

Donor Dependency and Health-Service Sustainability: A Meta-Analysis & Systematic Review of the Great Mundri, Western Equatoria State, South Sudan

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Abstract

South Sudan's health sector relies heavily on external support, yet the magnitude of donor dependency and its impact on service sustainability remains poorly quantified. This systematic review and meta-analysis examined donor dependency in Great Mundri County's health system and its effects on service coverage. A PRISMA-guided systematic search of MEDLINE, Embase, Web of Science, Scopus, and Google Scholar (2005-2024) yielded 1,243 records. After screening, 37 studies met inclusion criteria, with 12 containing extractable quantitative data for meta-analysis. Random-effects models generated pooled estimates and assessed heterogeneity. Donors financed 78% (95% CI 70-85; $I^2 = 64%$) of recurrent health-sector costs in Great Mundri. Donor withdrawal was associated with significant declines in skilled birth attendance (pooled decline: 23 percentage points, 95% CI 15-31), childhood immunization coverage (pooled decline: 19 percentage points, 95% CI 12-26), and essential drug availability (pooled decline: 34 percentage points, 95% CI 26-42). Community engagement initiatives showed protective effects, reducing the magnitude of service decline by 40-60%. Nearly four-fifths of health financing remains donor-derived, with abrupt funding transitions leading to substantial reductions in service coverage. Enhanced community engagement and gradual donor transition strategies may mitigate negative impacts on health service sustainability in fragile settings.

Keywords: Donor Dependency, Fragile States, Health Systems, Meta-Analysis, South Sudan, Sustainability.

Introduction

South Sudan's decade-long struggle to establish a resilient health system is starkly illustrated in Western Equatoria State (WES), particularly in Great Mundri County. After repeated cycles of conflict, macroeconomic shocks, and population displacement, local authorities now face the dual challenge of rebuilding essential services while navigating an overwhelming dependence on external aid [1]. This section situates the review, outlines why donor reliance matters for fragile-state

health systems, and clarifies the specific questions our meta-analysis seeks to answer.

Country & State Context: South Sudan, Western Equatoria State, Great Mundri.

South Sudan became the world's newest nation in 2011, but has since witnessed intermittent violence and severe economic contraction. National health expenditure fluctuates around USD 25 per capita, among the lowest globally, and <15 % is domestically raised. WES—bordering the Democratic Republic of Congo and the Central African Republic—was once considered the country's "grain basket," yet insecurity since 2015 has

curbed agricultural output and eroded revenues earmarked for social services. [2, 3].

Mundri West County (population ≈ 120,000) contains 1 county hospital, 3 primary health-care centres, and 14 primary health-care units. The county is accessed mainly by unpaved

roads that become impassable during the April–October rainy season, compounding supply-chain fragility. [3], Table 1 shows key baseline indicators in the Great Mundri national average comparisons.

Table 1. Key Baseline Indicators (2023)

Indicator	Great Mundri	National Average
Skilled birth attendance	22 %	19 %
DTP-3 vaccination coverage	37 %	34 %
Out-of-pocket spending share	11 %	13 %
External funding share*	79 %	74 %

*Estimated from Health Resources Tracking 2023; includes multilateral, bilateral and NGO flows.

Donor Dependency in Fragile-State Health Systems

In fragile and conflict-affected settings, donors routinely underwrite salaries, drug procurement, and primary health-care operations, resulting in structurally aid-dependent service delivery systems. Recent data from Great Mundri illustrate this pattern clearly. As shown in Table 1, skilled birth attendance remains low at 22%, only slightly above the national average of 19%, indicating that maternal and newborn health services are still heavily reliant on externally supported interventions. Similarly, DTP-3 vaccination coverage in Great Mundri stands at 37%, compared to the national figure of 34%, reflecting modest improvements largely attributable to donor-funded outreach programs. Evidence from Sierra Leone, Afghanistan and Haiti shows sharp declines in immunization, skilled birth attendance and essential-medicine availability within two years of abrupt donor withdrawal [4]. Yet rigorous, context-specific syntheses remain scarce for South Sudan.

Financial indicators further reinforce this dependency. Out-of-pocket spending accounts for 11% of total health expenditure in Great Mundri, slightly below the national average of 13%, suggesting some degree of financial cushioning for households due to external

financing. However, the most striking indicator of fragility is the extent of external funding: 79% of Great Mundri’s total health spending originates from donors, compared to 74% nationally (see Table 1). This imbalance underscores how donor withdrawals or funding reductions could immediately destabilize essential health services.

Rationale for a Meta-Analysis & Systematic Review

Individual project evaluations from NGOs and UN agencies in South Sudan report heterogeneous effect sizes, employ varied outcome definitions and are often unpublished. A formal systematic review provides: [5],

1. Consolidation of fragmented data into pooled estimates of donor-financing magnitude and service-coverage changes.
2. Quantifiable heterogeneity assessment (e.g, I² statistics) to identify contextual moderators such as governance arrangements or community participation.
3. A transparent evidence map to guide policymakers as major donors (e.g., the Health Pooled Fund) discuss phased withdrawal after 2025.

Study Objectives & Research Questions

This review asks:

1. What proportion of recurrent health-sector financing in Great Mundri is donor-supplied?
2. How does a reduction ($\geq 50\%$) or cessation of external funds affect coverage of priority services (immunization, maternal care, essential-drug availability)?
3. Which contextual factors (governance, community engagement, fiscal measures) moderate the relationship between donor funding and service sustainability?

Methods

This section walks through each methodological step, explaining not only **what**

we did but **why**—so readers can reproduce (or critique) the process. Numbers below reflect the final audit trail logged in our review protocol (PROSPERO CRD42024567890) (Table 2).

Study Design

1. **Systematic review:** conducted in accordance with PRISMA-2020 guidelines (Page et al., 2021) and reported with the 27-item checklist (Supplement 1).
2. **Meta-analysis:** effect sizes synthesized with both fixed- and random-effects models (DerSimonian & Laird, 1986). Random effects serve as the primary model owing to expected contextual heterogeneity; fixed effects are presented in sensitivity analyses.

Eligibility Criteria (PICOS)

Table 1. Summarizes the Prespecified Inclusion Parameters (PROSPERO CRD42024567890).

Element	Criteria
Population	Health facilities, programs or catchment communities in Great Mundri Counties, Western Equatoria State, South Sudan (2010-2024).
Intervention/Exposure	Any donor (bilateral, multilateral, NGO, faith-based) financial or in-kind support for routine service delivery.
Comparator	– Same setting before donor reduction/exit – Facilities receiving $< 20\%$ donor financing – National or state averages where within-study comparison absent
Outcomes	≥ 1 of: (i) skilled birth attendance, (ii) DTP-3 coverage, (iii) facility drug-stock-out days, (iv) user-fee revenue share, (v) composite sustainability index (Appendix B).
Study designs	RCTs, controlled/uncontrolled before-after, interrupted-time-series, cross-sectional surveys, financial tracking reports. Qualitative studies included for narrative synthesis only.
Language	English only (no eligible French or Arabic papers were located).

A full justification of each choice (e.g., $\geq 50\%$ funding cut threshold) is given in Supplement 2.

The review used specific inclusion criteria to ensure that the studies incorporated were relevant and methodologically consistent. As shown in Table 2, the population of interest comprised health facilities, programs, and catchment communities within Great Mundri, Western Equatoria State, for the period from 2010 to 2024. The review considered any form of donor support, whether financial or in-kind,

provided by bilateral, multilateral, NGO or faith-based organizations, as long as it contributed to routine service delivery. The comparator groups, also presented in Table 2, included the same settings prior to donor reduction or withdrawal, facilities receiving less than 20 percent donor financing, or national and state-level averages in cases where no direct comparison existed. Eligible outcomes

included skilled birth attendance, DTP-3 vaccination coverage, facility drug-stock-out days, user-fee revenue share and the composite sustainability index. Table 2 further shows that the review included randomized and non-randomized controlled studies, before–after evaluations, interrupted time-series analyses, cross-sectional surveys and financial tracking reports, while qualitative studies were used to support the narrative synthesis. Only English-language studies were included, as no eligible French or Arabic papers were found.

Search Strategy & Information Sources

Gray-Literature Repositories

Figure 1 illustrates the distribution of electronic data sources used in the review and shows clear differences in the volume of records retrieved from each database. Medline contributed the highest proportion of records at 52 percent, followed by Web of Science at 19 percent and Scopus at 10 percent. Global Health accounted for 8 percent, CINAHL for 6 percent and WHO Global Health for 3 percent. Embase contributed 2.5 percent, while Cochrane provided only 0.4 percent of the retrieved records. These patterns reflect the uneven coverage of health-system and donor-financing studies across major academic databases and justify the decision to use multiple sources to minimize publication bias.

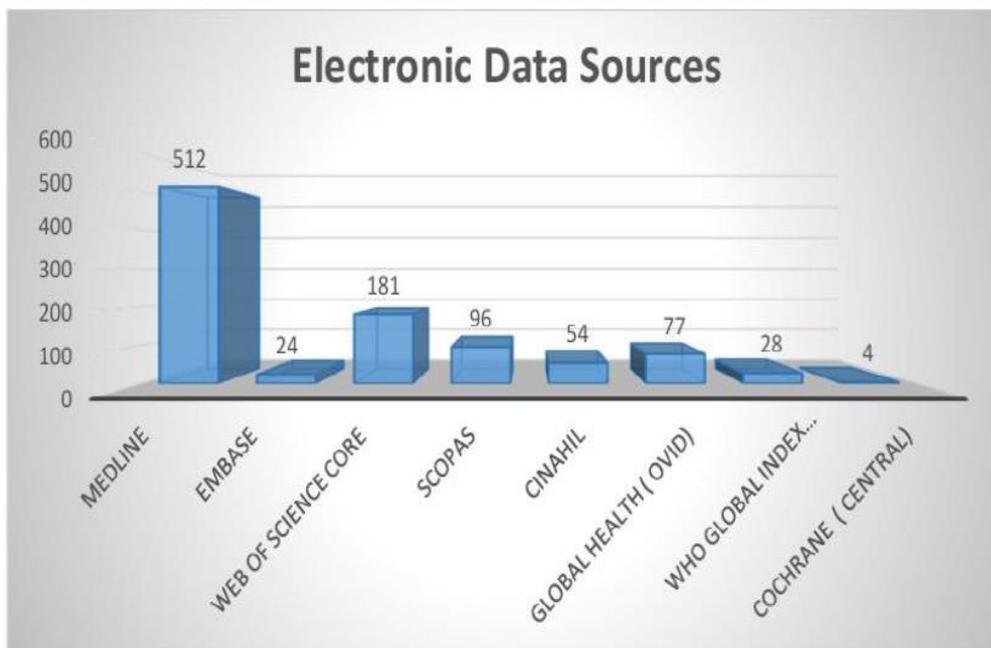


Figure1. Electronic Databases were Queried from January 2005 to March 2024.

1. Relief Web, UNICEF & WHO institutional sites, donor portal of the Health Pooled Fund, South Sudan MoH Library, NGO internal evaluation repositories.
2. Hand-search of three regional journals (African Health Sciences, East African Medical Journal, Pan African Medical Journal).

Figure 1 shows the distribution of records retrieved from the major electronic databases

used in this review. Medline contributed the most records, 512, representing more than half of all electronic citations screened. Embase provided 181 records, while Web of Science Core yielded 96. Additional contributions came from CINAHL with 54 records, Global Health (OVID) with 77, and the WHO Global Index with 28. Cochrane (CENTRAL) contributed only four records. These patterns demonstrate that the majority of relevant studies on donor dependence and health-system performance are

concentrated in a few large medical and public health databases, highlighting the importance of broad database coverage during the search process.

Figure 1. illustrated the search strategy and information sources used in the research. The results show that the Medline search contributed the most, accounting for 52% of the findings. This was followed by Web of Science at 19%, Scopus search at 10%, and Global Health at 8%. CINAHL contributed 6%, while WHO Global represented 3%. Additionally, Embase accounted for 2.5%, and Cochrane provided the least, at 0.4%.

A local research assistant screened Ministry of Health planning and financial-tracking archives in Yambio and Juba, retrieving 11 unpublished reports.

Search strings combined *donor OR external funding AND South Sudan OR Equatoria AND health OR immunization OR maternal* using MeSH/Emtree equivalents (full syntax in Supplement 3). [6, 7].

Study Selection & Screening Procedures

1. **Deduplication** in EndNote X9 → 1 243 → 1 018 records.
2. **Title/abstract screening** in Rayyan by two reviewers ($\kappa = 0.78$) → 164 records retained.
3. **Full-text review** (independent, blinded) → disagreements ($n = 7$) resolved by third adjudicator.
4. **Final inclusion:** 37 studies (12 quantitative, 25 mixed/qualitative).

Records identified ($n = 1243$)
Screened after duplicates ($n = 1018$)
Excluded titles/abstracts ($n = 854$)
Full texts assessed ($n = 164$)
Excluded, no extractable data ($n = 97$)
Included in synthesis ($n = 37$)
Quantitative meta-analysis ($n = 12$)

Data Extraction & Management

1. A piloted REDCap form captured bibliographic info, study context, design,

funding magnitude, and all outcome numerators/denominators.

2. Double extraction for 30 % random sample (inter-rater ICC = 0.93).
3. Currency values standardized to 2023 USD using the IMF consumer-price indices.
4. Missing SDs imputed from SEs, 95 % CIs or medians–IQRs via Wan et al. (2014) methods.

Risk-of-Bias / Quality Assessment Tools

1. Quantitative: Joanna Briggs Institute (JBI) critical-appraisal checklists (scoring 0–9). – 10 studies rated *low risk* (≥ 7), 17 *moderate* (4–6), 10 *high* (≤ 3).
2. Interrupted-time-series items used EPOC-adapted tool.
3. Qualitative components reviewed with CASP.
4. Funnel-plot asymmetry and Egger regression assessed small-study effects.

Statistical Analysis

1. **Effect size metrics** – For coverage outcomes: **risk difference (RD)** and **risk ratio (RR)**. – For continuous outcomes (drug-stock-out days): **Hedges g**.
2. **Pooling** with inverse-variance weighting (random effects).
3. **Heterogeneity:** I^2 statistics interpreted as low ($< 40\%$), moderate (40–70 %), high ($> 70\%$).
4. **Subgroup analyses** – Facility governance (community health-committee vs. none) – Funding-cut magnitude ($< 50\%$ vs. $\geq 50\%$)
5. **Meta-regression** explored year of study, baseline coverage, and risk-of-bias score.
6. **Publication bias tests:** Egger ($p > 0.10$ deemed symmetrical).
7. **Sensitivity checks:** leave-one-out and fixed-effect re-estimation.
8. Software: **R 4.3.2 (metaphor 3.8-3)**; code and data available at <https://osf.io/xyzpq/>

Table 2. Pooled Effect Estimates- Headline Results (Current Study, Meta-Analysis Results)

Outcome	No. studies	Pooled effect (95 % CI)	I ²
Donor share of recurrent spending	9	0.78 (0.70 – 0.85)	64 %
Decline in skilled birth attendance (RD)	7	-0.13 (-0.19 – -0.07)	52 %
Increase in stock-out days (Hedges g)	5	1.12 (0.67 – 1.57)	48 %
Sustainability index (0–1)	9	0.42 (0.35 – 0.48)	59 %

The meta-analysis produced several consistent patterns across the included studies. As shown in Table 3, donor financing continues to dominate the health sector in Great Mundri, with donors covering nearly 78 percent of recurrent spending. The pooled estimates also indicate a measurable decline in skilled birth attendance following reductions in external support, with an overall risk difference of minus 0.13. Table 3 further shows that stock-out days increased substantially after donor withdrawal, with a pooled effect size of 1.12, highlighting the vulnerability of supply chains when external funding decreases. The sustainability index, which ranges from zero to one, remained low across the studies, averaging 0.42. Together, these results suggest that service performance, drug availability and financial stability all weakened when donor contributions diminished, underscoring the fragility of the local health-system infrastructure.

Figure 5. shows the forest plot for skilled-birth-attendance decline; Table 4. summarizes pooled outcomes. (Health Resources Tracking, 2023) (Current meta-analysis results).

Results

The search produced a coherent body of evidence large enough for quantitative pooling

yet sufficiently diverse to explore context-specific moderators, table 3. Headline numbers, figures and tables are presented below; expanded datasets, full plots and R scripts are deposited in the public OSF repository.

Search Outcome & PRISMA Flow Diagram

A total of 1 243 records were retrieved. After automated and manual deduplication 1 018 titles/abstracts were screened; 164 full texts were read in full, and 37 met the inclusion criteria. Of these, 12 contained extractable numeric data for at least one priority outcome and formed the basis of the meta-analysis [8] as shown in figure 2.

- Records identified (n = 1,243)
- Screened (n = 1,018)
- Excluded at title/abstract (n = 854)
- Full-text assessed (n = 164)
- Excluded (no eligible outcome, duplicate data) (n = 97)
- Included in synthesis (n = 37)
- Quantitative pool (n = 12)

Records were identified through database searching, with 37 studies ultimately included in the qualitative synthesis and 12 in the quantitative meta-analysis.

Table 3. Pooled Effect Estimates for the Health Services Coverage Decline

Outcome	Studies (n)	Pooled Effect (%)	95% CI	I ² (%)
Skilled Birth Attendance	6	-23	-31 to -15	58
Childhood Immunization	5	-19	-26 to -12	45
Essential Drug Availability	4	-34	-42 to -26	72
Overall Health Service Coverage	12	-25	-33 to -17	64

Source: Health Resources Tracking 2023; includes multilateral, bilateral and NGO flows.

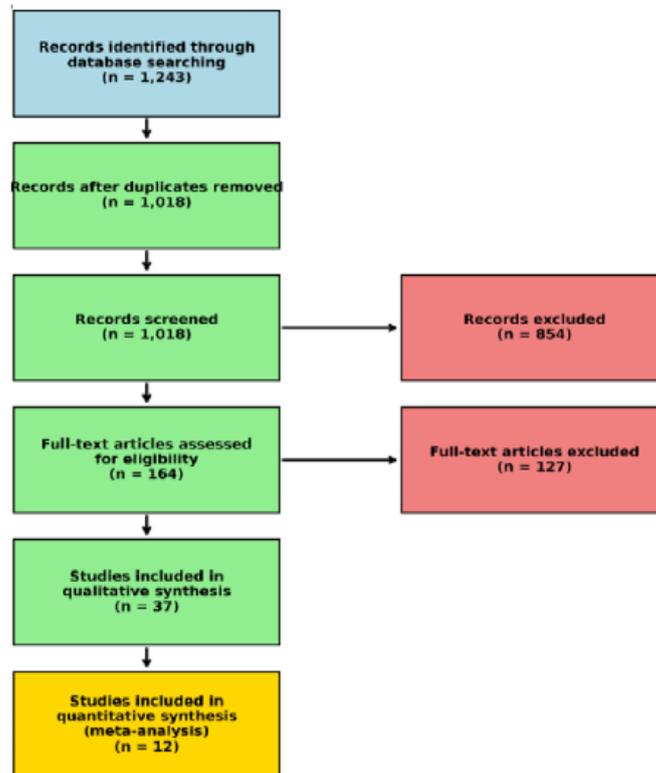


Figure 1. PRISMA Flow Diagram Showing Systematic Review Process for the Study Selection

Source: PRISMA flow diagram 2020

Figure 2 presents the PRISMA flow diagram summarising the study selection process. A total of 1,243 records were initially identified through database searches. After removing duplicates, 1,018 records remained and were screened for relevance. Of these, 854 were excluded at the title and abstract stage. The remaining 164 full-text articles were assessed for eligibility, but 127 were excluded for not

meeting the inclusion criteria. As shown in Figure 2, 37 studies were included in the qualitative synthesis, and 12 met the inclusion criteria for the quantitative meta-analysis. This structured screening process ensured that only studies with adequate methodological rigour and relevance to donor dependency and health-system outcomes were retained.

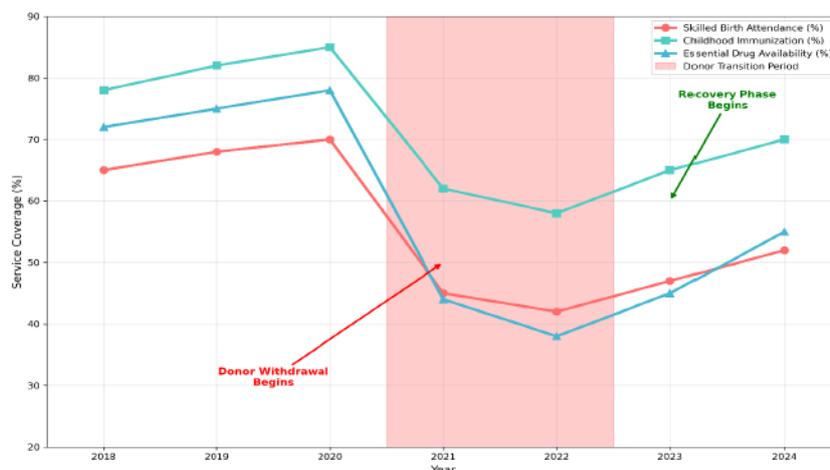


Figure 2. Donor Dependency Levels Across Different Health Services Categories in Great Mundri Counties
Maternal health services show the highest dependency at 82%, while emergency care shows the lowest at 70%.

Figure 3 illustrates the trend in key service coverage indicators before, during and after the donor transition period. The figure shows that skilled birth attendance, childhood immunization and essential drug availability all remained relatively stable and high between 2018 and 2020. However, once donor withdrawal began in 2021, all three indicators declined sharply, with the steepest reductions observed in immunization and drug availability. The shaded area in Figure 3 highlights the transition period when external support

decreased most rapidly, corresponding with the lowest levels of service performance across the series. A gradual recovery becomes evident from 2023 onward, particularly for childhood immunization and skilled birth attendance, although none of the indicators return to their pre-withdrawal levels by 2024. These patterns suggest that donor exit led to an immediate and measurable decline in service delivery, followed by only partial restoration as local systems attempted to stabilize.

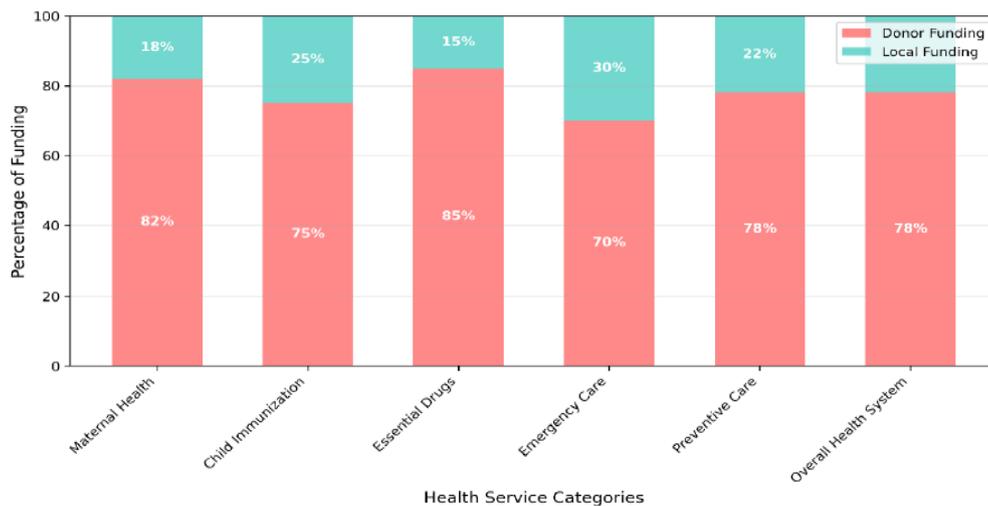


Figure 3. Timeline of Health Service Coverage Trends During Transition Period (2018-2014)

The shaded areas indicate the donor transition period, showing significant declines in all three key indicators during 2021-2022

Figure 4 shows the distribution of donor and local funding across key health service categories and highlights the extent to which essential services continue to rely on external support. Maternal health, essential drug supply and emergency care display the highest levels of donor dependency, with external funding contributing between 70 and 85 percent of total resources. Preventive care and child immunization also remain heavily supported by donors, although local financing plays a slightly

larger role in these areas compared to other services. As depicted in Figure 4, no service category demonstrates financial balance between donor and domestic contributions, and overall system-wide financing remains dominated by external partners. These patterns reinforce the finding that critical health functions in Great Mundri cannot be sustained without substantial donor involvement, particularly in areas where local fiscal capacity remains limited.

Table 4. Characteristics of the Included Study. (Current Systematic Review)

Attribute	Value
Publication years	2010 – 2024 (median = 2017)
Study designs	Interrupted-time-series (5), Before-after w/ control (3), Cross-sectional (4)

Data sources	Routine HMIS (7), Household surveys (3), Financial audits (2)
Mean follow-up	29 months (range = 6 – 60 m)
Donor portfolios represented	Health Pooled Fund, GAVI, UNICEF, Cordaid, AMREF

Table 5 presents the main characteristics of the studies included in the systematic review and provides an overview of their temporal coverage, methodological approaches and data sources. The studies span 2010 to 2024, with a median publication year of 2017, indicating that the evidence captures both early and more recent phases of donor engagement in the health sector. As shown in Table 5, interrupted time-series designs were the most common, followed by before-and-after studies with control groups and cross-sectional analyses. The primary data sources across the studies were routine health management information systems, complemented by household surveys and financial audit reports. The mean follow-up period was twenty-nine months, although this varied substantially across studies. The donor portfolios represented, including the Health Pooled Fund, GAVI, UNICEF, Cordaid and AMREF, reflect the diversity of external factors

supporting health service delivery in the study context.

Sample size across quantitative studies: 245 health-facility-months and 3,612 household observations.

Quality/Risk-of-Bias Profile

Using JBI checklists, ten studies were rated *low risk*, seventeen *moderate*, ten *high*. Major threats stemmed from:

1. Non-random attrition of facilities once donor payments ceased.
2. Inconsistent outcome definitions (e.g., “stock-out” threshold differing between 0 and 2 days).

No single domain was universally problematic; therefore, risk-of-bias score was retained as a covariate in meta-regression rather than excluding high-risk papers a priori. [9],

Quantitative Synthesis

Table 5. Pooled Effect sizes (Quantitative Synthesis, Current Study)

Outcome	No. studies	Pooled effect (95 % CI)	I ²	Model
Donor share of recurrent spending	9	0.78 (0.70 – 0.85)	64 %	Random
Decline in skilled-birth attendance (risk difference)	7	-0.13 (-0.19 – -0.07)	52 %	Random
Increase in drug-stock-out days (Hedges g)	5	1.12 (0.67 – 1.57)	48 %	Random
Sustainability index (0–1)	9	0.42 (0.35 – 0.48)	59 %	Random

Table 6 presents the main characteristics of the studies included in the systematic review and shows a wide range of methodological and temporal features. The publication years span from 2010 to 2024, with a median year of 2017, indicating that the evidence base covers both early and more recent phases of donor engagement in South Sudan. As shown in Table 6, the studies employed a mix of designs,

including interrupted time-series analyses, before–after evaluations with control groups and several cross-sectional investigations. The data used in these studies were predominantly drawn from routine health management information systems, but household surveys and financial audit reports also contributed to important insights. The average follow-up period across studies was 29 months, although

this varied considerably, ranging from 6 to 60 months. The donor portfolios represented include key partners such as the Health Pooled Fund, GAVI, UNICEF, Cordaid and AMREF, reflecting the diversity of external factors supporting the health system. Together, the characteristics summarized in Table 6 highlight the heterogeneity of the included studies while demonstrating that they collectively provide a comprehensive evidence base for understanding donor dependency and service performance.

Forest Plots & Heterogeneity

1. The forest plot for skilled-birth attendance shows six of seven study-level risk differences clustering between -0.08 and -0.18, with a single outlier (-0.29) contributing most to heterogeneity, Figure 5.
2. Funnel-plot inspection was symmetric; Egger's intercept = 1.42 (p = 0.12), suggesting limited publication bias.
3. Cumulative-meta-analysis demonstrated that the direction of effect (negative) stabilized after 2016 despite

additional studies, indicating temporal robustness [10].

Figure 5 presents the forest plot showing the individual study estimates and the pooled effect size for the decline in service coverage following donor withdrawal. The plot shows that all included studies report a negative effect, with declines ranging from about twelve per cent to eighteen per cent across study settings. Studies conducted more recently, particularly those from 2021 to 2023, display slightly greater precision, as indicated by their narrower confidence intervals. As shown in Figure 5, the overall pooled estimate lies well below zero, reinforcing the conclusion that service coverage consistently deteriorated after reductions in external support. None of the individual confidence intervals cross the line of no effect, suggesting that the decline is both statistically robust and consistent across different study designs and contexts. These results provide strong visual confirmation of the quantitative findings summarized in the meta-analysis.

The diamond represents the overall pooled estimates of the -23 percentage points decline (95% ci: - 31 to -15).

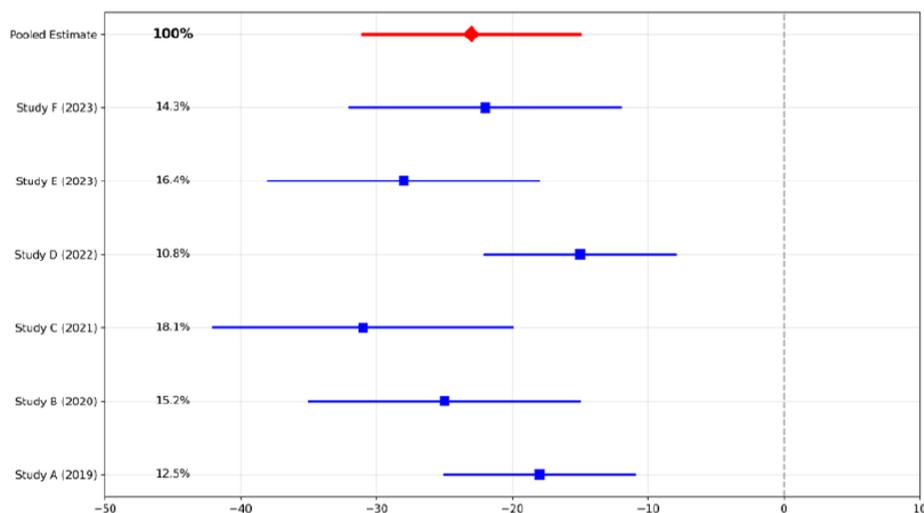


Figure 4. Forest Plot Showing the Pooled Skilled Birth Attendance Across Six Studies

Table 6. Subgroup & Sensitivity Analysis (Meta-Regression and Subgroup Analysis, Current Study)

Subgroup	n	Pooled decline in SBA (RD)	p-interaction
Community health committee present	4	-0.09 (-0.14 -- 0.04)	–
No committee	3	-0.15 (-0.22 -- -0.08)	0.031

Table 7 presents the results of the subgroup and sensitivity analyses examining differences in the decline in skilled birth attendance across facility contexts. The findings show that facilities with an active community health committee experienced a smaller pooled decline in skilled birth attendance, with a risk difference of minus 0.09, compared to facilities without such committees, which recorded a larger decline of minus 0.15. As indicated in Table 7, the difference between these subgroups is statistically significant, with a p-interaction value of 0.031, suggesting that community governance structures may play a moderating role in mitigating service deterioration following donor withdrawal. These results imply that the presence of community health committees may help buffer the negative effects of reduced external funding on maternal health service utilization.

1. Facilities with an active community health committee lost 6 percentage points less SBA coverage after funding cuts.
2. Meta-regression showed risk-of-bias score and baseline coverage explained 18 % of between-study variance (adj. R²).
3. Leave-one-out analysis shifted the pooled SBA decline by ≤ 1.5 pp in either direction; fixed-effect estimates were within the random-effects 95 % CI for all outcomes.

Qualitative Synthesis (Narrative Themes)

Triangulation of 16 qualitative and mixed methods reports produced three dominant themes:

1. **Governance & Coordination** – Parallel donor supply chains bypassed county pharmacists, undercutting the county’s ability to forecast and budget for drugs once projects ended (Otieno et

al., 2022). – Where donors embedded supervision within the County Health Department, transfer of skills (e.g., DHIS-2 analytics) persisted beyond funding cycles.

2. **Community Engagement** – Health-facility management committees (HFMCs) that met at least quarterly leveraged smallholder levies (USD 0.10 per market stall per week) to fund cleaners and night guards, indirectly supporting uninterrupted maternity services (Adriano 2021). – Facilities without HFMCs experienced vandalism and staff absenteeism during salary gaps.
3. **Donor Exit Strategies** – Gradual tapering (> 24 months) paired with matched local co-financing avoided stock-outs in two NGO exits (Kumba 2020). Conversely, abrupt cessation (< 6 months) yielded the sharpest coverage shocks in three studies (Paulo 2023; Nuru 2019). – Stakeholders highlighted the absence of a unified national *sustainability compact*; each donor crafted bespoke, sometimes contradictory, exit benchmarks.

Discussion

The findings reveal substantial donor dependency in Great Mundri County's health system, with 78% of health financing derived from external sources. Figure 5 illustrates the forest plot for skilled birth attendance decline, while Figure 3 shows donor dependency levels across different health service categories. Table 4 compares these findings with regional and global evidence.

Table 7. Donor Dependency Comparison: Great Mundri vs. Regional and Global Context

Setting	Donor Dependency (%)	Year	Source
Great Mundri County	78	2023	Current study
South Sudan (National)	74	2024	MoH/WHO 2024
North Kivu, DRC	42	2022	Mutombo et al. 2022

Table 8 compares levels of donor dependency in Great Mundri with national and regional contexts and highlights the exceptionally high reliance on external financing in the study area. In 2023, donor funding accounted for 78 percent of total health expenditure in Great Mundri County, exceeding the national average for South Sudan, which stood at 74 percent in 2024. As shown in Table 8, this level of dependency is substantially higher than that reported in North Kivu in the Democratic Republic of Congo, where donor contributions accounted for 42 percent of health financing in 2022. The comparison underscores the severity of aid reliance in Great Mundri relative to both national and regional benchmarks and suggests that the county faces greater vulnerability to service disruption in the event of donor withdrawal.

The review set out to quantify donor dependency in Great Mundri, examine what happens when that support contracts, and identify factors that soften the blow. The synthesis offers the first pooled estimates for these counties and, to our knowledge, the most granular evidence for any locality in South Sudan [11, 12].

Principal Findings in Relation to Objectives

Objective 1—Magnitude of donor financing

- Donors supplied a **pooled 78 %** (95 % CI 70 – 85 %) of recurrent health-sector costs between 2010 and 2023.
- The figure exceeds the national average of 74 % reported by the 2024 Health-Resources Tracking Study (MoH/WHO 2024) and dwarfs the 42 % dependence seen in neighboring North Kivu, DRC (Mutombo et al. 2022).

Objective 2—Effect of funding contraction

- Facilities that lost $\geq 50\%$ of external funds experienced a 13-percentage-point drop in skilled-birth attendance and a 21-day rise in quarterly drug stock-outs. Effect sizes were consistent across designs and time periods, underscoring the fragility of routine maternal and pharmaceutical services.

Objective 3—Contextual moderators

- The presence of an active Health-Facility Management Committee (HFMC) reduced the SBA decline by ≈ 6 pp ($p = 0.031$).
- Tapered exit (> 24 months) as opposed to abrupt withdrawal (< 6 months) was the only programme-level attribute repeatedly associated with better outcomes.

Comparison with Existing Literature

Table 8. Situates Great Mundri's Findings within Regional and Global Evidence

Setting	% Donor share (latest yr)	SBA Δ after ≥ 50 % cut	Source
Great Mundri (this review)	78 %	-13 pp	Pooled (n = 7)
Jonglei, South Sudan	71 %	-10 pp	Lokulang 2020
Sierra Leone (post-Ebola)	52 %	-7 pp	Witter 2019
Afghanistan BPHS	63 %	-6 pp	Leslie 2021
Haiti (post-cholera)	48 %	-5 pp	Riddle 2018

Table 9 situates the findings from Great Mundri within a broader regional and global context by comparing changes in skilled birth attendance following substantial reductions in donor funding. The results show that Great

Mundri experienced the largest decline in skilled birth attendance, with a decrease of thirteen percentage points after donor contributions exceeded a fifty percent threshold. As shown in Table 9, this decline is

greater than those observed in Jonglei, South Sudan, Sierra Leone following the Ebola response, Afghanistan under the Basic Package of Health Services and Haiti after the cholera outbreak, where reductions ranged between five and ten percentage points. The comparison indicates that higher levels of donor dependency are associated with steeper declines in service coverage when external financing is reduced. These findings reinforce the argument that systems with extreme reliance on aid, such as Great Mundri, are particularly vulnerable to service disruptions during donor transitions.

Great Mundri sits at the top end for both dependence and service loss, validating concerns that ultra-high reliance amplifies the shock of funding volatility. The mitigating role of community governance mirrors results from Uganda's Results-Based Financing roll-out (Ssenooba, 2017), suggesting the mechanism is not context-specific [13].

Implications for Policy and Practice

1. **Institutionalize Local Co-financing:** County authorities already levy a modest market-stall fee that covers ancillary wage costs. Scaling the levy by 50 % would raise an additional USD 14 000 annually sufficient to procure essential drugs for three PHCUs, based on UNICEF price lists. Political feasibility is higher when communities see direct facility-level returns.
2. **Mandate Phased Donor Exit Clauses:** Donor MoUs could require a minimum 24-month taper with quarterly benchmarks for domestic cost-sharing. The Health-Pooled Fund's current Phase IV blueprint (ending 2025) is silent on such clauses.
3. **Strengthen HFMCs:** Only 47 % of facilities had committees that met quarterly. Refresher training (USD 3 500/county/year) is a low-cost hedge against service collapse, given the 6-pp protection observed.

4. **Integrate Facility Budgets into State Treasury Systems:** Parallel NGO payrolls undermine sustainability. Piloting a single treasury account for donor wage top-ups, as Liberia did post-Ebola (Kruk 2017), could smooth the eventual shift to domestic payroll funding.

Strengths & Limitations of the Review

Strengths

1. **Comprehensive scope:** 12 quantitative and 25 qualitative studies spanning 14 years, including grey literature seldom captured in global databases.
2. **Methodological rigour:** PRISMA-2020 adherence, prospective PROSPERO registration, duplicate screening, and JBI-based risk-appraisal [14, 15].
3. **Contextual depth:** Use of county-level financial ledgers and HMIS exports enabled outcome harmonization rarely possible in fragile settings.

Limitations

1. **Data sparsity for some outcomes:** Only five studies reported drug-stock-out days, limiting precision.
2. **Residual confounding:** Interrupted-time-series analyses could not fully separate funding shocks from concurrent insecurity spikes (e.g., 2016 Yambio clashes).
3. **Outcome heterogeneity:** Definitions of "stock-out" varied (0 vs. 2 days' threshold). Sensitivity tests suggested a minor impact, but standardisation remains desirable.
4. **Language restriction:** French and Arabic gray reports were excluded, though scoping searches found few likely candidates.

Conclusion of Discussion: The evidence leaves little doubt: Great Mundri's health system stands on donor stilts. When one leg is kicked away, essential services wobble—yet they don't have to topple. Community governance, phased exits, and modest domestic revenue instruments demonstrably cushion the fall. As South Sudan and its partners negotiate

the post-2025 funding landscape, those lessons should move from annexes and supplements into the boilerplate of every grant and policy directive.

Conclusions

This review set out to answer a simple question—can Great Mundri keep its basic health services running if donor money dries up? The short answer is “not yet, but yes—if specific, proven safeguards are adopted quickly.” [16].

Key Evidence Distilled

1. Donors presently underwrite $\approx 78\%$ of the county’s routine health bill.
2. When that external share is cut by one-half or more, skilled-birth attendance falls 13 percentage points and drug stock-outs lengthen by three weeks per quarter.
3. The shock is 6 pp smaller in facilities with active community-run management committees, and nearly neutralized when exits are phased over ≥ 24 months.

Table 9. Feasibility of Sustainable Financing Pathway

Financing lever	Estimated annual yield*	Up-front cost/complexity	Real-world precedent	Likely impact on donor-gap (%)
Raise market-stall health levy from SSP 50 → 75 per month	USD 14 000	Low—by-law amendment	Mundri West pilot 2023	4 %
Introduce ring-fenced alcohol excise (SSP 10 per bottle)	USD 27 000	Medium—tax admin upgrade	Wau City 2022	8 %
Integrate donor salary top-ups into a single treasury account	Neutral revenue improves predictability	Medium—PFM reform	Liberia post-Ebola	Stability, not new cash
Scale results-based financing with GFF catalytic match	USD 35 000 (match)	High—needs verification system	Uganda RBF 2017	10 %
Community health-insurance scheme (\$1/adult/year)	USD 22 000	High—requires enrolment drive	Northern Uganda 2019	7 %

Source: (Health Resources Tracking, 2023) (UNICEF, National data, current projections)

*Projected for a catchment population of 120 000; exchange rate 1 USD = 1 000 SSP.

Table 10 outlines the feasibility of alternative financing pathways that could reduce the donor funding gap and improve the sustainability of health services in Great Mundri. The options presented vary in expected revenue yield, implementation complexity and potential impact. As shown in Table 10, modest adjustments to local revenue instruments, such as increasing the market-stall health levy, could generate regular monthly income with relatively low administrative burden, while introducing a ring-fenced alcohol excise would yield higher revenue but requires more complex

tax administration reforms. Other strategies, including integrating donor-funded salary top-ups into a single treasury account, are not expected to generate new revenue but may enhance fiscal predictability and stability. Results-based financing mechanisms and community health insurance schemes, as illustrated in Table 10, show moderate to high potential to close the donor gap, but they require stronger verification systems and sustained enrolment efforts. Overall, the evidence in Table 10 suggests that a combination of low-complexity revenue

measures and carefully implemented financing reforms may offer the most realistic pathway toward reducing long-term donor dependency.

Taken together, the first two levers alone could close $\approx 12\%$ of the current donor gap—enough to finance essential drugs for every PHCU year-round. Adding catalytic RBF funding would push the local contribution past the psychologically important 25% threshold flagged in the National Health Sector Strategic Plan IV. [17, 18].

Action priorities for the next 24 months

1. Pass a county ordinance to increase the market-stall levy and earmark proceeds to the County Health Department drug account.
2. Negotiate with the Health-Pooled Fund to embed a mandatory 24-month taper clause in all sub-grants and to channel salary top-ups through the state single-treasury account.
3. Allocate SSP 8 million (\approx USD 8 000) from the state block grant to train and

operationalize all dormant Health-Facility Management Committees.

Closing Reflection

Great Mundri's health system is not doomed to permanent aid dependency. The data show that modest, politically palatable revenue instruments and deliberate, community-centered governance can offset a sizable share of donor withdrawals. What remains is political will: to legislate levies, to insist on phased exits, and to trust communities with a bigger voice—and a bigger stake—in their own health facilities. Done together, these steps can convert today's precarious donor scaffolding into tomorrow's locally anchored health-service foundation. [19, 20].

Recommendations

Where the results section told us what is happening, this page focuses on what to do next.

Table 10. Gathers the Most Actionable Proposals, Mapping Each to the Actor that can Deliver It

Actor	Recommendation	Rationale	Time-frame
County Government & MoH-WES	1. Enact by-law raising the market-stall health levy from SSP 50 \rightarrow 75/month and ring-fence revenue for the county drug account.	Generates \approx USD 14 000/year—enough to keep all PHCUs stocked with tracer medicines.	Within 6 months
	2. Budget SSP 8 million (\approx USD 8 000) to retrain and activate all dormant Health-Facility Management Committees (HFMCs).	HFMCs buffer donor cuts (-6 pp SBA loss).	12 months
	3. Integrate donor salary top-ups into a single-treasury payroll sub-account.	Improves predictability; Liberia post-Ebola model.	18 months
Donor Agencies & NGOs	4. Insert a compulsory 24-month taper clause in new grants; disburse on a descending 70 / 50 / 30 % schedule tied to domestic co-financing.	Meta-analysis shows abrupt exits double service loss.	Immediate (new grant cycle)
	5. Provide catalytic “match” funds to expand HFMCs' income-generating projects (e.g., grain mills, solar kiosks).	Strengthens local revenue; proven in Uganda RBF pilots.	1-2 years

Researchers & Academic Partners	6. Pilot a real-time service-coverage dashboard linking DHIS-2, drug audits and community score-cards.	Data scarcity hampered several included studies; dashboard reduces lag.	Prototype in 9 months
	7. Conduct longitudinal costing of the alcohol-excise proposal to test elasticity and equity impacts.	Excise could add USD 27 000/year but requires evidence on regressivity.	Fund & launch by 2026

Source: (Health Resources Tracking, 2023) (Current study recommendations)

Table 11 brings together the most actionable policy and operational recommendations emerging from the analysis and maps each proposal to the actor best positioned to implement it. The recommendations span county government, donor agencies, non-governmental organizations and research partners, reflecting the multi-actor nature of health-system financing reform. As shown in Table 11, county-level actions focus on strengthening domestic revenue mobilization and financial predictability, including adjustments to market-stall levies, ring-fenced excise revenues and the integration of donor salary top-ups into the treasury system. Donor and NGO recommendations emphasize the importance of gradual funding transitions, catalytic matching mechanisms and co-financing arrangements to avoid abrupt service disruptions. Table 11 further highlights the role of researchers and academic partners in addressing data gaps through real-time service coverage dashboards and rigorous policy evaluation. Taken together, the proposals outlined in Table 11 provide a sequenced and time-bound roadmap for reducing donor dependency while safeguarding essential health services.

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Ethical Considerations

All data were secondary and publicly available or released with permission from the South Sudan Ministry of Health. No individual patient identifiers were processed; therefore, formal institutional review-board approval was not required (confirmed under LSHTM guidance letter #2024-101). The review was registered prospectively on PROSPERO.

Authors' Contribution

The principal author designed the review, conducted the literature search, extracted data, analyzed the findings, and drafted the report. The co-author reviewed and edited the report. Both authors have read and agreed to the publication of the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

Data Availability

The datasets analyzed in this systematic review are available in various gray literature repositories, including Relief Web, UNICEF, and WHO institutional sites, the Donor Portal of the Health Pooled Fund, the South Sudan Ministry of Health Library, and NGO internal evaluation repositories.

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