

Uptake of Group Antenatal and Postnatal Care Model and its effect on utilization of Maternal and Child Health Services among Pregnant and Breastfeeding Adolescent Girls and Young Women in Uganda. A retrospective descriptive study, 2021-2023

Simon Muhumuza

smuhumuza@musph.ac.ug

Makerere University

Linda Kisaakye Nabitaka

Ministry of Health

Emily Namara Lugolobi

Centers for Disease Control and Prevention

Julius Ssendiwala

Makerere University

Doreen Ondo

Ministry of Health

Ibrahim M. Lutalo

Makerere University

Perez Ochanda

Makerere University

Mark Tumwine

Centers for Disease Control and Prevention

Gertrude Namazzi

Centers for Disease Control and Prevention

Juliet Businge

Centers for Disease Control and Prevention

Rose Nakityo-Bosa

Centers for Disease Control and Prevention

Julius Ssempiira

Centers for Disease Control and Prevention

Sam Sendagala

Centers for Disease Control and Prevention

Charles Kavuma

Centers for Disease Control and Prevention

Kenneth Mwambi

Centers for Disease Control and Prevention

Evelyn Akello

Makerere University

Alice Namale

Makerere University

Steven Baveewo

Centers for Disease Control and Prevention

Dinah Amongin

Makerere University

Phoebe Monalisa Namukanja

Centers for Disease Control and Prevention

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Abstract

Background

Pregnant and breastfeeding adolescent girls and young women (PBF AGYW) face an increased risk of adverse maternal and newborn outcomes. To address these challenges, the Uganda Ministry of Health piloted the group-antenatal/postnatal care differentiated service delivery (G-ANC/PNC DSD) model at 33 health facilities and later expanded it to 685 facilities nationally. We assessed the uptake of the model, its cost and effect on utilization of maternal and child health (MCH) services among PBF AGYW.

Methods

We performed a retrospective review and analysis of data abstracted from records of PBF AGYW enrolling in ANC between July 1, 2021, through December 31, 2023. A total of 144 health facilities were selected: 72 implementing the G-ANC/PNC DSD model (intervention) and 72 providing standard ANC/PNC care (control). Uptake of the model was measured as the percentage of all AGYW attending the first ANC visit in the 72 intervention facilities. To assess the effectiveness of the model, 7,514 AGYWs were included in the analysis (intervention 3,861 and control 3,653). A modified Poisson regression model within a Generalized Estimating Equation framework was used. Measures were summarized using adjusted prevalence ratios (aPR) with 95% confidence intervals (CI). A retrospective cost analysis was performed using quantitative resource utilization data and qualitative insights at 25 intervention facilities.

Results

The overall uptake of the model was 34%. Attendance of 4 + ANC visits was higher in the intervention group (60.3%) (aPR = 1.93, 95% CI: 1.83–2.03). AGYW who enrolled in the model were more likely to retest for HIV during pregnancy (aPR = 2.30, 95% CI: 2.07–2.55); deliver at the health facility of ANC1 attendance (aPR = 2.47, 95% CI 2.30–2.65); attend PNC at 6 weeks (aPR = 4.61; 95% CI: 4.07–5.22); attend PNC at 6 months (aPR = 3.13; 95% CI: 2.65–3.69); and use modern post-partum contraceptive methods (aPR = 3.81; 95% CI: 3.26–4.44). The unit cost per G-ANC/PNC DSD model beneficiary was estimated at US \$2.70.

Conclusion

Although the uptake was low, our results show that the model was associated with improved utilization of MCH services among AGYW. National programs may consider integrating G-ANC/PNC into MCH health education sessions to improve uptake during scale up.

Introduction

Adolescent pregnancies (10–19 years) remain a critical public health burden in sub-Saharan Africa with the region being home to 50% of the global burden [1, 2]. With a teenage pregnancy rate (15–19 years) of 24% (2022), Uganda ranks among the highest burdened countries in sub-Saharan Africa [3]. Adolescent pregnancy and ensuing motherhood are associated with poor maternal and infant outcomes including increased health risks (eclampsia, puerperal endometritis, low birth weight, preterm birth and severe neonatal conditions) that lead to a higher likelihood of morbidity and mortality for infants and their mothers [4–7].

Young women aged 20 to 24 years face unique vulnerabilities that put them at risk of poor maternal and child health outcomes as well. For instance, in Uganda, 33% of women aged 20–24 are married before the age of 18 and 5.8% before the age of 15. Among all women aged 20–24 years, 28.4% had a live birth before age 18 years, and among these, 55.6% proceeded to have another (second birth order) live birth before age 20 years [3]. The high incidence of teenage marriages coupled with high parity, lack of education, poor social economic status and sex inequalities predispose adolescent girls and young women (AGYW) to poor maternal and infant outcomes [8, 9]. Furthermore, AGYW remain disproportionately affected by HIV/AIDS with a higher incidence and prevalence of HIV compared to their male counterparts [10, 11]. AGYW could specifically benefit from targeted interventions aimed at reducing maternal mortality and morbidity and preventing vertical transmission of HIV.

To improve access to and utilization of adolescent-youth friendly sexual reproductive health (SRH) and maternal and child health (MCH) services, including vertical transmission of HIV among AGYW and their infants, the Uganda Ministry of Health (MoH) adopted the group antenatal/postnatal differentiated service delivery (G-ANC/PNC DSD) model of care. This model of care has been implemented and evaluated in other countries such as Malawi and Senegal [1, 12]. In the G-ANC/PNC DSD model, health workers facilitate groups and provide continuity of care to about 6–12 pregnant and breastfeeding (PBF) AGYW with similar estimated due dates or infant age [13]. Group sessions replace traditional one-to-one appointments and last about two hours. Conventional methods of antenatal assessment such as clinical checks are combined with information sharing and peer support through group discussion led by participants [14]. This model aligns with the World Health Organization (WHO)'s recommendation to provide person-centered antenatal care (ANC) services to improve maternal experience and uptake of life saving interventions including birth preparedness, complication readiness, and maximizing continuity of care along the maternal and child health (MCH) care cascade [15].

Studies implemented in sub-Saharan Africa have demonstrated that G-ANC is feasible and acceptable to both the health care providers and AGYW [1]. The G-ANC model has been associated with improved patient satisfaction, improved level of knowledge about pregnancy and parenting, improved relationship with healthcare providers [16, 17], health facility deliveries, higher frequency of antenatal visits, improved birth planning and complication readiness, including among pregnant adolescent girls [1, 12, 18, 19]. One study that integrated HIV testing into the G-ANC showed improved partner communication and partner

testing compared to participants in routine care [20]. A previous study estimated the cost of introducing G-ANC at a health facility to be \$357 USD per health facility and a recurrent operational cost per G-ANC session to be \$81 USD [12]. These findings suggest that G-ANC has the potential to improve MCH service utilization and, consequently maternal and infant outcomes, supporting its adoption as an intervention in resource-limited settings [21, 22].

In 2018 the Uganda MoH rolled out the G-ANC/PNC DSD model for AGYW. The goal of the intervention was to improve access and utilization of adolescent and youth-friendly sexual and reproductive health (SRH) and maternal and child health (MCH) services including prevention of mother-to-child HIV transmission (PMTCT). In this model, the PBF AGYW are organized into cohorts of 6–12 women of similar gestational age irrespective of their HIV status and assigned similar clinic appointment dates. At the facility, PBF AGYW engage actively in their health assessments and interactive educational sessions led by a trained peer educator or health worker, receive psychological support through peer-to-peer interactions, and undergo individualized obstetric clinical assessments conducted by a health worker. The group members are supported to attend services and stay in care for 12 months postpartum (if HIV negative) or up to 24 months postpartum (if AGYW living with HIV).

Despite increasing evidence of G-ANC/PNC effectiveness, the impact of implementing the model among AGYW in Uganda is not known. The objective of this evaluation was to assess the uptake of the model and its effect on utilization of MCH services among PBF AGYW in Uganda. The cost of implementing the model was also estimated.

Methodology

Design

This was a retrospective analysis of data abstracted from records of PBF AGYW who enrolled into the G-ANC/PNC DSD model (intervention group) and received standard of care ANC services (control group) between July and December 2021 and monitored for over a 24-month period through December 2023. Longitudinal data for ANC, maternity and postnatal care were analyzed for all AGYW. Uptake of the G-ANC/PNC DSD model was measured as the percentage of AGYW attending the first ANC visit (ANC1) that enrolled into the model. The effectiveness of the model was assessed using the primary outcome of attendance of 4 or more ANC visits, and secondary outcomes of PNC attendance, delivery at facility where they attended the ANC1 visit, maternal HIV retesting, and use of modern methods of post-partum contraception. To assess the cost of G-ANC services, a retrospective cost analysis from the provider perspective was conducted using a mixed-methods approach, combining quantitative resource utilization data with qualitative insights.

Setting

The evaluation was carried out in 144 health facilities (72 in each group) across all fifteen health regions of the country. The intervention group included health facilities that had enrolled at least 20 AGYW into G-ANC/PNC DSD model between July and December 2021. The control group included health facilities that provided standard of care ANC services to at least 20 AGYWs within the same period but had never implemented G-ANC/PNC DSD model as of December 2023.

Sample size determination

The Yamane's (1967) formula, which helps to determine samples from finite populations with known size, was used to estimate the required number of health facilities. Between April and June 2021, a total of 295 health facilities reported outputs for G-ANC/PNC DSD model implementation and assuming a margin of error of 10.1%, the minimum sample size of 72 facilities in each group was required to detect a minimum improvement of 0.5% in retention in ANC among AGYW in the intervention group relative to the control group. Uptake of the model was measured among all AGYW (34,179) that attended ANC 1 in the 72 intervention facilities. To assess the effectiveness of the model, 7,514 AGYWs were included in the analysis (intervention 3,861 and control 3,653). Cost analysis was performed in 25 intervention facilities.

Sampling strategy

The sampling frame included all health facilities implementing the G-ANC/PNC DSD model by July 2021 (intervention group) and those providing standard of care ANC/PNC services only by end of December 2023 (control group). The health facilities were stratified by region, ownership (public or private not-for-profit), and level of care. In each selected health facility, all records for AGYW that attended ANC1 between July and December 2021 and utilized subsequent MCH services were abstracted, along with the corresponding records for their infants. A stratified random sampling approach was employed, using facility level, ownership, and location (rural or urban) as strata to select facilities for the cost analysis. To enable a comprehensive assessment of resource use, the G-ANC/PNC DSD model implementing partners were also included in the evaluation.

Study population

In both the intervention and control groups, AGYW who attended a ANC1 and had at least one subsequent visit were included in the study.

Data collection and management

Trained data collectors abstracted data on socio-demographic characteristics, enrollment into the G-ANC/PNC DSD model, ANC and PNC attendance, facility-based deliveries, and uptake of modern postpartum family planning methods. Data for both groups (intervention and control) were abstracted from health facility records between 15 July and 16 August 2024 using two structured abstraction tools

developed in Microsoft Excel. In the intervention group, a total of 11,750 unique records of AGYW were abstracted from a longitudinal group MCH register, which enabled direct tracking of individual clients across the continuum of care. In the control group, 200,280 records of AGYW were abstracted from multiple cross-sectional service registers, including ANC (76,494), maternity (24,659), PNC (64,048), and child health registers (35,079). To enable longitudinal analysis in the control group, probabilistic record linkage was performed using the Microsoft Excel Fuzzy Lookup function. Records were matched based on composite identifiers and matches with a similarity score of $\geq 85\%$ were retained, resulting in 18,939 linked records (Fig. 1). While this approach facilitated reconstruction of individual care trajectories, the possibility of misclassification due to imperfect matching was acknowledged.

To estimate the financial costs of the G-ANC/PNC DSD model from the provider perspective, the total annual costs were calculated by aggregating expenditures across G-ANC/PNC core activities as well as key cost centers such as personnel, travel, equipment, and space based on retrospective data from one year of G-ANC/PNC implementation in each of the 25 health facilities. For supplies, financial records from implementing partners were reviewed. In cases where records were unavailable, standardized prices from the 2022 Public Procurement and Disposal of Public Assets Authority (PPDA) Uganda price list were applied.

Data analysis

Participants' characteristics were summarized using frequencies and percentages for categorical variables and summary statistics for continuous variables. Uptake was measured as a percentage of AGYW who received ANC services that enrolled into the G-ANC/PNC DSD model (intervention group). MCH service utilization between the intervention and control groups were compared using chi-square tests. The effectiveness of the G-ANC/PNC DSD model was determined using a modified Poisson regression model fitted in a Generalized estimating Equation (GEE) framework to adjust for clustering effect at the health facility level. For each outcome, a univariate model was fitted with only the intervention dummy variable to calculate unadjusted estimates. Adjusted estimates of the intervention were calculated from the multivariable model that was fitted with the intervention dummy and potential confounders (i.e., age group, region, health facility level, health facility ownership). Effect measures were summarized using adjusted prevalence rate (aPR) and 95% confidence intervals (CI).

The total annual costs were calculated for the intervention sites only by aggregating expenditures across key cost centers such as personnel, travel, and equipment based on retrospective data collected over a one-year period of G-ANC implementation in 2023. Costs were stratified by facility level, ownership, and location. Capital items with a lifespan over one year were annualized using a discount rate of 3%, and shared costs such as utilities and furniture were allocated proportionally based on utilization. All figures were expressed in 2023 US dollars, using an exchange rate of US \$1 = UGX 3,726. STATA 17.0 (TX, USA) was used for the analysis.

Results

Uptake of the G-ANC/PNC DSD model

Overall, the uptake of the G-ANC/PNC DSD model was 34% (11,750/34,179) among all eligible AGYW at G-ANC/PNC DSD facilities. Uptake was significantly higher among AGYW aged 13–19 years (40%) compared to those aged 20–24 years (31%) ($p < 0.001$). Higher uptake was also observed among clients attending PNFP health facilities (60%) ($p < 0.001$) and those receiving care at Health Centre (HC) III (41%) ($p < 0.001$) compared to other levels of care (Table 1).

Table 1
Uptake of G-ANC/PNC DSD model by ownership and level of the health facility and age group, Uganda, 2021–2023

Variable	Uptake		P-value
	Enrolled	Not Enrolled	
	N (%)	N (%)	
Overall	11,750 (34)	22,429 (66)	
Age in years			
13–19	5,118 (40)	7,744 (60)	< 0.001
20–24	6,632 (31)	14,685 (69)	
Health Facility level			
Hospital	2,439 (37)	4,118 (63)	< 0.001
Health Centre IV	3,126 (25)	9,581 (75)	
Health Centre III	6,185 (41)	8,730 (59)	
Health Facility ownership			
Government	11,140 (34)	22,024 (66)	< 0.001
Private Not For Profit	610 (60)	405 (40)	

Effectiveness of the G-ANC/PNC DSD model

To measure the effectiveness of the model, a total of 7,514 AGYW (intervention 3,861 and control 3,653) were included in the study. The intervention group was significantly younger and differed from the control group in terms of regional distribution, facility ownership, and level of care ($p < 0.001$). Bivariate analysis showed that the intervention group had significantly higher utilization rates across all maternal health indicators (≥ 4 ANC visits, maternal HIV retesting, facility-based deliveries, PNC attendance at 6-week and 6-month intervals, and uptake of modern postpartum contraception) compared to the control group ($p < 0.001$) (Table 2).

Table 2
Characteristics of AGYW in the intervention and control group, Uganda, 2021–2023

Characteristics	Group		p-value
	Intervention group [N = 3,861 (%)]	Control group [N = 3,653 (%)]	
Age group (years)			
13–18	1,214 (31.4%)	733 (20.1%)	< 0.001
19–20	1,200 (31.1%)	991 (27.1%)	
21–22	806 (20.9%)	800 (21.9%)	
23–24	641 (16.6%)	1,129 (30.9%)	
Mean age			
Mean (SD)	19.89 (SD = 2.270)	20.80 (SD = 2.368)	0.038
Region			
Central	825 (21.4%)	908 (24.9%)	< 0.001
East	1,099 (28.5%)	553 (15.1%)	
North	878 (22.7%)	201 (5.5%)	
West	1,059 (27.4%)	1,991 (54.5%)	
Health facility Ownership			
Public (Government)	3,710 (96.1%)	3,172 (86.8%)	< 0.001
Private Not for Profit (PNFP)	151 (3.9%)	481 (13.2%)	
Health facility level			
Hospital	602 (15.6%)	115 (3.2%)	< 0.001
Health Centre IV	1,012 (26.2%)	884 (24.2%)	
Health Centre III	2,247 (58.2%)	2,654 (72.7%)	
Gestation age at enrolment (in weeks)			
0–12	591 (15.3%)	1,076 (29.5%)	< 0.001
13–27	2,616 (67.8%)	2,207 (60.4%)	
28+	654 (16.9%)	370 (10.1%)	
Retention in ANC (4 + Visits)	2,328 (60.3%)	1,412 (38.7%)	< 0.001

Characteristics	Group		p-value
	Intervention group [N = 3,861 (%)]	Control group [N = 3,653 (%)]	
Age group (years)			
Maternal HIV retesting during pregnancy	1,847 (51.5%)	364 (15.0%)	< 0.001
Delivered at facility of ANC1 attendance	2,218 (57.5%)	869 (23.8%)	< 0.001
Attended 6-week PNC visit at facility	1,314 (34.0%)	290 (7.9%)	< 0.001
Attended 6 months PNC visit at facility	977 (25.3%)	149 (4.1%)	< 0.001
Received modern post-partum contraceptive method	1,090 (63.7%)	185 (15.3%)	< 0.001

Effect of the G-ANC/PNC model

Overall, the G-ANC/PNC DSD model was significantly associated with improved maternal health service utilization. After adjusting for potential confounders such as age, region, facility ownership and facility level, AGYW in the intervention group were more likely to complete at least four ANC visits compared to those in the control group (adjusted prevalence ratio [aPR] = 1.93; 95% CI: 1.83–2.03; $p < 0.001$). Similarly, the AGYW in the intervention group were more likely to undergo HIV retesting during pregnancy (aPR = 2.30; 95% CI: 2.07–2.55; $p < 0.001$); deliver from the same facility where they initiated ANC (aPR = 2.47; 95% CI: 2.30–2.65; $p < 0.001$); attend PNC at 6 weeks (aPR = 4.61; 95% CI: 4.07–5.22; $p < 0.001$) and at 6 months (aPR = 3.13; 95% CI: 2.65–3.69; $p < 0.001$). Uptake of modern postpartum contraceptive methods was significantly higher among AGYW in the intervention group (aPR = 3.81; 95% CI: 3.26–4.44; $p < 0.001$) (Table 3).

Table 3
Unadjusted and adjusted effects of G-ANC/PNC DSD model on maternal health outcomes, Uganda, 2021–2023

Outcome	Group	Unadjusted			Adjusted ^a		
		PR	95% CI.	p-value	PR	95% CI	p-value
≥ 4ANC visits	Intervention	1.56	1.48–1.63	< 0.001	1.93	1.83–2.03	< 0.001
	Control	1					
Maternal HIV Retesting during Pregnancy	Intervention	3.43	3.11–3.79	< 0.001	2.30	2.07–2.55	< 0.001
	Control	1					
Delivered at facility of ANC1 attendance	Intervention	2.42	2.26–2.57	< 0.001	2.47	2.3–2.65	< 0.001
	Control	1					
Attended 6-week PNC visit at facility	Intervention	4.29	3.80–4.83	< 0.001	4.61	4.07–5.22	< 0.001
	Control	1					
Attended 6 months PNC visit at facility	Intervention	6.2	5.25–7.33	< 0.001	3.13	2.65–3.69	< 0.001
	Control	1					
Received modern post-partum contraceptive method	Intervention	4.16	3.62–4.77	< 0.001	3.81	3.26–4.44	< 0.001
	Control	1					

^a = adjusted for age, region, facility ownership and facility level:

Cost of implementing G-ANC in Uganda

The annual unit cost per beneficiary was estimated at US \$2.70, which was determined by dividing the annual total program cost of US \$71,386 by the total number of beneficiaries, 26, 117. Of the estimated annual total cost for G-ANC/PNC services (US \$71,386) personnel costs were the largest component (37.5%) of the annual total program expenditure, as shown in Table 4. Supplies accounted for 18.6%; utilities accounted for 14.8%; equipment represented 12.6%, while travel expenses accounted for 5.2% (Table 4).

Table 4
Annual total cost and mean cost per-facility by key cost centers, Uganda, 2023

Cost component	^a Total annual cost	^b Cost per facility			
		RRH (%)	GH (%)	HC III (%)	HC IV (%)
^c Mean (%)	Mean (%)	Mean (%)	Mean (%)	Mean (%)	Mean (%)
Personnel	\$26,766 (37.5%)	\$827 (33.0%)	\$756 (31.4%)	\$1,052 (34.7%)	\$1,597 (41.2%)
Travel	\$3,738 (5.2%)	\$55 (2.2%)	\$266 (11.0%)	\$265 (8.7%)	\$44 (1.1%)
Supplies	\$13,296 (18.6%)	\$198 (7.9%)	\$295 (12.2%)	\$828 (27.3%)	\$515 (13.3%)
Utilities	\$10,574 (14.8%)	\$706 (28.2%)	\$432 (17.9%)	\$240 (7.9%)	\$591 (15.2%)
Equipment	\$8,982 (12.6%)	\$238 (9.5%)	\$351 (14.6%)	\$322 (10.6%)	\$561 (14.5%)
Space	\$8,030 (11.2%)	\$483 (19.3%)	\$310 (12.9%)	\$325 (10.7%)	\$568 (14.7%)
Total	\$71,386	\$2,507	\$2,410	\$3,032	\$3,876
N		2	8	9	6

a – are total costs of all G-ANC related costs for all facilities included in the cost analysis.

b – represent mean cost per facility at the different facility levels. All costs are arranged by the key cost components. The unit per beneficiary (\$2.7) was determined by dividing the total cost (\$71,386) by the total number of beneficiaries (26,117).

c – are mean expenditure per cost key center for all 25 health facilities that were assessed

HC IVs incurred the highest total annual costs at \$3,876, followed by HC III at \$3,032, Reginal Referral Hospitals (RRHs) at \$2,507, and General Hospitals (GHs) at \$2,410. Annual average costs per facility level were estimated by G-ANC core activities. Group activities accounted for the highest total cost at \$3,119, followed by peer-led approaches (\$1,595), and self-care activities (\$1,456). Compared at facility level, HC IIIs accounted for 30% of mentorship activity costs, followed by general hospitals at 20.6%. Group activities at HC IVs represented 33.4% (\$1,043) and lowest at RRH at 19.6% (\$611). Annual cost estimates by facility ownership showed that PNFP facilities accounted for the higher proportion of resources utilized across all the core G-ANC/PNC activities (Table 5).

Table 5

Mean cost per G-ANC core activities by facility level, location and ownership, Uganda, 2021–2023

Category	Mean costs per GANC activity							
	Mentorship		Group activity		Peer-led approach		Self-care activity	
Facility level	Mean	%	Mean	%	Mean	%	Mean	%
RRH	\$240	26.0	\$611	19.6	\$566	35.5	\$264	18.1
GH	\$190	20.6	\$718	23.0	\$304	19.1	\$297	20.4
HC IV	\$215	23.3	\$1,043	33.4	\$255	16.0	\$470	32.3
HC III	\$278	30.1	\$747	23.9	\$470	29.5	\$425	29.2
Total	\$923		\$3,119		\$1,595		\$1,456	
Facility location								
Rural	\$260	55.4	\$856	53.2	\$385	51.5	\$449	57.7
Urban	\$209	44.6	\$753	46.8	\$363	48.5	\$329	42.3
Total	\$469		\$1,609		\$748		\$778	
Facility ownership								
Government	\$210	39.9	\$756	43.9	\$336	39.3	\$365	44.7
PNFP	\$316	60.1	\$968	56.1	\$520	60.7	\$451	55.3
Total	\$526		\$1,724		\$856		\$816	

Discussion

Our study is among the first in sub-Saharan Africa to evaluate the effect of G-ANC/PNC among AGYW receiving MCH services in a real-world setting. Although uptake was low, the findings showed that the model improved utilization of MCH and PNC services.

The evaluation showed that overall uptake of the model was low across all age groups including among teenage mothers. The model was designed to target all adolescent girls aged less than 20 years and vulnerable young mothers aged 20–24 years [23]. However, enrolment into the model is voluntary and this could explain the low uptake. Other reasons for low enrolment in the model include long waiting times, lack of privacy, inadequate resources, and transportation difficulties, and socio-cultural factors including cultural beliefs, low male involvement, low perceived value of G-ANC/PNC DSD model, and issues with decision-making and motivation [24]. Uptake varied by age group, level of care and ownership of health facility. This finding could not be compared to outcomes from other studies in a similar setting in sub-Saharan Africa given that all were either randomized controlled trials with stringent eligibility criteria [1, 12, 20, 22], pilot projects [17] or qualitative studies [16] that did not evaluate

uptake in a real-world setting. Given the positive outcomes realized among those who utilized the GANC/PNC model, there is need for innovative interventions to improve enrollment in the model.

The evaluation showed that AGYW enrolled in G-ANC/PNC DSD model were more likely to be re-tested for HIV later in pregnancy, deliver at the facility of ANC1 attendance, attend PNC at six weeks and six months and receive modern post-partum contraceptive methods. These findings are consistent with those reported in similar settings in Kenya, Nigeria and Senegal [12, 25, 26] and could be attributed to the stronger social support, enhanced health education, improved birth preparedness and complication readiness associated with the model [1, 12, 25]. PNC is particularly important for prevention, early detection and cure of health complications (if any), counselling on breastfeeding, immunization, maternal nutrition and birth spacing, among others. On the contrary, our study found no difference in ANC attendance among AGYW in both the intervention and control groups. This finding is inconsistent with what has been reported through randomized control trials [23]. Our design was based on retrospective cohort review which did not control for external factors. It is likely that system-level determinants for ANC attendance such as distance to health facility, health worker availability, and cultural norms are similar.

Cost analysis of G-ANC services showed the estimated additional cost of providing G-ANC services was \$2.7 per woman which ranges between \$16.2 to \$32.4 per G-ANC/PNC group. This is lower than the \$81 per group reported in Senegal [12] and \$54.6 reported in the Netherlands [27]. In our study, findings underscore the significant role of personnel costs in G-ANC service expenses across facility levels. HC IV facilities had the highest costs, mainly due to staffing, while HC III facilities, with lower costs, still prioritized personnel. Similar patterns at hospitals, including costs for utilities and space, suggest that infrastructure also contributes significantly. Group activities accounted for the largest costs, especially HC IVs and HC IIIs, emphasizing community engagement. Private Not for Profit facilities invested more in peer-led and self-care activities, while government facilities focused on mentorship. These differences provided insights for optimizing resource allocation and improving cost-efficiency across facility types.

Study limitations

Firstly, the evaluation heavily relied on retrospective review of routine paper-based medical records. The information obtained was limited by the data already collected, which may suffer from completeness and accuracy issues common to routinely collected data. Some outcomes of interest such as infant immunization, follow-up of HIV-exposed infants and HIV viral load monitoring for mothers could not be obtained. Secondly, a modified Poisson regression model was used in this evaluation to adjust for baseline variables such as age, facility type, and region. However, we were unable to account for unobserved factors such as socioeconomic status, educational background, or individual health-seeking behavior that could influence both program enrollment and service utilization. Consequently, while the associations are robust, they should not be interpreted as causal. Thirdly, the evaluation could not fully ascertain retention in MCH care for the AGYW because we could not track referrals and transfers across health facilities in the absence of a unique identification system. It is possible that retention in ANC or

PNC care could have been underestimated. Additionally, potential contamination between the study groups cannot be excluded, as AGYW and health workers may have moved between intervention and control sites, and information or practices could have been shared through community interactions.

Conclusion

Although the uptake of G-ANC/PNC DSD model enrollment was low, our results show that the model is associated with improved continuity of ANC maternal HIV re-testing during pregnancy, facility delivery, PNC and uptake of modern postpartum contraception among AGYW. To improve uptake of the model, the Ministry of Health may consider integrating the model in MCH education sessions, involving peers in MCH service delivery, sensitizing male partners about G-ANC/PNC and supporting logistics and infrastructure developments to enhance communication and create more space for adolescent friendly services.

Declarations

Ethics approval and consent to participate

Ethical clearance for the evaluation was obtained from the Makerere University School of Public Health Higher Degrees Research and Ethics Committee (Ref No SPH-2024-565) and the Uganda National Council for Science and Technology (Ref No SS2873ES). In addition, the evaluation was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy. 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. Permission to conduct the evaluation was obtained from the respective health managers at district and health facility level. Prior to the evaluation, the purpose and procedures of the evaluation were explained to the facility health teams. The evaluation was conducted in accordance with the Declaration of Helsinki. The consent to participate was waived by Makerere University School of Public Health Higher Degrees Research and Ethics Committee (Ref No SPH-2024-565) since the evaluation involved a retrospective review and abstraction of data from existing health facility records and did not collect any personally identifiable information. The data collectors signed confidentiality agreements to protect the participants and ensure legal follow-up should there be a breach of code of conduct and policy.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

SM, LKN, ENL, JS, DO, IML, PO, MT, DA and PMN conceptualized the study.

SM, PO, JS, ENL, IML and DA designed the study methods.

SM, LKN, JS, DO, IML, DA, PO, EA and AN participated in data collection and performed the analysis.

SM, LKN, ENL, JS, DO, IML, PO, MT, DA and PMN Wrote the original draft manuscript.

All authors reviewed and edited the manuscript.

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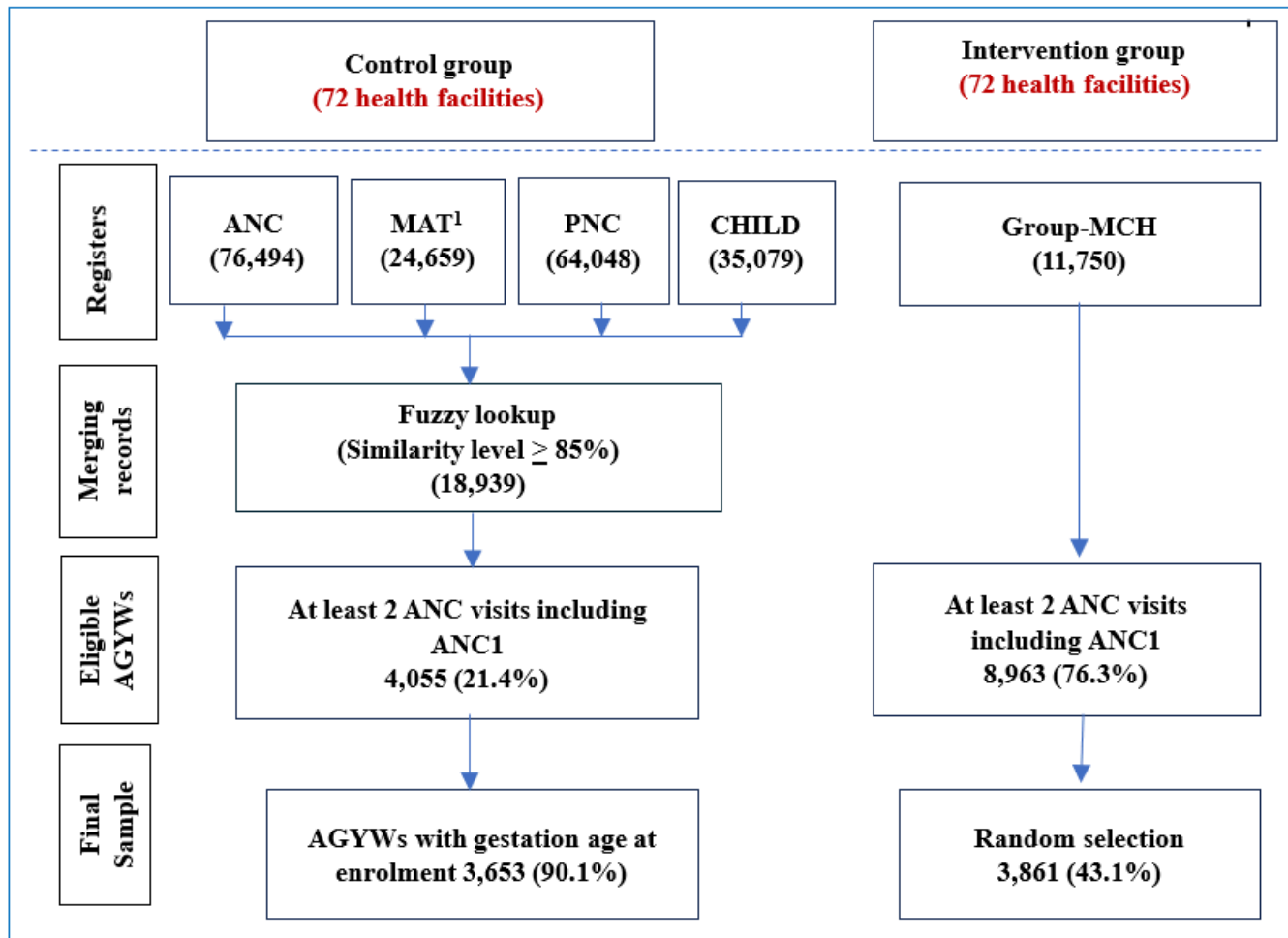
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Figures



¹ MAT = Maternity register

Figure 1

Data processing schematic flow diagram for the evaluation of G-ANC/PNC DSD model for pregnant and breastfeeding AGYW in Uganda, 2021-2023