Marko Kimi Milić[1], Šćepan Sinanović[1], Dejan Kostić[2,3], Milena Ratković[4]

ORGANIZATIONAL MODELS OF ”ONE-STOP” CLINICS FOR THYROID DISEASE: A REVIEW OF PROCESSES, PERFORMANCE INDICATORS, AND OUTCOMES FROM THE LITERATURE

Abstract: Background: Fragmented care pathways for thyroid nodular disease prolong time to decision and increase costs. “One-stop” clinics (OSCs) integrate clinical evaluation, ultrasound, ultrasound-guided fine-needle aspiration (FNA) and, when appropriate, rapid on-site evaluation (ROSE)/telecytology in a single visit.

Objective: To map organizational models of OSCs, define key performance indicators (KPIs), and summarize outcomes (time, visits, adequacy, repeat FNA, costs, patient satisfaction, safety).

Methods: Scoping review following PRISMA-ScR and JBI guidance. MEDLINE, Scopus, and Web of Science were searched (2000–August 2025). We included studies that operationalized OSCs and/or reported KPIs/outcomes. Data extraction covered organizational features, protocols (ACR/EU-TIRADS, Bethesda), flow metrics, FNA/ROSE adequacy, economics, satisfaction, and safety. Narrative synthesis was performed.

Results: Identified OSC models consistently shorten lead time to decision and reduce the number of visits. Sample adequacy is high–especially with ROSE/telecytology–thereby lowering repeat FNA rates. Patient satisfaction is high; the safety profile of FNA remains favourable. Economic analyses indicate that the cost-effectiveness of ROSE is context-dependent and greatest when baseline inadequacy is higher and/or ROSE costs are lower. A KPI set is proposed: lead time, proportion of “single-visit”

[1] Marko Kimi Milić, High Medical College of Professional Studies “Milutin Milanković”, Belgrade, Serbia, e-mail: drmarkokimimilic@gmail.com

[2] Univerity of Defence in Belgrade, Medical Faculty of the Military Medical Academy, Belgrade, Serbia

[3] Military Medical Academy in Belgrade, Institute of Radiology, Belgrade, Serbia

[4] Military Medical Academy, Belgrade, Serbia

completions, Bethesda I rate, ROSE utilization, repeat FNA ≤ 90 days, cost per episode, and satisfaction.

Conclusion: OSCs are an applicable, value-oriented model for thyroid diagnostics. Selective use of ROSE/telecytology and KPI-driven management enable efficient and safe implementation across diverse resource settings.

Keywords: one-stop clinic; thyroid; ultrasound; fine-needle aspiration; ROSE; TIRADS; Bethesda; performance indicators; health management.

INTRODUCTION

Thyroid nodular disease is among the most common reasons for referral to endocrinology and radiology clinics, spanning a wide spectrum of clinical scenarios–from incidentally detected nodules on ultrasound to suspected differentiated carcinoma. Over the past two decades, diagnostic standardization and decision-making based on the American Thyroid Association (ATA) guidelines have established a firm foundation for the rational use of ultrasound (US), fine-needle aspiration cytology (FNA), and individualized risk assessment (1). At the same time, the development of ultrasound-based risk stratification systems–particularly ACR TI-RADS and EU-TI-RADS–has brought greater consistency to estimating the probability of malignancy and determining indications for FNA, thereby improving alignment between endocrinologists and radiologists (2–3). Standardization of cytology reporting through The Bethesda System (2017 version) has further reduced "grey zones" and enabled clearer clinical decisions (4).

Despite these advances, clinical pathways often remain fragmented: patients make multiple visits (clinical examination, US in radiology, then FNA and a later return for results), which prolongs time to a definitive decision and increases system burden and costs for both patient and institution. Summary reviews indicate that optimized algorithms–which link US-based risk stratification, selective FNA, and early multidisciplinary discussion–shorten the diagnostic–therapeutic pathway and reduce inappropriate interventions (5). On this basis, the "one-stop" clinic (OSC) model emerged: an organization in which clinical examination, US, the indication for and performance of US-guided FNA (with rapid on-site cytologic evaluation, ROSE, when needed), and the initial treatment decision are completed in a single visit (5–8).

The OSC approach integrates key resources in one time slot and setting–an endocrinologist, a radiologist/sonographer, a cytopathologist, and, when necessary, a surgeon–relying on standardized tools (ACR/EU-TIRADS, Bethesda) and clear protocols. Data from practice across different health systems show that OSCs shorten the time from referral to treatment plan, reduce the number of visits and inter-special-

ty transfers, improve patient satisfaction, and can generate economic savings (6–8). Particularly informative are models of so-called "high-resolution" endocrinology clinics in which US and FNA are performed during the same visit, with demonstrated reductions in additional referral procedures and costs (7–8).

The critical "technical levers" of quality in OSCs are FNA adequacy and timely interpretation. Implementing ROSE–whereby a cytopathologist or trained professional confirms specimen adequacy during the same session–consistently increases the adequacy rate and reduces the need for repeat aspirations, thereby further shortening the pathway and conserving resources (9). This focus on sample quality, combined with consistent application of TI-RADS criteria and Bethesda categorization, enables rapid and reliable triage among surveillance, additional diagnostics, or surgery (2–4, 9).

Importantly, OSC feasibility has been confirmed in resource-limited settings while maintaining safety and outcomes–suggesting good transferability of the model beyond highly specialized centers (10). This is particularly relevant for health systems in transition and regions with uneven distribution of radiologic and cytopathologic capacity, where integrating services into a single appointment can significantly alleviate bottlenecks.

Building on this, the present paper has three aims: (i) to descriptively map organizational models and key processes of OSCs for thyroid nodular disease; (ii) to propose a set of key performance indicators (KPIs) to monitor quality, efficiency, and patient value; and (iii) to synthesize available outcomes (time to diagnosis/decision, FNA adequacy, number of visits, costs, satisfaction, and safety) from the literature, with practical guidance for implementation in our setting (1–10).

METHODOLOGY

Review design. A scoping review was conducted in accordance with PRISMA-ScR guidelines and current JBI methodological guidance (11–12). The PRISMA 2020 framework was used for transparent presentation of the study selection flow (diagram) and reporting, adapted to the scoping format (13). The search strategy and search reporting followed PRISMA-S recommendations (14).

Question framework (PCC).

– Population: adults with thyroid nodular disease or referred for thyroid diagnostics.

– Concept: models of "one-stop" clinics (OSCs), "high-resolution" endocrinology clinics, same-day US+FNA/ROSE organization, integrated diagnostics and triage.

– Context: outpatient and inpatient endocrinology–radiology services, all levels of health systems, without geographic restriction.

Inclusion/exclusion criteria. We included primary studies and reports (prospective/retrospective cohorts, pre–post evaluations, case series ≥30 patients, quality-im-

provement programs, economic evaluations) that describe the organization of OSC processes and/or report outcomes/KPIs (time to diagnosis/decision, number of visits, FNA adequacy, repeat aspirations, ROSE utilization, costs, satisfaction, safety events). We excluded isolated case reports, commentaries, review articles without original data, studies without a clear OSC concept, and papers lacking relevant outcomes.

Information sources and search strategy. MEDLINE/PubMed, Scopus, and Web of Science were searched from 2000 to 14 August 2025. No language restrictions were applied; in practice, English, Spanish, Portuguese, French, German, and Serbo-Croatian were covered. We used combinations of keywords and controlled vocabulary (database-specific):

("one-stop" OR "same-day" OR "high-resolution clinic" OR "rapid access clinic") AND (thyroid OR "thyroid nodule") AND (ultrasound OR FNA OR "fine-needle aspiration" OR ROSE OR cytology) AND (clinic* OR pathway OR workflow OR organization OR efficiency OR cost).*

Reference and citation snowballing was additionally performed in relevant papers (11–14).

Study selection. Titles/abstracts were screened in duplicate, with disagreements resolved by consensus. Potentially relevant records were retrieved in full text; inclusion was decided against pre-specified criteria. The selection flow will be presented in a PRISMA 2020 diagram (13).

Data extraction. A standardized template (piloted on 5 studies) captured: OSC model characteristics (disciplines involved; availability of US, FNA, ROSE; same-visit logistics), protocols (TI-RADS, Bethesda), flow metrics (lead time to decision; number of visits), diagnostic performance (FNA adequacy, repeat aspirations), economic indicators (direct costs, savings), patient satisfaction, and safety (complications). Data were matched/deduplicated by author, year, institution, and period.

Assessment of methodological characteristics (optional). Although formal quality appraisal is not required in scoping reviews (11–12), we planned descriptive mapping of potential sources of bias; for non-randomized comparative studies we referenced ROBINS-I domains (15). For diagnostic accuracy studies (e.g., US/TI-RADS vs. cytology/histology) we noted STARD 2015 elements (16); for observational studies, STROBE elements (17).

Synthesis and presentation. Results will be presented narratively by domain: (i) organizational models and workflows; (ii) KPI set; (iii) outcomes (time, visits, FNA/ROSE adequacy, costs, satisfaction, safety); (iv) contextual factors (facility type, resources). Where methodologically appropriate and homogeneous metrics are available, descriptive statistics will be summarized (e.g., median/IQR for time to decision) without formal meta-analysis (11–12).

Ethics. Previously published and aggregated data without identifiers were used; therefore, ethics approval was not required (11–12).

PROCESS MODELS OF "ONE-STOP" CLINICS (ORGANIZATION AND WORKFLOW)

Definition and aim. A one-stop clinic (OSC) for thyroid nodular disease organizes the clinical examination, ultrasound (US), US-guided FNA when indicated (with ROSE if needed), and the initial treatment decision within a single visit, relying on standardized tools (ACR/EU-TIRADS; Bethesda) and clearly defined protocols (2–4, 6–8, 10).

A) Standard workflow (example operating protocol)

1) Pre-arrival (e-intake and triage)
   - Electronic intake form with reasons for referral and prior results (TSH/FT4/anti-TPO, prior US/FNA).
   - Preliminary US-based risk stratification (if a prior report exists) and scheduling of the OSC slot with expected duration (2–3).
2) Check-in and clinical assessment
   - Endocrine history and examination; verification of indication for US and potential FNA according to ACR/EU-TIRADS thresholds (2–3).
   - Mandatory time-stamps (check-in, start of US, FNA decision) to track lead-time metrics.
3) US and FNA decision-making
   - Standardized US protocol (size, composition, echogenicity, margins, calcifications, shape; TI-RADS score) (2–3).
   - FNA decision based on TI-RADS category and size; informed consent and shared decision-making (1–3, 5).
4) US-guided FNA (ROSE as needed)
   - 25–27G needle; 2–4 passes, direct smears + cell block.
   - ROSE (rapid on-site evaluation) to verify adequacy; especially useful where baseline inadequacy is higher or operators are in training (9).
   - Alternative/combination: telecytology to provide remote ROSE support (e.g., real-time video) when a cytopathologist is not physically present (18).
5) Preliminary integration of findings and plan
   - Brief huddle among endocrinologist–radiologist–cytopathologist: provisional Bethesda classification (if rapid assessment available) and documented decision: surveillance / additional diagnostics (repeat FNA, molecular testing) / surgical evaluation (4–5, 9).
   - Documented individualized plan and patient education; appointment to deliver final cytology and MDT as needed.

6) Same-day–patient perspective
   - OSC models consistently show fewer visits and shorter time to decision, with high satisfaction; "high-resolution" endocrinology clinics additionally demonstrate economic benefits (6–8).
   - In same-day FNAC diagnosis models, a faster decrease in anxiety measured by the STAI scale has been reported (19).

OSC management should be aligned with the concept of "value" and the "Triple Aim" framework (outcomes, experience, cost), because KPIs must reflect what is clinically and organizationally most important (20–21).

B) Implementation variants (resource-dependent)

- OSC-Lite: US + FNA in a single visit, without formal ROSE; focus on shortening time-to-decision, with targeted repeat FNA the next day if the initial result is Bethesda I (4,6).
- OSC with ROSE (on-site or telecytology): maximal reduction of Bethesda I proportion and repeat aspirations (9, 18).
- OSC with same-day preliminary cytology: where logistics allow rapid staining and evaluation; preliminary report + final verification (4, 9, 18).

C) In-process quality control

- Standardization of US reports (ACR/EU-TIRADS) and consistent application of FNA indications (2–3).
- FNA adequacy: aim for a low Bethesda I proportion; ROSE has been shown to increase adequacy and reduce repeat aspirations (9, 22–23).
- Procedure time and logistics: ROSE can reduce deferred rescheduling but may sometimes prolong the individual procedure; balance via scheduling and resources (9, 23–24).
- Safety: track post-FNA adverse events (bleeding, vasovagal reactions) and "rescue" slots (5).
- MDT case review for borderline/indeterminate cases to reduce unnecessary interventions (1, 4–5).

PROPOSED KPI SET FOR OSCs

Framework and principles. Group KPIs into operational, clinical, economic, and experience indicators, aligned with a value-based approach and the Triple Aim paradigm (20–21). Set thresholds according to local baseline performance and priorities.

1) Operational KPIs (flow efficiency)

- Lead time from referral to initial plan (days); report median and IQR (6–8, 10).
- Proportion of patients completed in a single visit (%) (US ± FNA ± plan) (6–8).
- Proportion of FNAs performed the same day after US (%) (6–7).
- Proportion of FNAs with ROSE (%) and procedure time (min); benefit vs. resource burden (9, 23–24).
- Repeat FNA rate within ≤90 days (%) (lower is better) (4, 9).

2) Clinical KPIs (diagnostic quality/outcomes)

- Bethesda I (nondiagnostic) (%): target ≤10% with an optimal process; reduction expected after introducing ROSE (4, 9, 22).
- Distribution of Bethesda II–VI (%) and conversion to a definitive diagnosis (4).
- Rate of "benign" surgeries (%) among operated cases (indicator of appropriate selection) (1, 5).
- Time to surgical decision / to procedure (days) for Bethesda V–VI (6–7).
- Post-FNA adverse event rate (%) (5).

3) Economic KPIs (cost and utilization)

- Cost per episode (visit + US ± FNA ± ROSE) and savings per avoided visit (6–8).
- Incremental cost per adequate FNA with vs. without ROSE; cost-effectiveness depends on baseline adequacy and the cost of ROSE (22–23).

  – Practical thresholds: routine ROSE tends not to be cost-effective if baseline adequacy without ROSE is ≥85% and/or ROSE costs are high; it becomes cost-effective with lower baseline adequacy and/or lower ROSE cost (23).

4) Patient experience

- Satisfaction (Likert/NPS) after the OSC visit (7–8).
- Change in anxiety (STAI-6) pre/post visit in same-day diagnostic models (19).

Implementation note: Automate KPI capture from HIS/RIS/LIS (time-stamps, procedure codes, cytology); use monthly run-chart reviews and quarterly MDT audits (20–21).

OUTCOMES OF "ONE-STOP" CLINICS FROM THE LITERATURE

Summary of findings. In "one-stop"/high-resolution endocrinology clinics for thyroid nodular disease, studies consistently report fewer visits and shorter time to decision, together with good diagnostic adequacy, high patient satisfaction, and cost rationalization. Effects are most pronounced when US-based risk stratification (ACR/EU-TIRADS) and standardized FNA (with ROSE/telecytology where appropriate) are integrated into the same visit (6–9, 19, 22–23, 25–27, 32).

1) Time and flow efficiency

Implementing a "one-stop" model (US + same-day US-FNA in an endocrinology/surgical clinic) reduces the number of visits and shortens the median time to a treatment plan (e.g., 42→14 days) (6). In national experiences with high-resolution clinics, a second follow-up visit became unnecessary in 21–42% of cases, and radiology requests for thyroid US declined substantially, with measurable savings (7–8). Clinical pathway analyses further indicate that the key bottleneck is often scheduling US in radiology, which the OSC model overcomes by integrating US into the first visit (25).

2) Diagnostic quality (adequacy and repeat FNA)

Systematic and institutional analyses show that ROSE lowers the Bethesda I rate and optimizes the number of passes, although the effect varies by context (9, 22, 26–27). In a large series, ROSE shortened procedure time and reduced the number of needle passes (27), while meta-analyses confirm improved adequacy (9, 22). Introducing telecytology can reduce inadequacy to ~2–4%, approaching the performance of on-site cytopathology in centers without continuous on-site availability (32).

3) Patient experience

Models with same-day FNAC diagnosis lead to a rapid decrease in anxiety (STAI) while maintaining high diagnostic accuracy (19). Surveys show high user satisfaction in high-resolution clinics (mean ~4/5) (8).

4) Economics

Beyond direct savings from fewer appointments and fewer external US examinations (7–8), cost-effectiveness analyses for ROSE indicate that its value is context-dependent: ROSE is more likely to be cost-effective where baseline inadequacy is higher and/or ROSE costs are lower (23, 28). Otherwise, selective use (e.g., for "difficult" nodules or during training) may be more rational (22–23, 26–28).

5) Safety

US-guided FNA is a safe procedure with very low rates of serious adverse events (29–30). In a large cohort of core-needle biopsy (CNB) as an adjunct method, overall complications were ~0.8%, and serious events ~0.06% (31). In an OSC environment, standardized informed-consent protocols and post-procedural monitoring support safety (5, 29–31).

Conclusion: When protocols align with ACR/EU-TIRADS and Bethesda, and ROSE/telecytology is used selectively, OSCs for thyroid disease deliver faster, value-oriented diagnostics with high satisfaction and controlled costs, without compromising safety (6–9, 19, 22–23, 25–32).

DISCUSSION

Interpretation of key findings. In line with findings from multiple health systems, the "one-stop" (OSC) model for thyroid nodular disease yields shorter time to decision, fewer visits, and rationalized costs without compromising safety (6–8, 10, 22–23, 29–31). Effects are most pronounced when ACR/EU-TIRADS and Bethesda are applied consistently, and ROSE/telecytology is used selectively in contexts with a higher risk of inadequate samples (2–4, 9, 18, 22–23, 32). This organization aligns with the principles of value-based health care and the Triple Aim paradigm (20–21).

Implications for clinical practice. For institutions with limited radiology and cytopathology capacity, OSCs "bridge" bottlenecks by integrating US and (when needed) FNA into the same visit, thereby reducing delays and unnecessary handoffs (6–8, 25). ROSE has been shown to increase adequacy and reduce repeat aspirations, but routine use is not universally the most rational approach; economic models show that cost-effectiveness depends on baseline inadequacy rates and the cost of ROSE, arguing for targeted (selective) use–e.g., with operators in training, cystic/technically challenging nodules, or where baseline inadequacy is high (9, 22–23). Telecytology is a viable alternative where an on-site cytopathologist is not available, lowering inadequacy toward 2–4% (18, 32).

Organizational requirements. OSCs require a clear role protocol (endocrinologist–radiologist–cytopathologist), standardized US reports (TI-RADS), routine recording of time stamps, and embedded templates for Bethesda classification (2–4). For a same-day workflow, technical preparation (needle sets, rapid stains) and logistical slots for ROSE/telecytology are needed (9,18,22–23,32). The safety profile of FNA remains favorable with standardized consent and post-procedural monitoring (29–31).

Performance monitoring and data-driven management. The proposed KPI framework should be tied to patient value (20) and the Triple Aim (21): lead time to

decision, share of episodes completed in a single visit, Bethesda I (%), share of FNAs with ROSE, repeat FNA rates, cost per episode, and satisfaction. Operationally, the simplest way to track changes is via monthly run-chart displays, with thresholds for rapid team response (35). When performance declines (e.g., rising Bethesda I), the first step is a root-cause analysis: sampling technique, number of passes, availability of ROSE/telecytology, staff training (9, 22–23, 35).

Limitations of the evidence. Most available studies are observational (pre–post, case series) and heterogeneous in outcome definitions, which limits meta-analytic synthesis and introduces risks of bias (15,17). Diagnostic accuracy studies do not always implement STARD elements, and economic evaluations vary in perspective and cost components (16, 22–23). Multicenter, prospective evaluations with harmonized KPI definitions and transparent economic models are needed.

Recommendations for implementation in our setting.

1. Phased introduction of OSCs with a clearly defined US/FNA protocol, time-stamp capture, and standardized TI-RADS/Bethesda reporting (2–4).
2. Selective ROSE (or telecytology) focused on "difficult" nodules and/or training programs; periodic re-evaluation of cost-effectiveness (9, 18, 22–23, 32).
3. KPI package: lead time, Bethesda I, repeat FNA ≤90 days, single-visit completion rate, cost per episode, satisfaction; run-charts with quarterly MDT audit (20–21, 35).
4. Implementation frameworks: structure planning and evaluation using CFIR domains (intervention, inner/outer setting, individuals, process) and RE-AIM (reach, effectiveness, adoption, implementation, maintenance) for translation and scale-up (33–34).

Research gaps. We lack standardized thresholds for targeting ROSE within OSCs, robust estimates of OSC impact on "benign" surgeries and long-term outcomes, and comparative studies of different telecytology models (9, 18, 22–23, 32).

CONCLUSION

In our view, the one-stop clinic (OSC) model for thyroid nodular disease is the most rational way to make the diagnostic pathway faster, clearer, and more predictable for both patients and the care team. Integrating the clinical examination, standardized ultrasound, and–where appropriate–US-guided FNA with rapid adequacy assessment (ROSE/telecytology) into a single visit naturally removes unnecessary steps and reduces process variability.

We consider the keys to OSC success to be the consistent application of TI-RADS/Bethesda protocols, shared decision-making within a compact, co-located (or virtually networked) endocrinology–radiology–cytopathology unit, and active time management using mandatory time stamps. Such an organization allows the team to see daily where bottlenecks arise and to intervene promptly.

We recommend ROSE and/or telecytology selectively: for technically demanding nodules, operators in training, and settings with a higher baseline rate of inadequacy. This balances the additional resource commitment against gains in adequacy and reductions in repeat aspirations.

We propose a pragmatic KPI package for routine monitoring of OSC performance: (1) lead time from referral to initial plan, (2) proportion of episodes completed in a single visit, (3) Bethesda I (%), (4) proportion of FNAs with ROSE, (5) repeat FNA within ≤ 90 days, (6) cost per episode, and (7) patient satisfaction. As starting targets for the first year, we suggest: lead time ≤ 14 days, ≥ 70% of episodes completed in a single visit, Bethesda I ≤ 10%, repeat FNA ≤ 10%, and an average satisfaction score ≥ 4/5; after the process stabilizes, targets should be tightened.

For resource-limited institutions, we advocate a phased approach: OSC-Lite (US + FNA in a single visit, without routine ROSE) as a pilot, followed by targeted introduction of ROSE/telecytology and expansion to a full OSC model, with quarterly reviews of protocols and KPIs.

In our opinion, research priorities include developing standardized KPI definitions for OSCs, evaluating the impact of OSCs on "benign" surgeries and long-term outcomes, and building robust economic models that incorporate the perspectives of patients and payers. We believe these steps are sufficient for OSCs to become a sustainable standard of practice in clinical settings similar to ours.

References

1. Haugen BR, Alexander EK, Bible KC, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2016; 26(1): 1–133. doi:10.1089/thy.2015.0020
2. Tessler FN, Middleton WD, Grant EG, et al. ACR Thyroid Imaging, Reporting and Data System (TI-RADS): White Paper of the ACR TI-RADS Committee. J Am Coll Radiol. 2017; 14(5): 587–595. doi:10.1016/j.jacr.2017.01.046
3. Russ G, Bonnema SJ, Erdogan MF, Durante C, Ngu R, Leenhardt L. EU-TIRADS. Eur Thyroid J. 2017; 6(5): 225–237. doi:10.1159/000478927
4. Cibas ES, Ali SZ. The 2017 Bethesda System for Reporting Thyroid Cytopathology. Thyroid. 2017; 27(11): 1341–1346. doi:10.1089/thy.2017.0500
5. Durante C, Grani G, Lamartina L, Filetti S, Mandel SJ, Cooper DS. The Diagnosis and Management of Thyroid Nodules: A Review. JAMA. 2018; 319(9): 914–924. doi:10.1001/jama.2018.0898
6. Patel R, Skandarajah A, Gorelik A, et al. One-stop thyroid nodule clinic with same-day fine-needle aspiration cytology improves efficiency of care. ANZ J Surg. 2018; 88(4):354–358. doi:10.1111/ans.13833
7. Carral F, Ayala MC, Jiménez AI, García C. Care and economic impact of thyroid ultrasound examination at single visits to endocrinology clinics (ETIEN 1). Endocrinol Nutr. 2016; 63(2): 64–69. doi:10.1016/j.endonu.2015.10.008

8. Díaz-Soto G, Torres B, López Gómez JJ, et al. Economic impact of and satisfaction with a high-resolution thyroid nodule clinic. Endocrinol Nutr. 2016; 63(8): 414–420. doi:10.1016/j.endonu.2016.04.005
9. Witt BL, Schmidt RL. Rapid onsite evaluation improves the adequacy of fine-needle aspiration for thyroid lesions: meta-analysis. Thyroid. 2013; 23(4): 428–435. doi:10.1089/thy.2012.0211
10. Krishna A, Mishra SK, Mishra A, et al. One-stop thyroid clinic in a low- and middle-income country. S Afr J Surg. 2022; 60(3): 189–194. doi:10.17159/2078-5151/SAJS3633
11. Tricco AC, Lillie E, Zarin W, et al. PRISMA-ScR. Ann Intern Med. 2018; 169(7): 467–473. doi:10.7326/M18-0850
12. Peters MDJ, Marnie C, Tricco AC, et al. JBI guidance for scoping reviews. JBI Evid Synth. 2020; 18(10): 2119–2126. doi:10.11124/JBIES-20-00167
13. Page MJ, McKenzie JE, Bossuyt PM, et al. PRISMA 2020 statement. BMJ. 2021; 372: n71. doi:10.1136/bmj.n71
14. Rethlefsen ML, Kirtley S, Waffenschmidt S, et al. PRISMA-S. Syst Rev. 2021; 10(1): 39. doi:10.1186/s13643-020-01542-z
15. Sterne JAC, Hernán MA, Reeves BC, et al. ROBINS-I. BMJ. 2016; 355: i4919. doi:10.1136/bmj.i4919
16. Bossuyt PM, Reitsma JB, Bruns DE, et al. STARD 2015. BMJ. 2015; 351: h5527. doi:10.1136/bmj.h5527
17. von Elm E, Altman DG, Egger M, et al. STROBE. PLoS Med. 2007; 4(10): e296. doi:10.1371/journal.pmed.0040296
18. Post R, Chai SM, Wang L, et al. Telecytology ROSE with real-time streaming: comparative study. Diagn Cytopathol. 2023; 51(11): E383–E391. doi:10.1002/dc.25228
19. Lodewijk L, Vriens MR, Vorselaars WMC, et al. Same-Day FNAC reduces anxiety and maintains accuracy. Endocr Pract. 2016; 22(5): 561–566. doi:10.4158/EP151036.OR
20. Porter ME. What is value in health care? N Engl J Med. 2010; 363(26): 2477–2481. doi:10.1056/NEJMp1011024
21. Berwick DM, Nolan TW, Whittington J. The Triple Aim: care, health, and cost. Health Aff (Millwood). 2008; 27(3): 759–769. doi:10.1377/hlthaff.27.3.759
22. Pastorello RG, de Almeida DC, de Morais RM, et al. Impact of ROSE on thyroid FNAB: meta-analysis. Cancer Cytopathol. 2018; 126(12): 995–1006. doi:10.1002/cncy.22051
23. Zanocco K, Pitelka-Zengou L, Dalal S, et al. Cost-effectiveness of on-site adequacy for initial US-guided FNA. Ann Surg Oncol. 2013; 20(8): 2462–2467. doi:10.1245/s10434-013-2954-1
24. O'Malley ME, Weir MM, Hahn PF, et al. US-guided FNA: adequacy & time with/without immediate cytology. Radiology. 2002; 222(2): 383–387. doi:10.1148/radiol.2222010201
25. Sifontes-Dubón M, García-López JM, González-Ortega N, Pazos-Couselo M. Clinical pathway timings & delays in thyroid cancer. J Clin Med. 2021; 10(23): 5681. doi:10.3390/jcm10235681
26. Michael CW, Kameyama K, Kitagawa W, Azar N. ROSE: benefits, challenges, solutions. Gland Surg. 2020; 9(5): 1708–1715. doi:10.21037/gs-2019-catp-23

27. Jiang D, Zang Y, Jiang D, Zhang X, Zhao C. Value of ROSE for US-guided thyroid FNA. J Int Med Res. 2019; 47(2): 626–634. doi:10.1177/0300060518807060
28. Pearson LN, Layfield LJ, Eapen GA, Michael CW. Cost-effectiveness of ROSE by non-pathologists. Cancer Cytopathol. 2018; 126(10): 839–845. doi:10.1002/cncy.22047
29. Park JY, Choi W, Hong AR, et al. Harms of thyroid FNA: systematic review. Endocrinol Metab (Seoul). 2023; 38(1): 104–116. doi:10.3803/EnM.2023.1669
30. Lee YH, Baek JH, Jung SL, et al. US-guided FNA: basics and practical points. Korean J Radiol. 2015; 16(2): 391–401. doi:10.3348/kjr.2015.16.2.391
31. Ha EJ, Baek JH, Lee JH, et al. Complications after US-guided core-needle biopsy (n=6,169). Eur Radiol. 2017; 27(3): 1186–1194. doi:10.1007/s00330-016-4461-9
32. Lin DM, Tracht J, Rosenblum F, et al. Telecytology ROSE reduced unsatisfactory rates. Am J Clin Pathol. 2020; 153(3): 342–345. doi:10.1093/ajcp/aqz164
33. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. CFIR framework. Implement Sci. 2009; 4: 50. doi:10.1186/1748-5908-4-50
34. Glasgow RE, Vogt TM, Boles SM. RE-AIM framework. Am J Prev Med. 1999; 16(1): 50–57. doi:10.1016/S0749-3797(99)00158-0
35. Perla RJ, Provost LP, Murray SK. The run chart: learning from variation. BMJ Qual Saf. 2011; 20(1): 46–51. doi:10.1136/bmjqs.2010.044843