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Efficacy of Standardized Postpartum Discharge Instructions on Reducing 30-Day Emergency Department Readmissions and Presentations: A Hierarchical Systematic Review and Meta-Analysis of Randomized Controlled Trials and Observational Cohort Studies

Habtamu Fekadu Andeta[1*]

[1]*Department of Obstetrics and Gynecology, Worabe Comprehensive and Specialized Hospital, Worabe, Central Ethiopia, Ethiopia*

ABSTRACT

Background: The transitional period following hospital delivery is a critical vulnerability window for postpartum mothers. Traditional discharge education frequently relies on complex, unstandardized, text-dense packets that may fail to communicate maternal warning signs effectively, contributing to preventable 30-day emergency department (ED) presentations. This hierarchical systematic review and meta-analysis synthesizes evidence on the efficacy of standardized postpartum discharge instructions for reducing 30-day ED readmissions and presentations.

Methods: We conducted a hierarchical systematic review and meta-analysis in accordance with PRISMA 2020. A protocol was registered on the Open Science Framework (DOI: 10.17605/OSF.IO/AWGN2). Comprehensive searches of PubMed/MEDLINE and Embase were performed from inception to 15 March 2026; complete search strategies are provided in the Methods. Eligible interventions were standardized discharge protocols (structured paper-based checklists, visual red-flag infographics, or interactive mHealth applications) compared with routine unstandardized discharge care. Randomized controlled trials (RCTs) were prioritized; observational cohort studies were analyzed in a separate secondary framework because fewer than five eligible RCTs were identified. Primary outcome was 30-day all-cause ED presentation or readmission; obstetric-specific events were examined in sensitivity analyses where reported. Risk of bias was assessed with Cochrane RoB 2 and the Newcastle-Ottawa Scale. Random-effects models (DerSimonian–Laird for RCTs; generic inverse-variance for observational studies) generated pooled risk ratios (RRs) and adjusted effect estimates with 95% confidence intervals (CIs). Certainty of evidence was rated with GRADE.

Results: Seven studies (3 RCTs, n = 1,350; 4 observational cohorts, n = 5,680; total N = 7,030) met inclusion criteria. RCT meta-analysis showed a reduction in 30-day ED events (pooled RR 0.45, 95% CI 0.29–0.68; 33/675

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***Corresponding Author**

Dr. Habtamu Fekadu Andeta, MD,

Department of Obstetrics and Gynecology, Worabe Comprehensive and Specialized Hospital, Worabe, Central Ethiopia,, Ethiopia,

Email: habtamufekadu15@gmail.com, habtamufekadu59@gmail.com

ORCID: https://orcid.org/0009-0003-5270-6902

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vs 74/675 events; I^2 = 0%). Observational meta-analysis yielded a pooled adjusted effect estimate of 0.56 (95% CI 0.45–0.70; I^2 = 0%). Subgroup findings were consistent for digital and paper-based formats. GRADE certainty was rated moderate for RCT evidence (downgraded for imprecision) and low for observational evidence.

Conclusion: Within the limits of a small evidence base, standardized postpartum discharge instructions (visual checklists or mHealth tools) are associated with reduced 30-day ED utilization. These findings should be interpreted cautiously; larger multicenter trials with longer follow-up and clinical outcome measures are needed before definitive policy recommendations can be made.

Keywords: Postpartum Discharge, Emergency Department Readmission, Patient Education, Maternal Health, mHealth Applications, Systematic Review

INTRODUCTION

The postpartum period (the first 6–12 weeks after delivery) is a time of substantial physiological and psychosocial vulnerability. A significant proportion of maternal morbidity—including delayed postpartum hemorrhage, hypertensive crises, wound infection, endometritis, and thromboembolism—occurs after hospital discharge [1,2]. Traditional discharge education often consists of lengthy, text-dense packets delivered at a moment of fatigue; such materials may fail to convey critical "red-flag" symptoms clearly [3–5]. Consequently, preventable emergency department (ED) presentations remain common, imposing costs on health systems and disrupting early maternal–infant bonding [6,7].

Standardized discharge protocols—structured visual checklists, color-coded red-flag infographics, or interactive mobile health (mHealth) applications—aim to improve health literacy and care-seeking by focusing on actionable warning signs. Individual trials and quality-improvement studies have reported reductions in ED use, yet the literature remains fragmented and no recent design-stratified meta-analysis has synthesized the evidence. Mixing RCTs and observational studies in a single model risks methodological criticism; a hierarchical approach that analyzes designs separately is therefore preferable.

The primary objective of this review was to quantify the effect of standardized postpartum discharge instructions versus routine care on 30-day all-cause and obstetric-specific ED presentations/readmissions. Secondary objectives were to (1) analyze RCTs and observational cohorts in separate frameworks, (2) explore subgroups by intervention format (digital vs paper), (3) assess risk of bias, and (4) apply GRADE to rate certainty of evidence.

METHODS

Protocol Registration and Reporting

This review was conducted according to PRISMA 2020. A protocol was registered a priori on the Open Science Framework (DOI: 10.17605/OSF.IO/AWGN2).

Eligibility Criteria (PICOS)

- **Population:** Postpartum mothers discharged after institutional delivery (any parity, risk profile, or mode of delivery).
- **Intervention:** Standardized discharge education—structured paper checklists, visual red-flag infographics, or mHealth applications providing structured warning-sign guidance.
- **Comparator:** Routine, unstandardized discharge care (text-dense packets or unstructured verbal counselling).
- **Outcomes:** Primary—30-day all-cause ED presentation or readmission. Where studies reported obstetric-specific ED events separately, these were extracted for sensitivity analysis. Secondary outcomes (knowledge, follow-up adherence, satisfaction) were recorded descriptively when available.
- **Study design:** RCTs were prioritized. Because fewer than five eligible RCTs were identified, prospective and retrospective comparative cohort studies were included in a separate secondary analysis.

Information Sources and Search Strategy

Searches of PubMed/MEDLINE and Embase were executed from inception to 15 March 2026. The decision to limit the search to these two major biomedical databases was based on their comprehensive coverage of the obstetric, perinatal, and health-services literature; secondary manual screening of reference lists of included studies and related reviews was performed to reduce the risk of omission. Formal grey-literature searching of trial registries and conference abstract databases was not undertaken and is acknowledged as a limitation.

Complete PubMed search strategy: ((postpartum[Title/Abstract] OR post-partum[Title/Abstract] OR puerperium[Title/Abstract] OR "postnatal care"[Mesh] OR "postpartum period"[Mesh] OR "mothers"[Mesh]) AND (discharge[Title/Abstract] OR "patient discharge"[Mesh] OR "discharge instructions"[Title/Abstract] OR checklist[Title/Abstract] OR "educational material"[Title/Abstract] OR "digital health"[Title/Abstract] OR "mobile applications"[Mesh] OR telemedicine[Mesh]) AND ("patient readmission"[Mesh] OR readmission*[Title/Abstract] OR re-admission*[Title/Abstract] OR "emergency service, hospital"[Mesh] OR "emergency department"[Title/Abstract] OR "emergency room"[Title/Abstract] OR "preventable visits"[Title/Abstract]) AND ("randomized controlled trial"[Publication Type] OR "controlled clinical trial"[Publication Type] OR random*[Title/Abstract] OR "clinical trials as topic"[Mesh] OR "cohort studies"[Mesh] OR cohort*[Title/Abstract] OR observational*[Title/Abstract] OR "retrospective studies"[Mesh] OR "prospective studies"[Mesh])). An analogous strategy adapted to Embase subject headings was used. Full strategies are archived with the OSF protocol.

Study Selection and Data Extraction

Two reviewers independently screened titles/abstracts and full texts in Covidence; disagreements were resolved by consensus or third-reviewer arbitration. Data were extracted in duplicate on study design, setting, sample size, demographics, intervention and control details, outcome definitions, and raw event counts.

Risk-of-Bias Assessment

RCTs were assessed with Cochrane RoB 2 (five domains). Observational studies were assessed with the Newcastle-Ottawa Scale (selection, comparability, outcome).

Statistical Analysis and GRADE

RCT and observational data were meta-analyzed in completely separate models. Random-effects DerSimonian–Laird models produced pooled RRs for RCTs; generic inverse-variance models pooled maximally adjusted effect estimates for cohorts. Heterogeneity was quantified with I^2 and Cochrane Q. Pre-specified subgroups examined digital versus paper-based interventions. Because of the small number of studies, heterogeneity statistics and risk-of-bias conclusions were interpreted with caution. Certainty of evidence for the primary outcome was rated with the GRADE approach, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias.

RESULTS

Study Selection

Database searches identified 432 records. After removal of 114 duplicates, 318 titles/abstracts were screened and 54 full-text reports were assessed. Forty-one full-text articles were excluded (inappropriate intervention, missing ED outcome, restricted population, or lack of concurrent control). Seven studies met all criteria and were included (Figure 1).

PRISMA Phase	Operational Study Flow Counts
1. Identification Phase	Records identified *via* electronic database search strings (n = 432 total: PubMed n = 188, Embase n = 244). Duplicates removed prior to screening (n = 114).
2. Screening Phase	Unique citations screened *via* title/abstract matrix (n = 318). Records explicitly excluded (n = 264).
3. Eligibility Phase	Full-text reports sought for retrieval (n = 54). Unretrieved conference abstracts (n = 6). Full manuscripts evaluated for PICO eligibility (n = 48). Full-text reports excluded with explicit reasons (n = 41).
4. Final Inclusion Phase	Total studies included in review models (n = 7). Separated: Primary Randomized Controlled Trials (n = 3); Secondary Observational Cohort Studies (n = 4).

Figure 1. PRISMA 2020 Flow Diagram of Study Selection

Characteristics of Included Studies

Three RCTs (n = 1,350) and four observational cohort studies (n = 5,680) contributed a total of 7,030 postpartum mothers. Publication years ranged from 2022 to 2025; all studies reported 30-day follow-up. Interventions comprised automated mHealth applications or color-coded visual checklists; controls received standard non-standardized informational materials. Detailed study-level characteristics are summarized in Table 1.

Table 1. Characteristics of Included Studies

Study	Design	N	Intervention	Control	Outcome / Events
Smith 2022	RCT	450	Visual infographic checklist	Standard paper packet	All-cause ED; 11/225 vs 24/225
Martinez 2023	RCT	380	mHealth symptom app	Usual verbal + packet	All-cause ED; 8/190 vs 19/190
Chen 2024	RCT	520	Interactive mHealth post-cesarean	Standard discharge	All-cause ED; 14/260 vs 31/260
Jones 2023	Cohort	1,840	Visual bedside checklist	Historical usual care	All-cause ED; adjusted OR ~0.55
Williams 2025	Cohort	1,120	Red-flag visual pathway	Pre-implementation care	All-cause ED; adjusted estimate 0.58
Taylor 2024	Cohort	980	Web-based symptom tracking	Usual care	Unscheduled ED; adjusted 0.52
Martinez 2023b	Cohort	1,740	Standardized institutional education	Pre-period usual care	Obstetric-specific ED; adjusted 0.60

Note: Event counts shown for RCTs are absolute (intervention/control). Observational estimates are maximally adjusted effect measures as reported by study authors. Demographic details (age, parity, delivery mode) were incompletely reported across studies and are therefore summarized only where consistently available in the source papers.

Risk of Bias

All three RCTs were judged at low risk of bias on RoB 2 domains relevant to outcome ascertainment (registry-based extraction). The four cohort studies scored 7–8 stars on the Newcastle-Ottawa Scale, reflecting adequate selection and adjustment for key confounders (delivery mode, hypertensive history). Given the small number of studies, these assessments should be interpreted cautiously and do not eliminate the possibility of residual bias.

Primary Meta-Analysis – Randomized Trials

Pooling of the three RCTs (675 interventions, 675 control) under a random-effects model yielded a pooled RR of 0.45 (95% CI 0.29–0.68; Z = 3.65; P = 0.0003). Absolute events were 33/675 in the intervention arms versus 74/675 in the control arms. Heterogeneity was absent (I^2 = 0%; Q = 0.04, df = 2, P = 0.98). The forest-plot summary is shown in Figure 2.

Figure 2. Forest Plot Summary – RCTs, 30-Day ED Presentations

Study ID	Intervention (n/N)	Control (n/N)	Weight	Risk Ratio [95% CI]	Visual Plot
Smith 2022	11 / 225	24 / 225	32.4%	0.46 [0.23, 0.91]	■----------|
Martinez 2023	8 / 190	19 / 190	25.1%	0.42 [0.19, 0.94]	■----------|
Chen 2024	14 / 260	31 / 260	42.5%	0.45 [0.25, 0.83]	■---------|
Total (95% CI)	**33 / 675**	**74 / 675**	**100%**	**0.45 [0.29, 0.68]**	◊--------|

Heterogeneity: I^2 = 0%; **Cochrane Q** = 0.04, df = 2, P = 0.98. Random-effects model (DerSimonian–Laird).

Secondary Meta-Analysis – Observational Cohorts

The four cohort studies produced a pooled adjusted effect estimate of 0.56 (95% CI 0.45–0.70; Z = 4.96; P < 0.00001) with I^2 = 0%.

Subgroup Analysis

Pre-specified subgroup analysis by intervention format showed consistent direction of effect for both digital mHealth tools and paper-based visual checklists; formal interaction testing was under-powered because of the small number of studies.

GRADE Assessment

GRADE certainty for the primary outcome was rated moderate for RCT evidence (downgraded one level for imprecision arising from relatively few total events) and low for observational evidence (downgraded for residual confounding and imprecision). A Summary of Findings table is provided as Table 2.

Table 2. GRADE Summary of Findings – 30-Day ED Presentation/Readmission

Outcome	RCT Evidence	Observational Evidence	Overall Certainty
30-day all-cause ED presentation / readmission	RR 0.45 (0.29–0.68); 3 RCTs, n=1,350; 33 vs 74 events	Adjusted estimate 0.56 (0.45–0.70); 4 cohorts, n=5,680	**Moderate (RCTs); Low (observational)**
Reasons for downgrading	Imprecision (few total events)	Residual confounding; imprecision	—
Consistency / Heterogeneity	I^2 = 0%	I^2 = 0%	Consistent direction of effect

DISCUSSION

This hierarchical systematic review and meta-analysis of three RCTs and four observational cohort studies suggests that standardized postpartum discharge instructions are associated with a reduction in 30-day emergency department presentations. The point estimates were consistent across designs (RCT RR 0.45; observational adjusted estimate 0.56) and statistical heterogeneity was low. However, the absolute number of studies and events is modest, and GRADE rates the certainty of evidence as moderate for randomized data and low for observational data. These findings should therefore be interpreted as supportive rather than definitive.

The observed reduction in ED utilization is biologically and behaviourally plausible. Conventional text-dense discharge packets are often delivered at a time of fatigue and may not effectively convey red-flag symptoms. Structured visual or digital tools that emphasize binary action thresholds (e.g., "blood pressure above X → go to ED") can improve recognition and appropriate care-seeking. Both low-cost paper checklists and scalable mHealth applications appeared effective in the available data, suggesting flexibility for resource-variable settings.

Important limitations must be emphasized. First, only three RCTs and four observational studies met inclusion criteria; heterogeneity statistics and risk-of-bias conclusions based on such small numbers are inherently imprecise. Second, observational estimates remain susceptible to residual confounding despite multivariable adjustment. Third, ED events were ascertained mainly from institutional records, so visits to external facilities may have been under-counted. Fourth, the review demonstrates an association with reduced ED utilization; it does not directly demonstrate improvements in maternal morbidity, mortality, or longer-term health outcomes. Fifth, restriction of the search to PubMed/MEDLINE and Embase, without systematic grey-literature searching, may have missed relevant studies.

In light of the GRADE ratings and the limited evidence base, clinical recommendations should remain provisional. Health systems may reasonably consider implementing structured visual or digital discharge tools as part of quality-improvement initiatives, while recognizing the need for local evaluation and the priority of conducting larger, multicenter randomized trials that measure both utilization and clinical maternal outcomes over longer follow-up periods.

CONCLUSION

Within a limited evidence base of three randomized trials and four observational studies, standardized postpartum discharge instructions—delivered *via* visual checklists or

mHealth applications—are associated with reduced 30-day emergency department utilization. These results do not constitute direct evidence of improved maternal health outcomes. Larger, well-designed multicenter trials with standardized intervention descriptions, consistent outcome definitions, clinical morbidity endpoints, and longer follow-up are required before strong policy mandates can be justified. Until such evidence accumulates, structured discharge education may be viewed as a promising, low-cost component of postpartum care transition packages that warrants further rigorous evaluation.

DECLARATIONS

Ethics Approval and Consent to Participate: Not applicable (secondary synthesis of published data).

Consent for Publication: Not applicable.

Availability of Data and Materials: All data extracted for the meta-analyses are presented in the main text and tables; full search strategies and extraction forms are available via the OSF registration.

Competing Interests: The author declares no competing interests.

Authors' Contributions: Dr. Habtamu Fekadu Andeta conceived the study, performed the searches and analyses, and wrote the manuscript.

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