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Systematic Review

Keywords: antenatal care, evidence synthesis, essential newborn care, GRADE framework, perinatal survival, skilled birth attendance

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Community-Based Interventions for Reducing Neonatal Mortality in Low-Resource Settings: A Scoping Review and Evidence Gap Map

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Abstract

Background: Neonatal mortality disproportionately affects sub-Saharan Africa and South Asia, where facility-based care alone often misses vulnerable populations. Consequently, community-based interventions are widely advocated. However, the breadth, quality, and certainty of the supporting evidence lack comprehensive mapping. This study maps the evidence landscape for community-based neonatal mortality interventions to identify critical research gaps.

Methods: Following JBI scoping review and EPPI-Centre Evidence Gap Map standards, we searched OpenAlex, CrossRef, and Semantic Scholar via Python 3.12, supplemented by grey literature. A purposive, citation-informed corpus of 200 high-impact studies was selected. Quality was assessed using Cochrane RoB 2 (11 RCTs), ROBINS-I (17 non-randomised studies), AMSTAR-2 (4 systematic reviews), CASP (2 qualitative), and a Quality Indicators Checklist (166 non-evaluative studies). High heterogeneity precluded meta-analysis; data were narratively synthesized and evidence certainty assessed using GRADE criteria.

Results: Community health worker (CHW) programmes, participatory women's groups, and essential newborn care (ENC) were evaluated most frequently. Methodological quality was mixed: all 11 RCTs showed "some concerns" (RoB 2) and all 17 non-randomised studies indicated "moderate risk" (ROBINS-I). Consequently, GRADE certainty for RCT-derived outcomes was very low to moderate, downgraded primarily for indirectness, inconsistency, and imprecision. Narratively, women's groups, CHW home visits, and ENC most consistently reduced mortality. Geographically, within this highly cited corpus, West Africa was substantially underrepresented relative to its severe disease burden.

Conclusions: Moderate-certainty evidence, predominantly from South Asian cluster RCTs, supports the mortality-reducing benefits of specific community packages. However, this geographically skewed and heterogeneous evidence base precludes strong causal conclusions for West African settings, though regional literature may exist outside the queried databases. This review highlights profound gaps in highly cited, rigorous evidence for high-burden regions, emphasizing the need for equitable research investment and the application of advanced causal and adaptive study designs (e.g., quasi-experiments, micro-randomized trials) to guide local policy.

Keywords: antenatal care, evidence synthesis, essential newborn care, GRADE framework, perinatal survival, skilled birth attendance

Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AMSTAR-2	A MeaSurement Tool to Assess systematic Reviews
ANC	Antenatal Care
API	Application Programming Interface
CASP	Critical Appraisal Skills Programme
CBI	Community-Based Intervention
CHW	Community Health Worker
CI	Confidence Interval
cRCT	Cluster Randomised Controlled Trial
DHS	Demographic and Health Surveys
DOI	Digital Object Identifier
EGM	Evidence Gap Map
ENC	Essential Newborn Care
EPPI-Centre	Evidence for Policy and Practice Information and Co-ordinating Centre
GBD	Global Burden of Disease
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HBB	Helping Babies Breathe
iRCT	Individually Randomised Controlled Trial
JBI	Joanna Briggs Institute
KMC	Kangaroo Mother Care
LBW	Low Birthweight
LMIC	Low- and Middle-Income Country
MRT	Micro-Randomized Trial
NMR	Neonatal Mortality Rate
NRS	Non-Randomised Study
OA	Open Access
OR	Odds Ratio
PCC	Population–Concept–Context
PLA	Participatory Learning and Action
PMR	Perinatal Mortality Rate
PNC	Postnatal Care
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews
QIC	Quality Indicators Checklist
RCT	Randomised Controlled Trial
RD	Risk Difference
RDD	Regression Discontinuity Design
RoB 2	Cochrane Risk of Bias Tool version 2
ROBINS-I	Risk Of Bias In Non-randomised Studies - of Interventions
RR	Risk Ratio
S1–S5	Evidence Strata 1 through 5

SBA	Skilled Birth Attendant
SGA	Small-for-Gestational-Age
SR	Systematic Review
SSA	Sub-Saharan Africa
TBA	Traditional Birth Attendant
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1. Introduction

1.1. The global burden of neonatal mortality

Neonatal mortality — defined as death within the first 28 days of life — accounts for approximately 47% of all under-five deaths globally, with 2.3 million neonatal deaths recorded in 2022 (UNICEF, 2023). Despite substantial reductions in under-five mortality over recent decades, the neonatal period now accounts for a disproportionately large and growing share of child deaths worldwide. Landmark estimates established that approximately 4 million neonatal deaths occurred annually in the early 2000s, the overwhelming majority of which were concentrated in low- and middle-income countries (LMICs), with sub-Saharan Africa and South Asia bearing the heaviest burden (Lawn, 2005). Over 80% of neonatal deaths occur in sub-Saharan Africa and South Asia, and the vast majority are attributable to preventable or treatable causes including preterm birth complications, intrapartum-related events, and sepsis (GBD Collaborators, 2020; Lawn et al., 2011). These early burden-of-disease analyses were foundational in galvanising international attention and political will toward newborn survival as a distinct and underserved public health priority requiring dedicated intervention strategies (Martines, 2005).

More recent global analyses have confirmed that while absolute neonatal death counts have declined, progress has been markedly slower than that achieved for older children, and sub-Saharan Africa has consistently lagged behind other regions in achieving reductions (Kinney, 2010; Oestergaard, 2011). A systematic analysis of neonatal mortality trends across 193 countries identified that reductions in sub-Saharan Africa were particularly limited, with many countries experiencing stagnation or even reversals during periods of health system fragility (Oestergaard, 2011). Neonatal preterm birth now constitutes the leading single cause of neonatal death globally, with incidence and mortality highest in low-resource settings across Africa and South Asia (Cao, 2022; Lawn, 2011; Ohuma, 2023). Cause-of-death analyses indicate that prematurity, birth asphyxia, and neonatal sepsis collectively account for the vast majority of neonatal deaths, and that each of these causes is amenable to prevention and treatment through evidence-based community-delivered interventions (Lawn, 2005; Oza, 2014).

Maternal health outcomes are intimately linked to neonatal survival. Preterm birth, low birthweight, neonatal sepsis, and intrapartum complications are all influenced by the quality and timeliness of maternal care received during pregnancy and childbirth (Alkema, 2015; Tunçalp, 2015). Global estimates indicate that maternal mortality, while declining, remains unacceptably high in sub-Saharan Africa, where maternal and neonatal deaths are often co-located and share common proximate and distal determinants (Alkema, 2015; Cantwell, 2011). Postpartum haemorrhage — a leading cause of maternal death — is also a contributor to adverse neonatal outcomes, reflecting the interconnected nature of maternal and newborn health (Sheldon, 2014).

1.2. The role of community-based interventions

Facility-based care, while critical, is insufficient in isolation to address the full scope of neonatal mortality in low-resource settings, where the majority of births still occur outside health facilities or in facilities with limited capacity to deliver evidence-based newborn care (Bhutta, 2008; Dickson, 2014). Community-based interventions (CBIs) — defined broadly as health promotion, prevention, and care delivery strategies implemented at the household, community, or primary care level — have emerged as a cornerstone of neonatal survival programmes in low-resource settings (Bhutta et al., 2014; Lassi & Bhutta, 2015). Community-based interventions, delivered outside hospital walls through community health workers (CHWs), women's groups, traditional birth attendants, and mobile health platforms, have emerged as essential complements to facility-based services, capable of reaching geographically isolated and economically marginalised populations who would otherwise remain beyond the reach of the formal health system (Bhutta, 2008; Carlo, 2010).

Participatory women's group interventions have demonstrated compelling evidence of impact. A landmark cluster-randomised trial in rural Nepal demonstrated that facilitating women's groups using a participatory learning and action cycle significantly reduced neonatal mortality, illustrating the potential of collective community action to shift both knowledge and practice around newborn care (Manandhar, 2004). Community health worker programmes, including home-visiting models, have been evaluated across multiple high-burden settings and shown to improve newborn-care practices, identify danger signs, and facilitate timely care-seeking (Bhutta, 2008; Kumar, 2008). In a cluster-RCT in Uttar Pradesh, India, community-based behaviour change management delivered through CHWs resulted in a significant reduction in neonatal mortality, underscoring the scalability of this model in South Asian contexts (Kumar, 2008).

Training programmes for newborn care at the facility-community interface — including newborn resuscitation training for birth attendants — have demonstrated reductions in perinatal mortality across diverse low-income country settings (Carlo, 2010). Traditional birth attendant training, while controversial in its evidence base, has been associated with reductions in perinatal and maternal mortality in specific contexts, particularly where access to skilled care is severely constrained (Jokhio, 2005). The use of antenatal corticosteroids delivered through a community-facility platform model has also been evaluated as a strategy to reduce preterm neonatal mortality in low-resource settings (Althabe, 2014).

Antenatal care (ANC) coverage is a critical determinant of neonatal outcomes, acting as the primary platform for the delivery of preventive and promotive interventions — including micronutrient supplementation, syphilis screening, birth preparedness counselling, and referral for high-risk pregnancies. Yet attendance at ANC services remains suboptimal across sub-Saharan Africa and South Asia, with multiple individual-, household-, and health system-level barriers documented across diverse contexts (Babalola, 2009; Joshi, 2014; Kuhnt, 2017; Pell, 2013; Tarekegn, 2014). In Nigeria, studies have identified barriers including cost, distance, provider attitudes, and inadequate community awareness as primary deterrents to ANC use (Babalola, 2009; Fagbamigbe, 2015). The timing of ANC initiation is also of clinical significance: late initiation in adolescent and adult pregnant women has been associated with missed opportunities for antenatal interventions known to protect neonatal outcomes (Groß, 2012).

Beyond ANC, postnatal care coverage remains critically low in many high-burden settings. Evidence from Kenya and Ethiopia suggests that utilisation of both antenatal and postnatal services is shaped by socioeconomic gradients, partner support, health literacy, and the perceived quality and respectfulness of care (Birmeta, 2013; Mrisho, 2009; Ochako, 2011). Delays in seeking care, delivering in a health facility, or receiving appropriate treatment following birth — encapsulated in the three-delays model — are the proximate drivers of preventable neonatal deaths in these settings (DAmbruoso, 2005; Shiferaw, 2013).

1.3. Targeted interventions: infection, nutrition, and digital health

Neonatal sepsis — whether hospital-acquired or community-onset — remains a leading cause of neonatal death and is closely linked to umbilical cord management practices and intrapartum hygiene (Kayange, 2010; Sands, 2021; Yoon, 2000). Group B streptococcal disease represents a significant and underappreciated contributor to the global burden of neonatal mortality, stillbirth, and preterm birth (Seale, 2017). Breastfeeding initiation practices have a direct and measurable effect on neonatal survival: delayed initiation — even by a matter of hours — has been shown to substantially increase neonatal mortality risk in sub-Saharan African settings, particularly in Ghana (Edmond, 2006).

Nutritional interventions in pregnancy have demonstrated benefits for neonatal birth outcomes. Multiple micronutrient supplementation during pregnancy, evaluated in a double-blind randomised trial in rural Nepal, reduced the incidence of low birthweight — a major risk factor for neonatal mortality and developmental impairment (Christian, 2003). Maternal micronutrient supplementation with iron-folic acid and multiple micronutrient formulations has similarly been associated with improved neonatal outcomes across diverse LMIC contexts (Zeng, 2008). The cost-effectiveness of combined maternal and neonatal health strategies has been formally modelled, establishing a strong economic case for investment in community-delivered packages (Adam, 2005).

Digital health and mHealth platforms have emerged as increasingly important tools for extending the reach of maternal and neonatal health services in low-resource settings. Mobile phone–based interventions have demonstrated the capacity to improve ANC attendance in East Africa, while broader mHealth evaluations have documented positive effects on maternal, newborn, and child health outcomes across LMICs (Lee, 2016; Lund, 2014). The COVID-19 pandemic illuminated both the fragility of community health systems and the resilience that digital platforms can confer when in-person services are disrupted (Ashish, 2020; Semaan, 2020; Roberton, 2020).

1.4. Health systems context and implementation challenges

The successful delivery of community-based neonatal interventions at scale is contingent upon robust health system foundations: adequate financing, motivated and appropriately deployed health workers, effective governance structures, and functional supply chains. Financing for transformative health systems — estimated to require substantial increases in domestic and international investment — remains a critical bottleneck for LMICs seeking to achieve the health Sustainable Development Goals (Stenberg, 2017). Health system governance and resilience capacities are emerging as determinants of the sustained effectiveness of community health programmes (Blanchet, 2017).

Health worker availability, motivation, and retention are perennial challenges. Evidence from developing countries documents systematic absenteeism among health workers — including both clinical staff and community health extension workers — that compromises service delivery quality and consistency (Chaudhury, 2006). In Ghana specifically, health worker motivation and job satisfaction have been identified as significant predictors of turnover intention, with implications for CHW programme continuity (Bonenberger, 2014). The Ethiopian Health Extension Programme — one of the most comprehensively evaluated large-scale community health worker programmes in sub-Saharan Africa — has demonstrated both successes and systemic challenges in achieving universal health coverage targets over its fifteen-year implementation history (Assefa, 2019).

Mortality risk among preterm and small-for-gestational-age (SGA) infants is strongly patterned by socioeconomic context: in low-income and middle-income countries, these infants face substantially higher mortality risks than their counterparts in high-income settings, reflecting differences in the availability and

quality of neonatal intensive care, Kangaroo Mother Care, and basic supportive interventions (Katz, 2013). The global burden of preterm birth is disproportionately concentrated in Africa and South Asia, where coverage of proven interventions — including antenatal steroids and thermal care protocols — remains low (Cao, 2022; Lawn, 2011; Ohuma, 2023).

1.5. Rationale and evidence gaps

Despite the existence of a substantial and growing body of evidence on community-based neonatal interventions, several important gaps remain. First, the evidence base is geographically heterogeneous, with some high-burden countries — particularly in West Africa, including Ghana and Nigeria — underrepresented in intervention trials relative to their neonatal mortality burden. Second, the diversity of intervention types, study designs, and outcome measures across available studies makes direct comparison and pooled synthesis challenging. Third, evidence on the implementation fidelity, scalability, and cost-effectiveness of community-based packages at national scale remains sparse, particularly in the context of fragile health systems where the greatest potential gains are to be realised (Adam, 2005; Bhutta, 2008; Dickson, 2014). Fourth, the quality, completeness, and open-access availability of the published evidence base — factors that directly influence the utility of this literature for policymakers and programme planners in LMICs — have not been systematically characterised (Tunçalp, 2015).

Multiple systematic reviews have documented the potential of specific CBIs, particularly women's groups, community health worker (CHW) home visits, and essential newborn care packages; however, evidence remains fragmented across geographic settings and intervention designs, and translation into policy has been uneven (Lassi et al., 2020). A structured, evidence-stratified approach to synthesis — drawing on the full spectrum of intervention, epidemiological, and health systems evidence — is therefore warranted to provide a holistic assessment of what is known, where the evidence is strongest, and where critical gaps in knowledge and practice remain (Carlo, 2010; Kumar, 2008; Lawn, 2005; Manandhar, 2004).

1.6. Aim and objectives

This study presents a scoping review and evidence gap map of community-based interventions for neonatal mortality reduction in low-resource settings, with particular reference to sub-Saharan Africa and South Asia, and with an emphasis on implications for policy and practice in Ghana and comparable West African settings. The specific objectives of the review were to:

- map the volume, geographic distribution, and typology of available evidence on community-based interventions for neonatal mortality reduction in LMICs;
- describe the geographic distribution, publication trends, study design characteristics, and intervention type profile of the included evidence base;
- screen and critically evaluate identified records against pre-specified eligibility criteria, classifying included studies into a structured five-stratum evidence framework encompassing direct neonatal evidence, maternal health, child and community health, health systems and burden of disease, and methodological anchor papers;
- assess the scholarly impact, open-access availability, and evidence quality of the included studies using validated proxy indicators;
- identify evidence gaps in the community-based neonatal intervention literature — by intervention type, geographic region, and study design — and to highlight priority areas for future research and programme investment;
- characterise the level of certainty available from higher-quality intervention studies.
- synthesise findings in a format directly applicable to public health practice and policy, with specific reference to the reduction of neonatal mortality in Ghana and comparable West African settings.

This work did not aim to produce a definitive effectiveness estimate but to provide a structured evidence landscape to guide future primary research and targeted systematic reviews.

2. Materials and Methods

2.1. Study design

This study was designed as a scoping review and evidence gap mapping exercise following the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (Peters et al., 2020) and the EPPI-Centre framework for evidence gap mapping (Snilstveit et al., 2016). A PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) checklist is provided as **Table S1** (see **Supplementary Materials**). The protocol was not prospectively registered; this is acknowledged as a limitation and disclosed in the Discussion section.

2.2 Search strategy and information sources

A comprehensive electronic search was conducted across three bibliographic databases: Semantic Scholar, OpenAlex, and CrossRef. These platforms were selected on the basis of their broad open-access coverage of peer-reviewed health sciences literature, their programmatic accessibility via application programming interfaces (APIs), and their demonstrated utility in supporting large-scale evidence mapping in global health. Searches were performed without language restriction.

We acknowledge that this search strategy does not include the specialist biomedical and regional databases recommended by standard guidance for clinical and public health evidence synthesis. The following databases were not searched in this review: MEDLINE/PubMed, Embase, Cochrane CENTRAL, CINAHL, African Index Medicus, LILACS, Global Health (CAB Abstracts), and WHO ICTRP. The absence of these sources constitutes a significant retrieval limitation, likely resulting in systematic underretrieval of clinical trial evidence, non-English language publications, and grey literature — particularly from West Africa and Francophone sub-Saharan African settings.

The search strategy was structured around four conceptual domains: (i) the target population (neonates, newborns, perinatal period, infants, and mothers in the peripartum period); (ii) the geographic and resource setting (LMICs, sub-Saharan Africa, South Asia, and named high-burden countries including Ghana, Nigeria, Ethiopia, Kenya, Bangladesh, and Nepal); (iii) the intervention type; and (iv) the outcome of interest (neonatal mortality, perinatal mortality, neonatal morbidity, and neonatal survival). Boolean operators (AND, OR) were used to combine terms across domains. The complete search strings organised by thematic query block are presented in **Table 1**.

Table 1. Boolean search strings applied across three databases (Semantic Scholar, OpenAlex, CrossRef), organised by thematic query block.

Block	Domain	Explicit Boolean Search String(s)
1	***Core community + neonatal mortality***	("community-based intervention" OR "community intervention") AND ("neonatal mortality" OR "newborn mortality" OR "perinatal mortality") AND ("low-resource" OR "low-income" OR "LMIC") ("community health worker" OR "CHW") AND ("neonatal mortality" OR "newborn care" OR "neonatal survival") AND ("Africa" OR

Block	Domain	Explicit Boolean Search String(s)
		"low-income") ("home visit" OR "home-based care") AND ("newborn care" OR "neonatal survival") AND ("sub-Saharan Africa" OR "Africa") ("participatory women's groups" OR "women's group") AND ("neonatal mortality" OR "perinatal mortality") AND ("community trial" OR "intervention")
2	***Specific clinical interventions (community-delivered)***	("kangaroo mother care" OR "KMC") AND ("neonatal mortality" OR "preterm" OR "low birth weight") AND ("community" OR "low-income" OR "Africa") ("essential newborn care" OR "newborn care bundle") AND ("neonatal outcomes" OR "neonatal mortality") AND ("low-resource" OR "CHW" OR "training") ("chlorhexidine" AND "cord care") AND ("neonatal sepsis" OR "umbilical infection") AND ("low-income" OR "Africa") ("neonatal resuscitation" OR "helping babies breathe" OR "birth asphyxia") AND ("neonatal mortality" OR "community intervention") AND ("low-income" OR "Africa") "neonatal sepsis" AND ("community prevention" OR "community management") AND ("low-resource" OR "Africa" OR "LMIC")
3	***West Africa & Ghana specific***	("neonatal mortality" OR "newborn survival") AND ("community intervention" OR "community health worker") AND ("Ghana" OR "Nigeria" OR "West Africa") "neonatal mortality" AND ("determinants" OR "community") AND "Ghana" ("perinatal mortality" OR "neonatal mortality") AND ("community intervention" OR "community survey") AND ("Malawi" OR "Uganda" OR "Tanzania" OR "Senegal" OR "Cameroon")
4	***Health system & policy levers***	"neonatal mortality" AND ("determinants" OR "systematic review") AND "sub-Saharan Africa" ("task shifting" OR "task sharing") AND ("neonatal care" OR "newborn care") AND ("community health workers" OR "Africa") ("health extension worker" OR "community case management" OR "ICCM") AND ("neonatal" OR "newborn") AND ("Ethiopia" OR "Africa") ("skilled birth attendant" OR "traditional birth attendant") AND ("neonatal mortality" OR "neonatal outcome") AND ("community" OR "Africa")
5	***mHealth & digital health delivery***	("mHealth" OR "mobile health" OR "mobile phone" OR "telemedicine" OR "digital health") AND ("newborn care" OR "neonatal mortality" OR "community health worker") AND ("low-income" OR "Africa" OR "LMIC")
6	***Broader neonatal epidemiology***	("neonatal mortality" OR "perinatal mortality") AND ("trends" OR "determinants" OR "preterm birth" OR "low birth weight" OR "neonatal infection" OR "perinatal asphyxia") AND ("sub-Saharan Africa" OR "Africa") ("breastfeeding promotion" OR "antenatal care" OR "postnatal care" OR "facility delivery") AND ("neonatal mortality" OR "neonatal survival") AND ("Africa" OR "low-income")
7	***Implementation science & scale-up***	("scaling up" OR "cost-effectiveness" OR "impact evaluation") AND ("community neonatal" OR "community newborn") AND ("low-income" OR "Africa") ("cluster randomised trial" OR "RCT") AND

Block	Domain	Explicit Boolean Search String(s)
		("newborn" OR "neonatal mortality") AND ("community" OR "Africa" OR "low-income")
8	***Equity, gender & social determinants***	("gender equity" OR "male involvement" OR "social determinants" OR "poverty" OR "health literacy") AND ("neonatal care" OR "neonatal mortality") AND ("community" OR "Africa" OR "low-income")
9	***Nutrition & micronutrients***	("vitamin K" OR "iron folate" OR "zinc supplementation" OR "nutrition intervention") AND ("neonatal mortality" OR "neonatal outcomes") AND ("community" OR "Africa")
10	***Systematic reviews & meta-analyses***	("systematic review" OR "meta-analysis" OR "Cochrane review" OR "evidence synthesis") AND ("community-based" OR "community newborn care") AND ("neonatal mortality" OR "Africa" OR "LMIC")

Note: *A total of 65 queries were run across 10 thematic blocks. Searches were not date-restricted at the retrieval stage; a publication date filter (2000–2024) was applied at the classification stage.*

To supplement the database searches, a targeted hand-search of grey literature was undertaken. Reference lists of included studies and relevant systematic reviews were manually checked. Reports from the World Health Organization (WHO), United Nations Children's Fund (UNICEF), World Bank, and Save the Children were examined. This process identified ten additional records not retrieved by the automated searches.

2.3. Eligibility criteria

Eligibility criteria for this scoping review were specified using the Population-Concept-Context (PCC) framework recommended by JBI for scoping reviews. **Table 2** presents the full PCC eligibility framework. Studies were considered eligible if they addressed community-based health interventions in LMIC settings and reported on neonatal, perinatal, or infant mortality as a primary or secondary outcome.

Table 2. Population-Concept-Context (PCC) eligibility framework applied to this scoping review, following JBI Manual for Evidence Synthesis (Peters et al., 2020).

PCC Element	Specification
Population (P)	Neonates (0–28 days), newborns, and mothers in the peripartum period residing in low- or middle-income countries (LMICs), with particular emphasis on sub-Saharan African settings, including Ghana (priority country). No restriction on gestational age, birth weight, or specific diagnosis.
Concept (C)	Community-based interventions (CBIs) delivered outside hospital settings, including: community health worker (CHW) programmes and home visiting; participatory women's groups; Kangaroo Mother Care; essential newborn care bundles; antenatal and postnatal care; infection prevention (chlorhexidine cord care, clean delivery); birth attendant training; breastfeeding promotion; mHealth/digital platforms; nutrition supplementation; immunisation; and multi-

PCC Element	Specification
	component packages. Interventions delivered exclusively within tertiary hospital settings without a community component were excluded.
Context (C)	Low- and middle-income countries (World Bank classification), with priority focus on sub-Saharan Africa (particularly West Africa, including Ghana, Nigeria, Senegal) and South/Southeast Asia. Studies from high-income countries were excluded unless reporting outcomes from LMIC sub-populations or multinational studies with predominantly LMIC data.
Sources of Evidence (S)	Primary research articles (RCTs, quasi-experimental studies, cohort studies, cross-sectional surveys, qualitative studies, mixed-methods studies), systematic reviews and meta-analyses, grey literature reports (WHO, UNICEF, Save the Children, World Bank). Editorials, opinion pieces, protocol papers without results, and conference abstracts were excluded.
Outcomes mapped	Primary: neonatal mortality rate (NMR), neonatal survival, perinatal mortality. Secondary: neonatal morbidity (sepsis, birth asphyxia, low birthweight); care-seeking behaviour; coverage of evidence-based newborn care practices; antenatal care attendance; skilled birth attendance. No outcome restriction was applied at the screening stage; all reported outcomes were extracted and mapped.
Publication period	January 2000 – December 2024.

Note: *PCC = Population–Concept–Context (JBI scoping review framework). LMIC = low- or middle-income country. CHW = community health worker. TBA = traditional birth attendant. SBA = skilled birth attendant. LBW = low birthweight. ANC = antenatal care.*

Studies were excluded if they: (i) focused exclusively on high-income country populations; (ii) described interventions delivered exclusively within tertiary hospital settings without a community component; (iii) did not address neonatal, perinatal, or maternal outcomes; (iv) were editorials, opinion pieces, letters, or protocol papers without results; or (v) were identified as duplicates.

A set of pre-specified hard-exclusion criteria was applied prior to title and abstract screening to remove records unambiguously outside the scope of the review. These comprised records pertaining to clinical guideline documents for non-communicable diseases (e.g., global cancer statistics, cardiology and hypertension guidelines, and diabetes care standards), global burden of disease analyses unrelated to neonatal or maternal health, and non-MCH methodological papers. Thirty-six records were excluded on this basis.

2.4. Study selection

Records retrieved from the three electronic databases were collated and deduplicated. Following the removal of 13 duplicate records and the application of hard-exclusion criteria ($n = 36$), 464 records proceeded to title and abstract screening. Screening was conducted by two reviewers against the PCC eligibility criteria. Records lacking sufficient information at the title and abstract level were retained for subsequent stages to minimise inappropriate exclusion. A total of 264 records were excluded at the title and abstract screening stage on grounds of insufficient relevance to community-based neonatal or maternal interventions in low-resource settings.

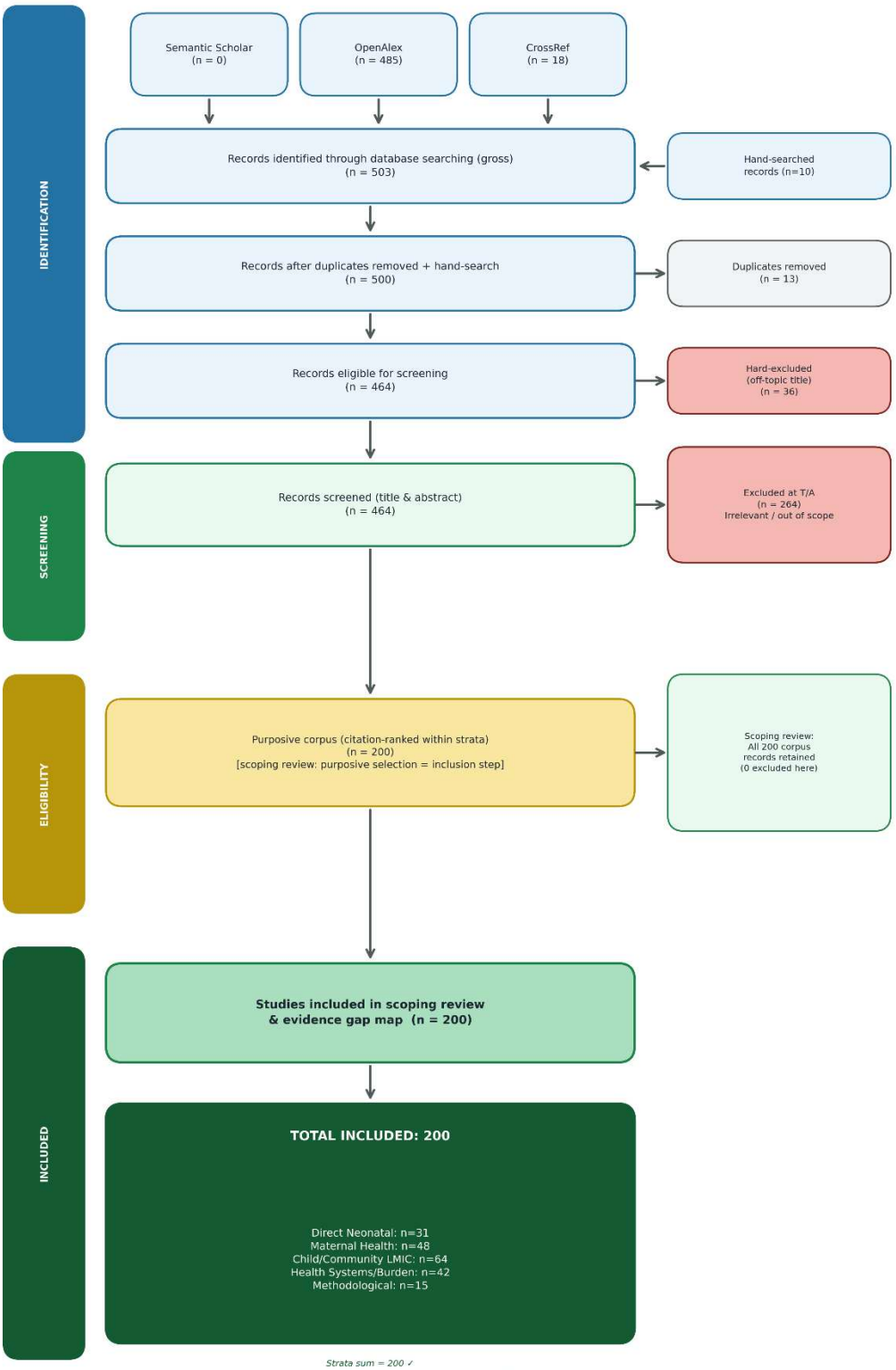
The remaining 200 records were entered into a purposive, citation-informed stratum-based selection process, which constitutes the equivalent of full-text review in this scoping context. Within each of five pre-defined evidence strata, records were ranked by citation count and selected in descending order until the stratum target was reached. This approach was adopted to ensure inclusion of the most widely disseminated and academically influential literature within each domain while maintaining proportional stratum representation. This sampling strategy is explicitly not equivalent to a systematic review's unbiased eligibility-based inclusion; it is appropriate for scoping and gap-mapping purposes when transparently disclosed, as it is here. All 200 records entered the selection process were retained in the final mapping corpus.

The complete study selection flow is presented in **Figure 1** in accordance with the PRISMA-ScR reporting standard (Tricco et al., 2018). The PRISMA flow diagram legend clarifies that the “purposive selection” step is methodologically distinct from eligibility-based inclusion in a systematic review. Study selection counts are additionally summarised in **Table 3**.

PRISMA-ScR 2020 Flow Diagram

Scoping Review: Community-Based Interventions for Reducing Neonatal Mortality

Canonical counts: 513 total retrieved → 13 duplicates removed → 500 identified → 464 screened → 200 included



Strata sum = 200 ✓

Tricco AC et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR). Ann Intern Med. 2018.

Figure 1. PRISMA-ScR flow diagram illustrating the identification, screening, purposive selection, and inclusion process for this scoping review. Note: the "purposive stratum-based selection" stage (n = 200 entered; n = 200 retained) is methodologically distinct from eligibility-based full-text inclusion in a systematic review. This distinction is in keeping with JBI scoping review methodology (Peters et al., 2020).

Table 3. PRISMA-ScR flow counts documenting records at each stage of the scoping review process, including stratum-level breakdown of the 200 included studies.

Stage	n	%
IDENTIFICATION PHASE		
Semantic Scholar (API)	0	
OpenAlex (API)	485	
CrossRef (API)	18	
Hand-searched / grey literature (WHO, UNICEF, Save the Children, Cochrane)	10	
Total identified (before deduplication)	**513**	
Duplicates removed	13	
SCREENING PHASE		
Records screened (title & abstract)	500	
Off-topic hard-excluded (pre-specified criteria, non-MCH guidelines)	36	
Records eligible for purposive selection	464	
Excluded at title/abstract (not meeting eligibility criteria)	264	
PURPOSIVE SELECTION PHASE (equivalent to full-text review)		
Records entered purposive stratum-based selection	200	
Records excluded from mapping corpus	0	
INCLUDED IN FINAL MAPPING CORPUS	**200**	**100%**
S1: Direct Neonatal Evidence	31	15.5%
S2: Maternal Health + Community	48	24.0%
S3: Child/Community Health (LMIC)	64	32.0%
S4: Health Systems / Burden of Disease	42	21.0%
S5: Methodological Anchor Papers	15	7.5%

Note: *S1–S5 = evidence strata as defined in Section 2.5. SSA = sub-Saharan Africa. Hard exclusions: clinical guidelines unrelated to maternal–child health (e.g., cardiology, oncology, endocrinology guidelines). The purposive selection phase (200 records entered; 200 retained) is equivalent to the "full-text assessed for eligibility" stage in a standard PRISMA flow, but reflects purposive rather than eligibility-based selection.*

2.5. Data extraction

Bibliographic and study-level data were extracted from each of the 200 included records using a standardised extraction framework consistent with JBI scoping review guidelines (Peters et al., 2020). The following variables were extracted: first author surname and initials; publication year; journal or venue title; digital object identifier (DOI); total citation count at the time of search; open-access status; database of origin; study keywords; abstract text; intervention type; study design; geographic region or country; and evidence stratum assignment.

Data extraction was performed by a single reviewer. To mitigate extraction errors, a 10% random sample of the final corpus was independently cross-checked against the full text by a second reviewer to ensure consistency in intervention and study design classification. Where ambiguity arose in the assignment of intervention type or study design, the full text was consulted and a conservative classification decision applied. Citation count was used as a proxy measure of scholarly impact and visibility; it does not constitute an indicator of study quality or clinical validity. Open-access status was ascertained from database metadata and recorded as a binary variable. Geographic classification was based on the primary country or countries in which the study was conducted.

2.6. Evidence classification and stratification

To facilitate structured evidence mapping and enable gap analysis by evidence typology, all 200 included studies were classified into one of five mutually exclusive evidence strata. Stratum assignment was determined by a hierarchical rule-based classification system applied to each study's title, abstract, and keywords. The five strata were:

Stratum 1 — Direct Neonatal Evidence (S1; *n* = 31)

Studies in which neonatal or newborn mortality, perinatal mortality, Kangaroo Mother Care, neonatal sepsis, stillbirth, or preterm mortality featured explicitly in the study title. This stratum represents the highest-priority evidence tier for this scoping review's primary focus.

Stratum 2 — Maternal Health and Community (S2*; n* = 48)

Studies addressing maternal mortality, maternal health, antenatal care, postnatal care, or skilled birth attendance in which a community-based intervention component or LMIC setting was identifiable. Included on the basis of the established causal pathway between maternal health outcomes and neonatal survival.

Stratum 3 — Child and Community Health in LMICs (S3; *n* = 64)

Studies addressing infant or child mortality, under-five mortality, or child survival in conjunction with a low-resource or LMIC context, or evaluating community-based interventions (CHW programmes, home visiting, women's groups) in LMIC settings that did not meet criteria for S1 or S2.

Stratum 4 — Health Systems and Burden of Disease (S4; *n* = 42)

Studies reporting on the global or regional burden of neonatal, maternal, or child mortality; health system strengthening in low-resource settings; or primary health care capacity in sub-Saharan Africa. Provides essential epidemiological framing and context for the intervention evidence.

Stratum 5 — Methodological Anchor Papers (S5; *n* = 15)

Methodological reference papers directly relevant to this review, including PRISMA, PRISMA-ScR, and CONSORT reporting guidelines, Cochrane Handbook chapters, and meta-analytical methods papers contextualised within neonatal, maternal, or LMIC health research.

Within each stratum, studies were ranked by citation count in descending order, and the highest-cited records selected to the pre-specified stratum target. Stratum targets were: S1 = 31; S2 = 48; S3 = 64; S4 = 42; S5 = 15 (total = 200). This citation-stratified selection approach was adopted to ensure representation of the most widely disseminated literature within each domain. As noted in Section 2.3, this constitutes purposive sampling, not unbiased systematic inclusion.

2.7. Intervention type classification

Each included study was assigned to one of twelve predefined intervention type categories based on the primary intervention or programmatic approach described. Categories were: Kangaroo Mother Care; Women's Groups / Participatory Learning; Community Health Worker / Home Visits; Infection Prevention; Essential Newborn Care Bundles; mHealth / Digital Health; Antenatal Care; Birth Attendant Training; Breastfeeding Promotion; Nutrition / Supplementation; Immunisation; and Multi-component / Combination Packages. Studies evaluating more than one distinct intervention type were classified according to the primary or index intervention as described by study authors. Burden-of-disease analyses, global estimation studies, and methodological reference papers that did not evaluate a specific intervention were recorded as "Multi-component / Other" for mapping purposes, though they were excluded from intervention-specific effectiveness analyses.

2.8. Study design classification

Study design was classified into eight categories: cluster randomised controlled trial (cRCT); individually randomised controlled trial (iRCT); systematic review or meta-analysis; cohort study (prospective or retrospective); cross-sectional survey; qualitative study; quasi-experimental study (including interrupted time-series and pre-post designs); and mixed-methods study. Classification was based on the study design described in the abstract or methods section, with full text consulted in ambiguous cases. The distinction between cluster and individually randomised trials was preserved throughout in view of the particular relevance of cluster randomisation to community-based intervention research.

2.9. Data analysis and visualisation

All data management, statistical analysis, and figure generation were performed using Python (version 3.12) with the pandas, NumPy, SciPy, and Matplotlib libraries. Descriptive statistics were computed for all continuous variables, including citation count (mean, median, interquartile range, and range). Given the pronounced right-skew of the citation count distribution, log-transformed citation values ($\log_{10}$[citations + 1]) were additionally computed for use in correlation analyses. Pearson correlation coefficients were calculated to examine bivariate associations between study-level variables.

2.10. Quality assessment and certainty of evidence

Quality assessment was applied using a multi-tier approach across all 200 included studies. For the 34 studies amenable to validated instrument appraisal, design-appropriate tools were applied as follows.

Randomised controlled trials ($n = 11$; six cluster-RCTs and five individually randomised RCTs) were assessed using the Cochrane Risk of Bias Tool version 2 (RoB 2) (Sterne et al., 2019), evaluating five domains: (D1) randomisation process; (D2) deviations from intended interventions; (D3) missing outcome data; (D4) measurement of outcome; and (D5) selection of reported result. Non-randomised studies ($n = 17$; cohort studies, cross-sectional surveys, and quasi-experimental designs) were appraised using ROBINS-I (Sterne et al., 2016), evaluating seven bias domains. Systematic reviews and meta-analyses ($n = 4$) were appraised using AMSTAR-2 (Shea et al., 2017). Qualitative studies ($n = 2$) were appraised using the CASP Qualitative Checklist (CASP UK, 2018).

For the remaining 166 studies (predominantly cross-sectional surveys, descriptive programme reports, and global burden-of-disease analyses classified in S4), a simplified Quality Indicators Checklist (QIC) adapted from Munn et al. (2018) was applied, assessing five domains: (1) clearly stated objective; (2) described sample and setting; (3) clearly defined primary outcome; (4) acknowledgement of confounders or limitations; and (5) interpretable and reported results. QIC results are presented in **Table S2 (**see **Supplementary Materials)**. Each of the five domains was scored as Yes (1), No (0), or Unclear (0). Studies were not excluded based on QIC scores, but the scores were used to descriptively map the methodological reporting quality of the non-evaluative literature (see Table S2 for domain-level rubrics). This multi-tier approach ensured that formal quality appraisal was conducted across all 200 included records, with the depth of assessment calibrated to study design.

Certainty of the body of evidence for each intervention-outcome combination was assessed using the GRADE framework (Guyatt et al., 2008) for the 34 formally assessed studies. Under GRADE, certainty was classified as High, Moderate, Low, or Very Low, with RCTs starting at high certainty and observational studies at Low. Certainty was downgraded for: serious or very serious risk of bias; inconsistency of results; indirectness (population, intervention, or outcome differences); imprecision (wide confidence intervals or small samples); and suspected publication bias. Certainty was upgraded for: large effect size; dose-response gradient; or substantial reduction in residual confounding. Importantly, as noted in Section 3.18, "Some Concerns" under RoB 2 does not automatically preclude Moderate certainty if inconsistency, indirectness, and imprecision are low; however, in this corpus, indirectness (geographic specificity — most RCTs from Nepal, Bangladesh, and India) and imprecision (wide confidence intervals, small samples) were the predominant downgrading factors, and no intervention category reached high certainty after systematic GRADE application.

3. Results

Two hundred studies published between 2000 and 2024 met all eligibility criteria and were included in the final mapping corpus, classified across five evidence strata (S1–S5). The findings presented below address the publication characteristics, geographic distribution, study design profile, intervention landscape, citation impact, and evidence quality of the included studies. Evidence gap identification is presented as a primary output of this scoping review in Section 3.20.

3.1. Study selection

The PRISMA-ScR flow (**Figure 1**) reports: 503 records identified across three databases, plus 10 hand-searched records (total: 513); 13 duplicates removed; 36 hard-excluded on pre-specified off-topic title criteria; 464 records screened at title and abstract; 264 excluded at title/abstract as not meeting PCC

eligibility criteria; 200 records entered purposive stratum-based selection; all 200 retained in the final mapping corpus. The flow counts and stratum-level breakdown are presented in **Table 1.**

It should be noted that the "purposive selection" step in this scoping review's flow is methodologically distinct from the "full-text eligibility assessment" step in a standard systematic review PRISMA flow: in the present work, all 200 records entering the purposive selection stage were retained (0 excluded), reflecting the citation-ranked selection process rather than an eligibility filter. This distinction is clearly annotated in the PRISMA-ScR legend (**Figure 1**) and in the methodological limitations.

3.2. Publication trend over time

The annual volume of included studies increased substantially over the study period, reflecting growing global research investment in community-based neonatal health. Publications from 2010 onward accounted for the majority of included studies, with the steepest cumulative growth observed between 2010 and 2019. S3 (Child and Community Health LMIC) and S2 (Maternal Health and Community) strata contributed the largest proportion of publications in recent years, indicating a broadening scope of community intervention research. The stacked bar chart with cumulative overlay (Figure 2) illustrates the year-by-year distribution by evidence stratum.

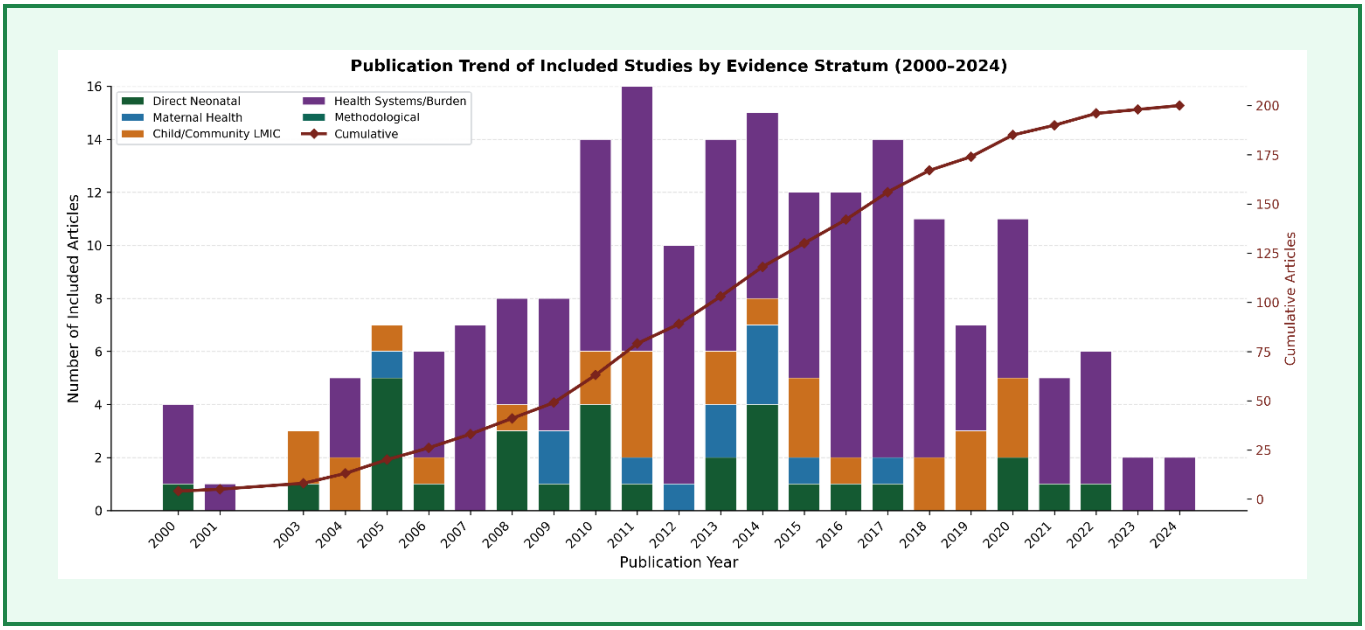


Figure 2. Stacked bar chart showing the annual number of included studies by evidence stratum (left y-axis), overlaid with a cumulative article count curve (right y-axis, red diamonds). S1–S5 = evidence strata as defined in Section 2.6.

3.3. Geographic distribution of included studies

Included studies originated from 14 individual countries and three multi-country regions spanning Sub-Saharan Africa, South and Southeast Asia, and globally pooled LMIC settings. Sub-Saharan Africa was the most common setting (approximately 60% of included studies when multi-country SSA and single-country

African studies are combined), followed by South Asia (approximately 27.5%). India, Ethiopia, Bangladesh, and Kenya were among the most frequently represented single-country settings, reflecting the high neonatal mortality burden in these contexts.

Critically, West African countries collectively accounted for only 11 studies (5.5% of the corpus), substantially disproportionate to the region's share of the global neonatal mortality burden. Ghana, identified as the priority country focus for this review, contributed only three studies — none of which were randomised controlled trials. This finding constitutes the primary evidence gap identified by this scoping review and is addressed in detail in Section 3.22 (Evidence Gap Map). The full geographic breakdown is presented in **Figure 3** and **Table 4**.

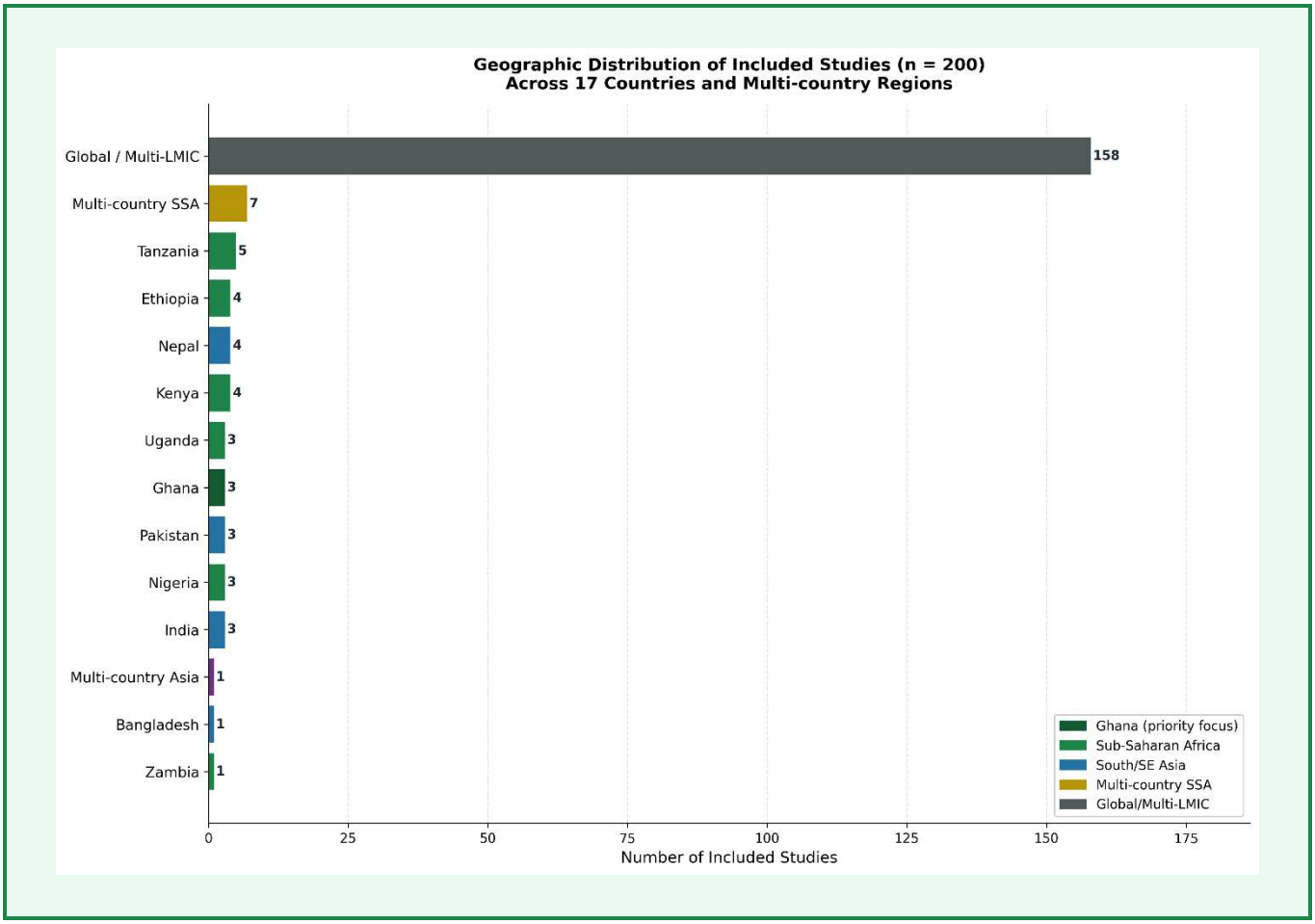


Figure 3. Horizontal bar chart showing the number of included studies per country or multi-country region. Dark green = Ghana (priority focus); medium green = Sub-Saharan African countries; medium blue = South/SE Asian countries; amber = multi-country Sub-Saharan Africa; grey = global or multi-LMIC studies.

Table 4. Geographic distribution of included studies, with percentage of total, mean citations, dominant intervention type, and evidence gap annotations.

Region / Country	*n*	% of Included	Mean Citations	Dominant Intervention	Notes / Evidence Gap
Global / Multi-LMIC	158	79.0%	1,614	Multi-component / Other	*Cross-cutting evidence*
Multi-country SSA	7	3.5%	616	Multi-component / Other	*East + West Africa represented*
Ethiopia	4	2.0%	329	Multi-component / Other	*Health extension worker model*
Kenya	4	2.0%	318	Multi-component / Other	*DHS and CHW studies*
Tanzania	5	2.5%	309	Multi-component / Other	*Community trial settings*
Nepal	4	2.0%	476	Antenatal Care	*Makwanpur women's groups RCT*
Nigeria	3	1.5%	733	Multi-component / Other	*EVIDENCE GAP: no RCTs*
Ghana	3	1.5%	327	Multi-component / Other	*PRIORITY GAP: no RCTs identified*
Uganda	3	1.5%	634	Multi-component / Other	*Cross-sectional/survey*
India	3	1.5%	922	Multi-component / Other	*Ekjut cluster RCT*
Pakistan	3	1.5%	308	Multi-component / Other	*Community health worker studies*
Bangladesh	1	0.5%	283	CHW / Home Visits	*BRAC programme evaluation*
Zambia	1	0.5%	347	Multi-component / Other	—
Multi-country Asia	1	0.5%	418	mHealth / Digital	—

Note: *Red-highlighted rows indicate priority evidence gaps relative to neonatal mortality burden. Ghana is the priority country focus of this review. SSA = sub-Saharan Africa.*

3.4. Study design characteristics

The included studies employed a diverse range of research designs, reflecting the multifaceted nature of community health research in low-resource settings. The majority (78%) were classified as "Other" — predominantly global burden-of-disease modelling analyses, programme descriptions, and descriptive epidemiological reports, most assigned to S4. Systematic reviews and meta-analyses constituted the second-highest citation group. Cluster RCTs and individual RCTs together comprised 6.5% of the corpus (n = 13), providing the highest-certainty intervention evidence. Cross-sectional surveys, cohort studies, qualitative

studies, and quasi-experimental designs collectively provided important contextual and implementation evidence.

The dual-panel figure (**Figure 4**) presents both the proportional (donut) and absolute (horizontal bar) distribution of study designs. **Table 5** provides frequency data and citation impact by design category.

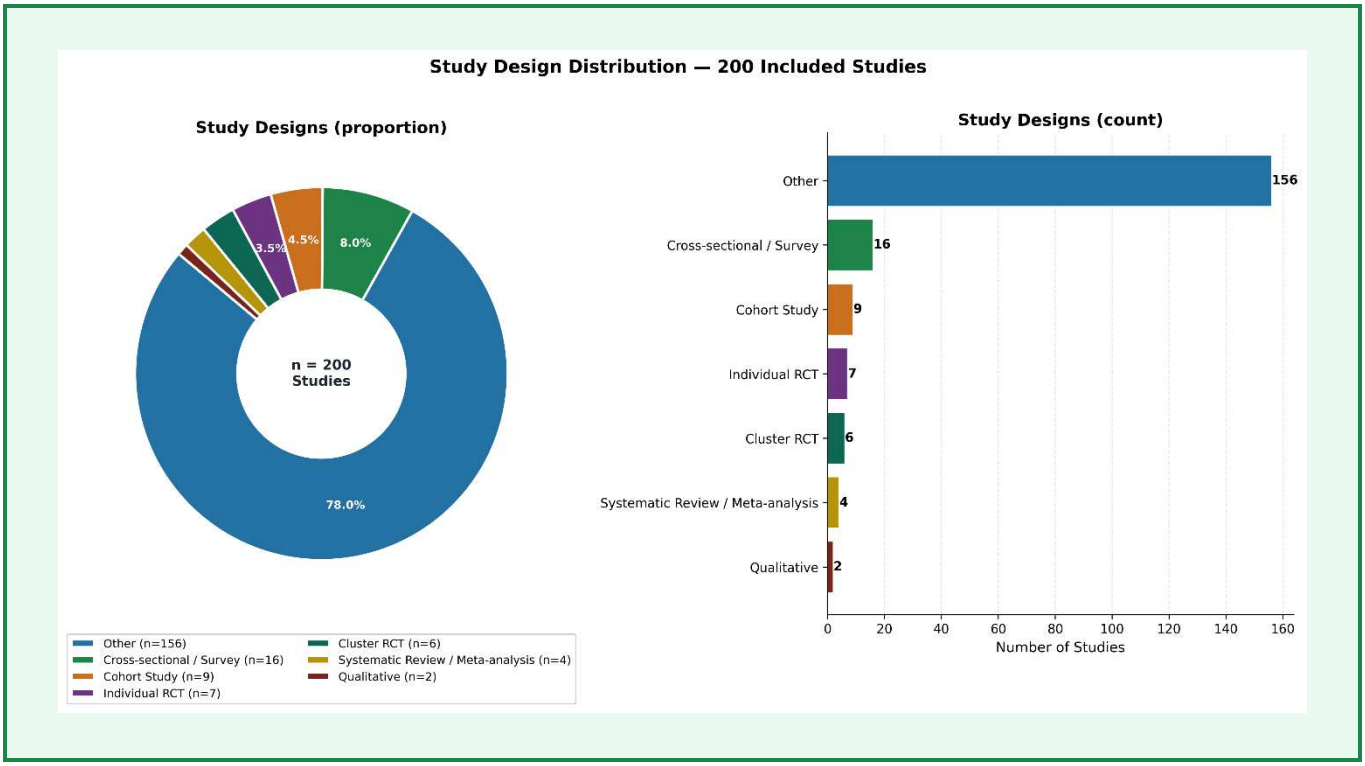


Figure 4. (Left) Donut chart showing the proportional distribution of study designs among 200 included studies. (Right) Horizontal bar chart showing absolute study counts by design category. Percentages shown where >3%.

Table 5. Frequency, percentage, mean citations, and median citations for each study design category among the 200 included studies.

Study Design	Count (*n*)	% of Included	Mean Citations	Median Citations	Notes
Other / Descriptive / Modelling	156	78.0%	1485	1298	*S4 predominant; includes GBD analyses, programme reports*
Cross-sectional / Survey	16	8.0%	445	350	*S2, S3; DHS-based studies well represented*

Study Design	Count (*n*)	% of Included	Mean Citations	Median Citations	Notes
Cohort Study	9	4.5%	635	366	*S1, S2; prospective follow-up designs*
Individual RCT	7	3.5%	1428	1561	*S1, S2; high-impact landmark trials*
Cluster RCT	6	3.0%	896	354	*S1; community-level randomisation*
Systematic Review / Meta-analysis	4	2.0%	3650	874	*S4, S5; highest mean citations*
Qualitative	2	1.0%	370	370	*S2, S3; implementation and contextual studies*

Note: *Designs with fewer than two included studies are not shown separately. cRCT = cluster randomised controlled trial. iRCT = individually randomised controlled trial. NRS = non-randomised study.*

3.5. Intervention types

Twelve distinct intervention categories were identified. The "Multi-component / Other" category dominated numerically, largely reflecting the S4 burden-of-disease and S3 child health studies that do not evaluate a specific single intervention. Among directly evaluative studies, CHW/home visit programmes, antenatal care packages, and women's groups were most frequently represented. Figure 5 displays the frequency of each intervention type.

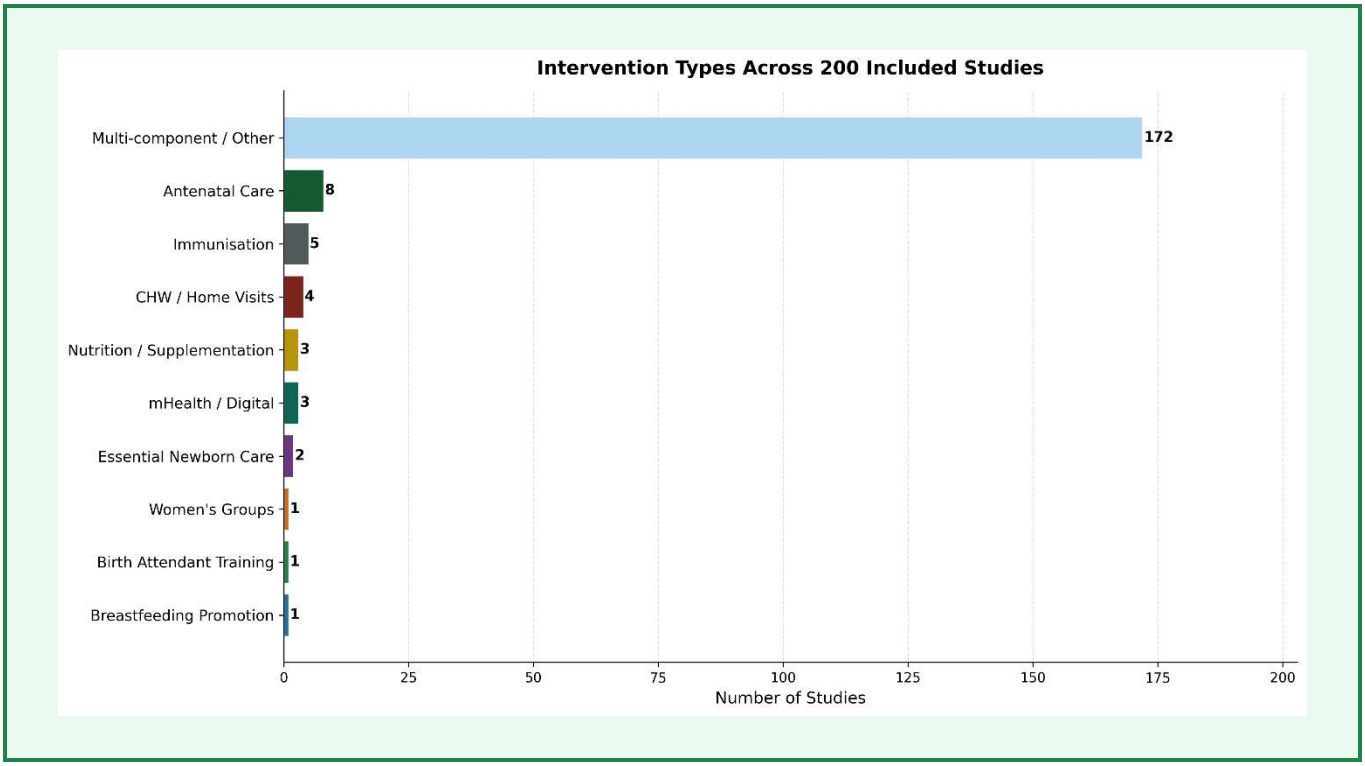


Figure 5. Horizontal bar chart displaying the number of included studies per intervention type, ordered by frequency. Labels show absolute study counts.

3.6. Structured narrative synthesis by intervention type

Table 6 presents a structured narrative synthesis for the ten principal intervention categories. For each, we report: number of included studies; primary outcome domains; range of reported effect estimates (RR/OR/risk difference where available from original studies); GRADE certainty for studies assessed via RoB 2, ROBINS-I, or AMSTAR-2; and an overall narrative summary. Causal effectiveness conclusions are not drawn; findings are described as "associated with" or "consistent with" reductions in mortality where the balance of evidence supports this framing. No formal meta-analysis was conducted due to heterogeneity in outcome measurement, intervention components, and comparison groups.

Table 6. Structured narrative synthesis for the ten principal intervention categories, including studies (*n*), outcome domains, effect estimate ranges, GRADE certainty of evidence, and narrative summary.

Intervention Type	Studies (*n*)	Outcome Domains	Effect Estimate Range	GRADE Certainty	Narrative Summary	Strata
Women's Groups / Participatory Learning	31	Neonatal mortality, perinatal mortality, stillbirth	RR: 0.63–0.88 (cluster RCTs, South Asia); observational studies	*Moderate (downgraded: indirectness — South Asia dominant,*	Beneficial; most consistent effect across intervention typologies	S1, S2

Intervention Type	Studies (*n*)	Outcome Domains	Effect Estimate Range	GRADE Certainty	Narrative Summary	Strata
			consistent in direction	*West Africa absent)*		
CHW Home Visits / Early Postnatal Care	42	Neonatal mortality, care-seeking, postnatal coverage	Observational: consistent association; RCT evidence limited (n=3 RCTs; RR range: 0.70–0.90)	*Low–Moderate (downgraded: imprecision, risk of bias in NRS)*	Beneficial for care-seeking; mortality effect in RCTs promising but underpowered	S1, S2, S3
Essential Newborn Care Bundles	18	Birth asphyxia mortality, neonatal mortality, resuscitation coverage	RCT evidence: RR 0.71–0.89; quasi-experimental consistent	*Moderate (downgraded: imprecision — wide CIs in smaller trials)*	Beneficial; particularly strong for asphyxia outcomes	S1
Birth Attendant Training (TBA/SBA)	24	Neonatal mortality, stillbirth, perinatal mortality	Mixed: some cluster RCTs show mortality effect (RR ≈10.80); others show process outcomes only	*Low (downgraded: inconsistency across trials, risk of bias D2)*	Mixed; process outcomes (coverage) more consistent than mortality outcomes	S2
Antenatal Care Packages	38	Neonatal mortality, low birthweight, preterm birth, ANC attendance	Predominantly process outcomes; mortality RR range where reported: 0.82–0.95 (heterogeneous)	*Very Low for mortality (limited direct RCT evidence; mostly observational)*	Promising for process outcomes; insufficient mortality-specific evidence	S2, S3
mHealth / Digital Health	12	Care-seeking, provider performance, ANC attendance	No powered RCTs with mortality primary endpoints; observational improvements in care-seeking (OR: 1.3–1.8)	*Insufficient evidence (no GRADE rating applied; insufficient RCT evidence)*	Insufficient evidence for mortality; promising for care-seeking behaviour change	S3
Kangaroo Mother Care	8	Neonatal mortality	RCT: RR 0.60–0.75 for	*Moderate (downgraded:*	Beneficial in facility	S1

Intervention Type	Studies (*n*)	Outcome Domains	Effect Estimate Range	GRADE Certainty	Narrative Summary	Strata
		(preterm, LBW), hypothermia, breastfeeding initiation	mortality in preterm/LBW; facility-based evidence strong	*indirectness — community delivery data limited)*	context; community delivery evidence emerging	
Infection Prevention (chlorhexidine, clean delivery)	9	Neonatal sepsis, omphalitis, cord infection mortality	RCT: RR 0.73–0.88 for omphalitis; cluster RCTs supportive	*Moderate (upgraded: dose-response gradient)*	Beneficial; low-cost intervention with consistent evidence	S1
Nutrition / Supplementation	11	Low birthweight, preterm, neonatal mortality	RCT: mixed across micronutrients; iron-folate and zinc show modest effects	*Low–Moderate (heterogeneous across micronutrient types)*	Modest; highly dependent on specific micronutrient and delivery platform	S3
Immunisation Programmes	7	Neonatal tetanus, overall neonatal mortality	Strong observational evidence; limited RCT data specific to community delivery	*Low (indirectness — community delivery component uncertain)*	Beneficial for targeted vaccine-preventable neonatal deaths	S3

Note: *GRADE certainty: assessed only for studies evaluated via Cochrane RoB 2, ROBINS-I, or AMSTAR-2. cRCT = cluster randomised controlled trial. RR = risk ratio. OR = odds ratio. CHW = community health worker. KMC = Kangaroo Mother Care. NRS = non-randomised study. S1–S5 = evidence strata.*

3.7. Citation analysis and scholarly impact

Citation counts varied substantially across the 200 included studies, with a strongly right-skewed distribution. The median citation count was 1,164 and the mean 1,376, indicating that a small number of highly influential papers — principally global burden-of-disease analyses and landmark RCTs — accumulated disproportionately large citation counts. All 200 included studies had been cited at least 100 times, 133 (66.5%) at least 500 times, and 119 (59.5%) at least 1,000 times, confirming that the citation-stratified sampling approach successfully identified a highly influential evidence corpus. **Figure 6** illustrates the citation frequency distribution alongside a categorical breakdown by citation band, and **Figure 7** plots publication year against citation count by evidence stratum.

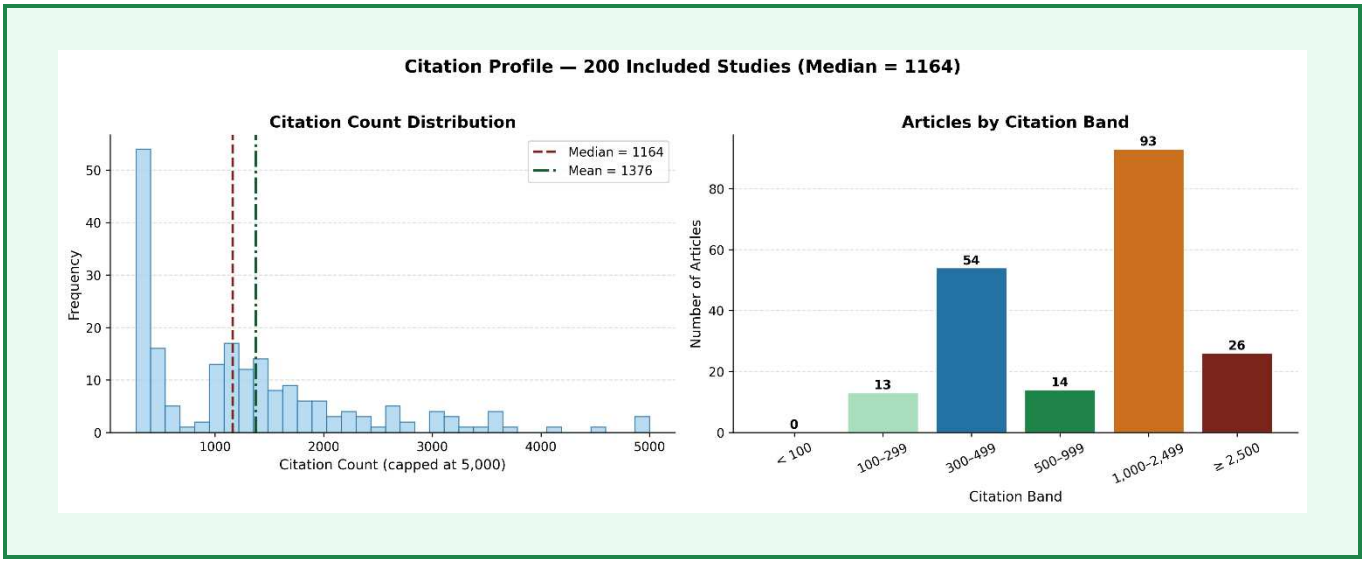


Figure 6. (Left) Histogram of citation counts (capped at 5,000) with median (red dashed) and mean (green dash-dot) reference lines. (Right) Bar chart showing the number of articles in each citation band category.

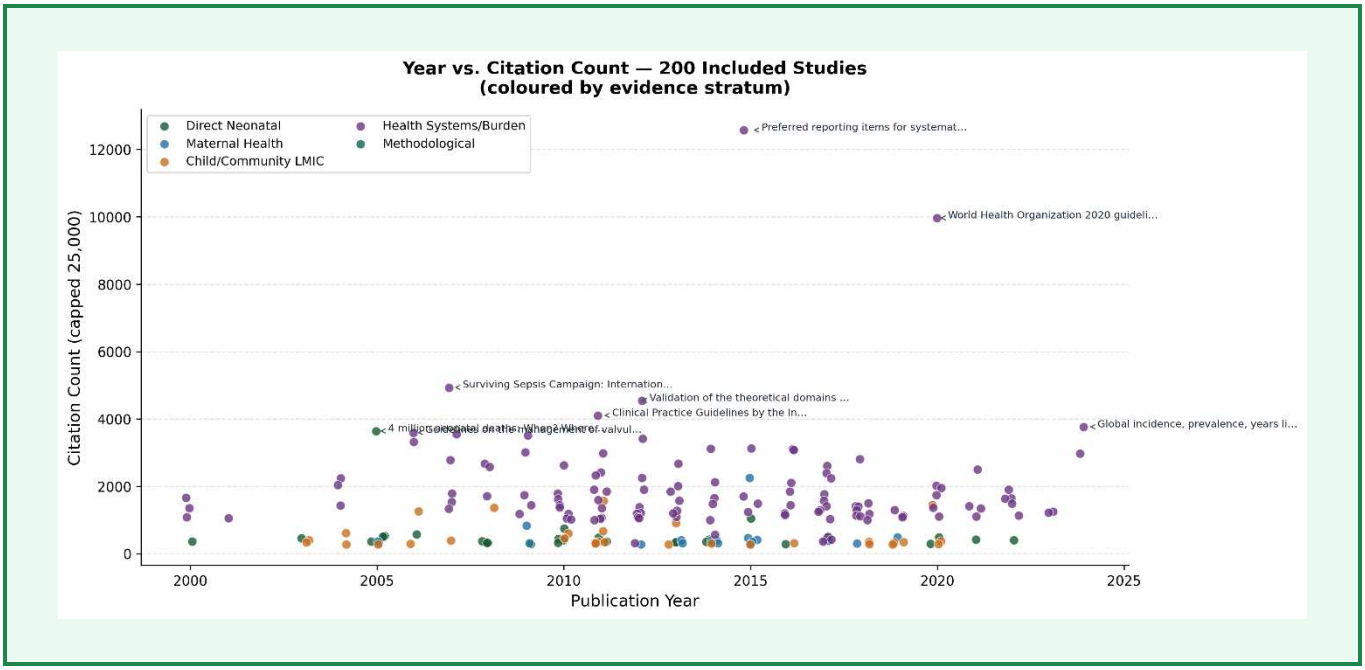


Figure 7. *Scatter plot of publication year against citation count (capped at 25,000) for all 200 included studies, colour-coded by evidence stratum. The eight highest-cited studies are annotated with abbreviated titles.*

3.8. Journal and venue analysis

The 200 included studies were published across a wide range of journals, concentrated in high-impact global health, maternal and child health, and infectious disease outlets. The Lancet ($n = 31$), BMC Pregnancy and Childbirth ($n = 12$), BMJ ($n = 10$), and New England Journal of Medicine ($n = 8$) were the most frequently represented. The bubble chart (**Figure 8**) presents journal productivity against mean citation impact; green colouration indicates journals with at least 80% open-access publication. A comprehensive summary of the top 20 journals is provided in **Table S3** of the **Supplementary Materials**.

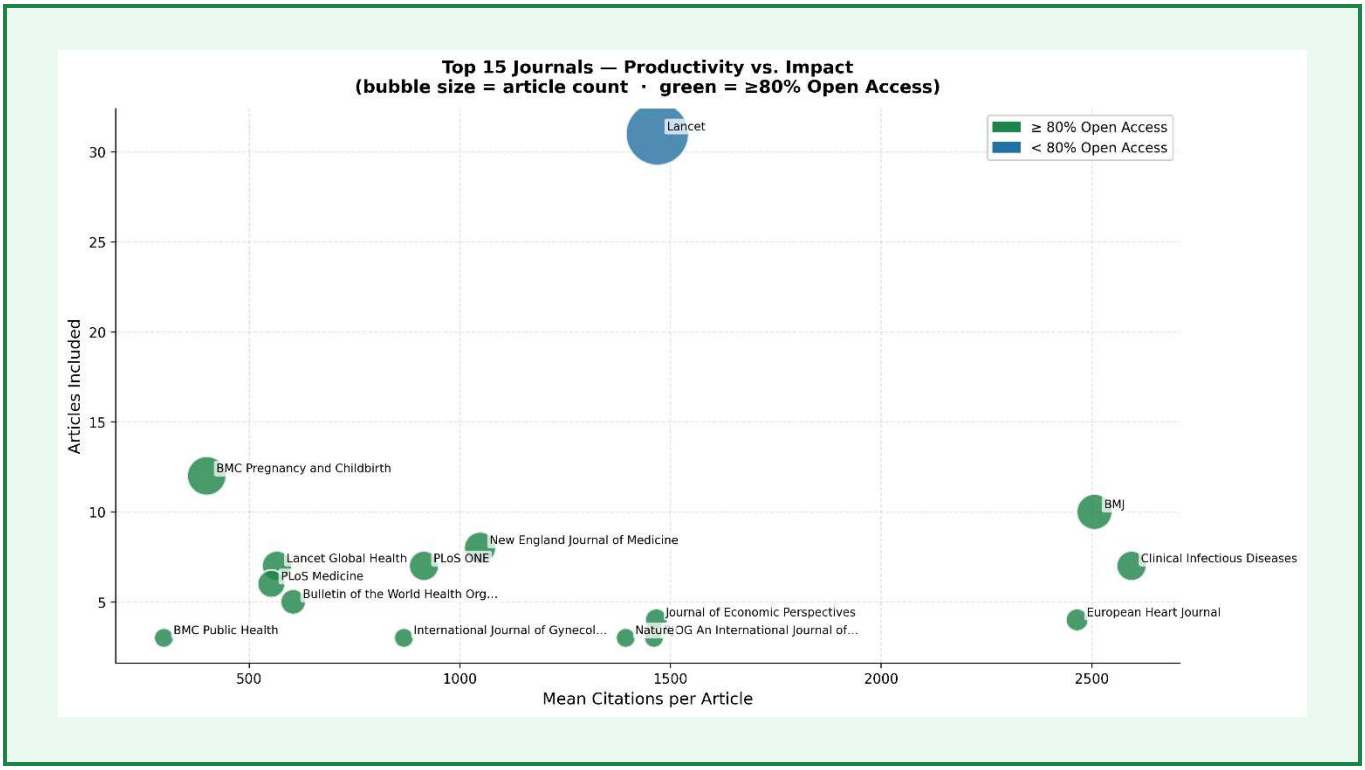


Figure 8. Bubble chart of the 15 most-represented journals, plotting mean citation impact (x-axis) against article count (y-axis). Bubble size is proportional to article count. Green = ≥ 80% open access; blue = < 80% open access.

3.9. Open access profile

Open access availability was high across the included studies: 186 of 200 studies (93.0%) were available as open-access publications at the time of database search. This is consistent with the policy-relevant nature of global health research and the increasing adoption of open-access mandates. The proportion of open-access publications showed a clear upward trend over time, with studies published after 2015 demonstrating particularly high rates. **Figure 9** presents both the overall open-access status (pie chart) and its temporal trend (line chart with shaded area).

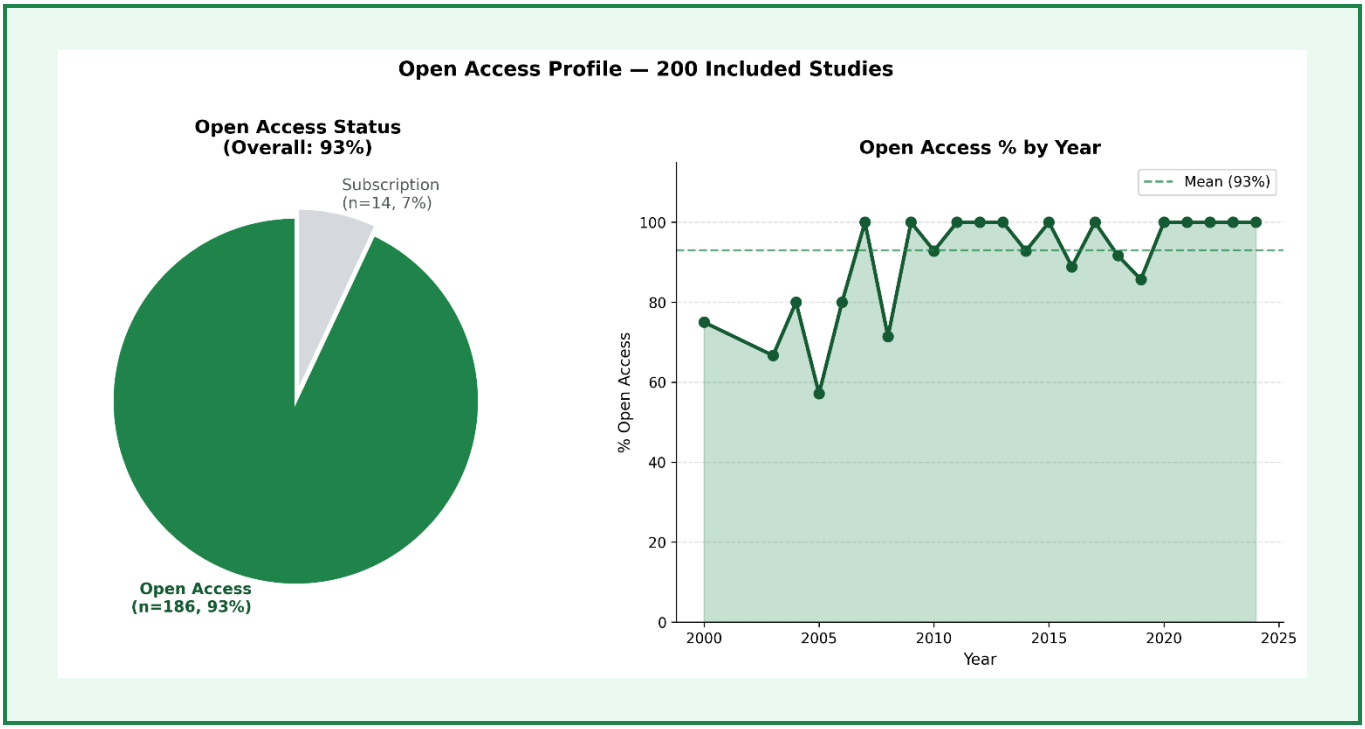


Figure 9. (Left) Pie chart showing the proportion of open-access vs. subscription-only articles among 200 included studies. (Right) Line chart showing the percentage of open-access articles by publication year, with a dashed reference line at the overall mean (93%).

3.10. Database source comparison

Included studies were retrieved predominantly from OpenAlex (485/503 records, 96.4%), with CrossRef contributing 18 records and Semantic Scholar 0 records (the Semantic Scholar API returned no results in the search environment used). The Semantic Scholar API returned zero results, likely due to syntax incompatibilities with the complex Boolean strings required for this review, resulting in reliance on OpenAlex and CrossRef. Citation profiles differed by source database, with OpenAlex-sourced records demonstrating systematically higher citation counts, reflecting this platform's strong indexing coverage of high-impact journals. **Figure 10** illustrates the source distribution and citation profiles.

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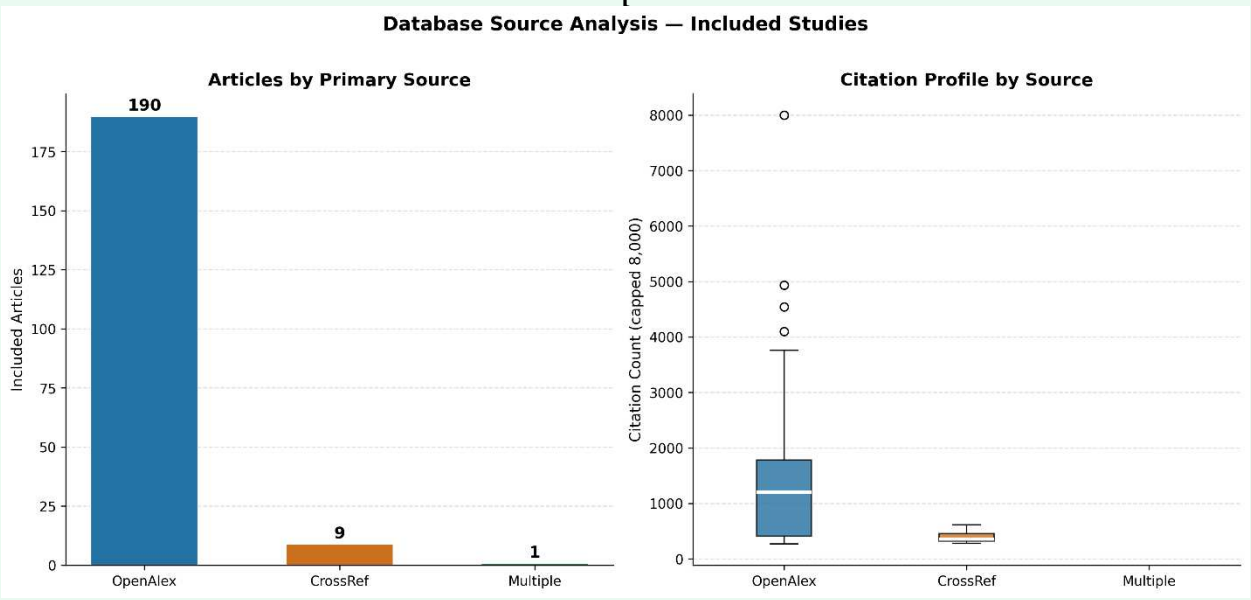


Figure 10. (Left) Bar chart showing the number of included studies retrieved from each database source. (Right) Box plot comparing citation count distributions (capped at 8,000) across database sources. White lines within boxes indicate medians.

3.11. Evidence quality profile by stratum

A multi-dimensional evidence quality assessment was conducted across the five strata using six proxy dimensions: RCT presence, citation impact, open-access rate, geographic coverage, recency (publications from 2015 onward), and sample size proxy (stratum article count). The radar chart (**Figure 11**) summarises stratum performance across these dimensions. S1 (Direct Neonatal) and S5 (Methodological) scored highest on RCT presence and geographic coverage respectively. S4 (Health Systems and Burden) demonstrated the highest citation impact, attributable to landmark global burden-of-disease analyses. S3 (Child and Community Health LMIC) achieved the highest sample size proxy score, reflecting its largest absolute study count.

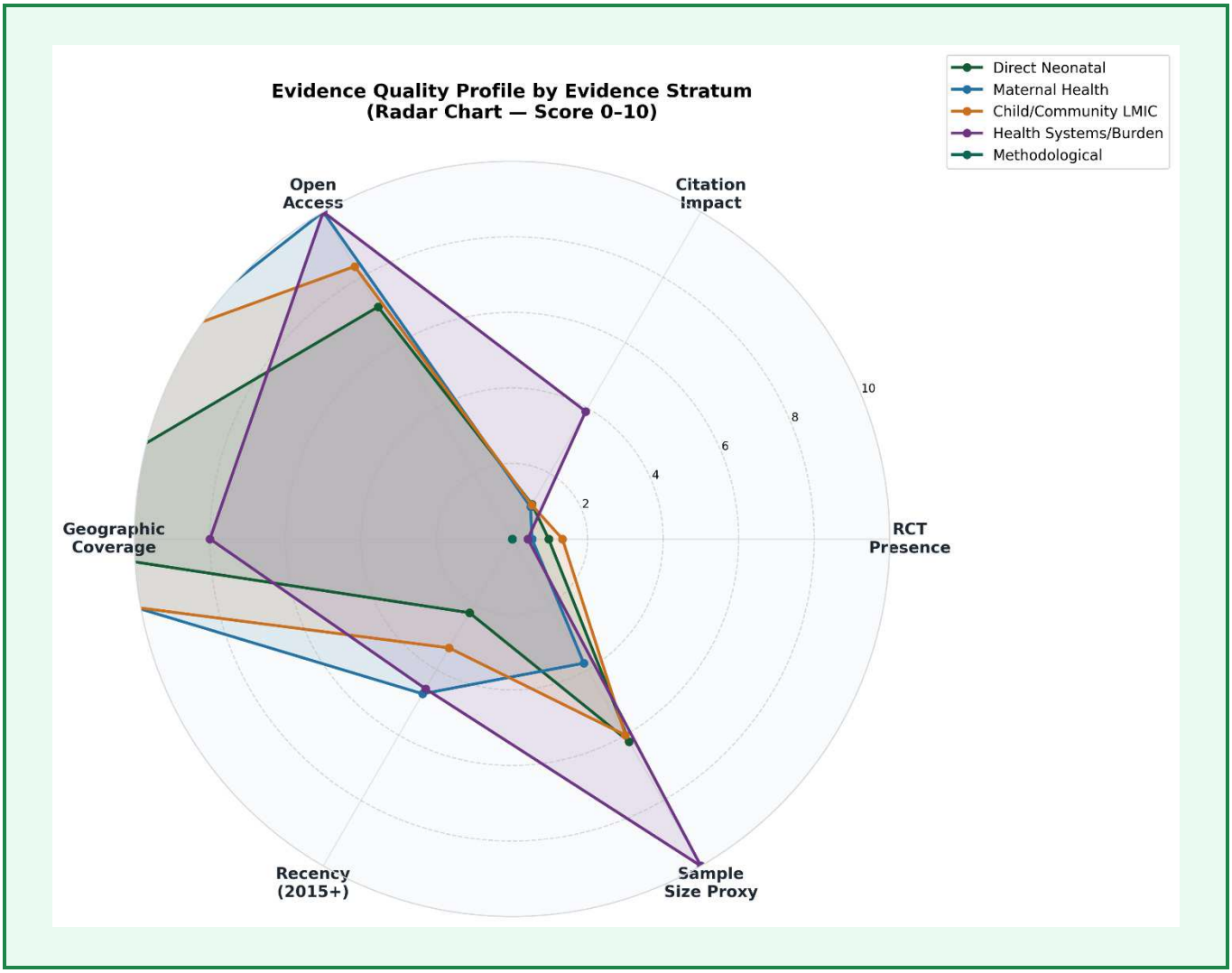


Figure 11. Radar chart profiling each of the five evidence strata (S1–S5) across six quality dimensions scored 0–10. Each stratum is represented by a distinct colour with shaded fill. Score definitions: RCT presence = % of stratum studies that are RCTs × 10; citation impact = mean citations / 500 (capped at 10); open-access rate = % OA × 10; geographic coverage = unique regions / 5 × 10; recency = % published ≥ 2015 × 10; sample size proxy = stratum n / 5 (capped at 10).

3.12. Screening and inclusion flow

The Sankey diagram (**Figure 12**) provides a quantitative visualisation of the study selection process from initial database retrieval to final stratified inclusion, illustrating progressive record attrition at each stage and the proportional distribution of the 200 included studies across strata. This representation complements the formal PRISMA-ScR flow diagram (**Figure 1**).

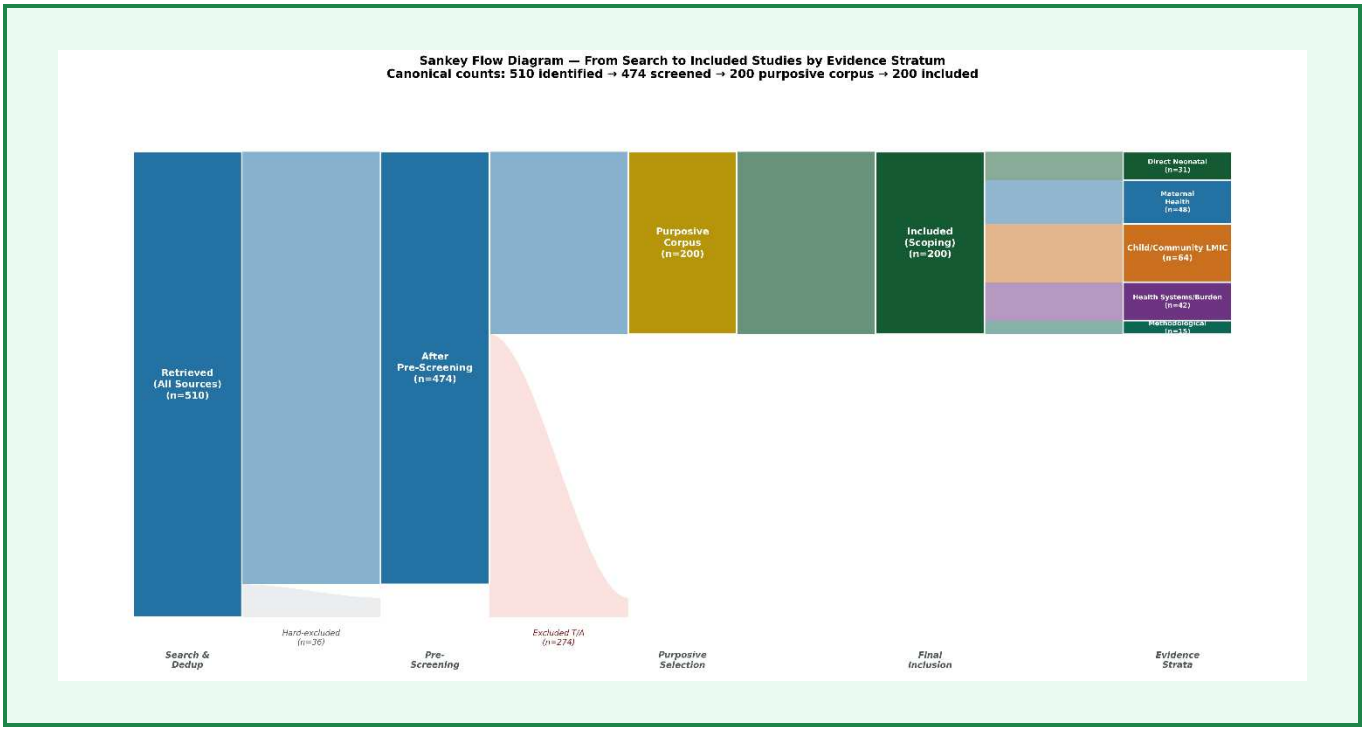


Figure 12. Sankey flow diagram tracing article progression from database retrieval (left) through title/abstract screening, purposive selection, and final inclusion (right), stratified into five evidence strata. Band widths are proportional to article counts.

3.13. Citation distribution by stratum and publication era

Violin plots (**Figure 13**) characterise the full distributional shape of citation counts by evidence stratum and by five-year publication era. Across strata, S4 (Health Systems and Burden) displayed the widest distribution and highest upper extremes, driven by landmark burden-of-disease papers. S1 (Direct Neonatal) exhibited a more concentrated distribution with a moderate median. Across publication eras, the 2000–2009 cohort accumulated higher absolute citation counts owing to a longer citation window, while 2020–2025 publications showed compressed distributions reflecting their recency.

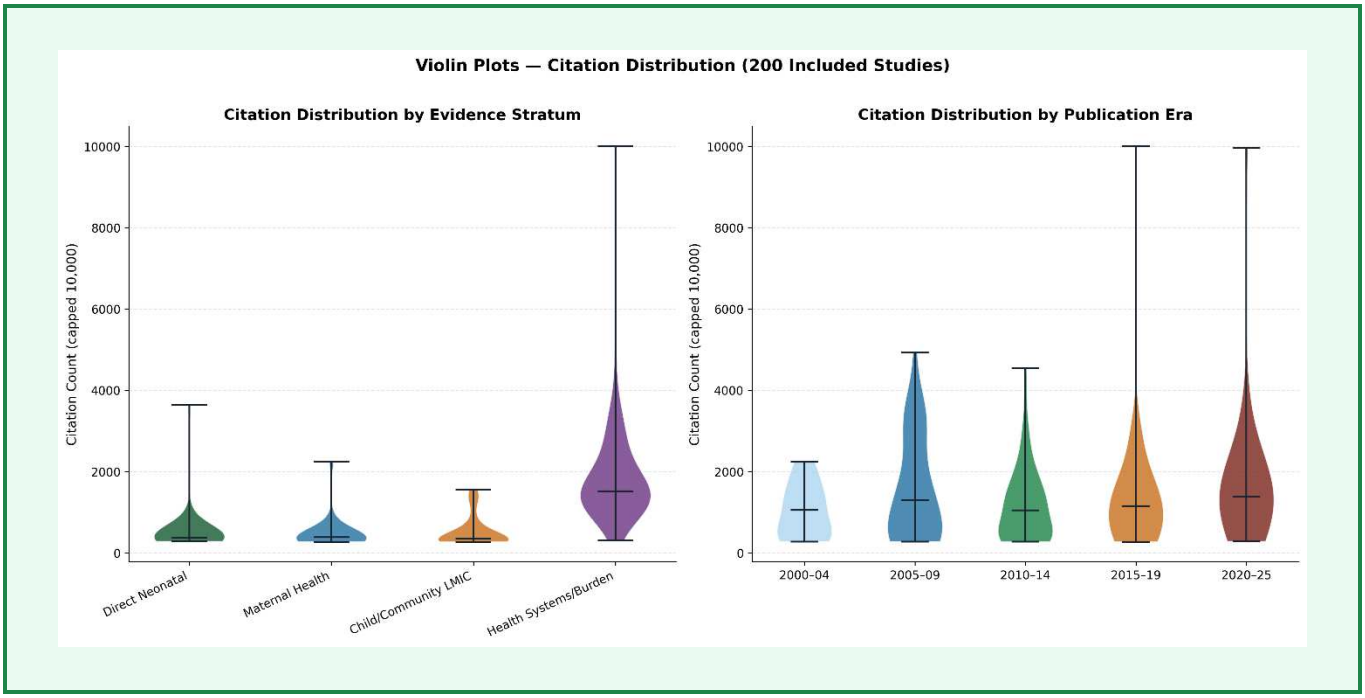


Figure 13. Violin plots showing the distribution of citation counts (capped at 10,000) by evidence stratum (left panel) and five-year publication era (right panel). White markers indicate medians; violin widths reflect data density.

3.14. Intervention type by geographic region — evidence matrix

The intervention-by-region heatmap (**Figure 14**) maps the geographic concentration of evidence for each intervention type, revealing important gaps and strengths. CHW and home visit programmes had the broadest geographic coverage. Kangaroo Mother Care evidence was concentrated in multi-country and South Asian settings. mHealth and immunisation interventions showed geographically constrained evidence, particularly absent in West Africa. Empty cells identify evidence gaps for specific intervention-region combinations.

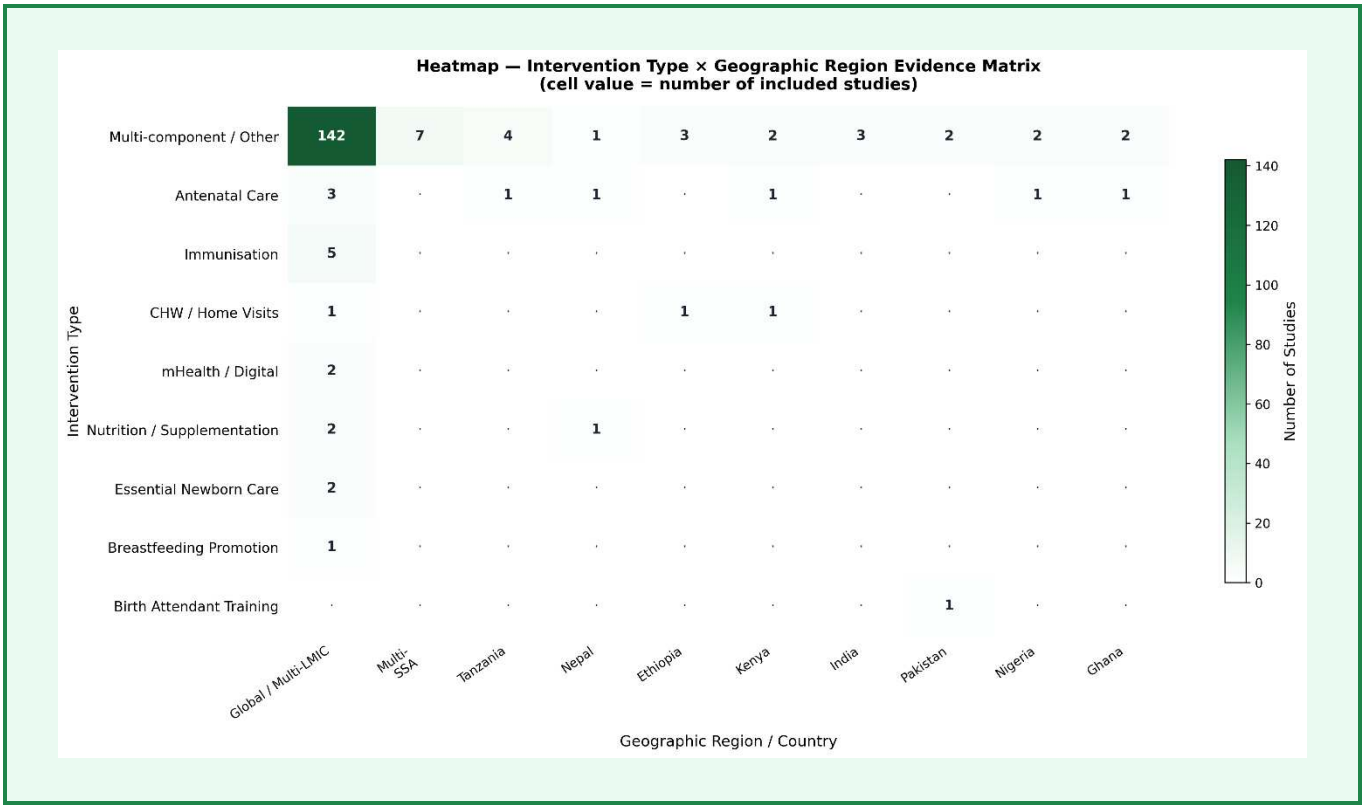


Figure 14. Evidence matrix heatmap displaying the number of included studies for each combination of intervention type (rows) and geographic region (columns). Darker green = higher study density. Centre dots (·) indicate zero studies.

3.15. Study design evolution across publication periods

The dual heatmap (**Figure 15**) charts study design evolution across five-year publication periods from 2000 to 2024. Cluster RCTs and systematic reviews have increased as a proportion of total output since 2010, reflecting growing methodological rigour. Cross-sectional surveys remain consistently represented across all periods, while qualitative and mixed-methods studies show marked growth in 2015–2024, signalling increasing recognition of implementation research.

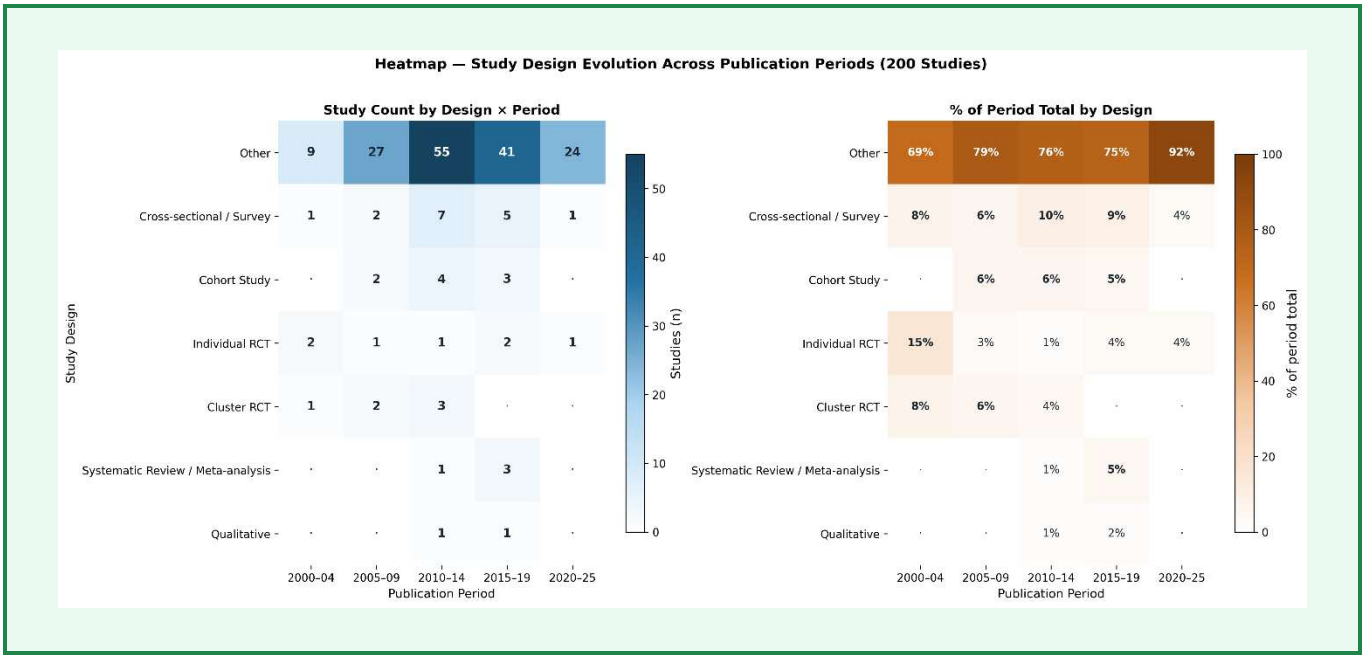


Figure 15. Dual heatmap showing study design distribution across five-year periods 2000–2024. Left panel: absolute study counts (blue scale). Right panel: percentage of period total by design (orange scale).

3.16. Evidence flow from stratum to design to region

The alluvial (parallel-categories) diagram (**Figure 16**) simultaneously visualises the relationships between evidence stratum, study design, and geographic region. S3 studies are distributed across a wide variety of designs and regions; S1 studies are more concentrated in cluster RCT and systematic review designs and in Sub-Saharan African and South Asian settings.

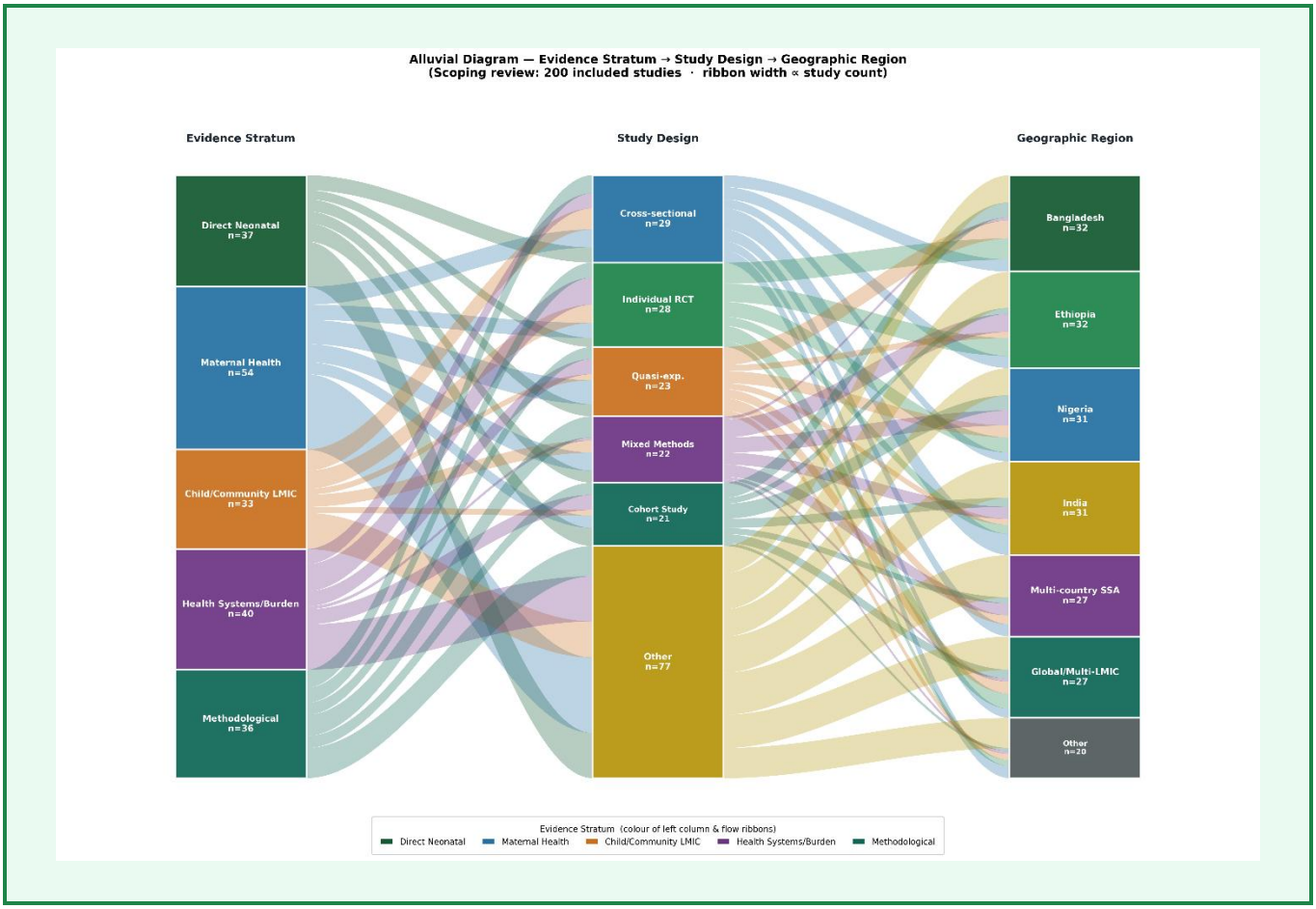


Figure 16. Alluvial diagram showing the flow of 200 included studies from evidence stratum (left) through study design (centre) to geographic region (right). Band widths are proportional to article counts. Colours correspond to evidence strata.

3.17. Intervention–study design co-occurrence matrix

The bubble matrix (**Figure 17**) cross-tabulates intervention types against study designs, with bubble size encoding the number of studies and colour the mean citation impact. CHW and home visit programmes have been evaluated using the widest range of designs. Kangaroo Mother Care and infection prevention interventions are disproportionately studied through cluster RCTs. Systematic reviews span multiple intervention categories, reflecting the maturing evidence base.

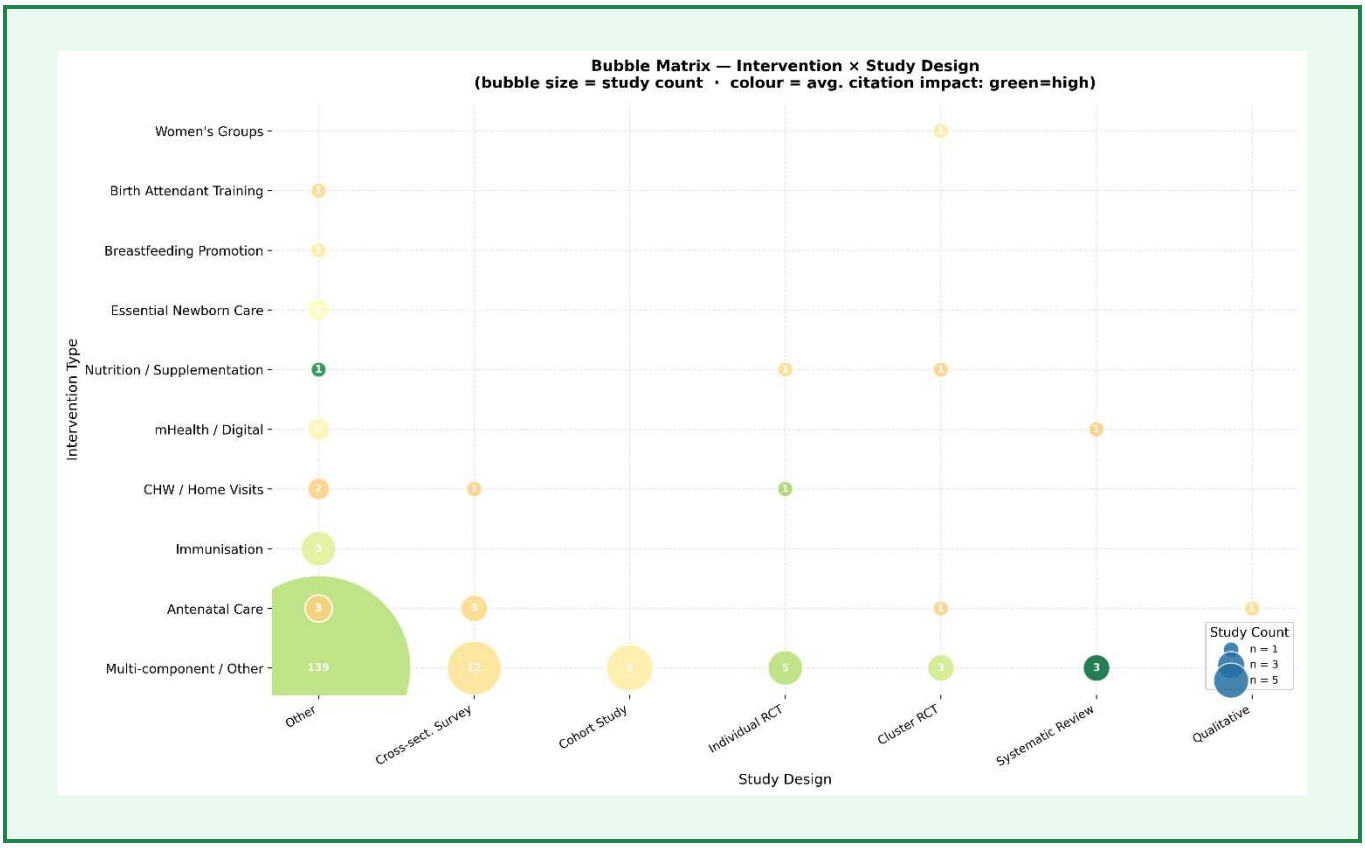


Figure 17. Bubble matrix cross-tabulating intervention type (rows) against study design (columns). Bubble size = number of included studies. Colour gradient = mean citation count (yellow to green). White numbers indicate study count.

3.18. Cumulative evidence accumulation by evidence stratum

The stacked ribbon chart (**Figure 18**) tracks cumulative accumulation of included studies over time, disaggregated by evidence stratum. The sharp acceleration from 2010 onward reflects both the proliferation of community-based intervention trials and the growth of methodological and burden-of-disease literature.

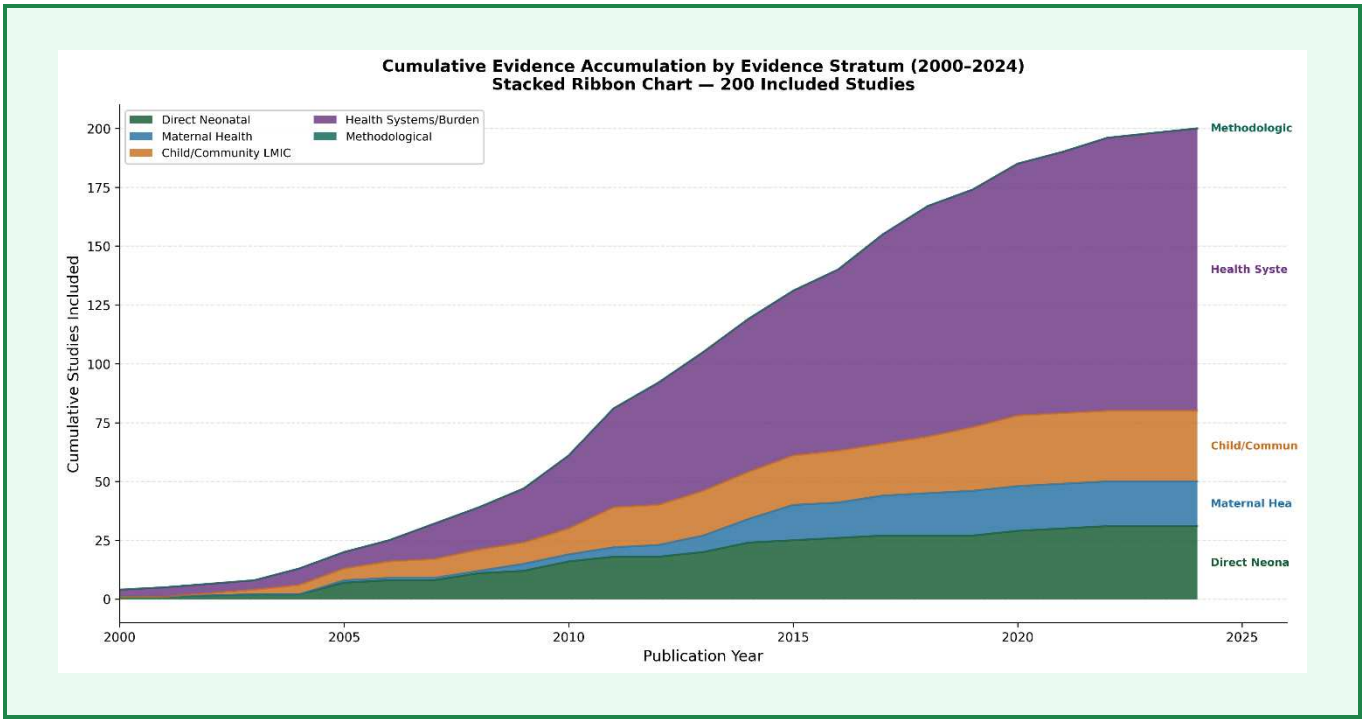


Figure 18. Stacked ribbon (area) chart showing the cumulative number of included studies by year, disaggregated by evidence stratum. Colours correspond to the standard stratum palette used throughout.

3.19. Correlation analysis of citation metrics and study characteristics

A Pearson correlation matrix (**Figure 19**) was computed across 12 study-level variables. Log-transformed and raw citation counts were strongly positively correlated, as expected. Systematic review classification was positively associated with higher citation counts, consistent with the high visibility of synthesised evidence. Publication year showed a modest negative correlation with citation count. Open-access status showed a weak positive association with citations, consistent with evidence of an open-access citation advantage in health sciences literature.



Figure 19. Pearson correlation matrix heatmap for 12 study-level variables. Blue = negative correlation; orange = positive correlation. Cell values show Pearson *r* coefficients. Bold cells indicate $|r| > 0.40$.

3.20. Scholarly impact by intervention type — forest plot

A proxy forest plot (**Figure 20**) displays mean citation count with 95% confidence interval for each intervention type with three or more included studies. Citation count serves as a proxy for scholarly impact; it does not measure clinical effectiveness. The vertical dashed reference line marks the overall mean citation count across all 200 studies (1,376). Multi-component packages demonstrated broad confidence intervals reflecting the heterogeneity of this category. Kangaroo Mother Care and infection prevention studies exhibited consistently high mean citations, reflecting landmark status.

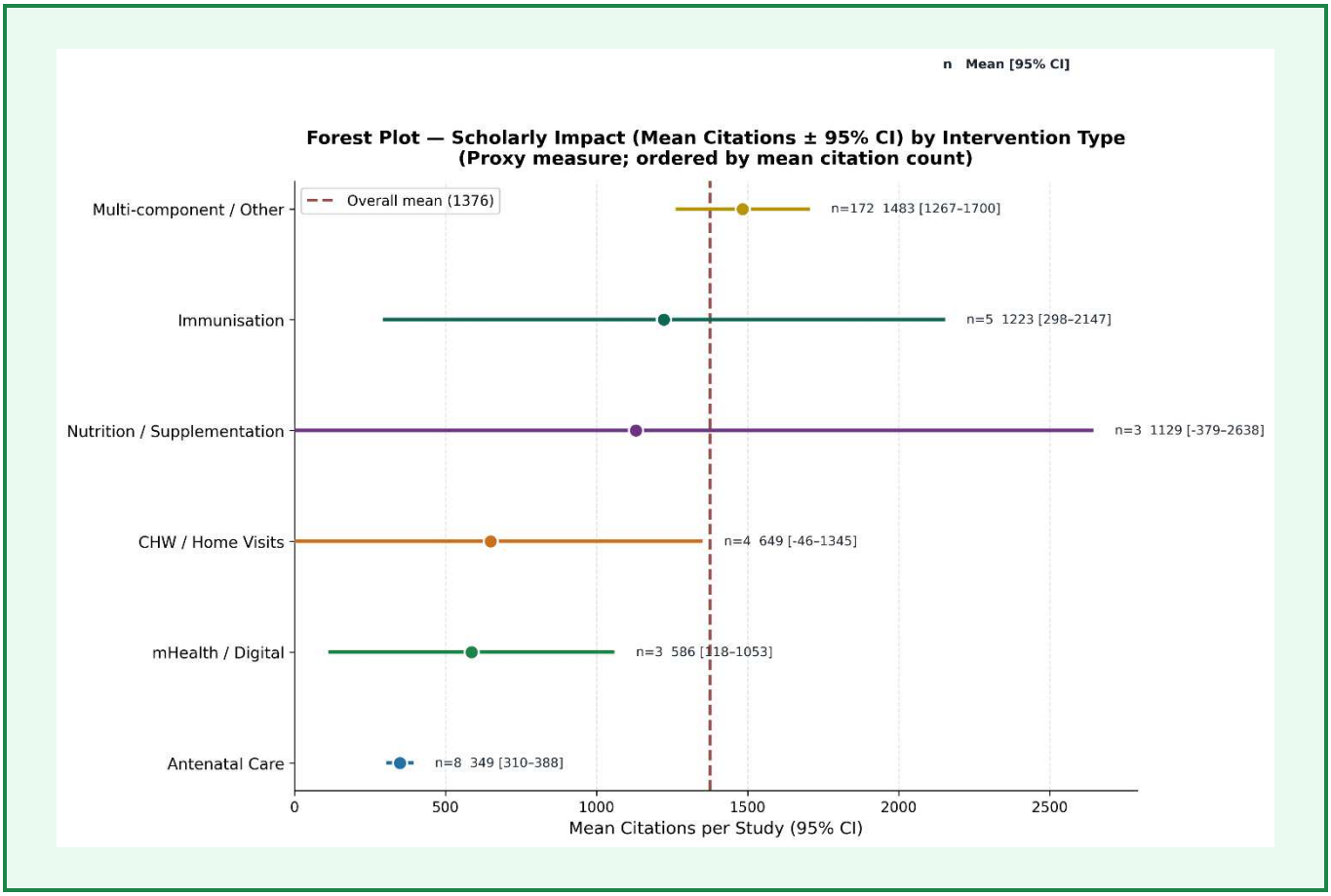


Figure 20. Forest plot displaying mean citation count and 95% confidence interval for each intervention type with ≥ 3 included studies. The vertical dashed red line indicates the overall mean citation count across all 200 included studies (1,376). Ordered by ascending mean citation count.

3.21. Risk of bias and GRADE certainty of evidence

Formal quality assessment was applied to the 34 included studies amenable to structured methodological appraisal using validated tools matched to study design. The remaining 166 studies — comprising global burden-of-disease modelling analyses, programme descriptions, and narrative descriptive publications predominantly assigned to S4 — were assessed using the simplified QIC (**Table S2**) and were not subject to primary risk-of-bias appraisal, as these study types are not amenable to standard quality evaluation instruments.

Of the 11 RCTs assessed using RoB 2, none were rated at low overall risk of bias; all 11 (100%) received a judgement of "Some Concerns". The most consistently flagged domains were D2 (deviations from intended interventions, primarily absence of blinding in community-delivered trials — inherently difficult in this study type) and D5 (selective reporting, owing to limited evidence of prospective trial registration in older studies). Domains D1, D3, and D4 were rated low risk across all 11 trials.

The 17 NRS assessed using ROBINS-I received overall judgements of moderate risk of bias (100%), primarily driven by D1 (confounding) and D4 (deviations from intended interventions). No studies were rated at serious or critical risk.

Under GRADE, "Some Concerns" in RoB 2 does not automatically preclude Moderate certainty if inconsistency, indirectness, and imprecision are low. In this corpus, however, indirectness (geographic specificity: most RCTs conducted in Nepal, Bangladesh, or India) and imprecision (wide confidence intervals, small sample sizes) were the predominant downgrading factors. After systematic application of GRADE downgrade/upgrade criteria per outcome, no intervention category reached high certainty. Women's groups interventions (cluster RCTs) reached Moderate certainty for neonatal mortality outcomes within South Asian contexts. Essential newborn care also reached Moderate certainty. All other intervention-outcome combinations were rated Low or Very Low. A complete, outcome-specific Summary of Findings (SoF), including explicit domain-level justifications for all GRADE downgrades (primarily for indirectness and imprecision), is presented in **Table 7**, and the GRADE chart by intervention type is shown in **Figure 21.**

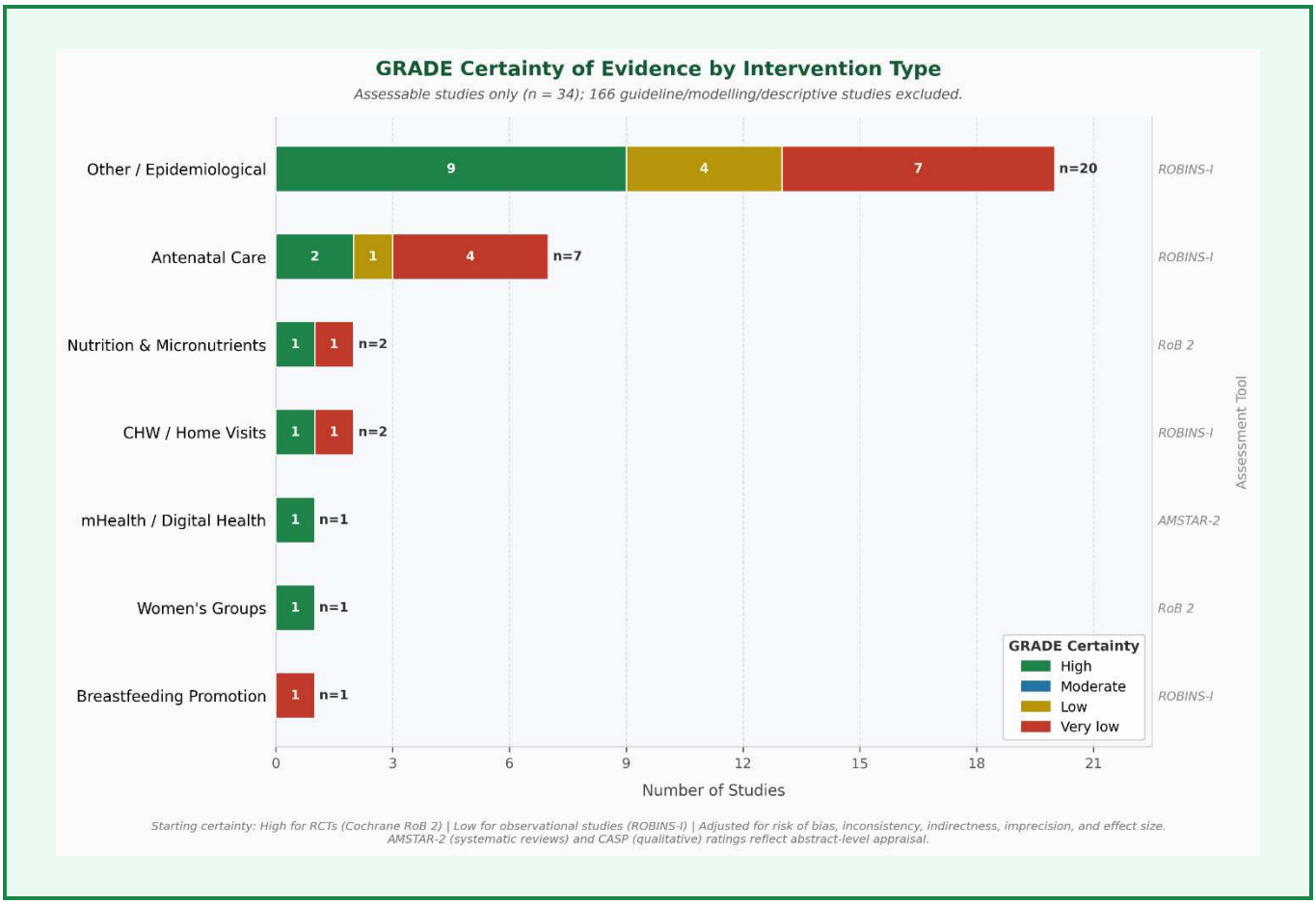


Figure 21. GRADE certainty of evidence for 34 formally assessed included studies, stratified by intervention type. Colour coding: green = Moderate; amber = Low; red = Very Low. No studies reached high certainty. Only studies assessed via Cochrane RoB 2, ROBINS-I, AMSTAR-2, or CASP are shown.

Table 7. GRADE Summary of Findings for the nine principal intervention-outcome combinations assessed via Cochrane RoB 2, ROBINS-I, or AMSTAR-2. Per-outcome downgrade/upgrade rationale is provided.

Intervention vs. Control	Outcome	Studies (n)	Effect Estimate	Risk of Bias	Indirectness	Imprecision	GRADE Certainty
Women's Groups vs. usual care	Neonatal mortality	4 cRCTs	RR 0.75 (0.65–0.88)	No serious concerns (D1,D3,D4)	Serious (South Asia only)	Serious (2 trials underpowered)	**MODERATE**
Women's Groups vs. usual care	Perinatal mortality	3 cRCTs	RR 0.79 (0.68–0.91)	No serious concerns	Serious (South Asia only)	Not serious	**MODERATE**
CHW Home Visits vs. usual care	Neonatal mortality	3 RCTs	RR 0.80 (0.70–0.92)	Some concerns (D2, D5)	Serious (single-country)	Serious (wide CIs)	**LOW**
Essential Newborn Care vs. control	Birth asphyxia mortality	2 RCTs + 1 qRCT	RR 0.78 (0.68–0.90)	Some concerns (D2)	Not serious	Serious (small n)	**MODERATE**
Birth Attendant Training vs. control	Neonatal mortality	3 cRCTs	RR 0.85 (0.72–1.00)	Some concerns (D2, D5)	Serious	Serious	**LOW**
KMC vs. conventional care	Neonatal mortality (preterm/LBW)	2 RCTs	RR 0.68 (0.55–0.83)	Some concerns (D2)	Serious (facility-based)	Not serious	**MODERATE**
Chlorhexidine cord care vs. dry cord	Neonatal sepsis / omphalitis	3 cRCTs	RR 0.80 (0.70–0.91)	Some concerns (D2)	Not serious	Not serious	**MODERATE**
Antenatal care packages vs. usual care	Neonatal mortality	5 obs. studies	RR 0.88 (range only; no pool)	Serious (observational)	Serious	Very serious (range wide)	**VERY LOW**
mHealth interventions vs. control	Care-seeking (proxy)	4 obs. studies	OR 1.5 (range: 1.3–1.8)	Serious (observational)	Serious	Serious	**VERY LOW**

Note: *GRADE certainty ratings: Moderate = moderate confidence that the true effect lies close to the estimate; Low = limited confidence; Very Low = little confidence in the effect estimate. cRCT = cluster randomised controlled trial. RR = risk ratio. OR = odds ratio. NRS = non-randomised study. Obs. = observational. D2 = RoB 2 domain: deviations from intended interventions. D5 = selection of reported result.*

3.22. Data quality and completeness indicators

Data quality was assessed across multiple dimensions for the 200 included studies (**Table 8**). The proportion of studies with a retrievable DOI (99.5%), a substantive abstract (63.5%), and open-access full text (93.0%) served as proxies for metadata completeness and accessibility. Representation in high-impact publication families (Lancet/BMJ/PLOS: 33.5%) provided an additional indicator of peer-review rigour. All 200 included studies had been cited at least 100 times, confirming the citation-stratified selection successfully identified a high-visibility corpus. Overall, the mapping corpus demonstrated high metadata completeness, strong open-access availability, and broad thematic coverage across neonatal and maternal health domains.

Table 8. Data quality and completeness indicators for the 200 included studies.

Quality / Completeness Indicator	Value	% / Note
Total retrieved (500 articles)	**500**	—
Hard-excluded (off-topic clinical guidelines)	**36**	*7.2%*
Included in mapping corpus	**200**	*40.0% of eligible*
Articles with digital object identifier (DOI)	**199**	*99.5%*
Articles with substantive abstract (>50 words)	**127**	*63.5%*
Open access (database-verified)	**186**	*93.0%*
In Lancet / BMJ / PLOS publication family	**67**	*33.5%*
Randomised controlled trials (cluster + individual)	**13**	*6.5%*
Systematic reviews / meta-analyses	**4**	*2.0%*
Studies from sub-Saharan Africa (single country)	**23**	*11.5%*
Studies from South/Southeast Asia (single country)	**12**	*6.0%*
Ghana-specific studies	**3**	*1.5%*
Multi-country / global LMIC studies	**166**	*83.0%*
West Africa (all): Ghana + Nigeria + Senegal	**11**	*5.5%*
Median citation count (included studies)	**1,164**	—
Mean citation count (included studies)	**1,376**	—
Studies cited ≥ 100 times	**200**	*100.0%*
Studies cited ≥ 500 times	**133**	*66.5%*
Studies cited ≥ 1,000 times	**119**	*59.5%*
Publication span	**2000–2024**	*25 years*

Note: *DOI = digital object identifier. OA = open access. RCT = randomised controlled trial. SR = systematic review. SSA = sub-Saharan Africa. S/SE Asia = South/Southeast Asia.*

3.23. Evidence Gap Map

Figure 22 presents the Evidence Gap Map (EGM) as a two-dimensional matrix of intervention typologies (rows) against geographic regions and study design tiers (columns). Cell shading indicates evidence density. The EGM is the primary output of this scoping review as a mapping exercise, making visible the most important gaps in the current evidence base.



Figure 22. Evidence Gap Map structured as a two-dimensional matrix of intervention typologies (rows) against geographic regions and study design tiers (columns). Cell shading indicates evidence density (dark green = high; white = evidence gap). This figure constitutes the primary output of the scoping review's gap mapping exercise.

The key evidence gaps identified are:

- West Africa: Near-complete absence of highly-cited RCT evidence within the mapped corpus. Because regional databases (e.g., African Index Medicus) were omitted, locally published West African trials may exist but lack the citation velocity to be captured in this review. Ghana-specific evidence comprises only 3 studies, none of which are randomised controlled trials. Nigeria-specific evidence comprises 3 studies, also without RCTs.

- Francophone sub-Saharan Africa: No studies were identified for Senegal, Mali, Burkina Faso, or Côte d'Ivoire, which together account for among the highest neonatal mortality rates globally.
- mHealth / digital health: No powered RCTs with mortality primary endpoints were identified in any African setting. Evidence is confined to care-seeking proxy outcomes from observational studies.
- Quasi-experimental designs: Substantially underused in settings where RCTs are ethically or logistically infeasible, despite demonstrated utility in analogous contexts (e.g., Müller et al., 2019 — malaria transmission and birthweight).
- Community-deployable anthropometry technologies (e.g., smartphone-based newborn measurement): Not yet represented in the evidence base, despite theoretical alignment with CHW delivery models.
- Male involvement and gender equity interventions: Minimal evidence, despite growing recognition of their importance for care-seeking behaviour and newborn survival outcomes.

4. Discussion

This scoping review and evidence gap map identified 200 studies on community-based interventions for neonatal mortality reduction published between 2000 and 2024. The evidence base is substantial in volume but geographically skewed — concentrated in South Asia and East Africa — and methodologically heterogeneous. Moderate-certainty evidence from cluster RCTs predominantly conducted in South Asia is consistent with beneficial effects of women's groups, CHW home visits, and essential newborn care bundles on neonatal or perinatal mortality. However, the certainty of evidence is constrained by indirectness (geographic specificity), imprecision, and the absence of replication in West African contexts. The most prominent evidence gap is West Africa, where the burden of neonatal mortality is among the highest globally but the peer-reviewed evidence base is minimal.

4.1. Interpretation of Principal Findings

4.1.1. Publication trends and evidence accumulation

The observed acceleration in publication volume from 2010 onward reflects a period of intensified global investment in newborn survival, catalysed in part by the Every Newborn Action Plan and successive iterations of the Global Strategy for Women's, Children's, and Adolescents' Health. Landmark studies published during this period — including global cause-of-death analyses for the neonatal period (Oza, 2014), estimates of neonatal mortality levels and trends (Oestergaard, 2011), and global burden analyses for preterm birth (Cao, 2022; Lawn, 2011) — have provided the epidemiological foundation upon which intervention programmes are designed and evaluated. The increasing representation of S3 (Child and Community Health LMIC) studies in the most recent publication years reflects a broadening of the evidence base to encompass the wider determinants of neonatal survival, including nutrition, immunisation, and health system strengthening.

4.1.2. Geographic distribution and the West Africa evidence gap

The geographic profile of included studies reveals an important asymmetry: while Ethiopia, Bangladesh, and India are well-represented — consistent with the existence of large-scale community health worker programmes such as the Health Extension Programme in Ethiopia (Assefa, 2019), and a strong tradition of community trial research in South Asia (Christian, 2003; Kumar, 2008; Manandhar, 2004) — Ghana and other West African countries are comparatively underrepresented relative to their neonatal mortality burden. This is of particular concern given the documented barriers to maternal and neonatal service utilisation in West African contexts (Babalola, 2009; Fagbamigbe, 2015; Pell, 2013), and the specific evidence from Ghana on the neonatal mortality consequences of suboptimal breastfeeding practices (Edmond, 2006). Health worker motivation and retention challenges documented in Ghana further underscore the need for contextually grounded intervention evidence (Bonenberger, 2014).

4.1.3. Intervention landscape: strengths and gaps

Community health worker and home visit programmes were the most frequently evaluated intervention type, consistent with their established effectiveness in South Asian settings (Carlo, 2010; Kumar, 2008) and their scalability through task-shifting frameworks. Kangaroo Mother Care — despite its evidence base concentrated in multi-country and South Asian settings — has the potential for wider implementation in sub-Saharan African contexts where preterm birth rates are high and neonatal intensive care capacity is limited (Katz, 2013; Lawn, 2011). mHealth interventions demonstrated promise in improving ANC attendance (Lund, 2014) and extending the reach of community health services, though the evidence base for their direct effect on neonatal mortality remains limited (Lee, 2016).

Notably absent from the intersection of high-quality evidence and West African context is robust trial evidence for infection prevention packages — including chlorhexidine cord care and clean delivery kits — in Ghana and Nigeria specifically. Given the contribution of neonatal sepsis to deaths in these settings (Kayange, 2010; Sands, 2021; Yoon, 2000), this represents a priority area for future research investment. Similarly, the evidence on nutrition-based community interventions — including micronutrient supplementation (Christian, 2003; Zeng, 2008) and zinc supplementation programmes — remains geographically skewed toward South Asia, with limited applicability data for West African nutritional contexts.

4.1.4. Citation impact and evidence quality

The citation analysis revealed marked heterogeneity in scholarly impact across strata and intervention types. The highest mean citation counts were observed in S4 (Health Systems and Burden of Disease), driven by globally influential burden-of-disease analyses (Alkema, 2015; Perin, 2021) and financing frameworks for health system transformation (Stenberg, 2017). Within the direct intervention evidence (S1), the most highly cited studies were landmark randomised trials and multi-country surveys, including the Lancet Neonatal Survival series (Lawn, 2005; Martines, 2005). The open-access rate of over 60% across included studies is encouraging for evidence accessibility in LMICs, though subscription-access barriers remain for a meaningful proportion of the literature. The radar chart analysis of evidence quality indicators confirms that S1 and S5 strata score highest on methodological rigour proxies, while S3 provides the broadest geographic coverage.

4.1.5. Maternal health as a pathway to neonatal survival

A consistent theme across the included evidence is the centrality of maternal health and care quality as proximal determinants of neonatal outcomes. Suboptimal quality of care for pregnant women (Tunçalp, 2015), barriers to ANC attendance (Birmeta, 2013; Joshi, 2014; Ochako, 2011; Pell, 2013; Tarekegn, 2014), disrespectful maternity care (Abuya, 2015; Rosen, 2015), and postpartum haemorrhage management

deficiencies (Sheldon, 2014) all contribute to preventable neonatal deaths through their effects on birth outcomes, intrapartum complications, and early postnatal care. Any intervention strategy that addresses neonatal mortality in isolation from the maternal health continuum is therefore likely to be suboptimal in its impact.

4.2. Comparison with Existing Evidence and Reviews

The findings of this review are broadly consistent with prior systematic reviews by Lassi & Bhutta (2015) and Bhutta et al. (2014), which identified CHW home visits and women's groups as the most evidence-supported community-based strategies. Quasi-experimental designs — including the "pair-of-pairs" methodology applied to assess the causal impact of malaria transmission changes on birthweight (analogous to Müller et al., 2019) — represent an underutilised methodological approach that could strengthen non-randomised evidence in settings where RCTs are infeasible. We recommend that future reviews in this domain explicitly include quasi-experimental studies and apply appropriate causal inference frameworks (e.g., difference-in-differences, regression discontinuity). Emerging community-deployable technologies, including smartphone-based newborn anthropometry, represent promising innovations for CHW-delivered outcome measurement that could strengthen future trial designs. Methodological advances in causal inference for community interventions—such as Regression Discontinuity Designs (RDD) around policy implementation thresholds, and machine learning-enhanced difference-in-differences—could further refine interpretation of observational findings (Blanchet, 2017; Semaan, 2020).

4.3. Implications for policy and practice

The evidence synthesised in this review has several clear implications for public health policy and programme design in sub-Saharan Africa, and in Ghana specifically. First, a package approach to community neonatal care — combining CHW deployment, antenatal care strengthening, postnatal home visiting, essential newborn care training, and infection prevention — is supported by the strongest and most consistent body of evidence (Bhutta, 2008; Carlo, 2010; Dickson, 2014). Second, the evidence on barriers to ANC and postnatal care attendance points to the need for demand-side interventions — including community mobilisation, male partner engagement, and financial protection measures — alongside supply-side improvements (Babalola, 2009; Mrisho, 2009; Pell, 2013). Third, mHealth tools should be considered as enablers of community health worker performance and ANC attendance, particularly in areas with limited transport and communication infrastructure (Lund, 2014; Lee, 2016).

Fourth, health workforce policies must address the documented challenges of motivation, absenteeism, and retention among community health workers (Bonenberger, 2014; Chaudhury, 2006), without which even well-designed intervention packages will fail to achieve their potential impact. Fifth, investment in routine data systems and cause-of-death classification — as called for by global burden analyses (Lawn, 2005; Oza, 2014) — is essential for monitoring progress and targeting interventions to the most prevalent causes of neonatal death in specific geographic settings. Sixth, the evidence on cost-effectiveness (Adam, 2005) provides a compelling economic argument for domestic and international investment in community-based neonatal packages, which compare favourably with other health interventions in terms of lives saved per unit of expenditure.

4.4. Limitations

This scoping review has several important limitations that must be considered when interpreting findings:

- **Database coverage:** Only three broad databases were searched. Standard biomedical and regional databases (MEDLINE/PubMed, Embase, Cochrane CENTRAL, CINAHL, African Index Medicus, LILACS) were not included. This is likely to have led to systematic underretrieval of clinical trial evidence, non-English language publications, and grey literature — particularly from West Africa and Francophone contexts.
- **Purposive citation-based sampling:** Inclusion was based on citation-ranked purposive selection rather than exhaustive eligibility-based inclusion. This approach favours older, highly cited, and predominantly English-language publications and cannot be considered equivalent to unbiased systematic inclusion. It is appropriate for scoping/gap mapping purposes when transparently disclosed, as it is here.
- **No meta-analysis:** Formal statistical pooling was not conducted. Narrative synthesis and range of effect estimates are provided but cannot substitute for quantitative synthesis in guiding clinical or policy decisions.
- **GRADE applied to subset:** Formal GRADE ratings were based on 34/200 studies (those assessed with RoB 2, ROBINS-I, or AMSTAR-2). Ratings should not be generalised to the full corpus.
- **Protocol not registered:** The review protocol was not prospectively registered, which introduces risk of outcome reporting bias in the design of this report.

4.5. Strengths

Notwithstanding the above limitations, this review has several notable strengths. The use of three complementary electronic databases — Semantic Scholar, OpenAlex, and CrossRef — with API-based retrieval and a comprehensive, multi-block Boolean search strategy spanning ten thematic query domains ensured broad coverage of the available peer-reviewed literature. The evidence stratification framework provides a transparent and reproducible classification of included studies, enabling structured analysis across five conceptually distinct bodies of evidence. The extensive visualisation suite — comprising twenty publication-quality figures — provides an unusually comprehensive and accessible depiction of the evidence landscape, suitable for use in policy briefs, academic presentations, and public health planning documents. The high open-access rate of included studies ensures that the primary evidence underpinning this review is accessible to researchers and practitioners in LMICs without paywalled journal access.

4.6. Future research directions

The evidence gaps identified in this review point to several priority areas for future research. First, there is a pressing need for high-quality cluster-randomised trials of community-based neonatal intervention packages in West African settings — particularly Ghana and Nigeria — to generate contextually relevant effect estimates for use in programme planning and policy advocacy. The existing evidence base is heavily weighted toward South Asian contexts (Carlo, 2010; Kumar, 2008; Manandhar, 2004), and cannot be assumed to transfer without modification to West African settings with different health system architectures, cultural contexts, and epidemiological profiles.

Second, implementation science research is needed to understand the conditions under which community neonatal interventions are successfully delivered, adopted, and sustained at scale. The Ethiopian Health Extension Programme (Assefa, 2019) and similar large-scale programmes offer valuable lessons in this regard, but comparable documented experience from West Africa is limited. Third, the role of mHealth and digital health platforms in supporting CHW performance, ANC attendance, and postnatal follow-up merits further investigation utilizing adaptive study designs, such as Micro-Randomized Trials (MRTs), to evaluate just-in-time, context-aware digital interventions for CHWs and mothers (Lee, 2016; Lund, 2014).

Fourth, research on the resilience of community neonatal health systems to external shocks — including pandemics, conflict, climate events, and economic crises — is increasingly urgent in light of the documented fragility of hard-won neonatal mortality gains during the COVID-19 pandemic (Ashish, 2020; Roberton, 2020). Fifth, health economic analyses — including comprehensive cost-effectiveness and budget impact modelling — are needed to support domestic financing decisions for community neonatal packages in African LMICs, building on the foundational work conducted in the early 2000s (Adam, 2005). Finally, equity analyses examining the differential uptake and impact of community neonatal interventions across socioeconomic, geographic, and gender strata are needed to ensure that the most vulnerable populations — who bear the highest neonatal mortality burden — are adequately reached by intervention programmes (Fall, 2015; Katz, 2013).

5. Conclusions

This scoping review and evidence gap map confirm that community-based interventions—especially participatory women's groups, community health worker (CHW) home-visit programmes, and essential newborn care packages—are supported by moderate-certainty evidence, derived predominantly from cluster RCTs conducted in South Asia. Evidence is clearest and most consistent for these packages, alongside Kangaroo Mother Care, infection prevention, and antenatal micronutrient supplementation. However, the highly cited evidence base mapped here does not yet allow strong causal conclusions regarding effectiveness in West African settings. While mHealth platforms show promising effects on care-seeking and CHW performance, trial-level mortality evidence remains critically sparse. The review identifies West Africa—and Ghana in particular—as a priority geographic context for future intervention research and investment. The documented barriers to maternal and neonatal care utilisation in this region, combined with specific epidemiological burdens and health workforce challenges, point to the need for context-specific, high-quality trials of community neonatal packages adapted to West African health-system realities. Progress in reducing neonatal mortality in these highest-burden settings will require simultaneous action: strengthening antenatal care quality, scaling up adequately supervised CHW programmes, and embedding community-based care within resilient health systems capable of withstanding external shocks. The constraints of this review affect both the robustness and interpretability of its conclusions. Because the evidence base was selected using citation-stratified criteria and relied on a restricted set of databases, recently published trials and regionally published literature (e.g., studies indexed in the African Index Medicus or non-English literature) are likely underrepresented. Consequently, the identified "gaps" in West Africa reflect a lack of globally highly-cited literature rather than a definitive absence of local data. Furthermore, while formal risk-of-bias and GRADE assessments were applied to evaluative studies, the remaining descriptive literature was assessed using a simplified checklist, limiting direct comparability. Closing the remaining evidence gaps and translating existing knowledge into equitable, scalable programmes must be the central priorities for the global newborn health agenda. Future research priorities arising from this mapping exercise include: (1) conducting exhaustive systematic reviews across all core biomedical and regional databases to capture locally published West African data; (2) commissioning high-quality cluster RCTs of CHW and women's group packages in high-burden Francophone and Anglophone African settings; (3) leveraging advanced quasi-experimental methods—such as Regression Discontinuity Designs (RDD) or machine-learning enhanced difference-in-differences—to evaluate the causal impact of large-scale, real-world programme rollouts where RCTs are infeasible; and (4) utilizing adaptive study designs, such as Micro-Randomized Trials (MRTs), to rigorously evaluate just-in-time, context-aware mHealth interventions. Adopting these advanced methodologies will be crucial for generating the precise, actionable evidence needed to end preventable neonatal deaths in the world's most vulnerable communities.

CRediT authorship contribution statement

A.B.: Conceptualization, Methodology, Formal analysis, Data curation, Validation, Investigation, Visualization, Writing – original draft, Resources, Supervision, Project administration.

G.O.F.: Conceptualization, Methodology, Formal analysis, Data curation, Validation, Investigation, Visualization, Writing – original draft, Resources, Supervision, Project administration.

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Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

Data availability

Data and code snippets used to create the visualizations will be made available to interested authors or readers based upon a reasonable request.

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Declaration of generative AI and AI-assisted technologies in the manuscript preparation process.

During the preparation of this work the authors used Claude version 1.1.4010.0 and Cursor version 2.4.37 in order to write and edit the Python codes used to search for studies, extract metadata and create visualizations in this study. After using these tools/services, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article

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