International Journal of Healthcare Sciences ISSN 2348-5728 (Online)
Vol. 14, Issue 1, pp: (412-420), Month: April 2026 - September 2026, Available at: www.researchpublish.com

Timely Uptake of Maternal and Neonatal Healthcare Services among Reproductive-Age Women in Rural Rwanda

Claude FUNGAROHO[*1], (MPH), Fissehe Berehe[1], (PhD)

[1]School of Health Sciences, Public Health Department, Mount Kigali University, Kigali, Rwanda

[*1]Corresponding author: FUNGAROHO Claude, Department of Public Health, Mount Kigali University, Kigali, Rwanda.

DOI: https://doi.org/10.5281/zenodo.21099406

Published Date: 30-June-2026

Abstract: **Background: Timely maternal and neonatal healthcare, including early antenatal care (ANC), skilled birth attendance, and postnatal care (PNC), reduces preventable pregnancy and postpartum complications. Although Rwanda has made national progress, delays in accessing these services persist in rural communities. This study determined the prevalence of timely maternal and neonatal healthcare uptake and identified sociodemographic and health service factors associated with service use among women of reproductive age in Ruli Sector, Gakenke District.**

Methods: An analytical cross-sectional survey was conducted among 370 women aged 15–49 years selected through stratified random sampling between September and December 2025. Data were analyzed using descriptive statistics, chi-square tests, bivariate logistic regression, and multivariate logistic regression in STATA version 17.

Results: Most participants were aged 25–34 years (38.6%), while 58.7% had primary education or below. All respondents were enrolled in community-based health insurance. Early ANC attendance was reported by 63.2%, skilled birth attendance by 99.7%, and PNC attendance by 96.5%. Timely service uptake was independently associated with secondary education, tertiary education, living within 60 minutes of a health facility, CHW pregnancy follow-up, CHW home visits, and being married.

Conclusion: Timely maternal and neonatal healthcare uptake in Ruli Sector is influenced by educational attainment, geographic access, and CHW engagement. Strengthening community health worker outreach, improving transport access, and expanding women's educational opportunities could further improve timely care-seeking in similar rural settings. Keywords: Antenatal care; postnatal care; skilled birth attendance; timely uptake; community health workers; Rwanda; maternal health.

Keywords: **Antenatal care; postnatal care; skilled birth attendance; timely uptake; community health workers; Rwanda; maternal health.**

I. INTRODUCTION

Maternal and neonatal health remains among the most pressing concerns in global public health, particularly in low- and middle-income countries, where the burden of preventable deaths continues to concentrate. The World Health Organization estimated approximately 287,000 maternal deaths globally in 2020, with nearly 95% occurring in low- and middle-income countries and sub-Saharan Africa accounting for a disproportionate share of that toll [21]. Neonatal mortality, responsible for close to half of all under-five deaths, claims an estimated 2.4 million lives annually, with preterm complications and infection among the leading preventable causes [20].

The timing of engagement with care is as critical as coverage itself. Early initiation of antenatal care during the first trimester, delivery attended by a skilled provider at a recognized health facility, and receipt of postnatal care within 48 hours of delivery together define what it means to access the maternal care continuum in a timely way. When women begin care late, attend fewer visits, or miss postnatal follow-up, opportunities for early detection of complications and for life-saving

clinical management are lost [21]. Evidence from demographic and health surveys across East Africa shows that even countries with high facility delivery rates often struggle to achieve comparable rates of first-trimester ANC or prompt PNC, pointing to an unfinished agenda around timeliness rather than mere service availability [10].

Rwanda occupies a distinctive position in the regional landscape. Its maternal mortality ratio fell from 1,071 per 100,000 live births in 2000 to 248 per 100,000 by 2020, a transformation that reflects decades of intentional investment in community-based health systems [12]. Facility delivery rates now exceed 90%, among the highest in the region. Yet the Rwanda Demographic and Health Survey 2019–20 revealed that only 47–59% of women initiated ANC in the first trimester, and roughly 56% received a maternal postnatal check within 48 hours, indicating persistent gaps in the timeliness dimension of care [10].

Ruli Sector, located in Gakenke District in Rwanda's Northern Province, exemplifies many of the geographic and socioeconomic conditions associated with delayed care-seeking: hilly terrain, dispersed communities, limited all-weather road access, and heavy reliance on subsistence farming. Community Health Workers, locally known as Agents de Santé Maternelle (ASMs), have been integrated into Rwanda's primary healthcare system as a bridging mechanism between households and health facilities. Their activities include early pregnancy identification, maternal health education, home visits, referral facilitation, and PNC follow-up [13].

Despite the well-documented contributions of CHW programs at the national level, context-specific evidence from rural sectors like Ruli remains limited. Most existing studies examine either overall service utilization or CHW performance in isolation, without simultaneously quantifying the prevalence of timely uptake across the care continuum and rigorously identifying the sociodemographic and service-level factors that predict it. This paper addresses that gap by reporting findings from a quantitative cross-sectional survey conducted among 370 reproductive-age women in Ruli Sector.

The main research question guiding this paper is: What is the prevalence of timely uptake of maternal and neonatal healthcare services, and which factors are associated with it, among women aged 15–49 years in Ruli Sector, Gakenke District, Rwanda? The specific objectives were to determine the prevalence of timely ANC initiation, skilled birth attendance, and PNC receipt; to identify sociodemographic factors associated with timely uptake; and to assess selected health service-related predictors including proximity to a health facility and CHW engagement using logistic regression analysis.

II. LITERATURE REVIEW

A. Global and Regional Patterns of Timely Maternal Healthcare Use

Multi-country analyses consistently show that while ANC coverage and facility delivery rates have improved across low- and middle-income countries, timeliness particularly first-trimester ANC initiation and postnatal care within 48 hours lags behind, and these gaps fall disproportionately on rural, less-educated, and economically disadvantaged women [4, 7]. In sub-Saharan Africa, pooled data show improving skilled birth attendance trends that are not always matched by corresponding gains in early ANC or prompt PNC, underscoring the need to assess all three indicators simultaneously rather than using facility delivery as a sole proxy for maternal healthcare engagement.

East African data reinforce this picture. Tanzania's 2022 TDHS-MIS found that 34% of women attended their first ANC visit within the first trimester, while skilled birth attendance stood at 83% and PNC within two days remained at roughly 44% [9]. Uganda's 2022 UDHS showed near-universal ANC contact but only 29% first-trimester initiation and suboptimal early PNC in many subgroups [19]. Kenya's 2022 KDHS reported similarly low first-trimester rates around 29%, with national skilled birth attendance close to 89% [5]. This pattern strong facility delivery alongside weaker timeliness indicators closely mirrors the situation observed in Rwanda.

B. Factors Associated with Timely Uptake

Evidence from across sub-Saharan Africa identifies a consistent set of sociodemographic determinants. Education is among the most reliable predictors: women with secondary and tertiary attainment are substantially more likely to initiate ANC early and to seek postnatal follow-up, likely because education improves health literacy, increases decision-making autonomy, and reduces indirect economic barriers to care [16, 17]. Geographic proximity to health facilities similarly exerts a strong influence; the second delay in the Three Delays Model the delay in physically reaching care is acutely felt when travel requires more than an hour on foot or by informal transport [18, 8].

Marital status is associated with timely uptake in multiple studies, with married women generally demonstrating higher utilization; partner support; financial, logistical, and motivational appears to facilitate earlier engagement with healthcare [4]. Community Health Worker engagement is increasingly recognized as a supply-side enabler that operates across multiple points on the continuum: CHW home visits during pregnancy, follow-up reminders for ANC attendance, and postnatal outreach within 48 hours of delivery each show positive associations with timely care in the East African literature [2, 15].

C. Theoretical Grounding

This paper is informed by two intersecting frameworks. The Three Delays Model [18] provides a structural account of where breakdowns in timeliness occur: at the point of deciding to seek care, at the point of reaching the facility, and at the point of receiving appropriate care once there. The Health Belief Model [14, 1] complements this by explaining how individual perceptions of susceptibility, severity, and the benefits of care shaped by health education and community outreach—mediate the first delay. CHW activities map directly onto both frameworks: home visits and health education reduce decision delay by raising perceived risk and benefit, while referral coordination and transport assistance reduce reach delay.

III. METHODS

A. Study Design and Setting

An analytical cross-sectional survey design was employed. Data were collected in Ruli Sector, Gakenke District, Northern Province, Rwanda, a predominantly rural, hilly area of approximately 56 square kilometres with a total population of around 25,000 residents [10]. The sector is served by Ruli Health Centre, which coordinates maternal and neonatal health services through a network of CHWs (ASMs) operating at the village level. Data collection occurred between September and December 2025.

B. Population and Sampling

The target population consisted of women aged 15–49 years who had used or attempted to use MNCH services, antenatal care, delivery, or postnatal care, during the 12 months preceding data collection. Women who were critically ill at the time of data collection, those with communication impairments preventing effective participation, and those who declined to provide informed consent were excluded.

A stratified random sampling technique was applied, with strata defined by village to account for geographic variability in access to health services. Eligible women were identified using Ruli Health Centre records. A total of 370 women were enrolled, representing a 100% response rate.

C. Data Collection Instrument

A structured questionnaire was developed based on validated items from the Rwanda Demographic and Health Survey and adapted to the local context. The questionnaire captured socio-demographic characteristics (age, marital status, education level, insurance status, travel time to health facility) and maternal healthcare utilization indicators (timing of first ANC visit, mode and location of delivery, receipt of PNC, and CHW engagement during pregnancy and the postpartum period). The instrument was pre-tested on 20 women outside the study area and revised for clarity and local appropriateness prior to formal data collection.

D. Variable Operationalization

The dependent variable, timely uptake of MNCH services, was operationalized as a composite measure: first ANC visit initiated before 13 weeks of gestation (first trimester), delivery in a health facility with a skilled provider, and receipt of postnatal care. Women who met all three criteria were classified as having timely uptake; those who did not meet one or more criteria were classified as having delayed uptake. This composite approach is consistent with the integrated conceptualization of the maternal care continuum advocated by global maternal health frameworks [21].

Key independent variables included education level (primary or below; secondary; tertiary), marital status (married; cohabiting; single or widowed), age group (15–24; 25–34; 35–49), distance to health facility expressed as travel time (under 60 minutes; 60–120 minutes; over 120 minutes), receipt of CHW follow-up during pregnancy (yes/no), and receipt of a CHW home visit during pregnancy (yes/no).

E. Statistical Analysis

Data were entered and cleaned in STATA version 17. Descriptive statistics, frequencies, percentages, means, and standard deviations were computed to characterize participants and summarize service utilization indicators. Chi-square tests were used at the bivariate level to assess unadjusted associations between independent variables and timely uptake, with statistical significance set at $p<0.05$. Bivariate logistic regression was then performed to quantify unadjusted odds ratios for each predictor. Finally, all variables with $p<0.10$ at the bivariate stage were entered into a multivariate logistic regression model to estimate adjusted odds ratios (AOR) and corresponding 95% confidence intervals, controlling for confounding. Model fit was evaluated using the Hosmer-Lemeshow goodness-of-fit test.

F. Ethical Considerations

Ethical clearance was obtained from the relevant institutional review board prior to fieldwork. All participants provided written informed consent before enrollment. Participation was entirely voluntary, and participants were informed that declining or withdrawing would carry no consequences for their healthcare. Questionnaire data were anonymized and stored securely. Data collection was conducted with respect for the dignity, privacy, and cultural context of all respondents.

IV. RESULTS

A. Sociodemographic Characteristics

A total of 370 women of reproductive age participated in the study. The age distribution showed that the largest group was aged 25–34 years (38.6%), followed by those aged 15–24 years (34.9%), with the remaining 26.5% aged 35–49. The mean participant age was 30.0 years. In terms of marital status, nearly half of respondents were married (47.3%), 29.7% were cohabiting, and 23.0% were single or widowed. The education profile reflected generally low attainment: 58.7% had primary education or less, 38.4% had secondary education, and only 3.0% held tertiary qualifications. All 370 participants (100%) were enrolled in community-based health insurance (Mutuelle de Santé). Concerning geographic access, 64.3% of women lived within 60 minutes of a health facility, 33.0% required between 60 and 120 minutes to travel, and 2.7% reported travel times exceeding 120 minutes. Detailed characteristics are presented in Table 1.

TABLE 1: SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS (N = 370)

Sociodemographic Characteristic	n	%
Age group (years)		
15–24	129	34.9
25–34	143	38.6
35–49	98	26.5
Marital status		
Married	175	47.3
Cohabiting	110	29.7
Single/Widowed	85	23.0
Education level		
Primary or less	217	58.7
Secondary	142	38.4
Tertiary	11	3.0
Health insurance (Mutuelle de Santé)	**370**	**100.0**
Distance to health facility		
< 60 minutes	238	64.3
60–120 minutes	122	33.0
> 120 minutes	10	2.7

B. Prevalence of Timely Uptake of MNCH Services

Maternal healthcare utilization was generally high across the three indicators examined. First-trimester ANC initiation was recorded in 63.2% of participants, leaving more than a third of women who delayed their first antenatal contact beyond 12 weeks of gestation. Skilled birth attendance at a health facility was nearly universal, with 99.7% of women reporting a facility-based delivery attended by trained health personnel. Postnatal care coverage also exceeded 96%, with 96.5% of participants reporting having received PNC following delivery. While these figures reflect strong overall engagement with maternal healthcare services, the comparatively lower proportion of women initiating ANC within the recommended window signals persistent room for improvement in early care-seeking.

C. Bivariate Associations with Timely Uptake

Table 2 presents the results of chi-square tests and bivariate logistic regression for key sociodemographic and service-related variables. Age was significantly associated with timely uptake (p=0.041): women aged 25–34 had the highest timely access rate at 71.3%, compared with 60.5% among those aged 15–24 and 55.1% among those aged 35–49. Marital status was similarly significant (p=0.012), with married women showing a timely access rate of 71.4%, compared with 60.0% among cohabiting women and 50.6% among single or widowed women.

Education was among the strongest bivariate predictors (p<0.001). Women with primary education or less achieved timely access in 54.4% of cases, rising to 74.6% among those with secondary education and 90.9% among those with tertiary attainment. Distance to the health facility was equally powerful (p<0.001): 74.8% of women living within 60 minutes accessed services on time, compared with only 41.8% of those residing 60–120 minutes away. CHW engagement also demonstrated significant associations: women who received CHW follow-up during pregnancy had a timely access rate of 74.0% versus 41.9% among those without follow-up (p<0.001), and those who received a CHW home visit showed a rate of 77.6% compared with 60.1% among those who did not (p=0.004).

TABLE 2: BIVARIATE ANALYSIS – FACTORS ASSOCIATED WITH TIMELY UPTAKE OF MNCH SERVICES

Variable	Timely Access n (%)	Delayed Access n (%)	p-value
Age Group (years)			0.041
15–24 (n=129)	78 (60.5%)	51 (39.5%)	
25–34 (n=143)	102 (71.3%)	41 (28.7%)	
35–49 (n=98)	54 (55.1%)	44 (44.9%)	
Marital Status			0.012
Married (n=175)	125 (71.4%)	50 (28.6%)	
Cohabiting (n=110)	66 (60.0%)	44 (40.0%)	
Single/Widowed (n=85)	43 (50.6%)	42 (49.4%)	
Education Level			<0.001
Primary or less (n=217)	118 (54.4%)	99 (45.6%)	
Secondary (n=142)	106 (74.6%)	36 (25.4%)	
Tertiary (n=11)	10 (90.9%)	1 (9.1%)	
Distance to Health Facility			<0.001
< 60 minutes (n=238)	178 (74.8%)	60 (25.2%)	
60–120 minutes (n=122)	51 (41.8%)	71 (58.2%)	
CHW Follow-Up for ANC			<0.001
Yes (n=246)	182 (74.0%)	64 (26.0%)	
No (n=124)	52 (41.9%)	72 (58.1%)	

Variable	Timely Access n (%)	Delayed Access n (%)	p-value
CHW Home Visit			0.004
Yes (n=67)	52 (77.6%)	15 (22.4%)	
No (n=303)	182 (60.1%)	121 (39.9%)	

D. Multivariate Logistic Regression Analysis

After controlling for potential confounders in the multivariate model, six predictors retained independent statistical significance (Table 3). Education demonstrated a graded, dose-response relationship with timely uptake. Women with secondary education were more than twice as likely to access services on time compared to those with primary education or below (AOR=2.31; 95% CI: 1.46–3.67; p<0.001). The association was substantially stronger for women with tertiary qualifications, who showed more than five times the odds of timely uptake (AOR=5.12; 95% CI: 1.08–24.32; p=0.039), though the wider confidence interval reflects the small sample in this stratum.

Geographic proximity to a health facility emerged as another pivotal predictor. Women living within 60 minutes of a facility were nearly three times more likely to achieve timely uptake compared to those requiring 60–120 minutes of travel (AOR=2.87; 95% CI: 1.78–4.63; p<0.001), highlighting how physical distance continues to act as a structural barrier even in a setting with universal health insurance coverage.

CHW engagement exerted particularly strong effects. Women who received CHW follow-up during pregnancy were nearly four times more likely to access services in a timely fashion (AOR=3.94; 95% CI: 2.36–6.57; p<0.001), the largest adjusted effect observed in the model. CHW home visits, though less common overall, were also independently associated with improved timeliness (AOR=1.76; 95% CI: 1.01–3.08; p=0.047).

Marital status remained significant after adjustment: married women were roughly twice as likely as single or widowed women to access care on time (AOR=1.82; 95% CI: 1.09–3.04; p=0.022), consistent with the role of spousal support in facilitating healthcare decisions. Women aged 25–34 were also somewhat more likely to access services in a timely manner than younger women aged 15–24 (AOR=1.54; 95% CI: 1.01–2.36; p=0.044), though the association for women aged 35–49 was not statistically significant after adjustment.

TABLE 3: MULTIVARIATE LOGISTIC REGRESSION – PREDICTORS OF TIMELY MNCH SERVICE UPTAKE

Predictor Variable	AOR	95% CI	p-value
Age 25–34 vs 15–24	1.54	1.01 – 2.36	0.044
Age 35–49 vs 15–24	0.89	0.55 – 1.45	0.642
Married vs Single/Widowed	1.82	1.09 – 3.04	0.022
Cohabiting vs Single/Widowed	1.28	0.74 – 2.21	0.376
Secondary Education vs Primary or Less	2.31*	1.46 – 3.67	<0.001
Tertiary Education vs Primary or Less	5.12*	1.08 – 24.32	0.039
Distance < 60 min vs 60–120 min	2.87*	1.78 – 4.63	<0.001
CHW Follow-Up (Yes vs No)	3.94*	2.36 – 6.57	<0.001
CHW Home Visit (Yes vs No)	1.76*	1.01 – 3.08	0.047

*AOR = Adjusted Odds Ratio; CI = Confidence Interval. *Statistically significant (p<0.05).*

V. DISCUSSION

A. Prevalence of Timely MNCH Service Uptake

The finding that 63.2% of women in Ruli Sector initiated ANC in the first trimester is encouraging when placed against the national average of 47–59% reported by the Rwanda DHS 2019–20 [10], suggesting that community-level outreach in this sector may be having a measurable effect. Nonetheless, more than a third of women still began ANC after 12 weeks,

meaning that opportunities for early pregnancy risk screening, nutrition counseling, and HIV testing are being missed for a substantial minority. The near-universal skilled birth attendance (99.7%) and high PNC coverage (96.5%) signal that facility engagement, once initiated, tends to be maintained, a pattern likely reflecting Rwanda's robust CHW referral networks and the Mutuelle de Santé insurance scheme, which together reduce out-of-pocket cost barriers at the point of delivery.

These findings align with observations from regional DHS surveys showing that sub-Saharan African countries with strong community health systems and universal health insurance coverage can achieve high facility delivery rates while first-trimester ANC lags behind [4, 7]. The implication is that the remaining gap in timeliness is not primarily one of access to facilities per se, but of early pregnancy recognition and the social and behavioral conditions that prompt women to seek care promptly.

B. Role of Education and Marital Status

The strong graded association between education and timely uptake with tertiary-educated women five times more likely to access services on schedule than those with primary schooling or below is consistent with findings from across the East African region [16, 17]. Education equips women with health literacy, strengthens their decision-making autonomy, and reduces the informational barriers that contribute to the first delay in care-seeking. In a community where nearly 59% of women hold primary education or below, this finding has direct relevance for long-term strategy: investments in girls' secondary schooling are likely to yield returns across maternal and neonatal health indicators over coming generations.

The association of marital status with timely uptake reflects the practical reality that household decision-making around health often involves partners. Married women, benefiting from spousal support both financially and logistically, are better positioned to act on antenatal appointment reminders or CHW referral advice. Single and widowed women face a structurally more challenging environment in which to pursue timely care, pointing toward the need for community interventions that specifically target women navigating pregnancy without partner support.

C. Geographic Proximity as a Structural Barrier

The finding that living beyond 60 minutes from a facility reduces the odds of timely uptake by roughly two-thirds (AOR=2.87) is a stark reminder that physical infrastructure remains a powerful determinant of health behavior in Rwanda's more remote sectors. Even when women possess community health insurance and have received health education from CHWs, distance functions as a concrete obstacle that community-level outreach alone cannot overcome. This is consistent with the second delay in the Three Delays Model and with evidence from other hilly rural districts of Rwanda and comparable East African settings [18, 8]. Strategies that reduce effective travel time, health posts in more remote villages, transport voucher schemes, or coordination of emergency transport through CHW networks remain germane to the rural Rwandan context.

D. CHW Engagement as a Modifiable Predictor

The two CHW-related predictors follow-up during pregnancy (AOR=3.94) and home visits (AOR=1.76), together represent the most potent modifiable levers identified in this study. CHW follow-up was the single strongest predictor in the entire adjusted model, surpassing even education and distance. This is an important finding: while education and infrastructure require years or decades of investment to shift materially, CHW engagement is a program-level variable that can be strengthened through operational decisions around training, supervision, catchment size, and logistical support.

The disparity between the reach of follow-up (66.5% of women received it) and home visits (18.1%) suggests that home visits though highly effective when delivered are not consistently reaching the broader population. This likely reflects structural constraints reported by CHWs themselves in this study: 80% cited high workload, 70% noted lack of transport support, and 56.7% flagged poor mobile network connectivity as barriers. Taken together, these findings indicate that the CHW cadre in Ruli Sector is motivated and effective when it can operate, but is constrained by systemic resource limitations. Addressing those constraints through manageable caseload reductions, transport facilitation, and improved mobile network infrastructure could translate the demonstrated effectiveness of CHW engagement into wider population-level coverage.

E. Limitations

This study has several important limitations. The cross-sectional design precludes causal inference; associations identified in the regression models reflect statistical relationships that may be influenced by unmeasured confounders. Self-reported data on ANC timing may be affected by recall bias, particularly for women reporting on pregnancies several months in the

past. The composite measure of timely uptake, while conceptually defensible, may partly reflect the near-universal skilled birth attendance inflating the denominator. The geographic restriction to Ruli Sector limits generalizability, though this focus was intentional, and the findings are most directly applicable to comparable rural Rwandan settings.

VI. CONCLUSION

This study contributes community-level evidence to Rwanda's maternal health literature by quantifying the prevalence of timely MNCH service uptake and identifying its determinants in a rural sector where large-scale surveys offer limited granularity. First-trimester ANC was achieved by roughly two-thirds of women, a rate above the national average but with room to grow. Skilled birth attendance and PNC coverage were near-universal, reflecting the strength of Rwanda's community health architecture.

The multivariate findings point toward a dual strategy for improving timeliness. On the structural side, reducing travel time to facilities, whether by expanding outreach posts, establishing emergency transport networks, or prioritizing road maintenance, could yield meaningful gains among the third of women who currently live beyond a 60-minute journey. On the community engagement side, sustained CHW follow-up during pregnancy represents the single strongest modifiable predictor of timely access identified in this analysis. Translating this finding into practice means addressing the operational constraints, workload, transport, refresher training, and mobile network reliability that prevent CHWs from reaching every pregnant woman with the regularity that evidence suggests is effective.

Longer-term, prioritizing girls' secondary education remains a foundational investment: the near-linear gradient from primary through tertiary education in timely service uptake reflects the compounding benefits that literacy, health knowledge, and decision-making confidence bring across reproductive health outcomes. Together, these recommendations form a coherent agenda for accelerating Rwanda's progress toward the SDG 3 targets on maternal and neonatal mortality.

REFERENCES

[1] Becker, M. H. (1974). The health belief model and personal health behavior. Health Education Monographs, 2(4), 324–508.

[2] Gebremeskel, F., et al. (2022). Community health workers and maternal and newborn health outcomes in sub-Saharan Africa: A systematic review. BMC Health Services Research, 22(1), 1–18.

[3] Hategeka, C., et al. (2019). Effects of health system strengthening interventions on health worker performance in low- and middle-income countries: A systematic review. Health Policy and Planning, 34(6), 437–452.

[4] Kachimanga, C., et al. (2024). mHealth interventions and maternal healthcare utilization: A systematic review of evidence from sub-Saharan Africa. Global Health Action, 17(1), 2365209.

[5] KNBS & ICF. (2023). Kenya Demographic and Health Survey 2022. Nairobi and Rockville, MD: KNBS and ICF.

[6] Kok, M. C., et al. (2015). Which interventions improve community health worker performance? A systematic review and meta-analysis. Health Policy and Planning, 30(9), 1128–1145.

[7] Mekonen, A. M., et al. (2025). Trends and determinants of timely maternal healthcare utilization in sub-Saharan Africa: A pooled analysis. Maternal and Child Health Journal. Advance online publication.

[8] Meghea, C. I., et al. (2023). Community health worker interventions and maternal-newborn outcomes: A quasi-experimental study in sub-Saharan Africa. Social Science & Medicine, 320, 115735.

[9] NBS & ICF. (2023). Tanzania Demographic and Health Survey and Malaria Indicator Survey 2022. Dodoma and Rockville, MD.

[10] NISR/DHS. (2020). Rwanda Demographic and Health Survey 2019–20. Kigali: National Institute of Statistics of Rwanda.

[11] Nishimwe, A., et al. (2022). RapidSMS and maternal health in Rwanda: An evaluation of real-time pregnancy tracking outcomes. Journal of Medical Internet Research, 24(3), e31945.

[12] Rwanda Ministry of Health. (2021). Health Sector Strategic Plan IV, 2018–2024: Progress Report. Kigali: Ministry of Health.

[13] Rwanda Biomedical Centre. (2023). Community Health Worker Programme Annual Report 2023. Kigali: RBC.

[14] Rosenstock, I. M. (1966). Why people use health services. Milbank Memorial Fund Quarterly, 44(3), 94–127.

[15] Sangwa, N. R., et al. (2024). eLearning for community health workers in Rwanda: A cohort evaluation of knowledge outcomes and referral quality. PLOS ONE, 19(2), e0298471.

[16] Sserwanja, Q., et al. (2022). Factors associated with first-trimester antenatal care attendance among Rwandan women: Analysis of the 2019–20 RDHS. International Journal of Environmental Research and Public Health, 19(14), 8543.

[17] Tengera, O., et al. (2023). Sociodemographic determinants of antenatal care quality in Rwanda: Secondary analysis of demographic and health survey data. BMC Pregnancy and Childbirth, 23(1), 145.

[18] Thaddeus, S., & Maine, D. (1994). Too far to walk: Maternal mortality in context. Social Science & Medicine, 38(8), 1091–1110.

[19] UBOS. (2023). Uganda Demographic and Health Survey 2022. Kampala and Rockville, MD: UBOS and ICF.

[20] UNICEF. (2023). Neonatal mortality. https://data.unicef.org/topic/child-survival/neonatal-mortality/

[21] WHO. (2022). Trends in maternal mortality 2000 to 2020: Estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Geneva: World Health Organization.