a procedure to enhance the likelihood of an accurate and timely diagnosis.

A number of professional societies have issued guideline recommendations on the use of ROSE for various diagnostic procedures. For pulmonary and mediastinal lesions, an increasingly used minimally invasive sampling modality has been endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA). In this setting, the Pulmonary Pathology Society has recommended ROSE to ensure sampling of the targeted lesion, enable appropriate specimen triage, minimize the need for repeat procedures for additional ancillary testing, and provide a preliminary diagnosis.[4] Likewise, the Papanicolaou Society of Cytopathology has encouraged the use of ROSE, because its use can reduce the need for subsequent procedures and it allows for efficient triage of sampled tissues.[5] A recent meta-analysis on the use of ROSE in the EBUS-TBNA setting found that "the use of ROSE neither improved the diagnostic yield nor reduced the procedure time during TBNA. However, the use of ROSE was associated with fewer number of needle passes during EBUS-TBNA and overall lower requirement for additional bronchoscopy procedures during TBNA to make a final diagnosis."[6] In addition, the World Association for Bronchology and Interventional Pulmonology Task Force on Specimen Guidelines issued guidance that the evidence to recommend ROSE for every procedure is insufficient, although its use is still highly recommended by expert consensus opinion.[7] Considering other organ systems, the European Society of Gastrointestinal Endoscopy technical guidelines state that endoscopic ultrasound-guided (EUS) sampling with or without on-site cytologic evaluation is equally recommended.[8] Finally, according to the 2015 American Thyroid Association Management Guidelines, a strong recommendation was issued for the use of ROSE, if available, for repeat ultrasound-guided FNA sampling of a thyroid nodule after an initial nondiagnostic cytology result.[9]

Although numerous studies have been reported on single-institution experiences with ROSE, to date, only limited data are available on how broadly ROSE has been used in current clinical practice. A previous survey of 368 cytologists by the American Society of Cytopathology (ASC) Clinical Practice Committee in 2014 revealed that 87% of cytology laboratories provide ROSE at some level.[10] In contrast, a 2016 multinational survey of 186 endosonographers reported that ROSE was used more often in the United States compared with European or Asian practices (98% versus 51%, respectively).[11] From anecdotal evidence at national meetings and reported studies, it is evident that the practice of ROSE varies considerably. Therefore, the ASC Clinical Practice Committee created a focused survey of the entire ASC membership to obtain an accurate assessment of the current state of practice and opinions on the use of ROSE in 2019. In this paper, we report the results of that survey relating to objective practice patterns.

Materials and methods

Survey

At the annual ASC meeting in Washington, DC, in November 2018, the Clinical Practice Committee met and

was presented with the primary objective for the year: to address the controversy regarding the performance of ROSE in cytopathology and the related reimbursement issues and to develop a national ROSE policy/consensus guideline. To first assess the current state of practice of ROSE and capture the varying opinions on the topic, the committee developed a focused 14-question survey to be distributed to the ASC membership online through Survey Monkey (Supplementary Fig. 1). The online survey was announced to the ASC membership via 3 separate e-mails and was open for response from January 22 through February 10, 2019. For the present report, questions 1 to 10, covering objective data on ROSE, were analyzed. An analysis of the responses to questions 11 to 14, covering the subjective views of ROSE, will be presented in a subsequent report.

Statistical analysis

Raw data were retrieved into an Excel file from Survey Monkey. Missing values and invalid entries were deleted from the analysis. To ensure a meaningful comparison among the subgroups with an effective sample size, the responses were regrouped during the data analyses and visualizations. For the demographic question regarding the participant's role in the laboratory (question [Q]1), the answers "cytopathology fellow" and "pathology resident" were grouped as "trainee." For the question pertaining to the average daily volume of ROSE procedures (Q9), the answers "<1" and "1-3" were combined, as well as the answers "11-20" and ">20." The responses to the question of the time required for a typical ROSE procedure for the cytology personnel (Q10) were also regrouped as "≤19," "20-29," 30-45," and ">45" minutes. To simplify the interpretation of the results for the reported personnel modalities used for ROSE (Q5), a new variable indicating the primary method used for ROSE was created from the original responses. The method (cytotechnologist with cytopathologist interpretation, cytotechnologist alone, cytopathologist alone, cytopathology resident/fellow with cytopathologist interpretation, cytopathology resident/fellow alone, or no single dominant modality) that accounted for >50% of ROSE procedures performed was identified as the primary method for each participant's practice.

Distributions for the continuous variables were visually inspected for normality on histograms. Non-normally distributed data are expressed as the mean and median, together with their 25% and 75% quartiles. Violin graphs with boxplots were generated to display the distribution of the data. Descriptive statistics were used to derive the percentages and frequencies for the categorical variables. Fisher's exact tests were applied to identify significant differences in responses among the participant roles, practice settings, and institution size (determined from the annual nongynecologic cytology volume). A P value of < 0.05 was considered statistically significant. Statistical analyses were performed using SAS, version 9.3 (SAS Institute Inc., Cary, NC), and charts were generated using Power BI (Microsoft, Redmond, WA).

Results

A total of 541 unique responses were received, accounting for 19.5% of the 2019 ASC membership (541 of 2,778). The respondent demographics are summarized in Table 1. Overall, the numbers of cytopathologists/pathologists (n = 255; 47%) and cytotechnologists (n = 261; 48%) were almost equal, with additional responses received from 19 resident/fellow trainees (3.5%) and 6 others (1.1%), including 3 cytology laboratory managers, an endocrinologist, an anatomic pathology quality specialist, and a pathology process analyst. Most respondents practiced in either an academic medical center (n = 304; 56%) or a community hospital or private practice (n = 197; 36%). The reported annual nongynecologic specimen volume varied considerably, although nearly two thirds of respondents reported 1,000 to 10,000 cases annually. A heat map of the responses comparing the practice setting with the annual nongynecologic cytology specimen volume is shown in Fig. 1.

ROSE was a cytology service offered by the vast majority of respondents (n = 516; 95.4%), with only 25 respondents (4.6%) reporting that ROSE was not offered in their practice setting. The practice settings most likely to not offer ROSE included a reference/commercial laboratory (n

Table 1 Respondent demographics for 2019 American Society of Cytopathology rapid on-site evaluation survey.

Demographic	n (%)
Role of respondent	
Cytopathologist/pathologist	255 (47.1)
Cytotechnologist	261 (48.2)
Cytopathology trainee (fellow or resident)	19 (3.5)
Other	6 (1.1)
Total	541 (100.0)
Practice setting	
Academic medical center	304 (56.2)
Community hospital/private practice	197 (36.4)
Reference/commercial laboratory	27 (5.0)
Veteran's hospital	11 (2.0)
Unknown	2 (0.4)
Total	541 (100.0)
Annual nongynecologic cytology specimen volume	
<1000	55 (10.2)
1000-4999	205 (37.9)
5000-9999	144 (26.6)
10,000-14,999	57 (10.5)
>15,000	75 (13.9)
Unknown	5 (0.9)
Total	541 (100.0)

	<1,000	1,000 - 4,999	5,000 - 9,999	10,000 - 14,999	>15,000	Unknown	Grand Total
Academic medical center	1.3%	15.7%	20.3%	8.3%	10.2%	0.4%	304
Community hospital/private practice	8.1%	19.0%	5.7%	1.5%	1.8%	0.2%	197
Reference/commercial laboratory	0.6%	1.3%	0.4%	0.7%	1.8%	0.2%	27
Veteran's hospital	0.2%	1.7%	0.2%	0.0%	0.0%	0.0%	11
Unknown	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	2
Grand Total	55	205	144	57	75	5	541

Figure 1 Heat map of respondent demographic data stratified by practice setting and annual nongynecologic cytology specimen volume.

= 7; 25.9%) or the settings in which the annual nongynecologic specimen volume was <1,000 cases annually (n = 8; 14.5%; Table 2).

Fewer than one quarter of the respondents (n = 118; 21.9%) provided ROSE via telecytology. Telecytology for ROSE was most often used by academic medical centers (n = 91; 29.9%; Table 3), and its use tended to correlate with an increasing annual nongynecologic cytology case volume.

For those practices that offered ROSE, the manner in which ROSE was staffed varied considerably. Most respondents reported that the personnel used for ROSE varied in their practice, including cytotechnologist with cytopathologist interpretation, cytotechnologist alone, cytopathologist alone, cytopathology trainee with cytopathologist interpretation, and cytopathology trainee alone. To simplify this complex data set, the data were summarized using a bubble plot (Fig. 2), which displays the frequency of the most common model for staffing ROSE for each practice setting. The presence of a cytotechnologist on site with interpretation by a cytopathologist was the most common staffing model in all practice settings, although a cytotechnologist alone was also frequently employed. ROSE performed by cytopathologist alone was frequently the primary model in the community/private practice setting. ROSE performed by cytopathology fellows/residents (either alone or with cytopathologist interpretation) was the most common model for ~20% of academic medical centers.

To help gauge the effect of providing ROSE on staffing in various settings, the survey queried how cytologist coverage for ROSE was managed: as either a dedicated service in which the cytopathologist and/or cytotechnologist was only responsible for covering ROSE or a combined service in which ROSE coverage was provided in addition to other clinical responsibilities. As summarized in Supplementary Fig. 2, the vast majority of practice settings arranged ROSE coverage as a combined service. A dedicated ROSE service was increasingly used with an increasing nongynecologic cytology specimen volume (8.7% when <1,000 nongynecologic cases annually compared with 36.6% when >15,000 cases annually).

ROSE can be used for multiple types of interventional procedures. To achieve a better appreciation for which procedures most frequently necessitated ROSE, the survey queried what percentage of each of the following procedures used ROSE: EBUS-TBNA, EUS-FNA, thyroid FNA, computed tomography (CT)-guided FNA, and CT-guided

Table 2 Rapid on-site evaluation availability stratified by practice setting and annual nongynecologic cytology specimen volume.

Variable	ROSE available		Total	*P* value
	Yes	No		
Practice setting				<0.001
Academic medical center	295 (97.0)	9 (3.0)	304	
Community hospital/private practice	189 (95.9)	8 (4.1)	197	
Reference/commercial laboratory	20 (74.1)	7 (25.9)	27	
Veteran's hospital	11 (100.0)	0 (0.0)	11	
Unknown	1 (50.0)	1 (50.0)	2	
Total	516 (95.4)	25 (4.6)	541	
Annual nongynecologic cytology specimen volume				0.007
<1000	47 (85.5)	8 (14.5)	55	
1000-4999	198 (96.6)	7 (3.4)	205	
5000-9999	139 (96.5)	5 (3.5)	144	
10,000-14,999	57 (100.0)	0 (0.0)	57	
>15,000	71 (94.7)	4 (5.3)	75	
Unknown	4 (80.0)	1 (20.0)	5	
Total	516 (95.4)	25 (4.6)	541	

Abbreviation: ROSE, rapid on-site evaluation.
Data presented as n (%).

Table 3 Use of telecytology for rapid on-site evaluation stratified by practice setting and annual nongynecologic cytology specimen volume.

Variable	ROSE available via telecytology		Total	*P* Value
	Yes	No		
Practice setting				<0.001
Academic medical center	91 (29.9)	213 (70.1)	304	
Community hospital/private practice	24 (12.2)	173 (87.8)	197	
Reference/commercial laboratory	2 (7.7)	24 (92.3)	26	
Veteran's hospital	1 (9.1)	10 (90.9)	11	
Unknown	0 (0.0)	2 (100.0)	2	
Total	118 (21.9)	442 (78.1)	540	
Annual nongynecologic cytology specimen volume				<0.001
<1000	1 (1.8)	54 (98.2)	55	
1000-4999	21 (10.2)	184 (89.8)	205	
5000-9999	45 (31.3)	99 (68.8)	144	
10,000-14,999	23 (40.4)	34 (59.6)	57	
>15,000	27 (36.5)	47 (63.5)	74	
Unknown	1 (20.0)	4 (80.0)	5	
Total	118 (21.9)	442 (78.1)	540	

Abbreviation: ROSE, rapid on-site evaluation.
Data presented as n (%).

core needle biopsy (CNB) with or without a touch preparation. The results are summarized in a violin plot (Fig. 3). A broad spread of ROSE usage was seen for all procedures, with a vaguely bimodal distribution and clustering toward the use of ROSE either almost all the time (near 100%) versus very infrequently (<5%). EBUS-TBNA had the highest reported mean and median ROSE usage rate (59.1% and 70%, respectively). In contrast, CT-guided CNB (with or without a touch preparation) had the lowest reported mean and median rates (44.7% and 30%, respectively). A more detailed violin plot breakdown for each procedure stratified by practice setting is provided in Supplementary Fig. 3.

For cytology laboratories that offered ROSE, most respondents reported performing ≤3 procedures daily (n = 213; 41.5%). However, nearly 10% of respondents reported performing ≥11 ROSE procedures daily (n = 51; 9.9%). A summary of the responses regarding how many ROSE procedures were performed daily, stratified by practice setting and annual nongynecologic cytology specimen volume, is shown in Fig. 4 and Supplementary Fig. 4. In general, academic medical centers and practices with greater nongynecologic cytology specimen volumes performed a greater number of ROSE procedures daily.

Finally, the survey queried the time required to perform each ROSE procedure. Overall, 71 respondents (13.9%)

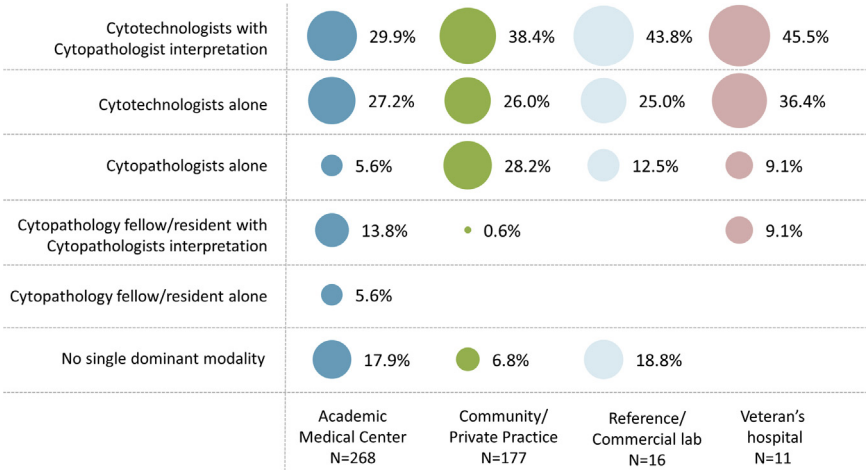
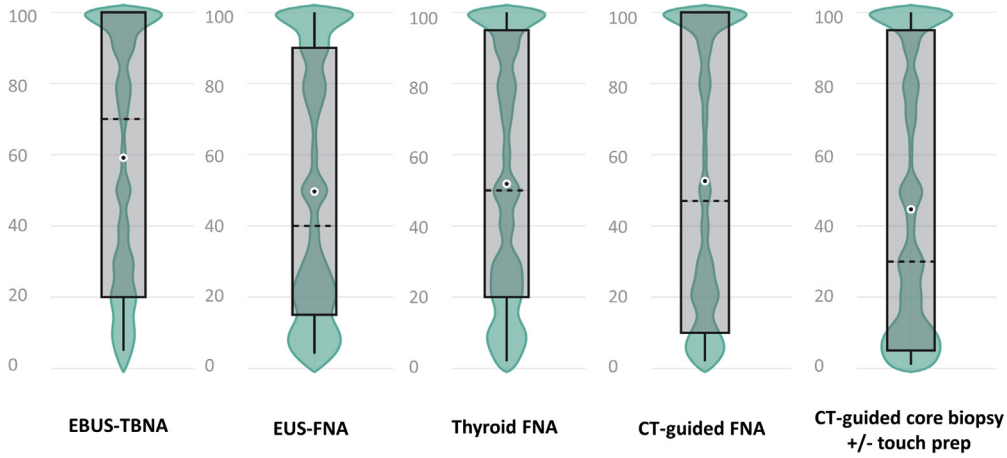


Figure 2 Bubble plot for the frequency of the most common model for staffing rapid on-site evaluation stratified by the respondent practice setting. lab, laboratory.



Procedures	Min	Q1	Median	Mean	Q3	Max	N
EBUS-TBNA	1.0	20.0	70.0	59.1	100.0	100.0	454
EUS-FNA	1.0	15.0	40.0	49.7	90.0	100.0	424
Thyroid FNA	1.0	20.0	50.0	51.9	95.0	100.0	409
CT-guided FNA	1.0	10.0	47.0	52.6	100.0	100.0	385
CT-guided core biopsy +/- touch prep	1.0	5.0	30.0	44.7	95.0	100.0	328

Figure 3 Violin plot for the distribution of cases that used rapid on-site evaluation stratified by procedure type. CT, computed tomography; EBUS-TBNA, endobronchial ultrasound-guided transbronchial needle aspiration; EUS, endoscopic ultrasound-guided; FNA, fine needle aspiration; prep, preparation; Max, maximum; Min, minimum; Q1, quartile 1; Q3, quartile 3.

reported that each ROSE procedure, on average, required <20 minutes, 88 (17.2%) reported 20 to 29 minutes, 215 (42.0%) reported 30 to 45 minutes, and 138 respondents (27.0%) reported the procedure required >45 minutes. Fewer than 25% of ROSE procedures performed in academic medical centers required <30 minutes, and

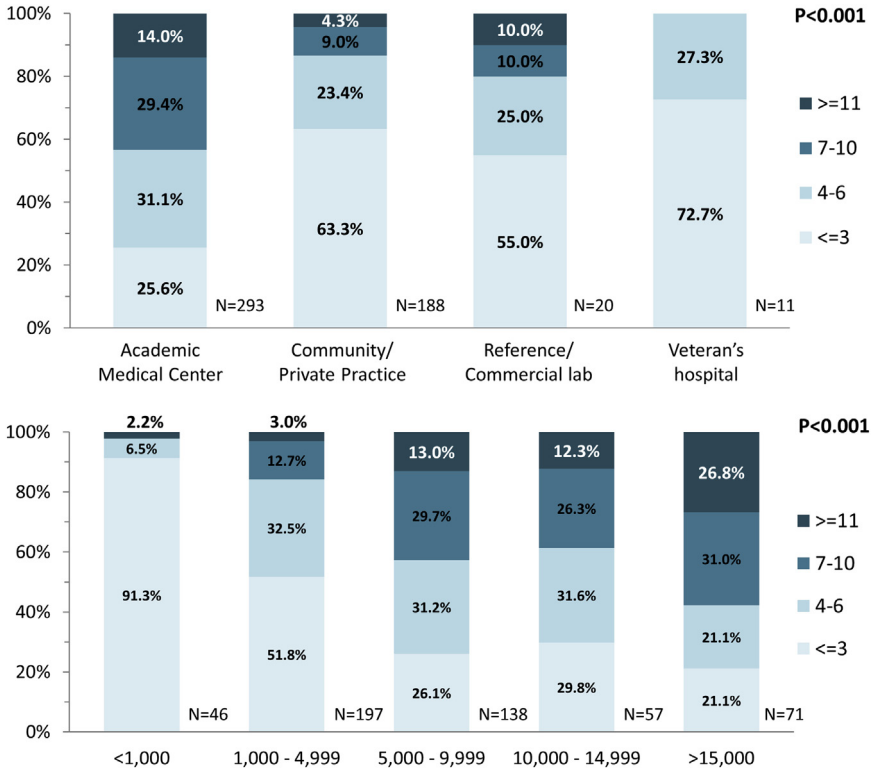


Figure 4 Number of rapid on-site evaluation procedures performed daily stratified by practice setting and annual nongynecologic cytology specimen volume. lab, laboratory.

cytotechnologists reported spending more time on average for ROSE procedures compared with cytopathologists.

Discussion

The most salient finding from our survey-based study of the ASC membership was that the practice of ROSE varies quite widely. Although the vast majority of practices offered ROSE at some level (95.4%; Table 2), the application of ROSE was not uniform with respect to the cytology personnel involved, method of performing ROSE, or the types of procedures for which ROSE was used.

Regarding who performs ROSE, most respondents indicated that a cytotechnologist was involved in ROSE for most cases, ~60% to 80% of the time, either alone (presumably providing a specimen adequacy assessment only) or with a cytopathologist. This finding was seen across all reported practice settings (Fig. 2). The skills of the cytotechnologist can be readily applied to the ROSE setting, and multiple studies have demonstrated excellent accuracy rates when a cytotechnologist performs ROSE, with high concordance compared with the findings from cytopathologists.[12-14] Substantial involvement by cytotechnologists in the setting of providing ROSE was also evident in the time commitment per procedure. As summarized in Fig. 5, 86% of cytotechnologists reported that a typical ROSE procedure requires >30 minutes, and 40.3% reported that it requires >45 minutes. In contrast, only 53.9% and 13.5% of cytopathologists reported those corresponding time requirements. These findings could have significant implications for future debate on reimbursement for ROSE, especially when considering that the role the cytotechnologist plays in this procedure is currently not reimbursed.[15]

A number of practical and logistical factors can dictate the practice of ROSE in a given practice setting. Many of these will be discussed in our next report on this topic. One relatively recent technological advancement is the use of telecytology to provide ROSE.[16] As found from the present survey, telecytology for ROSE was only used by 21.9% of respondents, mainly in the academic medical center setting (29.9%) or in practice settings with greater annual non-gynecologic cytology specimen volumes (Table 3). Recent reports from academic medical centers have provided encouraging single-center experiences with use of telecytology for ROSE,[17,18] which could also provide a roadmap for adoption in other practice settings.

In recent years, the usage of minimally invasive sampling techniques to obtain diagnostic tissue from radiologically identified lesions has increased.[19] Procedures performed by interventional pulmonologists (EBUS-TBNA), gastroenterologists (EUS-FNA), endocrinologists (thyroid FNA), and interventional radiologists (CT-guided FNA and CT-guided CNB) can potentially benefit from ROSE performed by cytology personnel, both to ensure diagnostic specimens are obtained and to appropriately triage material for ancillary studies such as flow cytometry, microbiologic cultures, or molecular studies. Substantial variability was found in the frequency that ROSE was used for each of these types of procedures (Fig. 3). Although the median and mean ROSE usage values for all these procedures were in the middle 30% to 70% range, most violin plots showed a vague

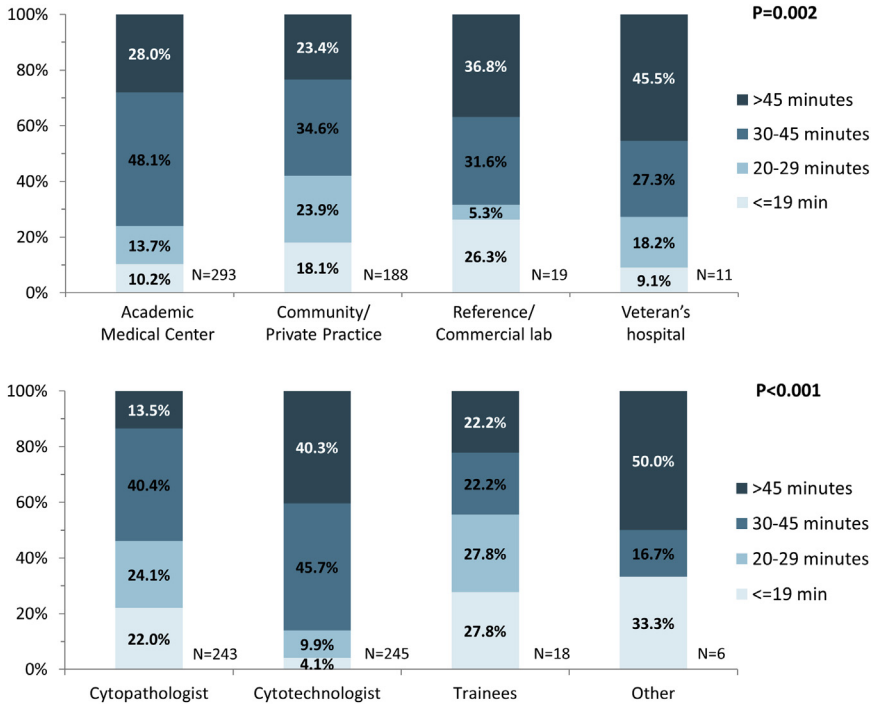


Figure 5 Average duration of rapid on-site evaluation procedure stratified by practice setting and cytologist role. lab, laboratory.

"dumbbell" shape, indicating a somewhat bimodal practice of either performing ROSE for all procedures or, conversely, performing ROSE for very few procedures. The reasons that could account for this dichotomous approach to using ROSE are unknown. Limits on the availability of cytology personnel could have been the reason in some cases, and the low rate of reimbursement might preclude the expansion of the number of staff to provide this service. However, the expertise and experience of the proceduralist could also account for some of the variability. Although a meta-analysis of the effect of ROSE on adequacy rates demonstrated an overall 12% increase in the use of ROSE, the investigators noted that studies with high non-ROSE adequacy rates showed minimal improvement after ROSE had been implemented.[20] As such, with an experienced expert proceduralist, the application of ROSE to all procedures might not be the most practical or cost-effective approach, because the skill of the proceduralist could be the most influential factor in the adequacy rates for some procedures.

The present study had several strengths and limitations. Our brief survey was targeted primarily to cytologists (eg, cytopathologists, cytotechnologists, cytology trainees) and was opened and offered to all members of the ASC in 2019. The 19.5% response rate may not truly reflect the ASC membership as a whole and might have biased the data toward responses from cytologists with the time or interest to complete the survey. Additionally, the overwhelming majority of ASC members practice in the United States (2,438 of 2,778 [87.8%], according to the 2019 ASC membership demographics), which might have biased the data toward practice patterns in the United States. However, the responses did represent a diverse cross-section of the practicing ASC community, with a nearly equal mixture of cytopathologists and cytotechnologists, practice settings ranging from academic medical centers to community hospitals and private practice, and a broad spectrum of annual nongynecologic specimen volumes (Table 1). Unfortunately, the cytopathology resident and fellow responses were low (n = 19; 3.5%), which could have limited the conclusions drawn from trainee experience with ROSE. Finally, just as with any survey-based study, the data were self-reported, and one must be cognizant of the possibility of inaccurate responses, skipped or incompletely answered questions, and/or interpretation issues. Notwithstanding, this survey represents the largest and most up-to-date assessment of the practice of ROSE by cytology professionals in the United States.

Conclusions

The central theme emerging from the results from our survey is that the reported practice patterns for the usage of ROSE vary considerably. A tremendous amount of data has been compiled and presented in our report, much more than could be specifically covered and discussed in detail. The reader is encouraged to evaluate the data presented in Supplementary Figs. 1 to 4 to not only gain a deeper appreciation for how ROSE is being used today, but also to consider the relevance of these responses in their own practice setting. The remainder of the survey results, including those questions that focused on the respondent's subjective view of ROSE and free-response entries, will be summarized and presented in a subsequent report in the Journal. Taken together, it is the hope of the ASC Clinical Practice Committee that these resources will expand the current data to help inform and direct the discussion on how ROSE should be best used in the future.

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Conflict of interest disclosures

P.B.I. has received consulting fees from Veran Medical Technologies, Abbvie, AstraZeneca, Bayer, and Guardant and research funding from Bristol-Meyers Squib and Genentech, all unrelated to the current study. P.V.L. has received consulting fees from Gala Therapeutics and Foundation Medicine, unrelated to the present study. The remaining authors made no disclosures.

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Supplementary data

Supplementary data accompanying this article can be found in the online version at https://dx.doi.org/10.1016/j.jasc.2019.07.007.

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