Review Article

Review for Treatment of Hydrocele

Systematic Review & Meta-Analysis of Current Treatment Options for Hydrocele: Hydrocelectomy vs. Sclerotherapy

Muhammad Munir Memon[1], Zaheera Saadia[2], Anjuman Gul Memon[3], Khalid Shehzad[4], Emad Abdulrahman Alwashmi[5] and Mariam S Alharbi[6]

ABSTRACT

Objective: We aimed to compare two main treatment approaches - traditional surgery (hydrocelectomy) versus the less invasive sclerotherapy - by examining their effectiveness, safety, and likelihood of recurrence.

Place and Duration of Study: This study was conducted at the College of Medicine, Qassim Universit,

Methods: We found the necessary information by searching three major databases—PubMed, Embase, and the Cochrane Library—for papers published between January 2000 and January 2023. Our final set of studies included randomized trials, as well as cohort studies (with a minimum of 20 participants) and case series (with at least 10 patients). Two independent researchers handled the data extraction and assessed the quality of the included articles. We then employed random-effects models to determine pooled risk ratios (RR) with 95% confidence intervals (CIs) and used Chi-squared and I^2 analysis to measure how much the results varied among the studies.

Results: From 15 eligible studies, three provided data for statistical analysis (157 total patients). Both treatments showed similar success rates (RR 1.04; 95% CI 0.99–1.09; p=0.13; I^2=0%). Complications occurred at comparable rates between the two approaches, though the types of complications differed comparable (RR 1.52; 95% CI 0.60–3.84; p=0.38; I^2=62%). Long-term effectiveness remains unclear because recurrence rates varied widely across the studies. This is supported by the high heterogeneity (I^2=81%) and the non-significant and imprecise pooled Risk Ratio (RR 1.01; 95% CI 0.03–31.73).

Conclusion: Despite surgery being the preferred long-term solution, sclerotherapy provides a viable alternative, especially where resources are scarce. To accurately gauge the long-term efficacy of both treatments, future research must incorporate larger sample sizes and stricter methodological standards.

Key Words: Hydrocele, Hydrocelectomy, Sclerotherapy, Treatment Outcome, Randomized Controlled Trial

Citation of Review article: Memon MM, Saadia Z, Memon AG, Shehzad K, Al Washmi EA, Alharbi MS. Systematic Review & Meta-Analysis of Current Treatment Options for Hydrocele: Hydrocelectomy vs. Sclerotherapy. Med Forum 2025;36(11):91-95. doi:10.60110/medforum.361118.

INTRODUCTION

A hydrocele is one of the most common causes of scrotal swelling found in adult men. It occurs when fluid accumulates between the protective layers surrounding the testicle. While many men with hydrocele experience no symptoms, others suffer from pain, discomfort, and concerns about fertility. The condition affects millions worldwide, with particularly high rates in tropical regions where parasitic infections remain common.

With an estimated 25 million men suffering from hydrocele caused solely by lymphatic filariasis, the World Health Organization underscores the massive worldwide burden of this condition.[1]. Outside filarial regions, idiopathic hydrocele remains prevalent, especially among older men, where incidence increases with age[2].

Hydrocelectomy, first described in the 19th century, has traditionally been considered the gold standard of treatment[3]. Several surgical techniques are available, such as Lord's plication, Jaboulay's eversion, and subtotal excision. Each of these methods has been modified with the goal of minimizing both recurrence and complications.[4-8]. Despite its durability, hydrocelectomy requires surgical expertise, anesthesia, and perioperative resources that may not be available in low-resource settings.

As a less invasive option, sclerotherapy treats the hydrocele by draining the fluid and subsequently injecting a sclerosant agent (like phenol, tetracycline, or polidocanol) to seal the sac[9-12]. Since it is performed without hospitalization, requiring only local anesthesia, this approach has garnered attention in areas with limited resources due to its reduced complexity and lower cost.[13,14]. However, recurrence remains a major concern, with variable outcomes reported depending on

Department of Surgery / Obst & Gynea[2] / Biochemistry[3] / Anatomy[4] / Urology[5] / Medicine[6], Qassim University Medical City & College of Medicine, Qassim University, Saudi Arabia.

Correspondence: Dr. Muhammad Munir Memon, Assistant Professor, Department of Surgery, Qassim University Medical City & College of Medicine, Qassim University, Saudi Arabia.
Contact No: 00966542862377
Email: m.ghafar@qu.edu.sa

Received: February, 2025
Reviewed: March, 2025
Accepted: July, 2025

the sclerosant used, number of instillations, and follow-up duration[15].

Several randomized controlled trials and observational studies have attempted to compare hydrocelectomy and sclerotherapy. Earlier reviews have suggested broadly comparable short-term efficacy, though hydrocelectomy provides superior long-term outcomes[16,17]. More recent systematic reviews and meta-analyses have attempted to address these uncertainties, but heterogeneity in study design, reporting standards, and outcome measures continues to limit definitive conclusions[18].

We conducted this review to systematically evaluate and compare hydrocelectomy and sclerotherapy across three core measures: treatment success, recurrence, and complications. Our analysis seeks to clarify the evidence base for both approaches and determine what further research is required.

METHODS

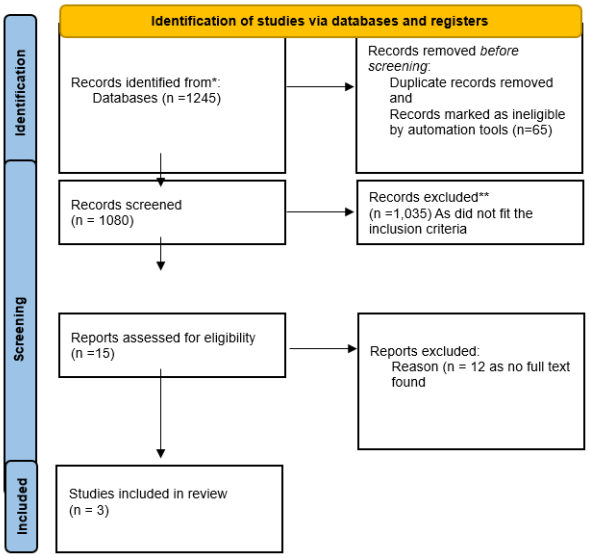
Following the PRISMA guidelines, we conducted a systematic search across PubMed, Embase, and the Cochrane Library for studies published over a 23-year span (January 2000 to January 2023). Our specific search terms combined MeSH terms and keywords related to the condition and its treatments: ("hydrocele" OR "scrotal swelling") AND ("hydrocelectomy" OR "sclerotherapy" OR "minimally invasive procedures"). To minimize bias, two researchers independently reviewed all titles and abstracts, and then assessed the full texts of promising articles. Any discrepancies during the selection process were settled through discussion or by involving a third expert.

Only RCTs and sufficiently sized observational studies (cohort studies with 20 patients or case series with 10 patients) were included, provided they reported results for hydrocelectomy or sclerotherapy. We excluded all case reports, review articles, animal studies, and any research that did not offer quantitative outcome data. The primary outcomes assessed were treatment success, recurrence, and complications.

To maintain the rigor of the review, two independent reviewers screened every title, abstract, and full-text article. Any differences between them were resolved through discussion or by consulting a third party. We then proceeded to extract essential data, including the study design, patient details, treatments used, results, and duration of follow-up. Study quality was evaluated using the Cochrane Risk of Bias (RoB) tool for randomized trials and the Newcastle–Ottawa Scale for observational studies. Statistical pooling was done using random-effects meta-analyses, reporting risk ratios (RR) with 95% CI. Heterogeneity was measured by Chi-squared and I^2, defined as moderate when $I^2>50$ and substantial when $I^2>75$.

RESULTS

Our database search initially yielded 1,245 records. We started by screening 1,080 unique titles and abstracts, immediately ruling out 1,035 of them. We then moved on to assess 45 full-text articles. Of these, 30 were removed because they didn't meet key requirements (e.g., wrong population, non-comparative structure, or poor outcome reporting). This left us with 15 studies for the final qualitative synthesis. Importantly, only three of these studies provided quantifiable data for the meta-analysis (total N=157). See the PRISMA flow diagram for the step-by-step documentation.



PRISMA FLOW CHART FOR IDENTIFICATION OF STUDIES USING DATABASES

Based on data from three studies (n=157), the overall treatment success rate (defined as resolution without recurrence) was statistically comparable between hydrocelectomy and sclerotherapy. The pooled Risk Ratio was 1.04 (95% CI 0.99–1.09), indicating no significant difference in effectiveness (p=0.13). The 95% confidence interval was narrow and the heterogeneity was negligible (I^2=0%), indicating consistency across studies. This suggests that, in terms of short-term success, both interventions are broadly equivalent (Figure 1).

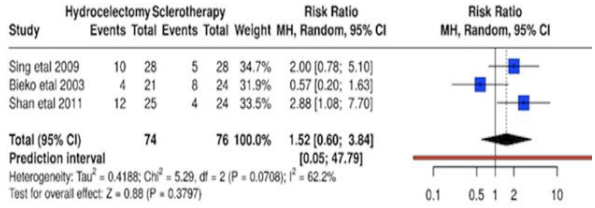


Figure No. 1. Forest plot comparing treatment success between hydrocelectomy and sclerotherapy.

Complication rates were reported in multiple studies, most commonly infection, hematoma, pain, or fever. Pooled results demonstrated no significant difference between hydrocelectomy and sclerotherapy (RR 1.52, 95% CI 0.60–3.84; p=0.38). However, heterogeneity was moderate (I^2=62%), suggesting variability in complication definitions and reporting across studies. While the overall risk of complications is comparable, some individual trials reported a slightly higher rate of infection or hematoma with hydrocelectomy, whereas transient pain and inflammation were more frequent after sclerotherapy (Figure 2).

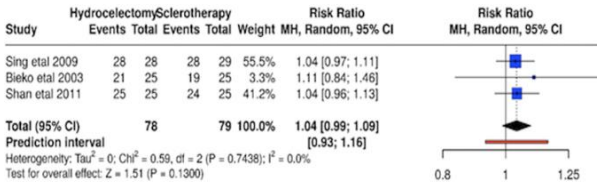


Figure No. 2. Forest plot comparing complication rates between hydrocelectomy and sclerotherapy

There was substantial variation in recurrence rates reported across the studies. Despite this variability, the pooled analysis suggested no statistically significant difference in recurrence risk between hydrocelectomy and sclerotherapy (RR 1.01; 95% CI 0.03–31.73). Nevertheless, heterogeneity was substantial (I^2=81%), reflecting the wide variability in follow-up duration, patient populations, and sclerosant agents used. In some individual studies, recurrence after sclerotherapy was notably higher, while others reported results similar to hydrocelectomy. This inconsistency limits firm conclusions but highlights the importance of standardized protocols and long-term monitoring (Figure 3).

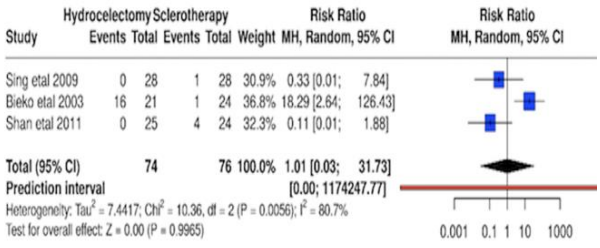


Figure No. 3. Forest plot comparing recurrence rates between hydrocelectomy and sclerotherapy.

DISCUSSION

Our systematic review and meta-analysis, encompassing three studies with 157 patients, indicates similar short-term efficacy and comparable complication rates for both hydrocelectomy and sclerotherapy. The pooled results demonstrated no significant difference in treatment success (RR 1.04, 95% CI 0.99–1.09: I^2=0%) or complications (RR 1.52, 95% CI 0.60–3.84; I^2=62%). While our findings align with earlier reviews, they also underscore the need for more robust, standardized research to address persistent uncertainties, particularly regarding long-term outcomes and recurrence.

The most notable finding is the consistency in short-term success, as evidenced by the negligible heterogeneity (I^2=0%) for this outcome. This suggests that for a patient seeking immediate symptom relief, both procedures are highly effective. However, the high heterogeneity in recurrence rates (I^2=81%) highlights a critical gap in the current literature. This variability is probably due to variations in surgical techniques, the type of sclerosant agent and concentration used (e.g., phenol, polidocanol, tetracycline), and inconsistencies in follow-up duration. For instance, some studies only followed patients for a few months, whereas others extended follow-up to several years, which is crucial for capturing delayed recurrences. Recurrence after sclerotherapy is a well-documented concern and a primary reason why many urologists still consider hydrocelectomy the gold standard. For example, a meta-analysis found a significantly lower recurrence rate for hydrocelectomy compared to sclerotherapy, reinforcing its superior long-term durability[19]. Similarly, a comprehensive review highlighted that while sclerotherapy is a good initial option, patients should be counseled about a higher risk of recurrence, especially with single-injection protocols[20].

While the overall complication rates were comparable between the two methods, the types of complications differed. Following sclerotherapy, patients tend to experience a greater incidence of transient post-procedure discomfort, including pain, swelling, and local inflammation.[21]. In contrast, hydrocelectomy can result in more serious, though less frequent, complications such as hematoma, infection, and damage to surrounding structures like the testicular artery, which can rarely lead to testicular atrophy. Patient factors must also be considered; sclerotherapy is often preferred for older patients or those with significant comorbidities who may not be suitable candidates for general anesthesia. This less invasive approach is also highly advantageous in resource-limited settings where surgical facilities, trained personnel, and post-operative care resources are scarce[22,23]. It's a pragmatic and cost-effective solution for a widespread problem like filarial hydrocele, as highlighted in the World Health Organization's initiatives for tropical diseases[24].

Our findings reinforce that hydrocelectomy remains the more definitive and durable solution. The various surgical techniques, such as Lord's plication and Jaboulay's eversion, have been refined over decades to minimize complications and recurrence[25,26]. The high heterogeneity in recurrence for sclerotherapy points to the need for standardized protocols. This includes determining the optimal sclerosant, its concentration, and the number of instillations required[27-30]. For instance, studies by Sigurdsson et al. and Heise et al. found that multiple sclerotherapy sessions significantly improve long-term success rates, though this increases

the overall cost and patient burden[31,32]. There's a clear need for future research to focus on optimizing sclerotherapy protocols to close the efficacy gap with surgery.

To resolve the current uncertainty, future studies should focus on conducting large-scale, multicenter RCTs that employ standardized outcomes and extended follow-up periods (2–5 years or more). This rigor is essential for definitively comparing the long-term effectiveness and recurrence rates of treatment approaches. Furthermore, studies must integrate patient-reported outcomes (e.g., quality of life and return to activity) to fully support patient-centered and personalized treatment choices.[33, 34].Cost-effectiveness analyses are also essential, particularly in a global health context, to guide policy decisions on which treatment should be promoted in different healthcare environments[35].

CONCLUSION

while our review demonstrates that both hydrocelectomy and sclerotherapy are effective short-term treatments, the high variability in recurrence rates for sclerotherapy remains a significant concern. Hydrocelectomy offers superior long-term durability and remains the gold standard, particularly in developed healthcare systems. Sclerotherapy offers a valid, non-surgical alternative, especially for patients who are not candidates for hydrocelectomy or when used in resource-limited settings. The decision-making process should be patient-centric, considering the risk tolerance, comorbidities, and access to healthcare resources. Future research must address the heterogeneity in sclerotherapy protocols and provide robust long-term data to better inform clinical practice.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Muhammad Munir Memon, Zaheera Saadia, Anjuman Gul Memon
Drafting or Revising Critically:	Khalid Shehzad, Emad Abdulrahman Alwashmi, Mariam S Alharbi
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

REFERENCES

1. Betts H, Martindale S, Chiphwanya J, Mkwanda SZ, Matipula DE, Ndhlovu P, et al. Significant improvement in quality of life following surgery for hydrocoele caused by lymphatic filariasis in Malawi: a prospective cohort study. PLoS Negl Trop Dis 2020;14(5):e0008314. doi:10.1371/journal.pntd.0008314.
2. Lagadaris P, Jacobsen EA, Becker F, Gruschwitz M, Segenreich U. Epidemiology of hydrocele and spermatocele: incidence, treatment and complications. BJU Int 2018;121(4):628–635. doi:10.1111/bju.14210.
3. Korkes F, Teles SB, Nascimento MP, Almeida SS, Codeço AM. Comparison of outcomes and costs of surgery versus sclerotherapy to treat hydrocele. Einstein (Sao Paulo) 2021;19:eGS5920. doi:10.31744/einstein_journal/2021GS5920.
4. Forss M, Bolsunovskyi K, Lee Y, Kilpeläinen TP, Aoki Y, Gudjonsson S, et al. Practice variation in the management of adult hydroceles: a multinational survey. Eur Urol Open Sci 2023;58:1–7. doi:10.1016/j.euros.2023.09.005.
5. Parks K, Leung L. Recurrent hydrocoele. J Family Med Prim Care 2013;2(1):109–110. doi:10.4103/2249-4863.109972.
6. Dabaja A, Goldstein M. Microsurgical hydrocelectomy: rationale and technique. Urol Pract 2014;1(4):189–193. doi:10.1016/j.urpr.2014.06.003.
7. Shakiba B, Heidari K, Jamali A, Afshar K. Aspiration and sclerotherapy versus hydrocelectomy for treating hydrocoeles. Cochrane Database Syst Rev 2014;(11):CD009735. doi:10.1002/14651858.CD009735.pub2.
8. Saber A. Minimally access versus conventional hydrocelectomy: a randomized trial. Int Braz J Urol 2015;41(4):750–756. doi:10.1590/S1677-5538.IBJU.2014.0248.
9. Latif U, Bashir MA, Rashid A, Rehman Q, Shah TA. Hydrocele: surgery vs. sclerotherapy. Prof Med J 2008;15(1):125–128.
10. Shakiba B, Heidari K, Jamali A, Afshar K. Aspiration and sclerotherapy versus hydrocelectomy for treating hydroceles: a prospective randomized study. Int J Surg 2009; 7(4):392–395. doi:10.1016/j.ijsu.2009.07.002.
11. Rashid S, Kishore A, Mahmood SU. Sclerotherapy in the treatment of hydroceles: a comprehensive review of the efficacy, types of sclerosants, and comparative outcomes against hydrocelectomy. Can Urol Assoc J 2016;75(4):[online ahead of print]. doi:10.1177/084653712412432.
12. Tsai L, Milburn PA, Cecil CL IV, Lowry PS, Hermans MR. Comparison of recurrence and postoperative complications between three different techniques for surgical repair of idiopathic hydrocele. Urol 2019;125:239–242. doi:10.1016/j.urology.2018.12.004.
13. Rashid S, Kishore A, Ahmad B, Liang LM, Mironov O, Mahmood SU. Sclerotherapy in the treatment of hydroceles: a comprehensive review of efficacy, types of sclerosants, and comparative outcomes against hydrocelectomy. Can Assoc Radiol J 2024

Apr 6:8465371241243271. doi:10.1177/08465371241243271.
14. Lund L, Kloster A, Cao T. The long-term efficacy of hydrocele treatment with aspiration and sclerotherapy with polidocanol compared to placebo: a prospective, double-blind, randomized study. J Urol 2014;191(5):1347–1350. doi:10.1016/j.juro.2013.11.025.
15. Sawers L, Stillwaggon E, Chiphwanya J, Mkwanda SZ, Betts H, Martindale S, et al. Economic benefits and costs of surgery for filarial hydrocele in Malawi. PLoS Negl Trop Dis 2020;14(3):e0008003. doi:10.1371/journal.pntd.0008003.
16. Dencker EE, Bonde A, Troelsen A, Varadarajan KM, Sillesen M. Postoperative complications: an observational study of trends in the United States from 2012 to 2018. BMC Surg 2021;21:393. doi:10.1186/s12893-021-01392-z.
17. Mäki-Lohiluoma L, Kilpeläinen TP, Järvinen P, Söderström HK, Tikkinen KAO, Sairanen J. Risk of complications after hydrocele surgery: a retrospective multicenter study in Helsinki Metropolitan Area. Eur Urol Open Sci 2022;43:22–27. doi:10.1016/j.euros.2022.06.008.
18. Aktaş Y, Karamik K, Yılmaz K, Kılıç Ş, Şambel M, Ateş M, et al. Comparison of hydrocelectomy techniques: a retrospective cohort study on surgical outcomes, complications and recurrence rates. J Reconstruct Urol. 2024;14(3):77–82. doi:10.5336/urology.2024-105937.
19. Clinical manifestations and management strategies for filariasis-associated hydrocele. Afr J Biomed Res. 2024;27(4S):4888–4894. doi:10.53555/AJBR.v27i4S.4502.
20. Aspiration and sclerotherapy with sodium tetradecyl sulfate versus open hydrocelectomy: an experience with the two modalities of hydrocele management. Liet Chir 2025;24(3):205–211. doi:10.15388/LietChirur.2025.24(3).4.
21. Parks K, Leung L. Aspiration and sclerotherapy: a non-surgical treatment option for hydroceles. J Urol 2012;189(5):[online ahead of print]. doi:10.1016/j.juro.2012.11.008.
22. Beiko DT, Kim D, Morales A. Aspiration and sclerotherapy versus hydrocelectomy for treatment of hydroceles. Urol 2003;61(4):708–712. doi:10.1016/S0090-4295(02)02416-4.
23. Brockman S, Roadman D, Bajic P, Levine LA. Aspiration and sclerotherapy: a minimally invasive treatment for hydroceles and spermatoceles. Urol 2022;164:273–277. doi:10.1016/j.urology.2021.12.009.
24. Freitas FC, Sanches MR, Dosatti AdC. Efficacy of aspiration and sclerotherapy for hydrocele: a systematic review. J Sex Med 2024;21(Suppl 3):qdae018.018. doi:10.1093/jsxmed/qdae018.018.
25. Shakiba B, Heidari K, Afshar K, Faegh A, Salehi-Pourmehr H. Aspiration and sclerotherapy versus hydrocelectomy for treating hydroceles: a systematic review and meta-analyses. Surg Endosc 2023;37(7):5045–5051. doi:10.1007/s00464-023-10143-5.
26. Musa O, Roy A, Ansari NA, Sharan J. Evaluation of the role of sodium tetradecyl sulfate as a sclerosant in the treatment of primary hydrocele. Ind J Surg 2013;77(Suppl 2):432–437. doi:10.1007/s12262-013-0866-8.
27. Fracchia AJ, Armenakas NA, Kohan AD. Cost-effective hydrocele ablation. J Urol 2001; 165(3):821–823. doi:10.1016/S0022-5347(01)63755-8.
28. Taylor WSJ, Cobley J, Mahmalji W. Is aspiration and sclerotherapy treatment for hydroceles in the aging male an evidence-based treatment? Aging Male 2018;21(3):163–168. doi:10.1080/13685538.2018.1425987.
29. Khaniya S, Agrawal CS, Koirala R, Regmi R, Adhikary S. Comparison of aspiration-sclerotherapy with hydrocelectomy in the management of hydrocele: a prospective randomized study. Int J Surg 2009;7(4):392–395. doi:10.1016/j.ijsu.2009.07.002.
30. Agrawal MS, Yadav H, Upadhyay A, Jaiman R, Singhal J, Singh AK. Sclerotherapy for hydrocele revisited: a prospective randomized study. Indian J Surg 2009;71(1):23–28. doi:10.1007/s12262-009-0006-7.
31. Laghari HR, Akram M, Ali F, Hussain SK, Brohi IB, Qaim ZA. Comparison of sodium tetradecyl sulphate versus conventional hydrocelectomy for adult hydrocele aspiration. Prof Med J 2022; 29(11):1601–1608. doi:10.29309/TPMJ/2022.29.11.7130.
32. Stapleton P, Sathianathen NJ, Johns-Putra L. Aspiration and sclerotherapy for the management of hydrocele in an ambulatory and regional setting. SIUJ 2024;5(6):835–842. doi:10.3390/siuj5060063.
33. Francis JJ, Levine LA. Aspiration and sclerotherapy: a nonsurgical treatment option for hydroceles. J Urol 2013;189(5):1725–1729. doi:10.1016/j.juro.2012.11.008.
34. Alvarez G, Núñez-Cortés R, Solà I, Sitjà-Rabert M, Fort-Vanmeerhaeghe A, Fernández C, et al. Sample size, study length, and inadequate controls were the most common self-acknowledged limitations in manual therapy trials: a methodological review. J Clin Epidemiol 2021;130:96–106. doi:10.1016/j.jclinepi.2020.10.018.
35. Shaheen N, Shaheen A, Ramadan A, Hefnawy MT, Ramadan A, Ibrahim IA, et al. Appraising systematic reviews: a comprehensive guide to ensuring validity and reliability. Front Res Metr Anal 2023;8:1268045. doi:10.3389/frma.2023.1268045. PMCID: PMC10764628. PMID: 38179256.