

Assessing Maternal and Child health Service Continuity Using Routine Health Information System Data: A Sub-National Analysis from Zambia

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Abstract:

➤ Background

Routine Health Management Information Systems (HMIS) generate extensive maternal and child health (MCH) data but remain under-utilized for sub-national performance analysis and supervisory decision-making, particularly in low- and middle-income countries (LMICs) (Ramadan et al., 2023; World Health Organization, 2023). Applying a continuum-of-care lens to routine data may reveal structural service delivery gaps that are not visible in survey-based evidence (Grewal et al., 2024).

➤ Methods

We conducted a desk-based secondary analysis of routine DHIS2 data for eight MCH indicators across all 15 districts in Eastern Province, Zambia, covering the period 2023–2025. Indicators represented antenatal, intrapartum, postnatal, and child preventive stages of the MCH continuum of care, consistent with WHO guidance on routine health facility data use (World Health Organization, 2023).

➤ Results

Average coverage for a first antenatal care visit at any point in pregnancy was relatively high (83.4%) while timely initiation of care remained low, with first-trimester antenatal attendance averaging 39.2%. Coverage improved during childbirth, with institutional deliveries averaging 71.6% and deliveries attended by skilled personnel accounting for 70.6% of expected deliveries. Postnatal care within 48 hours represented the most fragile stage of the continuum (70.6%), a pattern consistent with findings from recent sub-national and multi-country analyses (Ramadan et al., 2023; Grewal et al., 2024). Child preventive services demonstrated comparatively higher coverage, including BCG (80.5%), Pentavalent 3 (80.2%), and Measles (83.1%), indicating partial recovery of continuity after birth.

➤ Conclusion

Routine HMIS data reveal important structural discontinuities in MCH service delivery that are not captured by survey-based evidence. District-level continuum-of-care analysis can support risk-based supportive supervision and targeted health system strengthening without additional primary data collection, as recommended in recent HMIS and MNCAH policy guidance (World Health Organization, 2023; Countdown to 2030, 2024).

Keywords: Health Management Information System; Continuum of Care; Maternal and Child Health; Supportive Supervision; Sub-National Analysis.

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I. INTRODUCTION

The continuity of care across pregnancy, childbirth, and early childhood is a core principle of maternal and child health (MCH) systems and a critical determinant of survival and wellbeing. This continuum-of-care framework emphasizes sustained and timely contact with health services, recognizing that breakdowns at any stage can undermine overall system effectiveness (Grewal et al., 2024).

Facility births in Eastern Province have risen, along with skilled birth attendance. However, national, and District evidence continues to show persistent gaps in early antenatal care initiation and postnatal follow-up, particularly during the period immediately after childbirth (Countdown to 2030, 2024; World Health Organization, 2022). Most existing analyses rely on population-based household surveys, such as the Demographic and Health Survey (DHS), which provide valuable insights into utilization patterns and socio-demographic determinants but are not conducted frequently and offer limited support for routine performance monitoring (Ramadan et al., 2023).

Routine Health Management Information Systems (HMIS), implemented through DHIS2, capture continuous service delivery data across all districts and are now more recognized as essential tools for monitoring health system performance, informing planning, and guiding supportive supervision (World Health Organization, 2023; World Health Organization AFRO, 2024). Despite this, HMIS data is rarely analyzed systematically using a continuum-of-care lens at sub-national level, particularly for operational decision-making in maternal and child health programmes (World Health Organization, 2023).

This study addresses this gap by applying a maternal and child health continuum-of-care framework to routine HMIS data from Eastern Province, Zambia. By focusing on district-level performance over a recent three-year period, the study aims to generate operationally relevant evidence to support supportive supervision and targeted health system strengthening, in line with national and global policy priorities (Countdown to 2030, 2024; Ministry of Health Zambia, 2023).

II. METHODS

➤ Study Design

We conducted a descriptive, desk-based secondary analysis of routinely collected HMIS data. The analysis focused on identifying patterns, variability, and continuity breakpoints rather than establishing causal relationships, consistent with WHO guidance on the use of routine health facility data for programme management (World Health Organization, 2023).

➤ Study Setting

This study was conducted in 15 Districts within Eastern Province of Zambia and the province represents a complete administrative and supervisory unit with consistent reporting, planning, and supportive supervision structures under the national health system (Ministry of Health Zambia, 2023).

➤ Data Sources

Aggregated monthly MCH service delivery data was extracted from the national HMIS-DHIS2 platform. The data that was used came from routine reporting process and did not include individual or facility level identifiers, which was consistent with standard HMIS practice in Zambia (Countdown to 2030, 2024; World Health Organization AFRO, 2024).

➤ Indicators and Continuum-of-Care Framework

The MCH continuum of care was operationalized using eight HMIS indicators covering antenatal, intrapartum, postnatal, and child preventive services. The indicator selection was guided by WHO recommendations for routine MNCAH monitoring and analysis (World Health Organization, 2023).

➤ Time Period and Level of Analysis

The analysis covered three years of reported data starting from 2023 to 2025 in order to reflect current system performance and reduce temporal heterogeneity associated with earlier reporting contexts. The primary unit of analysis was the district, aligning with routine planning and supervision processes (Countdown to 2030, 2024).

➤ Data Analysis

District-level averages were calculated across the three-year period. The analysis of the results was conducted descriptively to assess overall coverage, sequential continuity across stages, and heterogeneity between districts. In line with the descriptive objectives of the study, no formal statistical hypothesis testing was conducted (World Health Organization, 2023).

➤ Ethical Considerations

The study utilized aggregated, routinely collected administrative data with no personal or patient-level identifiers and this did not require any formal ethical approval. The use of routine HMIS data was authorized through the day to day administrative processes within the Ministry of Health (World Health Organization AFRO, 2024).

III. RESULTS

Overall performance across Eastern Province demonstrated a clear gradient along the maternal and child health continuum of care. Coverage for a first antenatal care visit at any point during pregnancy was relatively high, averaging 83.4% across districts. However, timely entry into

care remained limited, with first-trimester antenatal attendance averaging 39.2%, indicating delayed initiation of care despite eventual contact with antenatal services (Figure 1). Similar patterns of delayed antenatal engagement have been reported in recent subnational analyses in Zambia and other LMICs (Ramadan et al., 2023; Countdown to 2030, 2024).

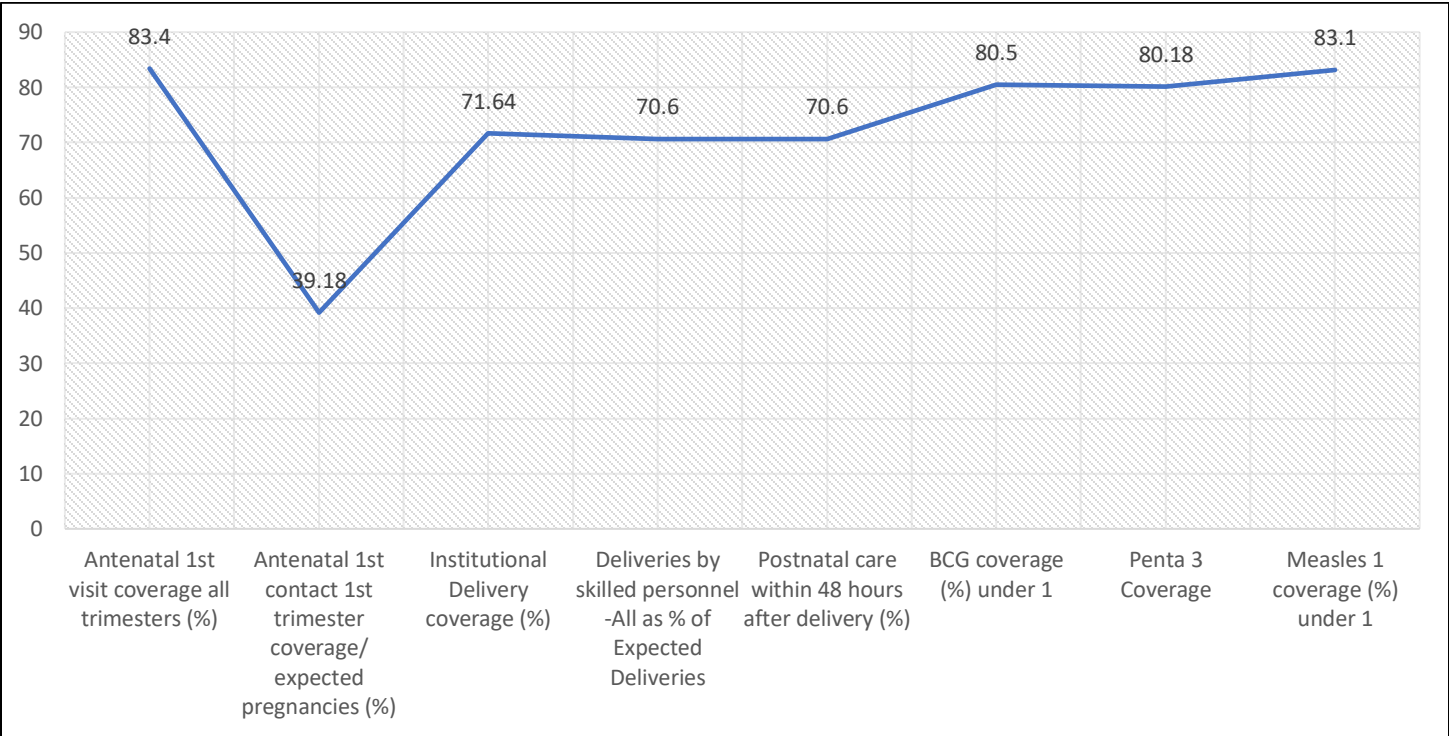


Fig 1: MCH Continuum of Care-Eastern Province (2023-2025)

Coverage improved during childbirth. Institutional delivery averaged 71.6%, while deliveries attended by skilled personnel accounted for 70.6% of expected deliveries, reflecting comparatively stronger performance at the intrapartum stage than during early pregnancy. These findings align with national and regional evidence showing prioritisation and improvement of delivery-related services over time.

Postnatal care within 48 hours of delivery emerged as a critical point of vulnerability in the continuum. Coverage declined slightly relative to delivery services, averaging 70.6%, and exhibited marked variability across districts, confirming the immediate postnatal period as one of the weakest stages of service continuity (Grewal et al., 2024; World Health Organization, 2022).

Child preventive services demonstrated consistently higher coverage than maternal and post-natal stages. BCG coverage averaged 80.5%, Pentavalent 3 coverage averaged 80.2%, and measles first-dose coverage reached 83.1%. In several districts, strong immunization performance was observed despite weaker continuity in antenatal and postnatal care, a pattern noted in other routine HMIS-based continuum analyses (Ramadan et al., 2023; Grewal et al., 2024).

Distinct district-level performance typologies were observed, including districts with relatively strong delivery services but weaker postnatal follow-up, as well as districts characterized by delayed maternal entry into care alongside stable child preventive service coverage (Figure 2). These patterns reflect underlying system differences with clear relevance for supervisory prioritization and targeted health system strengthening (World Health Organization, 2023; Countdown to 2030, 2024).

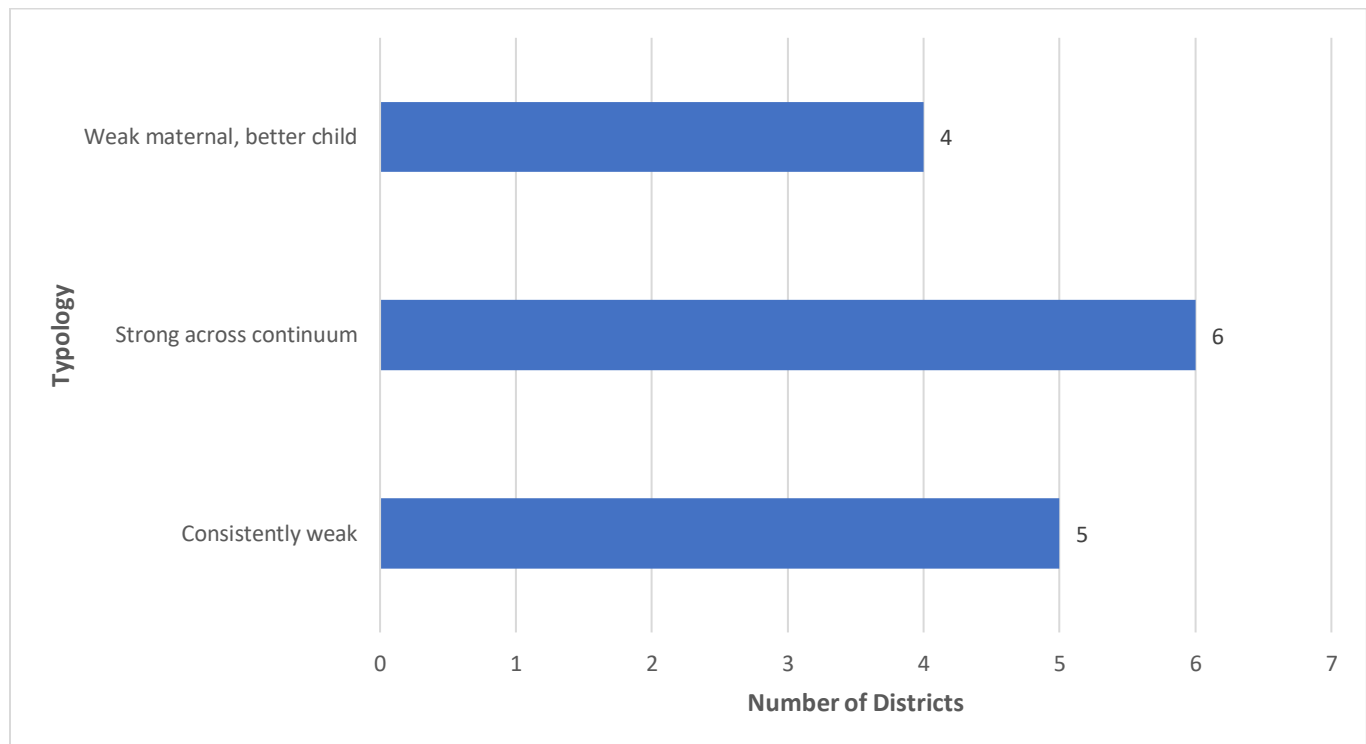


Fig 2: District Typologies - MCH Continuum Performance

IV. DISCUSSION

This study demonstrates the value of routine HMIS data in identifying structural discontinuities along the maternal and child health continuum of care at sub-national level. While facility-based delivery coverage has improved in many districts, low antenatal entry, and fragile postnatal follow-up persist, underscoring the need for a more balanced systems approach across all stages of care (Ramadan *et al.*, 2023; Grewal *et al.*, 2024).

➤ Implications for Policy

The findings from this analysis suggest that policy emphasis on delivery care may succeed in improving intrapartum contact while leaving out other key stages that are before and after the intrapartum contact. What is needed is to strengthen policies that promote early pregnancy identification, first-trimester ANC attendance, and structured post-delivery follow-up is critical, particularly given evidence that a substantial proportion of maternal and neonatal risks occur during the immediate postnatal period (Grewal *et al.*, 2024; World Health Organization, 2022; Wellbeing Foundation Africa, 2026).

➤ Implications for Supportive Supervision

District-level heterogeneity highlights the limitations of uniform supervision approaches and Indicators such as postnatal care within 48 hours function as effective supervisory tracer indicators, enabling early identification of service discontinuities and system weaknesses. Adopting

continuum-of-care analysis into routine performance reviews and supportive supervision processes aligns with current HMIS and health system strengthening guidance (World Health Organization, 2023; World Health Organization AFRO, 2024).

➤ HMIS and Survey Evidence

Unlike DHS-based analyses that focus on individual utilization and determinants, HMIS-based continuum analysis provides a system performance perspective that supports timelier, action-oriented decision-making. The apparent recovery of continuity at child immunization stages may mask upstream maternal gaps, reinforcing the need for integrated analysis across the entire continuum (Ramadan *et al.*, 2023; Grewal *et al.*, 2024).

V. CONCLUSION

When analyzed Routine a continuum-of-care framework, routine data acts as a powerful tool and provide valuable insights into maternal and child health system performance that complement survey-based evidence. Data to action can be strengthened through Institutionalizing such analyses within routine planning and supportive supervision processes, enabling early detection of system weaknesses, and support targeted health system strengthening in resource-constrained settings (World Health Organization, 2023; Countdown to 2030, 2024).

VI. LIMITATIONS AND STRENGTHS

This study leveraged complete district-level routine data over multiple years, avoiding sampling bias and ensuring operational relevance. HMIS data quality is dependent on routine reporting practices, and the analysis did not explore causal determinants or validate indicators against external data sources. These findings should be interpreted as signals for system learning and prioritization rather than causal inference (*World Health Organization, 2023*).

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APPENDIX

Table 1: District-Level Averages for MCH Continuum-of-Care Indicators, Eastern Province, Zambia (2023–2025)

District	Antenatal 1st ANC Contacts (%)	Antenatal 1st contact 1st trimester coverage/ expected pregnancies (%)	Deliveries by skilled personnel -All as % of Expected Deliveries	Institutional Delivery coverage (%)	Postnatal care within 48 hours after delivery (%)	BCG coverage (%) under 1	Penta 3 Coverage	Measles 1 coverage (%) under 1	Typology
Chadiza	22.8	34.9	73.5	73.9	72.8	79.2	81.8	81.1	Weak maternal, better child
Chama	23.2	40.2	64.1	66.8	66.8	76.4	95.2	99.3	Weak maternal, better child
Chasefu	26.3	38.8	65.6	67.1	65.2	79.1	77.5	84.5	Consistently weak
Chipangali	24.2	50.5	81	82	82.4	93.2	103.2	95.9	Strong across continuum
Chipata	23.7	31.2	82.7	82.9	79	103.4	70.6	80.3	Strong across continuum

Kasenen gwa	25	29.3	30.4	31.6	31.2	53.7	64.6	64.8	Consistentl y weak
Katete	20.8	41.5	92.5	93.8	91.4	83.4	83.1	83.6	Strong across continuum
Lumezi	26.5	44.6	65.2	66.2	64.3	77.9	68.6	76.2	Consistentl y weak
Lundazi	26.5	28.8	82.3	84.4	83.3	78.5	69.7	79.8	Strong across continuum
Lusanga zi	23.5	49	47.1	48.5	48.6	79.4	94.1	87.7	Weak maternal, better child
Mambw e	21.8	37.3	60.9	61.5	61.2	65.6	77	74.5	Consistentl y weak
Nyimba	23.9	45.9	75.2	75.8	77.4	90.8	87.5	93.1	Strong across continuum
Petauke	26.1	39.9	79.4	81	81	78.6	82.9	86.8	Strong across continuum
Sinda	21.9	37.6	59.1	59.4	58.8	64.7	72.2	72.4	Consistentl y weak
Vubwi	24.3	59.6	69.4	69.3	69	87.4	112.4	111.6	Weak maternal, better child