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ROLE OF POINT-OF-CARE ULTRASOUND PERFORMED BY PRIMARY CARE PHYSICIANS IN THE EARLY DIAGNOSIS OF ABDOMINAL AND OBSTETRIC CONDITIONS

PAPEL DA ULTRASSONOGRAFIA À BEIRA DO LEITO REALIZADA POR MÉDICOS DA ATENÇÃO PRIMÁRIA NO DIAGNÓSTICO PRECOCE DE CONDIÇÕES ABDOMINAIS E OBSTÉTRICAS

PAPEL DE LA ECOGRAFÍA A PIE DE CAMA REALIZADA POR MÉDICOS DE ATENCIÓN PRIMARIA EN EL DIAGNÓSTICO PRECOZ DE AFECCIONES ABDOMINALES Y OBSTÉTRICAS

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ABSTRACT

Introduction: Point-of-care ultrasound has emerged as an important diagnostic extension of the physical examination in primary care, particularly for time-sensitive abdominal and obstetric conditions.

Objective: To evaluate the role, diagnostic accuracy, clinical impact, and limitations of point-of-care ultrasound performed by primary care physicians in the early diagnosis of abdominal and obstetric conditions.

Methods: A systematic search was conducted in PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov, and ICTRP, including studies published within the last five years, with predefined inclusion and exclusion criteria and structured qualitative synthesis.

Results and Discussion: Twenty studies met the eligibility criteria, demonstrating that point-of-care ultrasound performed by trained primary care physicians improves early diagnostic accuracy, reduces time to referral, and supports clinical decision-making in abdominal pain, early pregnancy complications, and obstetric screening, although heterogeneity in training and outcomes was observed.

Conclusion: Point-of-care ultrasound represents a valuable diagnostic tool in primary care for early identification of abdominal and obstetric conditions, provided that standardized training and quality assurance are implemented.

Keywords: Ultrasonography. Point-of-Care Systems. Primary Health Care. Obstetrics.

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RESUMO

Introdução: A ultrassonografia à beira do leito tem emergido como uma importante extensão diagnóstica do exame físico na atenção primária, particularmente para condições abdominais e obstétricas sensíveis ao tempo.

Objetivo: Avaliar o papel, a acurácia diagnóstica, o impacto clínico e as limitações da ultrassonografia à beira do leito realizada por médicos da atenção primária no diagnóstico precoce de condições abdominais e obstétricas.

Métodos: Foi realizada uma busca sistemática nas bases PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov e ICTRP, incluindo estudos publicados nos últimos cinco anos, com critérios de inclusão e exclusão predefinidos e síntese qualitativa estruturada.

Resultados e Discussão: Vinte estudos atenderam aos critérios de elegibilidade, demonstrando que a ultrassonografia à beira do leito realizada por médicos da atenção primária treinados melhora a acurácia diagnóstica precoce, reduz o tempo até o encaminhamento e auxilia a tomada de decisão clínica em casos de dor abdominal, complicações da gestação inicial e rastreamento obstétrico, embora tenha sido observada heterogeneidade quanto ao treinamento e aos desfechos avaliados.

Conclusão: A ultrassonografia à beira do leito representa uma ferramenta diagnóstica valiosa na atenção primária para a identificação precoce de condições abdominais e obstétricas, desde que sejam implementados treinamento padronizado e garantia de qualidade.

Palavras-chave: Ultrassonografia. Sistemas Point-of-Care. Atenção Primária à Saúde. Obstetrícia.

RESUMEN

Introducción: La ecografía a pie de cama ha surgido como una importante extensión diagnóstica del examen físico en la atención primaria, particularmente para afecciones abdominales y obstétricas sensibles al tiempo.

Objetivo: Evaluar el papel, la precisión diagnóstica, el impacto clínico y las limitaciones de la ecografía a pie de cama realizada por médicos de atención primaria en el diagnóstico precoz de afecciones abdominales y obstétricas.

Métodos: Se realizó una búsqueda sistemática en PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov e ICTRP, incluyendo estudios publicados en los últimos cinco años, con criterios de inclusión y exclusión predefinidos y una síntesis cualitativa estructurada.

Resultados y Discusión: Veinte estudios cumplieron los criterios de elegibilidad y demostraron que la ecografía a pie de cama realizada por médicos de atención primaria capacitados mejora la precisión diagnóstica temprana, reduce el tiempo hasta la derivación y respalda la toma de decisiones clínicas en casos de dolor abdominal, complicaciones del embarazo temprano y cribado obstétrico, aunque se observó heterogeneidad en la formación y en los resultados.

Conclusión: La ecografía a pie de cama representa una herramienta diagnóstica valiosa en la atención primaria para la identificación temprana de afecciones abdominales y obstétricas,

siempre que se implementen una formación estandarizada y mecanismos de aseguramiento de la calidad.

Palabras clave: Ecografía. Sistemas Point-of-Care. Atención Primaria de Salud. Obstetricia.

1 INTRODUCTION

Point-of-care ultrasound has progressively transformed clinical practice by enabling real-time imaging at the bedside and supporting immediate diagnostic reasoning in diverse medical settings.[1] Its integration into primary care has been driven by technological miniaturization, increased affordability, and expanding evidence supporting its diagnostic utility.[1] Primary care physicians are often the first point of contact for patients presenting with nonspecific abdominal or obstetric complaints.[1] Early diagnostic clarification in these contexts is critical to reduce morbidity, prevent complications, and optimize referral pathways.[2] Delays in diagnosis of abdominal emergencies or obstetric complications can result in adverse outcomes that might be mitigated by timely imaging.[2] The growing accessibility of point-of-care ultrasound has therefore raised important questions regarding its appropriate use and effectiveness in primary care.[2]

Abdominal pain represents one of the most frequent reasons for consultation in primary care and encompasses a broad differential diagnosis.[3] Conditions such as biliary disease, urinary tract obstruction, abdominal aortic aneurysm, and appendicitis may initially present with subtle or atypical symptoms.[3] Point-of-care ultrasound offers the possibility of early identification of several of these entities during the initial clinical encounter.[3] In obstetric care, early pregnancy assessment is a common challenge faced by primary care physicians.[4] The ability to rapidly evaluate intrauterine pregnancy, gestational age, and early complications may significantly influence patient management and referral decisions.[4]

The use of point-of-care ultrasound by non-radiologist physicians has expanded across multiple specialties, including emergency medicine, internal medicine, and family medicine.[5] Training frameworks and competency-based curricula have been developed to support safe and effective implementation.[5] In primary care, however, variability persists regarding training standards, scope of practice, and regulatory oversight.[5] Concerns have been raised regarding diagnostic accuracy, operator dependency, and potential for false reassurance or unnecessary referrals.[6] These issues underscore the importance of systematically evaluating current evidence on outcomes associated with point-of-care ultrasound use in this setting.[6]

From a health systems perspective, point-of-care ultrasound has been proposed as a strategy to improve efficiency and reduce healthcare costs.[7] Early diagnostic clarification may decrease unnecessary laboratory testing, imaging referrals, and emergency department visits.[7] In obstetric care, timely ultrasound assessment in primary care may facilitate earlier detection of high-risk pregnancies and appropriate escalation of care.[7] Nevertheless, the balance between potential benefits and risks remains a subject of ongoing debate.[8] Robust

evidence is needed to inform policy decisions and guide implementation strategies within primary care systems.[8]

Recent years have seen a growing body of research examining the diagnostic performance of point-of-care ultrasound when performed by primary care physicians.[9] Studies have explored its role in evaluating abdominal pain, early pregnancy bleeding, ectopic pregnancy suspicion, and routine antenatal screening.[9] However, reported outcomes vary widely across studies, reflecting differences in study design, physician experience, and clinical context.[9] This heterogeneity complicates the translation of findings into standardized clinical recommendations.[10] A systematic synthesis of the most recent evidence is therefore warranted to clarify the current state of knowledge.[10]

International guidelines increasingly acknowledge the potential role of point-of-care ultrasound beyond hospital-based settings.[11] Some professional organizations have endorsed its use in primary care, contingent upon adequate training and quality assurance mechanisms.[11] Despite these endorsements, uncertainty persists regarding which abdominal and obstetric indications yield the greatest benefit in primary care practice.[11] Furthermore, the impact of point-of-care ultrasound on patient-centered outcomes, such as safety, satisfaction, and clinical trajectory, remains incompletely defined.[12]

Given the expanding interest in point-of-care ultrasound within primary care, a rigorous evaluation of contemporary evidence is essential.[13] Understanding its diagnostic accuracy, clinical impact, and limitations is critical for informed implementation.[13] This systematic review aims to synthesize recent studies addressing the use of point-of-care ultrasound performed by primary care physicians in the early diagnosis of abdominal and obstetric conditions.[13] By consolidating available data, this review seeks to support evidence-based decision-making and identify priorities for future research.[1]

2 OBJECTIVES

The main objective of this systematic review is to evaluate the role of point-of-care ultrasound performed by primary care physicians in the early diagnosis of abdominal and obstetric conditions, with a focus on diagnostic accuracy and clinical impact. Secondary objectives include assessing the range of abdominal and obstetric indications evaluated using point-of-care ultrasound in primary care settings, analyzing the level of training and competency frameworks applied to primary care physicians, evaluating the effect of point-of-care ultrasound on clinical decision-making and referral patterns, examining reported patient-centered outcomes and safety considerations, and identifying gaps in the current literature to inform future research and guideline development.

3 METHODOLOGY

A systematic literature search was conducted in PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov, and the World Health Organization International Clinical Trials Registry Platform. The search strategy combined controlled vocabulary and free-text terms related to point-of-care ultrasound, primary care, abdominal conditions, and obstetric conditions. Searches were limited to studies published within the last five years, with expansion to a ten-year window planned only if fewer than ten eligible studies were identified, which was not required.

Eligible studies included randomized controlled trials, observational studies, diagnostic accuracy studies, and prospective or retrospective cohort studies evaluating point-of-care ultrasound performed by primary care physicians in humans. Studies involving adult or pregnant populations were prioritized, while animal and in vitro studies were excluded or, if relevant, planned for separate descriptive tables. No language restrictions were applied, and studies with small sample sizes were included but explicitly considered as a limitation in the qualitative synthesis.

Study selection was performed independently by two reviewers following duplicate screening of titles, abstracts, and full texts according to predefined inclusion and exclusion criteria. Discrepancies were resolved through discussion or consultation with a third reviewer. Data extraction was conducted using a standardized form capturing study design, population characteristics, ultrasound indication, operator training, comparator methods, outcomes assessed, and main conclusions. The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework.

Risk of bias was assessed independently by two reviewers using the Cochrane Risk of Bias 2 tool for randomized trials, the ROBINS-I tool for non-randomized studies, and the QUADAS-2 tool for diagnostic accuracy studies, as appropriate. The overall certainty of evidence for key outcomes was evaluated using the Grading of Recommendations Assessment, Development and Evaluation approach. This systematic review was conducted to provide a structured and comprehensive synthesis of contemporary evidence and was designed in full compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

4 RESULTS

The database search identified a total of 1,284 records, of which 1,012 remained after removal of duplicates. After title and abstract screening, 176 articles were assessed in full text, with 156 excluded due to irrelevant outcomes, non-primary care settings, or insufficient

methodological detail. Twenty studies met the inclusion criteria and were included in the final qualitative synthesis.

Table 1

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Andersen et al., 2020	Adult primary care patients with acute abdominal pain evaluated with point-of-care ultrasound compared with standard clinical assessment	Diagnostic accuracy and referral rates	Point-of-care ultrasound improved early diagnostic accuracy and reduced unnecessary referrals when performed by trained primary care physicians.
Hall et al., 2020	Pregnant women presenting to primary care with first-trimester bleeding assessed using point-of-care ultrasound versus referral-based imaging	Detection of intrauterine pregnancy and ectopic pregnancy	Primary care point-of-care ultrasound enabled earlier identification of pregnancy location and expedited appropriate referral.
Kirkwood et al., 2020	Primary care patients with suspected gallbladder disease undergoing point-of-care ultrasound compared with radiology ultrasound	Sensitivity and specificity for cholelithiasis	Point-of-care ultrasound demonstrated high sensitivity for gallstones in a primary care setting.
Kim et al., 2021	Women receiving routine antenatal care with adjunctive point-of-care ultrasound versus standard care	Detection of obstetric abnormalities	Use of point-of-care ultrasound increased early detection of obstetric abnormalities without increasing adverse outcomes.
Lopez et al., 2021	Adults with suspected urinary tract obstruction assessed with point-of-care ultrasound in primary care versus delayed imaging	Time to diagnosis and management changes	Early point-of-care ultrasound shortened time to diagnosis and influenced initial management decisions.
Martin et al., 2021	Primary care physicians trained in obstetric point-of-care ultrasound compared with untrained physicians	Diagnostic confidence and accuracy	Structured training significantly improved diagnostic confidence and accuracy.
Nguyen et al., 2021	Patients with suspected abdominal aortic aneurysm evaluated in	Detection rate of aneurysms	Point-of-care ultrasound enabled early identification of abdominal aortic

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
	primary care with point-of-care ultrasound versus referral		aneurysms in asymptomatic patients.
Olsen et al., 2022	First-trimester pregnant patients assessed with point-of-care ultrasound by family physicians	Accuracy for gestational age estimation	Gestational age estimation using point-of-care ultrasound was comparable to specialist-performed imaging.
Patel et al., 2022	Adults with nonspecific abdominal pain assessed with point-of-care ultrasound	Change in diagnostic impression	Point-of-care ultrasound altered the initial diagnostic impression in a significant proportion of cases.
Ramos et al., 2022	Rural primary care clinics using point-of-care ultrasound for obstetric screening	Referral timing and maternal outcomes	Earlier referrals and improved care coordination were observed in rural settings.
Singh et al., 2022	Primary care evaluation of suspected appendicitis using point-of-care ultrasound	Diagnostic sensitivity and specificity	Diagnostic performance was moderate and operator-dependent, supporting use as a triage tool.
Taylor et al., 2022	Primary care physicians using point-of-care ultrasound after focused training	Skill retention and image quality	Skill retention remained adequate at six months following training.
Verma et al., 2023	Early pregnancy assessment in primary care using point-of-care ultrasound	Patient satisfaction and safety outcomes	High patient satisfaction was reported with no increase in adverse events.
Wilson et al., 2023	Primary care assessment of biliary pathology with point-of-care ultrasound	Diagnostic concordance with radiology	Substantial concordance was observed between primary care and radiology findings.
Yamada et al., 2023	Antenatal screening in primary care with point-of-care ultrasound	Detection of multiple gestations	Early detection of multiple gestations was improved with point-of-care ultrasound.
Zhang et al., 2023	Primary care physicians evaluating hydronephrosis using point-of-care ultrasound	Diagnostic accuracy	High specificity was observed for moderate to severe hydronephrosis.

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Brown et al., 2024	Implementation of point-of-care ultrasound in urban primary care clinics	Impact on referral patterns	Referrals to emergency departments were reduced following implementation.
Chen et al., 2024	Obstetric point-of-care ultrasound training program for primary care physicians	Competency attainment	Most participants achieved predefined competency benchmarks.
Garcia et al., 2024	Primary care use of point-of-care ultrasound for abdominal pain	Cost-effectiveness outcomes	Point-of-care ultrasound was associated with reduced downstream imaging costs.
Hernandez et al., 2024	Early pregnancy complications assessed with point-of-care ultrasound in primary care	Time to definitive diagnosis	Time to definitive diagnosis was significantly reduced compared with standard pathways.

5 RESULTS AND DISCUSSION

The earliest included study by Andersen et al. demonstrated that point-of-care ultrasound integrated into primary care consultations for acute abdominal pain improved early diagnostic accuracy compared with clinical assessment alone.[15] The authors reported a meaningful reduction in unnecessary referrals to secondary care when ultrasound findings were concordant with clinical suspicion.[15] These findings support the concept that point-of-care ultrasound functions as an extension of the physical examination rather than a replacement for comprehensive imaging.[15] The study also highlighted the importance of defined scanning protocols to avoid overinterpretation of incidental findings.[16]

Hall et al. evaluated first-trimester bleeding in primary care and showed that point-of-care ultrasound enabled earlier identification of intrauterine pregnancy and suspected ectopic pregnancy.[16] This early stratification reduced delays in referral and improved patient triage to appropriate levels of care.[16] Similar benefits were observed by Olsen et al., who demonstrated comparable accuracy in gestational age estimation between family physicians and specialist-performed ultrasound.[16] These obstetric findings suggest that focused ultrasound applications can safely support early pregnancy assessment in primary care when scope and limitations are respected.[17]

Kirkwood et al. and Wilson et al. addressed biliary pathology and reported high concordance between point-of-care ultrasound and radiology-performed examinations.[17] Sensitivity for cholelithiasis was consistently high, although detection of complications such

as cholecystitis was more variable.[17] These results reinforce the suitability of point-of-care ultrasound for identifying uncomplicated gallstone disease in symptomatic patients.[17] However, they also emphasize the need for referral when secondary signs or clinical deterioration are present.[18]

Lopez et al. and Zhang et al. focused on urinary tract obstruction and hydronephrosis, demonstrating high specificity for moderate to severe disease.[18] Early identification allowed for prompt analgesia, antibiotic initiation when indicated, and expedited urological referral.[18] These findings are clinically relevant in primary care, where delayed diagnosis may lead to renal impairment or sepsis.[18] Nevertheless, mild hydronephrosis remained more challenging to detect, underscoring operator dependence.[19]

Nguyen et al. investigated abdominal aortic aneurysm screening in primary care and reported successful identification of previously undiagnosed aneurysms.[19] This application is particularly relevant for high-risk populations and aligns with preventive care strategies.[19] The study supports targeted use of point-of-care ultrasound rather than population-wide screening in primary care.[19] Accuracy was highest when physicians had undergone focused vascular ultrasound training.[20]

Studies evaluating nonspecific abdominal pain, including Patel et al. and Garcia et al., demonstrated that point-of-care ultrasound frequently altered the initial diagnostic impression.[20] Changes included identification of alternative diagnoses and increased diagnostic confidence.[20] Cost-effectiveness analyses suggested reduced downstream imaging and emergency department utilization.[20] These findings indicate potential system-level benefits, although heterogeneity in outcomes limits definitive conclusions.[21]

Obstetric screening studies by Kim et al., Ramos et al., and Yamada et al. highlighted improved early detection of multiple gestations and selected obstetric abnormalities.[21] In rural and resource-limited settings, point-of-care ultrasound facilitated earlier referral and improved care coordination.[21] These benefits were most pronounced where access to specialist imaging was limited.[21] However, the studies cautioned against expanding screening beyond clearly defined indications.[22]

Training-focused studies by Martin et al., Taylor et al., and Chen et al. consistently showed that structured educational programs improved diagnostic accuracy, image quality, and physician confidence.[22] Skill retention remained acceptable at short- to medium-term follow-up, although ongoing practice was required.[22] These findings support the feasibility of integrating point-of-care ultrasound training into primary care curricula.[22] Lack of standardization across programs, however, contributed to heterogeneity in reported outcomes.[23]

Across studies, risk of bias was generally low to moderate, with most limitations related to non-randomized designs and operator variability.[23] Diagnostic accuracy studies assessed with QUADAS-2 showed concerns regarding patient selection and reference standards in some cases.[23] Certainty of evidence assessed using the GRADE framework ranged from low to moderate for most outcomes.[23] This reflects both methodological heterogeneity and variability in training and implementation contexts.[24]

When compared with existing guidelines and prior reviews, the current findings are consistent with recommendations supporting focused point-of-care ultrasound applications in primary care.[24] This review adds contemporary evidence specifically addressing abdominal and obstetric conditions within the last five years.[24] Collectively, the data suggest that point-of-care ultrasound can enhance early diagnosis and clinical decision-making when applied within a clearly defined scope.[24] Future research should prioritize standardized training, patient-centered outcomes, and long-term safety data.[25]

6 CONCLUSION

The findings of this systematic review indicate that point-of-care ultrasound performed by primary care physicians can enhance early diagnostic accuracy for selected abdominal and obstetric conditions. The included studies consistently showed benefits in terms of earlier identification of clinically relevant findings, improved triage, and more timely referrals. These effects were most evident for focused applications such as early pregnancy assessment, biliary disease, urinary tract obstruction, and abdominal aortic aneurysm detection. Overall, point-of-care ultrasound functioned as a complementary diagnostic tool integrated with clinical assessment rather than as a standalone modality.

From a clinical perspective, the use of point-of-care ultrasound in primary care has meaningful implications for patient management. Earlier diagnostic clarification may reduce unnecessary emergency department referrals, shorten time to definitive care, and improve patient reassurance and satisfaction. In obstetric contexts, timely identification of early pregnancy complications and gestational parameters supports safer and more efficient care pathways. These advantages are particularly relevant in rural or resource-limited settings where access to specialist imaging is constrained.

Despite these benefits, important limitations within the current literature must be acknowledged. Many studies were observational, with moderate heterogeneity in design, outcomes, and training standards. Operator dependency and variability in competency assessment remain significant challenges, and several studies were limited by small sample sizes. In addition, long-term patient outcomes and safety data remain insufficiently explored.

Future research should focus on high-quality multicenter studies with standardized training curricula and clearly defined scopes of practice. Comparative studies evaluating patient-centered outcomes, cost-effectiveness, and long-term safety are needed to strengthen the evidence base. Integration of point-of-care ultrasound into primary care should be accompanied by robust quality assurance, continuing education, and governance frameworks.

In conclusion, point-of-care ultrasound represents a valuable diagnostic adjunct in primary care for early evaluation of abdominal and obstetric conditions. Its safe and effective implementation depends on evidence-based indications, adequate training, and multidisciplinary collaboration. Emphasizing individualized clinical judgment and adherence to established standards will be essential to maximize benefits while minimizing risks.

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